

# Preliminary Water Quality Management Plan

For:

## Slover and Juniper Industrial Building

APN 0251-203-09

16726 SLOVER AVENUE, FONTANA, CA

Prepared for:

Lebbea, LLC

18031 IRVINE BOULEVARD, #106

TUSTIN, CA 92870

702.336.0636

Prepared by:

Inland Empire Survey and Engineering, Inc. (IESE)

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Submittal Date: 3/9/2020

Revision Date: 6/4/2020

Preliminary for Entitlements Complete Date: \_\_\_\_\_

Construction WQMP Complete Date: \_\_\_\_\_

Final WQMP Approved Date: \_\_\_\_\_

## Project Owner's Certification

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


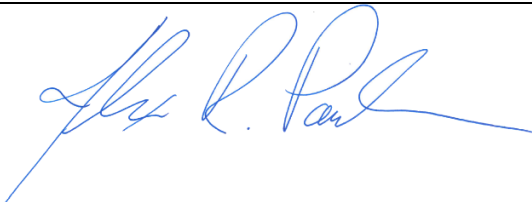
"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	WQMP 20-000032	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	Por. Blk 744, Book 11, Pg 12	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0251-203-09 MCN 20-035 GPA 20-011 ZCA 20-009
Owner's Signature			
<b>Owner Name:</b> Lebbea, LLC, c/o Mr. Marc Lebanoff			
Title	OWNER		
Company	Lebbea, LLC		
Address	18031 Irvine Boulevard, Unit 106		
Email	mlebanoff@gmail.com		
Telephone #	702.336.0636		
Signature		Date	

## Preparer's Certification

Project Data			
Permit/Application Number(s):	WQMP 20-000032	Grading Permit Number(s):	
Tract/Parcel Map Number(s):	Por. Blk 744, Book 11, Pg 12	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract): APN 0251-203-09 MCN 20-035 GPA 20-011 ZCA 20-009			APN 0251-203-09

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

<b>Engineer:</b> Alex R. Paulsen, PE		<p>PE Stamp Below</p> 
Title	Project Engineer	
Company	IESE	
Address	41146 ELM STREET, STE. "G"	
Email	apaulsen@iesurveyandeng.com	
Telephone #	951.698.1830	
Signature		
Date	3/9/2020	

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## Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Slover and Juniper Industrial Building			
Project Owner Contact Name:		Lebbea, LLC – C/O Mr. Marc Lebanoff			
Mailing Address:	41146 Elm Street, Suite G Murrieta, CA 92562	E-mail Address:	mlebanoff@gmail.com	Telephone:	(858) 336-5211
Permit/Application Number(s):		WQMP 20-000032	Tract/Parcel Map Number(s):		
Additional Information/Comments:		APN 0251-203-09			
Description of Project:		The proposed development is an already developed site on the referenced property. An industrial building, associated parking area and loading dock, and landscaping is being proposed. The development proposes to use an underground infiltration BMP before discharging to the MS4.			
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.		<p><b><u>Drainage Patterns</u></b></p> <p>The overall site drainage was designed to be 100% captured and treated before entering the MS4. The existing drainage pattern is in the southwesterly direction of the lot. The proposed drainage pattern is to the northeasterly direction due to the proposed building being located in the southwestern corner of the lot.</p> <p><b><u>Proposed LID BMPs</u></b></p> <p>The proposed LID BMP to handle the majority of the DCV is an underground infiltration BMP designed by Contech ES. Also, where applicable, roof drains will outlet into adjacent landscaping around building.</p>			

## Section 2 Project Description

### 2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project					
<b>1</b> Development Category (Select all that apply):					
<input type="checkbox"/> Significant re-development involving the addition or replacement of 5,000 ft <sup>2</sup> or more of impervious surface on an already developed site	<input checked="" type="checkbox"/> New development involving the creation of 10,000 ft <sup>2</sup> or more of impervious surface collectively over entire site	<input type="checkbox"/> Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	<input type="checkbox"/> Restaurants (with SIC code 5812) where the land area of development is 5,000 ft <sup>2</sup> or more		
<input type="checkbox"/> Hillside developments of 5,000 ft <sup>2</sup> or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	<input type="checkbox"/> Developments of 2,500 ft <sup>2</sup> of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	<input checked="" type="checkbox"/> Parking lots of 5,000 ft <sup>2</sup> or more exposed to storm water	<input type="checkbox"/> Retail gasoline outlets that are either 5,000 ft <sup>2</sup> or more, or have a projected average daily traffic of 100 or more vehicles per day		
<input type="checkbox"/> Non-Priority / Non-Category Project <i>May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</i>					
<b>2</b> Project Area (ft <sup>2</sup> ):		<b>3</b> Number of Dwelling Units:	0	<b>4</b> SIC Code:	
<b>5</b> Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					
<b>6</b> Does Project include roads? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)</i>					

## 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:

Because there is only one lot involved in the development, the owner and tenant of the proposed development will be responsible for ensuring that the proposed BMPs are clean and in proper working order. This includes ensuring that all drainage devices, catch basins, storm drains, and BMPs are free of silt and debris before and after qualifying storm events.

## 2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Receiving Waters: Santa Ana Reach 3, this stream is being treated with an approved USEPA TMDL
Nutrients - Phosphorous	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water
Noxious Aquatic Plants	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water. A detailed landscape plan will be a part of the project plans
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water. An Erosion control plan is expected to be a part of this project
Metals	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Receiving Waters: Santa Ana Reach 3.
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Parking will be open-air, asphalt parking lot.
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	On-Site Awareness. Property owner to be made aware of debris maintenance methods.
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water. No Down Stream Impairment. No legacy pollutants on-site
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water
Other: pH	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	This pollutant is not listed as causing an impairment to any downstream receiving water
Other: Copper.	E <input type="checkbox"/>	N <input type="checkbox"/>	Santa Ana Reach 3- Unknown Point Source. Approved TMDL
Other: Lead	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Santa Ana Reach 3- Unknown Point Source.
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	

## 2.4 Water Quality Credits

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

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

## Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example.

Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.***

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude 34.0636	Longitude -117.4394	Thomas Bros Map page
<sup>1</sup> San Bernardino County climatic region: <input checked="" type="checkbox"/> Valley <input type="checkbox"/> Mountain			
<sup>2</sup> Does the site have more than one drainage area (DA): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> 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			
<pre> graph BT     DA1DMAA[DA1 DMA A] --&gt; Outlet1[Outlet 1]     DA1DMAB[DA1 DMA B thru F] --&gt; Outlet1     DA2[DA2] --&gt; Outlet2[Outlet 2]         </pre>			
Example only – modify for project specific WQMP using additional form			
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA		
DA1 DMA A to Outlet 1	Sheet flow across pavement to proposed catch basins. Catch basins to convey runoff to underground infiltration BMP.		
DA1 DMA B thru D to Outlet 1	Roof drains to drain to local depressed landscape areas. These areas, when overflowing, will directly discharge to street via sidewalk underdrains.		

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
<b>1</b> DMA drainage area (ft <sup>2</sup> )	60,749	7,877	15,932	8,700
<b>2</b> Existing site impervious area (ft <sup>2</sup> )	4,150	0	565	1,900
<b>3</b> Antecedent moisture condition <i>For desert areas, use</i> <a href="http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf">http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</a>	3	3	3	3
<b>4</b> Hydrologic soil group <i>Refer to Watershed Mapping Tool –</i> <a href="http://sbcounty.permitrack.com/WAP">http://sbcounty.permitrack.com/WAP</a>	A	A	A	A
<b>5</b> Longest flowpath length (ft)	285	185	150	125
<b>6</b> Longest flowpath slope (ft/ft)	0.018	0.018	0.018	0.018
<b>7</b> Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Chaparral Narrow leaf	Chaparral Narrow leaf	Chaparral Narrow leaf	Chaparral Narrow leaf
<b>8</b> Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good &gt;75%; Fair 50-75%; Poor &lt;50% Attach photos of site to support rating</i>	Poor	Poor	Poor	Poor



Form 3-3 Watershed Description for Drainage Area 1	
<p>Receiving waters  Refer to Watershed Mapping Tool -  <a href="http://sbcounty.permitrack.com/WAP">http://sbcounty.permitrack.com/WAP</a>  See "Drainage Facilities" link at this website</p>	<p>Slover Avenue/Marigold Storm Drain  Declez Channel  San Sevaire Channel  Santa Ana River Reach 3  Prado Basin  Santa Ana River Reach 2  Santa Ana River Reach 1  Pacific Ocean</p>
<p>Applicable TMDLs  Refer to Local Implementation Plan</p>	<p>Declez is an EHM channel and the Drainage segment is not subject to TMDLs</p> <p>Santa Ana River Reach 3 Impairment - Pathogens beign addressed in a USEPA approved TMDL</p> <p>Santa Ana River Reach 3 -Copper TMDL on File</p> <p>Santa Ana River Reach 3 - Lead TMDL required</p>
<p>303(d) listed impairments  Refer to Local Implementation Plan and Watershed Mapping Tool –  <a href="http://sbcounty.permitrack.com/WAP">http://sbcounty.permitrack.com/WAP</a> and State Water Resources Control Board website –  <a href="http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml">http://www.waterboards.ca.gov/santaana/water issues/programs/tmdl/index.shtml</a></p>	<p>Prado Park Lake (Nutrients, Pathogens) -A USEPA approved TMDL is on file</p> <p>Santa Ana River Reach 3 - A USEPA approved TMDL is on file</p>
<p>Environmentally Sensitive Areas (ESA)  Refer to Watershed Mapping Tool –  <a href="http://sbcounty.permitrack.com/WAP">http://sbcounty.permitrack.com/WAP</a></p>	<p>n/a</p>
<p>Unlined Downstream Water Bodies  Refer to Watershed Mapping Tool –  <a href="http://sbcounty.permitrack.com/WAP">http://sbcounty.permitrack.com/WAP</a></p>	<p>Yes-Santa Ana River</p>
<p>Hydrologic Conditions of Concern</p>	<p><input type="checkbox"/> Yes Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal</p> <p><input checked="" type="checkbox"/> No</p>
<p>Watershed–based BMP included in a RWQCB approved WAP</p>	<p><input type="checkbox"/> Yes Attach verification of regional BMP evaluation criteria in WAP</p> <ul style="list-style-type: none"> <li>• More Effective than On-site LID</li> <li>• Remaining Capacity for Project DCV</li> <li>• Upstream of any Water of the US</li> <li>• Operational at Project Completion</li> <li>• Long-Term Maintenance Plan</li> </ul> <p><input checked="" type="checkbox"/> No</p>

## Section 4 Best Management Practices (BMP)

### 4.1 Source Control BMP

#### 4.1.1 Pollution Prevention

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

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

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner will be required to review and implement Storm Water Pollution Brochures, Hazardous Waste Guidelines, and the "After the Storm" handouts. Owner will also need to be familiar with this WQMP and will need to train all personnel. One method is a yearly training program that familiarizes all personnel on water quality guidelines.
N2	Activity Restrictions	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No CCR's Exist. The site is not intended to be a source for the raw creation of hazardous materials, Organic Compounds, Metals or etc.,. In general, the point source contaminants will be limited to those generated by the parking area and nutrients /repellents applied to the landscaped areas.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner shall Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator. Owner shall annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

Form 4.1-1 Non-Structural Source Control BMPs				
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner shall clean and maintain all proposed LID BMPs. Additionally, owner shall ensure that underground infiltration BMP is in proper working order by cleaning out the system of silt/sediment after every qualifying event. Or, at a minimum, inspect the system after each qualifying event.
N5	Title 22 CCR Compliance (How development will comply)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner is to properly clean and dispose of any hazardous spills. A list of hazardous waste disposal sites is listed in the Appendix of this Report
N6	Local Water Quality Ordinances	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner is required to comply with the City of Fontana Municipal Code.
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Owner is to properly clean and dispose of any hazardous spills. A list of hazardous waste disposal sites is listed in the Appendix of this Report
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There are no underground storage facilities proposed with this project
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Typically regulated by local fire protection

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner shall comply with Article 80 of the Uniform Fire Code as enforced by the fire protection agency.
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The owner shall implement trash management and litter control procedures in the common areas aimed at reducing pollution of drainage water.

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N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner shall prepare and implement a BMP maintenance and cleaning program. All new employees to be educated on their role in keeping BMPs in proper working order and cleaning up litter/trash.
N13	Housekeeping of Loading Docks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Industrial facility docks should be kept in a clean and orderly condition through a regular program of sweeping and litter control and immediate cleanup of spills and broken containers. Cleanup procedures should minimize or eliminate the use of water. If wash water is used, it must be disposed of in an approved manner and not discharged to the storm drain system. If there are no other alternatives, discharge of non-stormwater flow to the sanitary sewer may be considered only if allowed by the local sewerage agency through a permitted connection.
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	After any storm the owner shall inspect and clean drainage system, especially drainage inlets and the outlet structure within the water quality system. Owner shall flush the under ground collector pipes on an annual basis.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input type="checkbox"/>	<input checked="" type="checkbox"/>	At minimum, owner shall clean and vaccum driveways.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a suitable application
N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner shall comply with other NPDES permits such as General Industrial permits and shall also follow and implement a SWPPP during construction.

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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Stencilling shall be provided at all catch basin inlets that states "No Dumping - Drains to Ocean"
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not Applicable -No storage areas are provided on this site
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Drainage is routed around the trash enclosure area. Additionally, the trash enclosure area shall be walled to prevent off-site transport of trash. Enclosure area shall also have a roof and attached lids to prevent rainfall from entering the containers.
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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	A landscape plan is to be submitted to the city for approval. The landscape plan shall have an emphasis on efficient water use and irrigation methods and on water conservation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Landscape plan shall incorporate a detail to show a minimum of 1-2 inches of freeboard above finish surface of landscaping.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The water quality system will implement design features consistent with SD-10
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Loading dock drainage shall be directed, through use of trench drains, to the underground infiltration BMP and shall be pretreated with inlet filters and grate.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No maintenance bays proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No wash areas proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not an appropriate BMP

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S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a suitable application
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a suitable application
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a suitable application. the site is generally 2%
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a suitable application
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a suitable application

## 4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist
<p>Site Design Practices</p> <p><i>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</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: The city's zoning ordinance requires a minimum number of parking spaces. Aside from that, landscaping areas have been maximized to provide for more than enough area to capture and infiltrate the DCV.</p>
<p>Maximize natural infiltration capacity: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: The infiltration BMPs and the landscaped areas will maximize the natural infiltration capacity.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: The post-development condition will closely mimic the pre-development condition as stormwater will be retained in onsite infiltration and landscape areas. These BMPs will help make the post-development TOC match the pre-development TOC.</p>
<p>Disconnect impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: Roof drains will not be connected to an underground drain network. surface run-off will be implemented as much as possible. Landscaped areas shall double as areas.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/></p> <p>Explanation: Existing site is essentially barren.</p>
<p>Re-vegetate disturbed areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: To the MEP all Open Space will be re-vegetated.</p>
<p>Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: Because of the sensitivity of infiltration BMPs, contractor shall, to the MEP, ensure that construction equipment use will be limited in the proposed infiltration locations.</p>
<p>Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: In the design phase there are no intercept collection pipes. Only outflow pipe for exceeding the ponding depth are proposed.</p>
<p>Stake off areas that will be used for landscaping to minimize compaction during construction : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/></p> <p>Explanation: To the MEP the contractor is encouraged to minimize compaction in landscaped areas</p>

## 4.2 Project Performance Criteria

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft <sup>2</sup> ): 90,169	2 Imperviousness after applying preventative site design practices (Imp%): 83%	3 Runoff Coefficient (R <sub>c</sub> ): 0.64 $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P <sub>2yr-1hr</sub> (in): 0.533 <a href="http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html">http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</a>		
5 Compute P <sub>6</sub> , Mean 6-hr Precipitation (inches): 0.79 $P_6 = \text{Item 4} * C_1$ , where $C_1$ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)		
6 Drawdown Rate Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft <sup>3</sup> ): 7,457 – HSC (320 ft <sup>3</sup> ) = <b>7,138 ft<sup>3</sup></b> $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$ , where $C_2$ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		



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

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

Go to: <http://sbcounty.permitrack.com/WAP>

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below  
(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

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

Condition	Runoff Volume (ft <sup>3</sup> )	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	<b>1</b> <i>Form 4.2-3 Item 12</i>	<b>2</b> <i>Form 4.2-4 Item 13</i>	<b>3</b> <i>Form 4.2-5 Item 10</i>
Post-developed	<b>4</b> <i>Form 4.2-3 Item 13</i>	<b>5</b> <i>Form 4.2-4 Item 14</i>	<b>6</b> <i>Form 4.2-5 Item 14</i>
Difference	<b>7</b> <i>Item 4 – Item 1</i>	<b>8</b> <i>Item 2 – Item 5</i>	<b>9</b> <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	<b>10</b> % <i>Item 7 / Item 1</i>	<b>11</b> % <i>Item 8 / Item 2</i>	<b>12</b> % <i>Item 9 / Item 3</i>

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

Weighted Curve Number Determination for: <u>Pre-developed DA</u>	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
<b>1a</b> Land Cover type								
<b>2a</b> Hydrologic Soil Group (HSG)								
<b>3a</b> DMA Area, ft <sup>2</sup> <i>sum of areas of DMA should equal area of DA</i>								
<b>4a</b> Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
Weighted Curve Number Determination for: <u>Post-developed DA</u>	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
<b>1b</b> Land Cover type								
<b>2b</b> Hydrologic Soil Group (HSG)								
<b>3b</b> DMA Area, ft <sup>2</sup> <i>sum of areas of DMA should equal area of DA</i>								
<b>4b</b> Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
<b>5</b> Pre-Developed area-weighted CN:	<b>7</b> Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item 5}) - 10$				<b>9</b> Initial abstraction, I <sub>a</sub> (in): $I_a = 0.2 * \text{Item 7}$			
<b>6</b> Post-Developed area-weighted CN:	<b>8</b> Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$				<b>10</b> Initial abstraction, I <sub>a</sub> (in): $I_a = 0.2 * \text{Item 8}$			
<b>11</b> Precipitation for 2 yr, 24 hr storm (in): Go to: <a href="http://hdsc.nws.noaa.gov/hdsc/pfds/qa/sca_pfds.html">http://hdsc.nws.noaa.gov/hdsc/pfds/qa/sca_pfds.html</a>								
<b>12</b> Pre-developed Volume (ft <sup>3</sup> ): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
<b>13</b> Post-developed Volume (ft <sup>3</sup> ): $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
<b>14</b> Volume Reduction needed to meet HCOC Requirement, (ft <sup>3</sup> ): $V_{HCOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)			Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)								
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C						
<b>1</b> Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG \text{ Form 4.2-1 Item 4} - 0.6 LOG \text{ Form 4.2-4 Item 5} / 60)}$												
<b>2</b> Drainage Area of each DMA (Acres) <i>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)</i>												
<b>3</b> Ratio of pervious area to total area <i>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)</i>												
<b>4</b> Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>												
<b>5</b> Maximum loss rate (in/hr) $F_m = \text{Item 3} * \text{Item 4}$ <i>Use area-weighted <math>F_m</math> 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)</i>												
<b>6</b> Peak Flow from DMA (cfs) $Q_p = \text{Item 2} * 0.9 * (\text{Item 1} - \text{Item 5})$												
<b>7</b> Time of concentration adjustment factor for other DMA to site discharge point <i>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)</i>	DMA A	n/a		n/a								
	DMA B		n/a		n/a							
	DMA C		n/a			n/a						
<b>8</b> Pre-developed $Q_p$ at $T_c$ for DMA A: $Q_p = \text{Item 6}_{DMAA} + [\text{Item 6}_{DMAB} * (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAB}) / (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAB}) * \text{Item 7}_{DMAA/2}] + [\text{Item 6}_{DMAC} * (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAC}) / (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAC}) * \text{Item 7}_{DMAA/3}]$	<b>9</b> Pre-developed $Q_p$ at $T_c$ for DMA B: $Q_p = \text{Item 6}_{DMAB} + [\text{Item 6}_{DMAA} * (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAA}) / (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAA}) * \text{Item 7}_{DMAB/1}] + [\text{Item 6}_{DMAC} * (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAC}) / (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAC}) * \text{Item 7}_{DMAB/3}]$			<b>10</b> Pre-developed $Q_p$ at $T_c$ for DMA C: $Q_p = \text{Item 6}_{DMAC} + [\text{Item 6}_{DMAA} * (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAA}) / (\text{Item 1}_{DMAA} - \text{Item 5}_{DMAA}) * \text{Item 7}_{DMAC/1}] + [\text{Item 6}_{DMAB} * (\text{Item 1}_{DMAC} - \text{Item 5}_{DMAB}) / (\text{Item 1}_{DMAB} - \text{Item 5}_{DMAB}) * \text{Item 7}_{DMAC/2}]$								
<b>10</b> Peak runoff from pre-developed condition confluence analysis (cfs): <span style="float: right;">Maximum of Item 8, 9, and 10 (including additional forms as needed)</span>												
<b>11</b> Post-developed $Q_p$ at $T_c$ for DMA A: <i>Same as Item 8 for post-developed values</i>	<b>12</b> Post-developed $Q_p$ at $T_c$ for DMA B: <i>Same as Item 9 for post-developed values</i>			<b>13</b> Post-developed $Q_p$ at $T_c$ for DMA C: <i>Same as Item 10 for post-developed values</i>								
<b>14</b> Peak runoff from post-developed condition confluence analysis (cfs): <span style="float: right;">Maximum of Item 11, 12, and 13 (including additional forms as needed)</span>												
<b>15</b> Peak runoff reduction needed to meet HCOC Requirement (cfs): <span style="float: right;"><math>Q_{p-HCOC} = (\text{Item 14} * 0.95) - \text{Item 10}</math></span>												

## 4.3 Project Conformance Analysis

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

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

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

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

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

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

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2).

**Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.**

## Form 4.3-1 Infiltration BMP Feasibility (DA 1)

Feasibility Criterion – Complete evaluation for each DA on the Project Site

**1** Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒

*Refer to Section 5.3.2.1 of the TGD for WQMP*

If Yes, Provide basis: (attach)

**2** Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒

(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

**3** Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

**4** Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

**5** Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒

If Yes, Provide basis: (attach)

**6** Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒

*See Section 3.5 of the TGD for WQMP and WAP*

If Yes, Provide basis: (attach)

**7** Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒

*If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.*

**8** Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒

*If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.*

**9** All answers to Item 1 through Item 6 are "No":

*Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.*

### 4.3.1 Site Design Hydrologic Source Control BMP

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

<b>Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)</b>			
<b>1</b> 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 <input checked="" type="checkbox"/> No <input type="checkbox"/> If yes, complete Items 2-5; If no, proceed to Item 6	DA-1 DMA-B BMP Type – Imp. Area Dispersion	DA-1 DMA-C BMP Type – Imp. Area Dispersion	DA-1 DMA-D BMP Type – Imp. Area Dispersion
<b>2</b> Total impervious area draining to pervious area (ft <sup>2</sup> )	5,547	11,121	5,783
<b>3</b> Ratio of pervious area receiving runoff to impervious area	0.33	0.32	0.40
<b>4</b> Retention volume achieved from impervious area dispersion (ft <sup>3</sup> ) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$ , assuming retention of 0.5 inches of runoff	76	148	96
<b>5</b> Sum of retention volume achieved from impervious area dispersion (ft <sup>3</sup> ): 320 $V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$			
<b>6</b> Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> 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)
<b>7</b> Ponding surface area (ft <sup>2</sup> )			
<b>8</b> Ponding depth (ft)			
<b>9</b> Surface area of amended soil/gravel (ft <sup>2</sup> )	-		
<b>10</b> Average depth of amended soil/gravel (ft)			
<b>11</b> Average porosity of amended soil/gravel			
<b>12</b> Retention volume achieved from on-lot infiltration (ft <sup>3</sup> ) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$			
<b>13</b> Runoff volume retention from on-lot infiltration (ft <sup>3</sup> ): $V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$			

# Water Quality Management Plan (WQMP)

<b>14</b> Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 15-20. If no, proceed to Item 21</i>	DA      DMA BMP Type	DA      DMA BMP Type	DA      DMA BMP Type      (Use additional forms for more BMPs)
<b>15</b> Rooftop area planned for ET BMP (ft <sup>2</sup> )			
<b>16</b> Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i>			
<b>17</b> Daily ET demand (ft <sup>3</sup> /day) <i>Item 15 * (Item 16 / 12)</i>			
<b>18</b> Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i>			
<b>19</b> Retention Volume (ft <sup>3</sup> ) <i><math>V_{\text{retention}} = \text{Item 17} * (\text{Item 18} / 24)</math></i>			
<b>20</b> Runoff volume retention from evapotranspiration BMPs (ft <sup>3</sup> ): 0 <i><math>V_{\text{retention}} = \text{Sum of Item 19 for all BMPs}</math></i>			
<b>21</b> Implementation of Street Trees: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 22-25. If no, proceed to Item 26</i>	DA      DMA BMP Type	DA      DMA BMP Type	DA      DMA BMP Type      (Use additional forms for more BMPs)
<b>22</b> Number of Street Trees			
<b>23</b> Average canopy cover over impervious area (ft <sup>2</sup> )			
<b>24</b> Runoff volume retention from street trees (ft <sup>3</sup> ) <i><math>V_{\text{retention}} = \text{Item 22} * \text{Item 23} * (0.05/12)</math> assume runoff retention of 0.05 inches</i>			
<b>25</b> Runoff volume retention from street tree BMPs (ft <sup>3</sup> ): 0 <i><math>V_{\text{retention}} = \text{Sum of Item 24 for all BMPs}</math></i>			
<b>26</b> Implementation of residential rain barrel/cisterns: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, complete Items 27-29; If no, proceed to Item 30</i>	DA      DMA BMP Type	DA      DMA BMP Type	DA      DMA BMP Type      (Use additional forms for more BMPs)
<b>27</b> Number of rain barrels/cisterns			
<b>28</b> Runoff volume retention from rain barrels/cisterns (ft <sup>3</sup> ) <i><math>V_{\text{retention}} = \text{Item 27} * 3</math></i>			
<b>29</b> Runoff volume retention from residential rain barrels/Cisterns (ft <sup>3</sup> ): 0 <i><math>V_{\text{retention}} = \text{Sum of Item 28 for all BMPs}</math></i>			
<b>30</b> Total Retention Volume from Site Design Hydrologic Source Control BMPs: 320 <i>Sum of Items 5, 13, 20, 25 and 29</i>			



### 4.3.2

#### **Infiltration BMPs**

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

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

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

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

<b>1</b> Remaining LID DCV not met by site design HSC BMP (ft <sup>3</sup> ): 6,866 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$			
BMP Type Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs	DA 1 DMA A BMP Type – Underground Infiltration	DA DMA BMP Type -	DA DMA BMP Type (Use additional forms for more BMPs)
<b>2</b> Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods	1.4		
<b>3</b> Infiltration safety factor See TGD Section 5.4.2 and Appendix D	2		
<b>4</b> Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	0.7		
<b>5</b> Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48		
<b>6</b> Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details	-		
<b>7</b> Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	4		
<b>8</b> Infiltrating surface area, $SA_{BMP}$ (ft <sup>2</sup> ) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	2,702.5		
<b>9</b> 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	-		
<b>10</b> Amended soil porosity	-		
<b>11</b> Gravel depth, $d_{media}$ (ft) Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details	4		
<b>12</b> Gravel porosity	0.36		
<b>13</b> Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3		
<b>14</b> Above Ground Retention Volume (ft <sup>3</sup> ) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
<b>15</b> Underground Retention Volume (ft <sup>3</sup> ) Volume determined using manufacturer's specifications and calculations			
<b>16</b> Total Retention Volume from LID Infiltration BMPs: (Sum of Items 14 and 15 for all infiltration BMP included in plan)			
<b>17</b> Fraction of DCV achieved with infiltration BMP: $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$			
<b>18</b> Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and infiltration BMPs? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.			

### 4.3.3 Harvest and Use BMP

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

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

<b>Form 4.3-4 Harvest and Use BMPs (DA 1)</b>			
<b>1</b> Remaining LID DCV not met by site design HSC or infiltration BMP (ft <sup>3</sup> ): None $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30} - \text{Form 4.3-3 Item 16}$			
BMP Type(s) <i>Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
<b>2</b> Describe cistern or runoff detention facility			
<b>3</b> Storage volume for proposed detention type (ft <sup>3</sup> ) <i>Volume of cistern</i>			
<b>4</b> Landscaped area planned for use of harvested stormwater (ft <sup>2</sup> )			
<b>5</b> Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
<b>6</b> Daily water demand (ft <sup>3</sup> /day) <i>Item 4 * (Item 5 / 12)</i>			
<b>7</b> Drawdown time (hrs) <i>Copy Item 6 from Form 4.2-1</i>			
<b>8</b> Retention Volume (ft <sup>3</sup> ) $V_{retention} = \text{Minimum of (Item 3) or (Item 6 * (Item 7 / 24))}$			
<b>9</b> Total Retention Volume (ft <sup>3</sup> ) from Harvest and Use BMP <i>Sum of Item 8 for all harvest and use BMP included in plan</i>			
<b>10</b> Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest and use BMPs? Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.</i>			

### 4.3.4 Biotreatment BMP

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

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

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

<b>Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)</b>			
<b>1</b> Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft <sup>3</sup> ): <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</i>		List pollutants of concern <i>Copy from Form 2.3-1.</i>	
<b>2</b> Biotreatment BMP Selected <i>(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)</i>		<b>Volume-based biotreatment</b> <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i> <input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention	<b>Flow-based biotreatment</b> <i>Use Form 4.3-8 to compute treated volume</i> <input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment
<b>3</b> Volume biotreated in volume based biotreatment BMP (ft <sup>3</sup> ): <i>Form 4.3-6 Item 15 + Form 4.3-7 Item 13</i>		<b>4</b> Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft <sup>3</sup> ): <i>0 Item 1 – Item 3</i>	
<b>5</b> Remaining fraction of LID DCV for sizing flow based biotreatment BMP: <i>0% Item 4 / Item 1</i>			
<b>6</b> Flow-based biotreatment BMP capacity provided (cfs): <i>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)</i>			
<b>7</b> Metrics for MEP determination: <ul style="list-style-type: none"> <li>• 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: <input type="checkbox"/> <i>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.</i></li> </ul>			

### Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

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

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

Biotreatment BMP Type <i>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.</i>	DA      DMA BMP Type		DA      DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
<b>1</b> Pollutants addressed with BMP forebay and basin <i>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</i>				
<b>2</b> Bottom width (ft)				
<b>3</b> Bottom length (ft)				
<b>4</b> Bottom area (ft <sup>2</sup> ) $A_{bottom} = \text{Item 2} * \text{Item 3}$				
<b>5</b> Side slope (ft/ft)				
<b>6</b> Depth of storage (ft)				
<b>7</b> Water surface area (ft <sup>2</sup> ) $A_{surface} = (\text{Item 2} + (2 * \text{Item 5} * \text{Item 6})) * (\text{Item 3} + (2 * \text{Item 5} * \text{Item 6}))$				
<b>8</b> Storage volume (ft <sup>3</sup> ) <i>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</i> $V = \text{Item 6} / 3 * [\text{Item 4} + \text{Item 7} + (\text{Item 4} * \text{Item 7})^{0.5}]$				
<b>9</b> Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>				
<b>10</b> Outflow rate (cfs) $Q_{BMP} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) / (\text{Item 9} * 3600)$				
<b>11</b> Duration of design storm event (hrs)				
<b>12</b> Biotreated Volume (ft <sup>3</sup> ) $V_{biotreated} = (\text{Item 8}_{forebay} + \text{Item 8}_{basin}) + (\text{Item 10} * \text{Item 11} * 3600)$				
<b>13</b> Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : <i>(Sum of Item 12 for all BMP included in plan)</i>				

### Form 4.3-8 Flow Based Biotreatment (DA 1)

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

### 4.3.5 Conformance Summary

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

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)	
1	Total LID DCV for the Project DA-1 (ft <sup>3</sup> ): 7,138 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design hydrologic source control LID BMP (ft <sup>3</sup> ): 130 <i>Copy Item 30 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft <sup>3</sup> ): <i>Copy Item 16 in Form 4.3-3</i>
4	On-site retention with LID harvest and use BMP (ft <sup>3</sup> ): <i>Copy Item 9 in Form 4.3-4</i>
5	On-site biotreatment with volume based biotreatment BMP (ft <sup>3</sup> ): <i>Copy Item 3 in Form 4.3-5</i>
6	Flow capacity provided by flow based biotreatment BMP (cfs): <i>Copy Item 6 in Form 4.3-5</i>
7	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> <li>Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i></li> <li>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 <input type="checkbox"/> No <input type="checkbox"/> <i>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</i></li> <li>On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i></li> </ul>
8	<p>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:</p> <ul style="list-style-type: none"> <li>Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, <math>V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%</math></i></li> <li>An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: <input type="checkbox"/> <i>Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed</i></li> </ul>



### 4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA 1)	
<b>1</b> Volume reduction needed for HCOC performance criteria (ft <sup>3</sup> ): 0 <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i>	<b>2</b> On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft <sup>3</sup> ): <i>Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i>
<b>3</b> Remaining volume for HCOC volume capture (ft <sup>3</sup> ): 0 <i>Item 1 – Item 2</i>	<b>4</b> Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft <sup>3</sup> ): 0 <i>Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</i>
<b>5</b> If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification <input type="checkbox"/> <i>Attach in-stream control BMP selection and evaluation to this WQMP</i>	
<b>6</b> Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i> <ul style="list-style-type: none"> <li>Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP <input type="checkbox"/>  <i>BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)</i> </li> <li>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 <input type="checkbox"/></li> <li>Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/></li> </ul>	
<b>7</b> Form 4.2-2 Item 12 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i> <ul style="list-style-type: none"> <li>Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs <input type="checkbox"/>  <i>BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)</i> </li> <li>Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/></li> </ul>	

## 4.4 Alternative Compliance Plan (if applicable)

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

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

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

## Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

<b>Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)</b>			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
LID	Owner	Owner shall ensure that underground infiltration system is in proper working order and is free of silt/debris. Owner shall follow manufacturer cleaning recommendations and schedule.	As needed/Before and after wet season/per manufacturer recommendations
Inlets	Owner	After storm events, owner shall inspect the catch basin inlets. Remove any silt, sediment, or debris and ensure that catch basins are free from obstructions and are flowing freely. During large events or during the first major storm event of the year, owner shall inspect the drainage system to ensure no clogging is occurring.	Annually/as needed/after qualifying storm events
N <sub>1</sub>	Owner	Discuss stormwater BMPs and their importance. Educate property owners and their tenants.	Annually/as needed
N <sub>3</sub>	Owner	Clean and maintain all landscape areas, with a focus on water quality features.	As needed
N <sub>4</sub>	Owner	Perform inspections for cleaning of water quality basins and their associated outlet pipes. Clean piping and drains as necessary to allow proper performance.	As needed/Before wet season and after wet season
N <sub>5</sub>	Owner	Properly dispose of and clean up hazardous waste spills.	As needed

## Water Quality Management Plan (WQMP)

N6	Owner	Owner is required to comply with the City of Fontana Municipal Code.	As needed
N10	Owner	Landscaping and all water quality elements shall be maintained in accordance with applicable fire codes.	As needed
N11	Owner	Maintain cleanliness of property and practice good housekeeping standards.	As needed/Monthly
N12	Owner	Owner shall conduct annual training on all WQMP and BMP elements with employees.	Annually
N13	Owner	Loading docks shall be cleaned from trash debris weekly. Ensure loading docks are free from trash and sediment and that trench drains are cleaned as needed.	Annually/as needed
N14	Owner	After storm events, owner and/or tenants shall inspect and clean the drainage system, especially drainage inlets and the outlet structure within the water quality basin.	Before/After wet season/As needed
N15	Owner	Owner shall sweep parking lot areas at least once before wet season.	Before wet season/as needed
S1	Owner	Owner shall ensure that storm drain signage and stenciling is clearly visible and is not covered by dirt, debris, or trash.	Annually/as needed
S3	Owner	Ensure trash enclosures remain free of litter and debris and are in a clean state	As needed
S4	Owner	See landscape plan. Ensure system is working properly and repair as needed.	As needed
S5	Owner	Ensure landscape areas remain to grade as designed and intended	As needed
S6	Owner	Ensure any slopes on the property remain protected from erosion and have sufficient plant cover.	As needed
S7	Owner	Loading docks shall be cleaned from trash debris weekly. Ensure loading docks are free from trash and sediment and that trench drains are cleaned as needed.	Annually/as needed

## 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 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.

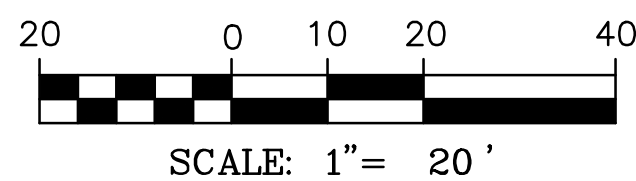
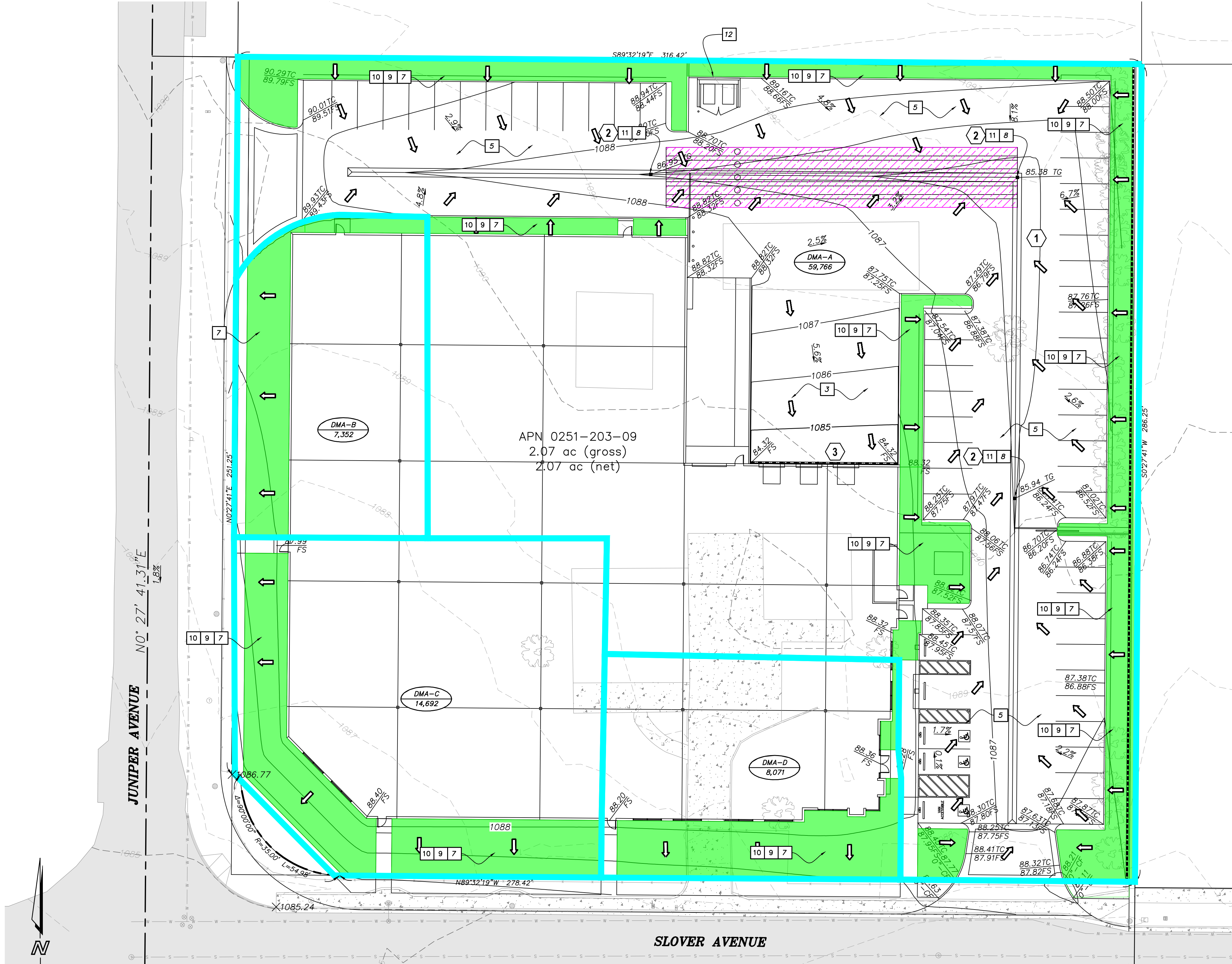
### 6.3 Post Construction

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

### 6.4 Other Supporting Documentation

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





**NOTE:**  
-THE ENGINEER OF RECORD HAS DETERMINED THAT CONSIDERING THE SITE CONDITIONS INCLUDING THE SOIL AND THE CLIMATE, THE PROPOSED SITE DRAINAGE SLOPES SHALL BE SATISFACTORY AND DO NOT WARRANT THE MORE CONSERVATIVE REQUIREMENTS OF THE BUILDING CODE.  
-ADD 1,000.00 FEET TO SPOT/PROPOSED CONTOUR ELEVATIONS TO GET TRUE ELEVATIONS.  
-ALL CUT/FILL SLOPES ARE 2:1 HORIZONTAL TO VERTICAL UNLESS OTHERWISE NOTED.

**SLOVER AVENUE**

### WQMP SUMMARY TABLE

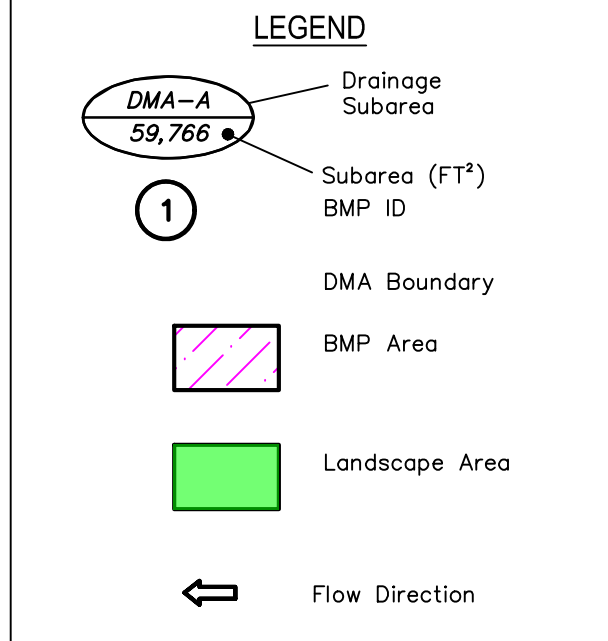
DMA	BMP	DCV	V-PROVIDED
A	UNDERGROUND INFILTRATION	4,572	7,234
B	HSC	560	0
C	HSC	1119	0
D	HSC	615	0

### SOURCE CONTROL NOTES

- 1 NON-STORMWATER DISCHARGES (SC-10), SITE-WIDE
- 2 SPILL PREVENTION, CONTROL & CLEANUP (SC-11), SITE-WIDE
- 3 OUTDOOR LOADING & UNLOADING (SC-30/SD-31)
- 4 WASTE HANDLING & DISPOSAL (SC-34), SITE-WIDE
- 5 PARKING LOT MAINTENANCE & SWEEPING (SC-43)
- 6 GOOD HOUSEKEEPING & LITTER CONTROL (SC-60), SITE-WIDE
- 7 LANDSCAPE MAINTENANCE & MANAGEMENT (SC-73)
- 8 DRAINAGE SYSTEM MAINTENANCE (SC-74)
- 9 SITE DESIGN & LANDSCAPE PLANTING (SD-10)
- 10 EFFICIENT IRRIGATION (SD-12)
- 11 STORM DRAIN SYSTEM SIGNS (SD-13)
- 12 TRASH ENCLOSURES (SD-32)

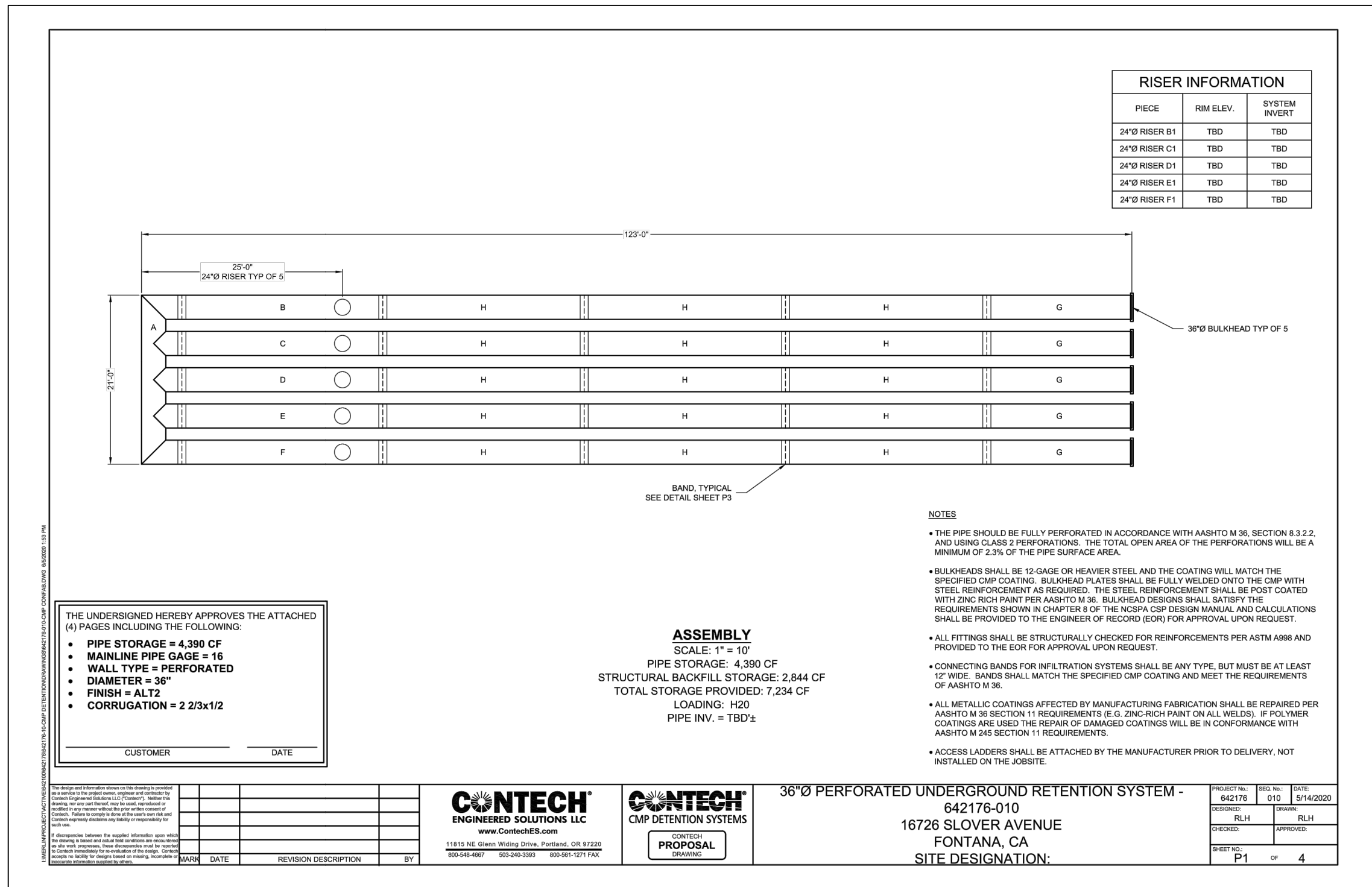
### VICINITY MAP

T:1S, R:6W  
NO SCALE



### WQMP NOTES

- 1 INSTALL CONTECH CMP INFILTRATION CHAMBERS PER DETAIL 'A' HEREON AND PER MANUFACTURERS RECOMMENDATIONS.
- 2 INSTALL 12-INCH BROOKS BOX WITH CATCH BASIN INLET FILTER TO PROVIDE WATER QUALITY PRETREATMENT.
- 3 INSTALL NDS TRENCH DRAIN WITH DRAIN FILTER.



### CONTECH UNDERGROUND INFILTRATION SYSTEM

NO SCALE



DATE	REVISION #	REVISIONS



ACCEPTED BY:	DATE:
FOR BUILDING AND SAFETY DEPARTMENT FONTANA, CALIFORNIA	
PREPARED BY:	
Alex R. Paulsen R.C.E. NO.: 87481	DATE:

CITY OF FONTANA, SAN BERNARDINO COUNTY, STATE OF CALIFORNIA

## WQMP SITE PLAN 16726 SLOVER AVENUE



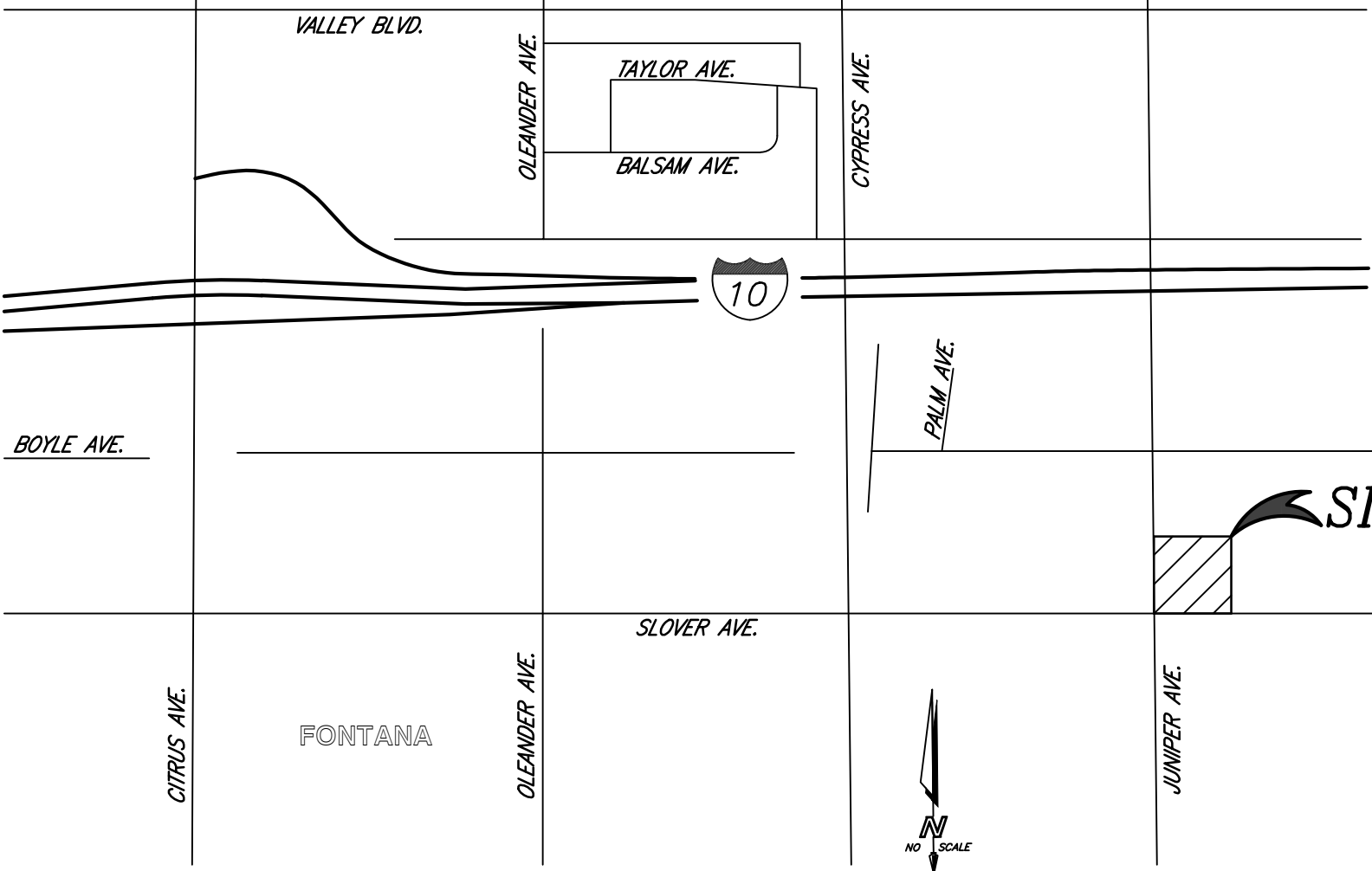
**IE SURVEY & ENGINEERING, INC.**  
41146 ELM STREET, SUITE G  
MURRIETA, CA 92562  
T: (951) 684-1830  
E: INFO@IESURVEYANDENG.COM

DESIGNED BY:	DRAWN BY:	CHECKED BY:
APAUlsen	APAUlsen	APAUlsen

SHEET NO.  
**1 OF 1**  
DATE: 6/8/20  
JOB NO.  
**19128**



DWG: 19128 GP R01.dwg DATE: Jun 05, 2020 - 1:02:26pm



VICINITY MAP  
T:1S, R:6W  
NO SCALE

LEGEND

- TREE
- PALM
- SHRUB
- WATER METER BOX
- WATER VALVE
- WATER SERVICE
- GAS METER BOX
- SEWER CLEAN OUT
- TOP OF DIKE
- ASPHALT CONCRETE
- NO ACCESS PER ITEM C
- CURB FACE
- WATER BLOW OFF
- FIRE HYDRANT
- MANHOLE
- STORMDRAIN
- LIGHT STANDARD
- TYPICAL
- OD
- EDISON VAULT
- WATER VAULT
- TELEPHONE VAULT
- IRRIGATION CONTROL VALVE
- ELECTRIC RISER
- SIGN
- TRAFFIC VAULT
- TRAFFIC BOX
- POWER POLE
- A.V.A.R
- ANCHOR
- SEWER RISER
- GAS VALVE
- DRAIN
- ELECTRIC BOX
- COMMUNICATION RISER
- AC PAVEMENT
- BLOCK WALL
- WOOD FENCE
- FF
- PAD
- HP
- GB
- FL
- e
- R
- 2:1 SLOPE (UNLESS OTHERWISE NOTED)
- 1040
- 1050

- CUT/FILL LINE
- DAYLIGHT
- RIP RAP
- SWALE
- CONCRETE INTERCEPTOR
- SPOT ELEVATION
- PAD ELEVATION INFORMATION

ENGINEER'S NOTES:

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

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A DILIGENT SEARCH OF ALL AVAILABLE RECORDS. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN AND ANY OTHER LINES OR STRUCTURES SHOWN OR NOT SHOWN ON THESE PLANS, AND IS RESPONSIBLE FOR THE PROTECTION OF, AND ANY DAMAGE TO THESE LINES OR STRUCTURES.

A PAD CERTIFICATION, A COMPACTION REPORT AND ANY OTHER REQUIRED DOCUMENTS SHALL BE PROVIDED TO THE BUILDING INSPECTOR AT ROUGH GRADING INSPECTION.

BUILDER'S SHALL PROVIDE THE BUILDING INSPECTOR WITH A FINAL PRECISE GRADING CERTIFICATE FROM THE ENGINEER OF RECORD PRIOR TO BUILDING'S FINAL INSPECTION.

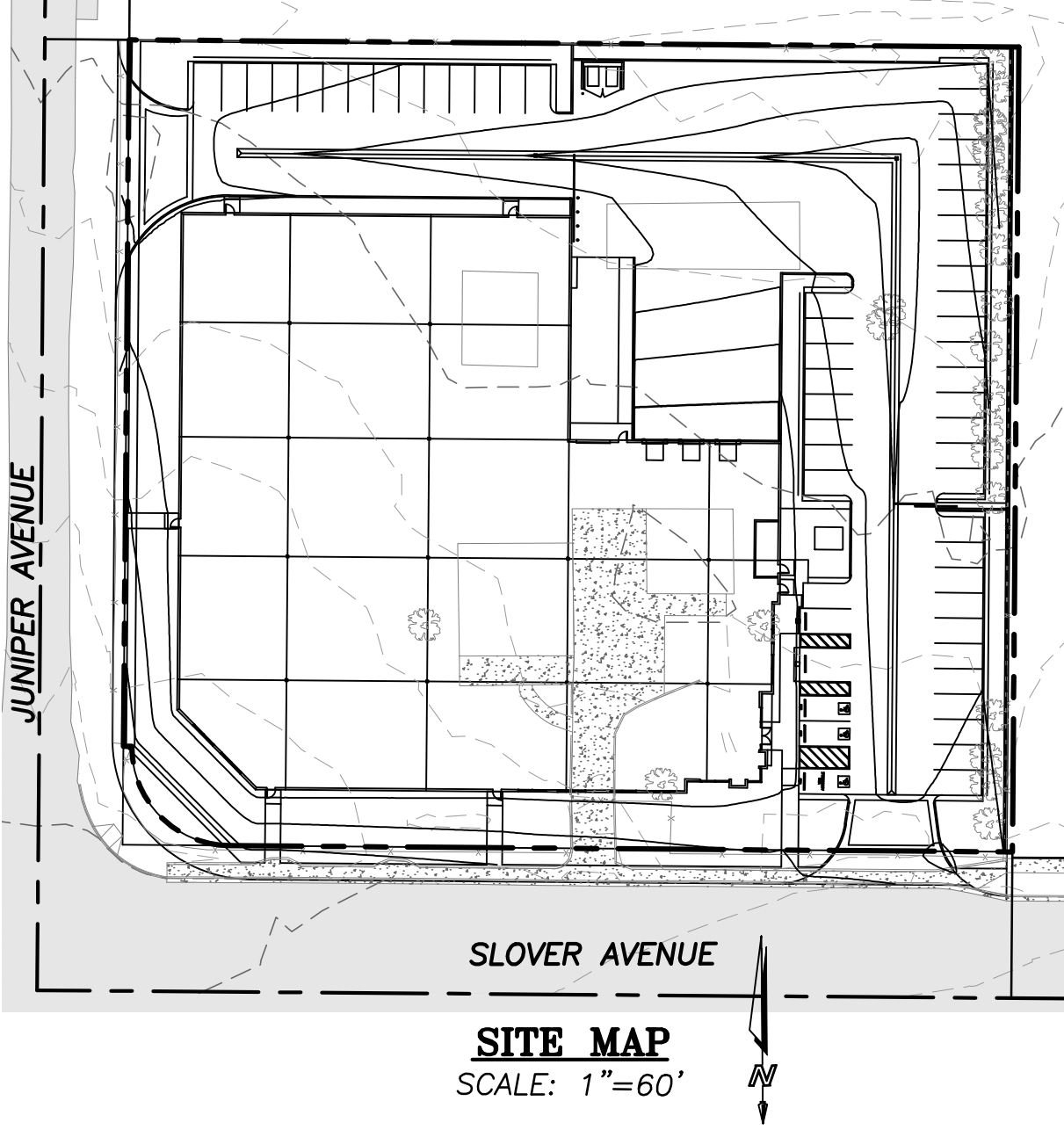
NUMBER OF ACCESSIBLE PARKING:

ACCESSIBLE PARKING STALLS: 3

PRECISE GRADING PLAN

ALL OF THE SOUTH 10.25 ACRES, EXCEPT THE EAST 7.56 ACRES, THEREOF, FARM LOT 744, ACCORDING THE MAP SHOWING SUBDIVISION OF LANDS BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, IN THE CITY OF FONTANA, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 11, PAGE 12 OF MAPS, RECORDS OF SAID COUNTY.

APN 0251-203-09, FONTANA, CA 92337



SITE MAP

SCALE: 1"=60'

DRAINAGE AND EROSION/ DUST CONTROL

- PROVIDE A SLOPE INTERCEPTOR DRAIN ALONG THE TOP OF CUT SLOPES WHEN THE DRAINAGE PATH IS GREATER THAN 40 FEET TOWARDS THE CUT SLOPE.
- PROVIDE 5' WIDE BY 1' HIGH BERM ALONG THE TOP OF ALL FILL SLOPES STEEPER THAN 3:1.
- MINIMUM BUILDING PAD DRAINAGE GRADIENT SHALL BE = 1% IF CUT OR FILL IS LESS THAN 10', 2% IF CUT OR FILL IS GREATER THAN 10'.
- DRAINAGE SWALES SHALL BE A MINIMUM OF 0.2' DEEP AND BE CONSTRUCTED A MINIMUM OF 2' FROM THE TOP OF CUT OR FILL SLOPES WITH A MINIMUM GRADIENT OF 1%.
- NO OBSTRUCTION OF NATURAL WATER COURSES SHALL BE PERMITTED.
- DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL (BEST MANAGEMENT PRACTICES, BMPS) SHALL BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
- DUST SHALL BE CONTROLLED BY WATERING OR OTHER APPROVED METHODS.
- ALL EXISTING DRAINAGE COURSES ON THE PROJECT SITE MUST CONTINUE TO FUNCTION. PROTECTIVE MEASURES AND TEMPORARY DRAINAGE PROVISIONS MUST BE USED TO PROTECT ADJOINING PROPERTIES DURING GRADING OPERATIONS.
- FINISH GRADE SHALL BE SLOPED AWAY FROM ALL EXTERIOR WALLS AT NOT LESS THAN 1/4" PER FOOT FOR A MINIMUM OF 3'.
- FOR SLOPES 3 TO 1 (H/V) OR STEEPER.
- ALL SLOPES EQUAL TO OR GREATER THAN 3' IN VERTICAL HEIGHT, ARE REQUIRED TO BE PLANTED WITH GRASS OR ROSEA ICE PLANT (OR EQUAL) GROUND COVER AT A MAXIMUM SPACING OF 12" ON CENTER. SLOPES EXCEEDING 15' IN VERTICAL HEIGHT SHALL BE PLANTED WITH APPROVED SHRUBS NOT TO EXCEED 10' ON CENTER, OR TREES SPACED NOT TO EXCEED 20' ON CENTER OR SHRUBS NOT TO EXCEED 10', OR A COMBINATION OF SHRUBS AND TREES NOT TO EXCEED 15' IN ADDITION TO THE GRASS OR GROUND COVER. SLOPES THAT REQUIRE PLANTING SHALL BE PROVIDED WITH AN IN-GROUND IRRIGATION SYSTEM EQUIPPED WITH AN APPROPRIATE BACKFLOW DEVICE PER U.P.C., CHAPTER 10. THE SLOPE PLANTING AND IRRIGATION SYSTEM SHALL BE INSTALLED PRIOR TO PRECISE GRADING FINAL.

COMPLETION OF WORK

- A REGISTERED CIVIL ENGINEER SHALL SUBMIT TO THE BUILDING AND SAFETY DEPARTMENT WRITTEN CERTIFICATION OF COMPLETION OF GRADING IN ACCORDANCE WITH THE APPROVED GRADING PLAN PRIOR TO REQUESTING INSPECTION AND ISSUANCE OF THE BUILDING PERMIT. CERTIFICATION SHALL INCLUDE LINE, GRADE, SURFACE DRAINAGE, ELEVATION, AND LOCATION OF PERMITTED GRADING ON THE LOT.

NPDES : WHEN ONE ACRE OR MORE IS BEING DISTURBED:

- CONSTRUCTION SITE BEST MANAGEMENT PRACTICES (BMPS) FOR THE MANAGEMENT OF STORM WATER AND NON-STORMWATER DISCHARGES SHALL BE DOCUMENTED ON THE GRADING PLAN WHICH THEREBY BECOMES THE SITE STORM WATER POLLUTION PREVENTION PLAN (SWPPP). ARRANGEMENTS SHALL BE MADE BY THE DEVELOPER TO RETAIN THE SWPPP ON THE JOBSITE THROUGHOUT THE TIME OF CONSTRUCTION. THE IMPLEMENTATION AND MAINTENANCE OF SITE BMPS IS REQUIRED TO MINIMIZE JOBSITE EROSION AND SEDIMENTATION. CERTAIN BMPS MAY BE REQUIRED TO REMAIN IN PLACE THROUGHOUT THE YEAR TO MINIMIZE EROSION AND SEDIMENTATION. ARRANGEMENTS SHALL BE MADE BY THE DEVELOPER TO MAINTAIN THOSE BMPS THROUGHOUT THE TIME OF CONSTRUCTION.
- EROSION CONTROL BMPS SHALL BE IMPLEMENTED AND MAINTAINED TO MINIMIZE THE ENTRAINMENT OF SOIL IN RUNOFF FROM DISTURBED SOIL AREAS ON CONSTRUCTION SITES.
- SEDIMENT CONTROL BMPS SHALL BE IMPLEMENTED AND MAINTAINED TO MINIMIZE THE TRANSPORT OF SOIL FROM THE CONSTRUCTION SITE.
- GRADING SHALL BE PHASED TO LIMIT THE AMOUNT OF DISTURBED AREAS EXPOSED TO THE EXTENT FEASIBLE.
- AREAS THAT ARE CLEARED AND GRADED SHALL BE LIMITED TO ONLY THE PORTION OF THE SITE THAT IS NECESSARY FOR CONSTRUCTION. THE CONSTRUCTION SITE SHALL BE MANAGED TO MINIMIZE THE EXPOSURE TIME OF DISTURBED SOIL AREAS THROUGH PHASING AND SCHEDULING OF GRADING AND THE USE OF TEMPORARY AND PERMANENT SOIL STABILIZATION.
- ONCE DISTURBED, SLOPES (TEMPORARY OR PERMANENT) SHALL BE STABILIZED IF THEY WILL NOT BE WORKED WITHIN 21 DAYS. DURING THE STORM SEASON, ALL SLOPES SHALL BE STABILIZED PRIOR TO A PREDICTED STORM EVENT. CONSTRUCTION SITES SHALL BE REVEGETATED AS EARLY AS FEASIBLE AFTER SOIL DISTURBANCE.
- STOCKPILES OF SOIL SHALL BE PROPERLY CONTAINED TO ELIMINATE OR REDUCE SEDIMENT TRANSPORT FROM THE SITE TO STREETS, DRAINAGE FACILITIES OR ADJACENT PROPERTIES VIA RUNOFF, VEHICLE TRACKING, OR WIND.
- CONSTRUCTION SITES SHALL BE MAINTAINED IN SUCH A CONDITION THAT A STORM DOES NOT CARRY WASTES OR POLLUTANTS OFF THE SITE. DISCHARGES OTHER THAN STORMWATER (NON-STORMWATER DISCHARGES) ARE PROHIBITED, EXCEPT AS AUTHORIZED BY AN INDIVIDUAL NPDES PERMIT. THE STATEWIDE GENERAL PERMIT-CONSTRUCTION ACTIVITY. POTENTIAL POLLUTANTS INCLUDE BUT ARE NOT LIMITED TO: SOLID OR LIQUID CHEMICAL SPILLS; WASTES FROM PAINTS, STAINS, SEALANTS, SOLVENTS, DETERGENTS, GLUES, LIME, PESTICIDES, HERBICIDES, FERTILIZERS, WOOD PRESERVATIVES, AND ASBESTOS FIBERS, PAINT FLAKES OR STUCCO FRAGMENTS; FUELS, OILS LUBRICANTS, AND HYDRAULIC, RADIATOR OR BATTERY FLUIDS; CONCRETE AND RELATED CUTTING OR CURING RESIDUES; FLOATABLE WASTES; WASTES FROM ENGINE/EQUIPMENT STEAM CLEANING OR CHEMICAL DEGREASING; WASTES FROM STREET CLEANING; AND SUPER-CHLORINATED POTABLE WATER FROM LINE FLUSHING AND TESTING. DURING CONSTRUCTION, DISPOSAL OF SUCH MATERIALS SHOULD OCCUR IN A SPECIFIED AND CONTROLLED TEMPORARY AREA ON-SITE PHYSICALLY SEPARATED FROM POTENTIAL STORMWATER RUNOFF, WITH ULTIMATE DISPOSAL IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REQUIREMENTS.
- RUNOFF FROM EQUIPMENT AND VEHICLE WASHING SHALL BE CONTAINED AT CONSTRUCTION SITE AND MUST NOT BE DISCHARGED TO RECEIVING WATERS OR THE LOCAL STORM DRAIN SYSTEM.
- APPROPRIATE BMPS FOR CONSTRUCTION-RELATED MATERIALS, WASTES, SPILLS OR RESIDUES SHALL BE IMPLEMENTED TO ELIMINATE OR REDUCE TRANSPORT FROM THE SITE TO STREETS, DRAINAGE FACILITIES, OR ADJOINING PROPERTIES BY WIND OR RUNOFF.
- ALL CONSTRUCTION CONTACTORS AND SUBCONTRACTOR PERSONNEL ARE TO BE MADE AWARE OF THE REQUIRED BMPS AND GOOD HOUSEKEEPING MEASURES FOR THE PROJECT SITE AND ANY ASSOCIATED CONSTRUCTION STAGING AREAS.
- DISCHARGING CONTAMINATED GROUNDWATER PRODUCED BY DEWATERING GROUNDWATER THAT HAS INFILTRATED INTO THE CONSTRUCTION SITE IS PROHIBITED. DISCHARGING OF CONTAMINATED SOILS VIA SURFACE EROSION IS ALSO PROHIBITED. DISCHARGING NON-CONTAMINATED GROUNDWATER PRODUCED BY DEWATERING ACTIVITIES MAY REQUIRE A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FROM THE REGIONAL WATER QUALITY CONTROL BOARD.
- BMPS SHALL BE MAINTAINED AT ALL TIMES. IN ADDITION, BMPS SHALL BE INSPECTED PRIOR TO PREDICTED STORM EVENTS AND FOLLOWING STORM EVENTS.
- AT THE END OF EACH DAY OF CONSTRUCTION ACTIVITY, ALL CONSTRUCTION DEBRIS AND WASTE MATERIALS SHALL BE COLLECTED AND PROPERLY DISPOSED OF IN TRASH OR RECYCLE BINS.

TEMPORARY EROSION CONTROL NOTES:

- TEMPORARY EROSION CONTROL MEASURES ARE REQUIRED FOR GRADING OPERATIONS SCHEDULED FROM OCTOBER 1st TO MAY 31st. APPROVED TEMPORARY EROSION CONTROL PLANS ARE REQUIRED FOR GRADING PROJECTS INVOLVING MORE THAN 4 STRUCTURES, OR WHEN DEEMED NECESSARY BY THE BUILDING OFFICIAL.
- IN CASE OF EMERGENCY, CALL MARC LEBANOFF AT (702) 336-0636.
- THE DESIGN CIVIL ENGINEER SHALL SUPERVISE THE EROSION CONTROL WORK AND VERIFY TO THE DEPARTMENT OF BUILDING AND SAFETY THAT THE WORK WAS COMPLETED IN ACCORDANCE WITH THE APPROVED TEMPORARY EROSION CONTROL PLAN.
- EQUIPMENT AND WORKERS FOR EMERGENCY WORK SHALL BE MADE AVAILABLE DURING THE RAINY SEASON. NECESSARY MATERIALS SHALL BE AVAILABLE ON SITE AND SHALL BE STOCKPILED AT CONVENIENT LOCATIONS TO FACILITATE RAPID CONSTRUCTION OF TEMPORARY DEVICES WHEN RAIN IS IMMINENT.
- DEVICES SHALL NOT BE MOVED OR MODIFIED WITHOUT THE APPROVAL OF THE BUILDING OFFICIAL.
- ALL REMOVABLE PROTECTION DEVICES SHOWN SHALL BE IN PLACE AT THE END OF EACH WORKING DAY WHEN RAIN IS PREDICTED.
- AFTER A RAINSTORM, ALL SILT AND DEBRIS SHALL BE REMOVED FROM CHECK BERMS, SILT FENCES, AND DESILTING BASINS ETC.
- AT THE CONCLUSION OF EACH WORKING DAY GRADED AREAS AROUND THE PROJECT PERIMETER SHALL DRAIN AWAY FROM THE FACE OF SLOPES.
- THE BUILDING OFFICIAL RESERVES THE RIGHT TO MAKE CHANGES OF MODIFICATIONS TO THE TEMPORARY EROSION CONTROL PLAN AS DEEMED NECESSARY.

SHEET INDEX

SHEET 1: TITLE SHEET  
SHEET 2: CONCEPTUAL GRADING PLAN  
SHEET 3: CROSS SECTIONS

OWNER:

LEBBEA, LLC  
C/O MR. MARC LEBANOFF  
18031 IRVINE BOULEVARD, TUSTIN, CA. 92780-3323  
Tel: (702) 336-0636  
Email: mlebanoff@gmail.com

APN NO.: 0251-203-09

SOURCE OF TOPO:

CLE ENGINEERING FIELD TOPO COLLECTED 11/10/2016

SITE AREA CALCULATIONS

TOTAL SITE AREA:	2.07 ac. GROSS
TOTAL SITE AREA:	2.07 ac. NET
TOTAL DISTURBED AREA:	2.07 ac., 100%
IMPERVIOUSNESS AREA:	1.67 ac., 81%

EARTHWORK QUANTITIES

CUT:	6000 Cu. Yds.
FILL:	500 Cu. Yds.
NET:	5500 Cu. Yds

NEAREST FIRE HYDRANT IS APPROXIMATELY 50 FEET AWAY.

BASIS OF BEARING:

CENTERLINE OF SLOVER AVENUE BEING N 89°32'18.69" W

BENCHMARK:

NCS BM UF-629; BRASS DISK LOCATED ON THE TOP OF THE WESTERLY CURB APPROX. 150' SOUTH OF THE INTERSECTION OF POPLAR AVE. & SANTA ANA AVE.; ELEV.=1018.06

WDID NO.:



Know what's below.  
Call before you dig.

DATE	REVISION #	REVISIONS



ACCEPTED BY:	DATE:
FOR BUILDING AND SAFETY DEPARTMENT FONTANA, CALIFORNIA	
PREPARED BY:	
Alex R. Paulsen R.C.E. NO.: 87481	DATE:

CITY OF FONTANA, SAN BERNARDINO COUNTY, STATE OF CALIFORNIA

TITLE SHEET  
16726 SLOVER AVENUE



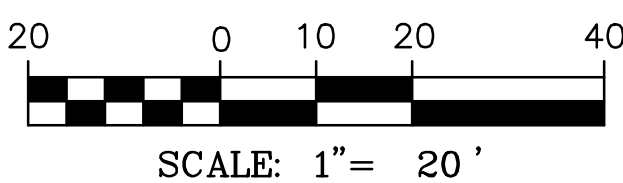
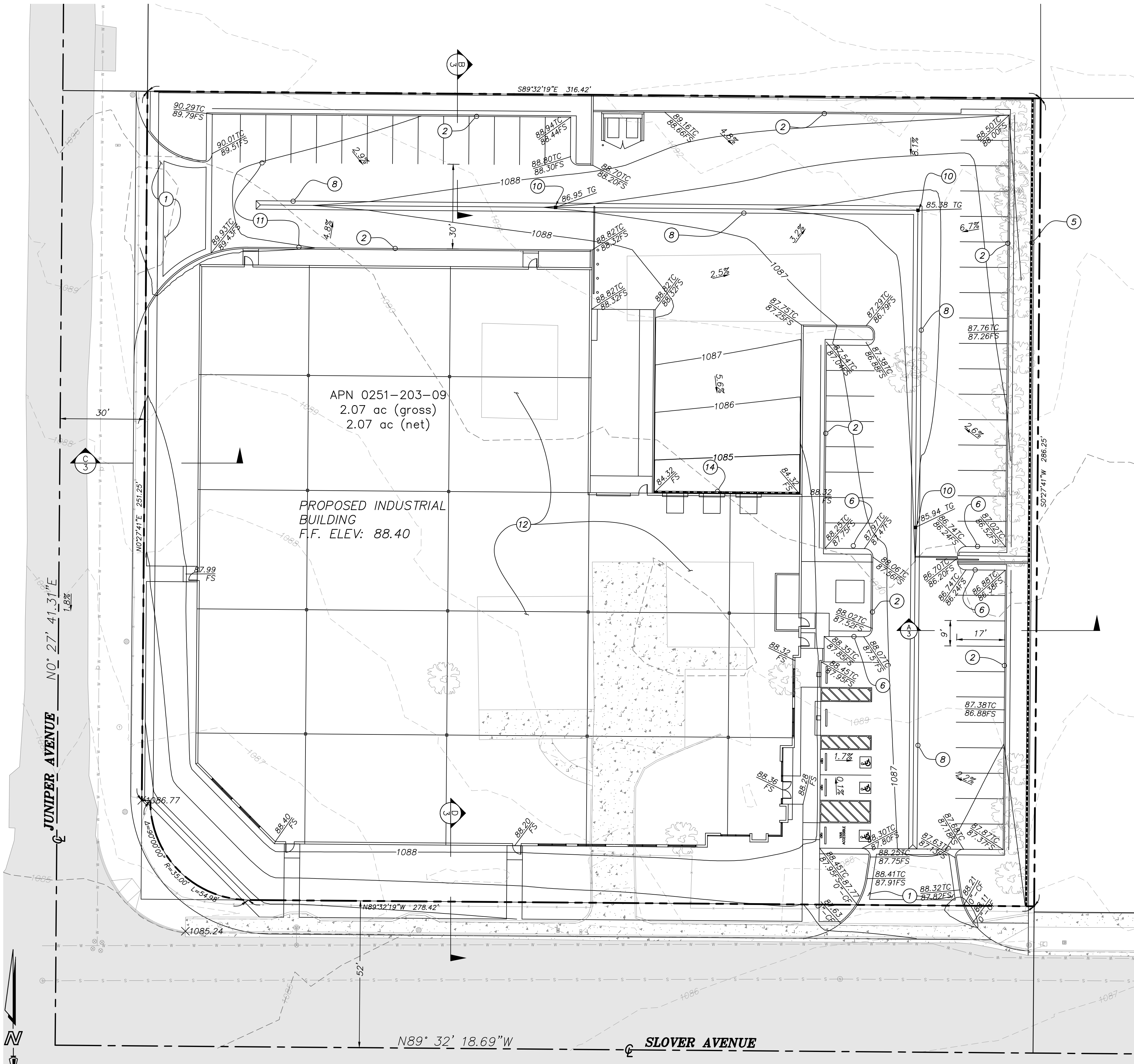
IE SURVEY &  
ENGINEERING, INC.

4116 ELM STREET, SUITE G  
MURRIETA, CA 92562  
T: (951) 696-1838  
E: INFO@IESURVEYANDENG.COM

DESIGNED BY:	DRAWN BY:	CHECKED BY:
APAULSEN	APAULSEN	APAULSEN

SHEET NO.
1 OF 3
DATE: 6/3/20
JOB NO.
19128





DATE	REVISION #	REVISIONS

REGISTERED PROFESSIONAL ENGINEER

ALEXANDER R. PAULSEN

No. 87481

CIVIL

STATE OF CALIFORNIA

ACCEPTED BY: \_\_\_\_\_ DATE: \_\_\_\_\_

FOR BUILDING AND SAFETY DEPARTMENT  
FONTANA, CALIFORNIA

PREPARED BY:  
Alex R. Paulsen  
R.C.E. NO.: 87481

DATE: \_\_\_\_\_

CITY OF FONTANA, SAN BERNARDINO COUNTY, STATE OF CALIFORNIA

**CONCEPTUAL GRADING PLAN**

**16726 SLOVER AVENUE**

IE

SE

SURVEYING & ENGINEERING

DESIGNED BY: APAULSEN

DRAWN BY: APAULSEN

CHECKED BY: APAULSEN

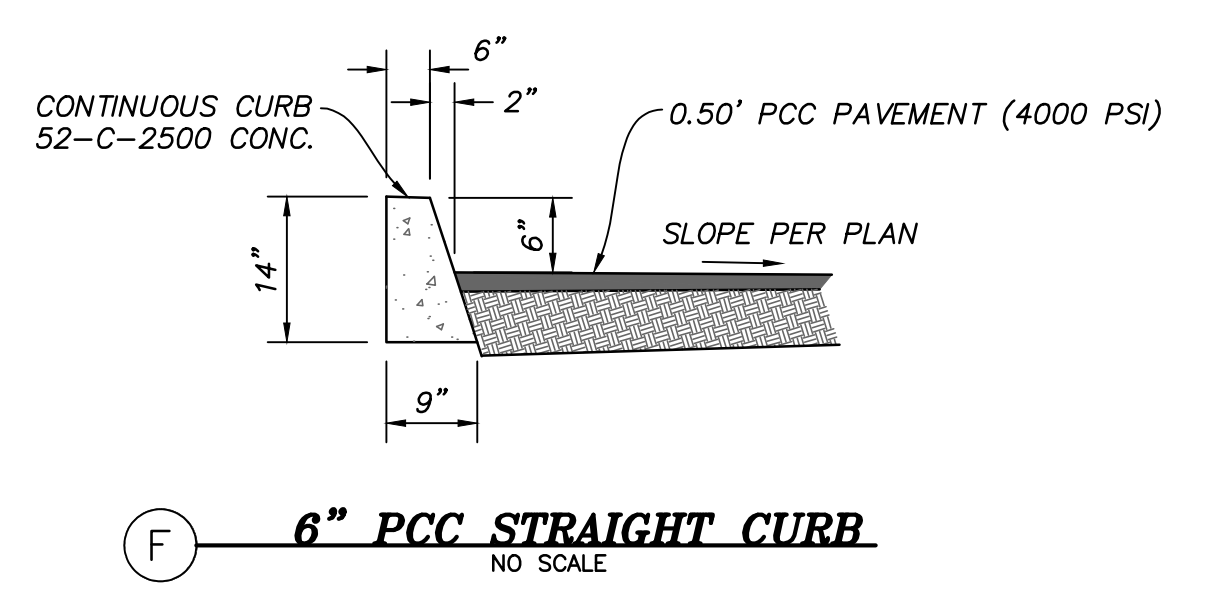
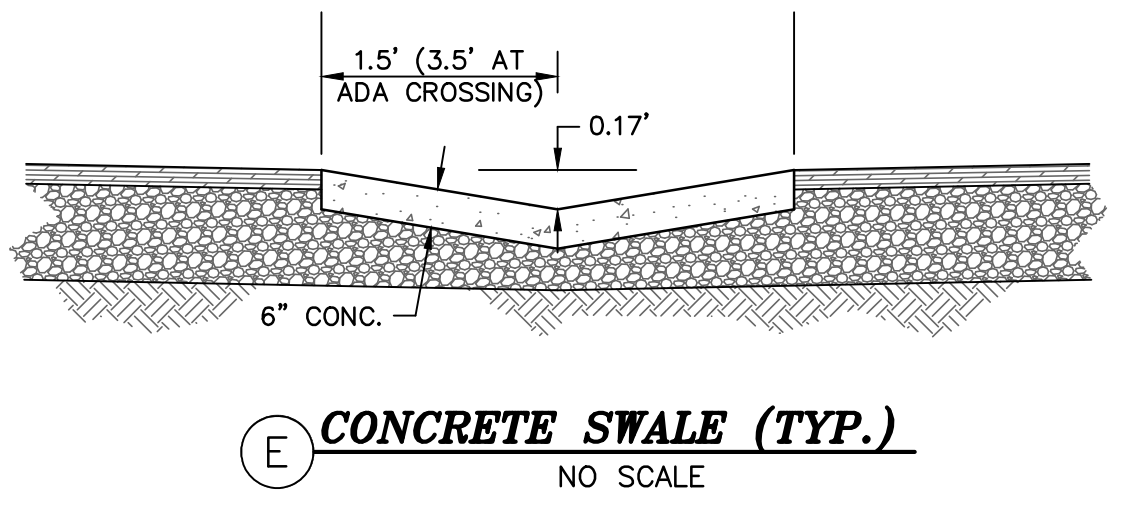
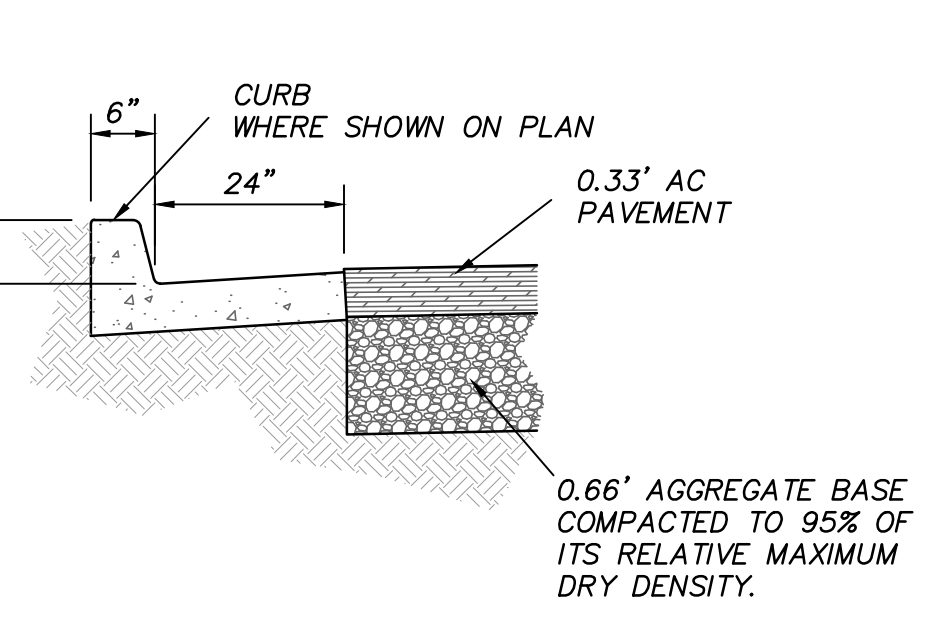
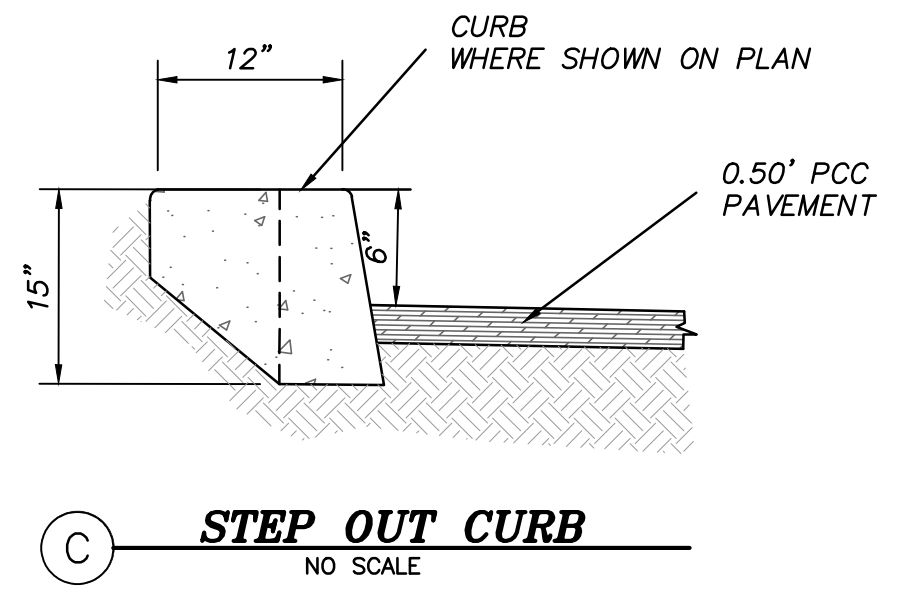
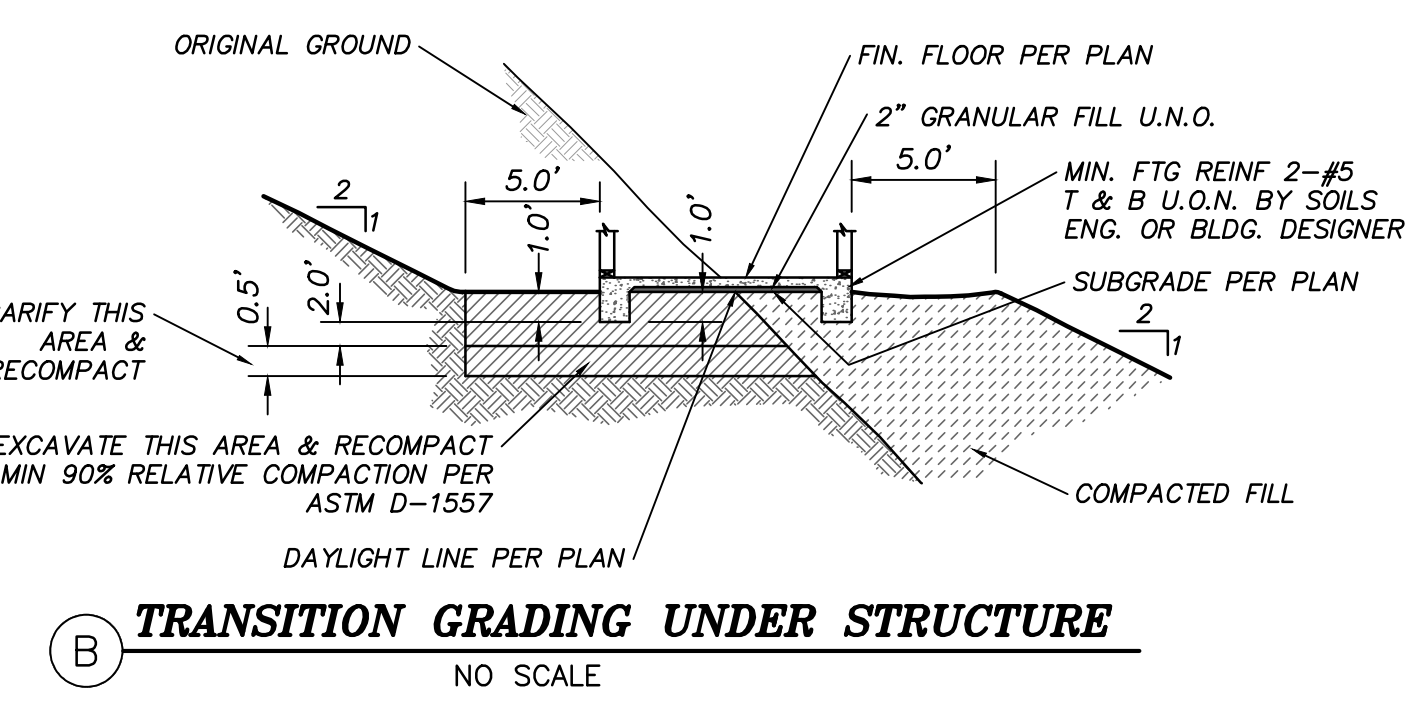
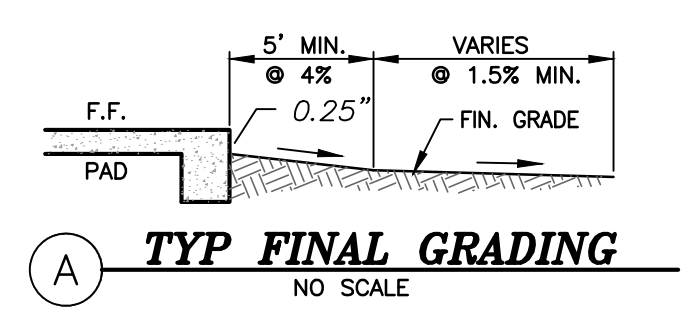
IE SURVEY & ENGINEERING, INC.

41146 ELM STREET, SUITE G  
MURRIETA, CA 92562  
T: (951) 698-1830  
E: INFO@IESURVEYANDENG.COM

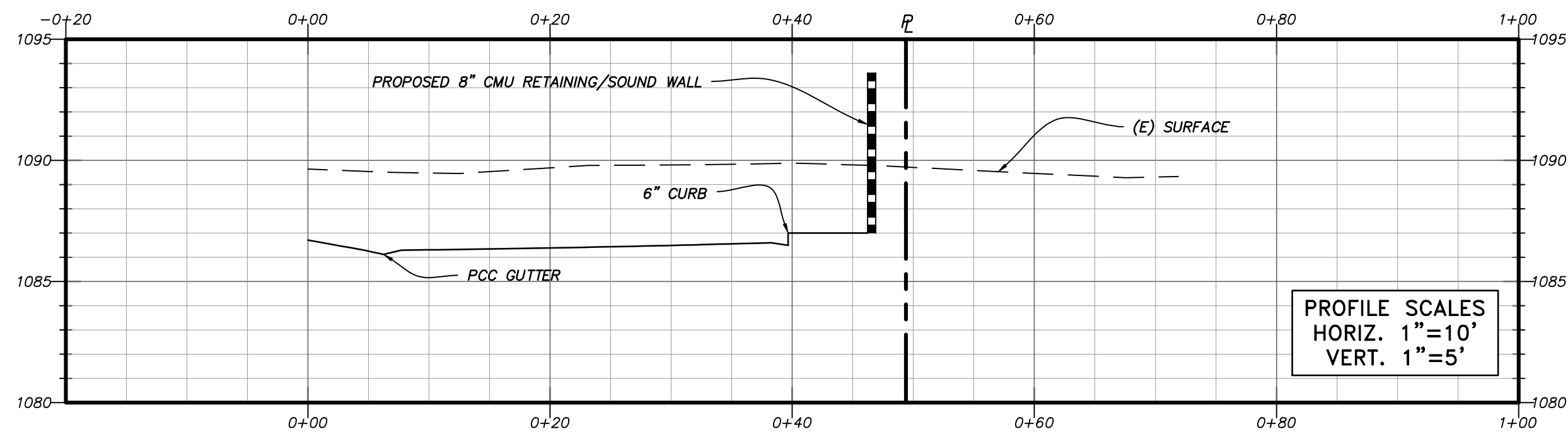
SHEET NO.	2 OF 3
DATE:	6/3/20
JOB NO.	19128

CONSTRUCTION NOTES

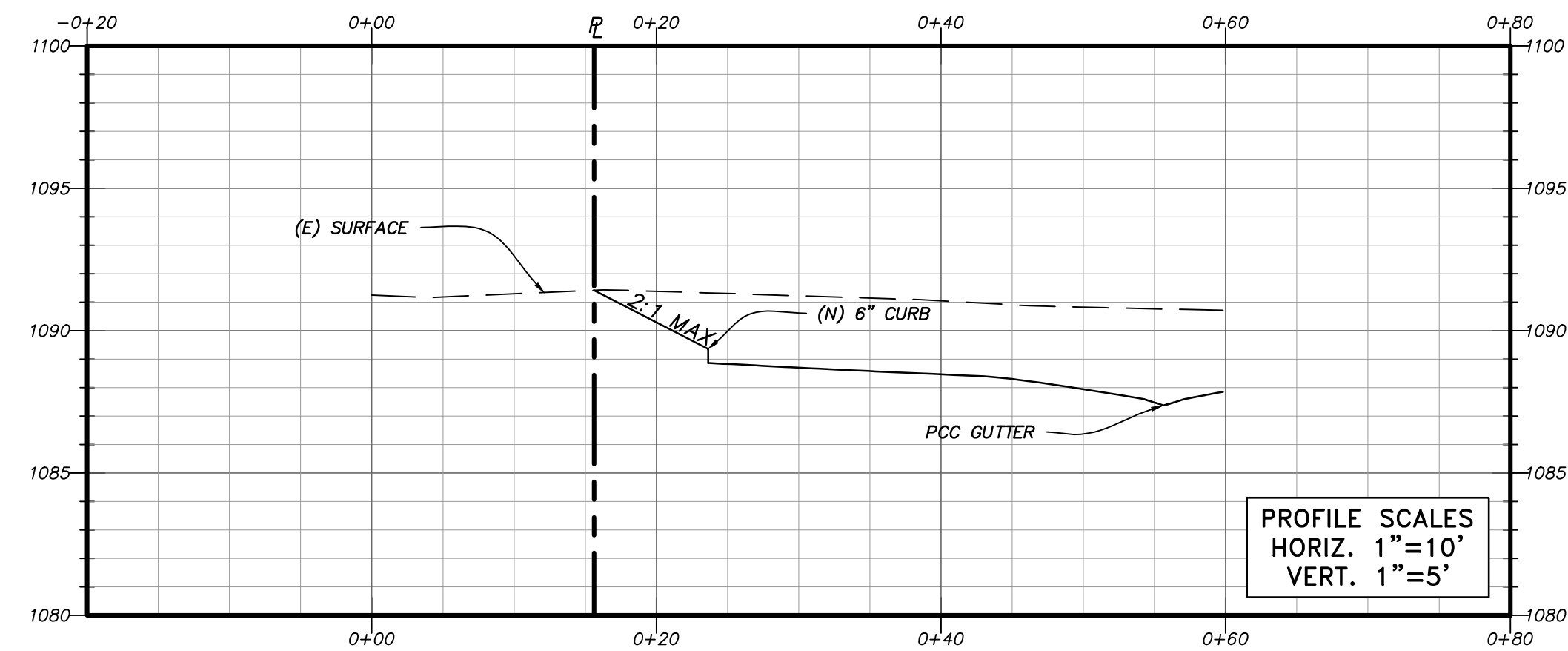
1. CONSTRUCT DRIVEWAY APPROACH PER COUNTY OF SAN BERNARDINO DEPARTMENT OF PUBLIC WORKS STANDARD 129B.
  2. CONSTRUCT 6" P.C.C. CURB PER DETAIL 'F'.
  3. CONSTRUCT 6" PCC PAVEMENT (4000 PSI) OVER 12" OF COMPACTED SUBGRADE, COMPACTED TO 95 PERCENT RELATIVE COMPACTION.
  4. CONSTRUCT CONTECH CMP INFILTRATION CHAMBER PER CONTECH REPORT AND PLANS.
  5. CONSTRUCT 8" NOMINAL CONCRETE MASONRY UNIT (CMU) BLOCK WALL.
  6. CONSTRUCT STEP OFF CURB PER DETAIL 'C'.
  7. FINAL PAD GRADING PER DETAIL 'A'.
  8. CONSTRUCT 3 FOOT WIDE RIBBON GUTTER PER DETAIL 'E'.
  9. CONSTRUCT 6 INCH CURB AND GUTTER PER DETAIL 'D'.
  10. CONSTRUCT 12 INCH BROOKS BOX WITH INLET FILTER FOR WATER QUALITY PRETREATMENT.
  11. WHEEL TRACK FOR 30' x 8.5' TRUCK WITH 20' WHEELBASE.
  12. ALL EXISTING BUILDINGS TO BE DEMOLISHED.
  13. ALL EXISTING TREES TO BE REMOVED. ROOT SYSTEM TO BE REMOVED TO ENSURE NO ORGANIC MATERIAL REMAINS UNDER ANY STRUCTURAL IMPROVEMENTS.
  14. INSTALL 8-INCH NDS TRENCH DRAIN WITH CLASS C LOAD GRATE OR ENGINEER APPROVED EQUIVALENT.
- NOTE: ANY PROPOSED GATE(S) SHALL BE REVIEWED AND APPROVED BY THE FIRE DEPARTMENT AND SHALL BE EQUIPPED WITH THE KNOX RAPID ENTRY SYSTEM.



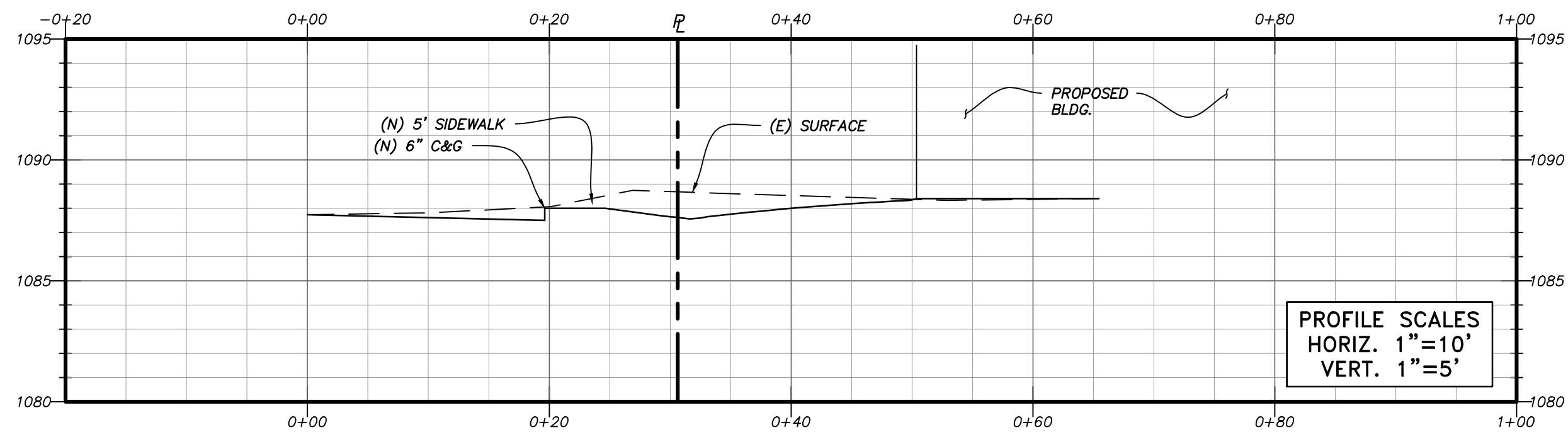




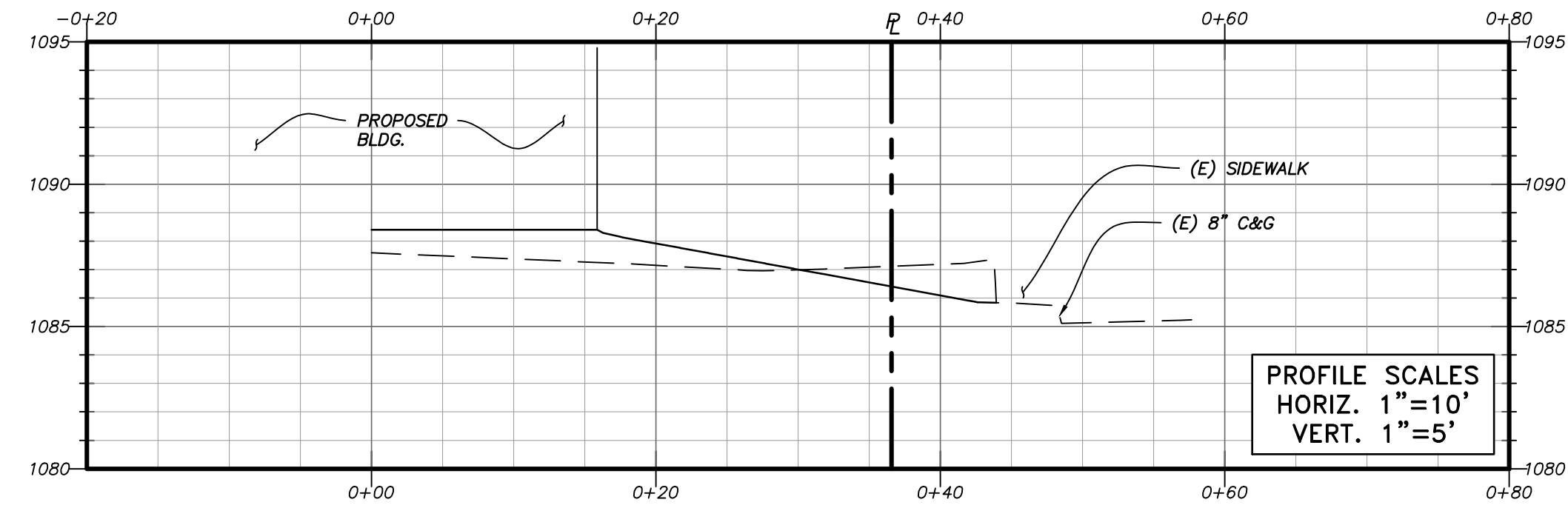
**A-A, EAST PL**



**B-B, NORTH PL**



**C-C, WEST PL**



**D-D, SOUTH PL**



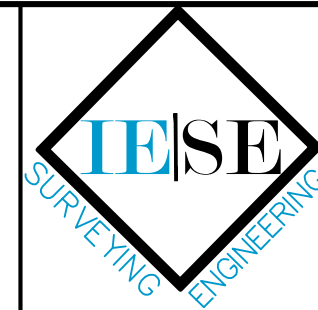
DATE	REVISION #	REVISIONS



ACCEPTED BY:	DATE: _____
FOR BUILDING AND SAFETY DEPARTMENT FONTANA, CALIFORNIA	
PREPARED BY:	
Alex R. Paulsen R.C.E. NO.: 87481	DATE: _____

CITY OF FONTANA, SAN BERNARDINO COUNTY, STATE OF CALIFORNIA

**CROSS SECTIONS**  
**16726 SLOVER AVENUE**



**IE SURVEY & ENGINEERING, INC.**  
41146 ELM STREET, SUITE G  
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T: (951) 698-1530  
E: INFO@IESURVEYANDENG.COM

DESIGNED BY: APAUlsen	DRAWN BY: APAUlsen	CHECKED BY: APAUlsen
--------------------------	-----------------------	-------------------------

SHEET NO. <b>3 OF 3</b>
DATE: 6/3/20
JOB NO. <b>19128</b>

**Attachment A**  
**Legal Description**



*First American*

ISSUED BY

**First American Title Insurance Company**

File No: NCS-932816-A-ONT1

## Exhibit A

File No.: NCS-932816-A-ONT1

The Land referred to herein below is situated in the City of Fontana, County of San Bernardino, State of California, and is described as follows:

ALL OF THE SOUTH 10.25 ACRES, EXCEPT THE EAST 7.56 ACRES, THEREOF, FARM LOT 744, ACCORDING THE MAP SHOWING SUBDIVISION OF LANDS BELONGING TO THE SEMI-TROPIC LAND AND WATER COMPANY, IN THE CITY OF FONTANA, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN [BOOK 11, PAGE 12](#) OF MAPS, RECORDS OF SAID COUNTY.

NOTE: THE AREA AND DISTANCES OF THE ABOVE DESCRIBED PROPERTY ARE COMPUTED TO THE CENTERS OF THE ADJOINING STREETS SHOWN ON SAID MAP.

For conveyancing purposes only: APN 0251-203-09-0-000

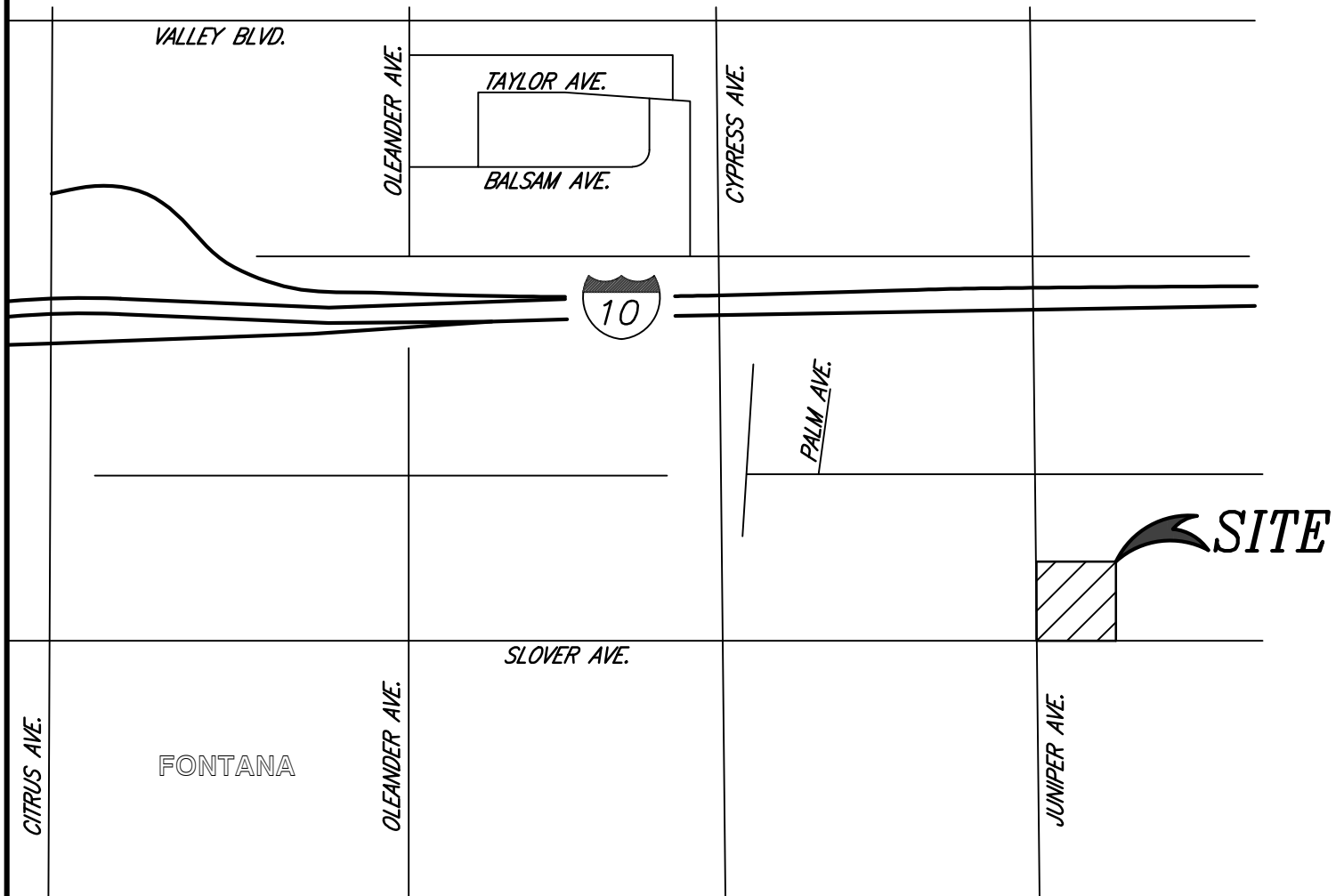
*This page is only a part of a 2016 ALTA® Commitment for Title Insurance issued by First American Title Insurance Company. This Commitment is not valid without the Notice; the Commitment to Issue Policy; the Commitment Conditions; Schedule A; Schedule B, Part I-Requirements; Schedule B, Part II-Exceptions.*

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**Attachment B**  
**Vicinity Map**

# WQMP VICINITY MAP



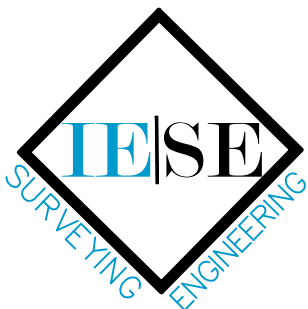
## VICINITY MAP

T:1S, R:6W  
NO SCALE

APN: 0251-203-09

LEBBEA, LLC  
C/O MR. MARC LEBANOFF  
18031 IRVINE BOULEVARD,  
TUSTIN, CA. 92780-3323

PREPARED BY:



**IE SURVEY &  
ENGINEERING, INC.**

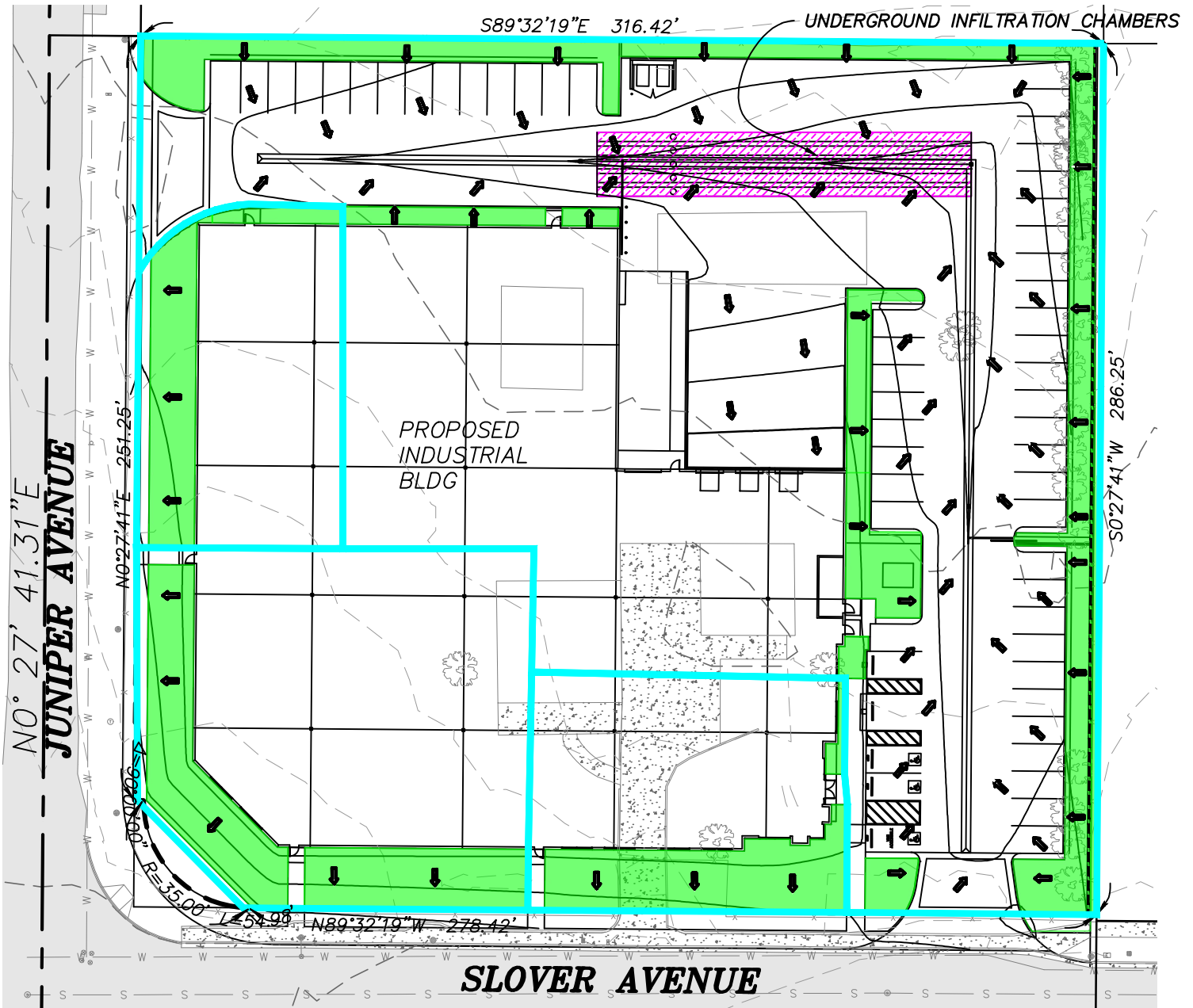
41146 ELM STREET, SUITE G  
MURRIETA, CA 92562  
T: (951) 698.1830  
E: INFO@IESURVEYANDENG.COM



**Attachment C**  
**8.5 x 11 WQMP Exhibit**

# EXHIBIT "C"

WQMP SITE PLAN - 8.5" X 11"

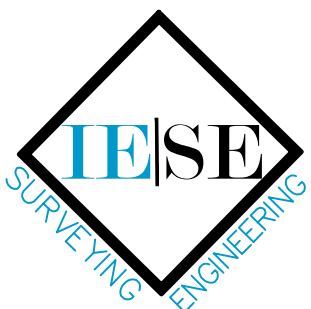


APN: 0251-203-09

LEBSEA, LLC  
C/O MR. MARC LEBANOFF  
18031 IRVINE BOULEVARD,  
TUSTIN, CA. 92780-3323

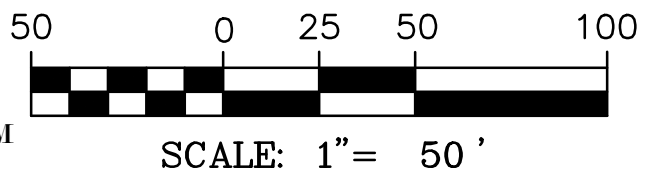
**LEGEND**  
SITE BMP INFILTRATION TRENCH  
FLOW DIRECTION

PREPARED BY:



**IE SURVEY &  
ENGINEERING, INC.**

41146 ELM STREET, SUITE G  
MURRIETA, CA 92562  
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E: INFO@IESURVEYANDENG.COM

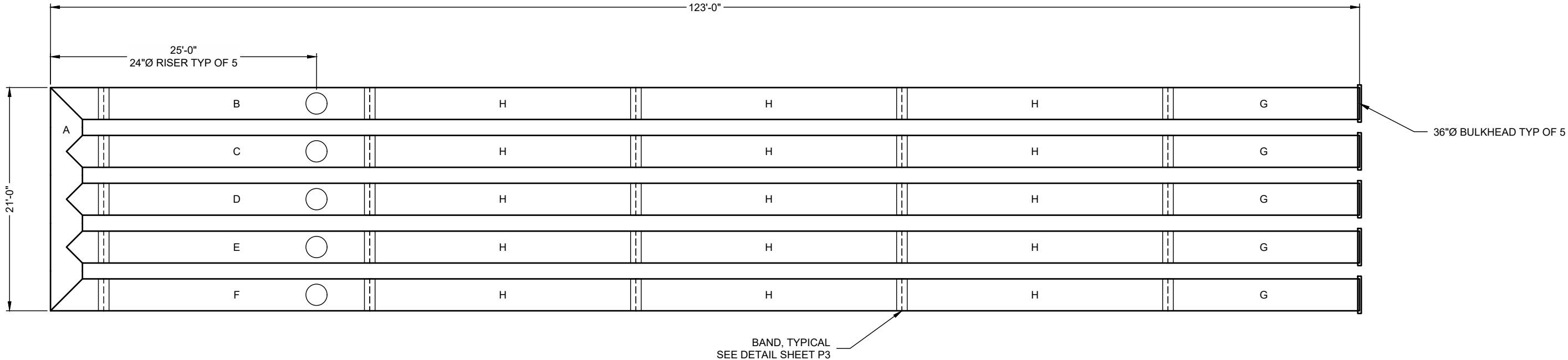


**Attachment D**  
**Underground Infiltration Manufacturer Plan and  
Specifications**



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RISER INFORMATION		
PIECE	RIM ELEV.	SYSTEM INVERT
24"Ø RISER B1	TBD	TBD
24"Ø RISER C1	TBD	TBD
24"Ø RISER D1	TBD	TBD
24"Ø RISER E1	TBD	TBD
24"Ø RISER F1	TBD	TBD



NOTES

- THE PIPE SHOULD BE FULLY PERFORATED IN ACCORDANCE WITH AASHTO M 36, SECTION 8.3.2.2, AND USING CLASS 2 PERFORATIONS. THE TOTAL OPEN AREA OF THE PERFORATIONS WILL BE A MINIMUM OF 2.3% OF THE PIPE SURFACE AREA.
- BULKHEADS SHALL BE 12-GAGE OR HEAVIER STEEL AND THE COATING WILL MATCH THE SPECIFIED CMP COATING. BULKHEAD PLATES SHALL BE FULLY WELDED ONTO THE CMP WITH STEEL REINFORCEMENT AS REQUIRED. THE STEEL REINFORCEMENT SHALL BE POST COATED WITH ZINC RICH PAINT PER AASHTO M 36. BULKHEAD DESIGNS SHALL SATISFY THE REQUIREMENTS SHOWN IN CHAPTER 8 OF THE NCSPA CSP DESIGN MANUAL AND CALCULATIONS SHALL BE PROVIDED TO THE ENGINEER OF RECORD (EOR) FOR APPROVAL UPON REQUEST.
- ALL FITTINGS SHALL BE STRUCTURALLY CHECKED FOR REINFORCEMENTS PER ASTM A998 AND PROVIDED TO THE EOR FOR APPROVAL UPON REQUEST.
- CONNECTING BANDS FOR INFILTRATION SYSTEMS SHALL BE ANY TYPE, BUT MUST BE AT LEAST 12" WIDE. BANDS SHALL MATCH THE SPECIFIED CMP COATING AND MEET THE REQUIREMENTS OF AASHTO M 36.
- ALL METALLIC COATINGS AFFECTED BY MANUFACTURING FABRICATION SHALL BE REPAIRED PER AASHTO M 36 SECTION 11 REQUIREMENTS (E.G. ZINC-RICH PAINT ON ALL WELDS). IF POLYMER COATINGS ARE USED THE REPAIR OF DAMAGED COATINGS WILL BE IN CONFORMANCE WITH AASHTO M 245 SECTION 11 REQUIREMENTS.
- ACCESS LADDERS SHALL BE ATTACHED BY THE MANUFACTURER PRIOR TO DELIVERY, NOT INSTALLED ON THE JOBSITE.

**ASSEMBLY**  
SCALE: 1" = 10'  
PIPE STORAGE: 4,390 CF  
STRUCTURAL BACKFILL STORAGE: 2,844 CF  
TOTAL STORAGE PROVIDED: 7,234 CF  
LOADING: H2O  
PIPE INV. = TBD±

THE UNDERSIGNED HEREBY APPROVES THE ATTACHED  
(4) PAGES INCLUDING THE FOLLOWING:

- PIPE STORAGE = 4,390 CF
- MAINLINE PIPE GAGE = 16
- WALL TYPE = PERFORATED
- DIAMETER = 36"
- FINISH = ALT2
- CORRUGATION = 2 2/3x1/2

CUSTOMER

DATE

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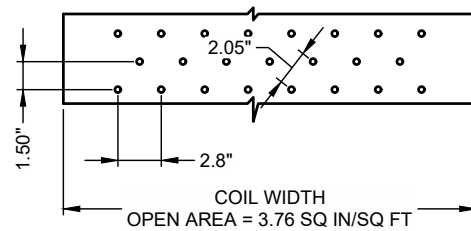
11815 NE Glenn Widing Drive, Portland, OR 97220  
800-548-4667 503-240-3393 800-561-1271 FAX

**CONTECH**  
CMP DETENTION SYSTEMS

CONTECH  
PROPOSAL  
DRAWING

36"Ø PERFORATED UNDERGROUND RETENTION SYSTEM -  
642176-010  
16726 SLOVER AVENUE  
FONTANA, CA  
SITE DESIGNATION:

PROJECT No.: 642176	SEQ. No.: 010	DATE: 5/14/2020
DESIGNED: RLH	DRAWN: RLH	
CHECKED:	APPROVED:	
SHEET NO.: P1	OF 4	



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. DIMENSIONS SUBJECT TO MANUFACTURER'S TOLERANCES.
4. ALL HOLES 3/8"Ø.

## EXFILTRATION AREA

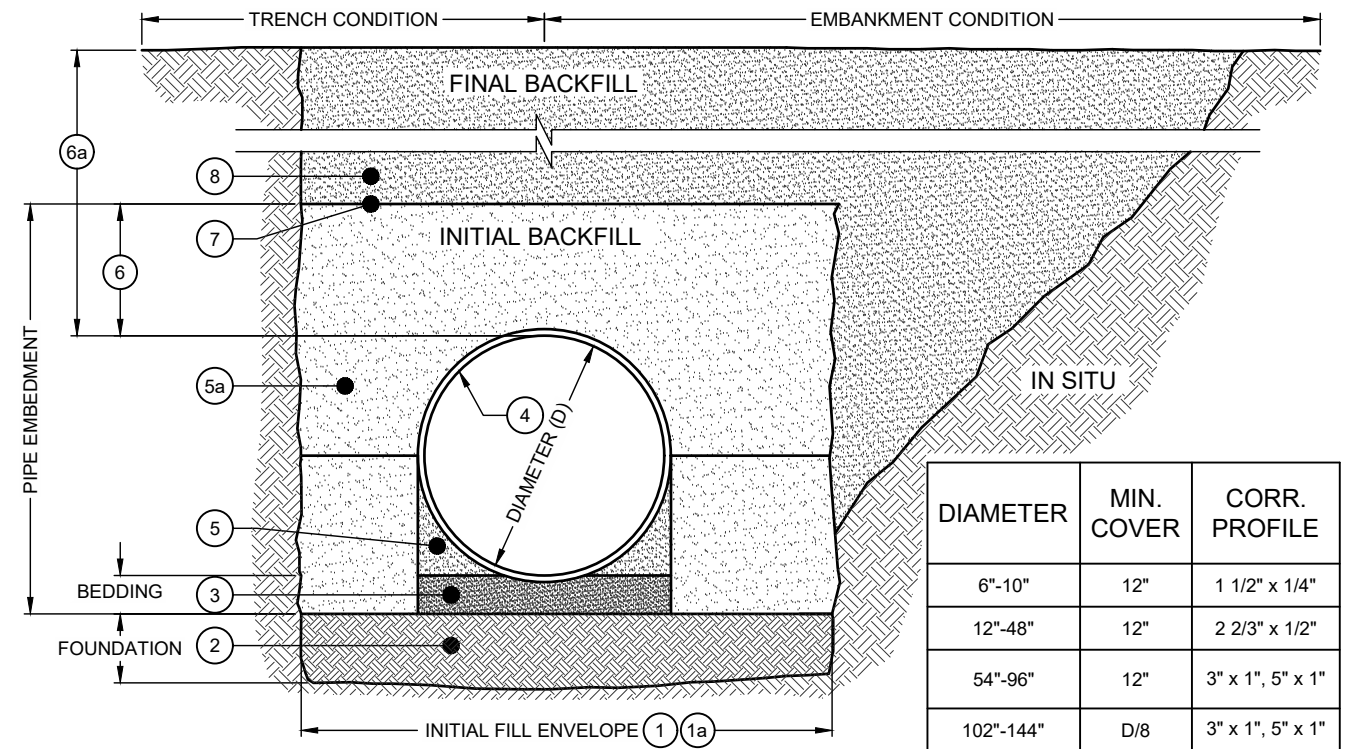
### STANDARD PERFORATION PATTERNS

APPROXIMATE AREA PER LINEAR FOOT OF PIPE				
PIPE	CORRUGATION PATTERN			
	2 2/3" x 1 1/2"	3" x 1"	5" x 1"	ULTRA FLO
36"Ø	36.6 SQ. IN.	38.7 SQ. IN.		

NOTES:

- GAGE AND COATING LIMITATIONS APPLY. 5" x 1" IS NOT AVAILABLE IN ALUMINUM.
- DIMENSIONS SUBJECT TO MANUFACTURER'S TOLERANCES.

**TYPICAL PERFORATION DETAIL**  
NOT TO SCALE



**BACKFILL REQUIREMENTS FOLLOW THE GUIDELINES OF AASHTO LRFD BRIDGE DESIGN (SEC 12) AND CONSTRUCTION (SEC 26)**

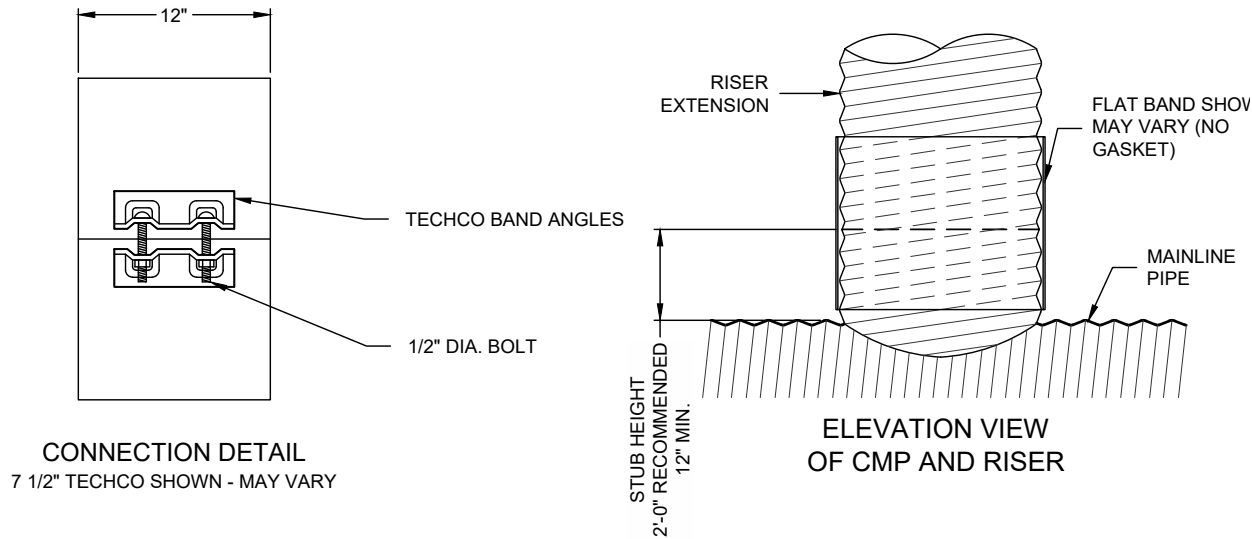
- 1 MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE.  
THE MINIMUM TRENCH WIDTH (12.6.6.1):  
PIPE  $\leq 12"$ :  $D + 16"$   
PIPE  $> 12"$ :  $1.5D + 12"$
- 1a MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE (12.6.6.2):  
PIPE  $< 24"$ :  $3.0D$   
PIPE  $24" - 144"$ :  $D + 4'0"$   
PIPE  $> 144"$ :  $D + 10'0"$
- 2 THE FOUNDATION UNDER THE PIPE AND SIDE BACKFILL SHALL BE ADEQUATE TO SUPPORT THE LOADS ACTING UPON IT (26.5.2).
- 3 BEDDING MATERIAL SHALL BE A RELATIVELY LOOSE GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, AND A MINIMUM OF TWICE THE CORRUGATION DEPTH IN THICKNESS, WITH THE MAXIMUM PARTICLE SIZE OF ONE-HALF OF THE CORRUGATION DEPTH (26.3.8.1, 26.5.3).
- 4 PERFORATED CORRUGATED STEEL PIPE (CSP / HEL-COR).
- 5 HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION (26.5.4).
- 5a BACKFILL MATERIAL SHALL BE A CLEAN, CRUSHED STONE MEETING SIZE NO. 3 OR 4, PER AASHTO M 43. IT IS RECOMMENDED THAT LIFTS NOT EXCEED AN 8" UNCOMPACTED LIFT HEIGHT TO PREVENT UNEVEN LOADING, AND THE LESSER OF 1/3 THE DIAMETER OR 24" AS THE MAXIMUM DIFFERENTIAL SIDE-TO-SIDE. 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 THEIR REPRESENTATIVE, IS SATISFIED WITH THE LEVEL OF COMPACTION (26.5.4).
- 6 INITIAL BACKFILL ABOVE PIPE MAY INCLUDE ROAD BASE MATERIAL (AND RIGID PAVEMENT IF APPLICABLE). SEE TABLE ABOVE.
- 6a TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT (12.6.6.3).
- 7 GEOTEXTILE SHALL BE USED TO WRAP TRENCH SIDES AND TOP ONLY TO PREVENT SOIL MIGRATION INTO VARYING SOIL TYPES (PROJECT ENGINEER).
- 8 FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD (26.5.4.1).

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE PIPE DIA./2 BUT NO LESS THAN 12", OR 36" FOR PIPE DIAMETERS 72" AND LARGER. CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING (TABLE C12.6.7-1).

**TYPICAL BACKFILL DETAIL**  
NOT TO SCALE

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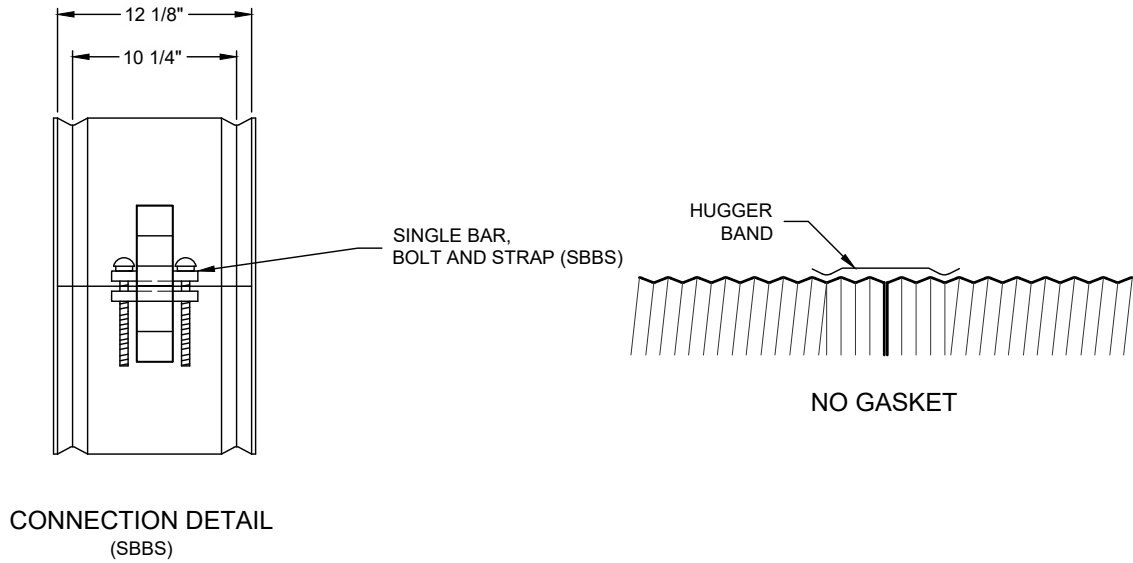
### PLAIN END CMP RISER PIPE

GENERAL NOTES:

1. **DELIVERED BAND STYLE AND FASTENER TYPE MAY VARY BY FABRICATION PLANT.**
2. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
3. BAND MATERIAL AND GAGE TO BE SAME AS RISER MATERIAL.
4. IF RISER HAS A HEIGHT OF COVER OF 10' OR MORE, USE A SLIP JOINT.
5. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
  - 12" THRU 48" 1-PIECE
  - 54" 2-PIECES
6. ALL RISER JOINT COMPONENTS WILL BE FIELD ASSEMBLED.
7. MANHOLE RISERS IN APPLICATIONS WHERE TRAFFIC LOADS ARE IMPOSED REQUIRE SPECIAL DESIGN CONSIDERATIONS.
8. DIMENSIONS SUBJECT TO MANUFACTURING TOLERANCES.

### 12" RISER BAND DETAIL

NOT TO SCALE



### 2 2/3"x1/2" RE-ROLLED END HEL-COR PIPE

GENERAL NOTES:

1. JOINT IS TO BE ASSEMBLED PER AASHTO BRIDGE CONSTRUCTION SPECIFICATION SEC 26.4.2.4.
2. BAND MATERIALS AND/OR COATING CAN VARY BY LOCATION. CONTACT YOUR CONTECH REPRESENTATIVE FOR AVAILABILITY.
3. BANDS ARE SHAPED TO MATCH THE PIPE-ARCH WHEN APPLICABLE.
4. BANDS ARE NORMALLY FURNISHED AS FOLLOWS:
  - 12" THRU 48" 1-PIECE
  - 54" THRU 96" 2-PIECES
  - 102" THRU 144" 3-PIECES
5. BAND FASTENERS ARE ATTACHED WITH SPOT WELDS, RIVETS OR HAND WELDS.
6. ALL CMP IS REROLLED TO HAVE ANNULAR END CORRUGATIONS OF 2 2/3"x1/2"
7. DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
8. ORDER SHALL DESIGNATE GASKET OPTION, IF REQUIRED (SEE DETAILS ABOVE).

### H-12 HUGGER BAND DETAIL

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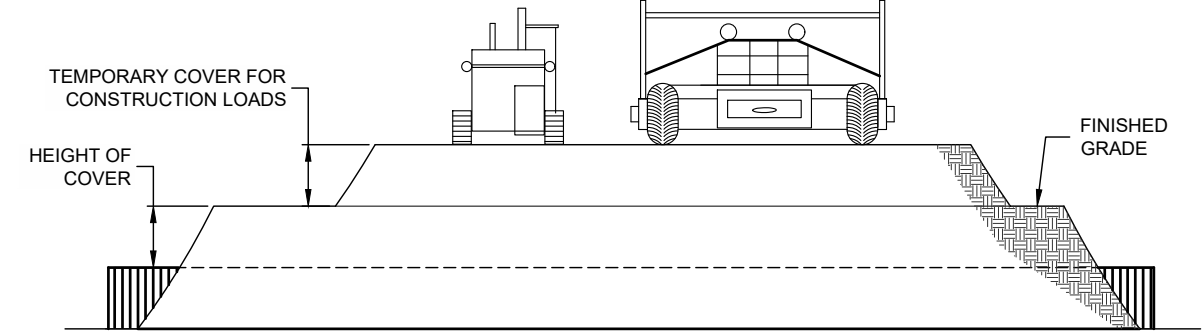
**CONTECH**  
CMP DETENTION SYSTEMS

CONTECH  
PROPOSAL  
DRAWING

36"Ø PERFORATED UNDERGROUND RETENTION SYSTEM -  
642176-010  
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FONTANA, CA  
SITE DESIGNATION:

PROJECT No.: 642176	SEQ. No.: 010	DATE: 5/14/2020
DESIGNED: RLH	DRAWN: RLH	
CHECKED: 	APPROVED: 	
SHEET NO.: P3	OF 4	

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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  
NOT TO SCALE

SPECIFICATION FOR CORRUGATED STEEL PIPE-ALUMINIZED TYPE 2 STEEL

SCOPE

THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE CORRUGATED STEEL PIPE (CSP) DETAILED IN THE PROJECT PLANS.

MATERIAL

THE ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M274 OR ASTM A929.

PIPE

THE CSP SHALL BE MANUFACTURED IN ACCORDANCE WITH THE APPLICABLE REQUIREMENTS OF AASHTO M36 OR ASTM A760. THE PIPE SIZES, GAGES AND CORRUGATIONS SHALL BE AS SHOWN ON THE PROJECT PLANS.

ALL FABRICATION OF THE PRODUCT SHALL OCCUR WITHIN THE UNITED STATES.

MATERIAL SPECIFICATION  
NOT TO SCALE

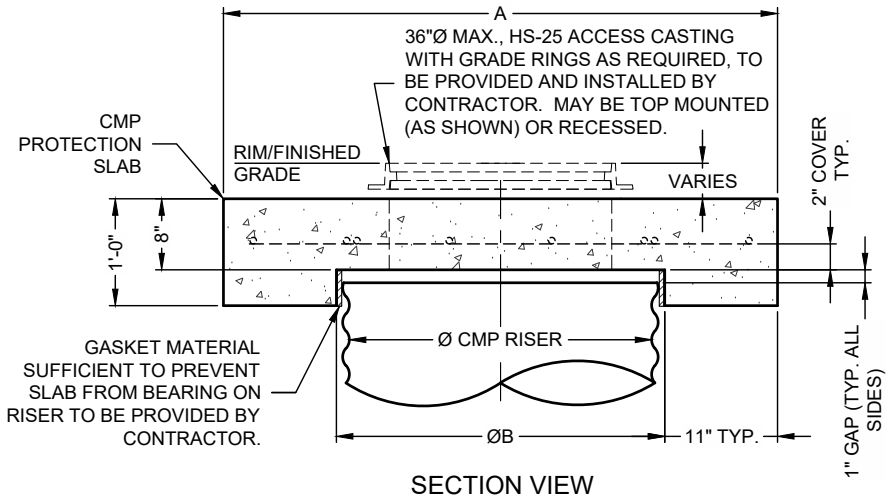
HANDLING AND ASSEMBLY

SHALL BE IN ACCORDANCE WITH RECOMMENDATIONS OF THE NATIONAL CORRUGATED STEEL PIPE ASSOCIATION (NCSPA)

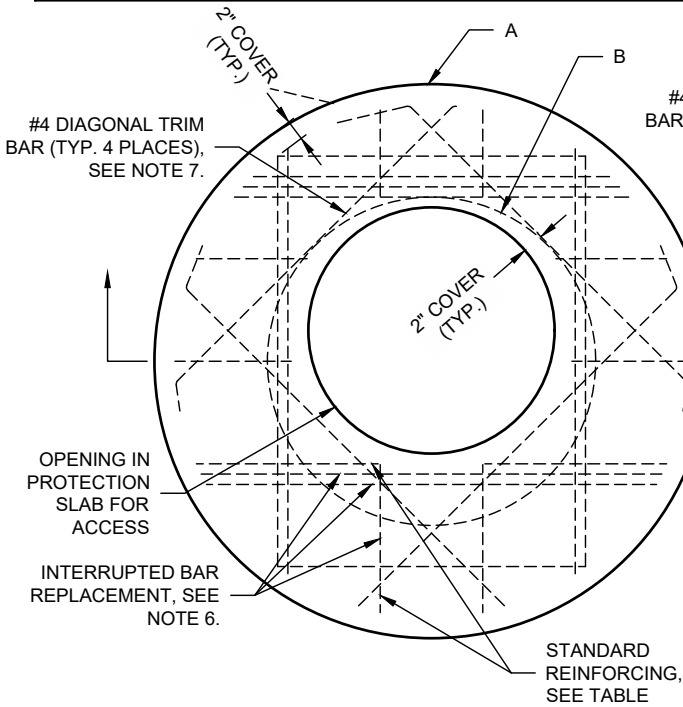
INSTALLATION

SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II OR ASTM A798 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.



ACCESS CASTING NOT SUPPLIED BY CONTECH



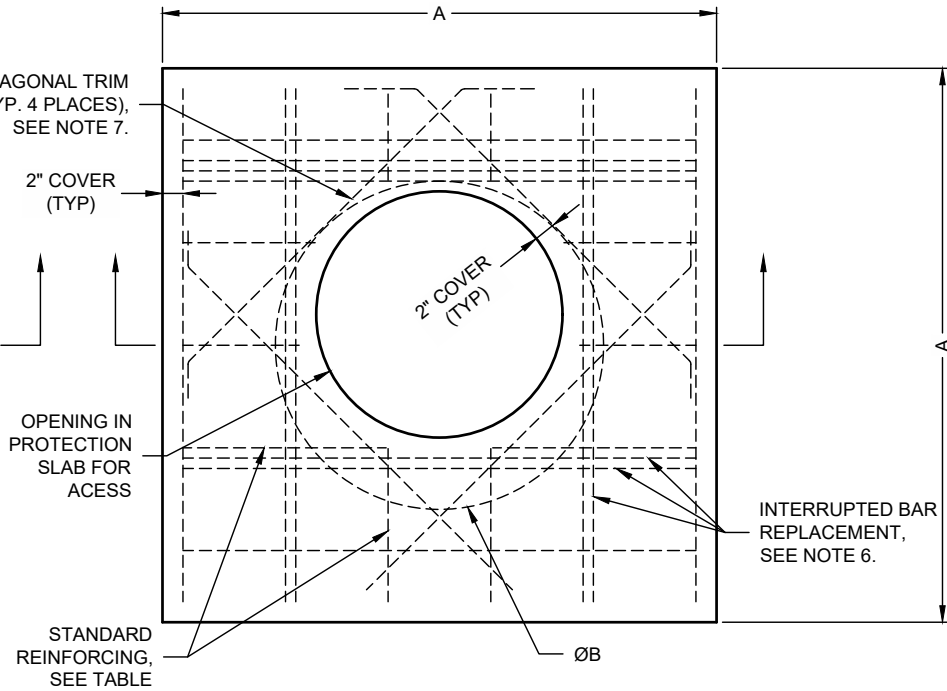
ROUND OPTION PLAN VIEW

NOTES:

- DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION AND ACI 350.
- DESIGN LOAD HS25.
- EARTH COVER = 1' MAX.
- CONCRETE STRENGTH = 4,000 psi
- REINFORCING STEEL = ASTM A615, GRADE 60.
- PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.

REINFORCING TABLE				
Ø CMP RISER	A	B Ø	REINFORCING	**BEARING PRESSURE (PSF)
24"	4'Ø 4'x4'	26"	#5 @ 10" OCEW #5 @ 10" OCEW	2,540 1,900
30"	4'-6"Ø 4'-6" x 4'-6"	32"	#5 @ 10" OCEW #5 @ 9" OCEW	2,260 1,670
36"	5'Ø 5' x 5'	38"	#5 @ 9" OCEW #5 @ 8" OCEW	2,060 1,500
42"	5'-6"Ø 5'-6" x 5'-6"	44"	#5 @ 8" OCEW #5 @ 8" OCEW	1,490 1,370
48"	6'Ø 6' x 6'	50"	#5 @ 7" OCEW #5 @ 7" OCEW	1,210 1,270

\*\* ASSUMED SOIL BEARING CAPACITY



SQUARE OPTION PLAN VIEW

- TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
- PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
- DETAIL DESIGN BY DELTA ENGINEERS, ARCHITECTS AND LAND SURVEYORS, ENDWELL, NY.

MANHOLE CAP DETAIL  
NOT TO SCALE

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DRAWING

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642176-010  
16726 SLOVER AVENUE  
FONTANA, CA  
SITE DESIGNATION:

PROJECT No.: 642176	SEQ. No.: 010	DATE: 5/14/2020
DESIGNED: RLH	DRAWN: RLH	
CHECKED:	APPROVED:	
SHEET NO.: P4	OF 4	

**Attachment E**  
**Infiltration Tests**

# Boring Percolation Testing Field Log B-7

Project No.:  
Project Name:  
Project Location: Slover Avenue & Oleander Avenue, Fontana  
Earth Description: alluvium  
Tested by: CR  
Liquid Description: Clear Clean Water

Date: 08/23/15 - 08/23/15

Boring/Test Number: B-7  
Diameter of Boring, inches: 8  
Diameter of Casing, inches: 2  
Depth of Boring, feet: 5  
Depth to Invert of BMP, feet:  
Depth to Groundwater, feet: NE  
Depth to Initial Water Depth, (d<sub>i</sub>) feet: 3.10

Start Time for Pre-Soak: 8/23/15 8:10  
Start Time for Standard: 8/23/15 9:27  
Standard Time Interval Between Readings, 10 mins.

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Depth (feet) <sup>1</sup>	Water Drop, Δd (feet)	Water Drop, Δd (inch)	Percolation Rate (in/hr)	Initial Height of Water (ft)	Initial Height of Water (in)	Final Height of Water (ft)	Final Height of Water (in)	Change in Height of Water, ΔH (inch)	Average Head Height of Water over Interval	Infiltration Rate (in/hr)	Notes
1	9:27	10	3.10	1.60	19.2	115.2	1.9	22.8	0.3	3.6	19.2	13.2	15.16	Refilled to initial water depth every 30 minutes
	9:37		4.70											
2	9:37	10	3.10	1.30	15.6	93.6	1.9	22.8	0.6	7.2	15.6	15.0	11.01	
	9:47		4.40											
3	9:47	10	3.10	1.30	15.6	93.6	1.9	22.8	0.6	7.2	15.6	15.0	11.01	
	9:57		4.40											
4	9:57	10	3.10	1.20	14.4	86.4	1.9	22.8	0.7	8.4	14.4	15.6	9.82	
	10:07		4.30											
5	10:07	10	3.10	1.00	12.0	72.0	1.9	22.8	0.9	10.8	12.0	16.8	7.66	
	10:17		4.10											
6	10:17	10	3.10	0.90	10.8	64.8	1.9	22.8	1.0	12.0	10.8	17.4	6.68	
	10:27		4.00											
7	10:27	10	3.10	0.80	9.6	57.6	1.9	22.8	1.1	13.2	9.6	18.0	5.76	
	10:37		3.90											
8	10:37	10	3.10	0.60	7.2	43.2	1.9	22.8	1.3	15.6	7.2	19.2	4.08	
	10:47		3.70											
9	10:47	10	3.10	0.60	7.2	43.2	1.9	22.8	1.3	15.6	7.2	19.2	4.08	
	10:57		3.70											
10	10:57	10	3.10	0.50	6.0	36.0	1.9	22.8	1.4	16.8	6.0	19.8	3.30	
	11:07		3.60											
11	11:07	10	3.10	0.30	3.6	21.6	1.9	22.8	1.6	19.2	3.6	21.0	1.88	
	11:17		3.40											
12	11:17	10	3.10	0.31	3.7	22.3	1.9	22.8	1.6	19.1	3.7	20.9	1.95	Final Reading used to calculate the infiltration rate.
	11:27		3.4											

<sup>1</sup>Water depth below ground surface

Infiltration Rate: 1.5 in/hr

# Boring Percolation Testing Field Log B-6

Project No.:  
 Project Name:  
 Project Location: Slover Avenue & Oleander Avenue, Fontana  
 Earth Description: alluvium  
 Tested by: CR  
 Liquid Description: Clear Clean Water

Date: 08/23/15 - 08/23/15

Boring/Test Number: B-6  
 Diameter of Boring, inches: 8  
 Diameter of Casing, inches: 2  
 Depth of Boring, feet: 5  
 Depth to Invert of BMP, feet:  
 Depth to Groundwater, feet: NE  
 Depth to Initial Water Depth, (d,) feet: 3.10

Start Time for Pre-Soak: 8/23/14 8:00  
 Start Time for Standard: 8/23/15 8:20  
 Standard Time Interval Between Readings, 10 mins.

Reading Number	Time Start/End (hh:mm)	Elapsed Time Δtime (min)	Water Depth (feet) <sup>1</sup>	Water Drop, Δd (feet)	Water Drop, Δd (inch)	Percolation Rate (in/hr)	Initial Height of Water (ft)	Initial Height of Water (in)	Final Height of Water (ft)	Final Height of Water (in)	Change in Height of Water, ΔH (inch)	Average Head Height of Water over Interval	Infiltration Rate (in/hr)	Notes
1	8:20	10	3.10	1.30	15.6	93.6	1.9	22.8	0.6	7.2	15.6	15.0	11.01	Refilled to initial water depth every 30 minutes
	8:30		4.40											
2	8:30	10	3.10	1.20	14.4	86.4	1.9	22.8	0.7	8.4	14.4	15.6	9.82	
	8:40		4.30											
3	8:40	10	3.10	1.10	13.2	79.2	1.9	22.8	0.8	9.6	13.2	16.2	8.70	
	8:50		4.20											
4	8:50	10	3.10	1.00	12.0	72.0	1.9	22.8	0.9	10.8	12.0	16.8	7.66	
	9:00		4.10											
5	9:00	10	3.10	0.90	10.8	64.8	1.9	22.8	1.0	12.0	10.8	17.4	6.68	
	9:10		4.00											
6	9:10	10	3.10	0.80	9.6	57.6	1.9	22.8	1.1	13.2	9.6	18.0	5.76	
	9:20		3.90											
7	9:20	10	3.10	0.70	8.4	50.4	1.9	22.8	1.2	14.4	8.4	18.6	4.89	
	9:30		3.80											
8	9:30	10	3.10	0.60	7.2	43.2	1.9	22.8	1.3	15.6	7.2	19.2	4.08	
	9:40		3.70											
9	9:40	10	3.10	0.50	6.0	36.0	1.9	22.8	1.4	16.8	6.0	19.8	3.30	
	9:50		3.60											
10	9:50	10	3.10	0.30	3.6	21.6	1.9	22.8	1.6	19.2	3.6	21.0	1.88	
	10:00		3.40											
11	10:00	10	3.10	0.10	1.2	7.2	1.9	22.8	1.8	21.6	1.2	22.2	0.60	
	10:10		3.20											
12	10:10	10	3.10	0.28	3.4	20.2	1.9	22.8	1.6	19.4	3.4	21.1	1.74	Final Reading used to calculate the infiltration rate.
	10:20		3.4											

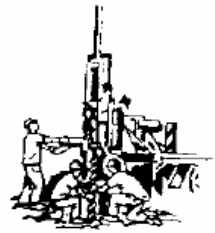
<sup>1</sup>Water depth below ground surface

Infiltration Rate: 1.3 in/hr

# **GEO-ETKA, INC.**

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## **GEOTECHNICAL INVESTIGATION REPORT**

**AT**

**THE PROPOSED OFFICE BUILDINGS  
NORTHEAST CORNER OF  
SLOVER AVENUE & OLEANDER AVENUE  
FONTANA, CALIFORNIA**

**FOR**

**SLOVER & OLEANDER LLC  
18031 IRVINE BOULEVARD, SUITE 106  
TUSTIN, CALIFORNIA 92780**

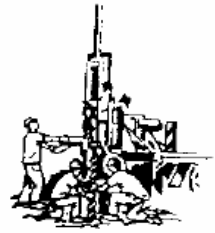
**Date: August 28, 2015  
Job No.: FP-11503-15**



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August 28 2015

Job No. FP-11503-15

Slover & Oleander LLC  
18031 Irvine Boulevard, Suite 106  
Tustin, California 92780

**Attention:** Mr. Mark Lebanoff

**Subject:** Geotechnical Investigation Report

**Project:** Proposed Office Buildings  
Northeast Corner of Slover Avenue & Oleander Avenue  
Fontana, California

Geo-Etka, Inc. is pleased to submit herewith our geotechnical investigation report for the proposed one-story Office Buildings to be located at Northeast Corner of Slover Avenue & Oleander Avenue in the City of Fontana, California. This report presents the results of our field investigation, laboratory testing and our engineering judgment, opinions, conclusions and recommendations pertaining to geotechnical design aspects of the proposed development.

It has been a pleasure to be of service to you on this project. Should you have any questions regarding the contents of this report, or should you require additional information, please do not hesitate to contact us.

Respectfully submitted,  
**GEO-ETKA, INC.**

A handwritten signature in blue ink, appearing to read 'C. Radvar'.

Cyrus Radvar,  
Geotechnical Engineer, G.E.2742  
Expires 06/30/2016



A handwritten signature in blue ink, appearing to read 'Ahmed Ali'.

Ahmed Ali, President  
MS, REA

# GEOTECHNICAL INVESTIGATION REPORT

**PROPOSED OFFICE BUILDINGS  
NORTHEAST CORNER OF SLOVER AVENUE & OLEANDER AVENUE  
FONTANA, CALIFORNIA**

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## **FIGURES**

Figure 1	Site Location Map
Figure 2	Boring Location Plan

## **APPENDIXES**

Appendix A	Subsurface Exploration Program
Appendix B	Laboratory Testing

**GEOTECHNICAL INVESTIGATION REPORT**  
**PROPOSED OFFICE BUILDINGS**  
**NORTHEAST CORNER OF SLOVER AVENUE & OLEANDER AVENUE**  
Fontana, California

**1.0 INTRODUCTION**

This report presents the results of our geotechnical investigation performed by Geo-Etka, Inc. (Geo-Etka) for the proposed Office Buildings to be located at northeast corner of Slover Avenue & Oleander Avenue in the City of Fontana, California. The general location of the project is shown on Figure 1.

The purposes of this investigation were to determine the geotechnical properties of subsurface soil conditions, to evaluate their in-place characteristics, evaluate site seismicity, and to provide geotechnical recommendations with respect to site grading and for design and construction of building foundations and other site improvements.

The scope of the authorized investigation included performing a site reconnaissance, conducting field exploration and laboratory testing programs, performing engineering analyses, and preparing this Geotechnical Investigation Report. Evaluation of environmental issues or the potential presence of hazardous materials was not within the scope of services provided.

This report has been prepared for Client and their other project team members, to be used solely in the development of facility described herein. This report may not contain sufficient information for other uses or the purposes of other parties.

**2.0 SITE AND PROPOSED DESCRIPTION**

The subject property is located at northeast corner of Slover Avenue & Oleander Avenue in the City of Fontana, California. The site is bounded on the north and east by adjoining properties, on the south by Slover Avenue, and on the west by Oleander Avenue. At the time of our field exploration, the subject property was occupied by a vacant land.

Based on our review of the Conceptual Site Plan, Figure 2, the project will include Office Buildings A through G, and other associated improvements. Other associated site improvements within the site will include surface parking, and various underground utilities.

It is also our understanding that the proposed buildings will be of wood-frame structures with the slabs-on-grade floor. No basement is planned for the buildings.

### **3.0 GEOTECHNICAL INVESTIGATION**

Our geotechnical investigation included a field exploration program and a laboratory testing programs. The field exploration and laboratory testing programs are briefly described below. A more detailed description of the field exploration and laboratory testing programs are provided in Appendix A and B, respectively.

#### **3.1 FIELD EXPLORATION PROGRAM**

A total of seven (7) exploratory borings were drilled using a truck-mounted drilling rig equipped with 8-inch diameter hollow stem augers. The borings were advanced to depths 6.5 to 21.5 feet (below ground surface). The approximate locations of the borings within the area of the proposed construction are shown on Figure 2.

Logs of subsurface conditions encountered in the borings were prepared in the field by the undersigned geotechnical engineer. Soil samples consisting of relatively undisturbed brass ring samples and Standard Penetration Tests (SPT) samples were collected at approximately 2 to 5-foot depth intervals and were returned to the laboratory for testing. One bulk sample was collected at depths of 1 to 5 feet below ground surface (bgs). The SPTs were performed in accordance with ASTM D 1586. Final boring logs were prepared from the field logs and are presented in Appendix A.

#### **3.2 LABORATORY TESTING**

Selected samples collected during drilling activities were sent to the laboratory to assist in evaluating controlling engineering properties of subsurface materials at the site. Physical tests performed included moisture and density determination, No. 200 Wash sieve, consolidation, and chemical analyses. Chemical analysis included pH, soluble sulfates and soluble chlorides. Copies of the laboratory testing results are presented in Appendix B.

### **4.0 DISCUSSION OF FINDINGS**

The following discussion of findings for the site is based on the results of the field exploration and laboratory testing programs.

#### **4.1 SITE AND SUBSURFACE CONDITIONS**

Generally, the subsurface conditions encountered in the seven borings consisted of silty sand, sandy silt and poorly graded sand with silt and gravel to the depths of 21.5 feet bgs.

The near surface soils consisted of silty sand and sandy silt. Based on sampler blowcounts, the near surface soils were found to be medium dense. Deeper granular soil layers were found to be very dense in relative density. Within our borings, fine to coarse gravel were encountered throughout the borings. For more detailed descriptions of the subsurface materials refer to the boring logs in Appendix A.

#### **4.2 GROUNDWATER CONDITIONS**

Groundwater was not encountered within our exploratory borings to the maximum depth of exploration (21.5 feet below ground surface). Groundwater is expected to be present at depths as shallow as 50 feet or greater below the ground surface.

Fluctuations of the groundwater table, localized zones of perched water, and rise in soil moisture content should be anticipated during the rainy season. Irrigation of landscaped areas can also lead to an increase in soil moisture content and fluctuations of intermittent shallow perched groundwater levels.

#### **4.3 PERCOLATION TESTING AND PROCEDURE**

Borings B-6 and B-7 were backfilled to 5 feet and percolation testing was performed in general accordance with the procedures of the County of San Bernardino Falling Head Percolation Test Procedures. The purpose of this testing was to assess the general percolation rates of the onsite soils for the design of an onsite infiltration system.

The continuous pre-soak (falling-head) test procedure was utilized for testing. Water was allowed to presoak in each test hole prior to obtaining test readings. Following the presoak period, the drop in water level in each hole was monitored every 10 to 30 minutes to determine the appropriate method for testing. Test holes were refilled following each reading or when the water depth was below 6 inches. Test times ranged from 240 to 270 minutes. The drop in water level was recorded to the nearest 1/10th inch to produce conservative water level readings.

Tests results are summarized below:

<b>Test Hole No.</b>	<b>Rate (IN/HOUR)</b>
1	1.3
2	1.5

It should be noted that the infiltration rates determined are ultimate rates based upon field test results. An appropriate safety factor should be applied to account for subsoil inconsistencies and potential silting of the percolating soils. The safety factor should be determined with consideration to other factors in the storm water retention system design (particularly storm water volume estimates) and the safety factors associated with those design components.

#### **4.4 SOIL ENGINEERING PROPERTIES**

Physical tests were performed on the relatively undisturbed samples to characterize the engineering properties of the native soils. Moisture content and dry unit weight determinations were performed on the samples to evaluate the in-situ unit weights of the different materials. Moisture content and dry unit weight results are shown on the boring logs in Appendix A.

#### **4.5 CONSOLIDATION CHARACTERISTICS**

Consolidation test was performed on sample of the existing native overburden soils recovered from the boring. Results of the consolidation test indicate that the overburden material will have low compressibility under the anticipated loads. These characteristics are compatible with the allowable bearing capacity values and corresponding settlement estimates presented in section 7.5 (Foundations).

#### **4.6 COLLAPSE POTENTIALS**

Results of consolidation test on a sample of native soil indicate that the native soil will have low collapse potential. The potential for hydro-collapse, in general, decreases with depth for the site materials. Removal and recompaction of the surficial soils is expected to reduce the anticipated amount of total differential settlement within the site.

#### **4.7 EXPANSION POTENTIAL**

Preliminary laboratory testing of representative sample of onsite soils indicate that these materials exhibit LOW expansion potentials.

## 5.0 STRONG GROUND MOTION POTENTIAL

The project site is located in a seismically active area typical of Southern California and likely to be subjected to a strong ground shaking due to earthquakes on nearby faults.

### 6.1 CBC DESIGN PARAMETERS

To accommodate effects of ground shaking produced by regional seismic events, seismic design can, at the discretion of the designing Structural Engineer, be performed in accordance with the 2013 edition of the California Building Code (CBC). Table below, 2013 CBC Seismic Parameters, lists (next) seismic design parameters based on the 2013 CBC methodology, which is based on ASCE/SEI 7-10:

2013 CBC Seismic Design Parameters	Value
Site Latitude (decimal degrees)	34.0636
Site Longitude (decimal degrees)	-117.4482
Site Class Definition (ASCE 7 Table 20.3-1)	D
Mapped Spectral Response Acceleration at 0.2s Period, $S_s$ (Figure 1613.3.1(1))	1.500
Mapped Spectral Response Acceleration at 1s Period, $S_1$ (Figure 1613.3.1(2))	0.600
Short Period Site Coefficient at 0.2s Period, $F_a$ (Table 1613.3.3(1))	1.0
Long Period Site Coefficient at 1s Period, $F_v$ (Table 1613.3.3(2))	1.5
Adjusted Spectral Response Acceleration at 0.2s Period, $S_{MS}$ (Eq. 16-37)	1.500
Adjusted Spectral Response Acceleration at 1s Period, $S_{M1}$ (Eq. 16-38)	0.900
Design Spectral Response Acceleration at 0.2s Period, $S_{DS}$ (Eq. 16-39)	1.000
Design Spectral Response Acceleration at 1s Period, $S_{D1}$ (Eq. 16-40)	0.600

### 6.0 LIQUEFACTION POTENTIAL

For liquefaction to occur, all of seven key ingredients are required: liquefaction-susceptible soils, groundwater within a depth of 50 feet or less, and strong earthquake shaking. Soils susceptible to liquefaction are generally saturated loose to medium dense sands and non-plastic silt deposits below the water table.

The site is not located within a liquefaction hazard zone. Groundwater was not encountered within our exploratory borings to the maximum depth of exploration (21.5 feet below ground surface). High historic groundwater is anticipated to be deeper than 50 feet bgs. The onsite soils are dense to very dense and would not likely liquefy under earthquake loading.



## **6.1 LIQUEFACTION ASSOCIATED HAZARDS**

Potential hazards associated with liquefaction include global landsliding, (lateral spreading and flow slides), foundation bearing failure, and ground surface settlement. Considering the upper 50 feet of the onsite soils are not likely to liquefy, these hazards are not considered to be design factors for this project.

## **7.0 DESIGN RECOMMENDATIONS**

Based upon the results of our investigation, the proposed structure is considered geotechnically feasible provided the recommendations presented herein are incorporated into the design and construction. If changes in the design of the structure are made or variations or changed conditions are encountered during construction, Geo-Etka should be contacted to evaluate their effects on these recommendations. The following geotechnical engineering recommendations for the proposed building are based on observations from the field investigation program and the physical test results.

### **7.1 EARTHWORK**

All earthworks, including excavation, backfill and preparation of subgrade, should be performed in accordance with the geotechnical recommendations presented in this report and applicable portions of the grading code of local regulatory agencies. All earthwork should be performed under the observation and testing of a qualified geotechnical engineer.

### **7.2 SITE AND FOUNDATION PREPARATION**

The construction area should be cleared of any vegetation and stripped of miscellaneous debris and other deleterious material. Organic matter and all other material that may interfere with the completion of the work should be removed from the limits of the construction area. Vegetation, construction debris, and organic matter should not be incorporated into engineered fill.

All existing low-density, near-surface soils will require removal to competent material from areas to receive newly compacted fill. The basis for establishing a competent exposed surface on which to place fill should consist of competent materials exhibiting an in-place relative compaction of at least 85 percent. Prior to placing structural fill, exposed bottom surfaces in each removal area approved for fill should first be scarified to a depth of at least 6 inches, water

or air dried as necessary to achieve near optimum moisture conditions, and then recompact in place to a minimum relative compaction of 90 percent.

### **7.3 FILL PLACEMENT AND COMPACTION REQUIREMENTS**

Material for engineered fill should be select free of organic material, debris, and other deleterious substances, and should not contain fragments greater than 3 inches in maximum dimension. On-site excavated soils that meet these requirements may be used to backfill the excavated building pad area.

All fill should be placed in 6-inch-thick maximum lifts, watered or air dried as necessary to achieve near optimum moisture conditions, and then compacted in place to a maximum relative compaction of 90 percent. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with Test Method ASTM D 1557. A representative of the project consultant should be present on-site during grading operations to verify proper placement and compaction of all fill, as well as to verify compliance with the other geotechnical recommendations presented herein.

### **7.4 IMPORTED SOILS**

If imported soils are required to complete the planned grading, these soils should consist of clean materials devoid of rock exceeding a maximum dimension of 8 inches, as well as organics, trash and similar deleterious materials. Imported soils should also exhibit an expansion potential no greater than LOW, as classified in accordance with UBC Table 18-I-B. Prospective import soils should be observed, tested and approved by this firm prior to importing the soils to the site.

### **7.5 SHALLOW FOUNDATIONS**

Following the site and foundation preparation recommended above, foundation for load bearing walls and interior columns may be designed as discussed below.

#### **7.5.1 Bearing Capacity and Settlement**

Load bearing walls and interior columns may be supported on continuous spread footings and isolated spread footings, respectively, and should bear entirely upon properly engineered fill. Continuous and isolated footings should have a minimum width of 14 inches and 24 inches, respectively. All footings should be embedded a minimum depth of 18 inches measured from the lowest adjacent finish grade. Continuous and isolated footings placed on such materials

may be designed using an allowable (net) bearing capacity of 2,000 pounds per square foot (psf). Allowable increases of 250 psf for each additional 1 foot in width and 250 psf for each additional 6 inches in depth may be utilized, if desired. The maximum allowable bearing pressure should be 2,500 psf. The maximum bearing value applies to combined dead and sustained live loads. The allowable bearing pressure may be increased by one-third when considering transient live loads, including seismic and wind forces.

Based on the allowable bearing value recommended above, total settlement of the shallow footings are anticipated to be less than one inch, provided foundation preparations conform to the recommendations described in this report. Differential settlement is anticipated to be approximately half the total settlement for similarly loaded footings spaced up to approximately 30 feet apart.

### **7.5.2 Lateral Load Resistance**

Lateral load resistance for the spread footings will be developed by passive soil pressure against sides of footings below grade and by friction acting at the base of the concrete footings bearing on compacted fill. An allowable passive pressure of 250 psf per foot of depth may be used for design purposes. An allowable coefficient of friction 0.30 may be used for dead and sustained live load forces to compute the frictional resistance of the footings constructed directly on compacted fill. Safety factors of 2.0 and 1.5 have been incorporated in development of allowable passive and frictional resistance values, respectively. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

### **7.5.3 Footing Reinforcement**

Reinforcement for footings should be designed by the structural engineer based on the anticipated loading conditions. Footings for lightly loaded wood-frame structures that are supported in low expansive soils should have No. 4 bars, two top and two bottom.

## **7.6 CONCRETE SLAB ON-GRADE**

Concrete slabs will be placed on properly compacted fill as outlined in Section 7.2. Moisture content of subgrade soils should be maintained near the optimum moisture content. At the time of the concrete pour, subgrade soils should be firm and relatively unyielding. Any disturbed soils should be excavated and then replaced and compacted to a minimum of 90 percent relative compaction.

Slabs should be designed to accommodate very low to low expansive fill soils. The structural engineer should determine the minimum slab thickness and reinforcing depending upon the expansive soil condition intended use. Unless a more stringent design is recommended by the structural engineer, we recommend a minimum slab thickness of 4 inches, and reinforcement consisting of No. 3 bars spaced a maximum of 24 inches on centers, both ways. All slab reinforcement should be supported on concrete chairs or brick to ensure the desired placement near mid depth.

If moisture-sensitive floor covering is planned, a layer of open-graded gravel, at least 4 inches thick, should be placed below the concrete slab to form a capillary break. Alternately, moisture-proof membrane (such as 10-mil) may be utilized. The vapor barrier should be placed between sand layers (2 inches above and below) to protect the membrane from damage during construction. Gravel for use under a concrete floor slab should be clean, crushed rock that meets the gradation requirements presented below.

<u>Sieve Size</u>	<u>Percentage</u>
1 inch	100
$\frac{3}{4}$ inch	90-100
No. 4	0-10

## **7.7 PRELIMINARY PAVEMENT DESIGN**

Pavement design should be confirmed at the completion of site grading when the subgrade soils are in-place. This should include sampling and R-Value testing of the actual subgrade soils and an analysis based upon the anticipated traffic loading.

For a preliminary pavement design, recommendations for pavement design section of asphalt parking areas are provided below. These values are based on an assumed R-value of 40.

For pavement design, Traffic indexes (TI) of 4.0 and 5.5 were used for the parking areas and auto driveways, respectively. The preliminary flexible pavement layer thickness is as follows:

## RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS

Pavement Material	Recommended Thickness	
	TI = 4.0	TI = 5.5
Asphalt Concrete Surface Course	3 inches	4 inches
Class II Aggregate Base Course	6 inches	8 inches
Compacted Subgrade Soils	12 inches	12 inches

Asphalt concrete should conform to Sections 203 and 302 of the latest edition of the Standard Specifications for Public Works Construction (“Greenbook”).

Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, latest edition. The aggregate base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Method D 1557.

### 7.8 SOLUBLE SULFATES AND SOIL CORROSIVITY

Concrete subject to exposure to sulfates shall comply with the requirements set forth in ACI 318, Section 4.3. Based on the available water soluble sulfate results the corrosion potential to buried concrete should be considered “low”, i.e., exposure Class S<sub>0</sub>, per ACI 318, Table 4.2.1. Consequently, injurious sulfate attack is not a concern with a minimum 28-day compressive strength of 2,500 psi.

Concrete reinforcement should be protected from corrosion and exposure to chlorides in accordance with ACI 318, Section 4.4.

The corrosion potential of the on-site materials to buried steel was evaluated in accordance with Caltrans corrosive environment evaluation criteria. Caltrans considers a site corrosive, if at least one of the following conditions exists:

- Chloride content  $\geq 500$  ppm;
- Soluble sulphate content  $\geq 2,000$  ppm;
- pH  $\leq 5.5$ .

Observations and laboratory tests indicate that based on the Caltrans' criteria the soils at the site are considered non-corrosive. If additional recommendations are desired, it is recommended that a corrosion specialist be consulted regarding suitable types of piping and necessary protection for underground metal conduits.

## **7.9 UTILITY TRENCH BACKFIL**

All utility trench backfill should be compacted to a minimum relative compaction of 90 percent. Trench backfill materials should be placed in lifts no greater than approximately 6 inches in thickness, watered or air-dried as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should probe and test the backfills to verify adequate compaction.

As an alternative for shallow trenches where pipe or utility lines may be damaged by mechanical compaction equipment, such as under building floor slabs, imported clean sand exhibiting a sand equivalent (SE) value of 30 or greater may be utilized. The sand backfill materials should be watered to achieve near optimum moisture conditions and then tamped into place. No specific relative compaction will be required; however, observation, probing, and if deemed necessary, testing should be performed by a representative of the project geotechnical consultant to verify an adequate degree of compaction and that the backfill will not be subject to settlement.

Where utility trenches enter the footprints of the building, they should be backfilled through their entire depths with on-site fill materials, sand-cement slurry, or concrete rather than with any sand or gravel shading. This "Plug" of less- or non-permeable materials will mitigate the potential for water to migrate through the backfilled trenches from outside of the building to the areas beneath the foundations and floor slabs.

## **8.0 CONSTRUCTION CONSIDERATIONS**

Based on our field exploration program, earthwork can be performed with conventional construction equipment.

### **8.1 TEMPORARY DEWATERING**

Groundwater was not encountered within our exploratory borings. Based on the anticipated excavation depths, it is unlikely that dewatering will be required during construction.

## **8.2 CONSTRUCTION SLOPES**

An Excavation during construction should be conducted so that slope failure and excessive ground movement will not occur. The short-term stability of excavation depends on many factors, including slope angle, engineering characteristics of the subsoils, height of the excavation and length of time the excavation remains unsupported and exposed to equipment vibrations, rainfall and desiccation.

Where space permits, and providing that adjacent facilities are adequately supported, open excavations may be considered. In general, unsupported slopes for temporary construction excavations should not be expected to stand at an inclination steeper than 1:1 (horizontal:vertical). The temporary excavation side walls may be cut vertically to a height of 3 feet and then laid back at a 1:1 slope ratio above a height of 3 feet.

Surcharge loads should be kept away from the top of temporary excavations a horizontal distance equal to at least one-half the depth of excavation. Surface drainage should be controlled along the top of temporary excavations to preclude wetting of the soils and erosion of the excavation faces. Even with the implementation of the above recommendations, sloughing of the surface of the temporary excavations may still occur, and workmen should be adequately protected from such sloughing.

Special care should be exercised when excavating adjacent to the property boundaries. Excavation along the property boundaries should be performed in a repeating “ABC” sequence to prevent exposing significant lengths of the existing building foundation at any one time. First, all the slots designated as “A” should be excavated, backfilled and recompacted. The procedure should continue with the “B” slots and end with the “C” slots. The width of each slot should not exceed 5 feet. If any evidence of potential instability is observed, revised recommendations such as narrower slot cuts may be necessary. All slot excavation and backfilling procedures should be performed under the observation and testing of a qualified geotechnical engineer.

## **8.3 POST INVESTIGATION SERVICES**

Final project plans and specifications should be reviewed prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. Following review of plans and specifications, observation should be performed by the geotechnical engineer during construction to document that foundation elements are

founded on/or penetrate onto the recommended soils, and that suitable backfill soils are placed upon competent materials and properly compacted at the recommended moisture content.

## **9.0 CLOSURE**

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

If parties other than Geo-Etka are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or providing alternate recommendations.

If pertinent changes are made in the project plans or conditions are encountered during construction that appear to be different than indicated by this report, please contact this office. Significant variations may necessitate a re-evaluation of the recommendations presented in this report.

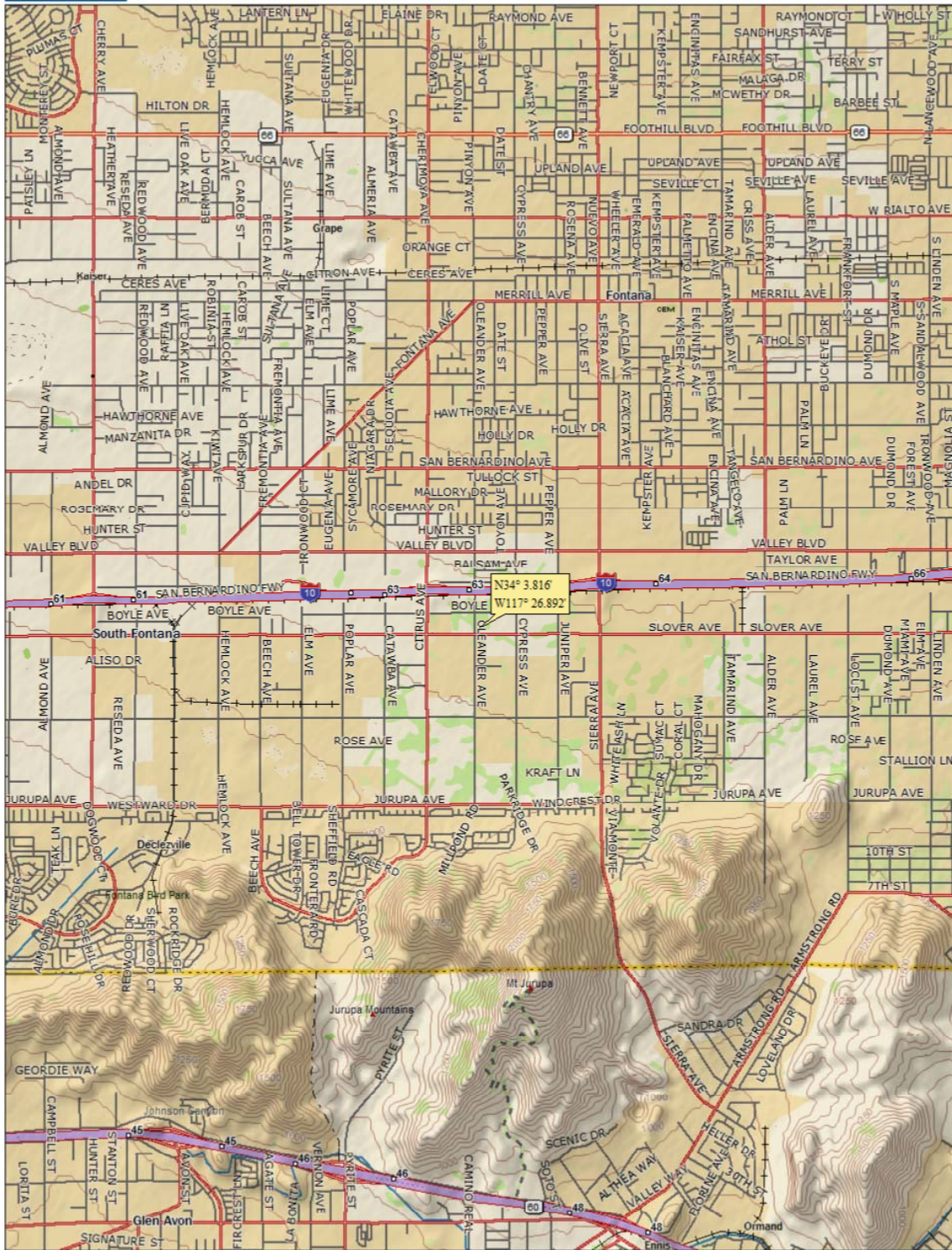


## **10.0 REFERENCES**

2013 California Building Code, Volume 2.

# FIGURES

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www.delorme.com

MN (12.0° E)

0 1/4 1/2 3/4 1 1 1/4 mi  
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GEO-ETKA  
INC.

**SITE VICINITY MAP**  
**Proposed Office Buildings**  
**Northeast Corner of Slover Avenue & Oleander Avenue**  
**Fontana, California**

Figure By  
S.R.

Map No.  
XX

Date  
08-26-15

Project No.  
FP-11503-15

Figure No.

1

**B-1**

**LEGEND**



**NUMBER AND APPROXIMATE  
LOCATION OF BORING**



**AREA CALCULATIONS**

OVERALL AREA 84,177 SF or 1.92 AC  
LANDSCAPE AREA 15,980 SF  
TOTAL BUILDING AREA 35,390 SF

**Phase I**

BLDG A 2,795  
BLDG B 2,795  
BLDG C 3,445  
BLDG D 3,640  
BLDG E 4,290  
TOTAL 16,965 SF

**PARKING CALCULATIONS**

15% OFFICE 2,545 / 250 = 10 SPACES  
85% WAREHOUSE 14,420 / 1000 = 15 SPACES

SPACES REQUIRED 25  
SPACES PROVIDED 23

**Phase II**

BLDG F 3,600  
BLDG G 5,400  
TOTAL 9,000 SF

**PARKING CALCULATIONS**

15% OFFICE 1,350 / 250 = 6 SPACES  
85% WAREHOUSE 7,650 / 1000 = 8 SPACES

SPACES REQUIRED 14  
SPACES PROVIDED 10

**Phase III**

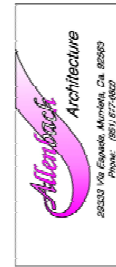
BLDG H 9,425  
TOTAL 9,425 SF

**PARKING CALCULATIONS**

15% OFFICE 1,414 / 250 = 6 SPACES  
85% WAREHOUSE 8,011 / 1000 = 8 SPACES

SPACES REQUIRED 14  
SPACES PROVIDED 31

TOTAL SPACES REQUIRED 50  
TOTAL SPACES PROVIDED 64



**LEBANOFF PROJECT**

OLEANDER AVENUE AND  
SLOVER AVENUE  
FONTANA, 92335

MARC LEBANOFF  
LEBANOFF  
DEVELOPMENT GROUP  
18031 IRVINE BLVD. # 108  
TUSTIN, CA 92780



**Revisions:**

Rev	Description

Drawing Title

Map Scale

Scale

Sheet No.

Client

Map No.

Map No.

Map No.

Map No.

Map No.

Map No.

Map No.

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Map No.

Map No.

**GEO-ETKA  
INC.**

**BORING LOCATION MAP  
Proposed Office Buildings  
Northeast Corner of Slover Avenue & Oleander Avenue  
Fontana, California**

Figure By S.R.	Project No. FP-11503-15
Map No. XX	Figure No. 2
Date 08-26-15	

**APPENDIX A**  
**SUBSURFACE**  
**EXPLORATION PROGRAM**

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## **APPENDIX A SUBSURFACE EXPLORATION PROGRAM**

### ***PROPOSED OFFICE BUILDINGS NORTHEAST CORNER OF SLOVER AVENUE & OLEANDER AVENUE FONTANA, CALIFORNIA***

Prior to drilling, the proposed borings were located in the field by measuring from existing site features.

A total of 7 exploratory borings (B-1 through B-7) were drilled using a CME-75 drill rig equipped with 8-inch outside diameter (O.D.) hollow-stem augers. The approximate locations of borings are shown on Figure 2.

Depth-discrete soil samples were collected at selected intervals from the exploratory borings using a 2 ½ -inch inside diameter (I.D.) modified California Split-barrel sampler fitted with 12 brass ring of 2 ½ inches in O.D. and 1-inch in height and one brass liner (2 ½ -inch O.D. by 6 inches long) above the brass rings. The sampler was lowered to the bottom of the boreholes and driven 18 inches into the soil with a 140-pound hammer falling 30 inches. The number of blows required to drive the sampler the lower 12 inches is shown on the blow count column of the boring logs.

After removing the sampler from the boreholes, the sampler was opened and the brass rings and liner containing the soil were removed and observed for soil classification. Brass rings containing the soil were sealed in plastic canisters to preserve the natural moisture content of the soil. One bulk sample of near surface soil was collected from selected exploratory borings and placed in plastic bags. Soil samples and bulk sample collected from exploratory borings were labeled, and submitted to the Cal Land Engineering laboratory for physical testing.

Standard Penetration Tests (SPTs) were also performed at selected depths. The SPT consists of driving a standard sampler, as described in the ASTM 1586 Standard Method, using a 140-pound hammer falling 30 inches. The number of blows required to drive the SPT sampler the lower 12 inches of the sampling interval is recorded on the blow count column of the boring logs.

The field staff recorded and logged the soil classifications and descriptions on field logs using the Unified Soil Classification System as described by the American Society for Testing and

Materials (ASTM) D 2488-90, “Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).” The final boring logs were prepared from the field logs and are presented in this Appendix.

The exploratory borings were backfilled with drilled cuttings after drilling and sampling.

GEO-ETKA, INC.

CLIENT \_\_\_\_\_

PROJECT NUMBER FP-11503-15

DATE STARTED 8/23/15 COMPLETED 8/23/15

DRILLING CONTRACTOR GeoBoden, Inc.

DRILLING METHOD Hollow Stem Auger

LOGGED BY C.R. CHECKED BY \_\_\_\_\_

NOTES \_\_\_\_\_

PROJECT NAME Proposed Office Buildings

PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana

GROUND ELEVATION \_\_\_\_\_ HOLE SIZE 8"

GROUND WATER LEVELS:  
AT TIME OF DRILLING ---  
AT END OF DRILLING ---  
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0												
5		SILTY SAND (SM): olive brown, moist, ~60% fine sand, ~40% fines	MC S-1		20		109	8				
10		SAND w. SILT & GRAVEL (SP-SM): olive gray, moist, ~30% fine gravel, ~10% fines, ~60% sand	MC S-2		62		121	6				
15		SILTY SAND (SM): olive brown, moist, ~30 fines, ~70% fine sand	SS S-3		16							
20		~10% fine gravel	SS S-4		29							

Bottom of borehole at 21.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.



GEO-ETKA, INC.

CLIENT PROJECT NAME Proposed Office Buildings
PROJECT NUMBER FP-11503-15 PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana
DATE STARTED 8/23/15 COMPLETED 8/23/15 GROUND ELEVATION HOLE SIZE 8"
DRILLING CONTRACTOR GeoBoden, Inc. GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING---
LOGGED BY C.R. CHECKED BY AT END OF DRILLING---
NOTES AFTER DRILLING ---

Table with 12 columns: DEPTH (ft), GRAPHIC LOG, MATERIAL DESCRIPTION, SAMPLE TYPE NUMBER, RECOVERY % (RQD), BLOW COUNTS (N VALUE), POCKET PEN. (tsf), DRY UNIT WT. (pcf), MOISTURE CONTENT (%), LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX, FINES CONTENT (%). Rows include SANDY SILT (ML), POORLY-GRADED GRAVEL (GP), SILTY SAND w. GRAVEL (SM), and SAND w. SILT (SP-SM).

Bottom of borehole at 21.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.

GEO-ETKA, INC.

CLIENT PROJECT NAME Proposed Office Buildings
PROJECT NUMBER FP-11503-15 PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana
DATE STARTED 8/23/15 COMPLETED 8/23/15 GROUND ELEVATION HOLE SIZE 8"
DRILLING CONTRACTOR GeoBoden, Inc. GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING---
LOGGED BY C.R. CHECKED BY AT END OF DRILLING---
NOTES AFTER DRILLING ---

Table with 12 columns: DEPTH (ft), GRAPHIC LOG, MATERIAL DESCRIPTION, SAMPLE TYPE NUMBER, RECOVERY % (RQD), BLOW COUNTS (N VALUE), POCKET PEN. (tsf), DRY UNIT WT. (pcf), MOISTURE CONTENT (%), LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX, FINES CONTENT (%). Rows include data for SANDY SILT (ML) and SAND w. SILT (SP-SM) at various depths.

Bottom of borehole at 21.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.

GEO-ETKA, INC.

CLIENT PROJECT NAME Proposed Office Buildings
PROJECT NUMBER FP-11503-15 PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana
DATE STARTED 8/23/15 COMPLETED 8/23/15 GROUND ELEVATION HOLE SIZE 8"
DRILLING CONTRACTOR GeoBoden, Inc. GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING---
LOGGED BY C.R. CHECKED BY AT END OF DRILLING---
NOTES AFTER DRILLING ---

Table with 12 columns: DEPTH (ft), GRAPHIC LOG, MATERIAL DESCRIPTION, SAMPLE TYPE NUMBER, RECOVERY % (RQD), BLOW COUNTS (N VALUE), POCKET PEN. (tsf), DRY UNIT WT. (pcf), MOISTURE CONTENT (%), LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX, FINES CONTENT (%). Rows include soil descriptions like SILTY SAND (SM) and SAND w. SILT (SP-SM) with corresponding test results.

Bottom of borehole at 21.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.

GEO-ETKA, INC.

CLIENT PROJECT NAME Proposed Office Buildings
PROJECT NUMBER FP-11503-15 PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana
DATE STARTED 8/23/15 COMPLETED 8/23/15 GROUND ELEVATION HOLE SIZE 8"
DRILLING CONTRACTOR GeoBoden, Inc. GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING---
LOGGED BY C.R. CHECKED BY AT END OF DRILLING---
NOTES AFTER DRILLING ---

Table with 12 columns: DEPTH (ft), GRAPHIC LOG, MATERIAL DESCRIPTION, SAMPLE TYPE NUMBER, RECOVERY % (RQD), BLOW COUNTS (N VALUE), POCKET PEN. (tsf), DRY UNIT WT. (pcf), MOISTURE CONTENT (%), LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX, FINES CONTENT (%). Rows include soil descriptions like SANDY SILT (ML), SILTY SAND (SM), and SAND w. SILT (SP-SM) with corresponding test results.

Bottom of borehole at 21.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.

GEO-ETKA, INC.

CLIENT PROJECT NAME Proposed Office Buildings
PROJECT NUMBER FP-11503-15 PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana
DATE STARTED 8/23/15 COMPLETED 8/23/15 GROUND ELEVATION HOLE SIZE 8"
DRILLING CONTRACTOR GeoBoden, Inc. GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger AT TIME OF DRILLING---
LOGGED BY C.R. CHECKED BY AT END OF DRILLING---
NOTES AFTER DRILLING ---

Table with 12 columns: DEPTH (ft), GRAPHIC LOG, MATERIAL DESCRIPTION, SAMPLE TYPE NUMBER, RECOVERY % (RQD), BLOW COUNTS (N VALUE), POCKET PEN. (tsf), DRY UNIT WT. (pcf), MOISTURE CONTENT (%), LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX, FINES CONTENT (%). Rows include soil descriptions like SANDY SILT (ML), SILTY SAND w. GRAVEL (SM), and SAND w. SILT (SP-SM) with corresponding test results.

Bottom of borehole at 11.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.

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GEO-ETKA, INC.

CLIENT _____	PROJECT NAME <u>Proposed Office Buildings</u>
PROJECT NUMBER <u>FP-11503-15</u>	PROJECT LOCATION <u>Slover Avenue &amp; Oleander Avenue, Fontana</u>
DATE STARTED <u>8/23/15</u> COMPLETED <u>8/23/15</u>	GROUND ELEVATION _____      HOLE SIZE <u>8"</u>
DRILLING CONTRACTOR <u>GeoBoden, Inc.</u>	GROUND WATER LEVELS:
DRILLING METHOD <u>Hollow Stem Auger</u>	AT TIME OF DRILLING ---
LOGGED BY <u>C.R.</u> CHECKED BY _____	AT END OF DRILLING ---
NOTES _____	AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0												
5		SILTY SAND (SM): olive brown, moist, ~60% fine sand, ~40% fines	MC R-1		28		106	14				
10		SILTY SAND w. GRAVEL (SM): olive gray, moist, ~20% fine to coarse gravel, ~30 fines, ~50% sand	MC R-2		34							

Bottom of borehole at 11.5 feet below ground surface. No groundwater was encountered. Boring was backfilled with cuttings.

# **APPENDIX B**

## **LABORATORY TESTING**

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## **APPENDIX B LABORATORY TESTING**

### ***PROPOSED OFFICE BUILDINGS NORTHEAST CORNER OF SLOVER AVENUE & OLEANDER AVENUE FONTANA, CALIFORNIA***

Laboratory tests were performed on selected samples to assess the engineering properties and physical characteristics of soils at the site. The following tests were performed:

- moisture content and dry density
- consolidation
- expansion index
- corrosion potential

Test results are summarized on laboratory data sheets or presented in tabular form in this appendix.

#### **Moisture Density Tests**

The field moisture contents, as a percentage of the dry weight of the soils, were determined by weighing samples before and after oven drying. The dry density, in pounds per cubic foot, was also determined for all relatively undisturbed ring samples collected. These analyses were performed in accordance with ASTM D 2937. The results of these determinations are shown on the boring logs in Appendix A.

#### **Consolidation**

The test was performed in accordance with ASTM Test method D-2345. The compression curve from the consolidation test is presented in this Appendix.



### Expansion Potential

Expansion index test was performed on a representative bulk sample of the on-site soils in accordance with Uniform Building Code. The result of expansion test is summarized in Table B-1.

**TABLE B-1 (Expansion Index Test Data)**

<b>Boring Designation</b>	<b>Depth (ft)</b>	<b>Expansion Index (EI)</b>
B-1	0-5	18

### Corrosion

The test was performed on selected soil sample in the near surface to determine the corrosivity of the site soil to steel and concrete. The soil samples were tested for soluble sulfate (Caltrans 417), soluble chloride (Caltrans 422), and pH and minimum resistivity (Caltrans 643). The results of corrosion tests are summarized in Table B-2.

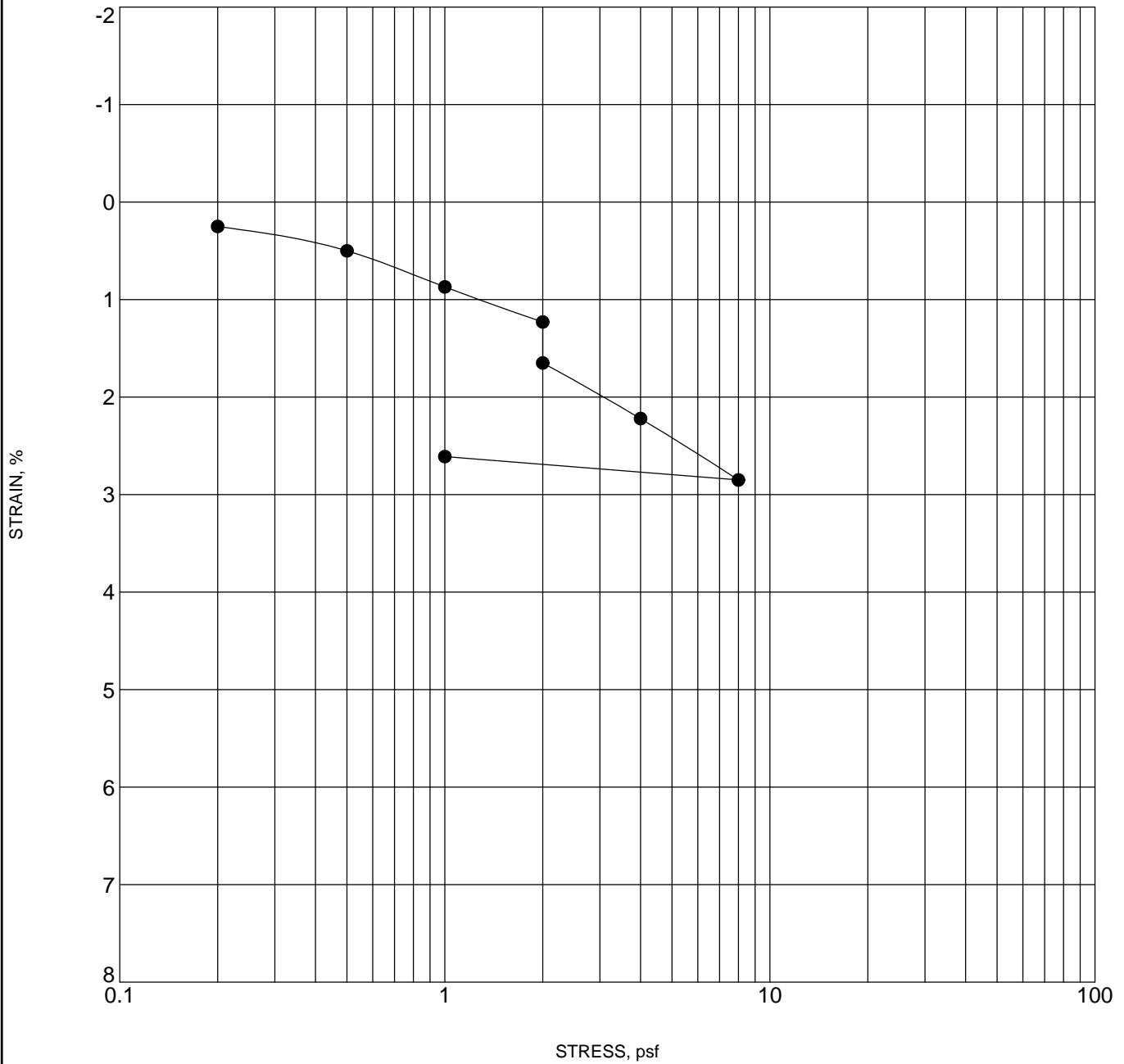
**TABLE B-2 (Corrosion Test Results)**

<b>Boring No.</b>	<b>Depth (ft)</b>	<b>Chloride Content (Calif. 422) ppm</b>	<b>Sulfate Content (Calif. 417) % by Weight</b>	<b>pH (Calif. 643)</b>	<b>Resistivity (Calif. 643) Ohm*cm</b>
B-1	0-5	65	0.0187	7.3	1,398

# CONSOLIDATION TEST

GEO-ETKA, INC.

CLIENT \_\_\_\_\_ PROJECT NAME Proposed Office Buildings  
PROJECT NUMBER FP-11503-15 PROJECT LOCATION Slover Avenue & Oleander Avenue, Fontana



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Specimen Identification		Classification	$\gamma_d$	MC%
●	B-25.0	SANDY SILT (ML)	101	12

**Attachment F**

**LID BMP Supporting Documents**

**WQMP Project Report****County of San Bernardino Stormwater Program**

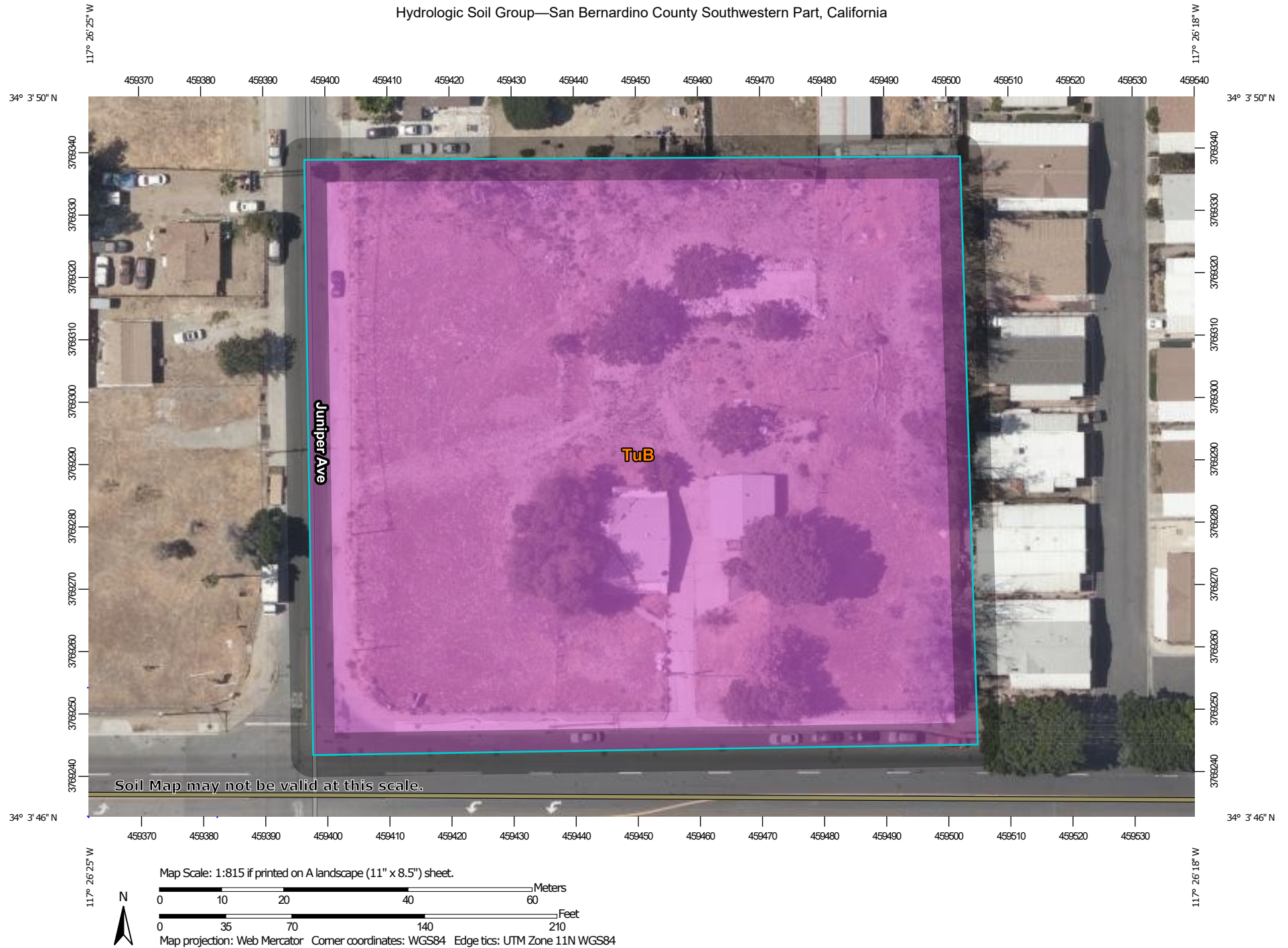
Santa Ana River Watershed Geodatabase

Monday, March 02, 2020

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

<b>Project Site Parcel Number(s):</b>	025120324, 025120320, 025120319, 025120309, 025120303
<b>Project Site Acreage:</b>	14.375
<b>HCOC Exempt Area:</b>	Yes. Verify that the project is completely with the HCOC exemption area.
<b>Closest Receiving Waters:</b>	<b>System Number</b> - 122
<small>(Applicant to verify based on local drainage facilities and topography.)</small>	<b>Facility Name</b> - Marigold Storm Drain
	<b>Owner</b> - OTHERS
<b>Closest channel segment's susceptibility to Hydromodification:</b>	EHM
<b>Highest downstream hydromodification susceptibility:</b>	EHM
<b>Is this drainage segment subject to TMDLs?</b>	No
<b>Are there downstream drainage segments subject to TMDLs?</b>	No
<b>Is this drainage segment a 303d listed stream?</b>	No
<b>Are there 303d listed streams downstream?</b>	No
<b>Are there unlined downstream waterbodies?</b>	No
<b>Project Site Onsite Soil Group(s):</b>	A
<b>Environmentally Sensitive Areas within 200':</b>	None
<b>Groundwater Depth (FT):</b>	-328
<b>Parcels with potential septic tanks within 1000':</b>	Yes
<b>Known Groundwater Contamination Plumes within 1000':</b>	Yes
<b>Studies and Reports Related to Project Site:</b>	<a href="#">Chino Basin Recharge Master Plan</a> <a href="#">Chino Basin Water Master 32nd Annual Report</a> <a href="#">Cactus Basin</a> <a href="#">Summary Report Master Storm Drainage Plan Study</a> <a href="#">Summary Report Master Storm Drainage Plan Map</a> <a href="#">CSDP 3-3 Rialto Channel Drainage Area Volume I</a> <a href="#">CSDP 3-3 Rialto Channel Drainage Area Volume II</a> <a href="#">CSDP 3-3 Rialto Channel Drainage Area Volume III</a> <a href="#">CSDP 3-3 Rialto Channel Drainage Area Volume I</a> <a href="#">CSDP 3-3 Rialto Channel Drainage Area Volume IV</a> <a href="#">CSDP 3-3 Rialto Channel Drainage Area Volume V</a> <a href="#">CSDP 3-4 100yr Hydrology Update</a> <a href="#">CSDP 3-4 Engineers Report Volume 1</a> <a href="#">CSDP 3-4 Hydrology Study West Portion Only</a> <a href="#">CSDP 3-4 Hydrology Study East Portion</a> <a href="#">CSDP 3 CALC SHEET FOR HYDRO</a> <a href="#">CSDP 3-3 Rialto Channel Drain Area Draft</a> <a href="#">FONTANA MPD FEE STUDY</a> <a href="#">Hydrology Study Project 3-4 East Portion</a> <a href="#">Hydrology Study Project 3-4 West portion Only</a> <a href="#">Master SD Hydrology Calcs for Fontana Vol III</a> <a href="#">Master SD Hydrology Calcs For Fontana Vol II</a> <a href="#">Master SD Hydrology Calcs for Fontana Vol V</a> <a href="#">Master SD Hydrology Calcs for Fontana Vol IV</a> <a href="#">Project #3-4 100yr Hydrology Update Sept1997</a> <a href="#">San Sevaine - Boyle Map 0001</a> <a href="#">San Sevaine - Boyle Map 0002</a> <a href="#">San Sevaine - Boyle Map 0003</a> <a href="#">SBCounty CSDP Project No.2 Volume 1</a> <a href="#">SBCounty CSDP Project No.2 Volume 2</a> <a href="#">Volume 2 Map</a> <a href="#">SBCounty CSDP Project No.3 Volume I</a> <a href="#">SBCounty CSDP Project No.3 Volume II</a> <a href="#">West Fontana Channel Preliminary Basin Study</a>

# Hydrologic Soil Group—San Bernardino County Southwestern Part, California



## MAP LEGEND

### Area of Interest (AOI)









 Area of Interest (AOI)

### Soils

#### Soil Rating Polygons





 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Lines


 A  
 A/D  
 B  
 B/D  
 C  
 C/D  
 D  
 Not rated or not available

#### Soil Rating Points






 A  
 A/D  
 B  
 B/D

 C  
 C/D  
 D  
 Not rated or not available

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

### Background

 Aerial Photography

## MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California  
 Survey Area Data: Version 11, Sep 16, 2019

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

Date(s) aerial images were photographed: Apr 1, 2018—Jun 30, 2018

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
TuB	Tujunga loamy sand, 0 to 5 percent slopes	A	2.5	100.0%
<b>Totals for Area of Interest</b>			<b>2.5</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher





**NOAA Atlas 14, Volume 6, Version 2**  
**Location name: Fontana, California, USA\***  
**Latitude: 34.0636°, Longitude: -117.4394°**  
**Elevation: 1088.73 ft\*\***  
 \* source: ESRI Maps  
 \*\* source: USGS



### POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps\\_&\\_aerials](#)

### PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	1.30 (1.08-1.57)	1.69 (1.40-2.05)	2.24 (1.86-2.72)	2.70 (2.22-3.31)	3.36 (2.68-4.27)	3.89 (3.02-5.05)	4.45 (3.37-5.93)	5.05 (3.72-6.94)	5.92 (4.18-8.46)	6.61 (4.51-9.82)
10-min	0.924 (0.774-1.12)	1.21 (1.01-1.47)	1.61 (1.33-1.96)	1.94 (1.60-2.38)	2.41 (1.91-3.06)	2.79 (2.17-3.62)	3.19 (2.42-4.25)	3.62 (2.67-4.97)	4.24 (2.99-6.07)	4.74 (3.23-7.03)
15-min	0.748 (0.624-0.904)	0.980 (0.816-1.19)	1.29 (1.08-1.58)	1.56 (1.28-1.92)	1.94 (1.54-2.47)	2.25 (1.75-2.92)	2.57 (1.95-3.42)	2.92 (2.15-4.00)	3.42 (2.41-4.89)	3.82 (2.60-5.67)
30-min	0.560 (0.466-0.678)	0.734 (0.610-0.890)	0.970 (0.804-1.18)	1.17 (0.962-1.44)	1.45 (1.16-1.85)	1.68 (1.31-2.19)	1.93 (1.46-2.57)	2.19 (1.61-3.00)	2.56 (1.81-3.66)	2.86 (1.95-4.25)
60-min	0.411 (0.342-0.498)	0.538 (0.448-0.652)	0.711 (0.590-0.865)	0.858 (0.706-1.05)	1.07 (0.848-1.36)	1.24 (0.961-1.60)	1.41 (1.07-1.88)	1.61 (1.18-2.20)	1.88 (1.33-2.69)	2.10 (1.43-3.12)
2-hr	0.306 (0.256-0.372)	0.396 (0.330-0.481)	0.516 (0.428-0.628)	0.616 (0.507-0.756)	0.754 (0.600-0.958)	0.862 (0.671-1.12)	0.975 (0.740-1.30)	1.09 (0.806-1.50)	1.26 (0.888-1.80)	1.39 (0.946-2.06)
3-hr	0.259 (0.216-0.314)	0.334 (0.278-0.405)	0.432 (0.359-0.526)	0.513 (0.422-0.630)	0.624 (0.496-0.793)	0.710 (0.552-0.921)	0.798 (0.605-1.06)	0.889 (0.655-1.22)	1.01 (0.717-1.45)	1.11 (0.759-1.65)
6-hr	0.186 (0.155-0.225)	0.239 (0.199-0.290)	0.308 (0.256-0.375)	0.363 (0.299-0.446)	0.438 (0.348-0.557)	0.495 (0.385-0.643)	0.552 (0.419-0.736)	0.611 (0.450-0.838)	0.690 (0.487-0.988)	0.751 (0.512-1.11)
12-hr	0.123 (0.102-0.148)	0.159 (0.132-0.193)	0.205 (0.170-0.249)	0.242 (0.199-0.296)	0.290 (0.230-0.368)	0.326 (0.254-0.423)	0.362 (0.274-0.482)	0.398 (0.293-0.546)	0.446 (0.315-0.638)	0.482 (0.328-0.715)
24-hr	0.083 (0.073-0.095)	0.109 (0.096-0.126)	0.142 (0.125-0.164)	0.168 (0.147-0.195)	0.201 (0.170-0.243)	0.226 (0.188-0.278)	0.251 (0.203-0.316)	0.275 (0.217-0.357)	0.307 (0.233-0.415)	0.331 (0.242-0.462)
2-day	0.050 (0.044-0.057)	0.067 (0.059-0.077)	0.089 (0.078-0.103)	0.106 (0.093-0.124)	0.129 (0.110-0.156)	0.146 (0.121-0.180)	0.163 (0.132-0.206)	0.180 (0.142-0.234)	0.203 (0.154-0.274)	0.220 (0.161-0.307)
3-day	0.036 (0.032-0.041)	0.049 (0.043-0.057)	0.066 (0.058-0.076)	0.080 (0.070-0.093)	0.098 (0.083-0.118)	0.112 (0.093-0.137)	0.125 (0.102-0.158)	0.139 (0.110-0.181)	0.158 (0.120-0.213)	0.172 (0.126-0.241)
4-day	0.029 (0.026-0.033)	0.040 (0.035-0.046)	0.054 (0.048-0.063)	0.066 (0.058-0.077)	0.082 (0.069-0.098)	0.094 (0.078-0.115)	0.106 (0.085-0.133)	0.118 (0.093-0.153)	0.134 (0.102-0.181)	0.147 (0.108-0.205)
7-day	0.019 (0.017-0.022)	0.026 (0.023-0.030)	0.036 (0.032-0.042)	0.045 (0.039-0.052)	0.056 (0.047-0.067)	0.064 (0.054-0.079)	0.073 (0.059-0.092)	0.082 (0.065-0.107)	0.095 (0.072-0.128)	0.104 (0.076-0.145)
10-day	0.014 (0.013-0.016)	0.020 (0.018-0.023)	0.028 (0.025-0.033)	0.035 (0.030-0.040)	0.044 (0.037-0.053)	0.051 (0.042-0.062)	0.058 (0.047-0.073)	0.065 (0.051-0.085)	0.075 (0.057-0.102)	0.083 (0.061-0.116)
20-day	0.008 (0.007-0.010)	0.012 (0.011-0.014)	0.017 (0.015-0.020)	0.022 (0.019-0.025)	0.027 (0.023-0.033)	0.032 (0.027-0.040)	0.037 (0.030-0.047)	0.042 (0.033-0.055)	0.049 (0.037-0.067)	0.055 (0.040-0.077)
30-day	0.007 (0.006-0.008)	0.010 (0.008-0.011)	0.014 (0.012-0.016)	0.017 (0.015-0.020)	0.022 (0.018-0.026)	0.026 (0.021-0.032)	0.030 (0.024-0.038)	0.034 (0.027-0.044)	0.040 (0.030-0.054)	0.045 (0.033-0.063)
45-day	0.005 (0.005-0.006)	0.008 (0.007-0.009)	0.011 (0.009-0.012)	0.013 (0.012-0.015)	0.017 (0.014-0.021)	0.020 (0.017-0.025)	0.024 (0.019-0.030)	0.027 (0.021-0.035)	0.032 (0.024-0.044)	0.037 (0.027-0.051)
60-day	0.005 (0.004-0.005)	0.007 (0.006-0.008)	0.009 (0.008-0.011)	0.011 (0.010-0.013)	0.015 (0.012-0.018)	0.017 (0.014-0.021)	0.020 (0.016-0.026)	0.024 (0.019-0.030)	0.028 (0.021-0.038)	0.032 (0.023-0.045)

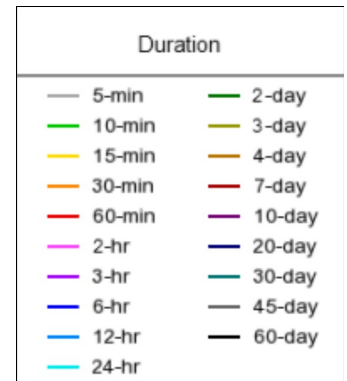
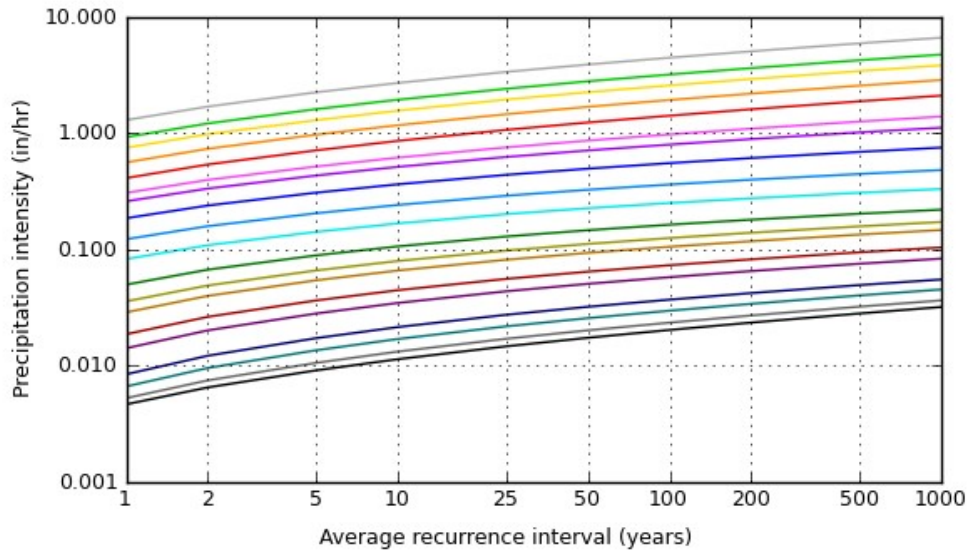
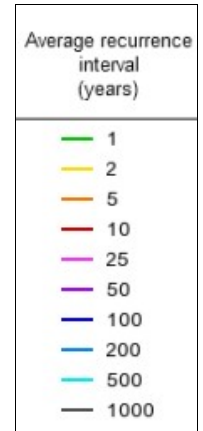
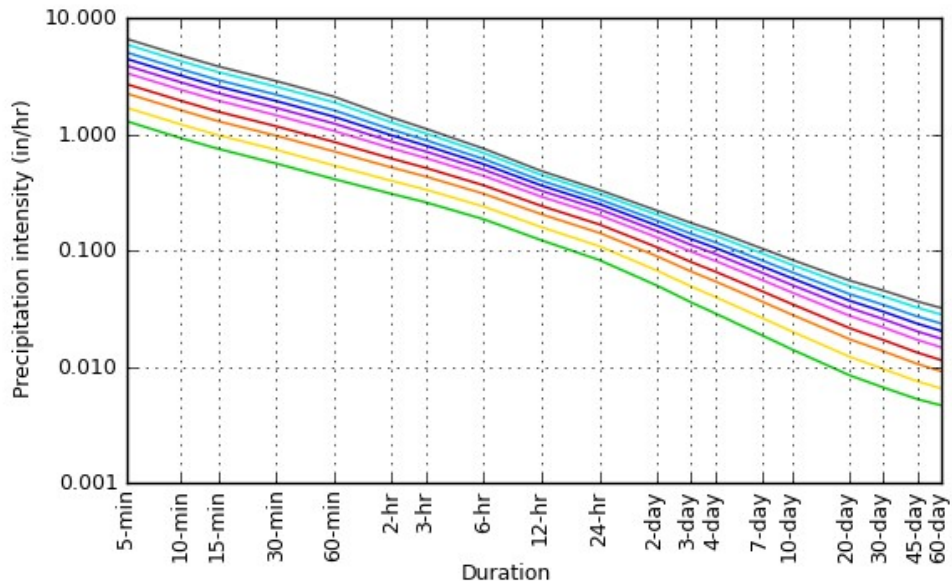
<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).  
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given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

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### PF graphical

## PDS-based intensity-duration-frequency (IDF) curves

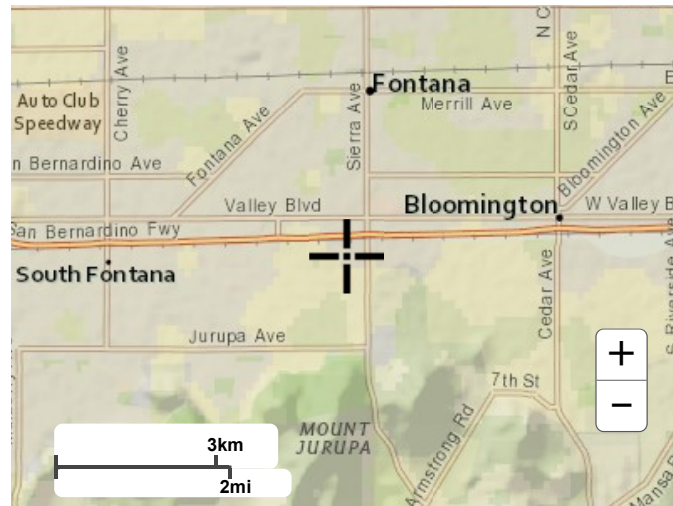
Latitude: 34.0636°, Longitude: -117.4394°



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Fri Feb 28 19:11:04 2020

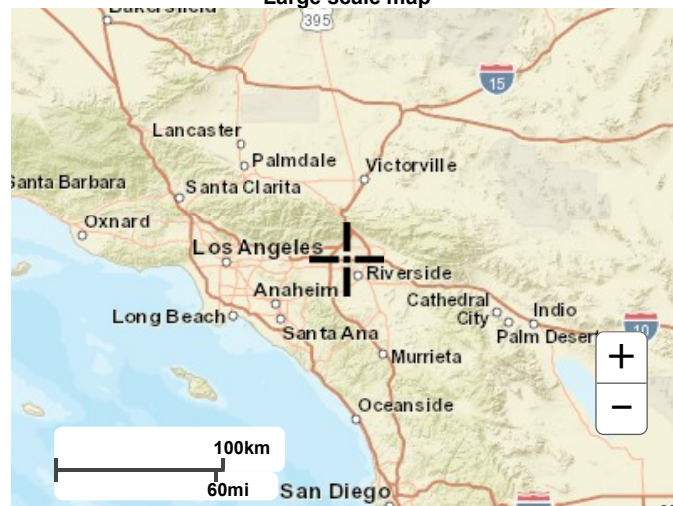
[Back to Top](#)**Maps & aerials****Small scale terrain**



Large scale terrain



Large scale map



Large scale aerial

[Back to Top](#)

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[National Weather Service](#)  
[National Water Center](#)  
1325 East West Highway  
Silver Spring, MD 20910  
Questions?: [HDSC.Questions@noaa.gov](mailto:HDSC.Questions@noaa.gov)

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

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, S <sub>A</sub> = 1			
B	Design	Tributary area size	0.25	1	0.25
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	2	0.50
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, S <sub>B</sub> = 1.25			
Combined Safety Factor, S <sub>TOT</sub> = S <sub>A</sub> x S <sub>B</sub>				1.25 (adjusted to 2)	
Measured Infiltration Rate, inch/hr, K <sub>M</sub> (corrected for test-specific bias)				1.4	
Design Infiltration Rate, in/hr, K <sub>DESIGN</sub> = K <sub>M</sub> / S <sub>TOT</sub>				0.7	

#### Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Infiltration testing was completed using the boring percolation test method. The field percolation rates were then converted to infiltration rates using the Porchet method. The two tests resulted in a 1.3 and 1.5 in/hr infiltration rate. The average rate of 1.4 in/hr was used for the measured infiltration rate. Reducing this rate by the combined safety factor resulted in a design infiltration rate of 0.7 in/hr.

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

**Attachment G**  
**Fact Sheets and Educational Materials**





# A Citizen's Guide to Understanding Stormwater



EPA  
United States  
Environmental Protection  
Agency

EPA 833-B-03-002

January 2003

Internet Address (URL) • HTTP://www.epa.gov  
Recycled/Recyclable • Printed With Vegetable  
Oil Based Inks on 100% Postconsumer  
Process Chlorine Free Recycled Paper

or visit  
[www.epa.gov/nps/stormwater](http://www.epa.gov/nps/stormwater)  
[www.epa.gov/nps](http://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

## 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.



## 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.

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried 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.

## Construction



## 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.



# IRRIGATION RUNOFF

## STORMWATER FACT SHEET



**Report Irrigation Runoff or Stormwater Pollution:**  
**800.506.2555**

**RIVERSIDE COUNTY**  
WATERSHED PROTECTION

### OVERWATERING

Overwatering causes irrigation runoff that may contain pollutants such as pesticides, herbicides, fertilizers, pet waste, yard waste, and sediments which can be hazardous to residents and harmful to our environment. Runoff can also serve as a transport mechanism for other pollutants already on the ground or in the curb gutter. Irrigation runoff entering the storm drain system is an illicit discharge.

### BEST PRACTICES

Urban runoff begins when yards and landscaped areas are over-irrigated. Irrigation systems require regular maintenance and visual inspection of the system should be performed to prevent over-spray, leaks, and other problems that result in runoff to storm drains, curbs and gutters.

You can **prevent pollution** by conserving water on your property. Water during cooler times of the day (before 10am and after 6pm).

- Adjust sprinklers to stop overspray and runoff.
- Make needed repairs immediately.
- Use drip irrigation, soaker hoses, or micro-spray systems.
- Use an irrigation timer to pre-set watering times.
- Use a control nozzle or similar mechanism when watering by hand.
- Switch to a water-wise landscape - native plants need less fertilizers, herbicides, pesticides and water.

### PROTECT OUR WATERSHED

Many people think that when water flows into a storm drain it is treated, but the storm drain system and the sanitary sewer system are not connected. Everything that enters storm drains flows untreated directly into our creeks, rivers, lakes, beaches and ultimately the ocean. Storm water often contains pollutants, including chemicals, trash, and automobile fluids, all of which pollute our watershed and harm fish and wildlife.

Whether at home or work, you can help reduce pollution and improve water quality by using the above Best Management Practices (BMP's) as part of your daily clean up and maintenance routine.



## We our Watershed!

A clean and healthy watershed is important to all of us.

Trash, debris, chemicals and other contaminants from business activities often make their way into the Riverside County storm drain system. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife.

### Did you know?

There is a difference between storm drains and sewers.

Storm drains capture rainwater and flow directly to our rivers, lakes and streams – untreated.

Sewers capture and collect water from sinks, toilets and floor drains, and then it is processed and treated before it is released into the environment.

For more information about how you can protect our watershed, please visit:

**[www.rcwatershed.org](http://www.rcwatershed.org)**

### Questions?

If you have questions about Best Management Practices, or if you have questions about illicit dumping and stormwater pollution visit the Pollution Prevention website: [rcwatershed.org](http://rcwatershed.org).

For more information on requirements for all retail food facilities go to Riverside County Environmental Health's website: [rivcoeh.org](http://rivcoeh.org)



**RIVERSIDE COUNTY**  
WATERSHED PROTECTION

Riverside County Watershed Protection Program is managed by Riverside County Flood Control & Water Conservation District in partnership with 27 Cities, the County of Riverside and the Coachella Valley Water District.

#### OUR MISSION

"To protect, preserve and enhance the quality of Riverside County watersheds by fostering a community-wide commitment to clean water."

# Watershed Protection

## Food Service Industry Best Practices



**Restaurants**  
**Mobile Food Trucks**  
**Grocery Stores**  
**Bakeries**  
**Delicatessens**

# Best Kitchen Practices

## Recycle Oil & Grease

- Never put oil or grease down the drain. Contain grease and oil by using covered grease storage containers or installing a grease interceptor.
- Never overfill your grease storage container or transport it without a cover.
- Grease control devices must be emptied and cleaned by permitted companies and according to manufacturer's specifications.
- Keep maintenance records on site.
- For a list of oil/grease recycling companies, contact CalRecycle [www.calrecycle.ca.gov](http://www.calrecycle.ca.gov) or contact your local sanitation district.

## Managing Spills

- Clean food spills in loading and trash areas by using absorbent materials and sweeping then mopping.
- 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 toxic materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash!
- Use non-toxic cleaning products whenever possible.
- For information on hazardous waste transporters, call (888) 722-4234.

## 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 leaking.



## Cleaning & Maintenance

- Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to a sanitary sewer.
- Sweep outside areas and put the debris in trash containers DO NOT hose down or sweep into the parking lot or street.
- Outside eating areas and sidewalks may not be hosed down or pressure washed UNLESS the following standards are met:
  - ✓ Use dry cleanup methods prior to any pressure washing – absorbing with kitty litter, sweeping, vacuuming, scraping off dried debris.
  - ✓ Wash waters must be captured for proper disposal: collected waters should be discharged to a sanitary drain.
  - ✓ DO NOT use any chemicals or detergents.
  - ✓ DO NOT wash or pour water in a parking lot, alley, sidewalk or street.

## Mobile Food Trucks

- The potential for generating stormwater pollution as part of a mobile food business requires special attention. Cleaning activities are required to be conducted at an approved fixed location with a connection to a sanitary sewer. For more information contact Riverside County Environmental Health at (888) 722-4234.
- Do not discharge wash water into storm drains.
- Clean on a properly equipped wash pad and drain wastewater to a sanitary sewer system.

## Food Waste Disposal

- Scrape food waste off of plates, pots and food prep areas and dispose of in the trash.
- Food scraps often contain grease, which can clog sewer pipes and result in costly sewer backups and overflows.
- Never put food waste down the drain.







## Riverside County Stormwater Program Members

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

City of Cathedral City  
(760) 770-0340

City of Coachella  
(760) 398-3502

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 Jurupa Valley  
(951) 332-6464

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) 826-5311

City of San Jacinto  
(951) 487-7330

City of Temecula  
(951) 694-6444

City of Wildomar  
(951) 677-7751

Coachella Valley Water District  
(760) 398-2651

County of Riverside  
(951) 955-1000

Riverside County Flood Control District  
(951) 955-1200

# Stormwater Pollution

*What you should know for...*

## Industrial & Commercial Facilities

Best Management Practices (BMPs) for:

- Industrial Facilities
- Commercial Facilities



# YOU can prevent Stormwater Pollution following these practices...

## Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

### Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

### Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.



### Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.

- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.
- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an emergency, call the Fire Department's Haz Mat Team at 911.



## Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

### Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at [www.cabmphandbooks.com](http://www.cabmphandbooks.com).

### Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: [www.waterboards.ca.gov](http://www.waterboards.ca.gov), select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: [fcnpdes@rcfllood.org](mailto:fcnpdes@rcfllood.org).



Graphic by: Margie Winter

## Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

## Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs

## Objectives

- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



the field staff must be trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

### ***Suggested Protocols***

#### **Fixed Facility**

##### *General*

- Post “No Dumping” signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.

##### *Illicit Connections*

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of “as-built” piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

##### *Visual Inspection and Inventory*

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

##### *Review Infield Piping*

- Review the “as-built” piping schematic as a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

##### *Smoke Testing*

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.

- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

## *Dye Testing*

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

## *TV Inspection of Storm Sewer*

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

## *Illegal Dumping*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

## **Field Program**

### *General*

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.



*Field Inspection*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

*Recommended Complaint Investigation Equipment*

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms.
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms

- Educational materials

## *Reporting*

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any onsite drainage points observed.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

## *Enforcement*

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
  - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
  - Provide information regarding BMPs to the responsible party, where appropriate.
  - Begin enforcement procedures, if appropriate.
  - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

## *Training*

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

***Spill Response and Prevention***

- See SC-11 Spill Prevention Control and Clean Up

***Other Considerations***

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

**Requirements*****Costs***

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

***Maintenance***

Not applicable

## Supplemental Information

### ***Further Detail of the BMP***

*What constitutes a “non-stormwater” discharge?*

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

### *Permit Requirements*

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

### *Illegal Dumping*

- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties

### *Outreach*

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There are a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

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  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
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of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

### *Storm Drain Stenciling*

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

### *Oil Recycling*

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

### *Household Hazardous Waste*

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

### *Training*

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

### *Spill Response and Prevention*

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling element and a HHW element within their integrated waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

## ***Examples***

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel “Do Not Disturb” signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control’s Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

## **References and Resources**

<http://www.stormwatercenter.net/>

California’s Nonpoint Source Program Plan <http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program,  
[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program  
(<http://www.projectcleanwater.org>)

Santa Clara Valley Urban Runoff Pollution Prevention Program  
[http://www.scvurppp-w2k.com/pdf%20documents/PS\\_ICID.PDF](http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF)



# Spill Prevention, Control & Cleanup SC-11



## Objectives

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

## Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

## Approach

- An effective spill response and control plan should include:
  - Spill/leak prevention measures;
  - Spill response procedures;
  - Spill cleanup procedures;
  - Reporting; and
  - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

## Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

## Targeted Constituents

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



# **SC-11 Spill Prevention, Control & Cleanup**

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- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
  - Assessment of the site and potential impacts
  - Containment of the material
  - Notification of the proper personnel and evacuation procedures
  - Clean up of the site
  - Disposal of the waste material and
  - Proper record keeping
- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

## ***Suggested Protocols***

### ***Spill/Leak Prevention Measures***

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

# Spill Prevention, Control & Cleanup SC-11

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- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.
- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.
- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.
- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.
- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.
- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

## ***Training***

- Educate employees about spill prevention, spill response and cleanup on a routine basis.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.
- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.
- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

## ***Spill Response and Prevention***

- Identify key spill response personnel and train employees on who they are.
- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.
- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

# SC-11 Spill Prevention, Control & Cleanup

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- Follow the Spill Prevention Control and Countermeasure Plan if one is available.
- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.
- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.
- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

## *Spill Cleanup Procedures*

- Small non-hazardous spills
  - Use a rag, damp cloth or absorbent materials for general clean up of liquids
  - Use brooms or shovels for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- Large non-hazardous spills
  - Use absorbent materials for general clean up of liquids
  - Use brooms, shovels or street sweepers for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.
- If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

## *Reporting*

- Report any spills immediately to the identified key municipal spill response personnel.

# Spill Prevention, Control & Cleanup SC-11

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- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)
- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)
- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

## ***Other Considerations***

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure Plan (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, if permitted to do so, prohibiting any hard connections to the storm drain.

## **Requirements**

### ***Costs***

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of wastes, contaminated soil and water is very expensive

### ***Maintenance***

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Reporting***

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and cleanup activities, and comply with legal requirements.

A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm drain.

# **SC-11 Spill Prevention, Control & Cleanup**

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These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

## ***Examples***

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

## **References and Resources**

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



## Description

Spills and leaks that occur during vehicle and equipment fueling can contribute hydrocarbons, oil and grease, as well as heavy metals to stormwater runoff. Implementing the following management practices can help prevent fuel spills and leaks.

## 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

- Use properly maintained offsite fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Educate employees about pollution prevention measures and goals
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.

## Suggested Protocols

### General

- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	



# SC-20      Vehicle and Equipment Fueling

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- Label drains within the facility boundary, by paint/stencil (or equivalent), to indicate whether they flow to an oil/water separator, directly to the sewer, or to a storm drain. Labels are not necessary for plumbing fixtures directly connected to the sanitary sewer but may be useful to help eliminate confusion about where the drain leads.
- Post signs to remind employees not to top off the fuel tank when filling and signs that ban employees from changing engine oil or other fluids at that location.
- Report leaking vehicles to fleet maintenance.
- Install inlet catch basin equipped with a small sedimentation basin or grit chamber to remove large particles from stormwater in highly impervious areas. Proper maintenance of these devices is necessary.
- Accumulated non-contaminated stormwater (e.g., in a secondary containment) should be released prior to next storm.
- Ensure the following safeguards are in place:
  - Overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
  - Protective guards around tanks and piping to prevent vehicle or forklift damage.
  - Clearly tagging or labeling all valves to reduce human error.
  - Automatic shut off for severed fuel hoses.

## *Fuel Dispensing Areas*

- Maintain clean fuel-dispensing areas using dry cleanup methods such as sweeping for removal of litter and debris, or use of rags and absorbents for leaks and spills. Do not wash down areas with water.
- Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
- Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- Design fueling area to prevent stormwater runoff and spills.
- Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area and if possible use a perimeter drain or slope pavement inward with drainage to a blind sump (must be properly maintained and water properly disposed of); pave area with concrete rather than asphalt.



- Apply a suitable sealant that protects the asphalt from spilled fuels in areas where covering is infeasible and the fuel island is surrounded by pavement.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Cover storm drains in the vicinity during transfer.

## *Outdoor Waste Receptacle Area*

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Minimize the possibility of stormwater pollution from outside waste receptacles by using an effective combination of the following:
  - use only watertight waste receptacle(s) and keep the lid(s) closed, or
  - grade and pave the waste receptacle area to prevent runoff of stormwater, or
  - install a roof over the waste receptacle area, or
  - install a low containment berm around the waste receptacle area, or
  - use and maintain drip pans under waste receptacles. Containment areas and drip pans must be properly maintained and collected water disposed of properly (e.g., to sanitary sewer). Several drip pans should be stored in a covered location near outdoor waste receptacle area so that they are always available, yet protected from precipitation when not in use.
- Post “no littering” signs.

## *Air/Water Supply Area*

- Minimize the possibility of stormwater pollution from air/water supply areas by implementing an effective combination of the following:
  - spot clean leaks and drips routinely to prevent runoff of spillage, or
  - grade and pave the air/water supply area to prevent runoff of stormwater, or
  - install a roof over the air/water supply area, or
  - install a low containment berm around the air/water supply area. Maintain containment areas and dispose of contaminated water properly (e.g., to sanitary sewer).

## *Inspection*

- Aboveground Tank Leak and Spill Control:
  - Check for external corrosion and structural failure.

# SC-20      Vehicle and Equipment Fueling

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- Check for spills and overfills due to operator error.
  - Check for failure of piping system.
  - Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
  - Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
  - Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
  - Periodically, integrity testing should be conducted by a qualified professional.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the facility boundary before October 1 each year.

## ***Training***

- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Train employees on proper fueling and cleanup procedures.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

## ***Spill Response and Prevention***

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place stockpiles of spill cleanup materials where they are readily accessible.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly and dispose properly.
- Store portable absorbent booms (long flexible shafts or barriers made of absorbent material) in unbermed fueling areas.
- Report spills promptly.
- Install an oil/water separator and connect to the sanitary sewer (if allowed), if a dead-end sump is not used to collect spills.

## ***Other Considerations***

- Carry out all federal and state requirements regarding underground storage tanks, or install above ground tanks.

## Requirements

### ***Costs***

- The retrofitting of existing fueling areas to minimize stormwater exposure or spill runoff can be expensive. Good design must occur during the initial installation.
- Extruded curb along the “upstream” side of the fueling area to prevent stormwater runoff is of modest cost.

### ***Maintenance***

- Clean oil/water separators at appropriate intervals.
- Keep ample supplies of spill cleanup materials onsite.
- Inspect fueling areas, storage tanks, catch basin inserts, containment areas, and drip pans on a regular schedule.

## Supplemental Information

### ***Design Considerations***

#### *Designing New Installations*

The elements listed below should be included in the design and construction of new or substantially remodeled facilities.

#### Fuel Dispensing Areas

- Fuel dispensing areas must be paved with Portland cement concrete (or, equivalent smooth impervious surface), with a 2% to 4% slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents runoff of stormwater to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the “fuel dispensing area” stated above.
- The fuel dispensing area must be covered, and the cover’s minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area, as defined above. The cover must not drain onto the fuel dispensing area.
- If necessary install and maintain an oil control device in the appropriate catch basin(s) to treat runoff from the fueling area.

#### Outdoor Waste Receptacle Area

- Grade and pave the outdoor waste receptacle area to prevent runoff of stormwater to the extent practicable.

#### Air/Water Supply Area

- Grade and pave the air/water supply area to prevent runoff of stormwater to the extent practicable.

# SC-20      Vehicle and Equipment Fueling

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## *Designated Fueling Area*

- If your facility has large numbers of mobile equipment working throughout the site and you currently fuel them with a mobile fuel truck, consider establishing a designated fueling area. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary “caps” over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain.

## ***Examples***

The Spill Prevention Control and Countermeasure (SPCC) Plan, which is required by law for some facilities, is an effective program to reduce the number of accidental spills and minimize contamination of stormwater runoff.

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program’s elements, including specific BMP guidance and lists of equipment suppliers, are also applicable to industrial facilities.

## **References and Resources**

Best Management Practice Guide for Retail Gasoline Outlets, California Stormwater Quality Task Force. 1997.

King County Stormwater Pollution Control Manual –  
<http://www.dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)



Photo Credit: Geoff Brosseau

## Description

Wash water from vehicle and equipment cleaning activities performed outdoors or in areas where wash water flows onto the ground can contribute toxic hydrocarbons and other organic compounds, oils and greases, nutrients, phosphates, heavy metals, and suspended solids to stormwater runoff. Use of the procedures outlined below can prevent or reduce the discharge of pollutants to stormwater during vehicle and equipment cleaning.

## 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

- If possible, use properly maintained off-site commercial washing and steam cleaning businesses whenever possible. These businesses are better equipped to handle and properly dispose of the wash waters.
- Good housekeeping practices can minimize the risk of contamination from wash water discharges.

## Objectives

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

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	



# SC-21      Vehicle and Equipment Cleaning

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## ***Suggested Protocols***

### *General*

- Use biodegradable, phosphate-free detergents for washing vehicles as appropriate.
- Mark the area clearly as a wash area.
- Post signs stating that only washing is allowed in wash area and that discharges to the storm drain are prohibited.
- Provide a trash container in wash area.
- Map on-site storm drain locations to avoid discharges to the storm drain system.
- Emphasize the connection between the storm drain system and runoff and help reinforce that car washing activities can have an affect on local water quality. This can be accomplished through storm drain stenciling programs.

### *Vehicle and Equipment Cleaning*

- Design wash areas to properly collect and dispose of wash water when engine cleaning is conducted and when chemical additives, solvents, or degreasers are used. This may include installation of sumps or drain lines to collect wash water or construction of a berm around the designated area and grading of the area to collect wash water as well as prevent stormwater run-on.
- Consider washing vehicles and equipment inside the building if washing/cleaning must occur on-site. This will help to control the targeted constituents by directing them to the sanitary sewer.
- If washing must occur on-site and outdoor:
  - Use designated paved wash areas. Designated wash areas must be well marked with signs indicating where and how washing must be done. This area must be covered or bermed to collect the wash water and graded to direct the wash water to a treatment or disposal facility.
  - Oil changes and other engine maintenance cannot be conducted in the designated washing area. Perform these activities in a place designated for such activities.
  - Cover the wash area when not in use to prevent contact with rain water.
- Use hoses with nozzles that automatically turn off when left unattended.
- Perform pressure cleaning and steam cleaning off-site to avoid generating runoff with high pollutant concentrations. If done on-site, no pressure cleaning and steam cleaning should be done in areas designated as wellhead protection areas for public water supply.

### *Disposal*

- Consider filtering and recycling wash water.

- Discharge equipment wash water to the sanitary sewer, a holding tank, or a process treatment system, regardless of the washing method used.
- Discharge vehicle wash water to (1) the sanitary sewer, a holding tank, or process treatment system or (2) an enclosed recycling system.
- Discharge wash water to sanitary sewer only after contacting the local sewer authority to find out if pretreatment is required.

## ***Training***

- Train employees on proper cleaning and wash water disposal procedures and conduct “refresher” courses on a regular basis.
- Train staff on proper maintenance measures for the wash area.
- Train employees and contractors on proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control and Cleanup.
- Keep your Spill Prevention Control and Counter Measure (SPCC) Plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Clean up spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations (Limitations and Regulations)***

- Some municipalities may require pretreatment and monitoring of wash water discharges to the sanitary sewer.
- Steam cleaning can generate significant pollutant concentrations requiring that careful consideration be given to the environmental impacts and compliance issues related to steam cleaning.
- Most car washing best management practices are inexpensive, and rely more on good housekeeping practices (where vehicles are washed, planning for the collection of wash water) than on expensive technology. However, the construction of a specialized area for vehicle washing can be expensive for municipal facilities. Also, for facilities that cannot recycle their wash water the cost of pre-treating wash water through either structural practices or planning for collection and hauling of contaminated water to sewage treatment plants can represent a cost limitation.

## **Requirements**

### ***Costs***

- Capital costs vary depending on measures implemented

# SC-21      Vehicle and Equipment Cleaning

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- Low cost (\$500-1,000) for berm construction,
  - Medium cost (\$5,000-20,000) for plumbing modifications (including re-routing discharge to sanitary sewer and installing simple sump).
  - High cost (\$30,000-150,000) for on-site treatment and recycling.
- O&M costs increase with increasing capital investment.

## ***Maintenance***

- Berm repair and patching.
- Sweep washing areas frequently to remove solid debris.
- Inspect and maintain sumps, oil/water separators, and on-site treatment/recycling units.

## **Supplemental Information**

### ***Design Considerations***

#### *Designated Cleaning Areas*

- Washing operations outside should be conducted in a designated wash area having the following characteristics:
  - Paved with Portland cement concrete,
  - Covered and bermed to prevent contact with stormwater and contain wash water,
  - Sloped for wash water collection,
  - Equipped with an oil/water separator, if necessary.

## ***Examples***

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program's elements, including specific BMP guidance and lists of equipment suppliers, are applicable to industrial vehicle service facilities.

The U.S. Postal Service in West Sacramento has a new vehicle wash system that collects, filters, and recycles the wash water.

## **References and Resources**

<http://www.stormwatercenter.net/>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>





## 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. Loading and unloading of material may include package products, barrels, and bulk products. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

## Approach

### ***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 materials with the potential to contaminate stormwater.
- Prevent stormwater runoff.
- Regularly check equipment for leaks.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



***Suggested Protocols******Loading and Unloading – General Guidelines***

- Develop an operations plan that describes procedures for loading and/or unloading.
- Do not conduct loading and unloading during wet weather, whenever possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- A seal or door skirt between delivery vehicles and building can reduce or prevent exposure to rain.
- Design loading/unloading area to prevent stormwater runoff which would include grading or berming the area, and positioning roof downspouts so they direct stormwater away from the loading/unloading areas.
- If feasible, load and unload all materials and equipment in covered areas such as building overhangs at loading docks.
- 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 dead-end sump.

***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.
- Employees trained in spill containment and cleanup should be present during the 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***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your spill prevention Control and countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Space, material characteristics and/or time limitations may preclude all transfers from being performed indoors or under cover.

## **Requirements**

### ***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.
- Regular broom dry-sweeping of area.
- Conduct major clean-out of loading and unloading area and sump prior to October 1 of each year.

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Special Circumstances for Indoor Loading/Unloading of Materials***

As appropriate loading or unloading of liquids should occur indoors 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.
  - Transfer area should be designed to prevent runoff 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.

- 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 (if allowed). 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**

<http://www.stormwatercenter.net/>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



## Objectives

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

## Description

Accidental releases of materials from above ground liquid storage tanks, drums, and dumpsters present the potential for contaminating stormwaters with many different pollutants. Tanks may store many potential stormwater runoff pollutants, such as gasoline, aviation gas, diesel fuel, ammonia, solvents, syrups, etc. Materials spilled, leaked, or lost from storage tanks may accumulate in soils or on other surfaces and be carried away by rainfall runoff. These source controls apply to containers located outside of a building used to temporarily store liquid materials and include installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

## Approach

### ***Pollution Prevention***

- Educate employees about pollution prevention measures and goals
- Keep an accurate, up-to-date inventory of the materials delivered and stored on-site. Re-evaluate inventory needs and consider purchasing alternative products. Properly dispose of outdated products.
- Try to keep chemicals in their original containers, and keep them well labeled.

## Targeted Constituents

Sediment	
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑



***Suggested Protocols******General***

- Develop an operations plan that describes procedures for loading and/or unloading. Refer to SC-30 Outdoor Loading/Unloading for more detailed BMP information pertaining to loading and unloading of liquids.
- Protect materials from rainfall, runoff, and wind dispersal:
  - Cover the storage area with a roof.
  - Minimize stormwater runoff by enclosing the area or building a berm around it.
  - Use a “doghouse” structure for storage of liquid containers.
  - Use covered dumpsters for waste product containers.
- Employ safeguards against accidental releases:
  - Provide overflow protection devices to warn operator or automatic shut down transfer pumps.
  - Provide protection guards (bollards) around tanks and piping to prevent vehicle or forklift damage, and
  - Provide clear tagging or labeling, and restricting access to valves to reduce human error.
- Berm or surround tank or container with secondary containment system using dikes, liners, vaults, or double walled tanks.
- Contact the appropriate regulatory agency regarding environmental compliance for facilities with “spill ponds” designed to intercept, treat, and/or divert spills.
- Have registered and specifically trained professional engineers can identify and correct potential problems such as loose fittings, poor welding, and improper or poorly fitted gaskets for newly installed tank systems.

***Storage Areas***

- Provide storage tank piping located below product level with a shut-off valve at the tank; ideally this valve should be an automatic shear valve with the shut-off located inside the tank.
- Provide barriers such as posts or guard rails, where tanks are exposed, to prevent collision damage with vehicles.
- Provide secure storage to prevent vandalism.
- Place tight-fitting lids on all containers.
- Enclose or cover the containers where they are stored.

- Raise the containers off the ground by use of pallet or similar method, with provisions for spill control and secondary containment.
- Contain the material in such a manner that if the container leaks or spills, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters or groundwater.
- Place drip pans or absorbent materials beneath all mounted container taps, and at all potential drip and spill locations during filling and unloading of containers. Drip pans must be cleaned periodically, and all collected liquids and soiled absorbent materials must be reused/recycled or properly disposed.
- Ensure that any underground or aboveground storage tanks shall be designed and managed in accordance with applicable regulations, be identified as a potential pollution source, have secondary containment, such as a berm or dike with an impervious surface.
- Rainfall collected in secondary containment system must not contain pollutants for discharge to storm drain system.

## *Container Management*

- Keep containers in good condition without corrosion or leaky seams.
- Place containers in a lean-to structure or otherwise covered to keep rainfall from reaching the drums.
- Replace containers if they are deteriorating to the point where leakage is occurring. Keep all containers undercover to prevent the entry of stormwater. Employees should be made aware of the importance of keeping the containers free from leaks.
- Keep waste container drums in an area such as a service bay. Drums stored outside must be stored in a lean-to type structure, shed or walk-in container.

## *Storage of Hazardous Materials*

- Storage of reactive, ignitable, or flammable liquids must comply with the fire and hazardous waste codes.
- Place containers in a designated area that is paved, free of cracks and gaps, and impervious in order to contain leaks and spills. The area should also be covered.
- Surround stored hazardous materials and waste with a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain and a dead-end sump should be installed in the drain.

## *Inspection*

- Provide regular inspections:
  - Inspect storage areas regularly for leaks or spills.

- Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Replace containers that are leaking, corroded, or otherwise deteriorating with ones in good condition. If the liquid chemicals are corrosive, containers made of compatible materials must be used instead of metal drums.
- Label new or secondary containers with the product name and hazards.

***Training***

- Train employees (e.g. fork lift operators) and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Train employees in proper storage measures.
- Use a training log or similar method to document training.

***Spill Response and Prevention***

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date, and implement accordingly.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Employees trained in emergency spill cleanup procedures should be present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Operator errors can be prevented by using engineering safe guards and thus reducing accidental releases of pollutant.
- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area.
- See Aboveground Tank Leak and Spill Control section of the Spill Prevention, Control & Cleanup fact sheet (SC-11) for additional information.



## ***Other Considerations***

- Storage sheds often must meet building and fire code requirements.
- The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.
- All specific standards set by federal and state laws concerning the storage of oil and hazardous materials must be met.
- Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code.
- Storage of oil and hazardous materials must meet specific federal and state standards including:
  - Spill Prevention Control and Countermeasure Plan (SPCC) Plan
  - Secondary containment
  - Integrity and leak detection monitoring
  - Emergency preparedness plans

## **Requirements**

### ***Costs***

- Will vary depending on the size of the facility and the necessary controls, such as berms or safeguards against accidental controls.

### ***Maintenance***

- Conduct weekly inspection.
- Sweep and clean the storage area regularly if it is paved, do not hose down the area to a storm drain.

## **Supplemental Information**

- The most common causes of unintentional releases are:
  - Installation problems,
  - Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves),
  - External corrosion and structural failure,
  - Spills and overfills due to operator error, and
  - Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

***Further Detail of the BMP******Dikes***

One of the best protective measures against contamination of stormwater is diking. Containment dikes are berms or retaining walls that are designed to hold spills. Diking is an effective pollution prevention measure for above ground storage tanks and railcar or tank truck loading and unloading areas. The dike surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater side of the dike area. Diking can be used in any industrial or municipal facility, but it is most commonly used for controlling large spills or releases from liquid storage areas and liquid transfer areas.

- For single-wall tanks, containment dikes should be large enough to hold the contents of the storage tank for the facility plus rain water.
- For trucks, diked areas should be capable of holding an amount equal to the volume of the tank truck compartment. Diked construction material should be strong enough to safely hold spilled materials.
- Dike materials can consist of earth, concrete, synthetic materials, metal, or other impervious materials.
- Strong acids or bases may react with metal containers, concrete, and some plastics.
- Where strong acids or bases are stored, alternative dike materials should be considered. More active organic chemicals may need certain special liners for dikes.
- Dikes may also be designed with impermeable materials to increase containment capabilities.
- Dikes should be inspected during or after significant storms or spills to check for washouts or overflows.
- Regular checks of containment dikes to insure the dikes are capable of holding spills should be conducted.
- Inability of a structure to retain stormwater, dike erosion, soggy areas, or changes in vegetation indicate problems with dike structures. Damaged areas should be patched and stabilized immediately.
- Accumulated stormwater in the containment area should be analyzed for pollutants before it is released to surface waters. If pollutants are found or if stormwater quality is not determined, then methods other than discharging to surface waters should be employed (e.g., discharge to sanitary sewer if allowed).
- Earthen dikes may require special maintenance of vegetation such as mulching and irrigation.

## *Curbing*

Curbing is a barrier that surrounds an area of concern. Curbing is similar to containment diking in the way that it prevents spills and leaks from being released into the environment. The curbing is usually small scaled and does not contain large spills like diking. Curbing is common at many facilities in small areas where handling and transfer liquid materials occur. Curbing can redirect stormwater away from the storage area. It is useful in areas where liquid materials are transferred from one container to another. Asphalt is a common material used for curbing; however, curbing materials include earth, concrete, synthetic materials, metal, or other impenetrable materials.

- Spilled materials should be removed immediately from curbed areas to allow space for future spills.
- Curbs should have manually-controlled pump systems rather than common drainage systems for collection of spilled materials.
- The curbed area should be inspected regularly to clear clogging debris.
- Maintenance should also be conducted frequently to prevent overflow of any spilled materials as curbed areas are designed only for smaller spills.
- Curbing has the following advantages:
  - Excellent runoff control,
  - Inexpensive,
  - Ease of installment,
  - Provides option to recycle materials spilled in curb areas, and
  - Common industry practice.

## ***Examples***

The “doghouse” design has been used to store small liquid containers. The roof and flooring design prevent contact with direct rain or runoff. The doghouse has two solid structural walls and two canvas covered walls. The flooring is wire mesh about secondary containment. The unit has been used successfully at Lockheed Missile and Space Company in Sunnyvale.

## **References and Resources**

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000  
<http://www.nalms.org/bclss/storage.html>

King County Stormwater Pollution Control Manual –  
<http://dnr.metrokc.gov/wlr/dss/spcm.htm>

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>

## Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, solid waste treatment and disposal, are examples of process operations that can lead to contamination of stormwater runoff. Source controls for outdoor process equipment operations and maintenance include reducing the amount of waste created, enclosing or covering all or some of the equipment, installing secondary containment, and training employees.

## Approach

### ***Pollution Prevention***

- Perform the activity during dry periods.
- Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.

### ***Suggested Protocols***

- Consider enclosing the activity in a building and connecting the floor drains to the sanitary sewer.
- Cover the work area with a permanent roof.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (runon prevention). If allowed, connect process equipment area to public sewer.
- Dry clean the work area regularly.

### ***Training***

- Train employees to perform the activity during dry periods only and to use less or non-toxic materials.
- Train employee and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

## Objectives

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

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	



# SC-32 Outdoor Equipment Maintenance

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## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your spill prevention control and countermeasure (SPCC) plan up-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Space limitations may preclude enclosing some equipment.
- Storage sheds often must meet building and fire code requirements.

## **Requirements**

### ***Costs***

- Costs vary depending on the complexity of the operation and the amount of control necessary for stormwater pollution control.
- Providing cover may be expensive.

### ***Maintenance***

- Conduct routine preventive maintenance, including checking process equipment for leaks.
- Clean the storm drain system regularly.

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Hydraulic/Treatment Modifications***

In some cases it may be necessary to capture and treat polluted stormwater. If the municipality does not have its own process wastewater treatment system, consider discharging to the public sewer system. Use of the public sewer might be allowed under the following conditions:

- If the activity area is very small (less than a few hundred square feet), the local sewer authority may be willing to allow the area to remain uncovered with the drain connected to the public sewer.
- It may be possible under unusual circumstances to connect a much larger area to the public sewer, as long as the rate of stormwater discharges does not exceed the capacity of the wastewater treatment plant. The stormwater could be stored during the storm and then transferred to the public sewer when the normal flow is low, such as at night.

## **References and Resources**

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

# Outdoor Equipment Maintenance SC-32

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Clark County Stormwater Pollution Control Manual  
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Stormwater Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

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

The Stormwater Managers Resource Center <http://www.stormwatercenter.net/>



## Objectives

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

## Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, re-use, and recycling; and preventing runoff and runoff.

## Approach

### ***Pollution Prevention***

- Reduction in the amount of waste generated can be accomplished using the following source controls such as:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>





***Suggested Protocols******General***

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater runoff and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

***Controlling Litter***

- Post “No Littering” signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

***Waste Collection***

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage or leaks regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Place waste containers under cover if possible.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be

disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

## *Good Housekeeping*

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g. sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil storm drains on the facility's property with prohibitive message regarding waste disposal.

## *Chemical/Hazardous Wastes*

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers protected from vandalism, and in compliance with fire and hazardous waste codes.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.

## *Runon/Runoff Prevention*

- Prevent stormwater runon from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent the waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

## *Inspection*

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

***Training***

- Train staff pollution prevention measures and proper disposal methods.
- Train employees and contractors proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- Train employees and subcontractors in proper hazardous waste management.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.
- Vehicles transporting waste should have spill prevention equipment that can prevent spills during transport. The spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

***Other Considerations***

- Hazardous waste cannot be re-used or recycled; it must be disposed of by a licensed hazardous waste hauler.

**Requirements*****Costs***

- Capital and operation and maintenance costs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

***Maintenance***

- None except for maintaining equipment for material tracking program.

## Supplemental Information

### ***Further Detail of the BMP***

#### *Land Treatment System*

- Minimize the runoff of polluted stormwater from land application of municipal waste on-site by:
  - Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, there is a closed drainage system.
  - Avoiding application of waste to the site when it is raining or when the ground is saturated with water.
  - Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site.
  - Maintaining adequate barriers between the land application site and the receiving waters. Planted strips are particularly good.
  - Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins.
  - Performing routine maintenance to ensure the erosion control or site stabilization measures are working.

## References and Resources

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Associations (BASMAA). On-line: <http://www.basmaa.org>



## Objectives

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

## Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, and abnormal pH. Utilizing the following protocols 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

### ***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.
- 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.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



# SC-41 Building & Grounds Maintenance

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## ***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 waste 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 water 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. Ensure that this practice does not kill grass.

### *Landscaping Activities*

- Do not apply any chemicals (insecticide, herbicide, or fertilizer) directly to surface waters, unless the application is approved and permitted by the state.
- 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.
- Check irrigation schedules so pesticides will not be washed away and to minimize non-stormwater discharge.

### *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 paint brushes 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. 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. In which case you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover with secondary containment 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 or mechanical 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.
- Follow manufacturers' recommendations and label directions. Pesticides must never be applied if precipitation is occurring or predicted. Do not apply insecticides within 100 feet of surface waters such as lakes, ponds, wetlands, and streams.
- Use less toxic pesticides that will do the job, whenever possible. 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.

# SC-41      Building & Grounds Maintenance

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- Apply pesticides only when wind speeds are low.
- Work fertilizers into the soil rather than dumping or broadcasting them 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 use of pesticides 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*

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## *Other Considerations*

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



## Requirements

### ***Costs***

- Overall costs should be low in comparison to other BMPs.

### ***Maintenance***

- Sweep paved areas regularly to collect loose particles, and 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, between flushes and 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>

King County - <ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF>

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -  
<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>

# Parking/Storage Area Maintenance SC-43



## Objectives

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

## Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The following protocols are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

## Approach

### ***Pollution Prevention***

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook).
- Keep accurate maintenance logs to evaluate BMP implementation.

### ***Suggested Protocols***

#### *General*

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



# SC-43 Parking/Storage Area Maintenance

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- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

## *Controlling Litter*

- Post “No Littering” signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel and dispose of litter in the trash.

## *Surface cleaning*

- Use dry cleaning methods (e.g. sweeping or vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- If water is used follow the procedures below:
  - Block the storm drain or contain runoff.
  - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- When cleaning heavy oily deposits:
  - Use absorbent materials on oily spots prior to sweeping or washing.
  - Dispose of used absorbents appropriately.

## *Surface Repair*

- Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc., where applicable. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

# **Parking/Storage Area Maintenance SC-43**

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- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

## ***Inspection***

- Have designated personnel conduct inspections of the parking facilities and stormwater conveyance systems associated with them on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

## ***Training***

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

## **Requirements**

### ***Costs***

Cleaning/sweeping costs can be quite large, construction and maintenance of stormwater structural controls can be quite expensive as well.

### ***Maintenance***

- Sweep parking lot to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities on a regular basis to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

# SC-43 Parking/Storage Area Maintenance

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## Supplemental Information

### ***Further Detail of the BMP***

#### *Surface Repair*

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Use only as much water as necessary for dust control, to avoid runoff.

## References and Resources

<http://www.stormwatercenter.net/>

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

#### Orange County Stormwater Program

[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>

## Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

## Approach

### ***Pollution Prevention***

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

### ***Suggested Protocols***

#### *General*

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

## Objectives

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

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

***Training***

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

***Other Considerations***

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

## Requirements

### ***Costs***

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

### ***Maintenance***

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

## Supplemental Information

### ***Further Detail of the BMP***

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

### ***Examples***

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

## References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.

<http://www.nalms.org/bclss/bmphome.html#bmp>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

San Mateo STOPPP - (<http://stoppp.tripod.com/bmp.html>)





## Objectives

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

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>

## Description

Streets, roads, and highways are significant sources of pollutants in stormwater discharges, and operation and maintenance (O&M) practices, if not conducted properly, can contribute to the problem. Stormwater pollution from roadway and bridge maintenance should be addressed on a site-specific basis. Use of the procedures outlined below, that address street sweeping and repair, bridge and structure maintenance, and unpaved roads will reduce pollutants in stormwater.

## Approach

### ***Pollution Prevention***

- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal)
- Recycle paint and other materials whenever possible.
- Enlist the help of citizens to keep yard waste, used oil, and other wastes out of the gutter.

### ***Suggested Protocols***

#### ***Street Sweeping and Cleaning***

- Maintain a consistent sweeping schedule. Provide minimum monthly sweeping of curbed streets.
- Perform street cleaning during dry weather if possible.



- Avoid wet cleaning or flushing of street, and utilize dry methods where possible.
- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc. For example:
  - Increase the sweeping frequency for streets with high pollutant loadings, especially in high traffic and industrial areas.
  - Increase the sweeping frequency just before the wet season to remove sediments accumulated during the summer.
  - Increase the sweeping frequency for streets in special problem areas such as special events, high litter or erosion zones.
- Maintain cleaning equipment in good working condition and purchase replacement equipment as needed. Old sweepers should be replaced with new technologically advanced sweepers (preferably regenerative air sweepers) that maximize pollutant removal.
- Operate sweepers at manufacturer requested optimal speed levels to increase effectiveness.
- To increase sweeping effectiveness consider the following:
  - Institute a parking policy to restrict parking in problematic areas during periods of street sweeping.
  - Post permanent street sweeping signs in problematic areas; use temporary signs if installation of permanent signs is not possible.
  - Develop and distribute flyers notifying residents of street sweeping schedules.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- If available use vacuum or regenerative air sweepers in the high sediment and trash areas (typically industrial/commercial).
- Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
- Dispose of street sweeping debris and dirt at a landfill.
- Do not store swept material along the side of the street or near a storm drain inlet.
- Keep debris storage to a minimum during the wet season or make sure debris piles are contained (e.g. by berming the area) or covered (e.g. with tarps or permanent covers).

### *Street Repair and Maintenance*

#### *Pavement marking*

- Schedule pavement marking activities for dry weather.

- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Provide drop cloths and drip pans in paint mixing areas.
- Properly maintain application equipment.
- Street sweep thermoplastic grindings. Yellow thermoplastic grindings may require special handling as they may contain lead.
- Paints containing lead or tributyltin are considered a hazardous waste and must be disposed of properly.
- Use water based paints whenever possible. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer.
- Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

## *Concrete installation and repair*

- Schedule asphalt and concrete activities for dry weather.
- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place sand bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- When making saw cuts in pavement, use as little water as possible and perform during dry weather. Cover each storm drain inlet completely with filter fabric or plastic during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site. Alternatively, a small onsite vacuum may be used to pick up the slurry as this will prohibit slurry from reaching storm drain inlets.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

*Patching, resurfacing, and surface sealing*

- Schedule patching, resurfacing and surface sealing for dry weather.
- Stockpile materials away from streets, gutter areas, storm drain inlets or watercourses. During wet weather, cover stockpiles with plastic tarps or berm around them if necessary to prevent transport of materials in runoff.
- Pre-heat, transfer or load hot bituminous material away from drainage systems or watercourses.
- Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and maintenance holes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from covered maintenance holes and storm drain inlets when the job is complete.
- Prevent excess material from exposed aggregate concrete or similar treatments from entering streets or storm drain inlets. Designate an area for clean up and proper disposal of excess materials.
- Use only as much water as necessary for dust control, to avoid runoff.
- Sweep, never hose down streets to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

*Equipment cleaning maintenance and storage*

- Inspect equipment daily and repair any leaks. Place drip pans or absorbent materials under heavy equipment when not in use.
- Perform major equipment repairs at the corporation yard, when practical.
- If refueling or repairing vehicles and equipment must be done onsite, use a location away from storm drain inlets and watercourses.
- Clean equipment including sprayers, sprayer paint supply lines, patch and paving equipment, and mud jacking equipment at the end of each day. Clean in a sink or other area (e.g. vehicle wash area) that is connected to the sanitary sewer.

*Bridge and Structure Maintenance**Paint and Paint Removal*

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Do not transfer or load paint near storm drain inlets or watercourses.

- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint container.
- Plug nearby storm drain inlets prior to starting painting where there is significant risk of a spill reaching storm drains. Remove plugs when job is completed.
- If sand blasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- Perform work on a maintenance traveler or platform, or use suspended netting or tarps to capture paint, rust, paint removing agents, or other materials, to prevent discharge of materials to surface waters if the bridge crosses a watercourse. If sanding, use a sander with a vacuum filter bag.
- Capture all clean-up water, and dispose of properly.
- Recycle paint when possible (e.g. paint may be used for graffiti removal activities). Dispose of unused paint at an appropriate household hazardous waste facility.

## *Graffiti Removal*

- Schedule graffiti removal activities for dry weather.
- Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.
- When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal above.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a landscaped or dirt area. If such an area is not available, filter runoff through an appropriate filtering device (e.g. filter fabric) to keep sand, particles, and debris out of storm drains.
- If a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound), plug nearby storm drains and vacuum/pump wash water to the sanitary sewer.
- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

## *Repair Work*

- Prevent concrete, steel, wood, metal parts, tools, or other work materials from entering storm drains or watercourses.
- Thoroughly clean up the job site when the repair work is completed.
- When cleaning guardrails or fences follow the appropriate surface cleaning methods (depending on the type of surface) outlined in SC-71 Plaza & Sidewalk Cleaning fact sheet.

- If painting is conducted, follow the painting and paint removal procedures above.
- If graffiti removal is conducted, follow the graffiti removal procedures above.
- If construction takes place, see the Construction Activity BMP Handbook.
- Recycle materials whenever possible.

#### *Unpaved Roads and Trails*

- Stabilize exposed soil areas to prevent soil from eroding during rain events. This is particularly important on steep slopes.
- For roadside areas with exposed soils, the most cost-effective choice is to vegetate the area, preferably with a mulch or binder that will hold the soils in place while the vegetation is establishing. Native vegetation should be used if possible.
- If vegetation cannot be established immediately, apply temporary erosion control mats/blankets; a comma straw, or gravel as appropriate.
- If sediment is already eroded and mobilized in roadside areas, temporary controls should be installed. These may include: sediment control fences, fabric-covered triangular dikes, gravel-filled burlap bags, biobags, or hay bales staked in place.

#### *Non-Stormwater Discharges*

Field crews should be aware of non-stormwater discharges as part of their ongoing street maintenance efforts.

- Refer to SC-10 Non-Stormwater Discharges
- Identify location, time and estimated quantity of discharges.
- Notify appropriate personnel.

#### ***Training***

- Train employees regarding proper street sweeping operation and street repair and maintenance.
- Instruct employees and subcontractors to ensure that measures to reduce the stormwater impacts of roadway/bridge maintenance are being followed.
- Require engineering staff and/or consulting A/E firms to address stormwater quality in new bridge designs or existing bridge retrofits.
- Use a training log or similar method to document training.
- Train employees on proper spill containment and clean up, and in identifying non-stormwater discharges.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Densely populated areas or heavily used streets may require parking regulations to clear streets for cleaning.
- No currently available conventional sweeper is effective at removing oil and grease. Mechanical sweepers are not effective at removing finer sediments.
- Limitations may arise in the location of new bridges. The availability and cost of land and other economic and political factors may dictate where the placement of a new bridge will occur. Better design of the bridge to control runoff is required if it is being placed near sensitive waters.

## **Requirements**

### ***Costs***

- The maintenance of local roads and bridges is already a consideration of most community public works or transportation departments. Therefore, the cost of pollutant reducing management practices will involve the training and equipment required to implement these new practices.
- The largest expenditures for street sweeping programs are in staffing and equipment. The capital cost for a conventional street sweeper is between \$60,000 and \$120,000. Newer technologies might have prices approaching \$180,000. The average useful life of a conventional sweeper is about four years, and programs must budget for equipment replacement. Sweeping frequencies will determine equipment life, so programs that sweep more often should expect to have a higher cost of replacement.
- A street sweeping program may require the following.
  - Sweeper operators, maintenance, supervisory, and administrative personnel are required.
  - Traffic control officers may be required to enforce parking restrictions.
  - Skillful design of cleaning routes is required for program to be productive.
  - Arrangements must be made for disposal of collected wastes.

- If investing in newer technologies, training for operators must be included in operation and maintenance budgets. Costs for public education are small, and mostly deal with the need to obey parking restrictions and litter control. Parking tickets are an effective reminder to obey parking rules, as well as being a source of revenue.

***Maintenance***

- Not applicable

**Supplemental Information*****Further Detail of the BMP******Street sweeping***

There are advantages and disadvantages to the two common types of sweepers. The best choice depends on your specific conditions. Many communities find it useful to have a compliment of both types in their fleet.

**Mechanical Broom Sweepers** - More effective at picking up large debris and cleaning wet streets. Less costly to purchase and operate. Create more airborne dust.

**Vacuum Sweepers** - More effective at removing fine particles and associated heavy metals. Ineffective at cleaning wet streets. Noisier than mechanical broom sweepers which may restrict areas or times of operation. May require an advance vehicle to remove large debris.

**Street Flushers** - Not affected by biggest interference to cleaning, parked cars. May remove finer sediments, moving them toward the gutter and stormwater inlets. For this reason, flushing fell out of favor and is now used primarily after sweeping. Flushing may be effective for combined sewer systems. Presently street flushing is not allowed under most NPDES permits.

***Cross-Media Transfer of Pollutants***

The California Air Resources Board (ARB) has established state ambient air quality standards including a standard for respirable particulate matter (less than or equal to 10 microns in diameter, symbolized as PM10). In the effort to sweep up finer sediments to remove attached heavy metals, municipalities should be aware that fine dust, that cannot be captured by the sweeping equipment and becomes airborne, could lead to issues of worker and public safety.

***Bridges***

Bridges that carry vehicular traffic generate some of the more direct discharges of runoff to surface waters. Bridge scupper drains cause a direct discharge of stormwater into receiving waters and have been shown to carry relatively high concentrations of pollutants. Bridge maintenance also generates wastes that may be either directly deposited to the water below or carried to the receiving water by stormwater. The following steps will help reduce the stormwater impacts of bridge maintenance:

- Site new bridges so that significant adverse impacts to wetlands, sensitive areas, critical habitat, and riparian vegetation are minimized.



- Design new bridges to avoid the use of scupper drains and route runoff to land for treatment control. Existing scupper drains should be cleaned on a regular basis to avoid sediment/debris accumulation.
- Reduce the discharge of pollutants to surface waters during maintenance by using suspended traps, vacuums, or booms in the water to capture paint, rust, and paint removing agents. Many of these wastes may be hazardous. Properly dispose of this waste by referring to CA21 (Hazardous Waste Management) in the Construction Handbook.
- Train employees and subcontractors to reduce the discharge of wastes during bridge maintenance.

## *De-icing*

- Do not over-apply deicing salt and sand, and routinely calibrate spreaders.
- Near reservoirs, restrict the application of deicing salt and redirect any runoff away from reservoirs.
- Consider using alternative deicing agents (less toxic, biodegradable, etc.).

## References and Resources

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program

[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Fresh Concrete and Mortar Application Best Management Practices for the Construction Industry. June.

Santa Clara Valley Urban Runoff Pollution Prevention Program. 2001. Roadwork and Paving Best Management Practices for the Construction Industry. June.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Roadway and Bridge Maintenance. On-line [http://www.epa.gov/npdes/menuofbmps/poll\\_13.htm](http://www.epa.gov/npdes/menuofbmps/poll_13.htm)



## Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

## Approach

### ***Pollution Prevention***

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

### ***Suggested Protocols***

#### *Surface Cleaning*

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- Dry cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash with or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

## Objectives

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

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or without soap. Collect water and pump to a tank or discharge to sanitary sewer if allowed. Street Repair and Maintenance.

#### *Graffiti Removal*

- Avoid graffiti abatement activities during rain events.
- Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.
- Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating with an appropriate filtering device.
- Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

#### *Surface Removal and Repair*

- Schedule surface removal activities for dry weather if possible.
- Avoid creating excess dust when breaking asphalt or concrete.
- Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.
- Designate an area for clean up and proper disposal of excess materials.
- Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.
- When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely with filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.
- Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

#### *Concrete Installation and Repair*

- Schedule asphalt and concrete activities for dry weather.

- Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place sand bags around inlets or work areas).
- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

## *Controlling Litter*

- Post “No Littering” signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

## *Training*

- Provide regular training to field employees and/or contractors regarding surface cleaning and proper operation of equipment.
- Train employee and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.

## *Spill Response and Prevention*

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

***Other Considerations***

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewerage agency will require coordination with the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

**Requirements*****Costs***

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

***Maintenance***

Not applicable

**Supplemental Information*****Further Detail of the BMP***

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences of littering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

**References and Resources**

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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[http://www.ocwatersheds.com/stormwater/swp\\_introduction.asp](http://www.ocwatersheds.com/stormwater/swp_introduction.asp)

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Maintenance Best Management Practices for the Construction Industry. Brochures: Landscaping, Gardening, and Pool; Roadwork and Paving; and Fresh Concrete and Mortar Application. June 2001.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Plan. 2001. Municipal Activities Model Program Guidance. November.



## Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

## Approach

### ***Pollution Prevention***

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

## Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	<input checked="" type="checkbox"/>



- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

***Suggested Protocols******Mowing, Trimming, and Weeding***

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

***Planting***

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

***Waste Management***

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.



- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

## ***Irrigation***

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

## ***Fertilizer and Pesticide Management***

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

### *Inspection*

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

### *Training*

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

## ***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in “agricultural use” areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

## **Requirements**

### ***Costs***

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

### ***Maintenance***

Not applicable

**Supplemental Information*****Further Detail of the BMP******Waste Management***

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

***Contractors and Other Pesticide Users***

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

**References and Resources**

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line:  
<http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities  
[http://ladpw.org/wmd/npdes/model\\_links.cfm](http://ladpw.org/wmd/npdes/model_links.cfm)

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program  
[http://www.ocwatersheds.com/StormWater/swp\\_introduction.asp](http://www.ocwatersheds.com/StormWater/swp_introduction.asp)

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United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: [http://www.epa.gov/npdes/menuofbmps/poll\\_8.htm](http://www.epa.gov/npdes/menuofbmps/poll_8.htm)



Photo Credit: Geoff Brosseau

## Objectives

- Contain
- Educate
- Reduce/Minimize

## Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

## Approach

### ***Suggested Protocols***

#### *Catch Basins/Inlet Structures*

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

## *Storm Drain Conveyance System*

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

## *Pump Stations*

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

## *Open Channel*

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a stream or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

## *Illicit Connections and Discharges*

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

## *Illegal Dumping*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

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- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

## ***Training***

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

## ***Spill Response and Prevention***

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.



- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

## Requirements

### ***Costs***

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from “environmental fees” or special assessment districts to fund their illicit connection elimination programs.

### ***Maintenance***

- Two-person teams may be required to clean catch basins with vactor trucks.
- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

## Supplemental Information

### ***Further Detail of the BMP***

#### ***Storm Drain flushing***

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents “plug flow” discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to

cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

### *Flow Management*

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows are allowed to spread out.

### *Stream Corridor Planning*

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for stream alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

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When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to be reclaimed.

## ***Examples***

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank and watershed instability and floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

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## Objectives

- Cover
- Contain
- Educate
- Reduce/Reuse

## Description

It is important to control litter to eliminate trash and other materials in stormwater runoff. Waste reduction is a major component of waste management and should be encouraged through training and public outreach. Management of waste once it is collected may involve reuse, recycling, or proper disposal.

## Approach

### ***Pollution Prevention***

- Reuse products when possible.
- Encourage recycling programs with recycling bins, used oil collection, etc.

### ***Suggested Protocols***

#### ***Solid Waste Collection***

- Implement procedures, where applicable, to collect, transport, and dispose of solid waste at appropriate disposal facilities in accordance with applicable federal, state, and local laws and regulations.
- Include properly designed trash storage areas. If feasible provide cover over trash storage areas.
- Regularly inspect solid waste containers for structural damage. Repair or replace damaged containers as necessary.

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.
- Refer to SC-34 Waste Handling and Disposal for more information regarding solid waste facilities.

#### *Waste Reduction and Recycling*

- Recycle wastes whenever possible. Many types of waste can be recycled, recycling options for each waste type are limited. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should either be incinerated or disposed of at a properly permitted landfill.
- Recycling is always preferable to disposal of unwanted materials.
- Recycling bins for glass, metal, newspaper, plastic bottles and other recyclable household solid wastes should be provided at public facilities and/or for residential curbside collection.

#### *Controlling Litter*

- Post “No Littering” signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Clean out and cover litter receptacles frequently to prevent spillage.

#### *Illegal Dumping*

Substances illegally dumped on streets and into the storm drain system and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clipping, and pet wastes.

- Post “No Dumping” signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Landscaping and beautification efforts of hot spots might also discourage future dumping.
- See SC-74 Drainage System Maintenance, and SC-10 Non-Stormwater Discharges.

## Requirements

### ***Costs***

- The costs for a solid waste source control program vary depending on the type of method. The cost of a community education program or a plan to increase the number of trash receptacles can be very minimal. Costs for structural controls such as trash racks, bar screens, and silt traps can be quite costly ranging from \$250,000 to \$900,000.
- A collection facility or curbside collection for used oil may result in significant costs. Commercial locations (automobile service stations, quick oil change centers, etc.) as collection points eliminate hauling and recycling costs.
- Collection and disposal of hazardous waste can be very expensive and requires trained operators; laboratory and detection equipment; and extensive record keeping including dates, types, and quantities.
- Use of volunteer work forces can lower storm drain stenciling program costs. Stenciling kits require procurement of durable/disposable items. The stenciling program can aid in the cataloging of the storm drain system. One municipality from the state of Washington has estimated that stenciling kits cost approximately \$50 each. Stencils may cost about \$8 each including the die cost on an order of 1,000. Re-orders cost about \$1/stencil. Stencil designs may be available from other communities. Stencil kits should be provided on a loan basis to volunteer groups free of charge with the understanding that kit remnants are to be returned.

### ***Maintenance***

- The primary staff demand for stenciling programs is for program setup to provide marketing and training. Ongoing/follow-up staff time is minimal because of volunteer services.
- Staffing requirements are minimal for oil recycling programs if collection/recycling is contracted out to a used oil hauler/recycler or required at commercial locations.
- Staff requirements for maintaining good housekeeping BMPs at waste handling sites is minimal.

## Supplemental Information

### ***Further Detail of the BMP***

#### ***Waste Reduction***

An approach to reduce stormwater pollution from waste handling and disposal is to assess activities and reduce waste generation. The assessment is designed to find situations where waste can be eliminated or reduced and emissions and environmental damage can be minimized. The assessment involves collecting process specific information, setting pollution prevention targets, and developing, screening and selecting waste reduction options for further study. Starting a waste reduction program is economically beneficial because of reduced raw material purchases and lower waste disposal fees.



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## Objectives

- Contain
- Educate
- Reduce/Minimize

## Description

Although the operation and maintenance of public utilities are not considered chronic sources of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Sewage incident response and investigation may involve a coordinated effort between staff from a number of different departments/agencies. Cities that do not provide maintenance of water and sewer utilities must coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

## Approach

### ***Pollution Prevention***

Inspect potential non-stormwater discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

### ***Suggested Protocols***

#### ***Water Line Maintenance and Cleaning***

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main

## Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



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breaks, sheared fire hydrants, equipment malfunction, and operator error.

## *Planned discharges*

- Identify a suitable discharge option in the following order of preference:
  - Apply to the land.
  - Reuse water for dust suppression, irrigation, or construction compaction.
  - Discharge to a sanitary sewer system with approval.
  - Discharge to the storm drain system using applicable pollution control measures. (Only available to clean water discharges such as water main/ water storage tank/water hydrant flushing).
- If water is discharged to a storm drain, control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain protection options include:
  - Silt fence – appropriate where the inlet drains a relatively flat area.
  - Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
  - Wooden weir and fabric – use at curb inlets where a compact installation is desired.
- Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- General Design considerations for inlet protection devices include the following:
  - The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
  - Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.
- The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made.

## *Unplanned Discharges*

- Stop the discharge as quickly as possible.
- Inspect flow path of the discharged water:
  - Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions

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- Identify the potential for pollutants to be washed into the waterway
- If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path.

## *Sanitary Sewer Maintenance*

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by a municipality. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

- Clean sewer lines on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- Cleaning activities may require removal of tree roots and other identified obstructions.
- During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
  - Cracked/deteriorating pipes
  - Leaking joints/seals at manhole
  - Frequent line plugs
  - Line generally flows at or near capacity
  - Suspected infiltration or exfiltration.
- Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure.

## *Spills and Overflows*

- Identify and track sanitary sewer discharges. Identify dry weather infiltration and inflow first. Wet weather overflow connections are very difficult to locate.

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- Locate wet weather overflows and leaking sanitary sewers using conventional source identification techniques such as monitoring and field screening. Techniques used to identify other illicit connection sources can also be used for sewer system evaluation surveys (see SC74 Drainage System Operation and Maintenance).
- Implement community awareness programs for monitoring sanitary sewer wet weather overflows. A citizen's hotline for reporting observed overflow conditions should be established to supplement field screening efforts.
- Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- When a spill, leak, and/or overflow occurs and when disinfecting a sewage contaminated area, take every effort to ensure that the sewage, disinfectant and/or sewage treated with the disinfectant is not discharged to the storm drain system or receiving waters. Methods may include:
  - Blocking storm drain inlets and catch basins
  - Containing and diverting sewage and disinfectant away from open channels and other storm drain fixtures (using sandbags, inflatable dams, etc.)
  - Removing the material with vacuum equipment
- Record required information at the spill site.
- Perform field tests as necessary to determine the source of the spill.
- Develop notification procedures regarding spill reporting.

## *Septic Systems*

- Ensure that homeowners, installers, and inspectors are educated in proper maintenance of septic systems. This may require coordination with staff from other departments. Outreach to homeowners should include inspection reminders informing them that inspection and perhaps maintenance is due for their systems. Recommend that the system be inspected annually and pumped-out regularly.
- Programs which seek to address failing septic systems should consider using field screening to pinpoint areas where more detailed onsite inspection surveys are warranted.

## ***Training***

- Conduct annual training of water utility personnel and service contractors. (field screening, sampling, smoke/dye testing, TV inspection).
- OSHA-required Health and Safety Training 29 CFR 1910.120 plus annual Refresher Training (as needed).
- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).

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## ***Spill Response and Prevention***

- See previous section regarding spills and overflows.
- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

## ***Other Considerations***

- Enact ordinance granting “right-of-entry” to locate potentially responsible parties for sewer overflows.
- Reliance on individual onsite inspection to detect failed septic systems can be a major limitation. The individual onsite inspection is very labor-intensive and requires access to private property to pinpoint the exact location of the failing system.
- A significant limitation to correcting failing septic systems is the lack of techniques available for detecting individual failed septic systems.

## **Requirements**

### ***Costs***

- Departmental cooperation recommended for sharing or borrowing staff resources and equipment from municipal wastewater department.
- Infiltration, inflow, and wet weather overflows from sanitary sewers are very labor and equipment intensive to locate.
- The costs associated with detecting and correcting septic system failures are subject to a number of factors, including availability of trained personnel, cost of materials, and the level of follow-up required to fix the system problems.

### ***Maintenance***

- Minimum 2-person teams to perform field screening and associated sampling.
- Larger teams required for implementing other techniques (i.e. zinc chloride smoke testing, fluorometric dye testing, television camera inspection and physical inspection with confined space entry) to identify sewer system leaks.
- Program coordination required for handling emergencies, record keeping, etc.
- Many of the problems associated with improper use of septic systems may be attributed to lack of user knowledge on operation and maintenance. Educational materials for homeowners and training courses for installers and inspectors can reduce the incidence of pollution from these widespread and commonly used pollution control devices.

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## Supplemental Information

### ***Further Detail of the BMP***

#### *Onsite Sewage Disposal Systems*

New onsite sewage disposal systems should be designed, located, and installed away from open waterbodies and sensitive resources such as wetlands and floodplains. A protective separation between the OSDS and groundwater should also be established. OSDSs should be operated and maintained to prevent surface water discharges and reduce pollutant loadings to groundwater. Inspection of OSDSs should occur regularly and repairs made immediately. New or replacement plumbing fixtures should be of the high efficiency type.

#### *Typical Sanitary Sewer Problems*

- Old and deteriorated main and lateral pipes - Sewers range in age from 30 to 100 years with an average age of 50 years.
- Cracked sewer pipes - Existing sewers are mostly clay pipes which can crack as they deteriorate with age and also by earth movement.
- Misaligned and open pipe joints - Most of the mortar used to seal the joints between sections of clay pipe has deteriorated.
- Undersized sewer pipe - The existing sewer system is overloaded due to new sewer hook-ups, underground water infiltration, and illegal roof and/or yard drain connections.
- Defective manholes - Old manholes are made of bricks. Typical problems associated with brick manholes are loose bricks, missing bricks, and misaligned manholes.
- Missing and/or unrecorded sewer pipes and manholes - This problem is typical in the easement/backline sewer. Sewer pipe locations shown on the sewer record map are different from the actual sewer location.
- Sewer main under houses and other improvements - Complaints of sewer main alignment crossing the house and other improvements. A solution to this problem requires an agreement with the property owner for a new sewer easement at a relocated line.

#### *Causes of Sanitary Sewer Backups*

- Root infiltration - Tree roots are a major cause of backups.
- Water inflow/infiltration - Rain water entering the sewer pipe causes overflows.
- Solids - Typical solids that buildup in the pipe and cause backups are grease, dirt, bones, tampons, paper towels, diapers, broken dishware, garbage, concrete, and debris.
- Structural defects in pipes and manholes - Sags in the line, cracks, holes, protruding laterals, misaligned pipe, offset joints are all possible causes of backups.

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## *Design Considerations*

Sanitary sewer overflows can often be reduced or eliminated by a number of practices, in addition to sewer system cleaning and maintenance, including the following:

- Reducing infiltration and inflow through rehabilitation and repair of broken or leaking sewer lines.
- Enlarging or upgrading the capacity of sewer lines, pump stations, or sewage treatment plants.
- Constructing wet weather storage and treatment facilities to treat excess flows.
- Addressing SSOs during sewer system master planning and facilities planning.

## *Septic Systems*

Two field screening techniques that have been used with success at identifying possible locations of failing septic systems are the brightener test and color infrared (CIR) aerial photography. The first involves the use of specific phosphorus-based elements found in many laundry products, often called brighteners, as an indicator of the presence of failing onsite wastewater systems. The second technique uses color infrared (CIR) aerial photography to characterize the performance of septic systems. This method has been found to be a quick and cost-effective method for assessing the potential impacts of failing systems and uses variations in vegetative growth or stress patterns over septic system field lines to identify those systems that may potentially be malfunctioning. Then a more detailed onsite visual and physical inspection will confirm whether the system has truly failed and the extent of the repairs needed. These inspections may be carried out by county health departments or other authorized personnel.

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