Preliminary

Water Quality Management Plan

For:

Tentative Tract Map NO. 20695

APNS: 0142-521-01, -02, -03, 0142-041-09, -10, -11, -17, -18, -20, -21, -32, -33, -34, -44

Prepared for:

Route 66 Truck Terminals LLC

1820 San Vicente BLVD

Santa Monica, CA 90402

310-466-7225

Prepared by:

BONADIMAN
JOSEPH E. BONADIMAN & ASSOCIATES, INC.
ENGINEERS • G.I.S. • SURVEYING • PLANNING

234 North Arrowhead Avenue

San Bernardino, CA 92408

(909) 885-3806

Submittal Date: April 2024

Revision Date: _____

Approval Date:_____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Tentative Tract Map NO. 20695 by Joseph E. Bonadiman & Associates, Inc. The WQMP is intended to comply with the requirements of the City of San Bernardino 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):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TM 20695	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APNs: 0142-521-01, -02, -03 0142-041-09, -10, -11, -17, -18, -20, -21, -32, -33, -34, -44

Owner's Signature			
Owner Name:	Route 66 Truck Terminals LLC		
Representative	Bob Nassir		
Title	***		
Address	1820 San Vicente BLVD Santa Monica, CA 90402		
Email			
Telephone #	310-466-7225		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
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"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: J.T. Stanton		PE Stamp Below
Title		
Company	Joseph E. Bonadiman & Associates, Inc.	
Address	234 North Arrowhead Avenue San Bernardino, CA 92408	
Email	jts@bonadiman.com	
Telephone #	(909) 885-3806	
Signature		
Date		

Table of Contents

Forms

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Tentative Tract Map NO. 20695				
Project Owner Contact Name:	Bob Nassir				
Mailing Address:	1820 San Vicente BLVD Santa Monica, CA 90402	E-mail Address:		Telephone:	310-466-7225
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):	TM 20695	
Additional Information/ Comments:					
Description of Project:	The proposed project is the development of a tract of 134 townhomes. There are two drainage management areas. The proposed LID BMP is an underground infiltration system.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	***				

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

1 Development Category (Select all that apply):

☐ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more
☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☐ Parking lots of 5,000 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2):	684,211	**3** Number of Dwelling Units:	134	**4** SIC Code:	1521

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

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

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:

Route 66 Truck Terminals LLC will be responsible for long term maintenance of WQMP stormwater facilities.

Contact:Bob Nassir

1820 San Vicente BLVD

Santa Monica, CA 90402

310-466-7225

2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include animal waste.
Nutrients - Phosphorous	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and eroded soils.
Sediment	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include eroded soils.
Metals	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include petroleum hydrocarbon products, motor products from leaking vehicles.
Trash/Debris	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include paper, plastic, polystyrene packing foam, and aluminum materials.
Pesticides / Herbicides	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include fertilizers and pest sprays.
Organic Compounds	E ☒	N ☐	Expected per Table 3-3 in the TGD for WQMP. Per section 3.3 of the TGD for WQMP, potential sources include solvents and cleaning compounds.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits

1 Project Types that Qualify for Water Quality Credits: *Select all that apply*

☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐ Vertical density [20%] ☐ 7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐ Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]

2 Total Credit % 0 *(Total all credit percentages up to a maximum allowable credit of 50 percent)*

Description of Water Quality Credit Eligibility (if applicable)	N/A

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed 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 34.1078°	Longitude -117.3427°	Thomas Bros Map page 576, 606

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

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

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 to BMP1	DA1 sheetflows to catch basins and is piped into BMP1
DA2 to BMP2	DA2 sheetflows to catch basins and is piped into BMP2

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DA, provide the following characteristics	DA 1			
1 DMA drainage area (ft^2)	455,014			
2 Existing site impervious area (ft^2)	13,650			
3 Antecedent moisture condition, *For desert areas use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A/B			
5 Longest flowpath length (ft)	869			
6 Longest flowpath slope (ft/ft)	0.017			
7 Current land cover type(s) Select *from Fig C-3 of Hydrology Manual*	Perennial Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2				
For Drainage Area 1's sub-watershed DA, provide the following characteristics	DA 2			
1 DMA drainage area (ft^2)	229,197			
2 Existing site impervious area (ft^2)	55,007			
3 Antecedent moisture condition, *For desert areas use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	II			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A/B			
5 Longest flowpath length (ft)	458			
6 Longest flowpath slope (ft/ft)	0.018			
7 Current land cover type(s) Select *from Fig C-3 of Hydrology Manual*	Perennial Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor			

Form 3-3 Watershed Description for Drainage Area

Receiving waters *Refer to Watershed Mapping Tool - http://permitrack.sbcounty.gov/wap/ See 'Drainage Facilities" link at this website*	East Rialto Storm Drain Lytle Creek Wash Santa Ana River, Reach 4 Santa Ana River, Reach 3 Prado Reservoir Santa Ana River, Reach 2 Santa Ana River, Reach 1 Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Lytle Creek - None Santa Ana River, Reach 4 - Pathogens Santa Ana River, Reach 3 - Nutrients, Pathogens, Toxic Organics, Pesticides, Metals Prado Reservoir - Pathogens, pH Santa Ana River, Reach 2 - Pathogens, Metals Santa Ana River, Reach 1 - Pathogens Pacific Ocean - None Source: 2018 California Integrated Report
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Lytle Creek - None Santa Ana River, Reach 4 - Indicator Bacteria Santa Ana River, Reach 3 - Copper, Lead, Indicator Bacteria Prado Reservoir - pH Santa Ana River, Reach 2 - Cadmium, Lead, Total Dissolved Solids Santa Ana River, Reach 1 - None Pacific Ocean - None Source: 2018 California Integrated Report
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Areas within 200': *NONE
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	Santa Ana River
Hydrologic Conditions of Concern	☐ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☒ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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

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

The information provided in Form 4.1.1 and 4.1.2 is based on section 7 of the TGD for WQMP (p.92-105) including table 7-3, CASQA BMP Handbooks and comments from the reviewing agency. The provided description of BMP implementation is a summary and not intended to be an all-inclusive list of actions. Refer to appendix 6.3 of the approved WQMP for applicable CASQA handouts and manufacturer information.

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	☒	☐	The Property Owner will provide practical information materials to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially included in the approved WQMP. Thereafter such materials will be available through the local jurisdiction's stormwater education program.The current website is www.sbcountystormwater.org
N2	Activity Restrictions	☒	☐	Activity restrictions will be imposed by the owner to limit exposure of stormwater to potential pollutants listed above in table 2.3-1.Restrictions should include fertilizers and pesticides be applied by certified persons.
N3	Landscape Management BMPs	☒	☐	Owner will ensure landscaping and irrigation is properly maintained. Fertilizers and pesticides be applied by certified persons. This information has been derived from information in CASQA handout "Landscape Management", which is provided in appendix B of the O&M plan.
N4	BMP Maintenance	☒	☐	The property owner will ensure that all the applicable BMP maintenance is done in accordance with industry standards for the non-structural and structural BMPs. See forms 4.1-1, 4.1-2 and 5-1 for BMP list as well as the WQMP O&M plan for maintenance activities.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Per San Bernardino County Fire, Hazardous Materials Division, the basic quantities for disclosure are: hazardous materials at or exceeding 55 gallons, 500 pounds, or 200 cubic feet at any time in the course of a year. The proposed use of this site does not meet this threshold. A licensed waste management company will service this facility.
N6	Local Water Quality Ordinances	☒	☐	This project will comply with NPDES Permit No. CAS618036 by implementation of the approved WQMP.
N7	Spill Contingency Plan	☐	☒	No outdoor storage is proposed. This is a residential project.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed

Form 4.1-1 Non-Structural Source Control BMPs				
N9	Hazardous Materials Disclosure Compliance	☐	☒	Per San Bernardino County Fire, Hazardous Materials Division, the basic quantities for disclosure are: hazardous materials at or exceeding 55 gallons, 500 pounds, or 200 cubic feet at any time in the course of a year. The proposed use of this site does not meet this threshold.
N10	Uniform Fire Code Implementation	☐	☒	Project plans are reviewed for compliance by local fire protection agency based on determination by planning department. Article 80 of the Uniform Fire Code deals with storage of Hazardous Materials, which are not being stored on this site.
N11	Litter/Debris Control Program	☒	☐	Litter/Debris inspection and clean up will be made part of the regular grounds maintenance and house keeping. At-least once a week. When trash/debris is seen it will be cleaned up as soon as possible.
N12	Employee Training	☐	☒	Residential project, no employees
N13	Housekeeping of Loading Docks	☐	☒	No proposed loading docks.
N14	Catch Basin Inspection Program	☒	☐	For privately maintained drainage systems, the owner is required to have at least 80 percent of drainage facilities inspected, cleaned and maintained on an annual basis with 100 percent of the facilities included in a two-year period. Cleaning should take place in the late summer/early fall prior to the start of the rainy season. This information has been derived from information in CASQA handout MP-52, which is provided in appendix B of the O&M plan.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	At a minimum paved parking areas of a business shall be swept in late summer or early fall, prior to the start of the rainy season. This information has been derived from information in CASQA handout SC-43, which is provided in appendix B of the O&M plan.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Project is not a public agency Priority Project and this is not required by the local jurisdiction.
N17	Comply with all other applicable NPDES permits	☒	☐	The proposed site will comply with current NPDES permit requirements through implementation of the site specific Storm Water Pollution Prevension Plan (SWPPP) BMPs. Refer to separate SWPPP document.

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)	☒	☐	All storm drain inlets and catch basins being constructed or modified will be labeled. Stenciled labels shall be blue on a white background with lettering 2-1/2" in height and reading "No Dumping – Drains to River." In lieu of a stencil, a catch basin curb marker that is at least 4" in height or diameter and contains a similar message may be used. A painted circular stencil shall not be bigger than 8" in diameter. Catch basin labels will be inspected once annually and relabeled as necessary to maintain legibility. This information has been derived from information in CASQA handout SD-13, which is provided in appendix B of the O&M plan.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage is proposed.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas will be designed in accordance with the reviewing juristiction development code and will provide secondary trash containment for the trash bins, as required by NPDES Permit No. CAS618036. These areas will provide storage of the state compliant receptacles with attached lids, that are provided by the local refuse service provider. Trash bin lids will be kept closed. See approved grading plan for construction.
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)	☒	☐	Owner will ensure landscaping and irrigation is properly maintained in accordance with The Water Conservation in Landscaping Act of 2006, Assembly Bill 1881 (AB 1881). The landscaping and irrigation will be installed per the approved landscaping plans,which will incorporate rain-triggered shutoff devices and automatic irrigations controllers. This information has been derived from information in CASQA handout SD-12, which is provided in appendix B of the O&M plan.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscape areas are designed with a minimum of 1 inch below adjacent impervious areas.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☐	Slopes will be protected by vegetation/energy dissipation as shown on the approved grading plan. This information has been derived from information in CASQA handout SD-10, which is provided in appendix B of the O&M plan.

S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No dock areas are proposed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle washing is proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing proposed.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment washing proposed.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling is proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping is proposed.
S14	Wash water control for food preparation areas	☐	☒	No food preparation proposed.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No car washing proposed.

4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Impervious area has been minimized as much as possible for the proposed use of this site.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Landscape and BMP areas will be marked with flagging tape or other method at the contractor's discretion, during construction to minimize compaction and maximize natural infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Existing time of concentration and drainage patterns will change due to the proposed development.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: Impervious areas have been disconnected as much as possible for this site.
Protect existing vegetation and sensitive areas: Yes ☒ No ☐ Explanation: No sensitive areas exist on site. Existing vegetation is perennial and will not meet the landscaping requirements. See WQMP exhibit in appendix 6.1 for landscaping locations.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Disturbed areas will be re-vegetated where possible. See WQMP exhibit in appendix 6.1 for landscaping locations.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Stormwater BMP areas will be marked with flagging tape or other method at the contractor's discretion, during construction to minimize compaction and maximize natural infiltration capacity.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Vegetated swales will not be used on this project due to elevation/grading constraints. The LID BMP selected to meet this target is detailed on form 4.3-3.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscape areas will be marked with flagging tape or other method at the contractor's discression, during construction to minimize compaction and maximize natural infiltration capacity.

4.2 Project Performance Criteria

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

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)

1 Project area DA 1 (ft^2): 455,014	**2** Imperviousness after applying preventative site design practices (Imp%): 60.20	**3** Runoff Coefficient (Rc): _0.41 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.59 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.873 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 26,690 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 1 (ft^2): 229,197	**2** Imperviousness after applying preventative site design practices (Imp%): 62.51	**3** Runoff Coefficient (Rc): _0.42 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.59 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.873 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 14,038 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** *Form 4.2-3 Item 12*	**2** *Form 4.2-4 Item 13*	**3** *Form 4.2-5 Item 10*
Post-developed	**4** *Form 4.2-3 Item 13*	**5** *Form 4.2-4 Item 14*	**6** *Form 4.2-5 Item 14*
Difference	**7** 0 *Item 4 – Item 1*	**8** 0 *Item 2 – Item 5*	**9** 0 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** % *Item 7 / Item 1*	**11** 0% *Item 8 / Item 2*	**12** 0% *Item 9 / Item 3*

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

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

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

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

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

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

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – 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 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o *= Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) V_{fps} *= (1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) T_t *= Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) T_c *= Item 5 + Item 11*								
13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*								
14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*								
15 Additional time of concentration needed to meet HCOC requirement (min): $T_{C\text{-}HCOC}$ *= (Item 13 * 0.95) – 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
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

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

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&2)

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

[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒
(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.

[8] Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP. If no, then proceed to Item 9, below.

[9] All answers to Item 1 through Item 6 are "No":
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP. Proceed to Form 4.3-2, Hydrologic Source Control BMP.

4.3.1 Site Design Hydrologic Source Control BMP

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

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1&2)

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

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1&2)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) $V_{retention}$ *= Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): 0 $V_{retention}$ *=Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ *= Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): 0 $V_{retention}$ *= Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ *= Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): 0 $V_{retention}$ *=Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 0 *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

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

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

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 26,690 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA BMP Type Underground Infiltration	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	10.67		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.500		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	4.26		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0.00		
10 Amended soil porosity	0.00		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0.00		
12 Gravel porosity	0.00		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	0		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	26,690		
16 Total Retention Volume from LID Infiltration BMPs: 26,690 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 14,038 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA BMP Type Underground Infiltration	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	10.67		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.500		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	4.26		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*			
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*			
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	0.00		
10 Amended soil porosity	0.00		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0.00		
12 Gravel porosity	0.00		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	0		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	14,038		

16 Total Retention Volume from LID Infiltration BMPs: 14,038 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 100% *Retention% = Item 16 / Form 4.2-1 Item 7*

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

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

4.3.3 Harvest and Use BMP

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

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

Form 4.3-4 Harvest and Use BMPs (DA 1&2)

1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): 0 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			
9 Total Retention Volume (ft^3) from Harvest and Use BMP0 *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.*			

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1&2)

1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft^3): 0 *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 Volume Based Biotreatment (DA 1&2) – Bioretention and Planter Boxes with Underdrains

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

Form 4.3-7 Volume Based Biotreatment (DA 1&2) – Constructed Wetlands and Extended Detention

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

Form 4.3-8 Flow Based Biotreatment (DA 1&2)

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

4.3.5 Conformance Summary

Complete Form 4.3-9 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^3): 26,690 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 26,690 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

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

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

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

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

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 14,038 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 14,038 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

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

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

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

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

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  *Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

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

Form 4.3-10 Hydromodification Control BMPs (DA 1&2)

1 Volume reduction needed for HCOC performance criteria (ft^3): 0 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☐
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

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

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

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☐
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Building & Grounds Maintenance	Property Owner	Inspect site for trash and debris. Clean as needed. These maintenance activities have been derived from information in CASQA handout SC-41, which is provided in appendix B of the O&M plan.	Weekly
Underground Chambers	Property Owner	Inspect for trash, debris, sediment and damage. Clean as needed and repair per manufacturer's recommendations. These maintenance activities have been derived the manufacturer handouts, which is provided in appendix B of the O&M plan.	Annually (prior to October 1st) and after major storm events
Education of Property Owners, Tenants & Occupants on Stormwater BMPs [N1]	Property Owner	The Property Owner will provide practical information materials to the first residents/occupants/tenants on general housekeeping practices that contribute to the protection of stormwater quality. These materials will be initially included in the approved WQMP. Thereafter such materials will be available through the local jurisdiction's storm water education program. The current website is www.sbcountystormwater.org	Within 3 months of occupancy and annually thereafter
Activity Restrictions [N2]	Property Owner	- Vehicles and equipment should not be maintenanced in areas exposed to storm water - Restrictions shall conform to local water quality ordinance.	Revised annually prior to training (N1)
Landscape Management [N3]	Property Owner	Application of pesticides or herbicides shall be done per industry standards. Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Adjust timers, sprinkler heads and make repairs as needed. These maintenance activities have been derived from information in CASQA handout "Landscape Management", which is provided in appendix B of the O&M plan.	Monthly

BMP Maintenance [N4]	Property Owner	Identify responsibility for implementation of each non-structural BMP and scheduled cleaning and/or maintenance of all structural BMP facilities. Maintain BMPs per Form 5-1	Revised annually prior to training (N1)
Local Water Quality Ordinance [N6]	Property Owner	This project will comply with NPDES Permit No. CAS618036 by implementation of the approved WQMP. Local water quality ordinances shall be followed per local agency.	Revised annually prior to training (N1)
Litter/Debris Control Program [N11]	Property Owner	Implement trash management and litter control procedures in common areas to reduce pollution of drainage area. Empty trash receptacles.	Weekly
Catch Basin Inserts [N14]	Property Owner	Inspect for trash, debris sediment and damage. Clean and repair as needed. These maintenance activities have been derived from information in CASQA handout MP-52, which is provided in appendix B of the O&M plan.	Annually (prior to October 1st) and after major storm events
Sweeping [N15]	Property Owner	Inspect parking lots for debris accumulation. Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the potential discharge of pollutants into the storm water conveyance system. These maintenance activities have been derived from information in CASQA handout SC-43, which is provided in appendix B of the O&M plan.	Annually (prior to October 1st)
NPDES Permits [N17]	Property Owner	The owner will implementation of the approved WQMP. The owner/tenant shall insure that a industrial SWPPP is created if required based on the use of the site. The owner/tenant will implement SWPPP requirements per separate document.	Ongoing
Provide storm drain system stenciling and signage [S1]	Property Owner	Inspected storm drain system stenciling and signage. Repair/replace as needed. These maintenance activities have been derived from information in CASQA handout SD-13, which is provided in appendix B of the O&M plan.	Annually (prior to October 1st)
Trash Enclosure [S3]	Property Owner	Inspect trash enclosure for debris. Clean enclosure area and dry sweep as needed. Inspect receptacle for damage/leaks. Contact contracted refuse company for replacement as needed	Monthly
Use Efficient Irrigation Systems and Landscape Design [S4]	Property Owner	Designing irrigation systems to each landscape area's specific water requirements. Adjust irrigation system as needed to prevent overwatering. These maintenance activities have been derived from information in CASQA handout SD-12, which is provided in appendix B of the O&M plan.	Monthly
Finished Grade of Landscape Areas [S5]	Property Owner	Landscape areas are to be constructed with a minimum of 1 inch below adjacent impervious areas. Adjust landscape areas so they are a minimum of 1 inch below adjacent impervious areas.	Prior to occupancy approval

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.

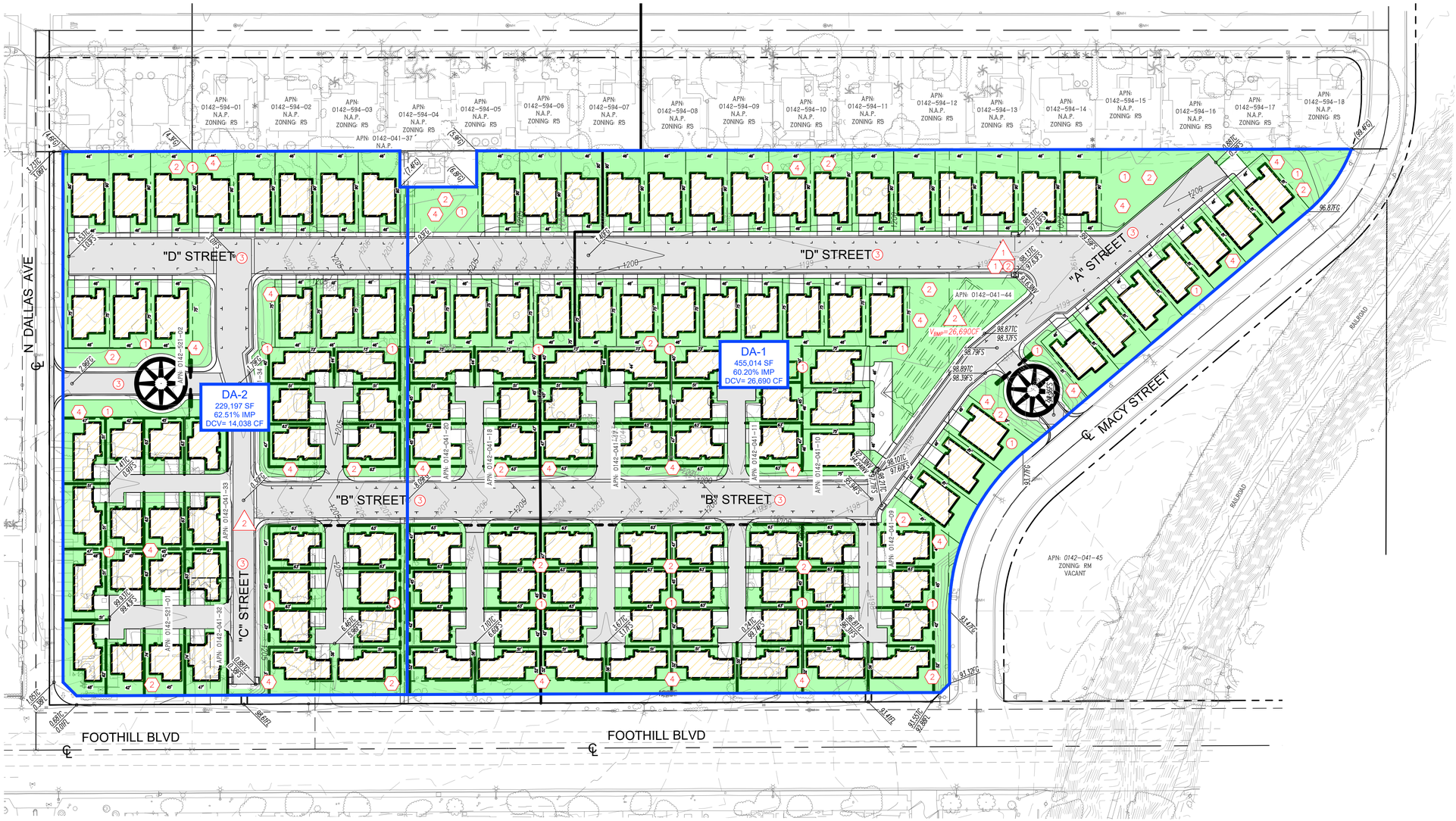
6.3 Post Construction

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

6.4 Other Supporting Documentation

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

Appendix 6.1 – Site Plan and Drainage Plan



OWNER INFORMATION:

ROUTE 66 TRUCK TERMINAL LLC
1820 SAN VICENTE BOULEVARD
SANTA MONICA, CA 90402
TEL. (310) 466-7225
ATTN: BOB NASSIR

NON-STRUCTURAL SOURCE CONTROL BMPS (FORM 4.1-1):

- EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPS [N1]
- ACTIVITY RESTRICTIONS [N2]
- (1) LANDSCAPE MANAGEMENT BMPS [N3]
- BMP MAINTENANCE [N4]
- LOCAL WATER QUALITY ORDINANCES [N6]
- LITTER/DEBRIS CONTROL PROGRAM [N11]
- (2) CATCH BASIN INSPECTION PROGRAM [N14] (CASQA SC-44)
- (3) VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS [N15] (CASQA SC-43)
- COMPLY WITH ALL OTHER APPLICABLE NPDES PERMITS [N17]

STRUCTURAL SOURCE CONTROL BMPS (FORM 4.1-2):

1. PROVIDE STORM DRAIN SYSTEM STENCILLING AND SIGNAGE [S1] (CASQA SD-13)
2. USE EFFICIENT IRRIGATION SYSTEMS & LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, AND SOURCE CONTROL [S4] (CASQA SD-12)
3. FINISH GRADE OF LANDSCAPED AREAS AT A MINIMUM OF 1-2 INCHES BELOW TOP OF CURB, SIDEWALK, OR PAVEMENT [S5]

PROPOSED TREATMENT CONTROL BMP'S:

1. DRAIN INSERTS (MP-52)
2. UNDERGROUND INFILTRATION SYSTEM

LEGEND:

- W.Q.M.P DRAINAGE AREA
- PROPERTY LIMITS
- FLOW LINE
- PROPOSED LANDSCAPING AREAS
- PROPOSED CONCRETE PAVING AREAS
- PROPOSED A/C PAVING AREAS
- PROPOSED STRUCTURES

60 0 60 120 180
SCALE: 1"=60'

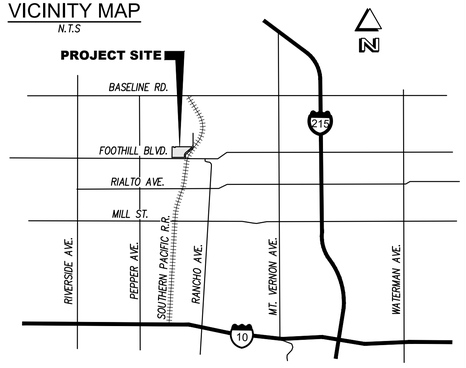
W.Q.M.P. NOTES:

1.) THIS WQMP EXHIBIT SHALL NOT BE USED FOR CONSTRUCTION. SEE APPROVED GRADING PLANS FOR CONSTRUCTIONS DETAILS AND CROSS-SECTIONS.

2.) STRUCTURAL BMPS MAY BE SUBSTITUTED FOR EQUIVALENT PRODUCTS WITH WRITTEN APPROVAL FROM THE ENGINEER OF RECORD, BASED ON AVAILABILITY AT TIME OF CONSTRUCTION.

3.) TREATMENT CONTROL BMPS MAY BE SUBSTITUTED FOR EQUIVALENT PRODUCTS WITH WRITTEN APPROVAL FROM THE ENGINEER OF RECORD.

VICINITY MAP
N.T.S



CITY OF SAN BERNARDINO

PRELIMINARY W.Q.M.P.

TENTATIVE TRACT MAP NO. 20695
SAN BERNARDINO, CA 92410

JOSEPH E. BONADIMAN & ASSOCIATES, INC.
ENGINEERS • C.I.S. • SURVEYING • PLANNING
TEL. (909) 885-3806
FAX (909) 381-7291
www.bonadiman.com

PREPARED FOR: ROUTE 66 TRUCK TERMINAL LLC

DRAWN BY:	S.G.	SCALE:	1" = 60'	SHEET: 1 OF 1	
CHECKED BY:	J.T.S.	JOB NO:	235132		
DISREGARD PRINTS BEARING EARLIER REVISION DATES →		04-19-24			

Appendix 6.2 – Electronic Data Submittal

Note: A cd containing PDF versions of the WQMP documents will be included in this section during final engineering, when requested by the reviewing agency.

Appendix 6.3 – Post Construction

Note: As indicated in section 8.2.3 of the "Technical Guidance Document for Water Quality Management Plans", dated June 7, 2013, a maintenance agreement may be required by local jurisdiction for proposed BMPs. A maintenance agreement will be provided in this section if requested by the local jurisdiction.

Appendix 6.4 – Other Supporting Documentation

WQMP Project Report - San Bernardino Co. Stormwater Program

Area of Interest (AOI) Information

Area : 703,124.23 ft²

Apr 16 2024 15:37:37 Pacific Daylight Time

Project Site Parcel Numbers

#	ParcelNumber	Acreage	Area(ft²)
1	*No Data*	*No Data*	1,645.62
2	014204133	0.21	9,100.21
3	014204132	0.21	9,100.30
4	014252101	0.35	14,798.23
5	014252102	0.81	33,971.45
6	014204111	0.90	39,785.01
7	014204110	0.95	41,503.75
8	014252103	1.05	46,564.00
9	014204120	1.11	48,290.10
10	014204118	1.41	61,237.15
11	014204121	1.33	61,241.31
12	014204134	1.41	61,426.65
13	014204109	1.54	66,978.77
14	014204144	2.23	97,363.56
15	014204117	2.44	110,117.92

HCOC Exempt Area

#	Type	Status	Area(ft²)
1	HCOC Exempt Areas	Yes	703,124.23

Drainage Segment Details

#	System Number	Facility Name	Closest channel segment's susceptibility to Hydromodification	Highest downstream hydromodification susceptibility	Is this drainage segment subject to TMDLs?
1	2-105-6D	East Rialto Storm Drain	EHM	High	No
2	2-202-1D	Lytle Creek Wash	EHM	High	No

#	Are there downstream drainage segments subject to TMDLs?	Is this drainage segment a 303d listed stream?	Are there 303d listed streams downstream?	Area(ft²)
1	No	No	Yes	62,709.28
2	No	Yes	Yes	640,414.79

Onsite Soil Groups

#	Onsite Soils Group	Soil Type	Soil Type Abbreviation	Area(ft²)
1	Soils - Hydro Group B	HbA HANFORD SANDY LOAM, 0 TO 2 PERCENT SLOPES B	HANFORD SANDY LOAM	127,077.80
2	Soils - Hydro Group A	Db DELHI FINE SAND A	DELHI FINE SAND	182,694.25
3	Soils - Hydro Group A	TuB TUJUNGA LOAMY SAND, 0 TO 5 PERCENT SLOPES A	TUJUNGA LOAMY SAND	393,351.97

Delhi Sands within 200'

#	SANDFLY_HA	SANDFLY__1	Area(ft²)
1	4	3	447,371.83

Studies and Reports Related to Project Site

#	Report Link	Source	Date	Area(ft²)
1	SBVMWD_High_Groundwater_/_Pressure_Zone_Area	USGS & San Bern Valley Municipal Water District	2005	703,124.23
2	CSDP_3_CALC_SHEET_FOR_HYDRO	San Bernardino County Flood Control District	April 1973	49,313.34
3	CSDP_3-5_Engineers_Report	San Bernardino County Flood Control District	April 1990	49,313.34
4	Preliminary_Report_on_Proposed_North_SBFCP	San Bernardino County Flood Control District	December 1954	703,124.23
5	Upper_Lytle_Creek_Drainage_Investigation	San Bernardino County Flood Control District	January 1966	703,124.23
6	CSDP_3-5_Area_Drainage_Plan	San Bernardino County Flood Control District	March 1991	49,313.34
7	School_Site_Map	CM Engineering Associates	October 1982	703,124.23
8	Comprehensive_Storm_Drain_Plan	CM Engineering Associates	October 1982	703,124.23

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. without independent verification.

NOAA Atlas 14, Volume 6, Version 2
Location name: San Bernardino, California, USA*
Latitude: 34.1078°, Longitude: -117.3427°
Elevation: 1208 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.126** (0.105-0.153)	**0.163** (0.135-0.198)	**0.211** (0.175-0.257)	**0.250** (0.206-0.307)	**0.304** (0.242-0.387)	**0.346** (0.269-0.450)	**0.389** (0.295-0.518)	**0.434** (0.319-0.595)	**0.495** (0.349-0.709)	**0.543** (0.370-0.806)
10-min	**0.181** (0.151-0.220)	**0.233** (0.194-0.283)	**0.302** (0.250-0.368)	**0.358** (0.295-0.441)	**0.436** (0.346-0.554)	**0.496** (0.385-0.644)	**0.557** (0.423-0.743)	**0.622** (0.458-0.853)	**0.710** (0.501-1.02)	**0.779** (0.531-1.16)
15-min	**0.219** (0.182-0.266)	**0.282** (0.234-0.343)	**0.365** (0.303-0.445)	**0.434** (0.356-0.533)	**0.527** (0.419-0.670)	**0.600** (0.466-0.779)	**0.674** (0.511-0.898)	**0.752** (0.554-1.03)	**0.858** (0.606-1.23)	**0.942** (0.642-1.40)
30-min	**0.322** (0.268-0.391)	**0.415** (0.345-0.505)	**0.538** (0.446-0.656)	**0.639** (0.525-0.785)	**0.777** (0.617-0.988)	**0.884** (0.687-1.15)	**0.993** (0.753-1.32)	**1.11** (0.816-1.52)	**1.26** (0.892-1.81)	**1.39** (0.946-2.06)
60-min	**0.459** (0.382-0.557)	**0.591** (0.491-0.718)	**0.765** (0.634-0.933)	**0.909** (0.747-1.12)	**1.10** (0.878-1.40)	**1.26** (0.977-1.63)	**1.41** (1.07-1.88)	**1.58** (1.16-2.16)	**1.80** (1.27-2.58)	**1.98** (1.34-2.93)
2-hr	**0.660** (0.549-0.801)	**0.847** (0.704-1.03)	**1.09** (0.906-1.33)	**1.30** (1.06-1.59)	**1.57** (1.25-2.00)	**1.78** (1.38-2.32)	**2.00** (1.52-2.66)	**2.22** (1.64-3.05)	**2.53** (1.79-3.62)	**2.77** (1.89-4.11)
3-hr	**0.817** (0.680-0.992)	**1.05** (0.871-1.27)	**1.35** (1.12-1.65)	**1.60** (1.31-1.96)	**1.94** (1.54-2.46)	**2.19** (1.71-2.85)	**2.46** (1.86-3.28)	**2.73** (2.01-3.75)	**3.11** (2.19-4.45)	**3.40** (2.32-5.04)
6-hr	**1.15** (0.957-1.40)	**1.47** (1.22-1.79)	**1.90** (1.57-2.31)	**2.24** (1.84-2.76)	**2.71** (2.15-3.45)	**3.07** (2.38-3.99)	**3.43** (2.60-4.58)	**3.81** (2.81-5.22)	**4.32** (3.05-6.18)	**4.72** (3.21-7.00)
12-hr	**1.54** (1.28-1.87)	**1.98** (1.65-2.41)	**2.55** (2.12-3.11)	**3.02** (2.48-3.71)	**3.64** (2.89-4.63)	**4.11** (3.20-5.34)	**4.59** (3.48-6.12)	**5.09** (3.75-6.98)	**5.75** (4.06-8.23)	**6.26** (4.27-9.29)
24-hr	**2.06** (1.83-2.38)	**2.67** (2.36-3.08)	**3.44** (3.04-3.98)	**4.07** (3.56-4.75)	**4.91** (4.16-5.92)	**5.55** (4.60-6.82)	**6.19** (5.01-7.80)	**6.84** (5.39-8.86)	**7.72** (5.84-10.4)	**8.40** (6.14-11.7)
2-day	**2.51** (2.23-2.90)	**3.30** (2.92-3.80)	**4.32** (3.81-5.00)	**5.15** (4.50-6.00)	**6.28** (5.32-7.56)	**7.14** (5.92-8.78)	**8.02** (6.50-10.1)	**8.92** (7.03-11.6)	**10.1** (7.68-13.7)	**11.1** (8.12-15.5)
3-day	**2.65** (2.35-3.05)	**3.54** (3.14-4.09)	**4.73** (4.17-5.47)	**5.71** (5.00-6.66)	**7.07** (5.98-8.51)	**8.12** (6.74-9.99)	**9.22** (7.46-11.6)	**10.4** (8.16-13.4)	**11.9** (9.02-16.1)	**13.2** (9.63-18.4)
4-day	**2.82** (2.50-3.25)	**3.81** (3.37-4.40)	**5.14** (4.53-5.95)	**6.25** (5.47-7.29)	**7.79** (6.60-9.39)	**9.01** (7.48-11.1)	**10.3** (8.33-12.9)	**11.6** (9.15-15.0)	**13.5** (10.2-18.2)	**15.0** (10.9-20.9)
7-day	**3.20** (2.83-3.68)	**4.34** (3.84-5.01)	**5.88** (5.18-6.80)	**7.16** (6.27-8.35)	**8.96** (7.58-10.8)	**10.4** (8.61-12.8)	**11.9** (9.60-14.9)	**13.4** (10.6-17.4)	**15.6** (11.8-21.0)	**17.3** (12.7-24.2)
10-day	**3.48** (3.08-4.01)	**4.74** (4.19-5.47)	**6.44** (5.68-7.45)	**7.86** (6.88-9.16)	**9.84** (8.34-11.9)	**11.4** (9.47-14.0)	**13.1** (10.6-16.5)	**14.8** (11.7-19.2)	**17.2** (13.0-23.2)	**19.2** (14.0-26.7)
20-day	**4.24** (3.76-4.89)	**5.83** (5.16-6.73)	**7.97** (7.03-9.22)	**9.77** (8.55-11.4)	**12.3** (10.4-14.8)	**14.3** (11.9-17.6)	**16.4** (13.3-20.6)	**18.6** (14.7-24.1)	**21.7** (16.4-29.3)	**24.2** (17.7-33.8)
30-day	**5.02** (4.44-5.78)	**6.93** (6.13-7.99)	**9.50** (8.38-11.0)	**11.7** (10.2-13.6)	**14.7** (12.5-17.7)	**17.1** (14.2-21.1)	**19.7** (15.9-24.8)	**22.4** (17.6-29.0)	**26.2** (19.8-35.3)	**29.3** (21.4-40.8)
45-day	**5.94** (5.26-6.85)	**8.21** (7.26-9.47)	**11.3** (9.95-13.0)	**13.9** (12.1-16.2)	**17.5** (14.8-21.1)	**20.4** (16.9-25.1)	**23.4** (19.0-29.5)	**26.7** (21.0-34.5)	**31.2** (23.6-42.1)	**34.9** (25.6-48.7)
60-day	**6.90** (6.11-7.95)	**9.52** (8.42-11.0)	**13.1** (11.5-15.1)	**16.0** (14.0-18.7)	**20.2** (17.1-24.4)	**23.6** (19.5-29.0)	**27.1** (21.9-34.1)	**30.8** (24.3-39.9)	**36.1** (27.3-48.7)	**40.4** (29.5-56.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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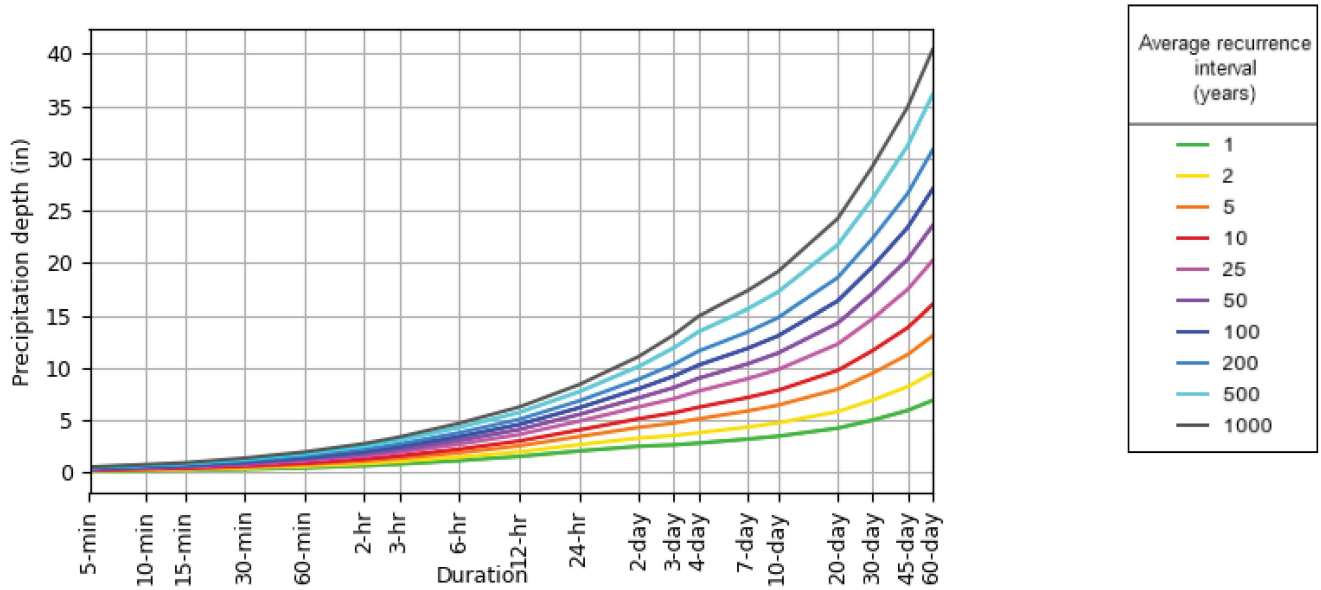
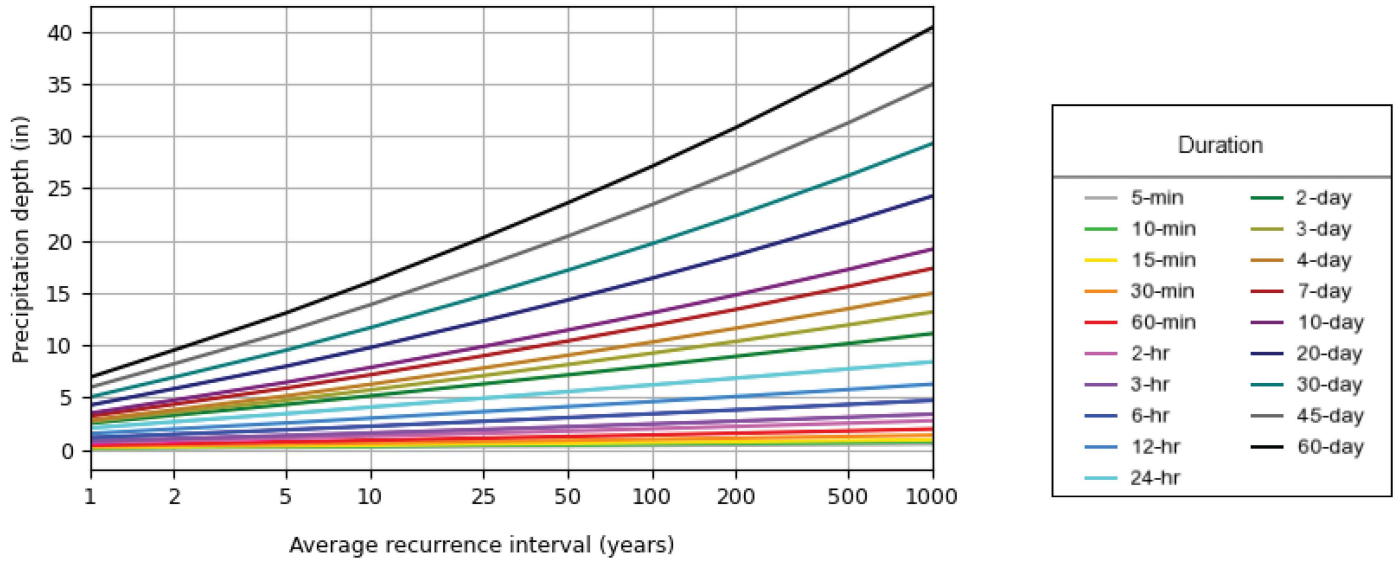
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 34.1078°, Longitude: -117.3427°





NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Tue Apr 16 22:29:46 2024

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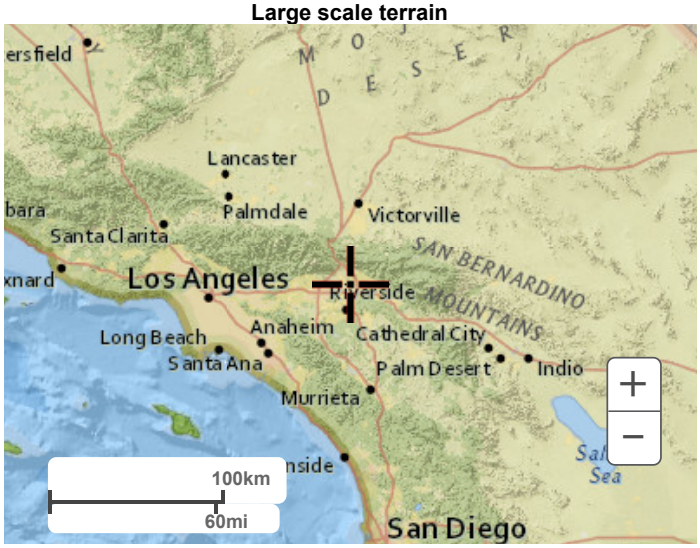
Maps & aerials

Small scale terrain

Large scale terrain



Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

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SOILS SOUTHWEST, INC.
SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

Report of Geotechnical Investigations & Soil Infiltration Testing for WQMP-BMP Design

Proposed Truck Terminal Facility
NW Foothill Boulevard and Macy Street
San Bernardino, CA
A.P.N.: 014-204-109, 110, 111, 117, 118, 120, 121, 144, & 145

Project No. 20047-F/BMP

April 1, 2021

Prepared for:

Truck Terminal Properties
1820 San Vincente Blvd.
Santa Monica, CA 90402

soilssouthwest@aol.com
Established 1984

SOILS SOUTHWEST, INC.

SOILS, MATERIALS AND ENVIRONMENTAL ENGINEERING CONSULTANTS

897 VIA LATA, SUITE N • COLTON, CA 92324 • (909) 370-0474 • (909) 370-0481 • FAX (909) 370-3156

April 1, 2021 Project No. 20047-F/BMP

Truck Terminal Properties
1820 San Vicente Boulevard
Santa Monica, California 90402

Attention: Mr. Bobby Nassir

Subject: Report of Geotechnical Investigation & Soil Infiltration Testing for WQMP-BMP Design
Proposed Trucking Facility
NW Foothill Boulevard and Macy Street, San Bernardino, California
A.P.N.: 014-204-109, 110, 111, 117, 118, 120, 121, 144, & 145

Reference: Project Plan provided by Bonadiman & Associates

Gentlemen:

Presented herewith is the Reports of (1) Soils and Foundation Evaluations and (2) Soil Infiltration Testing for WQMP-BMP Design for the site of the proposed Trucking Facility to be located on a vacant parcel located at the NW intersection of Foothill Boulevard and Macy Street, City of San Bernardino, California. The recommendations included should be considered "preliminary", subject to revision during site preparations and grading.

Based on the test explorations completed, it is our opinion that the soils encountered primarily consist of upper low to medium dense well-graded sands with traces of silts, pebbles and rock fragments overlying moderately dense silty gravely medium to coarse sands to the maximum 31 feet depth explored. Descriptions of the soils encountered are provided in the Log of Borings B-1 to B-6 and infiltration test boring logs P-1 and P-2, attached.

No shallow depth groundwater or bedrock was encountered. Based on review of the available published documents, it is our opinion that the site is not situated within an A-P Special Study Zone, and with the historical groundwater table at a depth 100 feet and below, based on the USGS Bulletin 1898, Plate 4, it is our opinion that potential for site susceptibility to seismically induced soils liquefaction should be considered "remote".

With the variable consistency soils existing as described, it is our opinion that when the site is graded as described herein the proposed truck terminal paving and the structural pad proposed should be feasible for the development planned.

We offer no other warranty, expressed or implied.

Respectfully submitted,
Soils Southwest, Inc.

REGISTERED PROFESSIONAL ENGINEER
MOLOY K. GUPTA
No 31708
Exp. 12-31-22
CIVIL
STATE OF CALIFORNIA

Moloy Gupta, RCE 31708

John Flippin, Project Manager

dist/ 1-bobnass5@gmail.com cc: JFS@bonadiman.com

1.0 Introduction

1.1 Purpose and Scope of Services

This report presents geotechnical recommendations for the site of the proposed Trucking Terminal Facility to be located near the northwest intersection of Foothill Boulevard and Macy Street, City of San Bernardino, California.

The recommendations contained reflect our best estimate of the soils' conditions as encountered as described. It is not to be considered as a warranty of the soils for other areas or for the depths beyond the explorations completed at this time.

The recommendations supplied should be considered valid and applicable when the following conditions, in minimum, are observed:

i. Pre-grade meeting with contractor, public agency and soils engineer,
ii. Excavated bottom inspections and verifications by soils engineer prior to backfill placement,
iii. Continuous observations and testing during site preparation and structural fill soils placement,
iv. Observation and inspection of footing trench prior to steel and concrete placement,
v. Plumbing trench backfill placement prior to concrete slab-on-grade placement,
vi. On and off-site utility trench backfill testing and verifications, and
vii. Consultations as required during construction, or upon your request.

In absence of precise grading plan, the geotechnical recommendations supplied should be considered as 'preliminary'. Supplemental recommendations may be warranted following grading plan review.

1.2 Site Description

The near level irregular shaped parcels are currently vacant and undeveloped except for an existing single-family residence bridging two parcels (014204110&11). In general, the site is bounded by a single-family tract on the north, by Foothill Boulevard on the south, by North Macy Street on the east, and by vacant undeveloped property on the west. Overall vertical relief is currently unknown, but sheet-flow from incidental rainfall appears to flow towards the east and west/northwest. With the exception of scattered soil and debris stockpiles along with scattered trees, abandoned concrete slabs, block wall and fencing, no other significant features are noted.

1.3 Proposed Development

No detailed development plans are available for review. However, based on the preliminary project information supplied, it is understood that the subject development will primarily include open-air commercial truck parking/truck storage facility with a minor guard structure. Supplemental improvements are anticipated to include installation of an underground WQMP-BMP infiltration chambers, drive approaches, paving, and others. Moderate site preparation and grading should be anticipated with the development proposed.

2.0 Scope of Services

Geotechnical evaluations included review of the available publications for the site and adjacent, along with necessary sub-surface explorations, soil sampling, necessary laboratory testing, engineering analyses and the preparation of this report. In general, our Scope of Services included the following:

o Field Explorations

For geotechnical evaluations six (6) exploratory test borings (B-1-B-6) were made using a limited access hollow-stem auger drilling rig advanced to 31 feet below existing grade. For WQMP-BMP soil infiltration rat determinations, supplemental two (2) explorations (P-1 and P-2) are made advanced to maximum 12 feet below grade as suggested by the project design engineer. Prior to test excavations, an underground utility clearance was established with Underground Service Alert (USA) of Southern California to avoid possible subsurface life-line obstruction and rupture. Following necessary soil sampling and in-situ testing, the test excavations were backfilled with local soils using minimum compaction effort. Collected samples were subsequently transferred to our laboratory for necessary geotechnical testing. Approximate test excavation locations are shown on the attached Plate 1.

During excavations, the soils encountered were continuously logged and bulk and undisturbed samples were procured. Collected samples were subsequently transferred to our laboratory for necessary geotechnical testing. Description of the soils encountered is shown on the Test Exploration Logs in Appendix A.

o Laboratory Testing

Representative bulk and undisturbed site soils were tested in laboratory to aid in the soils classification and to evaluate relevant engineering properties pertaining to the project requirements. The laboratory tests completed include the following:

- In-situ moisture contents and dry density (ASTM Standard D2216),
- Maximum Dry Density and Optimum Moisture Content (ASTM Standard D1557),
- Direct Shear (ASTM Standard D3080),
- Soil consolidation (ASTM Standard D2435),
- Soils Gradation evaluations (ASTM D422),
- Soils Sand Equivalent, SE (ASTM D 2419). and
- Expansion Potential Index (ASTMD4829)

No soils chemical analysis is currently included. Post-grading soil chemical analysis analyses, including pH, sulfate, chloride, and resistivity will be performed prior to actual construction and concrete pour.

Description of the test results and test procedures used are provided in Appendix B.

o Based on the field investigation and laboratory testing, engineering analyses and evaluations were made on which to base our preliminary recommendations for design of foundations, slab-on-grade, paving and parking, site preparations and grading monitoring during construction, and preparation of this report for initial use by the project design professionals.

3.0 Geotechnical Descriptions

3.1 Soils Conditions

Based on the geotechnical investigation completed as described, it is our opinion that the site soils encountered primarily consist of upper compressible and variable density silty fine to medium coarse sands with minor pebbles and rock fragments overlying medium dense gravely silty fine to medium coarse sands to the maximum 31 feet depth explored. No free groundwater was encountered. Descriptions of the soils encountered are provided in the Log of Borings, B-1 to B-6.

Description of the soils encountered for determination of water infiltration rate for WQMP-BMP design are described in test boring logs P-1 and P-2, attached.

Laboratory shear tests conducted on the upper bulk samples remolded to higher density indicate moderate shear strengths under increased soil moisture conditions. Results of the laboratory shear tests are provided in Appendix B of this report.

Sandy gravely and slightly silty in nature, the site soils are considered "very low" in expansion characteristics with Expansion Index, EI, less than 20, thereby requiring no special construction requirements other than those as described herein.

3.2 Subsurface Variations

During site preparations and grading, presence of buried irrigation, seepage pits, debris, organic and other non-structural materials may be anticipated. In addition, variations in soil strata and their continuity and orientations may be expected. Due to the nature and depositional characteristics of the natural soils existing as described, care should be exercised in interpolating or extrapolating the subsurface soils conditions existing in between and beyond the test explorations conducted.

3.3 Excavatibility

It is our opinion that the grading required for the project may be accomplished using conventional heavy-duty construction equipment. However, some difficulty may be expected during deep trenching due to soil caving. No blasting or jackhammering, however, should be anticipated.

3.4 Soil Corrosivity

Since change in soils chemical compositions are expected following site preparations and grading, no laboratory soil corrosivity potential evaluations are currently initiated. Following mass grading completion, results of such, in minimum, the pH, sulfate, chloride and resistivity will be supplied on request.

3.5 Groundwater

Groundwater was not encountered within the maximum depth of 31 feet explored and none such is anticipated during grading and construction. The following table lists the historical groundwater table based on the information as supplied by the local reporting agency.

GROUNDWATER TABLE	
Reporting Agency	Water Master Support Services-San Bernardino Valley Conservation District/Western Municipal Water District Cooperative Well Measuring Program, Fall 2018
Well Number	01S/04W-06B001S City 5
Well Monitoring Agency	City of Rialto
Well Location: Township/Range/Section	T1S-R4W-Section 6
Well Elevation:	1211
Current Depth to Water (Measured in feet)	331.0
Current Date Water was Measured	November 13, 2018
Depth to Water (Measured in feet) (Shallowest)	148.0
Date Water was Measured (Shallowest)	April 12, 2000

4.0 Faulting and Seismicity

4.1 Faulting and Seismicity

Based on the information published by the Department of Conservation, State of California, it is understood that the subject site is not situated within an A-P Special Study Zone, where a fault(s) runs through or its immediate adjacent. However, considering Southern California being in a seismically risky area, it is our opinion that with the conventional design/construction knowhow it is not possible to develop a site economically that are totally resistant to earthquake-related hazards. Although implementation of the current design and construction knowhow using the current CBC may benefit to the structure planned.

4.2 Direct or Primary Seismic Hazards

Surface ground rupture along with active fault zones and ground shaking represent primary or direct seismic hazards to structures. There are no known active or potentially active faults that pass through or towards the subject site, and the site is not situated within an AP Special Studies Zone. According to the current CBC, the site is considered within Seismic Zone 4. As a result, it is likely that moderate to severe ground shaking may be experienced for the development proposed.

4.3 Induced or Secondary Seismic Hazards

In addition to ground shaking, effects of seismic activity may include flooding, land-sliding, lateral spreading, settlements, and subsidence. Potential effects of such are discussed as below.

4.3.1 Flooding

Flooding hazards include tsunamis (seismic sea waves), Seiches, and failure of manmade reservoirs, tanks and aqueducts. In absence of such nearby, such potential is considered remote.

4.3.2 Land Sliding

Considering the subject site being near level with developed surrounding, potential for seismically induced land sliding is considered "remote".

4.3.3 Lateral Spreading

Structures or facilities proposed are expected to withstand predicted ground softening and/or predicted vertical and lateral ground spreading/displacements, to *an acceptable level of risk*. Seismically induced lateral spreading involves lateral movement of soils due to ground shaking.

The topography of the site being near level, it is our opinion that the potential for seismically induced lateral ground spreading should be considered "remote".

4.4 Site Specific Seismic Effects

The site is situated at about 0.59 miles from the San Jacinto Fault capable of generating an earthquake magnitude of M=7.3 and PGA of 0.655g. Considering the project involving no major construction other than the asphaltic paving/parking and a guard shack, no site soils liquefaction evaluation is included and none such should be considered necessary for the project described.

4.5 Seismic Design Coefficients

Using s Site Coordinates of 34.107090°N, -117.341503W and considering the site being situated at about 0.59 miles from the San Jacinto Fault. For foundation and structural design, the following seismic parameters are suggested based on the current 2019 CBC.

Recommended values are based upon the USGS ASCE 7-Hazard Reports Parameters and the California Geologic Survey: PSHA Ground Motion Interpolator Supplemental seismic parameters are provided in Appendix C of this report. The following presents the seismic design parameters as based on the available publications as currently published by the California Geological Survey and 2019 CBC.

The following presents the seismic design parameters as based on available publications as currently published by the California Geological Survey and 2019 CBC.

TABLE 4.5.1 Seismic Design Parameters

CBC Chapter 16	2019 ASCE 7-16 Standard Seismic Design Parameters	Recommended Values
1613A.5.2	Site Class	C
1613.5.1	The mapped spectral accelerations at short period	S_s
1613.5.1	The mapped spectral accelerations at 1.0-second period	S_1
1613A5.3(1)	Site Class B / Seismic Coefficient, S_s	2.400g
1613A5.3(2)	Site Class B / Seismic Coefficient, S_1	0.961 g
1613A5.3(1)	Site Class C / Seismic Coefficient, F_a	1.000 g
1613A5.3(2)	Site Class C / Seismic Coefficient, F_v	NA
16A-37 Equation	Spectral Response Accelerations, $S_{Ms} = F_a S_s$	2.400 g
16A-38 Equation	Spectral Response Accelerations, $S_{M1} = F_v S_1$	NA
16A-39 Equation	Design Spectral Response Accelerations, $S_{Ds} = 2/3 \times S_{Ms}$	1.600 g
16A-40 Equation	Design Spectral Response Accelerations, $S_{D1} = 2/3 \times S_{Ms}$	NA

TABLE 4.5A.2 Seismic Source Type

Based on California Geological Survey-Probabilistic Seismic Hazard Assessment Peak Horizontal Ground Acceleration (PHGA) having a 10 percent probability of exceedance in a 50- year period is described as below:

Seismic Source Type / Appendix C	
Nearest Maximum Fault Magnitude	M>\=7.35
Peak Horizontal Ground Acceleration	0.655 g

In design, vertical acceleration may be assumed to about 1/3 to 2/3 of the estimated horizontal ground accelerations described.

It should be noted that lateral force requirement in design by structural engineer should be intended to resist total structural collapse during an earthquake. During lifetime use of the structure built, it is our opinion that some structural damage may be anticipated requiring some structural repairs. Adequate structural design and implementation of such in construction should be strictly observed.

5.0 Evaluations and Recommendations

5.1 General Evaluations

Based on field explorations, laboratory testing and subsequent engineering analysis, the following conclusions and recommendations are presented for the site under study:

(I) From geotechnical viewpoint, the proposed conventional on-grade open-air truck-terminal paving/parking and guard shack should be considered feasible provided the recommendations included are incorporated in design and construction.
(II) Post-earthquake paving distress may occur requiring minor to moderate repair/reconstruction.
(III) The recommended subexcavation depths are for estimation purposes. Supplemental deeper subexcavations may be warranted within areas underlain by buried debris, utilities, presence of deeper undocumented fills and others.
(IV) To minimize adverse effects of ground shaking. use of the described peak horizontal ground acceleration (PGA) along with the design procedures as outlined in the current CBC should be considered.
(V) Provisions should be maintained during construction to divert incidental rainfall away from the structural pads, once constructed.
(VI) It is our opinion that paving proposed will not adversely affect the stability of the site or adjacent.

5.1 Alternative Load Bearing Surface for Paving/Parking and Truck Storage

5.1.1 Flexible Asphalt Concrete Surface

Based on the Soils Sand Equivalent, SE, of 36, estimated soil R-value of 65 and Traffic Index, TI, of 6.5, for 20-year design life, the following recommendations are suggested for paving for truck storage/truck traffic yard planned:

Design Paving Section

Paving/Parking and Truck Storage	Traffic Index, TI, used	Designed asphalt (AC) Thickness	Designed Class II or CMB Thickness	Designed Total Thickness
On-Site Paving	6.5-7.0	4"	4"	8"

The subgrades to received paving should subexcavated/scarified to minimum 18-inch, followed by their replacement compacted to minimum 90% and the base material compacted to 95% of the soils/base material Maximum Dy Density as determined by ASTM Standard D1557. Use of thickened edge should be considered to protect paving from accidental edge-loading and/or lateral sliding.

The paving materials used, including the asphalt and aggregate base should meet the minimum gradation and quality requirements of the Green Book and the requirements of the Caltrans Standard Specifications. It should be noted that with repeated use of the paving by heavy trucks etc., regular maintenance should be expected.

5.1.2 Alternative Rigid Concrete Paving

If selected, Rigid Concrete Paving may be considered as described as follows:

Materials	Autos/Light Trucks (TI=6.0)	Truck Traffic TI= 7.0
Portland Cement Concrete, PCC, over	5" (net)*	6" (net) *
Class II Base, or Miscellaneous Base compacted to min. 95%, over	-0-	-0-
local soils compacted to min. 95%	18"	18"

Note: *- use of paving reinforcing may be omitted provided the subgrades *prepared are compacted to minimum 95% and expansion joint spacings are limited to within 24 to 30-times the pcc thickness, or to within 12 to 15 feet* both-ways, with joint depth to minimum 1/3 of paving thickness.

Use of thickened edge should be considered to protect concrete paving from accidental edge-loading and/or lateral sliding. Regular maintenance should be expected.

Actual concrete paving thickness, construction/expansion joints and reinforcing requirements should be supplied by the project structural engineer using an Annual Daily Traffic (ADT), and a Soil Subgrade Reaction, ks, of 350 kcf.

5.2 Spread Foundations for Guard-Shack/ Office

The proposed minor office structure may be supported by conventional load bearing footings sized to minimum 12-inch wide, embedded to minimum 12-inch into the lowest adjacent final grade surface. Actual foundation dimensions should be supplied by structural engineer based upon 1800 psf soils vertical bearing and the seismic design parameters and the horizontal Peak Horizontal Ground Acceleration (PGA) as described.

The above soil bearing capacity may be increased for each additional footing depth and width in excess of the minimum recommended. Total maximum vertical bearing capacity is recommended not to exceed 2000 psf. If normal code requirements are applied, the above capacities may further be increased by an additional 1/3 for short duration of loadings, including the effects of wind and seismic forces. Actual foundation dimensions should be determined by the project structural engineer based on the static and seismic design parameters described.

From geotechnical viewpoint, load bearing footing should be reinforced using minimum 2-#4 rebar placed near the top and 2-#4 rebar near bottom of continuous footings.

Based on the laboratory determined soils consolidation characteristics, settlements to properly designed and constructed foundations supported exclusively into engineered fills of site soils or its equivalent or better, and carrying the maximum anticipated vertical structural loadings are expected to be within tolerable limits. Under static loading conditions over a 40-ft. span the estimated total and differential settlements are about 1 and 1/2-inch, respectively. Most of the elastic deformations, however, are expected to occur during construction.

It is recommended that excavated footing trenches should be verified, tested and certified by the soils engineer prior to actual concrete placement.

5.2.1 Concrete Slab-on-Grade for Office Structure

The prepared subgrades to receive footings should be adequate for concrete slab-on-grade placement. For conventional loadings, structural slabs placed should be a minimum 4-inch thick, reinforced with #3 rebar at 18-inch o/c.

Within moisture sensitive areas concrete slabs should be underlain by 2-inch of clean sand, followed by commercially available 6-mil thick Stego Wrap or Visqueen or other similar commercially available vapor barrier, or as suggested by the project structural engineer. The sand used should be free of rock, with a minimum Sand Equivalent, SE of 30.

Subgrades to receive concrete should be moistened as would be expected in any such concrete placement. Use of low-slump concrete is recommended.

In addition, prior to surfacing, it is recommended that, utility trenches underlying concrete slabs and driveways, if any, should be thoroughly backfilled with gravelly sandy soils and mechanically compacted to minimum 90%.

No jetting should be allowed for soil compaction in lieu of conventional mechanical compaction.

5.3 Active Pressure and Passive Resistance

With compacted level backfills using local gravelly sandy soils equivalent active lateral fluid pressures of 30 pcf and 45 pcf may be considered for "unrestrained" and "restrained" structural conditions, respectively.

Resistance to lateral loads can be provided by friction acting at the base of foundation and by passive earth pressures. A coefficient of friction of 0.3 may be assumed with normal dead load forces for footings when established into compacted engineered fills.

For design, an allowable passive lateral earth resistance of 230 lb/ft2./ft depths may be assumed for sides of foundations poured against the grade as described above. Maximum passive earth resistance is recommended not to exceed 2300 lb/ft2.

The above values may be increased by 1/3 when designing for short duration wind or seismic forces. The above values are based on footings placed on compacted engineered fills. In the case where footing sides are formed, all backfill placed against the footings should be compacted to at least 90 percent of maximum dry density.

5.4 Shrinkage and Subsidence

With the presence of upper loose and compressible local soils as described; it is our opinion that such soils may be subjected to volume change during grading. In average, such volume change due to shrinkage is estimated to about 15 percent, or more.

Further volume change may be expected following removal of undetected buried utilities etc. Supplemental shrinkage is anticipated during preparation of the underlying natural soils prior to compacted fills placement. Such subsoil subsidence may be approximated to about 2.5-inch when conventional construction equipments are used.

5.5 Construction Consideration

5.5.1 Unsupported Excavation

Temporary construction excavations up to an approximate depth of 5 feet may be made without any lateral support. It is recommended that no surcharge loads such as construction equipment may be allowed within a line drawn upward at 45 degree from the toe of temporary excavations. Use of sloping for deep excavation may be considered where plan excavation dimensions are not constrained by any existing structure.

5.5.2 Supported Excavations

If vertical excavations exceeding 5 feet become warranted, for the excavation adjacent to existing development, such should be achieved using shoring to support side walls. Alternatively, excavations with a combination of sloping and vertical may be considered. Further recommendations on such will be supplied on request.

5.6 Utility Trench Backfill

Utility trenches backfill below interior concrete slabs or within structural pad and beyond should be placed in accordance with the following recommendations:

- Trenches backfill for wet and dry utilities should be placed in 6 to 8-inch thick lifts and mechanically compacted to minimum 90 percent. Jetting is not recommended.
- Exterior trenches along foundations or a toe of a slope extending below a 1:1 imaginary line projected from outside bottom edge of the footing or toe of the slope, should be compacted to 90 percent of the Maximum Dry Density for the soils used as backfill. All trench excavations should conform to the requirements and safety as specified by the Cal-Osha

5.7 Soil Caving

With the dry silty nature of the local soils, some caving may be expected. Temporary excavations in excess of 5 feet should be feasible at 2 to 1 (h:v) slope ration or flatter, and as per the construction guidelines provided by Cal-Osha.

5.8 Pre-Construction Meeting

It is suggested that no site clearance and grading should be commenced without the presence of a representative of this office. On-site pre-grading meeting should be arranged between the soils engineer and grading contractor. Over-night pre-moistening is recommended.

5.9 Seasonal Limitations

No fill shall be placed, spread or rolled during unfavorable weather conditions. Where the work is interrupted by heavy rains, fill operations shall not be resumed until moisture conditions are considered favorable by the soils engineer.

5.10 Observations and Testing During Construction

Recommendations provided are based on the assumption that structural footings and slab-on-grade be established exclusively into engineered fill of local sandy soils compacted to minimum 90%. Excavated footings and slab subgrades should be inspected, verified, and certified by soils engineer prior to steel and concrete placement. Structural backfills discussed, should be placed under direct observations, and testing by this facility.

5.11 Plan Review

No precise grading plans are available at this time for review. Precise grading plans, when prepared, should be available to verify applicability of the assumptions and the recommendations supplied. If during construction, conditions are observed different from those as presented, revised and/or supplemental recommendations will be required.

6.0 General Recommendations for Site Preparations and Grading

Site preparations and grading should involve over-excavation and replacement of local soils as structural fill compacted to the minimum relative compactions as described earlier.

Structural Backfill:

Local soils free of debris, large rocks and organic should be considered suitable for reuse as backfill. Loose soils, formwork and debris should be removed prior to backfilling retaining walls. On-site sand backfill should be placed and compacted in accordance with the recommended specifications provided below. Where space limitations do not allow conventional backfilling operations, special backfill materials and procedures may be required. Pea gravel or other select backfill can be used in limited space areas. Recommendations for placement and densification of pea gravel or other special backfill can be provided during construction.

Site Drainage:

Adequate positive drainage should be provided away from the structure to prevent water from ponding and to reduce percolation of water into backfill. A desirable slope for surface drainage is 2 percent in landscape areas and 1 percent in paved areas. Planters and landscaped areas adjacent to building perimeter should be designed to minimize water filtration into sub-soils. Considerations should be given to the use of closed planter bottoms, concrete slabs, and perimeter sub-drains where applicable.

Utility Trenches:

Buried utility conduits should be bedded and backfilled around the conduit in accordance with the project specifications. Where conduit underlies concrete slab-on-grade and pavement, the remaining trench backfill above the pipes should be placed and compacted in accordance with the following grading specifications.

General Grading Recommendations:

Recommended general specifications for surface preparation to receive fill and compaction for structural and utility trench backfill and others are presented below.

1. Areas to be graded or paved, shall be grubbed, stripped and cleaned of all buried and undetected debris, structures, concrete, vegetation and other deleterious materials prior to grading.

2. Where compacted fill is to provide vertical support for foundations, all loose, soft and other incompetent soils should be removed to full depth as approved by soils engineer, or at least up to the depth as previously described in this report. The areas of such removal should extend at least 5 feet beyond the perimeter of exterior foundation limit or to the extent as approved by soils engineer during grading.

3. The recommended compaction for fill to support foundations and slab-on-grade is 90% of the soils' maximum dry density at near optimum moisture content. To minimize any potential differential settlement for foundations and slab-on-grade straddling over cut and fill, the cut portion should be over-excavated and replaced as compacted fill, compacted to the maximum dry density as described in this report.

   Utility trenches within the structural pad areas and beyond, should be backfilled with the local granular soils and such should be compacted to the minimum compaction as described earlier.

4. Compaction for fill soils shall be determined relative to the Maximum Dry Density as determined by ASTM D1557 compaction method. In-situ field density of compacted fill shall be determined by ASTM Standard D1556, or by using Nuclear Density Gauge as per the ASTM standard D2922.

5. Imported soils if required shall be clean, granular, non-expansive in nature as approved by soils engineer.

6. During grading, fill soils shall be placed as thin layers, thickness of which following compaction, shall not exceed 6 inches.

7. No rocks over six inches in diameter shall be permitted to use as a grading material without prior approval of soils engineer.

8. No jetting and/or water tampering be considered for backfill compaction for utility trenches without prior approval of the soils engineer. For such backfill, hand tampering with fill layers of 8 to 12 inches in thickness, or as approved by the soils engineer is recommended.

9. All utility trenches at depth as well as cesspool and abandoned septic tank within building pad area and beyond, should either be completely excavated and removed from the site, or should be backfilled with gravel, slurry or by other material, as approved by soils engineer.

10. Site preparations and grading required for pavement should be constructed under direct supervision of soils engineer or as required by the local public agency.

11. A site meeting should be held between the grading contractor and soils engineer prior to actual construction. Two days of notice will be required by soils engineer for such meeting.

7.0 WQMP-BMP Stormwater Disposal Design Water Infiltration Rate Using Porchet Method

Presented herewith are the preliminary results of soils infiltration testing performed for the planned storm water disposal design system proposed for the project site described. Considering the relatively homogenous silty sand during preliminary site explorations, no known changes are anticipated during site grading, however test results should be considered tentative given the potential for changes to site finish grade(s) or changes in soil conditions during grading.

Two (2) infiltration tests were performed at about twelve (12) feet below the current grades as suggested by the project civil engineer for the proposed underground stormwater chamber at the locations P-1 and P-2, using the standardized "falling-head" test method converted infiltration rate using the Porchet Method as per the guidelines as described in Table 1, Infiltration Basin Option 2 of Appendix A of the Riverside County-Low Impact Development (LID) BMP design Handbook, as well as the Appendices Section VII.3.8.2, Appendix VII: Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations of the San Bernardino County Technical Guidance Document for Water Quality Management Plan Handbook. Approximate test locations, P-1 and P-2, are shown on Plate 1, attached.

The soils encountered consist in general of upper fine to medium silty sands overlying gravely fine to medium coarse sands with rock fragments and rocks to the maximum 12 feet depth explored and proposed chamber bottom (P-1&P-2). For the purposes of determining the presence/or lack of presence of groundwater or any impermeable soils, soils encountered below twelve (12) feet to maximum depth of thirty-one (31) feet consists, in general of, silty fine damp sands overlying very moist gravely coarse sands with pebbles and rock fragments, test boring (B-1),

No free groundwater was encountered. Descriptions of the soils encountered are provided in the Log of Borings, P-1 and P-2, attached.

Based on the field infiltration testing completed, it is our opinion that for the infiltration system design proposed at about 12 feet below grade, the observed soils infiltration rates are 12.71 and 10.67 in/hr.

For design, it is suggested that use of an appropriate factor of safety as determined by the design engineer should considered to the observed rate to account for long-term saturation, inconsistencies in subsoil conditions, potential for silting and lack of maintenance. The observed soils percolation rates are provided in Table7.4.1 in Section 7.4 of this report.

7.1 EXCAVATED TEST BORINGS

For BMP soil infiltration testing at the location as shown on the accompanying Plate 1, two (2) tests borings (P-1 and P-2) were made using an 8-inch diameter hollow-stem auger drilling rig, advanced to approximately 12 feet below the current grade as suggested the project engineer. Water used during infiltration percolation testing was supplied by using water jugs and a water tank.

7.2 METHODOLOGY AND TEST PROCEDURES:

EQUIPMENT SET-UP (POST EXCAVATION) PROCEDURES

Following test boring completion, each of the test holes were fitted with perforated pvc pipes backfilled with 2-inch-thick crushed rock at the bottom to minimize potentials for scouring and caving. For testing, each test hole was initially filled using water supplied by water jugs.

Prior to actual testing, in order to determine test intervals, as per the Section 2.3 for deep percolation testing of the referenced handbook guideline, one to two consecutive readings were performed to determine if six (6) or more inches of water seeped in 25 minutes. Since 6 inches or more of water seeped away in less than 25 minutes for both P-1 and P-2, subsequent ten percolation testing were performed at 10-minute time intervals for at least the minimum one hour or until the rates were consistent.

Testing included water placement at about 10 feet below existing grade surface (inlet depth or 24 inches above infiltration system bottom).

The final 10-mfinute recorded percolation test rate was converted into an Infiltration Rate (I_t) for inches per hour using the "Porchet Method" equation as described in the Reference 2, Riverside County Low Impact Development BMP Design Handbook.

7.3 INFILTRATION TEST RESULT

Based on the soils infiltration testing completed at the test locations and at the test depths, the observed soil percolation rates are 11.7 inch/hour for the test locations P-1 and P-2, as described.

Calculations to convert the percolation test rate to infiltration test rates in accordance with Section 2.3 of the County Handbook are presented in Table I and II below. For design, it is suggested that, use of a factor of safety of 2.0 to 3.0, or an appropriate Factor of Safety as selected by the design engineer should be considered to the observed field percolation rate described.

7.3.1. Conversion Calculations & Summary:

TABLE I

Summary of Observed Infiltration Rates

Test Date (11-5-2020) Test No.	Test Depth Below Grade (ft)	Change in Water Level (in)	Observed Rate Porchet Method (in/hr)
P-1	12.0	18.0	12.71
P-2	12.0	16.0	10.67

TABLE II

Conversion Table (Porchet Method)

Test No.	Test Hole Depth, D_T (in)	Time Interval, Δt (min)	Initial Depth, D_O (in)	Final Depth, D_f (in)	Initial Water Height, (in) $H_O = D_T - D_O$	Final Water Height, (in) $H_f = D_T - D_f$	Change in Water Height (in) $\Delta H = H_O - H_f$	Average Head Height (in) $H_{avg} = (H_O + H_f)/2$
P-1	144	10	120	138	24	6	18	15
P-2	144	10	120	136	24	8	16	16

	Infiltration Rate (I_t)=$\Delta H60r/\Delta t(r+2H_{avg})$		
	A	B	C
Test No.	$\Delta H60r$	$\Delta t(r+2Havg)$	A/B=in/hr
P-1	4320	340	**12.71**
P-2	3840	360	**10.67**

Use of safety factor should be considered to account for long-term saturation, inconsistencies in subsoil conditions, along with the potential for silting of percolating soils.

The infiltration rate described is based on the in-situ testing completed at the locations as suggested by the project civil engineer. In event the final chamber location and depth vary considerably from those as described herein, supplemental soils infiltration testing may be warranted.

It should be noted that over prolong use and lack of maintenance the detention/infiltration basins or deep chambers constructed based on the suggested design rate may experience much lower infiltration rate due to the accumulation of silts, fines, oils and others. Regular maintenance of the chambers in form of removal of debris, oil and fines are strongly recommended. A maintenance record of such is suggested for future use, if any.

Suggested Site Requirements for Stormwater BMP installation

The invert of stormwater infiltration shall be at least 10 feet above the groundwater elevation. Stormwater infiltration BMPs shall not be placed on steep slopes and shall not create the condition or potential for slopes instability.

Stormwater infiltration shall not increase the potential for static or seismic settlement of structures on or its adjacent.

Stormwater infiltration shall not place an increased surcharge on structures or foundations on or its adjacent. The pore-water pressure shall not be increased on soil retaining structures on or adjacent to the site.

The invert of stormwater infiltration shall be set back at least 15 feet, and outside a 1:1 plan drawn up from the bottom of adjacent foundations.

Stormwater infiltration shall not be located near utility lines where the introduction of stormwater could cause damage to utilities or settlement of trench backfill.

Stormwater infiltration is not allowed within 100 feet of any potable groundwater production well.

Once installed, regular maintenance of the detention basin is recommended.

8.0 Closure

The conclusions and recommendations presented are based on the findings and observations as made during subsurface test explorations. In absence of site-specific grading plan, finished floor grades are assumed at or near grade existing surface. The recommendations included should be considered "preliminary" and thus may require supplemental investigations including additional borings, laboratory testing and engineering evaluations. If during construction, the subsoil conditions appear to be different from those as described, this office should be notified to consider modification of the geotechnical recommendations included in this report.

Recommendations provided are based on assumptions that structural loadings will be established exclusively into compacted fills of local gravelly sandy soils or its equivalent or better. No footings and/or load bearing paved surface should be allowed straddling over cut/fill transition interface.

Final grading and foundation plans should be reviewed by this office when they become available. As the project Geotechnical Consultant, Soils Southwest, Inc. should be provided with the opportunity to verify footing excavations and slab subgrades prior to steel and concrete placement. Soils Southwest, Inc: will assume no responsibility in event concrete is poured without the required verifications described.

A pre-grading meeting between grading contractor and soils engineer is recommended prior to construction preferably at the site, to discuss the grading procedures to be implemented and other requirements described in this report to be fulfilled.

This report has been prepared exclusively for the use of the addressee for the project referenced in the context. It shall not be transferred or be used by other parties without a written consent by Soils Southwest, Inc. We cannot be responsible for use of this report by others without the necessary inspection and testing by our personnel.

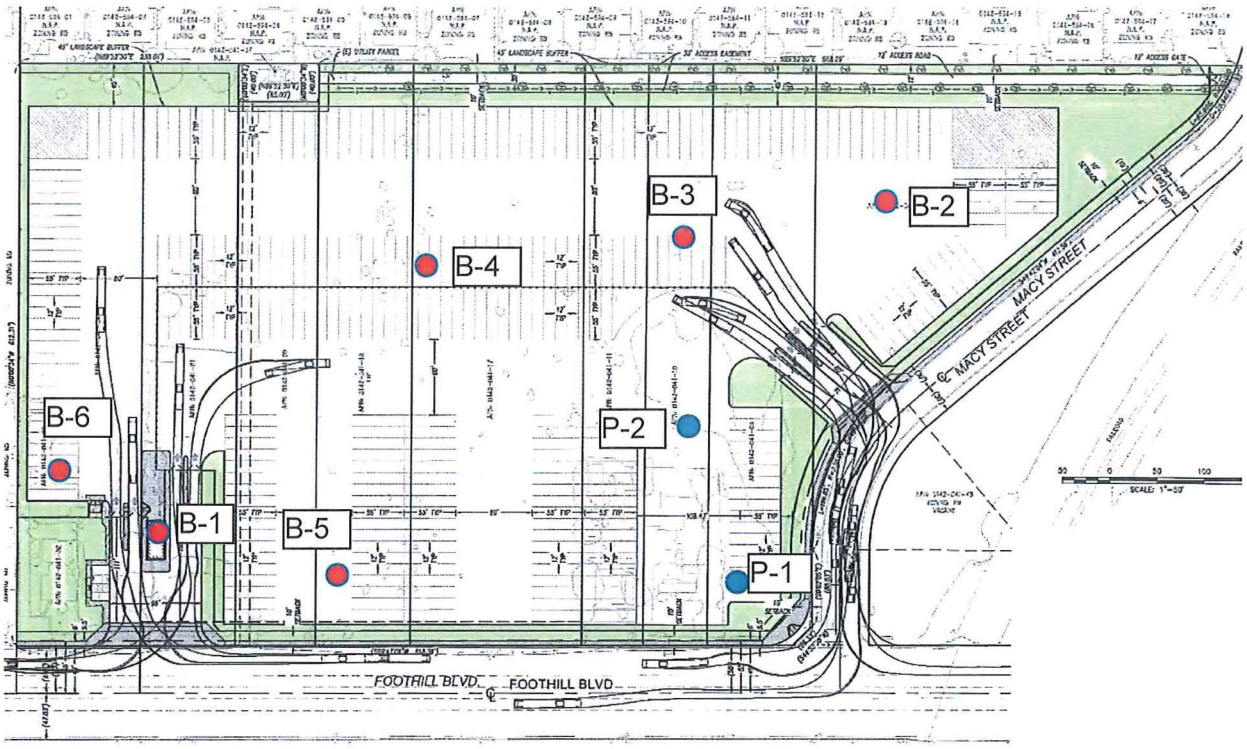
Should the project be delayed beyond one year after the date of this report; the recommendations presented shall be reviewed to consider any possible change in site conditions.

The recommendations presented are based on the assumption that the geotechnical observations and testing required for the project shall be performed by a representative of Soils Southwest, Inc.

The field observations are considered as a continuation of the geotechnical investigation performed. If another firm is retained for geotechnical observations and testing, our professional liability and responsibility shall be limited to the extent that Soils Southwest, Inc. would not be the geotechnical engineer of record. A letter of Transfer of Responsibility shall be supplied by the new geotechnical engineer clearly describing Soils Southwest, Inc. as 'harmless and non-responsible" for any distress that may occur to the structure during life-time use.

PLOT PLAN AND TEST LOCATIONS
Proposed Trucking Facility
NW Foothill Boulevard and Macy Street
San Bernardino, CA
A.P.N.: 014-204-109, 110, 111, 117, 118, 120, 121, 144, & 145

(Not to Scale)



Legend:
- B-1 Approximate Location of Exploratory Test Borings
- P-1 Approximate Location of WQMP-BMP Infiltration Test Borings

Plate 1

GOOGLE EARTH SITE MAP TEST LOCATIONS
Proposed Trucking Facility
NW Foothill Boulevard and Macy Street
San Bernardino, CA
A.P.N.: 014-204-109, 110, 111, 117, 118, 120, 121, 144, & 145

Legend:
- B-1 Approximate Location of Exploratory Test Borings
- P-1 Approximate Location of WQMP-BMP Infiltration Test Borings

Plate 2

9.0 APPENDIX A

Field Explorations

For geotechnical evaluations field evaluations included six(6) exploratory test borings (B-1 to B-6) along with two (2) infiltration test borings (P-1 & P-2) using a limited access hollow-stem auger drilling rig advanced to maximum 26 feet below existing the grade surface. Approximate test exploration locations are shown on attached Plate 1.

Soils encountered during explorations were logged and such were classified by visual observations in accordance with the generally accepted classification system. The field descriptions were modified, where appropriate, to reflect laboratory test results.

In addition to undisturbed soils sampling during test borings, within areas of excavated test pits portable nuclear gauge is used for determining relative soil density and moisture content (ASTM D2261). The bulk and undisturbed soil samples procured were sent to our laboratory for geotechnical analyses as described in the attached Log of Boring.

Logs of test explorations are presented in the following summary sheets that include the description of the soils and/or fill materials encountered.

LOG OF TEST BORINGS
&
WQMP-BMP FIELD TEST DATA

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING P-1

Project: Truck Terminal Properties		**Job No.:** 20047-F/BMP
Logged By: John F.	**Boring Diam.:** 8" HSA	**Date:** November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SM			gravels, scattered weeds and debris SAND - tan, silty, fine to medium, pebble, rock fragments, damp
					SP-SM		5	- color change to grayish brown, slightly silty, fine to medium, pebble, rock fragments, dry
					SP		10	- color change to light grayish brown, fine to medium, pebble, rock fragments, rock 1/2"-1", dry
							15	- End of infiltration test boring @ 12.0 ft. - no bedrock - no groundwater
							20	
							25	
							30	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** n/a **Elevation:** n/a	**Site Location** Proposed Truck Parking/Storage Facility NWC Foothill Blvd. & Macy St. San Bernardino, California	**Plate #**

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING P-2

Project: Truck Terminal Properties		**Job No.:** 20047-F/BMP
Logged By: John F.	**Boring Diam.:** 8" HSA	**Date:** November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			tilled weeds
								SAND - yellowish tan brown, medium, pebble, scattered rock fragments, dry
								- color change to light gray brown, gravely medium, pebble, occasional rock fragments, dry
							5	
					SM			- color change to tan, silty, fine to medium coarse, gravely, rock fragments, rock 1/2" to 1", dry
							10	
								- End of infiltration test boring @ 12.0 ft. - no bedrock - no groundwater
							15	
							20	
							25	
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location
Proposed Truck Parking/Storage Facility
NWC Foothill Blvd. & Macy St.
San Bernardino, California

Plate #

Bulk/Grab sample

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-1

Project: Truck Terminal Properties		**Job No.:** 20047-F/BMP
Logged By: John F.	**Boring Diam.:** 8" HSA	**Date:** November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			scattered debris
								SAND - tannish light brown, small traces of silt, fine to medium, pebbles, dry
								- (Max Dry Density = 116 pcf @ 11.8%)
							5	
		0.8	107.6	92.75	VS			SILT/SAND mixture-color change to light yellowish gray, fine to medium, pebbles, scattered dry
					SW-SM			-well-graded fine sand with traces of silt and scattered pebbles and rock fragments
							10	
24					SP			- color change to light grayish brown, gravely, medium to coarse, pebbles, rock fragments, medium dense
							15	
							20	
32					GP-SP			- gravely, medium coarse to coarse with isolated traces of silt, rock fragments, dry - dense
							25	
							30	
41					GM-SM			- gravely with some silts, fine to coarse, rock fragments
								- End of test boring @ 31.0 ft - no bedrock - no groundwater

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** n/a **Elevation:** n/a	**Site Location** Proposed Truck Parking/Storage Facility NWC Foothill Blvd. & Macy St. San Bernardino, California	**Plate #**

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-2

Project: Truck Terminal Properties		**Job No.:** 20047-F/BMP
Logged By: John F.	**Boring Diam.:** 8" HSA	**Date:** November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
								scattered tilled weeds
					SP-SM			SAND - gray-brown, slightly silty, fine to medium, pebble, rock fragments, very loose, dry
5								- color change to light brown, slightly silty, fine to medium, pebble, damp
							5	
11					SP			- traces of silt, fine to medium coarse, pebble, rock fragments, damp, low to medium dense
								- End of test boring @ 6.0 ft.
								- no bedrock
								- no groundwater
							10	
							15	
							20	
							25	
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location
Proposed Truck Parking/Storage Facility
NWC Foothill Blvd. & Macy St.
San Bernardino, California

Plate #

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-3

Project: Truck Terminal Properties		Job No.: 20047-F/BMP
Logged By: John F.	Boring Diam.: 8" HSA	Date: November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			tilled weeds SAND - brown, traces of silt, fine to medium, pebbles, damp, loose
		4.9	107.8	92.93	SP-SM		5	- color change to light brown, slightly silty, fine, scattered pebbles and rock fragments, dry - low density
11								- End of test boring @ 6.0 ft. - no bedrock - no groundwater
							10	
							15	
							20	
							25	
							30	

Groundwater: n/a
Approx. Depth of Bedrock: n/a
Datum: n/a
Elevation: n/a

Site Location
Proposed Truck Parking/Storage Facility
NWC Foothill Blvd. & Macy St.
San Bernardino, California

Plate #

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-4

Project: Truck Terminal Properties		Job No.: 20047-F/BMP
Logged By: John F.	Boring Diam.: 8" HSA	Date: November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP-SM			scattered tilled weeds
								SAND - light brown, slightly silty, fine, pebble, damp
		3.2	109.1	94.1	SW			- color change to tannish light brown, well-graded fine to medium, dry
4							5	
								- End of test boring @ 5.0 ft. - no bedrock - no groundwater
							10	
							15	
							20	
							25	
							30	

Groundwater: n/a Approx. Depth of Bedrock: n/a Datum: n/a Elevation: n/a	**Site Location** Proposed Truck Parking/Storage Facility NWC Foothill Blvd. & Macy St. San Bernardino, California	**Plate #**

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-5

Project: Truck Terminal Properties		**Job No.:** 20047-F/BMP
Logged By: John F.	**Boring Diam.:** 8" HSA	**Date:** November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			loose sands
								SAND - light yellowish gray-brown, fine to medium, pebble, dry
12					SW			- color change to light gray brown, well-graded fine to medium, dry
							5	
12								- dry to damp
								- End of test boring @ 6.0 ft. - no bedrock - no groundwater
							10	
							15	
							20	
							25	
							30	

Groundwater: n/a **Approx. Depth of Bedrock:** n/a **Datum:** n/a **Elevation:** n/a	**Site Location** Proposed Truck Parking/Storage Facility NWC Foothill Blvd. & Macy St. San Bernardino, California	**Plate #**

Bulk/Grab sample California sampler Standard penetration test

Soils Southwest, Inc.
897 Via Lata, Suite N
Colton, CA 92324
(909) 370-0474 Fax (909) 370-3156

LOG OF BORING B-6

Project: Truck Terminal Properties		Job No.: 20047-F/BMP
Logged By: John F.	Boring Diam.: 8" HSA	Date: November 5,2020

Standard Penetration (Blows per Ft.)	Sample Type	Water Content in %	Dry Density in PCF	Percent Compaction	Unified Classification System	Graphic	Depth in Feet	Description and Remarks
					SP			scattered tilled weeds SAND - light gray brown, traces of silt, fine to medium, pebble, dry, loose
		1.3	101.7	87.6	SW			- color change to tannish light brown, well-graded, fine, very dry, loose
11							5	
								- End of test boring @ 6.0 ft. - no bedrock - no groundwater
							10	
							15	
							20	
							25	
							30	

Groundwater: n/a Approx. Depth of Bedrock: n/a Datum: n/a Elevation: n/a	**Site Location** Proposed Truck Parking/Storage Facility NWC Foothill Blvd. & Macy St. San Bernardino, California	**Plate #**

Bulk/Grab sample California sampler Standard penetration test

KEY TO SYMBOLS

Symbol Description

Strata symbols


Silty sand


Poorly graded sand with silt


Poorly graded sand


Variable sand and silt mix


Well graded sand with silt


Poorly graded gravel and sand


Silty sand and gravel


Well graded sand

Soil Samplers


Bulk/Grab sample


California sampler


Standard penetration test

Notes:

1. Exploratory borings were drilled on November 5,2020 using a 4-inch diameter continuous flight power auger.

2. No free water was encountered at the time of drilling or when re-checked the following day.

3. Boring locations were taped from existing features and elevations extrapolated from the final design schematic plan.

4. These logs are subject to the limitations, conclusions, and recommendations in this report.

5. Results of tests conducted on samples recovered are reported on the logs.

Percolation Test Data Sheet

Project:	TRUCK TERMINAL MAP	Project No:	20047-BMP	Date:	11-5-20
Test Hole No:	P-1	Tested By:	JF & A.D.		
Depth of Test Hole, D_T:	144 INCH	USCS Soil Classification:	SP		
Test Hole Dimensions (inches)			Length	Width	
Diameter (if round)=	8 INCHES	Sides (if rectangular)=			

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	12:18	12:43	25	120	144	24	Y
2	12:45	1:10	25	120	140	20	Y

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	1:13	1:23	10	120	138	18	
2	1:25	1:35	10	120	138	18	
3	1:36	1:46	10	120	138	18	
4	1:47	1:57	10	120	138	18	
5	1:59	2:09	10	120	138	18	
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

COMMENTS:

Percolation Test Data Sheet

Project:	Truck Terminal Prop	Project No:	20047-BMP	Date:	11-5-20
Test Hole No:	P-2	Tested By:	JF & A.D.		
Depth of Test Hole, D_T:	144 inch	USCS Soil Classification:	SP		

Test Hole Dimensions (inches)				Length	Width	
Diameter (if round)=	8 inches	Sides (if rectangular)=				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval, (min.)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	12:25	12:50	25	120	144	24	y
2	12.52	1:17	25	120	144	24	y

*(if two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min.)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	1:19	1:29	10	120	138.5	18.50	
2	1:31	1:41	10	120	138.0	18.00	
3	1:43	1:53	10	120	137.75	17.75	
4	1:55	2:05	10	120	137.50	17.50	
5	2:06	2:16	10	120	137.50	17.50	
6	2:19	2:29	10	120	137.25	17.25	
7	2:31	2:41	10	120	136.00	16.0	
8	2:42	2:52	10	120	136.00	16.0	
9	2:53	3:03	10	120	136.00	16.0	
10							
11							
12							
13							
14							
15							

COMMENTS:

9.0 APPENDIX B

Laboratory Test Programs

Laboratory tests were conducted on representative soils for the purpose of classification and for the determination of the physical properties and engineering characteristics. The number and selection of the types of testing for a given study are based on the geotechnical conditions of the site. A summary of the various laboratory tests performed for the project is presented below.

Moisture Content and Dry Density (D2937):

Data obtained from the tests performed on undisturbed samples are used to aid in the classification and correlation of the soils and to provide qualitative information regarding soil strength and compressibility.

Direct Shear (D3080):

Data obtained from this test performed at increased and field moisture conditions on relatively remolded soil sample is used to evaluate soil shear strengths. Samples contained in brass sampler rings, placed directly on test apparatus are sheared at a constant strain rate of 0.002 inch per minute under saturated conditions and under varying loads appropriate to represent anticipated structural loadings. Shearing deformations are recorded to failure. Peak and/or residual shear strengths are obtained from the measured shearing load versus deflection curve. Test results, plotted on graphical form, are presented on Plate B-1 of this section.

Consolidation (D2835):

Drive-tube samples are tested at their field moisture contents and at increased moisture conditions since the soils may become saturated during lifetime use of the planned structure.

Data obtained from this test performed on relatively undisturbed and/or remolded samples, were used to evaluate the consolidation characteristics of foundation soils under anticipated foundation loadings. Preparation for this test involved trimming the sample, placing it in one-inch-high brass ring, and loading it into the test apparatus which contained porous stones to accommodate drainage during testing. Normal axial loads are applied at a load increment ratio, successive loads being generally twice the preceding.

Soil samples are usually under light normal load conditions to accommodate seating of the apparatus. Samples were tested at the field moisture conditions at a predetermined normal load. Potentially moisture sensitive soil typically demonstrated significant volume change with the introduction of free water. The results of the consolidation tests are presented in graphical forms on Appendix B of this report.

Potential Expansion (ASTM Standard D4829-88)

Silty and clayey sandy in nature, the site soils are considered 'low to medium' in expansion characteristic. Supplemental testing for soil expansion should be performed following mass grading completion.

Laboratory Test Results

A Table I: In-Situ Moisture-Density (ASTM D2216-80)

Test Boring No.	Sample Depth, ft.	Dry Density, pcf.	Moisture Content, %
1	5	107.6	0.80
3	3	107.8	4.90
4	2	109.1	3.16
6	3	101.7	1.23

B Table II: Max. Density/Optimum Moisture Content (ASTM D1557)

Sample Location @ depth, ft.	Max. Dry Density, pcf	Optimum Moisture (%)
B-1 @ 0-5 ft. Sand-tannish light brown, well-graded fine with pebbles, scattered rock fragments and debris (broken glass and red brick), scattered weeds, very dry	116.0	11.8

C. Table III: Direct Shear (ASTM D3080)

Test Boring & Sample Depth (ft)	Test Condition	Cohesion (psf)	Friction (degree)
B-1 @ 0-5	Remolded to 90%	150	39

D. Table IV: Consolidation (D2435)

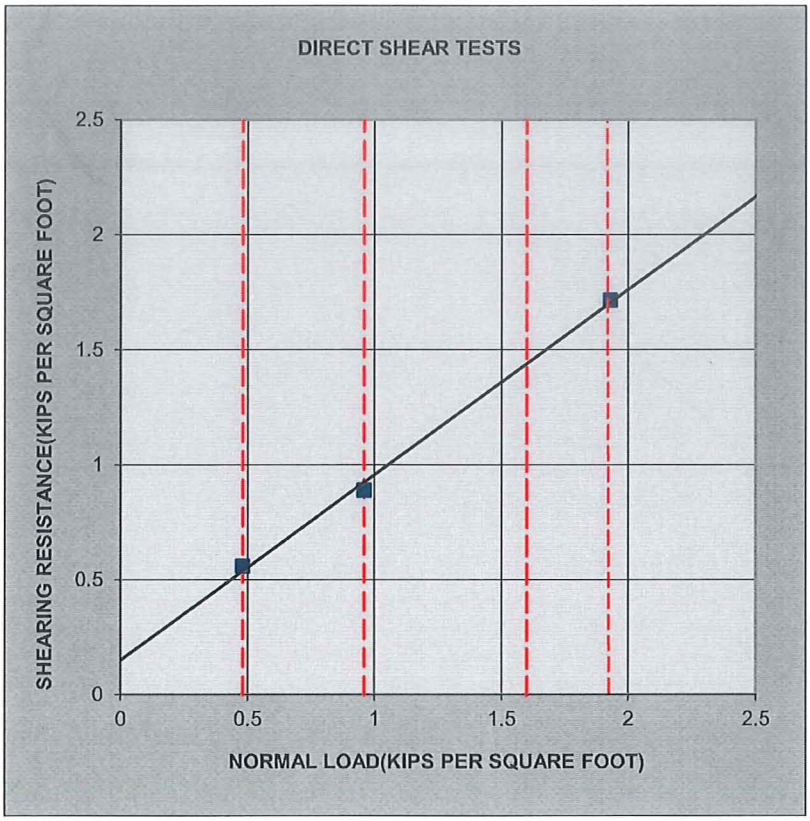
Boring B #	Depth (ft.)	Consolidation prior to saturation (%) @ 2 kips	Hydro collapse (%) @ 2 kips	Total Consolidation (%@ 8 kips) (saturated)
1 (remolded) 90%	0-5	0.9	0.1	2.1
1 (undisturbed)	5	1.0	0.1	2.3
4 (undisturbed)	2	0.8	0.5	2.8

E. Table V: Sand Equivalent

Sample Location @ depth, ft.	Sand Equivalent Average
B-3 @ 0-3	36.58

F. Table VI: Soils Expansion Index, EI. (ASTM D4829)

Sample Location & Soils Type	Soil Expansion Index, EI	Expansion Potential
B-1 @ 0-5' Sand-silty, gravelly	16	"very low"

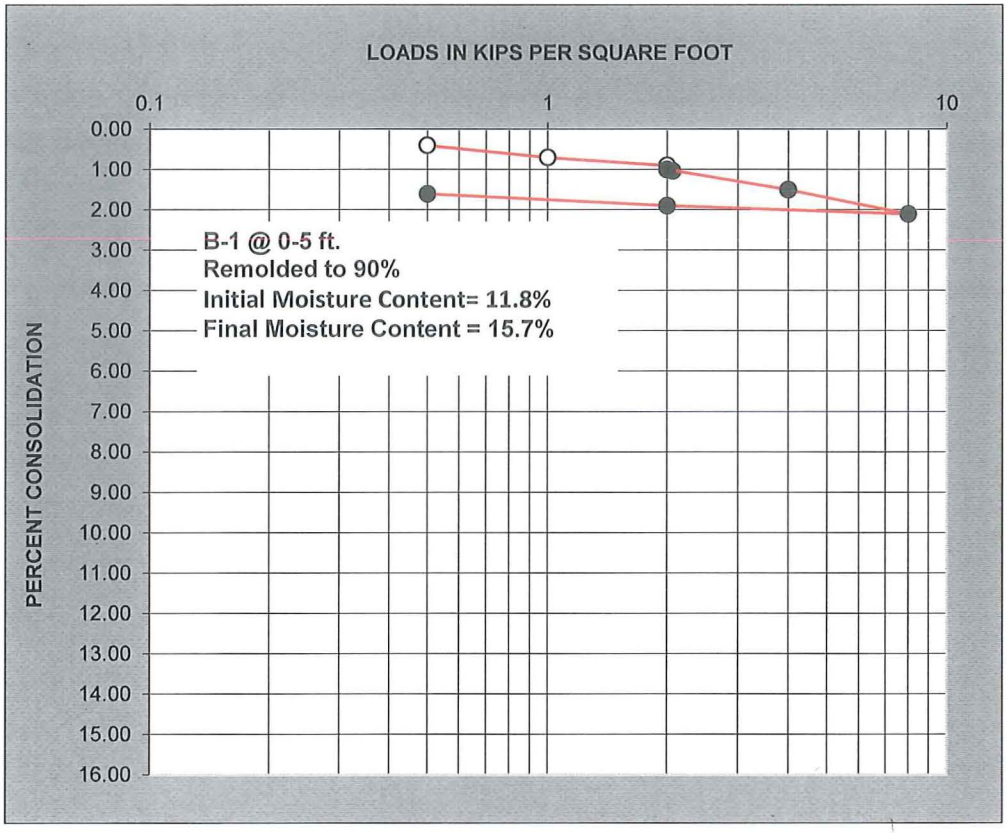


SYMBOL	LOCATION	DEPTH (FT)	TEST CONDITION	COHESION (psf)	FRICTION (degree)
■	B-1	0 to 5	Remolded to 90%	150.41	38.86

Proposed Tractor Trailer Parking & Guard Shack NW Foothills Boulevard & Macy Street San Bernardino, California	PROJECT NO.	20047-F
	PLATE	B-1

SOILS SOUTHWEST, INC.
Consulting Foundation Engineers

CONSOLIDATION TESTS

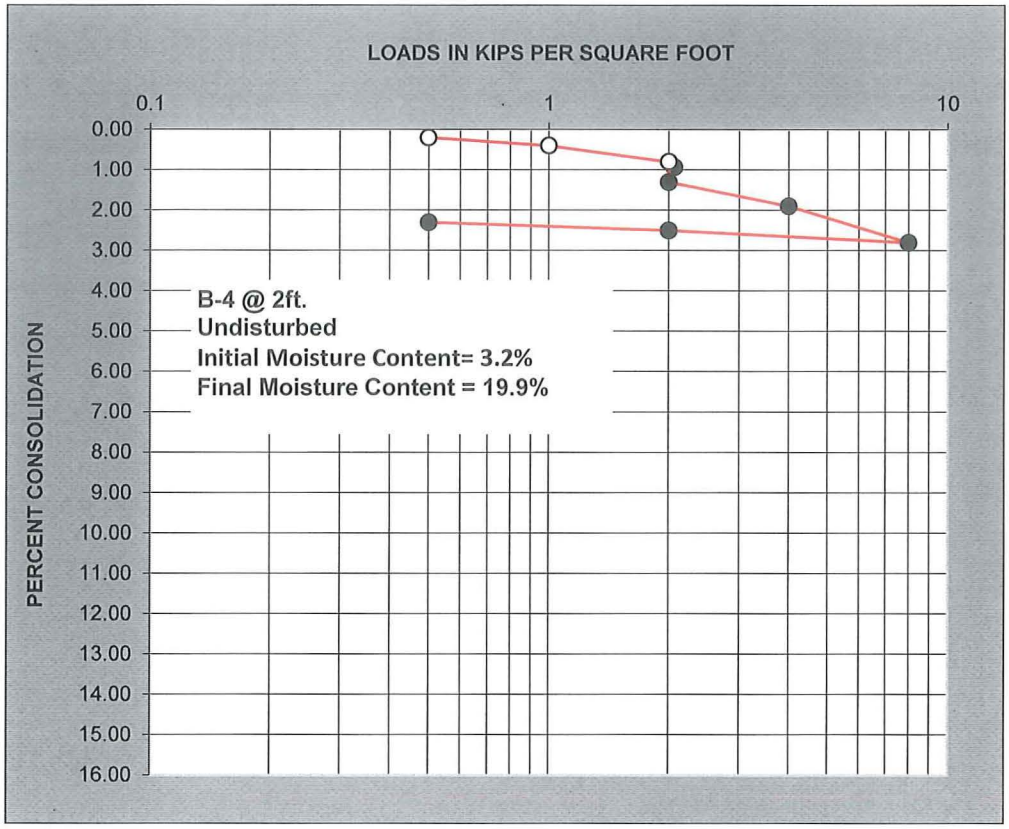


- **WATER PERMITTED TO CONTACT SAMPLE**

	PROJECT	Proposed Tractor Trailer Parking Facility NW Foothill Boulevard & Macy Street, San Bernardino		
	PROJECT NO.	20047-F	PLATE	B-2

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

CONSOLIDATION TESTS

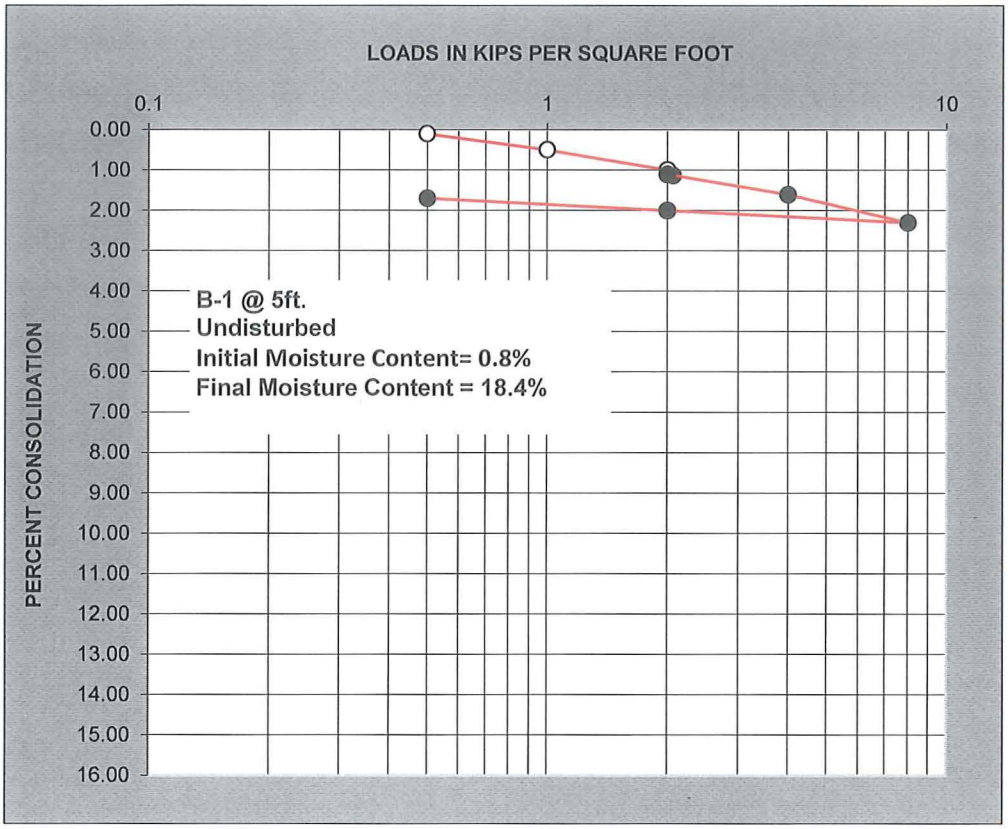


- **WATER PERMITTED TO CONTACT SAMPLE**

	PROJECT	Proposed Tractor Trailer Parking Facility NW Foothill Boulevard & Macy Street, San Bernardino		
	PROJECT NO.	20047-F	PLATE	B-2-1

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

CONSOLIDATION TESTS



- **WATER PERMITTED TO CONTACT SAMPLE**

	PROJECT	Proposed Tractor Trailer Parking Facility NW Foothill Boulevard & Macy Street, San Bernardino		
	PROJECT NO.	20047-F	PLATE	B-2-2

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

SAND EQUIVALENT TEST

Test Date: January 27,2021

Project No.: 20047-F

Job Name: Truck Terminal Properties/Bobby Nassir
NW Foothill Blvd. & Macy St. San Bernardino

Sample Location: B-3 @ 0-3'

Sample by: JF Tested by: RM

LABORATORY DATA

SAMPLE NO.	1	2	3	4
TIME START	2:55	3:00	3:05	
TIME SOAK (10 min.)	3:05	3:10	3:15	
TIME AT LEVEL 15ML	3:07	3:12	3:17	
TIME of READING (20-min)	3:27	3:32	3:37	
FINE, ML	5.5	5.5	5.4	
COARSE, ML	2.1	1.9	2.0	
SE = 100x (coarse/fine)	38.18	34.54	37.04	
SE Average	36.58			

Soil Description: SP-SM fine to medium with some silts, pebbles, and rock fragments.

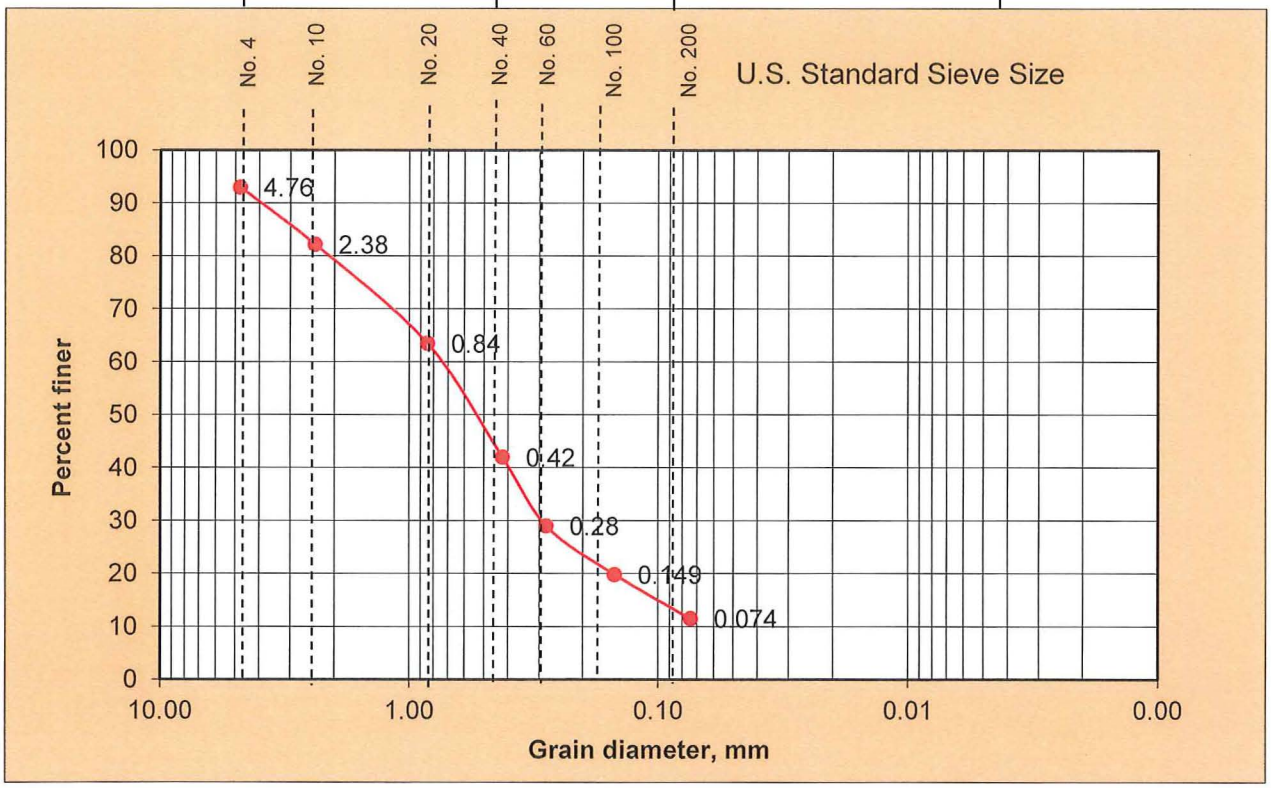
GRAIN SIZE DISTRIBUTION

Project: Bobby Nassir **Job #** 20047-F/BMP
Location: WC of Foothill Blvd and Macy St, SE **Boring No:** P-2 12' **Sample No:** 1
Description of Soil: SP-SM fine to medium coarse with traces of silt, pebbles to rocks
Date of Sample: 1/13/2021
Tested By: John **Date of Testing:** 1/15/2021

Sieve No.	Sieve Openings in mm	Percent Finer
4	4.76	93.00
10	2.38	82.22
20	0.84	63.52
40	0.42	42.00
60	0.28	29.02
100	0.149	19.86
200	0.074	11.54

Grain Size	% Retained
Gravel	8
Med. to Crs	47
Fines	32
Silts	13
Clays	0

Gravel	Sand			
	Coarse to Medium	Fine	Silt	Clay



Visual Soil Description : Sand - grayish lt brown, traces of silt, fine to medium coarse, pebbles, rock fragments, rocks

Soil Classification: SP-SM

System: USC

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

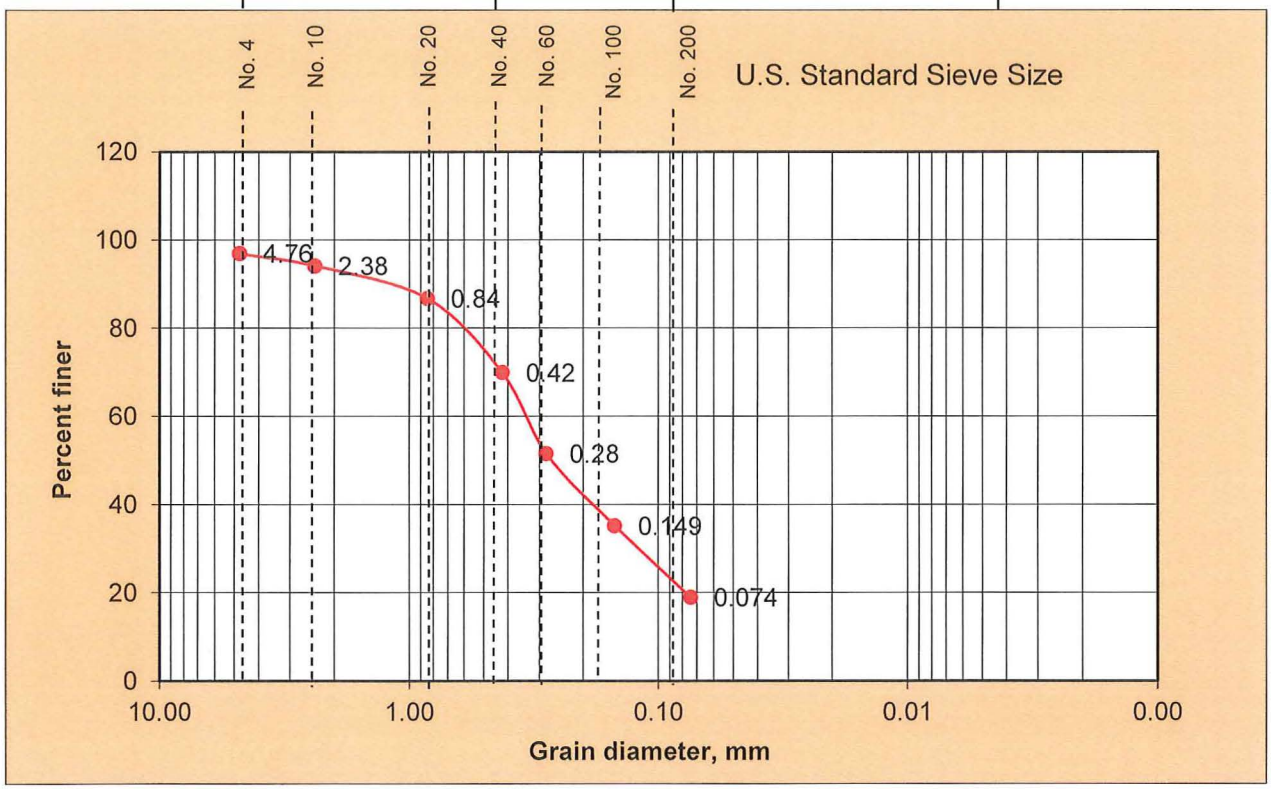
GRAIN SIZE DISTRIBUTION

Project: Bobby Nassir **Job #** 20047-F/BMP
Location: WC of Foothill Blvd and Macy St, SE **Boring No:** B-3 @0-3 **Sample No:** 2
Description of Soil: SM silty fine to medium sands
Date of Sample: 1/13/2021
Tested By: RM **Date of Testing:** 1/27/2021

Sieve No.	Sieve Openings in mm	Percent Finer
4	4.76	97.00
10	2.38	94.20
20	0.84	86.80
40	0.42	70.00
60	0.28	51.60
100	0.149	35.20
200	0.074	19.00

Grain Size	% Retained
Gravel	3
Med. to Crs	24
Fines	49
Silts	24
Clays	0

Gravel	Sand		Silt	Clay
	Coarse to Medium	Fine		



Visual Soil Description : Sand - silty, fine to medium

Soil Classification: SM

System: USC

SOILS SOUTHWEST INC.
Consulting Foundation Engineers

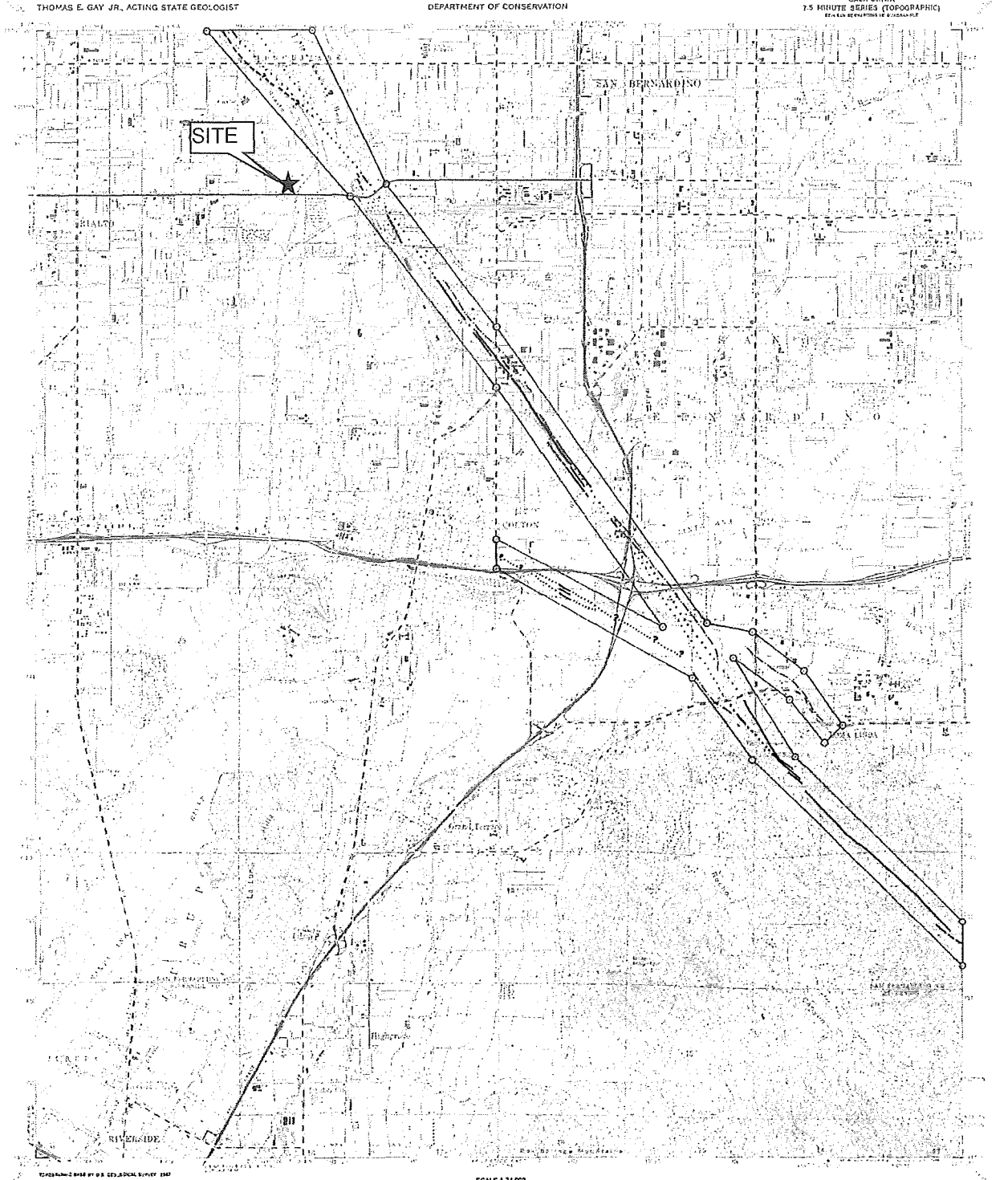
APPENDIX C

Supplemental Seismic Design Parameters

CALIFORNIA DIVISION OF MINES AND GEOLOGY
THOMAS E. GAY JR., ACTING STATE GEOLOGIST

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF CONSERVATION

SAN BERNARDINO SOUTH QUADRANGLE
CALIFORNIA
7.5 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:24 000

CONTOUR INTERVAL 20 FEET

MAP EXPLANATION

Potentially Active Faults

1906 C — Faults considered to have been active during Quaternary time; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Aerial photo lineaments (not field checked); based on youthful geomorphic and other features believed to be the results of Quaternary faulting.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.

STATE OF CALIFORNIA
SPECIAL STUDIES ZONES

Delineated in compliance with
Chapter 7.5, Division 2 of the California Public Resources Code

SAN BERNARDINO SOUTH QUADRANGLE

REVISED OFFICIAL MAP
Effective: January 1, 1977

T. E. Gay Jr. Acting State Geologist

REFERENCES USED TO COMPILE FAULT DATA

San Bernardino South Quadrangle

Dutcher, L.C. and Garrett, A.A., 1963, Geology and hydrologic features of the San Bernardino area, California, with special reference to underflow across the San Jacinto fault: U.S. Geological Survey Water-Supply Paper 1419, 114 p.

Huber, O.L., 1974, Personal communication based on unpublished data in file with the California Department of Water Resources (Final geologic report, Santa Ana Valley Pipeline — Devil Canyon Power Plant to Perris Reservoir)

Sharp, R.V., 1972, Map showing recently active breaks along the San Jacinto fault Zone between the San Bernardino area and Borrego Valley, California: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-675

Starr, K., 1974, Lineament based on aerial photographic interpretation

Sun, K., and others, 1973, Geologic investigations of portions of the San Jacinto fault zone, San Bernardino Valley, California, in W.A. Blake (Editor), Geologic investigations of the San Jacinto fault zone, and aspects of the seismic hazard of Riverside and the Riverside San Bernardino area: California Geological Survey, Riverside, Campus Museum Contributions No. 3, p. 1-49

IMPORTANT - PLEASE NOTE

1) *This map may not show all potentially active faults, either within the special studies zones or outside their boundaries.*
2) Faults shown are the basis for establishing the boundaries of the special studies zones.
3) The identification of these potentially active faults and the location of such fault traces are based on the best available data. Traces have been drawn as accurately as possible at this map scale, however, the quality of data used is highly varied. The faults shown have not been field checked during this map compilation.
4) Fault information on this map is not sufficient to serve as a substitute for information developed by the special studies that may be required under Chapter 7.5, Division 2, Section 2623 of the California Public Resources Code.

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Miles	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
0.59	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
0.59	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
0.59	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
0.59	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
0.59	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
0.59	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
0.59	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
5.89	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
5.89	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
5.89	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
5.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
5.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
5.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
5.89	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
5.89	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
5.89	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps – Source Parameters

New Search

Fault Name	State
San Jacinto;SBV+SJV	**California**

GEOMETRY	
Dip (degrees)	90
Dip direction	V
Sense of slip	strike slip
Rupture top (km)	0
Rupture bottom (km)	16
Rake (degrees)	180
Length (km)	88

MODEL VALUES		
Slip Rate	n/a	
Probability of activity	1	
	ELLSWORTH	HANKS
Minimum magnitude	6.5	6.5
Maximum magnitude	7.35	7.27
b-value	0.8	0.8

Fault Model	Deformation	Char Rate[1]	GR-a-value[1]	Weight

Ground Motion Interpolator (2008)

Longitude: -117.341503

Latitude: 34.10709

Site Condition (VS30): 270 (180-1050 m/sec)

Return Period:

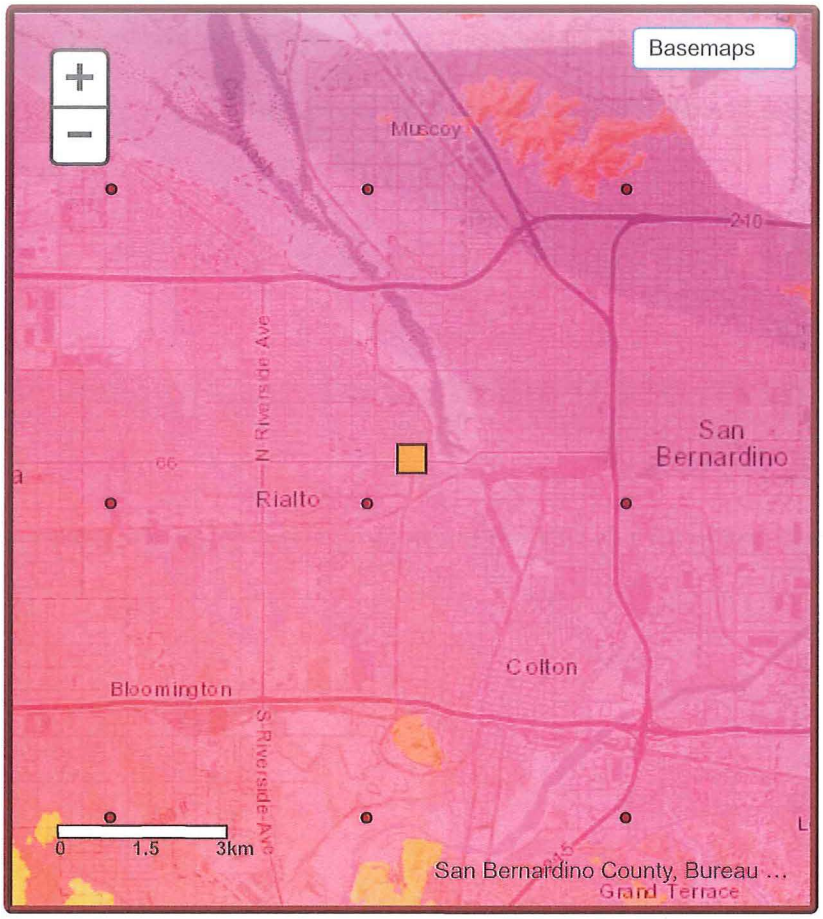
2% in 50 years 10% in 50 years

Spectral Acceleration:

PGA 0.2 second SA 1.0 second SA

Submit

Inputs:	**Result:**
-117.341503, 34.10709 vs30: 270 m/sec 10% in 50 years PGA	**0.655 g**



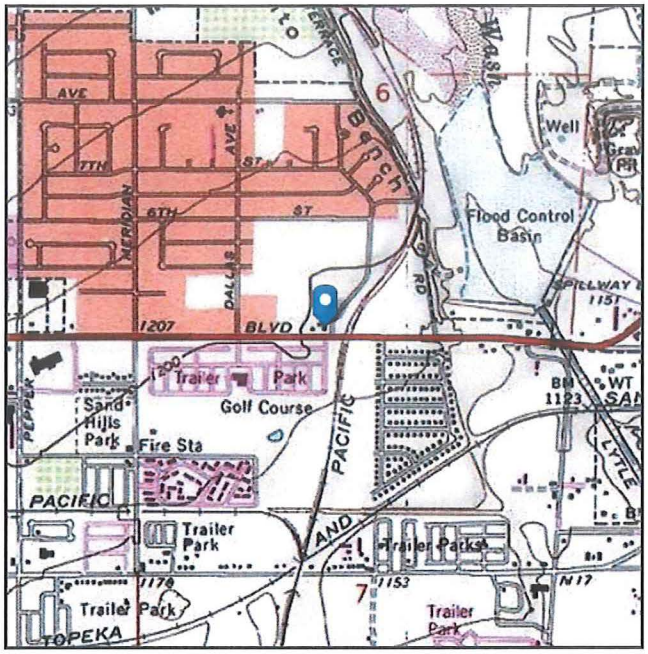
Information and Disclaimer

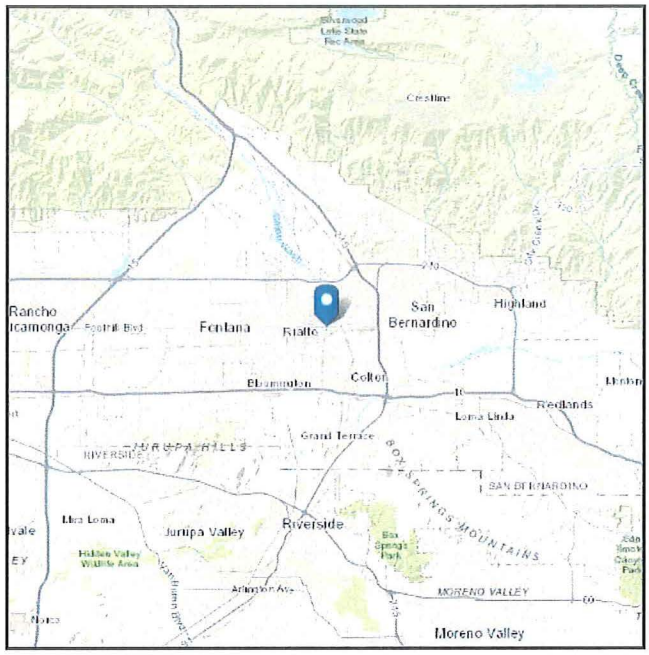
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-16
Risk Category: III
Soil Class: D - Stiff Soil

Elevation: 1193.55 ft (NAVD 88)
Latitude: 34.10709
Longitude: -117.341503





ASCE
AMERICAN SOCIETY OF CIVIL ENGINEERS

Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	2.4	S_{D1} :	N/A
S_1 :	0.961	T_L :	8
F_a :	1	PGA :	1.01
F_v :	N/A	PGA_M :	1.111
S_{MS} :	2.4	F_{PGA} :	1.1
S_{M1} :	N/A	I_e :	1.25
S_{DS} :	1.6	C_v :	1.5

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Thu Oct 22 2020

Date Source: USGS Seismic Design Maps

PROFESSIONAL LIMITATIONS

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances by other reputable Soils Engineers practicing in these general or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The investigations are based on soil samples only, consequently the recommendations provided shall be considered as "preliminary". The samples taken and used for testing and the observations made are believed representative of site conditions; however, soil and geologic conditions can vary significantly between test excavations. If this occurs, the changed conditions must be evaluated by the Project Soils Engineer and designs adjusted as required or alternate design recommended.

The report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the project architect and engineers. Appropriate recommendations should be incorporated into structural plans. The necessary steps should be taken to see that out such recommendations in field.

The findings of this report are valid as of this present date. However, changes in the conditions of a property can occur with the passage of time, whether they due to natural process or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur from legislation or broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by change outside of our control. Therefore, this report is subject to review and should be updated after a period of one year.

RECOMMENDED SERVICES

The review of grading plans and specifications, field observations and testing by a geotechnical representative of this office is integral part of the conclusions and recommendations made in this report. If Soils Southwest, Inc. (SSW) is not retained for these services, the Client agrees to assume SSW's responsibility for any potential claims that may arise during and after construction, or during the life-time use of the structure and its appurtenant.

The recommendations supplied should be considered valid and applicable, provided the following conditions, in minimum, are met:

i. Pre-grade meeting with contractor, public agency, and soils engineer,
ii. Excavated bottom inspections and verification s by soils engineer prior to backfill placement,
iii. Continuous observations and testing during site preparation and structural fill soils placement,
iv. Observation and inspection of footing trenching prior to steel and concrete placement,
v. Subgrade verifications including plumbing trench backfills prior to concrete slab-on-grade placement,
vi. On and off-site utility trench backfill testing and verifications,
vii. Precise-grading plan review, and
viii. Consultations as required during construction, or upon your request.

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

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.50
		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, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	2	0.50
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00
Combined Safety Factor, $S_{Total} = S_A \times S_B$					2.50
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)					10.67
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$					4.27

Supporting Data

Briefly describe infiltration test and provide reference to test forms:
See infiltration report in Appendix 6.4

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

Treatment Control BMPs

Drainage System Maintenance Guide

Most of the following information was compiled by AASHTO-AGC-ARTBA Task Force 17 on Storm Water Management. Much of this information was also published in the *Modern Sewer Design* "Blue Book".

GENERAL

Drainage systems should be inspected on a routine basis to ensure that they are functioning properly. Inspections can be on an annual or semi-annual basis but should always be conducted following major storms. Systems that incorporate infiltration are most critical since poor maintenance practices can soon render them inefficient. Inspection of pipes, covered trenches, and wells can be accomplished with closed circuit television; and still photographs can be obtained by either taking a picture of the monitor, or mounting a still camera alongside the video camera and triggering it electronically. Other more economical alternate methods of inspection are also available. Procedures for maintenance of these systems are discussed in this review. It should be stressed that good records be kept on all maintenance operations to help plan future work and identify facilities requiring attention.[1]

CORRUGATED STEEL PIPE

One of the advantages of corrugated steel pipe detention systems is the ease of maintenance. Like any system that collects pollutants, the corrugated steel pipe detention system must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment.

The system can be accessed easily through the manhole cover. This allows unobstructed access to the bottom of the tank for inspection and/or cleaning when the need arises.

Periodic inspections should be performed to determine the need for and frequency of maintenance. Inspecting may begin as soon as construction is finished and thereafter on a quarterly basis. Typically, in an average setting not introducing a lot of Styrofoam cups, sediment, paper bags, cigarette butts, oils, etc. , cleaning should only be necessary every 12-18 months. Cleaning should be performed when approximately one (1) foot of sediment and/or other pollutants has accumulated.

All debris/ pollutants removed from the system should be disposed of properly at an approved facility.

CORRUGATED PLASTIC PIPE

Grit and debris often enter a retention/detention system and can gradually impact its effectiveness by taking up storage volume or sealing off perforations. The system may need to be flushed and debris pumped out. The smooth interior of plastic pipe makes it easier to clean. Access ports can be designed into plastic pipe at regular intervals so that inspection can be easily conducted. These ports can also serve as entry ports for pumping and flushing equipment. Isolating debris and sediment collection in these pipes can simplify routine maintenance.

Sediment can reduce the capacity of a stormwater pipe over time. In some installations, it may render the pipe useless until the system can be cleaned. This is an expensive, time-consuming undertaking, so preventive measures should be taken during design. Sedimentation is of great concern in storm sewer application, because large, heavy grit may be present. Finally, it is important that any debris, natural growth or other obstructions at any entry point to the pipe be cleared the insure proper flow into the pipe.

BASINS

Infiltration basin surfaces are sometimes scarified to break up silt deposits and restore topsoil porosity. This should be done when all sediment has been removed from the basin floor. However, this operation can be eliminated by the establishment of grass cover on the basin floor and slopes. Such cover helps maintain soil porosity.

Algae or bacterial growth can also inhibit infiltration. While chlorination of the runoff water can solve this problem, it is more practical to make certain that the basin is permitted to dry out between storms and during summer months. Algae and bacteria will perish during dry spells, provided that standing water is dissipated.

Holding ponds or sedimentation basins can be used to reduce maintenance in conjunction with infiltration basins by settling out suspended solids before the water is released into the infiltration basin.

Chemical flocculants can be used to speed up settlement in holding ponds. Flocculants should be added to the runoff water within the settlement pond inlet pipe or culvert where turbulence will ensure more thorough mixing. After suspended matter has flocculated and settled in the pond, the water may be released into the infiltration basin for disposal. Although chemical flocculants may be impractical for general use, they might well be considered in special cases.

Alum (Aluminum Sulfate) is readily available, inexpensive and highly effective as a flocculating agent. It is widely used in water treatment plants. Various trade name flocculation agents are also available.

Cleanout frequency of infiltration basins will depend on whether they are vegetated or non-vegetated and will be a function of their storage capacity, infiltration characteristics, volume of inflow and sediment load. Infiltration basins should be inspected at least once a year. Sedimentation basins and traps may require more frequent inspection and cleanout.

Grass surfaces in infiltration basins seldom need replacement since grass serves as a good filter material. This is particularly true of Bermuda grass, which is extremely hardy and can withstand several days of submergence. If silty water is allowed to trickle through Bermuda grass, most of the suspended material is strained out within a few meter's, of surface travel. Well established Bermuda grass on a basin floor will grow up through silt deposits, forming a porous turf and preventing the formation of an impermeable layer. Bermuda grass filtration would work well with long, narrow, shoulder-type (swales, ditches, etc.) basins where a high runoff flows down a grassy slope between the roadway and the basin. Bermuda demands very little attention besides summer irrigation in states having dry summers and looks attractive when trimmed. Planted on basin side slopes it will also prevent erosion.

Non-vegetated basins should be scarified on an annual basis following removal of all accumulated sediments. Rotary tillers or disc harrows with light tractors are recommended for maintenance of infiltration basins where grass cover has not been established. Use of heavy equipment should be discouraged to prevent excessive compaction of surface soils. The basin floor should be left level and smooth after the tilling operation to ease future removal of sediment and minimize the amount of material to be removed during future cleaning operations. A levelling drag towed behind the equipment on the last pass, will accomplish this.

Coarse rock or pea gravel is often placed on the bottom of a drainage basin to prevent the formation of a filter cake on the soil, by screening out suspended solids. After a period of operation, the aggregate becomes partially clogged, and it is then necessary to remove and clean it or replace it with new material. This could be done on an annual basis. Since basins are usually accessible, this kind of operation is seldom expensive or difficult. The subsequent disposal of silt and other sediments should comply with local area codes.

TRENCHES

The clogging mechanism of trenches is similar to that associated with other infiltration systems. Although the clogging of trenches due to silt and suspended material is more critical than that of basins, it is less critical than the clogging of vertical wells. The use of perforated pipe will minimize clogging by providing catchment for sediment without reducing overall efficiency. Maintenance methods associated with these systems are discussed later in this chapter.

WELLS

The same clogging and chemical reactions that retard basin and trench infiltration can affect wells to an even greater extent. One problem unique to wells is chemical encrustation of the casing, with consequent blocking of the perforations or slots in the well casing. Alternate wetting and drying builds up a scale of water-soluble minerals, which can be broken up or dissolved by jetting, acid treatments or other procedures.

Some agencies restore well efficiency by periodic jetting, which removes silt and fines. Jetting consists of partially filling a well with water, then injecting compressed air through a nozzle placed near the bottom of the shaft (refer to 4. Compressed Air Jet, of this chapter). Dirt or sand that has settled in the shaft or has clogged the casing perforations is forced out the top of the well. Wells cleaned in this manner will operate fairly efficiently for several years, providing that drainage was good initially.

Clogging due to silt and suspended material is much more critical in cased wells than in basins. Filters or sedimentation basins and special maintenance procedures will help prevent silting up of wells. Underground sediment traps in the form of drop inlets are frequently used with small wells, but these inlets do little more than trap the heaviest dirt and trash, allowing finer suspended matter to flow into the well. Larger settling basins hold water longer for more efficient silt removal and provide some temporary storage volume at the same time.

Sand and gravel or other specially selected filter materials used in “gravel packed” wells cannot be removed for cleaning if they should become clogged. Nor can well screens that become partially or totally clogged by corrosion, bacteria, or other deposits, be removed for repair. Generally, the only practical solution to the problem is to drill another well and abandon the inoperative one. Problems of clogging of gravel packing (and well walls) can often be minimized by using sediment traps and by treating the water to remove substances that will clog the soil, the gravel packing, or the well screen. Problems of corrosion of well screens can be eliminated by using slotted PVC pipes for well screens. Furthermore, the PVC is not attacked by acids or other chemicals that are sometimes used for flushing wells to remove deposits that clog the gravel packing or the walls of wells.

It is important that those maintaining infiltration facilities that employ wells be knowledgeable of the kind of materials used in screens and other parts of the systems that could be damaged by acids and other corrosive substances. The importance of regular well maintenance cannot be over stressed. Periodic cleaning and redevelopment are essential, and chlorination or other chemical treatments may be necessary if biological growth or encrustation impedes drainage. Should there be any signs of bacterial groundwater contamination, a 5-10 ppm dosage of chlorine should be added to the wells in question.

When infiltration well systems are being designed, preference should be given where practicable to the use of filter materials that would facilitate maintenance. If aggregate filter material is mounded over the infiltration well, designers should realize that it will be necessary to periodically remove the upper part of the filter material and clean it or replace it with clean material. In some situations, this may not be practical. When cased, gravel-packed wells are used, it would be impractical to use a fine aggregate filter, although some designers make use of a bag constructed of filter fabric, which is fitted to the top of a well to trap sediment. When the inflow rate has decreased to the maximum tolerable amount, the bag is removed, and cleaned much as a vacuum cleaner bag is cleaned, or a new filter bag is inserted. Consideration should also be given to back flushing the well system using methods like those defined in earlier sections of this chapter.

CATCH BASINS

Catch Basins Catch basins should be inspected after major storms and be cleaned as often as needed. Various techniques and equipment are available for maintenance of catch basins, as discussed in the next section. Filter bags can be used at street grade to reduce the frequency for cleaning catch basins and outflow lines. Filter bags have been used successfully in Canada and various parts of the United States.

METHODS AND EQUIPMENT FOR CLEANOUT OF SYSTEMS[2]

Various types of equipment are available commercially for maintenance of infiltration systems. The mobility of such equipment varies with the application and the equipment versatility. The most frequently used equipment and techniques are listed below.

1. **Vacuum Pumps**
   This device is normally used to remove sediment from sumps and pipes and is generally mounted on a vehicle. It usually requires a 760 to 1200 l (200 to 300 gal) holding tank and a vacuum pump that has a 250 mm (10 in.) diameter flexible hose with a serrated metal end for breaking up caked sediment. A two-man crew can clean a catch basin in 5 to 10 minutes. This system can remove stones, bricks, leaves, litter, and sediment deposits. Normal working depth is 0 to 6 m (0 to 20 ft).
2. **Waterjet Spray**
   This equipment is generally mounted on a self-contained vehicle with a high-pressure pump and a 760 to 1200 l (200 to 300 gal) water supply. A 76 mm (3 in.) flexible hose line with a metal nozzle that directs jets of water out in front is used to loosen debris in pipes or trenches. The nozzle can also emit umbrella-like jets of water at a reverse angle, which propels the nozzle forward as well as blasting debris toward the catch basin. As the hose line is reeled in, the jetting action forces all debris to the catch basin where it is removed by the vacuum pump equipment. The normal length of hose is approximately 60 m (200 ft). Because of the energy supplied from the water jet, this method should not be used to clean trench walls that are subject to erosion.

3. **Bucket Line**
   Bucket lines are used to remove sediment and debris from large pipes or trenches (over 1200 mm (48 in.) diameter or width). This equipment is the most commonly available type. The machine employs a gasoline engine driven winch drum, capable of holding 300 m (1000 ft) of 13 mm (1⁄2 in.) wire cable. A clutch and transmission assembly permits the drum to revolve in a forward or reverse direction, or to run free. The bucket is elongated, with a clam shell type bottom that opens to allow the material to be dumped after removal. Buckets of various sizes are available. The machines are trailer-mounted, usually with three wheels, and are moved in tandem from site to site. When a length of pipe or trench is to be cleaned, two machines are used. The machines are set up over adjacent manholes. The bucket is secured to the cables from each machine and is pulled back and forth through the section until the system is clean. Generally, the bucket travels in the direction of the flow and every time the bucket comes to the downstream manhole, it is brought to the surface and emptied.
4. **Compressed Air Jet**
   The compressed air jet is normally used to clean and remove debris from vertical wells. This equipment requires a holding tank for water and the removed debris, a source of water supply (if the well is above the groundwater level), an air compressor, two 6 mm (1⁄4 in.) air lines, a diffusion chamber, and a 100 mm (4 in.) diameter pipe to carry the silty water and other debris to the surface. The well should be partially filled with water, if required, and the compressed air injected through a nozzle near the bottom of the well. As the silty water enters the diffusion chamber Increaser, prefabricated in CSP, reduces the overall total installed cost. (to which the other air line is connected) it becomes filled with entrained air and is forced up the 100 mm (4 in.) disposal pipe and out of the top of the well by the denser water entering the bottom of the diffusion chamber intake. Normal working depths are typically 0 to 20 m (0 to 75 ft).
5. **Surging and Pumping**
   This procedure is another means of removing silt and redeveloping a well. The process involves partially filling the well with water and then pumping a snugfitting plunger up and down within the casing. This action loosens silt and sediment lodged into the packing and the immediately adjacent soil and pulls it into the well. Surging is immediately followed by pumping silt-laden water from the bottom of the well. If the well is situated in clay soil or if clay materials have been washed into the well, the surging and air jetting methods will be more effective if sodium polyphosphate is added to the water in the well prior to cleaning or redeveloping. A 2-5 ppm concentration of this chemical will deflocculate clay particles in the well and the immediately surrounding soil, and the clay can then be pumped or jetted out very easily. The depth is limited by the pumping capacity available.
6. **Fire Hose Flushing**
   This equipment consists of various fittings that can be placed on the end of a fire hose such as rotating nozzles, rotating cutters, etc. When this equipment is dragged through a pipe, it can be effective in removing light material from walls. Water can be supplied by either hydrant or truck.
7. **Sewer Jet Flushers**
   The machine is typically truck-mounted and consists of a large water tank of at least 3800 l (1000 gal), a triple action water pump capable of producing 7000 kPa (1000 lb./in.2) or more pressure, a gasoline motor to run the pump, a hose reel large enough for 150 m (500 ft) of 25 mm (1 in.) inside diameter high pressure hose, and a hydraulic pump to remove the hose reel. To clean pipes properly, a minimum nozzle pressure of 4100 kPa is

usually required. All material is flushed ahead of the nozzle by spray action. This extremely mobile machine can be used for cleaning areas with light grease problems, sand and gravel infiltration and for general cleaning.

REFERENCES

1. Smith, T. W., Peter, R.R., Smith, R.E., Shirley, E.C., "Infiltration Drainage of Highway Surface Water," Transportation Laboratory, California Department of Transportation, Research Report M&R 632820-1, Aug. 1969.

2. Sewer Maintenance Manual, prepared by Municipal Engineers Association of Ontario for Ministry of the Environment, Ontario, Canada, Mar. 1974.

Most of the information contained in this guide was compiled by AASHTO-AGC-ARTBA Task Force 17 on Storm Water Management. Additionally, much of the information contained in this document was published in the *Modern Sewer Design* "Blue Book". Finally, all HDPE corrugated pipe guidelines have been supplied by the Plastic Pipe Institute (PPI).

FLEXSTORM OPERATION AND MAINTENANCE PLAN

OPERATION & MAINTENANCE PLAN

Installation Instructions:

1. Remove grate from the drainage structure
2. Clean stone and dirt from ledge (lip) of drainage structure
3. Drop the FLEXSTORM inlet filter through the clear opening such that the hangers rest firmly on the lip of the structure.
4. Replace the grate and confirm it is not elevated more than 1/8", the thickness of the steel hangers.

Frequency of Inspections:

1. Inspection should occur following any rain event >½".
2. Post construction inspections should occur 4 times per year. In snowfall affected regions additional inspections should take place before and after snowfall season.
3. Industrial application site inspections (loading ramps, wash racks, maintenance facilities) should occur on a regularly scheduled basis no less than 3 times/year.

Maintenance Guidelines:

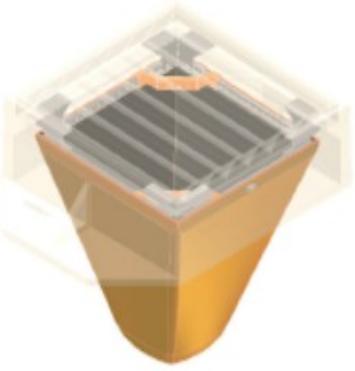
1. Empty the sediment bag if more than half filled with sediment and debris, or as directed.
2. Remove the grate, engage the lifting bars with the FLEXSTORM Removal Tool, and lift from drainage structure.
3. Dispose of sediment or debris as directed by the Engineer or Maintenance contract.
4. An industrial vacuum can be used to collect sediment.
5. Remove caked on silt from sediment bag and flush with Medium spray with optimal filtration.
6. Replace bag if torn or punctured to >½" diameter on lower half of bag.

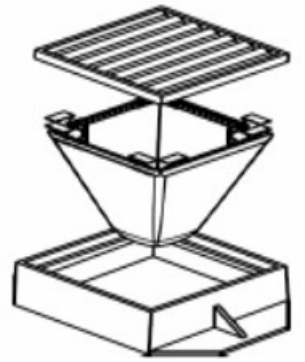
Post Construction PC Bag Maintenance:

1. At 50% saturation the average 2'x2' Adsorb-it lined PC filter will retain approximately 75 oz (4.2 lbs) of oil and should be serviced. To recover the oils the filter can be centrifuged or passed through a wringer.
2. Oil skimmer pouches start to turn black when saturated, indicating time for replacement. Each ClearTec Rubberizer pouch will absorb ~62oz (4 lbs) of oil before needing replacement.
3. Dispose of all oil contaminated products in accordance with EPA guidelines. ClearTec Rubberizer, since a solidifier, will not leach under pressure and can be disposed of in most landfills, recycled for industrial applications, or burned as fuel.

Sediment Bag Replacement:

1. Remove the bag by loosening or cutting off clamping bag.
2. Take new sediment bag and secure worm drive clamping band to the frame channel.
3. Ensure Bag is secure and there is no slack around perimeter.



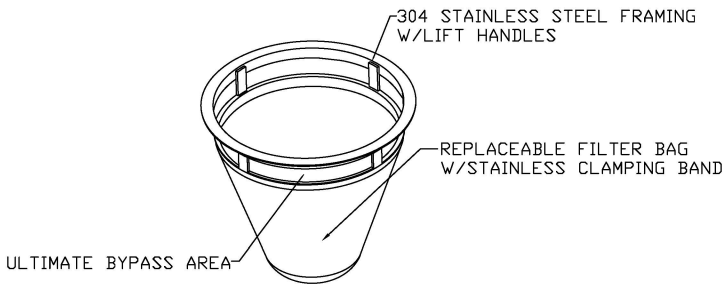


STRUCTURE ID#/LOCATION:

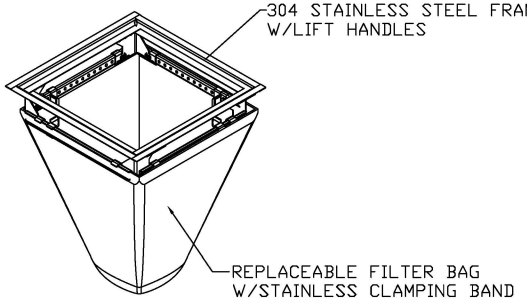
DATE	TASK PERFORMED	INSPECTOR

FLEXSTORM PURE FILTERS FOR PERMANENT INLET PROTECTION
PRODUCT SELECTION AND SPECIFICATION DRAWING

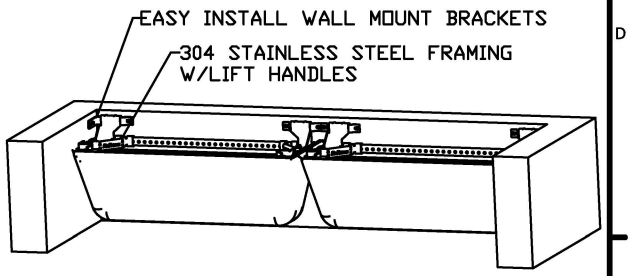
CALIFORNIA



FLEXSTORM PURE INLET FILTERS
FOR ROUND OPENINGS



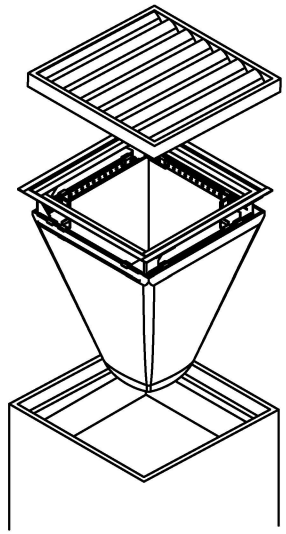
FLEXSTORM PURE INLET FILTERS FOR
RECTANGULAR OPENINGS WITH GRATES



FLEXSTORM HDWM WALL MOUNT INLET
FILTERS FOR OPEN THROAT GUTTERS

Product selection for FLEXSTORM PURE Filters (Permanent Inlet Protection)

Standard	Inlet Type	Grate Size	Clear Opening Size	Bag Cap. (ft^3)	Flow Ratings (CFS)			PRICE			
					FX/FX+	PC/PC+	Bypass	FX	FX+	PC	PC+
36" Open Throat Inlet	Open Throat (WM)	N/A	**36**	2.5	1.9	1.4	N/A	62HDWM36FX	62HDWM36FXP	62HDWM36PC	62HDWM36PCP
42" Open Throat Inlet	Open Throat (WM)	N/A	**42**	3.0	2.5	1.7	N/A	62HDWM42FX	62HDWM42FXP	62HDWM42PC	62HDWM42PCP
48" Open Throat Inlet	Open Throat (WM)	N/A	**48**	3.3	2.5	1.7	N/A	62HDWM48FX	62HDWM48FXP	62HDWM48PC	62HDWM48PCP
60" Open Throat Inlet (2 piece)	Open Throat (WM)	N/A	**60**	4.2	2.5	1.7	N/A	62HDWM60FX	62HDWM60FXP	62HDWM60PC	62HDWM60PCP
84" Open Throat Inlet (2 piece)	Open Throat (WM)	N/A	**84**	5.8	2.5	1.7	N/A	62HDWM84FX	62HDWM84FXP	62HDWM84PC	62HDWM84PCP
48" Open Throat wiith Side Wings	Open Throat (WM)	N/A	**48 Winged**	5.1	2.7	1.7	N/A	62HDWM4818FX	62HDWM4818FXP	62HDWM4818PC	62HDWM4818PCP
12" x 12" precast	Concrete Box (HD)	15 x 15	**12 x 12**	0.9	1.0	0.7	2.4	62HD12FX	62HD12FXP	62HD12PC	62HD12PCP
18" x 18" precast	Concrete Box (HD)	21 x 18	**18 x 18**	2.0	1.5	1.0	3.7	62HD18FX	62HD18FXP	62HD18PC	62HD18PCP
21" Round Opening	Round (RD)	23	**21**	1.5	1.3	1.1	4.5	62HDR23FX	62HDR23FXP	62HDR23PC	62HDR23PCP
24" Round Opening	Round (RD)	26	**24**	1.9	1.5	1.3	4.9	62HDR21FX	62HDR21FXP	62HDR21PC	62HDR21PCP
24" x 24"	Concrete Box (HD)	27 x 24	**24 x 24**	3.2	1.9	0.8	6.1	62HD24FX	62HD24FXP	62HD24PC	62HD24PCP
24" x 24" (shallow)	Concrete Box (HD)	27 x 24	**24 x 24**	3.2	1.9	0.8	6.1	62HD24SFX	62HD24SFXP	62HD24SPC	62HD24SPCP
36" x 18" precast	Concrete Box (HD)	40 x 18	**36 x 18**	3.8	2.2	1.5	5.6	62HD3618FX	62HD3618FXP	62HD3618PC	62HD3618PC
36" x 18" precast	Combination	40 x 18	**36 x 18**	3.5	2.1	1.5	6.9	62HDFCB3618F	62HDFCB3618FXP	62HDFCB3618P	62HDFCB3618PCP
36" x 24" precast	Concrete Box (HD)	40 x 24	**36 x 24**	3.9	2.5	1.7	6.5	62HD3624FX	62HD3624FXP	62HD3624PC	62HD3624PCP
36" X 24" Combination Inlet	Concrete Box (HD)	40 x 24	**36 x 32**	4.3	2.3	2.0	5.8	62HDFCB3624FX	62HDFCB3624FXP	62HDFCB3624PC	62HDFCB3624PCP
36" X 36" precast +	Concrete Box (HD)	40 x 36	**36 x 36**	7.2	4.4	3.2	9.6	62HD36FX	62HD36FXP	62HD36PC	62HD36PCP
48" X 48" precast+	Concrete Box (HD)	48 x 48	**48 x 48**	13.0	5.4	4.2	11.4	62HD48FX	62HD48FXP	62HD48PC	62HD48PCP



INSTALLATION:

1. REMOVE GRATE
2. DROP FLEXSTORM INLET FILTER ONTO LOAD BEARING LIP OF CASTING OR CONCRETE STRUCTURE
3. REPLACE GRATE

NOTES:
1. ALL FRAMING IS CONSTRUCTED OF 304 STAINLESS STEEL FOR 25 YEAR SERVICE LIFE RATING
2. TOTAL BYPASS CAPACITY WILL VARY WITH EACH SIZED DRAINAGE STRUCTURE. FLEXSTORM DESIGNS FRAMING BYPASS TO MEET OR EXCEED THE DESIGN FLOW OF THE PARTICULAR DRAINAGE STRUCTURE.
3. UPON ORDERING ADS P/N CONFIRMATION OF THE DOT CALLOUT, FLEXSTORM ITEM CODE, CASTING MAKE AND MODEL, OR DETAILED DIMENSIONAL FORMS MUST BE PROVIDED.
4. FOR WRITTEN SPECIFICATIONS AND MAINTENANCE GUIDELINES VISIT WWW.INLETFILTERS.COM

*FLOW RATINGS SHOWN ARE 50% MAXIMUM

FLEXSTORM INLET FILTERS PURE

ADS

ALL PRODUCTS MANUFACTURED
BY INLET & PIPE PROTECTION, INC
A DIVISION OF ADS, INC.
WWW.INLETFILTERS.COM
(866) 287-8655 PH
(630) 355-3477 FX
INFO@INLETFILTERS.COM

SIZE		DWG NO	REV
C		P-CA-SUBMIT	A
SCALE			SHEET 1 OF 1

FLEXSTORM®
INLET FILTERS

FILTER BAG OPTIONS

FLEXSTORM offers seven different filter bag options for any of the framing styles. For complete test results visit www.inletfilters.com

FLEXSTORM FILTER BAGS	STANDARD BAG P/N (22" depth)	SHORT BAG P/N (12" depth)
FX: Standard Woven Bag	FX	FX-S
FX+: Woven w/ MyCelx	FXP	FXP-S
FXO: Woven w/ Oil Boom	FXO	FXO-S
PC: Post Construction Bag	PC	PC-S
PC+: PC Bag w/ MyCelx	PCP	PCP-S
LL: Litter and Leaf Bag	LL	LL-S
IL: IDOT NonWoven Bag	IL	IL-S

FILTER BAG TEST RESULTS

FX FILTRATION EFFICIENCY = 82% †

† Large scale, 3rd party testing per ASTM D 7351, Standard Test Method for Determination of Sediment Retention Device Effectiveness in Sheet Flow Application using 7% USDA Sandy Loam

PC/PC+ TSS = 99% TPH = 97% ‡

‡ Large scale testing at 90 GPM. 3rd party results using US Silica OK-110 sand at 1750 mg/L measuring TSS per SM 2540D. TPH tested at 243 mg/L used motor oil using EPA Method 1664A.

FILTER BAG SPECIFICATIONS & CAPABILITES

Bag Type (P/N)	Clean Water Flow Rate (GPM/SqFt)	Min A.O.S. (US Sieve)
Woven (FX)	200	40
Post Construction (PC)	137	140
NonWoven (IL)	145	70
Litter & Leaf Bag (LL)	High	3.5

Total Bypass Capacity: Bypass capacity will vary with each size drainage structure. Flexstorm designs filter bypass to meet the minimum design flow of the particular drainage structure.

Standard Bag Sizes (match frame sizes) §	Solids Storage Capacity (CuFt)	Filtered Flow Rate at 50% Max (CFS)			Oil Retention (Oz)		
		FX	PC	IL	PC*	PCP**	FX+
Small	1.6	1.2	0.8	0.9	66	155	89
Medium	2.1	1.8	1.2	1.3	96	185	89
Large	3.8	2.2	1.5	1.6	120	209	89
XL	4.2	3.6	2.4	2.6	192	370	178

* PC filter bag at 50% max adsorption capacity

** PC filter bag at 50% capacity and MyCelx skimmer at 100% capacity

§ Bag Sizes match the framing sizes based on clear opening dimensions. Standard bags are 22" in depth. Short bags are 12" in depth, reducing solids storage capacity by approximately 50%.

MPM-52 Drain Inlet Insert

General Description

Drain inlet inserts, also known as catch basin, drop inlet or curb inlet inserts, are used to remove pollutants at the point of entry to the storm drain system. There are a multitude of inserts of various shapes and configurations including baffles, baskets, boxes, fabrics, sorbent media, screens, and skimmers. The effectiveness of drain inlet inserts depends on their design, application, loading, and frequency of maintenance to remove accumulated sediment, trash, and debris.

Inspection/Maintenance Considerations

Routine inspection and maintenance is necessary to maintain functionality of drain inlet inserts and to prevent re-suspension and discharge of accumulated pollutants. Maintenance activities vary depending on the type of drain inlet insert being implemented; refer to the manufacturer's recommendations for more information.

Drain inlet inserts installed for trash control must be operated and maintained in accordance with manufacturer's recommendations for the BMP to maintain its Trash Full Capture Systems status.

Advanced BMPs Covered

Treatment Control

Maintenance Concerns

- *Sediment, Trash, and Debris Accumulations*
- *Pollutant Re-suspension and Discharge*

Targeted Constituents*	
Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

**Removal Effectiveness varies for different manufacturer designs. See Development BMP Handbook-Section 5 for more information.*

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MPM-52 Drain Inlet Insert

Suggested Frequency	Inspection Activities
After construction.	☐ Verify that stormwater enters the unit and does not leak around the perimeter.
At the beginning of the wet season and after significant storms	☐ Inspect for sediment, trash, and debris buildup and proper functioning.
Suggested Frequency	**Maintenance Activities**
At the beginning of the wet season and as necessary	☐ Remove accumulated sediment, trash, and debris. ☐ Replace sorbent media.

References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06),* April, 2010. http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf.

California Stormwater Quality Association. 2019. *Stormwater Best Management Practice Handbook, Development*. https://www.casqa.org/resources/bmp-handbooks/.

Orange County Stormwater Program. Technical Guidance Document BMP Fact Sheets. http://media.ocgov.com/gov/pw/watersheds/documents/wqmp/tgd/technical_guidance_document_bmp_fact_sheets.asp.

San Francisco Public Utilities Commission, et al. San Francisco Stormwater Design Guidelines. Appendix A, Stormwater BMP Fact Sheets, June, 2010. http://www.sfwater.org/modules/showdocument.aspx?documentid=2778.

Tahoe Regional Planning Agency. Best Management Practices Handbook, 2012. http://www.tahoebmp.org/Documents/2012 BMP Handbook.pdf.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development and Redevelopment. BMP Fact Sheets. Available at: https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#post.

Ventura Countywide Stormwater Quality Management Program. *Technical Guidance Manual for Stormwater Quality Control Measures*, May, 2010. http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura Technical Guidance Document_5-6-10.pdf.

Site Design & Landscape Planning SD-10

Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

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

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

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

Conserve Natural Areas during Landscape Planning

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

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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

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

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

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

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

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

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

- Signage on top of curbs tends to weather and fade.

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

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

Approach

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

Design Objectives

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

BG-40 Landscape Maintenance

Photo Credit: Geoff Brosseau

Pollutant Sources

- Selecting plants or landscape design
- Installing new landscaping
- Maintaining landscapes
- Using pesticides and fertilizers
- Using gas-powered equipment

Relevant Pollutants

- Nutrients (fertilizers, yard wastes)
- Pesticides
- Hydrocarbons (fuels, oils and grease)
- Sediments

Description

This category includes businesses that provide landscaping and landscape maintenance/gardening services.

Approach

Minimize the potential for stormwater pollution and the need for resources and controls (water, pesticides, and fertilizers) by creating and maintaining landscapes that are compatible with the local soils, climate, and amount of rain and sun. Make stormwater pollution prevention best management practices (BMPs) a part of standard operating procedures and the employee training program. Provide employee education materials in the first language of employees, as necessary.

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BG-40 Landscape Maintenance

Source Control BMPs

The BMPs are listed in this table by activity or area.

Landscape Design	☐ Specify native, low-maintenance, and insectary (attract beneficial insects) plants and landscape designs. ☐ Design zoned, water-efficient irrigation systems using technologies such as drip irrigation, soaker hoses, and microspray systems. Landscape design should be consistent with the local water-efficient landscape ordinance. See the following website for a list of local ordinances: http://www.water.ca.gov/wateruseefficiency/landscapeordinance/. ☐ Do not landscape riparian areas except to remove nonnative plants and replace them with native riparian landscaping. ☐ Replant with native species where possible when landscaping or building an ornamental pond. Do not assume a plant is native because you have seen it in your area. Contact the local nursery for information or visit the California Invasive Plant Council website at http://www.cal-ipc.org.
Landscape Installation	☐ Protect stockpiles and landscaping materials from wind and rain by storing them under tarps or secured plastic sheeting. ☐ Schedule grading and excavation projects during dry weather. ☐ Divert runoff from exposed soils or lower its velocity by leveling and terracing. ☐ Use temporary check dams or ditches to divert runoff away from storm drains. ☐ Protect storm drains with sandbags or other sediment controls. ☐ Revegetation is an excellent form of erosion control for any site. Keep soils covered with vegetation or temporary cover material (mulch) to control erosion. ☐ Check a plant's roots before buying the plant. Do not buy plants with roots that are kinked or circling around the container. Do not buy plants with soft, rotten, or deformed root crowns. ☐ Do not pile soil around the plant any higher than the root crown.
Landscape Maintenance	**Yard Waste** ☐ Allow leaf drop to become part of the mulch layer in tree, shrub, and groundcover areas, and grass cycle. ☐ Keep lawn mower blades sharp.

- Grass cycle—leave grass clippings on the lawn when you mow. Once cut, grass clippings first dehydrate, and then decompose, quickly disappearing from view. Proper mowing is required for successful grass cycling. Cut grass when the surface is dry, and keep mower blades sharp. Follow the 1/3 rule: Mow the lawn often enough so that no more than one-third of the length of the grass blade is cut in any one mowing. Frequent mowing will produce short clippings that will not cover up the grass surface. You might have to mow the lawn every 7 days when it is growing fast but only every 7 to 14 days when it is growing slowly.
- Do not leave clippings on pavement or sidewalks where they can wash off into the street, gutter, or storm drain.
- Collect lawn and garden clippings, pruning waste, and tree trimmings. Chip if necessary, and compost or take to the local municipal yard waste recycling/composting facility.
- In communities with curbside pickup of yard waste, place clippings and pruning waste at the curb in approved bags or containers.

  Note: No curbside pickup of yard waste is available for commercial properties.
- Do not blow or rake leaves or other yard waste into the street, or place yard waste in gutters or on dirt shoulders, unless it is being piled up for recycling (allowed by some municipalities). After pickup, sweep up any leaves, litter, or residue in gutters or on the street.

Fertilizing and Pruning

- Perform soil analysis seasonally to determine actual fertilizer need and application rates.
- Fertilize garden areas with a mulch of leaves, bark, or composted manure and/or garden waste.
- Apply chemical fertilizer only as needed, when plants can best use it, and when the potential for it being carried away by runoff is low. Make sure the fertilizer spreader is calibrated.
- Prune plants sparingly, if at all. A healthy plant—one that is native to the area and growing under the right conditions—should not need pruning, except when it is not in the right location (where safety or liability is a concern).

Watering

- Use soil probes to determine soil moisture depth, overall moisture levels, and the need to adjust irrigation schedules.
- Check sprinklers regularly. Adjust as needed to minimize or eliminate overspray onto impervious surfaces. Replace broken sprinklers or lines.

Pest and Weed Control

- ☐ Obtain appropriate licenses for pest control and pesticides. Contact the Department of Pesticide Regulation for more information online at http://www.cdpr.ca.gov/.
- ☐ Become trained in and offer customers less toxic pest control or integrated pest management.
- ☐ The label on a pesticide container is a legal document. Use the pesticide only as instructed on the label.
- ☐ Store pesticides, fertilizers, and other chemicals indoors or in a shed or storage cabinet.
- ☐ Use pesticides sparingly, according to instructions on the label. Rinse empty containers, and use rinse water as product.
- ☐ Dispose of rinsed, empty containers in the trash. Dispose of unused pesticides as hazardous waste.
- ☐ To control weeds, use drip irrigation and mulch. Hand-pull weeds including roots or cut down to the ground. Repeat cutting before they flower, grow new leaves, or go to seed. Use herbicides containing pelargonic acid or herbicidal soap as a last resort.

Handling Gasoline

- ☐ Use only containers approved by a nationally recognized testing laboratory such as Underwriters Laboratories. Keep each container tightly sealed. Containers should be fitted with a spout to allow pouring without spilling and to minimize the generation of vapors.
- ☐ Fill cautiously. Always use a funnel and/or spout to prevent spilling or splashing when fueling power mowers, blowers, and all other gas-powered equipment.
- ☐ Avoid spilling gasoline on the ground, especially near wells. If a spill occurs, use kitty litter, saw dust, or an absorbent towel to soak up the spill, then dispose of it properly.
- ☐ Store carefully. Gasoline moves quickly through soil and into groundwater; therefore, store and use gasoline and fuel equipment as far away from your drinking water well as possible. Be certain to keep the cap closed on the gasoline container. Store the container at ground level instead of on a shelf to minimize the danger of it falling and spilling.
- ☐ Do not dispose of gasoline down a drain, into surface water, onto the ground, or in the trash. Contact the local municipality for directions on proper disposal of excess or old gasoline. Transport old gas in an approved gasoline container.

Working Near Water Bodies

- ☐ Do not dump lawn clippings, other yard waste, or soil along creek banks or into creeks.

	☐ Do not store stockpiles of materials (soil or mulch) along creek banks. These piles can erode into the creek over time. ☐ Do not spray pesticides or fertilizers by creeks. ☐ Do not overwater near streams. The excess water could carry pesticides, fertilizers, sediments, and anything else in its path directly into the creek.

BG-40 Landscape Maintenance

More Information

Bay Area Stormwater Management Agencies Association. 1999. Start at the Source—Design Guidance Manual for Stormwater Quality Protection. Available online at http://basmaa.org/.

Bay Area Stormwater Management Agencies Association. 2012. *Landscape Designs for Stormwater Management—Stormwater Control for Small Projects*. Available online at http://basmaa.org/.

California Department of Resources Recycling and Recovery (CalRecycle). 1999. *Grass cycle! Make the Most of Your Lawn. Make the Most of Your Time*. Available online at http://www.calrecycle.ca.gov/publications/Documents/Organics/44399011.pdf.

California Department of Resources Recycling and Recovery (CalRecycle). n.d. *Capitol Park Training Manual Description and Guidelines for Horticultural Practices*. Available online at http://www.calrecycle.ca.gov/organics/landscaping/Demos/Manual.pdf.

California Invasive Plant Council. 2012. *Prevention BMPs for Land Managers*. Available online at https://www.cal-ipc.org/resources/library/publications/landmanagers/.

Southern Sonoma County Resource Conservation District. Undated. *A Guide for Rural Landowners and Residents of Petaluma and Sonoma Creek Watersheds*. (Pamphlet). Available online at http://www.conservation.ca.gov/dlrp/watershedportal/Documents/SSCRCD Creek Care Guide (southern sonoma rcd).pdf.

U.S. Environmental Protection Agency, Office of Water National Pollution Discharge Elimination System. Undated website. *Stormwater Menu of BMPs Municipal Landscaping*. Available online at https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater - edu.

References

City of San Diego. 2012. *Storm Water Standards*. Available online at https://www.sandiego.gov/stormwater/regulations.

City of San Francisco. 2009. *San Francisco Stormwater Design Guidelines*. Available online at http://www.sfwater.org/modules/showdocument.aspx?documentid=2779.

County of Los Angeles Department of Public Works. 2010. *Stormwater Best Management Practice Design and Maintenance Manual for Publicly Maintained Storm Drain Systems*. Available online at http://ladpw.org/des/Design_Manuals/StormwaterBMPDesignandMaintenance.pdf.

Building & Grounds Maintenance SC-41

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

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

Landscaping Activities

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

Building Repair, Remodeling, and Construction

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

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

Mowing, Trimming, and Planting

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

Fertilizer and Pesticide Management

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

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

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

References and Resources

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

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

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

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

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

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

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

SC-41 Building and Grounds Maintenance

Description

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

Approach

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

General Pollution Prevention Protocols

- ☐ Switch to nontoxic chemicals for maintenance to the maximum extent 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 on-site recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Substitute Products*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance and Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.

Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations in which soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum, or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, and 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. See also SC-40 Contaminated and Erodible Areas for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement or ground, or toward a storm drain.

- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.

- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with nonwater-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner and turpentine) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is especially necessary on rainy days. The containment device(s)

must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

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

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, and other collected vegetation as garbage, by composting, or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- When soils are exposed, use mulch or other erosion control measures.
- 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; instead pour it over landscaped areas.
- Use hand weeding when practical.

Fertilizer and Pesticide Management

- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalks if fertilizer is spilled on these surfaces before applying irrigation water.

SC-41 Building and Grounds Maintenance

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.

Spill and Leak Prevention and Response

- ☐ Keep your spill prevention, control, and countermeasure (SPCC) plan up to date.
- ☐ Place a stockpile of spill cleanup materials such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where they are readily accessible.
- ☐ Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- ☐ Familiarize employees with the SPCC plan.
- ☐ Clean up spills immediately.

Material Handling and Waste 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.
- ☐ Do not over-apply fertilizers, herbicides, and other pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Unless on steep slopes, till fertilizers into the soil rather than hydraulic application. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried offsite by runoff. Do not apply these chemicals before predicted rainfall.
- ☐ Dispose of empty pesticide containers according to the instructions on the container label.
- ☐ Rinse containers and use the 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.

- ☐ Refer to Fact Sheet BG-30 for additional pest control best practices.

Employee Training Program

- ☐ Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.

- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the needs of individual staff members.

Quality Assurance and Record Keeping

- Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and the method use to dispose of the waste.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

Site fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, although in some areas it could 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; that coating will contaminate the water from the first flush but not from subsequent flushes. Nitrates, polyphosphates, and other corrosion inhibitors, as well as fire suppressants and antifreeze might be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and, between flushes, could 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 might result in a significant biochemical oxygen demand problem, and the water often smells. Consequently dispose of fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to enter the storm drain or infiltration because of the potentially high levels of pollutants in fire sprinkler line water.

SC-41 Building and Grounds Maintenance

References and Resources

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SC-42 Building Repair and Construction

Description

Site modifications are common, particularly at large industrial sites. The activity can range from minor and normal building repair to major remodeling and the construction of new facilities. These activities can generate pollutants that include solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos insulation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and minor construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

This fact sheet is intended to be used for minor repairs and construction. If major construction is required, the guidelines in the *Construction BMP Handbook* should be followed.

Approach

The best management practice (BMP) approach is to reduce the potential for pollutant discharges 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.

General Pollution Prevention Protocols

- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- Avoid outdoor repairs and construction during periods of wet weather.
- Use safer alternative products to the maximum extent practicable. See also SC-35 Safer Alternative Products for more information.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Substitute Products*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	✓
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Buy recycled products to the maximum extent practicable.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contracts to ensure that certain proper housekeeping and disposal practices are implemented.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Good Housekeeping

Repair and Remodeling

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep and vacuum the area regularly to remove sediment and small debris.
- Cover raw materials of particular concern that must be left outside, especially during the rainy season. See also SC-33 Outdoor Storage of Raw Materials for more information.
- Use equipment and tools such as bag sanders to reduce accumulation of debris.
- Limit/prohibit work on windy days; implement roll-down walls or other measures to reduce wind transport of pollutants.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store liquid materials properly that are normally used in repair and remodeling such as paints and solvents. See also SC-31 Outdoor Liquid Container Storage for more information.
- Sweep out rain gutters or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed. See also SC-44 Drainage System Maintenance for more information.

Painting

- Enclose painting operations consistent with local air quality and Occupational Safety and Health Administration (OSHA) regulations.
- Local air pollution regulations may, in many areas of the state, specify painting procedures that, if properly carried out, are usually sufficient to protect water quality.
- Develop paint-handling procedures for proper use, storage, and disposal.

SC-42 Building Repair and Construction

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using it so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100 percent effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- When there is risk of a spill reaching storm drains, plug nearby storm drain inlets prior to starting to paint and remove the plugs when the job is complete.
- If sandblasting is used to remove paint, cover nearby storm drain inlets prior to starting work.
- If painting requires scraping or sandblasting of the existing surface, use a ground cloth to collect the chips. Dispose of the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- If water-based paints are being used, clean the application equipment in a sink that is connected to the sanitary sewer.
- Capture all cleanup-water and dispose of it properly.
- Dispose properly of paints containing lead or tributyl tin and considered a hazardous waste.
- If leftover paints are to be kept for the next job, store them properly, or dispose of them properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Spill and Leak Prevention and Response

- Keep your spill prevention, control, and countermeasure (SPCC) plan up to date.
- Place a stockpile of spill cleanup materials where they are readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Material Handling and Waste Management

- Post “No littering” signs, and enforce antilitter laws.
- Provide a sufficient number of litter receptacles for the facility.

SC-42 Building Repair and Construction

- Clean out litter receptacles frequently and cover them to prevent spillage.
- Keep waste collection areas clean.
- Inspect solid waste containers regularly for structural damage. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are put in the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, and pesticides may not be disposed of in solid waste containers
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers clearly stating what they contain.
- Make sure that hazardous waste is collected, removed, and disposed of properly. See also SC-34 Waste Handling and Disposal for more information.

Erosion and Sediment Controls

- Limit disturbance of bare soils and preserve natural vegetation whenever possible. See also EC-2 Preservation of Existing Vegetation in the *Construction BMP Handbook*.
- Stabilize loose soils by revegetating whenever possible. See also EC-4 Hydroseeding in the *Construction BMP Handbook*.
- Use nonvegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:
  - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;
  - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
  - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
  - ✓ Areas where vegetation will not grow adequately within the construction time frame.

  There are several nonvegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization in the *Construction BMP Handbook*.
- Use chemical stabilization when needed. See also EC-5 Soil Binders in the *Construction BMP Handbook*.

- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats in the *Construction BMP Handbook*.
- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control in the *Construction BMP Handbook*.
- Refer to the supplemental information later in this fact sheet for projects that involve more extensive soil disturbance activities.

Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly implement the source control BMPs described above. Detailed information for erosion and sediment control BMPs is provided in the *Construction BMP Handbook*.
- Proper education of off-site contractors is often overlooked. The conscientious efforts of well-trained employees can be wasted by unknowing off-site contractors, so make sure they are well informed about pollutant source control responsibilities.
- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for building repair and construction, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and the method used to dispose of the waste.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing, and time limitations that preclude implementation of BMPs. The following are typical limitations and recommended work-arounds.

- This BMP is for minor construction only. The state's General Construction Activity Stormwater Permit has more extensive requirements for larger projects that would disturb 1 or more acres of surface.
  - ✓ Refer to the companion *Construction BMP Handbook* for specific guidance and BMPs for larger scale projects.
- Time constraints might require some outdoor repairs and construction during wet weather.

- ✓ Require employees to understand and follow good housekeeping and spill and leak prevention BMPs.
- ✓ Inspect erosion and sediment control BMPs daily during periods of wet weather and repair or improve BMP implementation as necessary.

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
  - ✓ Minimize use of hazardous materials to the maximum extent practicable.
- Be certain that actions to help stormwater quality are consistent with Cal/ and Fed/OSHA and air quality regulations.
- Prices for recycled/safer alternative materials and fluids may be higher than those of conventional materials.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Limited capital investments may be required at some sites if cover and containment facilities are inadequate for construction materials and wastes.
- Purchase and installation of erosion and sediment controls, if needed, will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.
- Minimize costs by maintaining existing vegetation and limiting construction operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.
- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the *Construction BMP Handbook*. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated and Erodible Areas.

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If, because of the remodeling, a new drainage system is

to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

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SC-43 Parking Area Maintenance

Description

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

BMPs for other outdoor areas on-site (loading/unloading, material storage, and equipment operations) are described in fact sheets SC-30 through SC-33.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Substitute Products*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance and Record Keeping	✓

Approach

The goal of this program is to ensure that stormwater pollution prevention practices are considered when conducting activities on or around parking areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this Handbook for additional information.
- ☐ Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- ☐ Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.
- ☐ Post "No littering" signs, and enforce antilitter laws.
- ☐ Provide an adequate number of litter receptacles.

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- Clean out litter receptacles frequently and cover them to prevent spillage.

Preventative Maintenance

Inspection

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

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below if water is used to clean surfaces:
  - ✓ Block the storm drain or contain runoff.
  - ✓ Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
- Follow the procedures below when cleaning heavy oily deposits:
  - ✓ Clean oily spots with absorbent materials.
  - ✓ Use a screen or filter fabric over inlet, then wash surfaces.
  - ✓ Do not allow discharges to the storm drain.
  - ✓ Vacuum/pump discharges to a tank or discharge to sanitary sewer.
  - ✓ Dispose of spilled materials and absorbents appropriately.

Surface Repair

- Check local ordinances for standard urban stormwater mitigation plan/low impact development (SUSMP/LID) ordinance.
- Preheat, transfer, or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, and so forth. Leave

covers in place until the job is completed and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control during sweeping 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.

Spill and Leak Prevention and Response

- Keep your spill prevention, control, and countermeasure (SPCC) plan up to date.
- Place a stockpile of spill cleanup materials where they are readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Employee Training Program

- 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.
- Use a training log or similar method to document training.

Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and the method used to dispose of the waste.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the number of BMPs required.

SC-43 Parking Area Maintenance

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the treatment control fact sheets and the *Development BMP Handbook* for more information.

- When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Use sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lots to include semipermeable hardscape.

References and Resources

California Stormwater Quality Association. 2019. *Development Stormwater Best Management Practice Handbook*. Available online at https://www.casqa.org/resources/bmp-handbooks.

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SC-43 Parking Area Maintenance

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SC-44 Drainage System Maintenance

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the off-site conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable best management practices (BMPs) and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the proper hydraulic functioning of the system to avoid flooding.

- ☐ Develop and follow a site-specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- ☐ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

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

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance and Record Keeping	✓

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- ✓ Identify evidence of spills such as paints, discoloring, and odors.
- ✓ Record locations of apparent illegal discharges or illicit connections.
- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques that include zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, and television camera inspection.
- ✓ Eliminate the discharge once the origin of the flow is established.

- ☐ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste—Drains to Stream" or similar wording stenciled on or 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 for additional information.

Illegal Dumping

- ☐ Inspect regularly 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 for additional information.

Preventative Maintenance

Catch Basins/Inlet Structures

- ☐ Staff should regularly inspect facilities to ensure compliance with the following:
  - ✓ Immediate repair of any deterioration threatening structural integrity.
  - ✓ Cleaning before the sump is 40 percent full. Catch basins should be cleaned as frequently as necessary to meet this standard.

SC-44 Drainage System Maintenance

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Prioritize storm drain inlets; clean and repair them as needed.
- Keep accurate logs of the number of catch basins cleaned.
- 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 if necessary 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 disposed of properly. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of the storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removal, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification and improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural state of any river, stream, or lake in California must enter into a stream or lake alteration agreement with the Department of Fish and Wildlife. The developer-applicant should also contact local governments (city, county, or special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, or Department of Water Resources), and the U.S. Army Corps of Engineers and U.S. Fish and Wildlife Service.

SC-44 Drainage System Maintenance

Spill and Leak Prevention and Response

- ☐ Keep your spill prevention, control, and countermeasure (SPCC) plan up to date.
- ☐ Investigate promptly all reports of spills, leaks, and illegal dumping.
- ☐ Place a stockpile of spill cleanup materials where they are readily accessible or at a central location.
- ☐ Clean up all spills and leaks using dry methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

Employee Training Program

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- ☐ Train employees and subcontractors in proper hazardous waste management.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's SPCC plan and/or proper spill cleanup procedures.
- ☐ Have staff involved in detection and removal of illicit connections trained in the following:
  - ✓ OSHA-required health and safety training (Title 29 of the Code of Federal Regulations [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).

Quality Assurance and Record Keeping

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and the method used to dispose of the waste.
- ☐ Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system, including how wastes were cleaned up and disposed of.
- ☐ Establish procedures to complete logs and file them in the central office.

SC-44 Drainage System Maintenance

Potential Limitations and Work-Arounds

The following are typical limitations and recommended work-arounds for drainage system maintenance:

- Cleanup activities might create a slight disturbance for local aquatic species. Access to items and material on private property might be limited. Trade-offs might 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.

  - ✓ Perform all maintenance on-site and do not flush accumulated material downstream to private property or riparian habitats.

- Storm drain flushing is most effective in small-diameter pipes (i.e., a pipe 36 inches in diameter or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.

  - ✓ Develop and follow a site-specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

- Regulations might include adoption of substantial penalties for illegal dumping and disposal.

  - ✓ Do not dump illegal materials anywhere on-site.

  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.

  - ✓ Clean up spills immediately, and properly dispose of wastes.

- Local municipal codes might include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.

  - ✓ Collect all materials and pollutants accumulated in the drainage system and dispose of them according to local regulations.

  - ✓ Install debris excluders in areas with a trash total maximum daily load.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential.

- Developing and implementing a site-specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

Maintenance

- Two-person teams might be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.
- Methods used for illicit connection detection (e.g., smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors such as the amount of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Supplemental Information

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants from storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents plug flow discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drains usually are flushed along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An inflatable device is placed in an upstream manhole to temporarily plug 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 impacts of stormwater pollution, a second inflatable device placed well downstream might be used to recollect the water after the force of the flushing wave has dissipated. A pump could then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure might be more practical or required to recollect the flushed waters.

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 if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

City of Seattle. 2016. *City of Seattle Stormwater Manual*. Seattle Public Utilities Department of Planning and Development. Available online at http://www.seattle.gov/dpd/cs/groups/pan/@pan/documents/web_informational/p2358283.pdf.

Knox County, Tennessee. 2008. Drainage System Maintenance. Chapter 5 in *Stormwater Management Manual*. Available online at http://www.knoxcounty.org/stormwater/manual/Volume 1/knoxco_swmm_v1_chap5_jan2008.pdf.

U.S. Environmental Protection Agency. 2016. National Pollutant Discharge Elimination System. *National Menu of Best Management Practices (BMPs) for Stormwater*. Available online at https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#edu

Stormwater Pollution Prevention

Best Management Practices for Homeowner's Associations, Property Managers and Property Owners

Your Guide To Maintaining Water Friendly Standards In Your Community

sbcountystormwater.org

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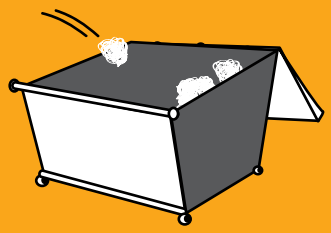
COMMERCIAL TRASH ENCLOSURES

FOLLOW THESE **REQUIREMENTS** TO **KEEP OUR WATERWAYS CLEAN**

Trash enclosures, such as those found in commercial and apartment complexes, typically contain materials that are intended to find their way to a landfill or a recycling facility. **These materials are NOT meant to go into our local lakes and rivers.**

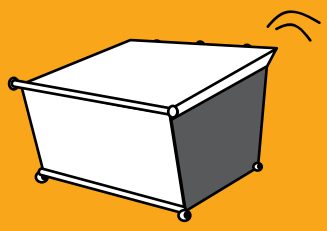
PROTECT WATER QUALITY BY FOLLOWING THESE SIMPLE STEPS

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags)

CLOSE THE LID



Prevent rain from entering the bin in order to avoid leakage of polluted water runoff

KEEP TOXICS OUT

- Paint
- Grease, fats and used oils
- Batteries, electronics and fluorescent lights

SOME ADDITIONAL GUIDELINES, INCLUDE

✓ SWEEP FREQUENTLY
Sweep trash enclosure areas frequently, instead of hosing them down, to prevent polluted water from flowing into the streets and storm drains.

✓ FIX LEAKS
Address trash bin leaks immediately by using dry clean up methods and report to your waste hauler to receive a replacement.

✓ CONSTRUCT ROOF
Construct a solid cover roof over the existing trash enclosure structure to prevent rainwater from coming into contact with trash and garbage. Check with your local City/County for Building Codes.

In San Bernardino County, stormwater pollution is caused by food waste, landscape waste, chemicals and other debris that are washed into storm drains and end up in our waterways - untreated! You can be part of the solution by maintaining a water-friendly trash enclosure.

THANK YOU FOR HELPING TO KEEP SAN BERNARDINO COUNTY CLEAN AND HEALTHY!

San Bernardino County STORMWATER PROGRAM

In the event of a spill or discharge to a storm drain or waterway, contact San Bernadino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

sbcountystormwater.org

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CESQG PROGRAM

Conditionally Exempt Small Quantity Generator

WHAT IS A CESQG?

Businesses that generate 27 gallons or 220 lbs. of hazardous waste, or 2.2 lbs. of extremely hazardous waste per month are called "Conditionally Exempt Small Quantity Generators," or CESQGs. San Bernardino County Household Hazardous Program provides waste management services to CESQG businesses. The most common CESQGs in San Bernardino County are painters, print shops, auto shops, builders, agricultural operators and property managers, but there are many others. When you call, be ready to describe the types and amounts of waste your business generates in a typical month. If you generate hazardous waste on a regular basis, you must:

- Register with San Bernardino County Fire Department (909) 386-8401 as a hazardous waste generator.
- To obtain an EPA ID# and application form from the State visit www.dtsc.ca.gov.
- Manage hazardous waste in accordance with all applicable local, state and federal laws and regulations.

HOW DO I GET SERVICE?

To arrange an appointment for the CESQG Program, call 1-800-OILY CAT or 909-382-5401. Be ready to describe the type and amount of hazardous waste your business is ready to dispose of, and the types and size(s) of containers that the waste is in.

Waste Type and Cost

There is a small handling fee involved in the collection of hazardous waste from your business. Disposal costs depend on the type of waste.

Aerosols	$1.29/lb.
Automobile motor oil	$.73/gal.
Anti-freeze	$1.57/gal.
Contaminated oil	$4.48/gal.
Car batteries	$.62/ea.
Corrosive liquids, solids	$2.80/lb.
Flammable solids, liquids	$1.57/lb.
Latex Paint	$.73/lb.
Mercury	$10.08/lb.
NiCad/Alkaline Batteries	$2.13/lb.
Oil Base Paints	$1.00/lb.
Oil Filters	$.56/ea.
Oxidizers	$9.63/lb.
PCB Ballasts	$5.94/lb.
Pesticides (most)	$2.91/lb.
Photofixer, developer	$4.31/gal.
Television & Monitors	$11.20/ea.
Additional Handling	$138.00/hr.

Rates subject to change without notice

WE CANNOT ACCEPT

- Radioactives
- Water reactives
- Explosives
- Compressed gas cylinders
- Medical or biohazardous waste
- Asbestos
- Remediation wastes

HAZARDOUS WASTE

WHY IS THE FIRE DEPARTMENT COLLECTING HAZARDOUS WASTE?

Small Quantity Generators often have difficulty disposing of small quantities of hazardous waste. Hazardous waste companies usually have a minimum amount of waste that they will pick up, or charge a minimum fee for service. Typically, the minimum fee exceeds the cost of disposal for the hazardous waste. This leaves the small quantity generator in a difficult situation. Some respond by storing hazardous waste until it becomes economical for the hazardous waste transporter to pick it up, putting the business out of compliance by exceeding regulatory accumulation time limits. Other businesses simply store their hazardous wastes indefinitely, creating an unsafe work environment and exceeding accumulation time limits. Yet other businesses attempt to illegally dispose of their waste at household hazardous waste collection facilities. These facilities are not legally permitted to accept commercial wastes, nor are prepared to provide legal documentation for commercial hazardous waste disposal. In answer to the problems identified above, the San Bernardino County Fire Department Household Hazardous Program instituted the Conditionally Exempt Small Quantity Generator Program.

PAYMENT FOR SERVICES

The CESQG Program will prepare an invoice for your business at the time of service. You can pay at the time of service with cash or a check, or you can mail your payment to the Fire Department within 30 days. Please note that we do not accept credit card payments. The preferred method of payment is to handle payment at time of service. Additional charges may apply for accounts not paid within 30 days.

ARE THERE ANY OTHER WAYS THAT I CAN SAVE MONEY ON HAZARDOUS WASTE DISPOSAL?

Yes! First, start by reducing the amount of waste that you produce by changing processes or process chemicals, at your business. Next, examine if there is a way that you can recycle your waste back into your processes. Network with similar businesses or trade associations for waste minimization and pollution prevention solutions.

WHAT IF YOUR BUSINESS DOES NOT QUALIFY?

Call the San Bernardino County Fire Department Field Services Division for assistance with hazardous waste management at 909-386-8401. If you reduce the amount of waste you generate each month to 27 gallons or less, you may qualify in the future.

WHAT HAPPENS TO YOUR HAZARDOUS WASTE?

Hazardous waste collected by the CESQG Program is transported to a state permitted processing facility in San Bernardino. The waste is further processed at this point and packaged for off-site recycling (oil filters, oil, latex paint, antifreeze, and batteries) or destructive incineration (pesticides, corrosives, flammables, oil based paint).

San Bernardino County Fire Department
CESQG Program
2824 East "W" Street
San Bernardino, CA 92415-0799
Phone: 909-382-5401
Fax: 909-382-5413
www.sbcfire.org/hazmat/hhw.asp
Email: jschwab@sbcfire.org

WHEN WORKING OUTDOORS USE THE 3Cs

CUANDO TRABAJE AL AIRE LIBRE UTILICE LAS 3Cs

CONTROL | CONTROL

Locate the nearest storm drain and ensure nothing can enter or be discharged into it.
Ubique el desagüe de aguas pluviales más cercano y asegúrese de que nada pueda ingresar a éste ni descargarse en él.

CONTAIN | CONTENER

Isolate your area to prevent material from potentially flowing or being blown away.
Aísle su área para evitar que el material pueda discurrirse o ser llevado por el viento.

CAPTURE | CAPTURAR

Sweep up debris and place it in the trash. Clean up spills with an absorbent material (e.g. kitty litter) or vacuum with a Wet-Vac and dispose of properly.
Recoja los restos y colóquelos en la basura. Limpie los derrames con un material absorbente (como la arena para gatos) o aspírelos con una Wet-Vac (aspiradora de humedad) y deséchelos correctamente.

COMMERCIAL LANDSCAPE

DISCHARGE TO THE STORM DRAIN, **ACCIDENTAL OR NOT**, COULD LEAD TO ENFORCEMENT ACTIONS, WHICH COULD INCLUDE FINES.

Follow the best practices below to **prevent water pollution from landscaping activities.**

RECYCLE YARD WASTE

- Recycle leaves, grass clippings and other yard waste.
- Do not blow, sweep, rake or hose yard waste into the street or catch basin.
- **Try grasscycling:** the natural recycling of grass by leaving clippings on the lawn when mowing.

  For more information, please visit: **www.calrecycle.ca.gov/organics/grasscycling**

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY

- Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural and non-toxic alternatives as often as possible.
- If you must use chemical fertilizers, herbicides or pesticides:
  - Spot apply, rather than blanketing entire areas.
  - Avoid applying near curbs and driveways, and **never** before a rain.
  - Apply fertilizers as needed: when plants could best use it and when the potential runoff would be low.
  - Follow the manufacturer's instructions carefully—this will not only give the best results, but will save money.

USE WATER WISELY

- Control the amount of water and direction of sprinklers. Sprinklers should only be on long enough to allow water to soak into the ground, but not so long as to cause runoff.
- Periodically inspect, fix leaks and realign sprinkler heads.
- Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.

HOMEOWNERS

KEEP THESE TIPS IN MIND WHEN HIRING PROFESSIONAL LANDSCAPERS AND REMIND AS NECESSARY.

Leftover pesticides, fertilizers, and herbicides contaminate landfills and should be disposed of through a Hazardous Waste Facility.

For more information on proper disposal call,

(909) 382-5401 or 1-800-OILY CAT.

*FREE for San Bernardino County residents only. Businesses can call for cost inquiries and to schedule an appointment.

In the event of a spill or discharge to a storm drain or waterway, contact San Bernadino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

sbcountystormwater.org

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SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. Fountain water containing chlorine and copperbased algaecides is toxic to aquatic life. Proper inspection, cleaning, and repair of pedestrian areas and HOA owned surfaces and structures can reduce pollutant runoff from these areas. Maintaining these areas may involve one or more of the following activities:

1. **Surface Cleaning**
2. **Graffiti Cleaning**
3. **Sidewalk Repair**
4. **Controlling Litter**
5. **Fountain Maintenance**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for sidewalk, plaza, and fountain maintenance and cleaning include:

- 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).
- Once per year, educate HOA staff and tenants on pollution prevention measures.

MODEL PROCEDURES:

1. Surface Cleaning

Discharges of wash water to the storm water drainage system from cleaning or hosing of impervious surfaces is prohibited.
Sidewalks, Plazas

✓ Use dry methods (e.g. sweeping, backpack blowers, vacuuming) whenever practical to clean sidewalks and plazas rather than hosing, pressure washing, or steam cleaning. DO NOT sweep or blow material into curb; use devices that contain the materials.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

Parking Areas, Driveways, Drive-thru

✓ Parking facilities should be swept/vacuumed on a regular basis. Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

✓ Sweep all parking lots at least once before the onset of the wet season.

✓ Use absorbents to pick up oil; then dry sweep.

✓ Appropriately dispose of spilled materials and absorbents.

OPTIONAL:

- 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.

Building Surfaces, Decks, etc., without loose paint

✓ Use high-pressure water, no soap.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

Unpainted Building Surfaces, Wood Decks, etc.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

✓ Use biodegradable cleaning agents to remove deposits.

✓ Make sure pH is between 6.5 and 8.5 THEN discharge to landscaping (if cold water without a cleaning agent) otherwise dispose of properly.

2. Graffiti Cleaning

Graffiti Removal

✓ Avoid graffiti abatement activities during rain events.

✓ When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal in the Roads, Streets, and Highway Operation and Maintenance procedure sheet.

✓ 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.

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

✓ Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.

OPTIONAL:

• Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

3. Sidewalk Repair

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 material.

✓ Designate an area for clean up and proper disposal of excess materials.

✓ Remove and recycle as much of the broken pavement as possible.

✓ When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet 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 shovel or vacuum the slurry, remove from site and dispose of properly.

✓ 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. Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so or contain and dispose of properly.

Concrete Installation and Repair

✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.

✓ Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other storm water conveyance structures. (See Concrete Waste Management BMP WM – 8)

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

✓ Store dry and wet concrete materials under cover, protected from rainfall and runoff and away from drainage areas. After job is complete remove temporary stockpiles (asphalt materials, sand, etc.) and other materials as soon as possible.

✓ Return leftover materials to the transit mixer. Dispose of small amounts of excess concrete, grout, and mortar in the trash.

✓ When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.

✓ Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.

✓ Protect applications of fresh concrete from rainfall and runoff until the material has hardened.

4. Litter Control

✓ 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.

OPTIONAL:

• Post "No Littering" signs.

5. Fountain Maintenance

✓ Do not use copper-based algaecides. Control algae with chlorine or other alternatives, such as sodium bromide.

✓ Allow chlorine to dissipate for a few days and then recycle/reuse water by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present (concentration must be less than 0.1 ppm).

✓ Contact local agency for approval to drain into sewer or storm drain.

✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.

EQUIPMENT MAINTENANCE & REPAIR

Vehicle or equipment maintenance has the potential to be a significant source of stormwater pollution. Engine repair and service (parts cleaning, spilled fuel, oil, etc.), replacement of fluids, and outdoor equipment storage and parking (dripping engines) can all contaminate stormwater. Conducting the following activities in a controlled manner will reduce the potential for stormwater contamination:

1. **General Maintenance and Repair**
2. **Vehicle and Machine Repair**
3. **Waste Handling/Disposal**

Related vehicle maintenance activities are covered under the following program headings in this manual: "Vehicle and Equipment Cleaning", "Vehicle and Equipment Storage", and "Vehicle Fueling".

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for equipment maintenance and repair include:

- Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters. Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Minimize use of solvents. Clean parts without using solvents whenever possible. Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.
- Once per year, educate HOA staff and tenants on pollution prevention measures.

EQUIPMENT MAINTENANCE & REPAIR

MODEL PROCEDURES:

1. General Maintenance and Repair

General Guidelines

➔ *Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.*

- ✓ Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters. Keep accurate maintenance logs to evaluate materials removed and improvements made.
- ✓ Regularly inspect vehicles and equipment for leaks.
- ✓ Move activity indoors or cover repair area with a permanent roof if feasible.
- ✓ Minimize contact of stormwater with outside operations through berming the local sewering and drainage routing.
- ✓ Place curbs around the immediate boundaries of the process equipment.
- ✓ Clean yard storm drain inlets regularly and stencil them.

Good Housekeeping

- ✓ Avoid hosing down work areas. If work areas are washed and if discharge to the sanitary sewer is allowed, treat water with an appropriate treatment device (e.g. clarifier) before discharging. If discharge to the sanitary sewer is not permitted, pump water to a tank and dispose of properly.
- ✓ Collect leaking or dripping fluids in drip pans or container. Fluids are easier to recycle or dispose of properly if kept separate.
- ✓ Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, any discharge of or remove other parts. Place a drip pan under any vehicle that might leak while you work on it to keep splatters or drips off the shop floor.
- ✓ Educate employees on proper handling and disposal of engine fluids.
- ✓ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- ✓ Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- ✓ Post signs at sinks and stencil outdoor storm drain inlets.

2. Vehicle Repair

General Guidelines

- ✓ Perform vehicle fluid removal or changing inside of a building or in a contained covered area, where feasible, to prevent the run-on of stormwater and the runoff of spills.
- ✓ Regularly inspect vehicles and equipment for leaks, and repair as needed.

EQUIPMENT MAINTENANCE & REPAIR

- ✓ Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ Immediately drain all fluids from wrecked vehicles. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g. larger pans are needed to contain antifreeze, which may gush from some vehicles).
- ✓ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- ✓ Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.
- ✓ Oil filters disposed of in trash cans or dumpsters can leak oil. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- ✓ Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling facilities or at County hazardous waste disposal site.

Vehicle Leak and Spill Control

- ✓ Use absorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- ✓ Place a stockpile of spill cleanup materials where it will be readily accessible.
- ✓ Sweep floor using dry absorbent material.

3. Machine Repair

- ✓ Keep equipment clean; don't allow excessive build-up of oil or grease.
- ✓ Minimize use of solvents.
- ✓ Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ Perform major equipment repairs at the corporation yard, when practical.
- ✓ Following good housekeeping measures in Vehicle Repair section.

4. Waste Handling/Disposal

Waste Reduction

- ✓ Prevent spills and drips of solvents and cleansers to the shop floor.
- ✓ Do liquid cleaning at a centralized station so the solvents and residues stay in one area. Recycle liquid cleaners when feasible.

✓ Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse.

OPTIONAL:

- If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

  -Use non-caustic detergents instead of caustic cleaning for parts cleaning.

  -Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.

  -Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.

  -Choose cleaning agents that can be recycled.

Recycling

OPTIONAL:

- Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.

- Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries).

- Purchase recycled products to support the market for recycled materials.

LIMITATIONS:

Space and time limitations may preclude all work being conducted indoors. It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours. Dry floor cleaning methods may not be sufficient for some spills – see spill prevention and control procedures sheet. Identification of engine leaks may require some use of solvents.

POOL MAINTENANCE

Pool chemicals and filter solids, when discharged to the City streets, gutters or storm drans, DO NOT GET TREATED before reaching the Santa Ana River. Chlorine, acid cleaning chemicals and metal-based algaecides used in pools can kill beneficial organisms in the food chain and pollute our drinking water.

When emptying your swimming pool, spa or fountain, please use one of the following best management practices to prevent water pollution:

- Reuse the water as landscape irrigation
- Empty the water into the sewer between midnight and 6:00 am
- Remove solids and floating debris and dispose of in the trash, de-chlorinate the water to a chlorine residual = 0, wait 24 hours, then discharge the water to the street or storm drain
- Try not to use metal-based algaecides (i.e. copper sulfate) in your pool or spa. If you have, empty your pool or spa into the sewer. *Prior to discharging pool water into the sanitary sewer system, contact your local agency.*
- If the pool contains algae and mosquito larvae, discharge the water to the sewer

When acid cleaning or other chemical cleaning:

- Neutralize the pool water to pH of 6.5 to 8.5, then discharge to the sewer

For swimming pool and spa filter backwash:

- Dispose of solids into trash bag, then wash filter into a landscape area
- Settle, dispose of solids in trash and discharge water to the sewer, never to the storm drain

» For Residents

The following is a preview of the information we have available to residents. For more fact sheets, visit ***sbcountystormwater.org***

Household Hazardous Waste Center Locations

TOO TOXIC TO TRASH

Dispose of your **HOUSEHOLD HAZARDOUS WASTE** (HHW) at a **FREE** HHW Center near you. Examples of items collected: pesticides, fertilizers, paints, cleaners, antifreeze, batteries, motor oil, oil filters, and electronic waste.

SERVICE AREA	LOCATION	DAYS OPEN	HOURS
Big Bear Lake (does not accept E-waste)	42040 Garstin Dr. (cross: Big Bear Blvd.)	Saturdays	9 a.m. - 2 p.m.
Chino	5050 Schaefer Ave. (cross: 4th St.)	2nd & 4th Sat.	8 a.m. - 1 p.m.
Fontana (Fontana residents only)	16454 Orange Way (cross: Cypress Ave.) Note: Provide a trash bill and a driver's license as proof of residency.	Saturdays	8 a.m. - 12 p.m.
Ontario	1430 S. Cucamonga Ave. (cross: Belmont St.)	Fri. & Sat.	9 a.m. - 2 p.m.
Rancho Cucamonga	8794 Lion Street. (Off 9th St, between Vineyard and Hellman)	Saturdays	8 a.m. - 12 p.m.
Redlands	500 Kansas St. (cross: Park Ave.)	Saturdays	9:30 a.m. - 12:30 p.m.
Rialto (does not accept E-waste)	246 Willow Ave. (cross: Rialto Ave.)	2nd & 4th Fri. & Sat.	8 a.m. - 12 p.m.
San Bernardino	2824 East 'W' St., 302 (cross: Victoria Ave.)	Mon. – Fri.	9 a.m. - 4 p.m.
Upland	1370 N. Benson Ave. (cross: 14th St.)	Saturdays	9 a.m. - 2 p.m.

San Bernardino County STORMWATER PROGRAM

To report illegal dumping, call (877) WASTE18 or visit sbcountystormwater.org

Artwork Courtesy of the City of Los Angeles Stormwater Program. Printed on recycled paper.

TAKE ONE

WE DID IT OURSELVES AND WE DID IT RIGHT

When painting your home, protect your family and community.

- **PAINTS** that are water-based are less toxic and should be used whenever possible.
- **BRUSHES** with water-based paint should be washed in the sink. Those with oil-based paint should be cleaned with paint thinner.
- **SAFELY** dispose of unwanted paint and paint thinner. The County of San Bernardino offers 9 HHW Centers that accept paint and other household hazardous waste from residents FREE of charge. For a list of acceptable materials, location information, and hours of operation call 1-800-OILY CAT.

VEHICLE MAINTENANCE

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

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

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

Preventing Leaks and Spills
Conduct all vehicle maintenance inside of a garage. Place drip pans underneath vehicle to capture fluids. Use absorbent materials instead of water to clean work areas.

Cleaning Spills
Use dry methods for spill cleanup (sweeping, absorbent materials). To report accidental spills into the street or storm drain call (877) WASTE18 or 911.

Proper Disposal of Hazardous Waste
Dispose of household hazardous waste by taking it to your nearest household hazardous waste center. For more information, call 1-800-OILY CAT or check out sbcountystormwater.org/Disposal.html

PET WASTE DISPOSAL

FREE

DOGGIE WASTE BAGS

Remember to pick up after your pet every time to keep San Bernardino County clean and healthy!

San Bernardino County STORMWATER PROGRAM

In the event of a spill or discharge to a storm drain or waterway, contact San Bernadino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

sbcountystormwater.org

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernadino • San Bernadino County • San Bernadino County Flood Control District • Upland • Yucaipa

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