

Water Quality Management Plan

For:
Proposed Commercial Building

APN: 0132-021-18

Prepared for:
Gevork Martirosian
285 E. Imperial Hwy, Ste 208,
Fullerton, CA 92835
(714)-680-6182

Prepared by:
E&A Engineers
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Submittal Date: July 1, 2022
Revision Date: February 15, 2023

Approval Date: _____

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Gevork Martirosian by E&A Engineers. The WQMP is intended to comply with the requirements of the City of Rialto 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):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0132-021-18
Owner's Signature			
Owner Name: Gevork Martirosian			
Title			
Company			
Address	285 E. Imperial Hwy, Ste 208, Fullerton, CA 92835		
Email	geork@aol.com		
Telephone #	(714) 680-6182		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0132-021-18

“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: Gil Evangelista		PE Stamp Below
Title	Project Manager	
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Signature		
Date		

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Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name		Proposed Commercial Building			
Project Owner Contact Name:		Gevork Martirosian			
Mailing Address:	285 E. Imperial Hwy, Ste 208, Fullerton, CA 92835	E-mail Address:	geork@aol.com	Telephone:	(714) 879-1203
Permit/Application Number(s):				Tract/Parcel Map Number(s):	
Additional Information/ Comments:					
Description of Project:		<p>The project site in consideration is located at the Southeast corner of W. Randall Avenue and Lilac Avenue, in the City of Rialto, California with a total area of 1.56 acres. The existing site is mostly vacant with the exception of 2 buildings, asphalt driveways and concrete paths/areas. The existing drainage relies on sheet flow over pavement in a southerly to easterly direction.</p> <p>The project will remove the existing asphalt/concrete pavement and demolish the existing buildings. The proposed development will construct the two commercial buildings and parking areas. There will be Landscape areas around the perimeter of the site.</p> <p>Runoff from the site will sheet flow over the pavement towards V-gutters that lead to catchbasins, where runoff will enter the Cultec 180HD Recharger underground chambers. Runoff exceeding the capacity of the underground chambers incase of highflows will be pumped out westerly to the street's drainage system along Lilac Avenue.</p>			

Water Quality Management Plan (WQMP)

<p>Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</p>	<p>To follow.</p>
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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):					
<input checked="" type="checkbox"/> Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input type="checkbox"/> New development involving the creation of 10,000 ft ² or more of impervious surface collectively over entire site	<input type="checkbox"/> Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	<input type="checkbox"/> Restaurants (with SIC code 5812) where the land area of development is 5,000 ft ² or more		
<input type="checkbox"/> Hillside developments of 5,000 ft ² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	<input type="checkbox"/> Developments of 2,500 ft ² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	<input type="checkbox"/> Parking lots of 5,000 ft ² or more exposed to storm water	<input type="checkbox"/> Retail gasoline outlets that are either 5,000 ft ² or more, or have a projected average daily traffic of 100 or more vehicles per day		
<input type="checkbox"/> Non-Priority / Non-Category Project <i>May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</i>					
2 Project Area (ft ²):	68,079.95	3 Number of Dwelling Units:	N/A	4 SIC Code:	1542
5 Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					
6 Does Project include roads? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)</i>					

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

Gevork Martirosian will be responsible for the construction and maintenance of the site, Right of way improvements and post development BMP's. No infrastructure will be transferred to a public agency after the project completion. A property owner's association (POA) will not be formed for long-term maintenance of project stormwater facility.

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2.3 Potential Stormwater Pollutants

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

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Santa Ana Reach 4 and 3 are impaired with pathogens.
Nutrients - Phosphorous	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Downstream receiving waters are not impaired by phosphorous.
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Downstream receiving waters are not impaired by nitrogen
Noxious Aquatic Plants	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Downstream receiving waters are not impaired by Noxious aquatic plants
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Expected pollutant if landscaping exists on-site Downstream receiving waters are not impaired by sediments
Metals	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Santa Ana River Reach 3 is impaired with copper and lead.
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Downstream receiving waters are not impaired by oil and grease
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Downstream receiving waters are not impaired by trash and debris
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Downstream receiving waters are not impaired by pesticides/herbicides
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Downstream receiving waters are not impaired by organic compounds
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	

2.4 Water Quality Credits

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

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: <i>Select all that apply</i>			
<input type="checkbox"/> Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects <input type="checkbox"/> Vertical density [20%] <input type="checkbox"/> 7 units/ acre [5%]	<input type="checkbox"/> Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	<input type="checkbox"/> Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
<input type="checkbox"/> Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	<input type="checkbox"/> Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	<input type="checkbox"/> In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	<input type="checkbox"/> Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % <i>(Total all credit percentages up to a maximum allowable credit of 50 percent)</i>			
Description of Water Quality Credit Eligibility (if applicable)	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 34.084427	Longitude -117.378718	Thomas Bros Map page 605
<p>¹ San Bernardino County climatic region: <input checked="" type="checkbox"/> Valley <input type="checkbox"/> Mountain</p>			
<p>² Does the site have more than one drainage area (DA): Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>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</i></p>			
<pre> graph BT DA1[DA1] --> UC[Cultec Underground chambers] UC --> O1[Outlet 1] </pre>			
Conveyance	Runoff from the site is primarily conveyed through sheet flow towards V-gutters into catchbasins THEN drain into the Cultec Underground chambers.		
DA1 to Outlet 1	DA 1 has an area of 1.56 acres, runoff from this area will sheetflow over pavement towards V-gutters that drains to a catchbasin and the Cultec 180HD Recharger Underground Chambers.		

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft ²)	68079.95			
2 Existing site impervious area (ft ²)	58956.69			
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	AMC II			
4 Hydrologic soil group <i>Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/</i>	A			
5 Longest flowpath length (ft)	437.90			
6 Longest flowpath slope (ft/ft)	0.015			
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Grass - Natural Cover			
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Good			



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

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	Santa Ana River (Reach 4) Santa Ana River (Reach 3) Prado Dam Santa Ana River (Reach 2) Santa Ana River (Reach 1) Pacific Ocean
Applicable TMDLs Refer to Local Implementation Plan	Santa Ana River (Reach 4)- Pathogens, Santa Ana River (Reach 3)- Copper, Lead, Pathogens
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	Santa Ana River (Reach 4)- Pathogens, Santa Ana River (Reach 3)- Copper, Lead, Pathogens,
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/	None
Unlined Downstream Water Bodies Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/	Santa Ana River
Hydrologic Conditions of Concern	<input type="checkbox"/> Yes Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal <input checked="" type="checkbox"/> No
Watershed-based BMP included in a RWQCB approved WAP	<input type="checkbox"/> Yes Attach verification of regional BMP evaluation criteria in WAP <ul style="list-style-type: none"> • 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 <input checked="" type="checkbox"/> 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.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Practical education materials will be provided to the property owners and staff covering various water quality issues that will need to be addressed on their specific site. These materials will include general practices that contribute to the protection of storm water quality and BMP's that eliminate or reduce pollution during property improvements. The developer/owner will provide educational material attached to this report on Appendix A supporting documentation and BMP Educational materials. The Property Owners shall be responsible to disseminate the educational materials to employees 30 days prior to building opening to public.
N2	Activity Restrictions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Restrictions may be developed by property owner, or other mechanism. Such restriction will include but not limited to Pesticide applications will be performed by an applicator certified by the California Department of Pesticide Regulation. Vehicle washing will be prohibited.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Landscape maintenance activities include vegetation removal , herbicide and insecticide application, fertilizer application, watering and other gardening and lawn care practices. Also a large portion of the runoff will be routed through the two proposed infiltration trench and retention basins, and landscape areas provided by the owner and/or building operator.
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	See section 5, Table 5.1 for details on BMP maintenance.
N5	Title 22 CCR Compliance (How development will comply)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There are no hazardous materials in the site.
N6	Local Water Quality Ordinances	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Project does not consist of fuel dispensing areas or other areas of concern to public properties.
N7	Spill Contingency Plan	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There are no hazardous materials in the site.

Form 4.1-1 Non-Structural Source Control BMPs				
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There are no underground storage tanks in the site.
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There are no hazardous materials in the site.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	There are no Hazardous Materials stored or used onsite.
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Promote efficient and safe housekeeping practices (CASQA BMP HANDBOOK SC-60) (storage, use and clean up) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products. Please also see BMP fact sheets SC-11 and SC-34. Provide by the owner and/or building operator.
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner to provide Employee training at time of hiring or change of procedures as described per development CC&Rs.
N13	Housekeeping of Loading Docks	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Loading Docks proposed.
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Catch basins will be inspected and cleaned as needed a minimum of once every three months during the dry season and a minimum of once every two months during the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Parking lot and onsite streets sweeping and vacuuming will be done by a specialized street sweeping company contracted by owner on a regular frequency based on usage and field observation of waste accumulation, using a vacuum assisted sweeper. As minimum all paved areas shall be swept before the rainy season starts.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a public agency project.
N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General construction permit, grading plan permit.

Form 4.1-2 Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Signs stating "drains to the ocean" will be placed above storm drain inlets to warn the public of prohibitions against waste disposal. See BMP fact sheet SD-13 Owners will be responsible for maintenance.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No proposed outdoor storage areas.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	A proposed trash enclosure is provided for the entire site.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Owner to appoint professional landscaping company to provide maintenance and inspection of landscaping irrigation system. Inspection should be provided at minimum one time per month.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Landscape shall be depressed, where possible for self retention and shall be maintained by the Owner appointed professional landscaping company.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No slopes and channels inside the project site.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No covered docks proposed.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Maintenance Bays proposed.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Vehicle wash areas proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No outdoor processing areas proposed.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There will be no outdoor equipment/accessory washing and steam cleaning activities on the site.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Fueling areas are proposed.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Hillside in the site.
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No food preparation activities done in the site.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Carwash not proposed for the site.

4.1.2 Preventative LID Site Design Practices

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

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

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

Form 4.1-3 Preventative LID Site Design Practices Checklist
<p>Site Design Practices <i>If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: The site will be designed to optimize the pervous surfaces with additional landscape areas.</p>
<p>Maximize natural infiltration capacity: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Areas where landscape are proposed will be cordoned off prior to construction to avoid unnecessary compaction by heavy construction vehicles and maintain the natural infiltration capacity of the site.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Site will be designed to maintain the historic drainage path of travel.</p>
<p>Disconnect impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Roof Runoff will flow into adjacent landscape areas.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: existing weeds shall be replaced by landscaping with drought tolerant plants.</p>
<p>Re-vegetate disturbed areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: disturbed areas with vegetation will be replaced with landscape with drought tolerant plants.</p>
<p>Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Areas where landscape are proposed will be cordoned off prior to construction to avoid unnecessary compaction by heavy construction vehicles and maintain the natural infiltration capacity of the site.</p>
<p>Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: landscape areas are maximized for infiltration trench and retention basin use.</p>
<p>Stake off areas that will be used for landscaping to minimize compaction during construction : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Landscape areas will be staked to minimize unnecessary compaction during construction. Designated access routes for heavy equipment will be provided to avoid areas where landscape are proposed.</p>

4.2 Project Performance Criteria

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

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P₆ 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 mi²), 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): 68,079.95	2 Imperviousness after applying preventative site design practices (Imp%): 83.68%	3 Runoff Coefficient (Rc): 0.644 $R_c = 0.858(\text{Imp}\%)^{0.3} - 0.78(\text{Imp}\%)^{0.2} + 0.774(\text{Imp}\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.566 http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.838 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</i>		
6 Drawdown Rate <i>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.</i>		24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 6013.08 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, where C ₂ is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) <i>Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</i>		

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

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

Go to: <http://permittrack.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 <i>Form 4.2-3 Item 12</i>	2 <i>Form 4.2-4 Item 13</i>	3 <i>Form 4.2-5 Item 10</i>
Post-developed	4 <i>Form 4.2-3 Item 13</i>	5 <i>Form 4.2-4 Item 14</i>	6 <i>Form 4.2-5 Item 14</i>
Difference	7 <i>Item 4 – Item 1</i>	8 <i>Item 2 – Item 5</i>	9 <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	10 % <i>Item 7 / Item 1</i>	11 % <i>Item 8 / Item 2</i>	12 % <i>Item 9 / Item 3</i>

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 <i>sum of areas of DMA should equal area of DA</i>								
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
Weighted Curve Number Determination for: 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)								

Water Quality Management Plan (WQMP)

3b DMA Area, ft ² <i>sum of areas of DMA should equal area of DA</i>								
4b Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item } 5) - 10$				9 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item } 7$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item } 6) - 10$				10 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item } 8$			
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): $V_{pre} = (1 / 12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 9)^2 / ((\text{Item } 11 - \text{Item } 9 + \text{Item } 7))$								
13 Post-developed Volume (ft ³): $V_{pre} = (1 / 12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 10)^2 / ((\text{Item } 11 - \text{Item } 10 + \text{Item } 8))$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): $V_{HCOC} = (\text{Item } 13 * 0.95) - \text{Item } 12$								

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>			Post-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>		
	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) <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
3 Ratio of pervious area to total area <i>For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) $F_m = Item 3 * Item 4$ <i>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)</i>						
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 <i>Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)</i>	DMA A	n/a		n/a		
	DMA B		n/a		n/a	
	DMA C		n/a			n/a
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): <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>		
14 Peak runoff from post-developed condition confluence analysis (cfs): <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): $Q_{p-HCOC} = (Item 14 * 0.95) - Item 10$						

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)

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)			
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 <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 2-5; If no, proceed to Item 6</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
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) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³):		$V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; if no, proceed to Item 14</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
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) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$			
13 Runoff volume retention from on-lot infiltration (ft ³):		$V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$	

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)			
14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 15-20. If no, proceed to Item 21</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Rooftop area planned for ET BMP (ft ²)			
16 Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i>			
17 Daily ET demand (ft ³ /day) <i>Item 15 * (Item 16 / 12)</i>			
18 Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i>			
19 Retention Volume (ft ³) <i>V_{retention} = Item 17 * (Item 18 / 24)</i>			
20 Runoff volume retention from evapotranspiration BMPs (ft ³): <i>V_{retention} = Sum of Item 19 for all BMPs</i>			
21 Implementation of Street Trees: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 22-25. If no, proceed to Item 26</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft ²)			
24 Runoff volume retention from street trees (ft ³) <i>V_{retention} = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i>			
25 Runoff volume retention from street tree BMPs (ft ³): <i>V_{retention} = Sum of Item 24 for all BMPs</i>			
26 Implementation of residential rain barrel/cisterns: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 27-29; If no, proceed to Item 30</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft ³) <i>V_{retention} = Item 27 * 3</i>			
29 Runoff volume retention from residential rain barrels/Cisterns (ft ³): <i>V_{retention} = Sum of Item 28 for all BMPs</i>			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs:		<i>Sum of Items 5, 13, 20, 25 and 29</i>	

4.3.2 Infiltration BMPs

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

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

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

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): 6,013.08 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$

BMP Type <i>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</i>	DA 1 Cultec Underground Chambers	DA BMP Type	
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods</i>	5.2		
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>	3		
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$	1.73		
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>	48		
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>	n/a		
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$	1.6		
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>	3,264		
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>	n/a		
10 Amended soil porosity	n/a		
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>	n/a		
12 Gravel porosity	n/a		
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>	3		
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$	n/a		
15 Underground Retention Volume (ft ³) <i>Volume determined using</i>	6,133.40		
16 Total Retention Volume from LID Infiltration BMPs:	6,133.40		
17 Fraction of DCV achieved with infiltration BMP:	100%		

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

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)		
<p>1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</i></p>	<p>List pollutants of concern <i>Copy from Form 2.3-1.</i></p>	
<p>2 Biotreatment BMP Selected <i>(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)</i></p>	<p>Volume-based biotreatment <i>Use Forms 4.3-6 and 4.3-7 to compute treated volume</i></p>	<p>Flow-based biotreatment <i>Use Form 4.3-8 to compute treated volume</i></p>
	<p><input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet extended detention <input type="checkbox"/> Dry extended detention</p>	<p><input type="checkbox"/> Vegetated swale <input type="checkbox"/> Vegetated filter strip <input type="checkbox"/> Proprietary biotreatment</p>
<p>3 Volume biotreated in volume based biotreatment BMP (ft³): <i>Form 4.3-6 Item 15 + Form 4.3-7 Item 13</i></p>	<p>4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): <i>Item 1 – Item 3</i></p>	<p>5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % <i>Item 4 / Item 1</i></p>
<p>6 Flow-based biotreatment BMP capacity provided (cfs): <i>Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project’s precipitation zone (Form 3-1 Item 1)</i></p>		
<p>7 Metrics for MEP determination:</p> <ul style="list-style-type: none"> • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: <input type="checkbox"/> <i>If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.</i> 		

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP</i>			
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>			
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>			
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Copy Item 6 from Form 4.2-1</i>			
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Amended soil surface area (ft ²)			
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity, <i>n</i>			
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
12 Gravel porosity, <i>n</i>			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7}/2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

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

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

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

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): 6,013.08 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design hydrologic source control LID BMP (ft ³): 0 <i>Copy Item 30 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 6,133.40 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site retention with LID harvest and use BMP (ft ³): 0 <i>Copy Item 9 in Form 4.3-4</i>
5	On-site biotreatment with volume based biotreatment BMP (ft ³): 0 <i>Copy Item 3 in Form 4.3-5</i>
6	Flow capacity provided by flow based biotreatment BMP (cfs): 0 <i>Copy Item 6 in Form 4.3-5</i>
7	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> • Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized</i> ▪ On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
8	<p>If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:</p> <ul style="list-style-type: none"> • Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> • An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: <input type="checkbox"/> <i>Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed</i>

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)	
<p>1 Volume reduction needed for HCOC performance criteria (ft³): <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i></p>	<p>2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): <i>Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction</i></p>
<p>3 Remaining volume for HCOC volume capture (ft³): <i>Item 1 – Item 2</i></p>	<p>4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): <i>Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)</i></p>
<p>5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification <input type="checkbox"/> <i>Attach in-stream control BMP selection and evaluation to this WQMP</i></p>	
<p>6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p><i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP <input type="checkbox"/> <i>BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)</i> • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities <input type="checkbox"/> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	
<p>7 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input type="checkbox"/> No <input type="checkbox"/></p> <p><i>If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:</i></p> <ul style="list-style-type: none"> • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs <input type="checkbox"/> <i>BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)</i> • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California <input type="checkbox"/> 	

4.4 Alternative Compliance Plan (if applicable)

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Cultec Recharger 180HD Underground Chambers	Owner	Check inlets and outlets for clogging and remove any debris, as required.	Monthly in first year then semi annually (Spring and Fall)
		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.	Every 3 years
		<ul style="list-style-type: none"> • Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated. 	2 years after commissioning
		<ul style="list-style-type: none"> • Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. 	9 years after commissioning every 9 years following
		<ul style="list-style-type: none"> • Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. 	45 years after commissioning

Water Quality Management Plan (WQMP)

		<ul style="list-style-type: none">• Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection.• Attain the appropriate approvals as required.• Establish a new operation and maintenance schedule	

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

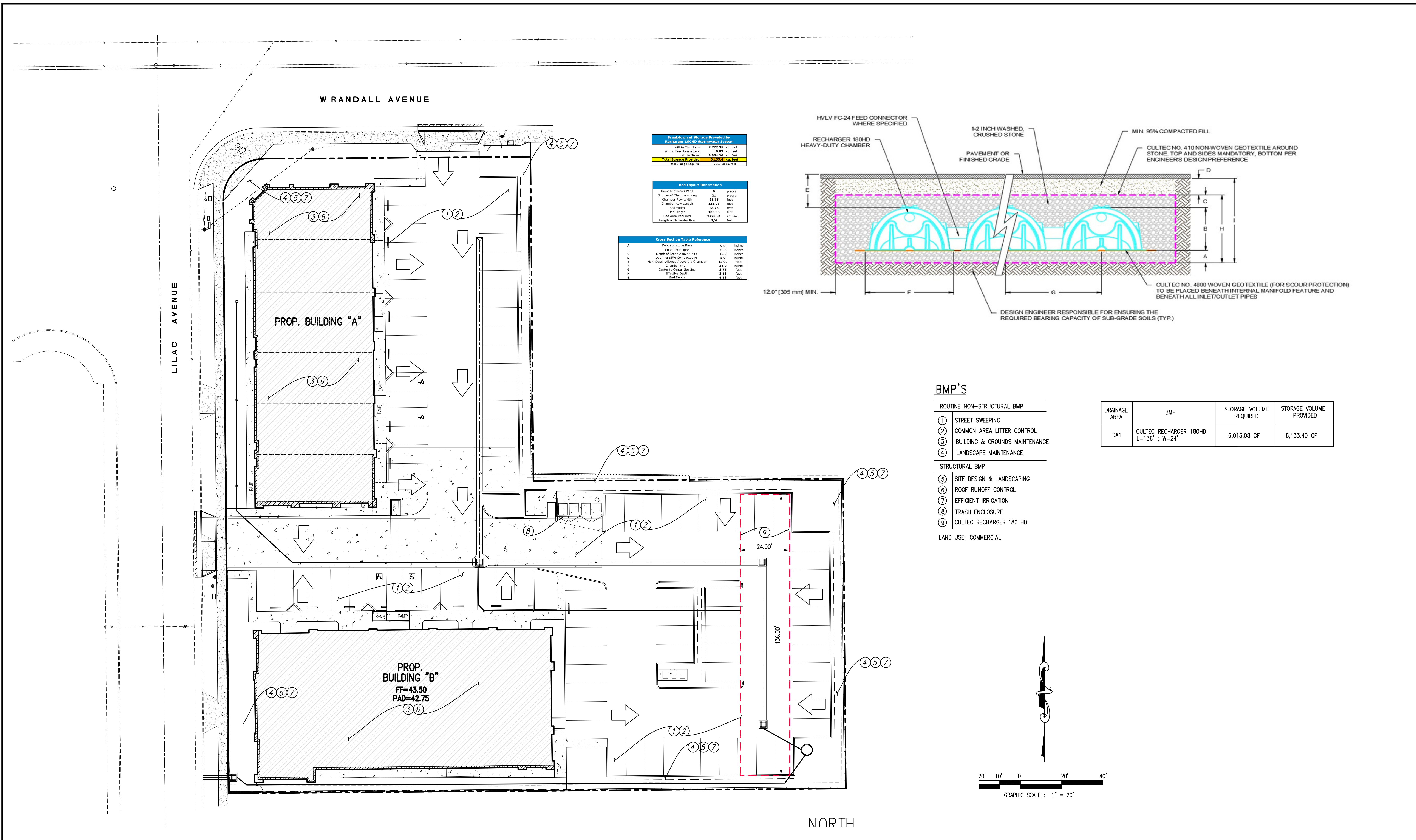
Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (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

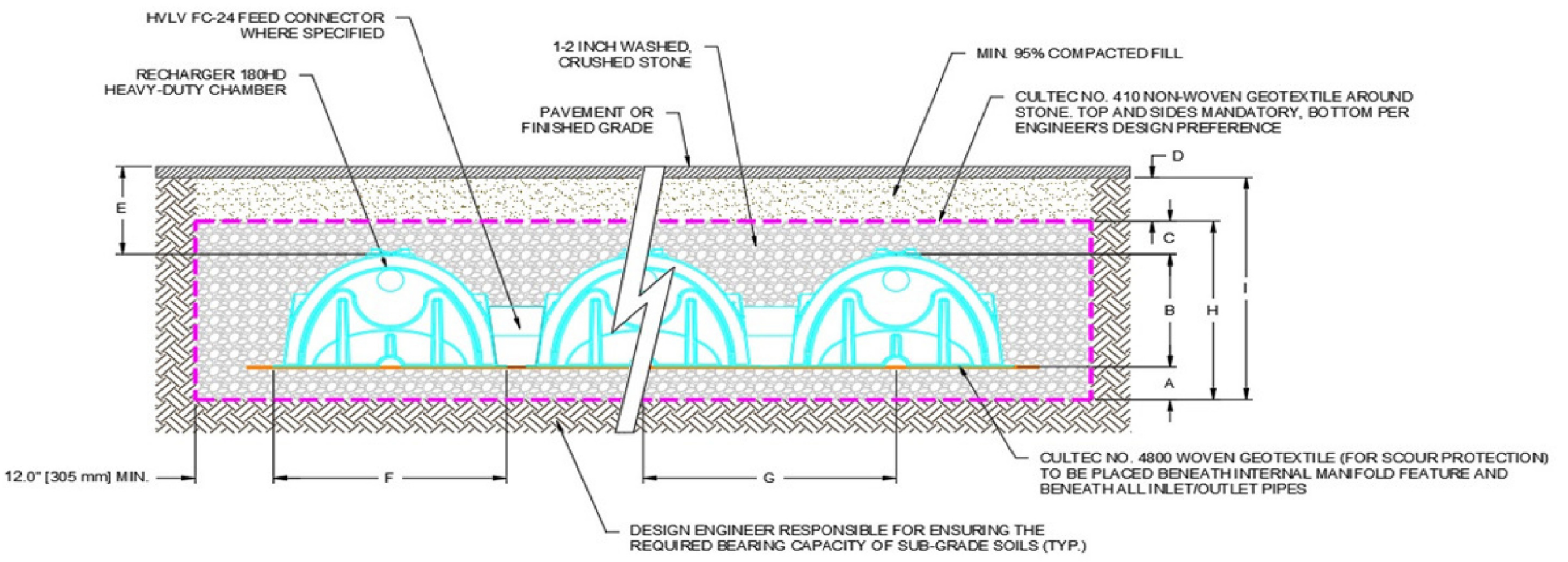
- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements



Breakdown of Storage Provided by Recharger 180HD Stormwater Systems	
With Chambers	2,772.35 cu. feet
With Feed Connectors	6.83 cu. feet
With Stone	3,354.20 cu. feet
Total Storage Provided	6,133.40 cu. feet
Net Storage Required	923.00 cu. feet

Bed Layout Information	
Number of Rows Wide	6 pieces
Number of Chambers Long	21 pieces
Chamber Row Width	23.75 feet
Chamber Row Length	133.83 feet
Bed Width	23.75 feet
Bed Length	133.83 feet
Bed Area Required	3228.34 sq. feet
Length of Separator Rows	N/A feet

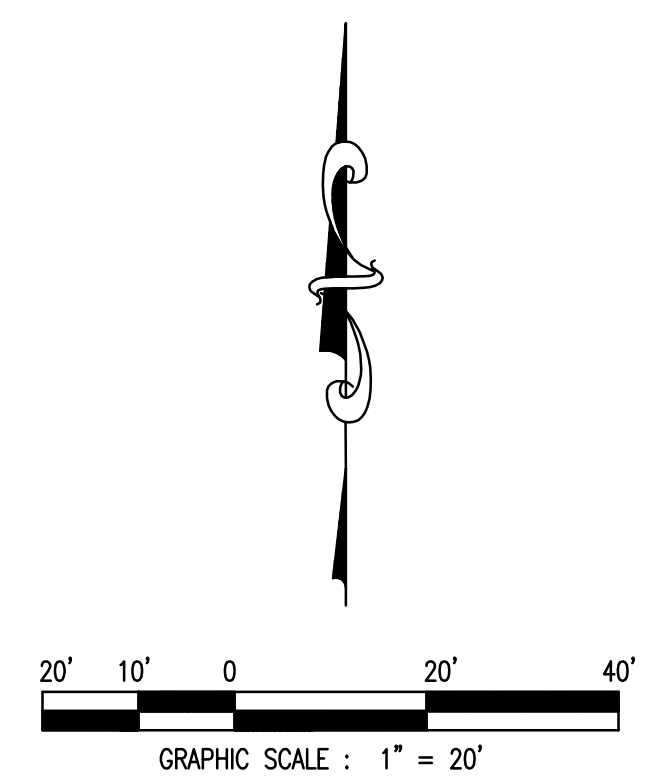
Cross Section Table Reference		
A	Depth of Stone Base	9.0 inches
B	Chamber Height	20.5 inches
C	Depth of Stone Above Units	12.0 inches
D	Depth of 95% Compacted Fill	8.0 inches
E	Max. Depth Allowed Above the Chamber	12.00 feet
F	Chamber Width	36.0 inches
G	Center to Center Spacing	3.75 feet
H	Effective Depth	3.40 feet
I	Bed Depth	4.13 feet



BMP'S

- ROUTINE NON-STRUCTURAL BMP**
- ① STREET SWEEPING
 - ② COMMON AREA LITTER CONTROL
 - ③ BUILDING & GROUNDS MAINTENANCE
 - ④ LANDSCAPE MAINTENANCE
- STRUCTURAL BMP**
- ⑤ SITE DESIGN & LANDSCAPING
 - ⑥ ROOF RUNOFF CONTROL
 - ⑦ EFFICIENT IRRIGATION
 - ⑧ TRASH ENCLOSURE
 - ⑨ CULTEC RECHARGER 180 HD
- LAND USE: COMMERCIAL

DRAINAGE AREA	BMP	STORAGE VOLUME REQUIRED	STORAGE VOLUME PROVIDED
DA1	CULTEC RECHARGER 180HD L=136' ; W=24'	6,013.08 CF	6,133.40 CF



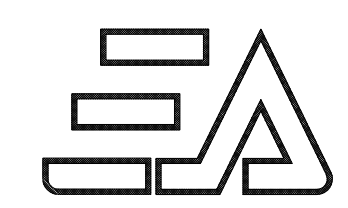
UNDERGROUND SERVICE ALERT
CALL-TOLL FREE
1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE

DESIGNED BY: JR DRAWN BY: RR CHECKED BY: GE

SEAL-DESIGN ENGINEER
GIL EVANGELISTA
NO. 32512
Exp. 06-30-23
STATE OF CALIFORNIA

PREPARED UNDER THE SUPERVISION OF:
GIL EVANGELISTA RCE 32512, EXP. 06/30/2023 DATE
RECOMMENDED FOR APPROVAL BY LOCKWOOD ENGINEERING:
CARLETON W. LOCKWOOD, JR., RCE 45935 DATE
APPROVED BY:
ROBERT G. EISENBEISZ, PUBLIC WORKS DIRECTOR/CITY ENGINEER, RCE 54931 DATE



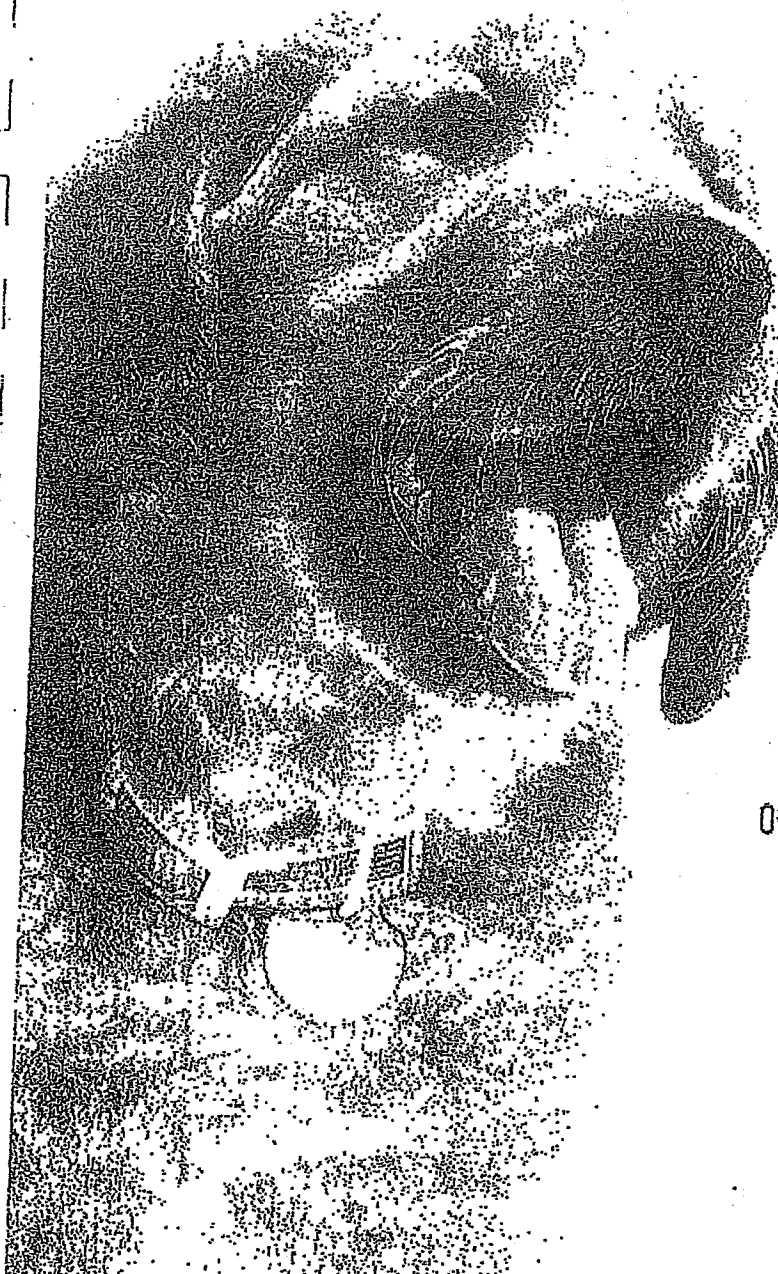
E&A ENGINEERS
ENGINEERING • PLANNING
CONSTRUCTION MANAGEMENT
CALIFORNIA • GUAM • SAIPAN • METRO MANILA
20505 E Valley Blvd. Ste. 110, Walnut, CA 91789
tel (909) 598-5045 fax (909) 598-8585

CITY OF RIALTO
PROPOSED COMMERCIAL BUILDING
PRELIMINARY GRADING PLAN
935 S. LILAC AVENUE, CA 92376
WATER QUALITY MANAGEMENT PLAN

FOR: MR. GEVORK MARTIROSIAN PPD No. 2021- PLAN No.

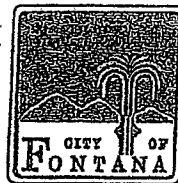
APPENDIX A

Pick up after your pooch to curb pollution.



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

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



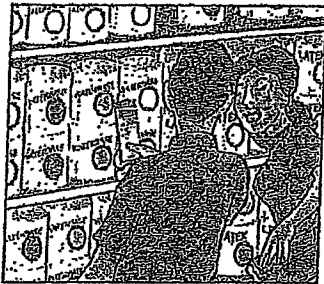
♻️ Printed on recycled paper

POLLUTION PREVENTION

STORMWATER

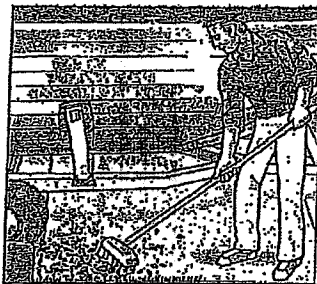
PAINTING

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



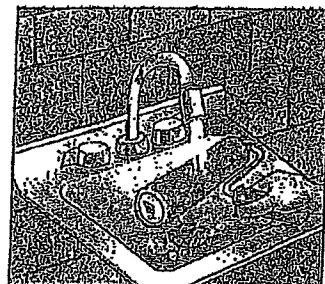
Water-Based Paints

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



Paint Removal

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

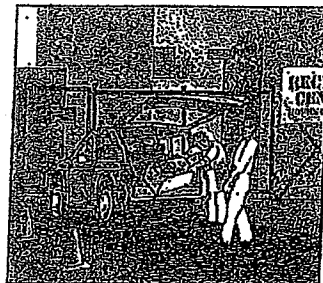


Painting Cleanup

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

Exterior Paint Removal

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



Recycling Paint

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

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

1 (800) CLEANUP

www.1800cleanup.org

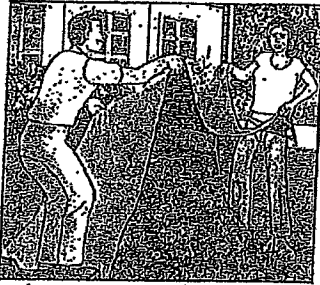


POLLUTION PREVENTION

STORMWATER

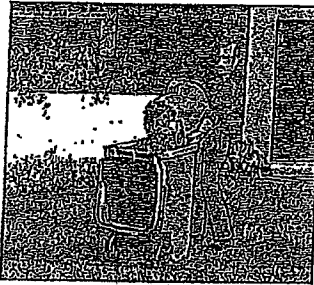
HOME REPAIR & REMODELING

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



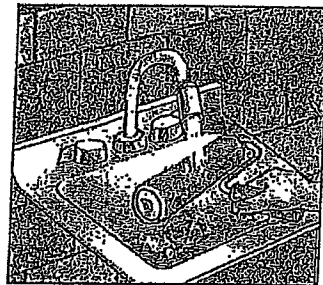
Construction Projects

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



Landscaping & Gardening

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



Painting Cleanup

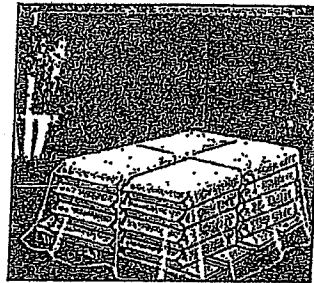
Avoid cleaning brushes or rinsing paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which you can filter and reuse. Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or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

Recycle Household Hazardous Waste

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

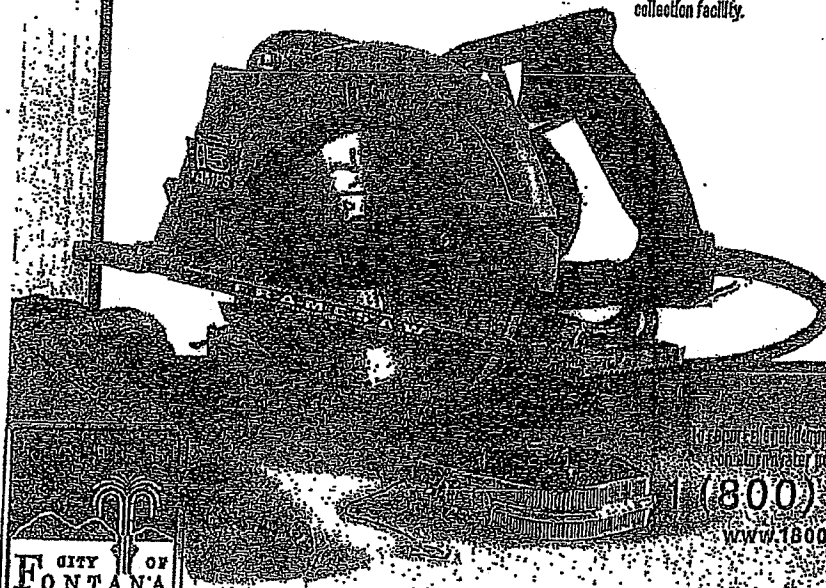
Paint Removal

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



Concrete and Masonry

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



For more information on landscaping or for more information on household hazardous waste collection, call:

(800) CLEANUP

www.1800cleanup.org

POLLUTION PREVENTION

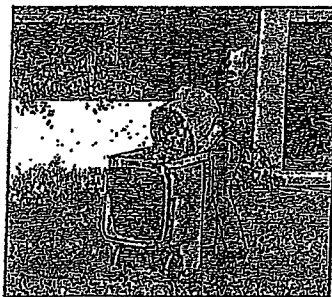
STORMWATER

HOME & GARDEN

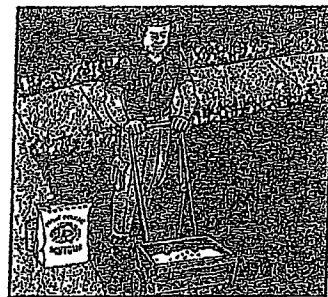
Yard waste and household toxics like paints and pesticides often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow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



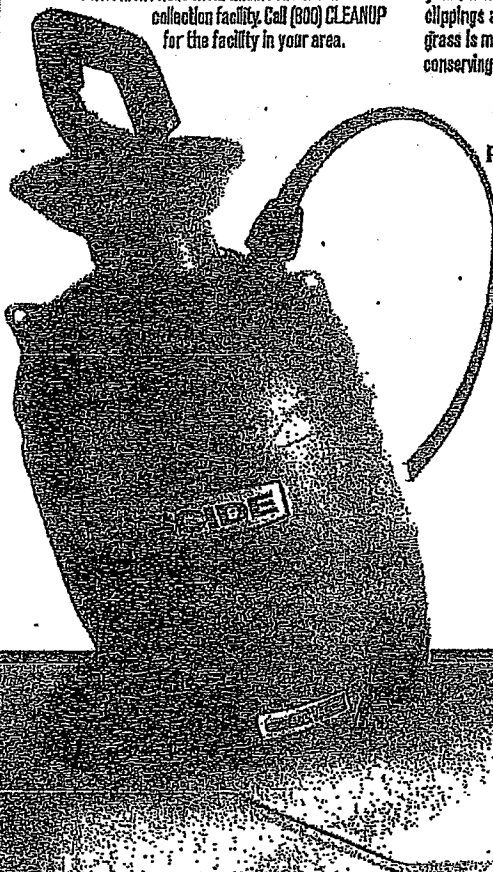
Recycle Household Hazardous Waste
Household products like paint, pesticides, solvents and cleaners are too dangerous to dump and too toxic to trash. Take them to be recycled at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



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

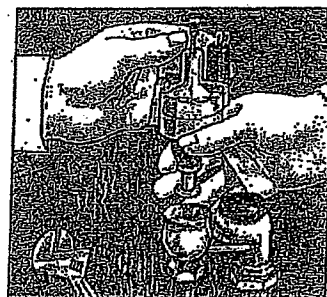


Use Fertilizers & Pesticides Safely
Fertilizers and pesticides are often carried into the storm drain system by sprinkler runoff. Try using organic or non-toxic alternatives. If you use chemical fertilizers or pesticides, avoid applying near curbs and driveways and never apply before a rain.



Planting in the Yard

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



Use Water Wisely

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



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

1 (800) CLEANUP

www.1800cleanup.org

Fertilizer Tips to Prevent Pollution

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



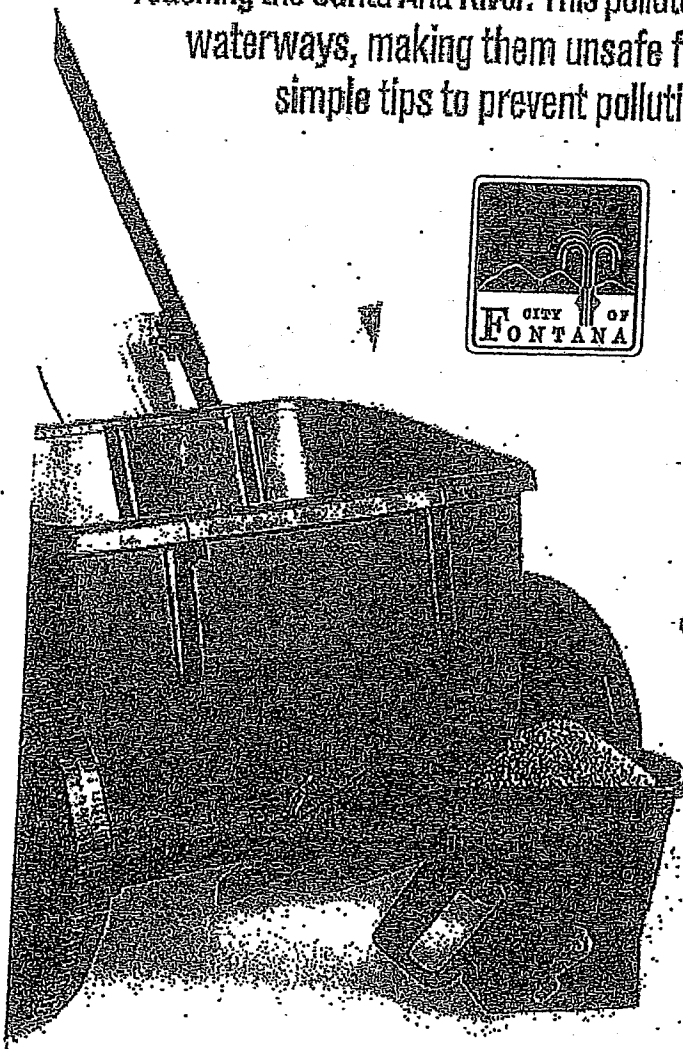
- Read the product label and follow the directions carefully, using only as directed.
- Avoid applying near driveways or gutters.
- Never apply fertilizer before a rain.
- Store fertilizers and chemicals in a covered area and in sealed, waterproof containers.
- Take unwanted lawn or garden chemicals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

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



1 (800) CLEANUP

www.1800cleanup.org

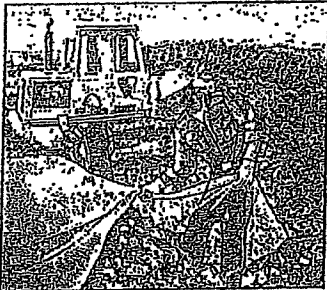


POLLUTION PREVENTION

STORMWATER

FRESH CONCRETE & MORTAR APPLICATION

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



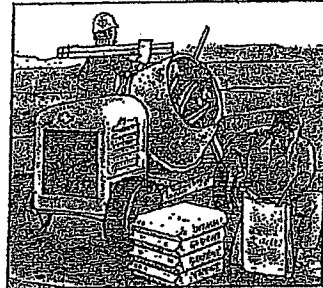
Storing Materials

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



Ordering Materials & Recycling Waste

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

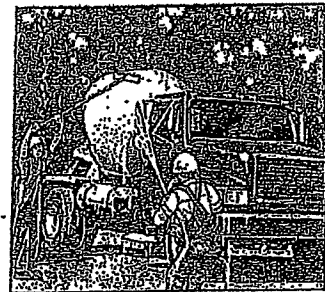


During Construction

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

Cleaning Up

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



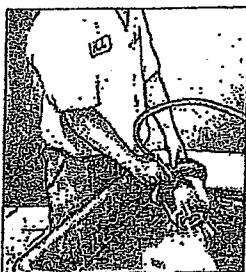
For more information on stormwater pollution prevention, call (800) CLEANUP or visit our website at www.1800cleanup.org



STORMWATER Pollution Prevention

AUTO MAINTENANCE

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



Cleaning Auto Parts

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



Storing Hazardous Waste

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



Metal Grinding and Polishing

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



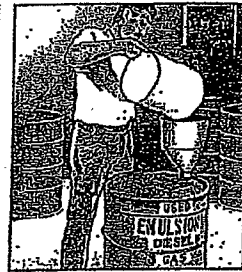
Preventing Leaks and Spills

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



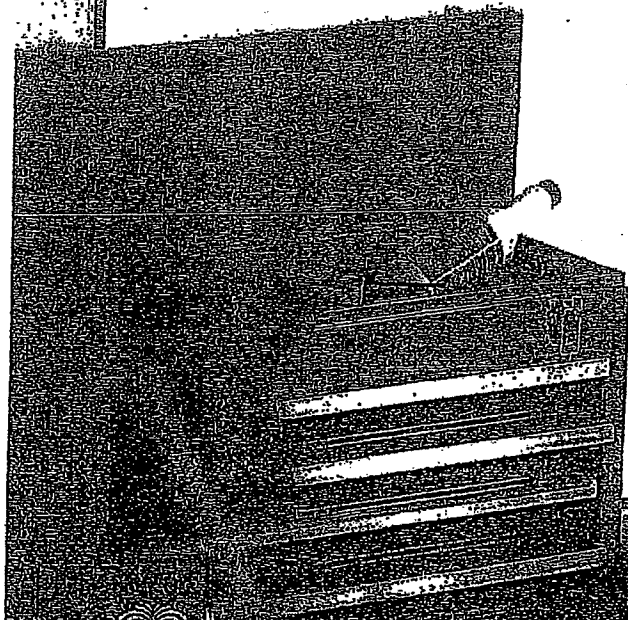
Cleaning Spills

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



Proper Disposal of Hazardous Wastes

Recycle used motor oil and oil filters, anti-freeze and other hazardous automotive fluids, batteries, tires and metal filings collected from grinding or polishing auto parts. Contact a licensed hazardous waste hauler. For more recycling information, call (909) 388-9401.



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

1 (800) CLEANUP

www.1800cleanup.org



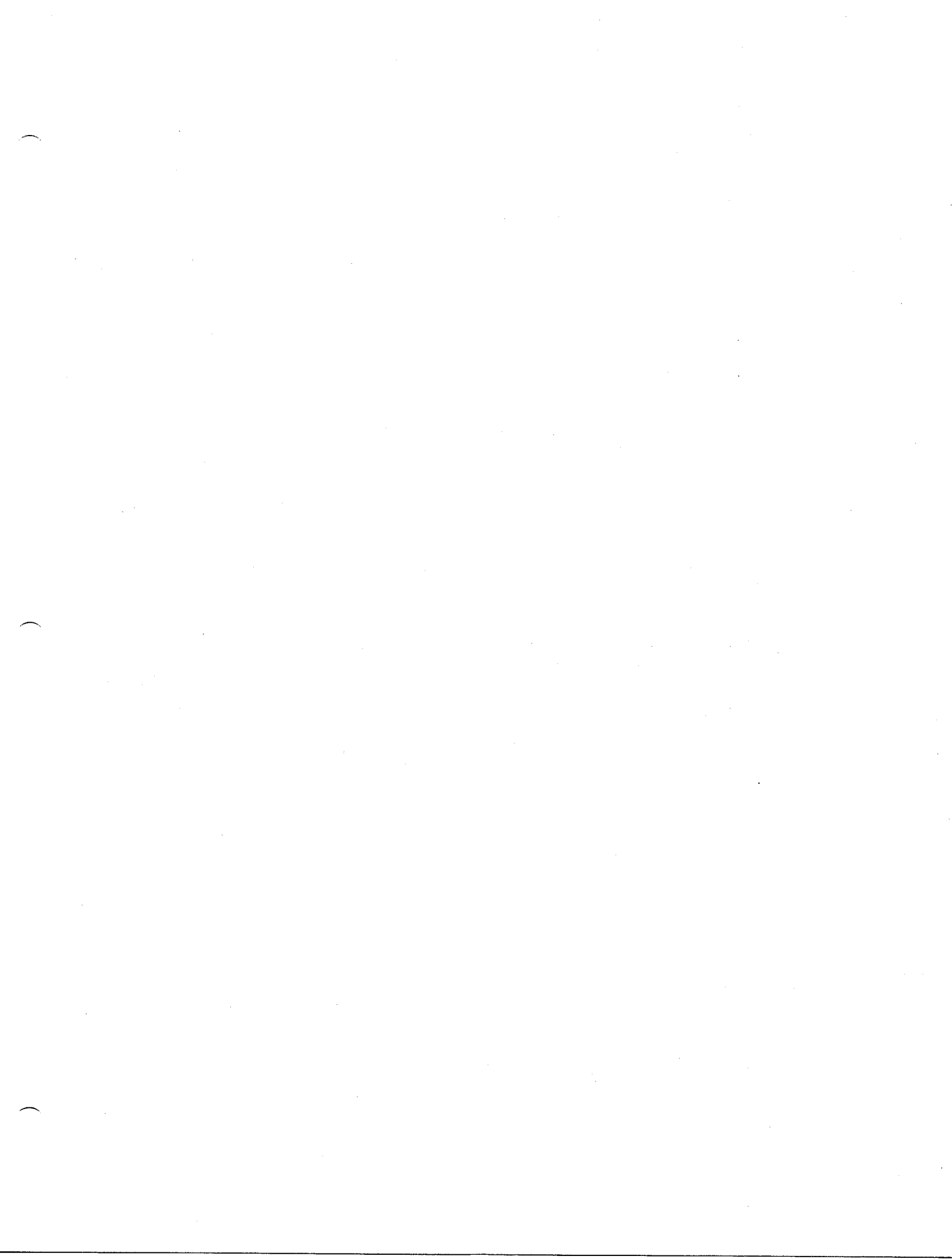


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1) INTRODUCTION

This section include copies of the educational materials that will be used in implementing the project specific Water Quality Management Plan.

2. NON-STORM WATER DISCHARGES

2.1 Description

Non-storm water discharges are those flows that do not consist entirely of storm water. Some non-storm water discharges do not include pollutants and may be discharged to the storm drain. These include unneon laminated groundwater and natural springs. There are also some non-storm water discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-storm water discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-storm water discharges to the storm water drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

2.2 Approach

Initially the industry must make an assessment of non-storm water discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-storm water discharges.

Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented.

Encourage litter control.

Develop clear protocols and lines of communication for effectively prohibiting non storm water discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be 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 stenciled or demarcate next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

Isolate problem areas and plug illicit discharges points.

Inventory and inspect each discharges point during dry weather.

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

2.3 Inspection & Reporting

Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.

Never hose down or bury dry material spills. Sweep up the material and dispose of Properly.

For larger spills, a private spill cleanup company or Hazmat team may be necessary. Lighting or barriers may also be-needed to discourage future dumping.

Conduct field investigations of the industrial storm drain system for potential sources of non-storm water discharges.

Report prohibited non-storm water discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.

Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

2.4 Training

Training of technical staff in identifying and documenting illegal dumping incidents is required. Train employees to identify non-storm water discharges and report discharges to the appropriate departments.

Educate employees about spill prevention and cleanup. Well trained employees can reduce human errors that lead to accidental releases or spills.

The employees should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Counter measure Plan.

Determine and implement appropriate outreach efforts to reduce non-permissible non-storm water discharges.

When a responsible party is identified, educate the party on the impacts of his or her actions.

Non-storm water discharges to the storm water collection system may include any water used directly in the manufacturing process, air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters. One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it Therefore, train field staff to recognize and report the incidents.

3. SPILL PREVENTION, CONTROL & CLEANUP

3.1 Description

Many activities (that occur at an industrial or commercial site) have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of storm water pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the storm water drainage system, and train personnel to prevent and control future spills.

3.2 Approach

Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

Recycle, reclaim or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.

Check tanks daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

Label all containers according to their contents.

3.3 Spill Control and Cleanup Activities

Follow the Spill Prevention Control Countermeasure Plan.

Clean up leaks and spills immediately.

Place a stockpile of spill cleanup materials where it will be readily accessible.

Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

Chemical cleanups of material can be achieved with the use of adsorbents, gels, and forms.

Use adsorbent materials on small spills rather than hosing down the spill.

Remove the adsorbent materials promptly and dispose of properly.

For larger spills, a private spill cleanup company or Hazmat team may be necessary.

3.4 Reporting

Reporting spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.

Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center(NRC) at 800-424-8802 (24 hours)

Report spills to local agencies, such as the fire department; they can assist in cleanup. Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.

Maintenance is critical to preventing leaks and spills. Conduct routing inspections. Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of storm water and the runoff of spills.

3.5 Training

Educate employees about spill prevention and cleanup.

The employee should have the tools and knowledge to immediately begin cleaning up as spill should one occurs. Employees should be familiar with the spill Prevention Control and Countermeasure Plan.

Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control Countermeasure Plan and the plan should be readily available.

Train employees to recognize and report illegal dumping incidents.

For the purposes of developing a spill prevention and response program to meet the storm water regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheet in this handbook, for specific activities.

4. OUTDOOR EQUIPMENT OPERATIONS

4.1 Description

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

4.2 Approach

Perform the activity during dry periods.

Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents. Consider enclosing the activity in a building and connecting the floor drains to the sanitary sewer.

Minimize contact of storm water with outside process equipment operations through berming and drainage routing. If possible, connect process equipment area to public sewer or facility wastewater treatment system. Some municipalities require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Keep your Spill Prevention Control and Countermeasure Plan up-to-date. Place a stockpile of spill cleanup materials where it will be readily accessible.

Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.

Inspect storage areas regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.

4.3 Training

Train employees to perform the activity during dry periods only or substituting benign materials for more toxic ones.

Train employee and contractors in proper techniques for spill containment and cleanup. Employees should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

4.4 Prevention

Keep Spill Prevention Control and Counter measure Plan up-to-date.

Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.

Place a stockpile of spill cleanup materials where it will be readily accessible.

5. OUTDOOR LOADING / UNLOADING

5.1 Description

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

5.2 Approach

Reduce potential for pollution 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.

Keep accurate maintenance logs to evaluate materials removed and improvements made.

Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.

Limit exposure of material to rainfall whenever possible.

Prevent storm water run-on.

Check equipment regularly for leaks

Develop an operations plan that describes procedures for loading and/or unloading.

Conduct loading and unloading in dry weather if possible.

Cover designated loading/unloading areas to reduce exposure of materials to rain

Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.

Load/unload only at designated loading areas.

Pave loading areas with concrete instead of asphalt.

Avoid placing storm drains in the area.

Keep your Spill Prevention Control and Countermeasure Plan up-to-date

Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site spill control plan and proper spill cleanup procedures.

Have an emergency spill cleanup plan readily available

Use drip pans or comparable devices when transferring oils, solvents, and paints.

5.3 Inspection

Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.

Look for dust or fumes during loading or unloading operations.

5.4 Training

Train employees and contractors on proper spill containment and cleanup.

Have employees trained in spill containment and cleanup present during loading/unloading.

Train employees in proper handling techniques during liquid transfers to avoid spills

Make sure forklift operators are properly trained on loading and unloading procedures.

5.5 Prevention

Keep Spill Prevention Control Countermeasure Plan up-to-date.

Contain leaks during transfer.

Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site spill control plan and proper spill cleanup procedures.

Have an emergency spill cleanup plan readily available.

Use drip pans or comparable devices when transferring oil, solvents, and paints.

6. WASTE HANDLING & DISPOSAL

6.1 Description

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

Accomplish reduction in the amount of waste generated using the following source controls:

Production planning and sequencing Process or equipment modification -
Raw material substitution or elimination Loss prevention and housekeeping Waste segregation and separation Close loop recycling

Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.

Recycle materials whenever possible, Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.

Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.

Transfer waste from damaged containers into safe containers.

Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist.

Vacuum transfer systems can minimize waste loss.

Controlling Litter and Waste Collection

Post No Littering signs and enforce antilitter laws.

Provide a sufficient number of litter receptacles for the facility.

Clean out and cover Utter receptacles frequently to prevent spillage.

Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.

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

Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers.

6.2 Inspection

Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.

Check waste management areas for leaking containers or spills.

Repair leaking equipment including valves, lines, seals, or pumps promptly.

6.3 Training

Train staff in pollution prevention measures and proper disposal methods.

Train employees and contractors in proper spill containment and cleanup.

The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

Train employees and subcontractors in proper hazardous waste management

6.4 Prevention

Keep Spill Prevention Control and Countermeasure Plan up-to-date.

Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.

Collect all spilled liquids and properly dispose of them.

Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.

7. OUTDOOR STORAGE OF RAW MATERIALS

7.1 Description

Raw materials, by-products, finished products, containers, and material storage areas exposed to rain and/or runoff can pollute storm water. Storm water can become contaminated when materials wash off or dissolve into water or are added to runoff by spills and leaks. Improper storage of these materials can result in accidental spills and the release of materials. To prevent or reduce the discharge of pollutants to storm water from material delivery and storage, pollution prevention and source control measures must be implemented, such as minimizing the storage of hazardous materials on-site, enclosing or covering materials, storing materials in a designated area, installing secondary containment, conducting regular inspections, preventing storm water run-on and runoff, and training employees and subcontractors.

7.2 Approach

Emphasize employee education for successful BMP implementation.

Keep an accurate, up-to-date inventory of the materials delivered and stored on-site.

Keep chemicals in their original containers and keep them well labeled.

Keep outdoor storage containers in good condition.

Minimize storm water run-on by enclosing the area or building a berm around it.

Secure drums stored in an area where unauthorized persons may gain access to prevent accidental spillage, pilferage, or any unauthorized use. Curbing should be placed along the perimeter of the area to prevent the run-on of uncontaminated storm water from adjacent areas as well as runoff of storm water from the stockpile areas.

7.3 Inspection

Conduct regular inspections of storage areas so that leaks and spills are detected as soon as possible.

Check berms, curbing, containment for repair and patching.

7.2 Training

Train employees well in proper material storage.

Train employees and contractors in proper techniques for spill containment and cleanup.

7.3 Prevention

Keep Spill Prevention Control and Countermeasure Plan up-to-date. Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers near the storage area where it will be ready accessible.

Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.

8. BUILDING & GROUNDS MAINTENANCE

8.1 Description

Storm water 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 storm water 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 storm water collection system.

8.2 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.

Switch to non-toxic chemicals for maintenance when possible.

Choose cleaning agents that can be recycled.

Encourage proper lawn management and landscaping, including use of native vegetation.

Encourage use of Integrated Pest Management techniques for pest control.

Encourage proper onsite recycling of yard trimmings.

Recycle residual paints, solvents, lumber, and other material as much as possible.

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 pressured 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

8.3 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 system. Use mulch or other erosion control measures on exposed soils.

8.4 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 storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grits, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days.

Store toxic material under cover during precipitation events and when not in use. A Cover would include tarps or other temporary cover material.

8.5 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.

8.6 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.

8.7 Prevention

Keep Spill Prevention Control and Countermeasure Plan up-to-date.

Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers 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. Clean up spills immediately.

9. PARKING / STORAGE AREA MAINTENANCE

9.1 Description

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

9.2 Approach

The goal of this program is to ensure storm water pollution prevention practices are considered when conducting activities on or around parking areas and storage 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.

Encourage alternative designs and maintenance strategies for impervious parking lots. Keep accurate maintenance logs to evaluate BMP implementation. Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.

Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

9.3 Controlling Litter, Surface Cleaning, and Repair

Post No Littering signs and enforce anti-litter laws.

Provide an adequate number of litter receptacles.

Routinely sweep, shovel, and dispose of litter in the trash.

Use dry cleaning methods to prevent the discharge of pollutants into the storm water conveyance system if possible.

Sweep all parking lots at least once before the onset of the wet season.

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting storm water runoff.

Use only as much water as necessary for dust control, to avoid runoff.

Catch drips from paving equipment that is not in use with pans or absorbent material place under the machines. Dispose of collected material and absorbents properly.

9.4 Inspection

Have designated personnel conduct inspections of parking facilities and storm water conveyance systems associated with parking facilities on a regular basis.

9.5 Training

Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.

Train employees and contractors in proper techniques for spill containment and cleanup.

9.6 Prevention

Keep Spill Prevention Control Countermeasure Plan up-to-date.

Place stockpile of spill cleanup materials where it will be readily accessible or at a central location.

Clean up fluid spills immediately with absorbent rags or material. *JBS* Dispose of spilled material and absorbents properly.

10. METHOD TO PREVENT STORM WATER POLLUTION

Who is responsible for Storm Water Pollution Prevention?

10.1 In one sentence

Each individual working in the company is a responsible party. Of course there is one employee in charge of the program, but without your co-operation his/her job will be very difficult. We should keep our eyes open watching for any possible source of pollutants and either eliminate it or at least if you can't report the situation immediately to the management.

What is our company's propose to prevent storm water pollution?

(a) Facility Design

The site storm water run off is mainly directed to underground filtration chambers. This means mat the storm water run off is going to the underground reservoirs. To Reduce the underground water pollution the storm water run off is going first to a "Filtration System" with high efficiency to capture the majority of sediments, oil and grease, suspended solid and will treat some of the dissolved solids and nutrients. Any equipment in the world has a limit in capacity. If we over load the filtration system with pollutants, the result are some of the pollutants will escape the system and go to the Filtration Chambers. We have to do what we agreed on; otherwise the "Filtration System" will be overwhelmed. It is not only some pollutants will escape the Filter but also it will be clogged with debris.

In the Original design of the facility there are two major Best Management Measures used:

- (1) Filtration System (Show the slide of the filter drawing/picture)
- (2) Filtration Chambers. (Show the drawing/picture of the filtration chamber)

Offer brief explanation of how these two BMP's function.

In the Water Quality Management Plan you can find the maintenance procedures and schedule for these two measures.

(b) Operation and Maintenance

Through the implementation of the Water Quality Management the company is taking all possible precautions to prevent the storm water run off pollution. Actually the training we have today is part of this plan.

Periodical inspection and maintenance of at the BMP's are required.
Copy of the "WQMP" is available for you to review.

[At this time the trainer will pick up a copy of the plan and show it to the trainees. Also the trainer shall highlight the main sections of the plan]

Once the trainer completes that he/she will guide the trainees through the facility to show them where are the "Filtration System" inlet and the location of the "Filtration Chambers". Then the trainer shall guide the group to show the landscape areas around the parameter of the site and how the sprinkler system is designed and controlled.

Then back to the class room to complete the training.

GOVERNMENT ORGANIZATIONS INVOLVED IN THE WQMP AND REGULATIONS:

Storm water pollution prevention started with Federal Regulations "Clean Water Act"/ States and Countries established detailed regulations in implementing the federal program. The program in the State of California is managed by The State Water Quality Control Board. San Bernardino County and City of Rialto are responsible for enforcing the program and monitoring the compliance of all Commercial and Industrial Facilities in their jurisdiction.

The regulations allow the local authorities to impose penalties on violators. These penalties range from warning to fines and imprisonment depending on the kind of violation. Repeated violations or ignoring the required corrective actions can escalate the level of penalty even if it is a minor violation.

It is for every employee benefit to avoid any kind of violation. Penalties can threaten the continuation of the business operation. The bottom line is, when preventing storm water pollution we are:

- (1) Protecting our health and our children's health
- (2) Protecting our job in Gas Station and C-Store, 684 E. Foothill Blvd. Rialto, CA

Let's make Pollution Prevention Part of our Daily Life.

APPENDIX B



soil PACIFIC INC.
Geotechnical and Environmental Services

Project No. A-8895-21
January 8, 2022

Mr. Gevork Martirosian, P.E.
Gevork Consulting Engineering
285 E. Imperial Hwy, Suite 208
Fullerton, Ca. 92835

Subject: Soil and Foundation Evaluation Report
Proposed Commercial Buildings
935 S Lilac Ave, Rialto, CA 92376


Dear Sir;

Pursuant to your authorization, we are pleased to submit our report for the subject project. Our evaluation was conducted in December 2021. This evaluation consists of field exploration; sub-surface soil sampling; laboratory testing; engineering evaluation and preparation of the following report containing a summary of our conclusions and recommendations.

The opportunity to be of service is appreciated. Should any questions arise pertaining to any portion of this report, please contact this firm in writing for further clarification.

Very truly,

Soil Pacific Inc.


Dr. Yones Kabir
President


Hoss Eftekhari
RCE



**Soil and Foundation Evaluation Report
Proposed Commercial Buildings
935 S Lilac Ave, Rialto, CA 92376**

Prepared For:

**Mr. Gevork Martirosian,P.E.
Gevork Consulting Engineering
285 E. Imperial Hwy , Suite 208
Fullerton, Ca. 92835**

Prepared by:

**SOIL PACIFIC INC.
675 N. ECKHOFF STREET, SUITE A
ORANGE, CALIFORNIA 92868
Tel. (714) 879 1203**

Project No. A-8895-21
January 8, 2022

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**Soil and Foundation Evaluation Report
Proposed Commercial Buildings
935 S Lilac Ave, Rialto, CA 92376**

LIMITATIONS

Between exploratory excavations and/or field testing locations, all subsurface deposits, consequent of their anisotropic and heterogeneous characteristics, can and will vary in many important geotechnical properties. The results presented herein are based on the information in part furnished by others and as generated by this firm, and represent our best interpretation of that data benefiting from a combination of our earthwork related construction experience, as well as our overall geotechnical knowledge. Hence, the conclusions and recommendations expressed herein are our professional opinions about pertinent project geotechnical parameters which influence the understood site use; therefore, no other warranty is offered or implied.

All the findings are subject to field modification as more subsurface exposures become available for evaluations. Before providing bids, contractors shall make thorough explorations and findings. Soil Pacific Inc., is not responsible for any financial gains or losses accrued by persons/firms or third party from this project.

In the event the contents of this report are not clearly understood, due in part to the usage of technical terms or wording, please contact the undersigned in writing for clarification.

SECTION 1.0 PRELIMINARY EVALUATION

1.1 Site Description

The area covered by our investigation consists of a parcel located at the southeast intersection of Randall Avenue and South of Lilac Avenue of the City of Rialto. The item site is a L shaped property occupied by a single-family residential building at the south portion.

A paved driveway from the S Lilac Avenue provides site access to the existing building. The remaining area are unpaved and undeveloped. Surrounding properties are mixed use of single-family residences and commercial buildings. Site access is through S Lilac Avenue. The building pad is flat in general having an average mean elevation of 1143 feet and sheet flow is toward the south/east.

1.2 Planned Land Use

It is understood that the proposed development will consist of construction of detached commercial buildings/strip shops with an access way and conventional parking areas. Existing building will be demolished.

1.3 Field Exploration

Subsurface conditions were explored by excavating four auger borings to maximum depth of 12 feet below the existing grade. Based on this evaluation the site is mostly underlain by fine to pebbly grained sand and gravel with some silt, interbedded with silty sand layers.

Based on this evaluation, the site is mostly underlain by fine to gravel and pebbles, sand with some silty matrix. The native soils underlain the thin top soils. The topsoils/fill soils mantel composed of silty sand and gravel. Encountered native soils at deeper elevation are mostly fine to large pebbles interbedded with sandy layers.

Boring locations and depths was determined by a combination of factors: accessibility, validity of information, and depth and extent of the encountered materials. The approximate locations of exploration borings are shown on the attached plot plan, Figure A-1-1. Soil sampling was performed by our staff engineer who logged the soils and obtained bulk and undisturbed samples for laboratory testing.

1.4 Laboratory Testing

1.4.1. Classification

Soils were classified visually according to the Unified Soil Classification System. Moisture content and dry density determinations were made for the samples taken at various depths

in the exploratory excavations. Results of moisture-density and dry-density determinations, together with classifications, are shown on the boring logs, Appendix A.

1.4.2 Expansion

An expansion index test was performed on a representative sample in accordance with the California Building Code Standard. A very low to null expansion potential (EI=00) is anticipated for the encountered soils at the proposed sub-grade elevation (0-5 feet).

1.4.3 Direct Shear

Shear strength parameters are determined by means of strain-controlled, double plain, direct shear tests performed in general accordance with ASTM D-3080. Generally, three or more specimens are tested, each under a different normal load, to determine the effects upon shear resistance and displacement, and strength properties such as Mohr strength envelopes. The direct shear test is suited to the relatively rapid determination of consolidated drained strength properties because the drainage paths through the test specimen are short, thereby allowing excess pore pressure to be dissipated more rapidly than with other drained stress tests. The rate of deformation is determined from the time required for the specimen to achieve fifty percent consolidation at a given normal stress. The test can be made on all soil materials and undisturbed, remolded or compacted materials. There is however, a limitation on maximum particle size. Sample displacement during testing may range from 10 to 20 percent of the specimen's original diameter or length.

The sample's initial void ratio, water content, dry unit weight, degree of saturation based on the specific gravity, and mass of the total specimen may also be computed. The shear test results are plotted on the attached shear test diagrams and unless otherwise noted on the shear test diagram, all tests are performed on undisturbed, saturated samples.

Address:	935 S LILAC AVE
APN	013202118
City	RIALTO
Address	935 S LILAC AVE
Fault Zone	This parcel is NOT WITHIN an Earthquake Fault Zone.
Liquefaction Zone	This parcel has NOT been EVALUATED by CGS for liquefaction hazards.
Landslide Zone	This parcel has NOT been EVALUATED by CGS for seismic landslide hazards.



Fig. 1: Site aerial photo.

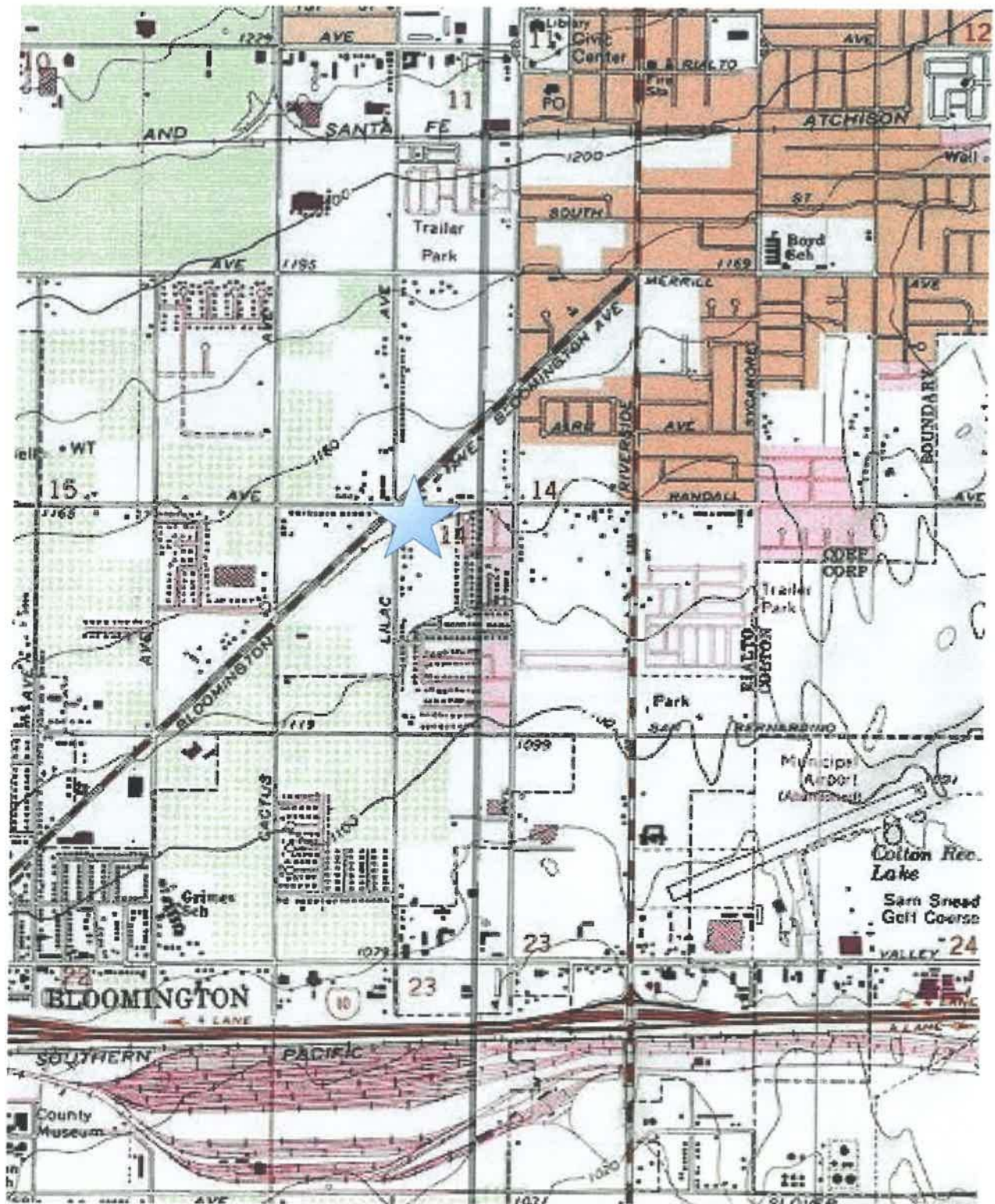


Figure 2: Site topographic map by USGS.

Section 2.0 Conclusions

The proposed construction is considered feasible from a soils engineering standpoint. All earthwork should be performed in accordance with applicable engineering recommendations presented herein or applicable Agency Codes, whichever are the most stringent.

2.1 Earth Materials

The site is mostly underlain by gray to light brown, sand, gravel and pebbly silty sand of Quaternary fan deposits (Qa). The depth of topsoil/fill mantel may varies throughout the site. The thickness of top soil where the borings were performed was limited to a maximum 2-3 feet. Underlying materials are relatively dense and damp in place.

2.2 Foundations

All foundation will be embedded into the same type of engineered fill soils. All newly designed isolated pad or continuous foundation must be embedded into firm and approved engineered soils. Cut and fill transition is not allowed.

2.3 Bearing Materials

The surficial soils up to 3 feet are disturbed and inadequate from a soil engineering standpoint.

2.4 Groundwater

The site is located within Upper Santa Ana Valley, Riverside -Arlington Basin/(California Department of Water Resources, [CDWR], 2018). Groundwater depth varies within the area and flow direction beneath the subject site is toward the south-southeast. No groundwater wells were listed on the property; however, several groundwater wells are listed in the site vicinity.

During our investigation, groundwater was not encountered within 12 feet of sub-surface exploration below the existing grade. The depth of groundwater may fluctuate depending upon the time and period of the year.

2.5 CBC Seismic Design Parameters

Earthquake loads on earthen structures and buildings are a function of ground acceleration which may be determined from the site-specific acceleration response spectrum. To provide the design team with the parameters necessary to construct the site-specific acceleration response spectrum for this project, we used two computer applications that are available on the United States Geological Survey (USGS) website, <http://geohazards.usgs.gov/>.

The attached printout attached in Appendix C provides parameters required to construct the site-specific acceleration response spectrum based 2020 CBC guidelines.

2.6 Chemical Contents

Chemical testing for detection of hydrocarbon or other potential contamination is beyond the scope of this report.

2.7 Liquefaction Study/ Secondary Seismic Hazard Zonation

Based on our site evaluation and review of the available information such a published “Emergency Operations Plan of The City of Rialto”, liquefaction phenomenon is not expected in the City of Rialto except within the narrow Lytle Creek Wash and Near the Santa Ana River.

Liquefaction usually occurs due to dynamic loading of a saturated sand or silt causes pore water pressures to increase to levels where grain-to-grain contact pressure is significantly decreased and the soil material temporarily behaves as a viscous fluid.

2.8 Faulting and Seismicity

The subject site is not located with an active fault zone. The nearest active fault is located within 2.5 miles northeast of the site known as “ San Jacinto Fault Zone”.

CGS A-P	Fault Traces
QUAD NAME	San Bernardino North
FAULT NAME	San Jacinto Fault
FAULT ZONE	San Jacinto Fault Zone
LINE TYPE	Concealed

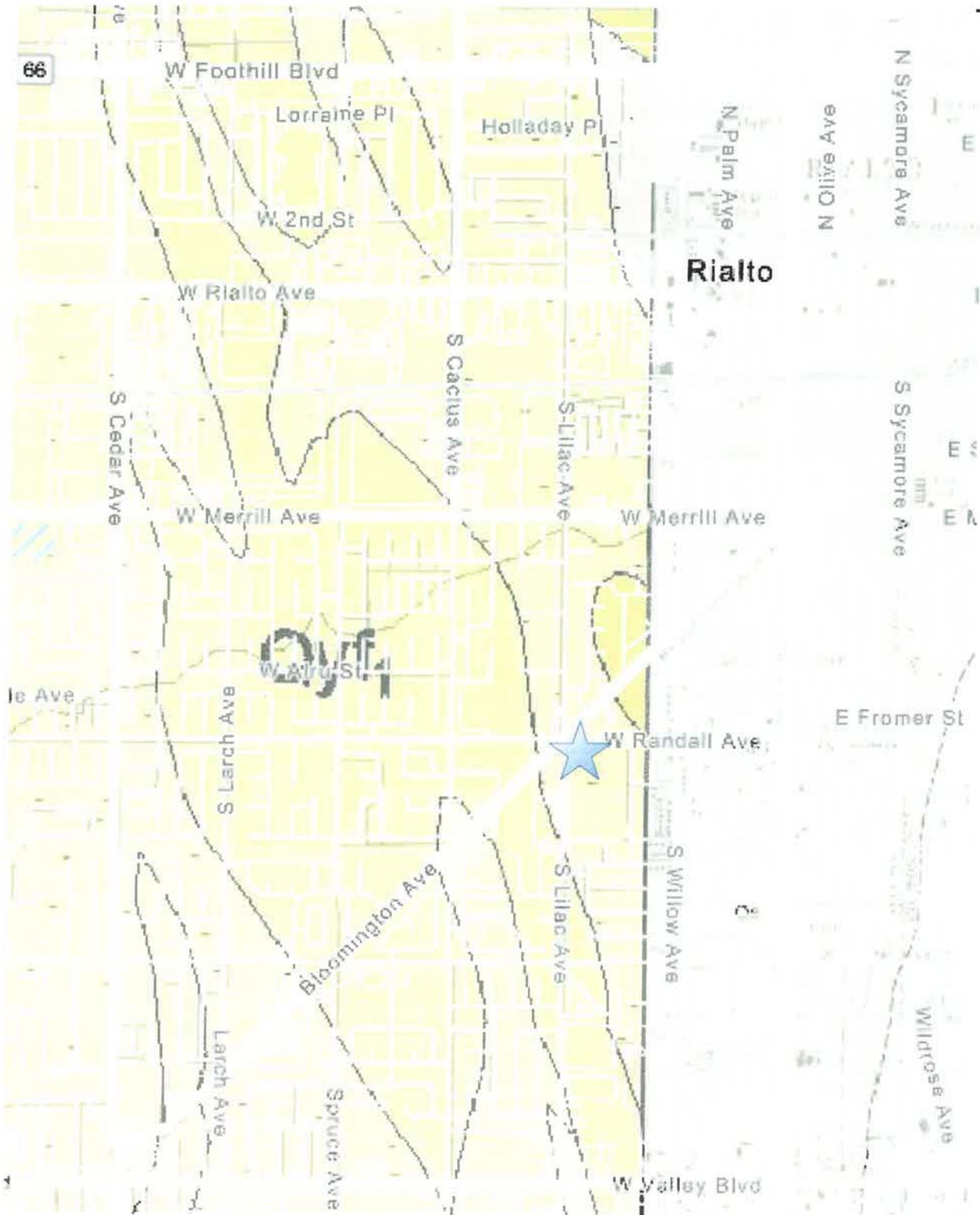


Figure 3: Site geologic Map (USGS)

Section 3.0 Recommendations

Based on our exploration and experience with similar projects, the proposed construction is considered feasible from a soils engineering standpoint providing the following recommendations are made a part of the plans and are implemented during construction.

3.1 Clearing and Site Preparation

The following recommendation will be used in preparation of the grading plan/ soil removal and recompaction with the proposed building pad and beyond.

1. The areas to receive compacted fill should be stripped of all vegetation, construction debris and trashes, non engineered fill, left in place incompetent material up to approved soils (-3 feet). If soft spots are encountered, project soil engineer will evaluate the site conditions and will provide necessary recommendations.
2. The excavated area should be scarified to a minimum of 8 inches, adjusted to optimum moisture content, and reworked to achieve a minimum of 90 percent relative compaction.
3. Compacted fill should extend at least 5 feet beyond all perimeter footings or to a distance equal to the depth of the certified compacted fill, whichever is the greatest and feasible.
4. Compacted fill, consisting of on-site soil shall be placed in lifts not exceeding 6 inches in uncompacted thickness. The excavated onsite materials are considered satisfactory for reuse in the fill if the moisture content is near optimum. All organic material and construction debris should be removed and shall be segregated. Any imported fill should be observed, tested, and approved by the soils engineer prior to use as fill. Rocks larger than 6 inches in diameter should not be used in the fill.
5. The fill should be compacted to at least 90 percent of the maximum dry density for the material. The maximum density should be determined by ASTM Test Designation D 1557-00.
6. Field observation, and compaction testing should be performed by a representative of Soil Pacific Inc. during the grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compaction effort should be made with adjustment of the moisture content, as necessary, until a minimum of 90 percent relative compaction is obtained.

3.2 Site Preparation and Excavations

If any unanticipated subsurface improvements (pipe lines, irrigation lines, etc.) are encountered during earthwork construction, this office should be informed and appropriate remedial recommendations would subsequently be provided. During earthwork construction, all remedial removals, and the general grading and construction procedures of the contractor should be observed, and the fill selectively tested by a representative of this office. If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and if warranted, additional recommendations will be offered.

3.3 Stability of Temporary Cuts

The stability of temporary cuts required during removal process depends on many factors, including the slope angle, the shearing strength of the underlying materials, and the height of the cut and the length of time the excavation remains open and exposed to equipment vibrations and rainfall. The geotechnical consultant should be present to observe all temporary excavations at the site. The possibility of temporary excavations failing may be minimized by:

- 1) keeping the time between cutting and filling operations to a minimum;
- 2) limiting excavation length exposed at any one time; and,
- 3) cutting no steeper than a 1: 1 (h:v) inclination for cuts in excess of 4 feet in height.
- 4) or shoring prior to cut.

3.4 Foundations

The following recommendations may be used in preparation of the design and construction of the foundation system.

3.4.1 Bearing Value

The allowable bearing value for conventional footings, having a minimum width of 18 inches and a minimum embedment of 24 inches embedded into approved competent materials should not exceed 2500 pounds per square foot. This value may be increased by one-third for short duration (wind or seismic) loading.

3.4.2 Isolated Square Pad Footings

The proposed structure can be adequately supported by shallow spread footing or isolated footings. The minimum embedment for individual pad footings should be 24 inches below the lowest adjacent grade. Allowable bearing value is 2500 psf to a maximum of 4000 psf. The bearing value may be increased by 1/3 when considering short duration seismic or wind loads.

3.4.3 Foundation Settlement

Based upon anticipated structural loads, the maximum total settlement for the proposed foundation is not expected to exceed 1 inch at design load. Differential settlement between adjacent footings and lateral displacement of lateral resisting elements should not exceed 1/2 inch.

3.4.4 Concrete Type

Based on experience with similar projects in the area, Type II concrete should be used.

3.4.5 Slabs-on-grade

If slabs-on-grade is designed then it should be a minimum of 5 inches in nominal thickness. Slab areas that are to be carpeted or tiled, or where the intrusion of moisture is objectionable, should be underlain by a moisture barrier consisting of 15-mil Visqueen, properly protected from the puncture by four inches of gravel per Calgreen requirements.

3.5 Utility Trench Backfill

Utility trenches backfill should be placed in accordance with Appendix D. It is the owners' and contractors' responsibility to inform subcontractors of these requirements and to notify Soil Pacific when backfill placement is to begin.

3.6 Seismic Design and Construction

Construction should be in conformance with seismic design parameters of the latest edition of California Building Code (C.B.C.) Please refer to the following table for related seismic design parameters.

SS (0.2 sec)	S1 (1.0 sec)	Soil Site Class	SDS (0.2 sec)	SD1 (1.0 sec)	PGAm	Seismic Design Cat
2.32	.86	D	1.56	1.52	.81	II

3.7 Surface and Sub-surface Drainage Provisions

Proper surface drainage gradients are helpful in conveying water away from foundations and other improvements. Subsurface drainage provisions are considered essential in order to reduce pore-pressure build-up behind retaining structures. Ponding of water enhances infiltration of water into the local soils, and should not be allowed anywhere on the pad.

3.8 Conventional Retaining Wall

If a conventional retaining wall is planned, the following design criteria may be used:

- 1) Where a free standing structure is proposed, a minimum equivalent fluid pressure, for lateral soil loads, of 40 pounds per cubic foot may be used for design for onsite non expansive granular soils conditions and level backfill (10:1 or less). If the wall is restrained against free movement ($= \pm 1\%$ of wall height) then the wall should be designed for lateral soil loads approaching the at-rest condition. Thus, for restrained conditions, the above value should be increased to 61pcf. In addition, all retaining structures should include the appropriate allowances for any anticipated surcharge loads.
- 2) An allowable soil bearing pressure of 2500 lbs. per square foot may be used in design for footings imbedded a minimum of 24 inches below the lowest adjacent competent grade.
- 3) A friction coefficient of 0.30 between concrete and natural or compacted soil and a passive bearing value of 340 lbs. per square foot per foot of depth, up to a maximum of 1500 pounds per square foot at the bottom excavation level may be employed to resist lateral loads.

Back drain system will consist of free-draining material consisting of at least 1 cubic foot of 3/4-inch crushed rock/ gravel should be utilized around pipe drains. If an open space greater than 1 foot exists between the back of the wall and the soil face, gravel backfill should be compacted by vibration. An impervious soil cap should be provided at the top of the wall backfill to prevent infiltration of surface waters into the back drain system. The cap may be a combination of concrete and/or compacted fine grained soils. The compacted backfill soil cap should be at least 1 foot thick when used in conjunction with a concrete slab type cap and at least 2 feet thick when used exclusively.

Any surcharges such as traffic and adjacent building loads shall be computed and adhered into the design by the structural engineer justification.

3.9 Concrete Driveway

1. The subgrade soils for all flatwork should be checked to have a minimum moisture content of 2 percentage points above the optimum moisture content to a depth of at least 18 inches.
2. Local irrigation and drainage should be diverted from all flatwork areas. Area drains and swales should be utilized to reduce the amount of subsurface water intrusion beneath the foundation and flatwork areas. Planter boxes adjacent to buildings should be sealed on the bottom and edges to retard intrusion of water beneath the structure.
3. The concrete flatwork should have enough cold joints to prevent cracking. Adequate reinforcement considering the expansion potential is required. A minimum of rebar no. 3 placed at 18 inches on center must be used.

4. Surface and shrinkage cracking of the finished slab may be significantly reduced if a low slump and water-cement ratio is maintained during concrete placement. Excessive water added to concrete prior to placement is likely to cause shrinkage cracking.
5. Construction joints and saw cuts should be designed and implemented by the concrete contractor or design engineer based on the medium expansive soil conditions. Maximum joint spacing should not exceed 8 feet in any direction.
6. Patio or driveway subgrade soil should be compacted to a minimum of 90 percent to a depth of 18 inches. All run-off should be gathered in gutters and conducted off site in a non-erosive manner. Planters located adjacent to footings should be sealed, and leach water intercepted.

3.10 Storm Water Management

For the storm water management percolation testing, one boring hole was used. Based on a single wall percolation method, on-site percolation will be 5.2 inches per hour not including the factor of safety.

3.11 Observation and Testing

It is recommended that **Soil Pacific Inc.** be present to observe and test during the following stages of construction:

- Site grading to confirm proper removal of unsuitable materials and to observe and test the placement of fill.
- Inspection of all foundation excavations prior to placement of steel or concrete.
- During the placement of retaining wall subdrain and backfill materials.
- Inspection of all slab-on-grade areas prior to placement of sand, Visqueen.
- After trenches have been properly backfilled and compacted.
- When any unusual conditions are encountered.

APPENDIX A
Field Exploration

Log of Sub-surface Exploration

Boring B-1

Std. Pen	Drive Wt: Drop:	USCS Letter		Equipment Type: Sh-2800	Boring # B-1
Bulk/Bag		Graphic		Diameter: 5"	Logged by: Y.K. Date: 12/22/21
Ring	c/s	Laboratory		Depth: 12 feet	G.water: - feet Backfilled: Y
Elev. (feet)	N	Moisture	Dry Reading	Description of Earth Materials	
0					
5	6/7/9			Gray, light brown fine to gravelly sand, rounded bedrock fragments, pebbles with some silt. Damp and dense.	
10	13/16/18				
15	14/12/19			End of subsurface exploration 12 feet.	
20	16/19/28				
25					
30					
35					
40					

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.

Geotechnical and Environmental Services

Project Name: 935 S Lilac Avenue, Rialto, California

Project Number: A-8895-21

Report Date:

Figure:

Log of Sub-surface Exploration

Boring B-2

Std. Pen	Drive Wt: Drop:	USCS Letter		Equipment Type: Sh-2800		Boring # B-2
Bulk/Bag	c/s	Graphic		Diameter: 5"	Logged by: Y.K.	Date: 12/22/21
Ring		Laboratory		Depth: 12 feet	G.water: - feet	Backfilled: Y
Elev. (feet)	N	Moisture	Dry Reading	Description of Earth Materials		
-				SM	Brown fine to coarse grained silty sand, sand and gravel, damp and dense	
5	6/6/8			SP	Gray, light brown fine to gravelly sand, rounded bedrock fragments, pebbles with some silt. Damp and dense.	
10	18/19/19			GW	Light brown, gravelly sand with some pebbels fragments, dense and damp.	
15	16/17/23					
20					End of subsurface exploration 12 feet.	
25						
30						
35						
40						

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.

Geotechnical and Environmental Services

Project Name: 935 S Lilac Avenue, Rialto, California

Project Number: A-8895-21

Report Date:

Figure:

Log of Sub-surface Exploration

Boring B-3

Std. Pen	Drive Wt: Drop:	USCS Letter		Equipment Type: 7700		Boring # B-3
Bulk/Bag	C/S	Graphic		Diameter: 5"	Logged by: Y.K.	Date: 1/3/21
Ring		Laboratory		Depth: 12 feet	G.water: - feet	Backfilled: Y
Elev. (feet)	N	Moisture	Dry Reading	Description of Earth Materials		
-		5.1	115.2	SM	Brown fine to coarse grained silty sand, sand and gravel, damp and dense	
-		4.3	117.1	SP	Gray, light brown fine to gravelly sand, rounded bedrock fragments, pebbles with some silt. Damp and dense.	
5		4.0	116.8	GW	Light brown, gravelly sand with some pebbels fragments, dense and damp.	
10						
15						
20					End of subsurface exploration 12 feet.	
25						
30						
35						
40						

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.

Geotechnical and Environmental Services

Project Name: 935 S Lilac Avenue, Rialto, California

Project Number: A-8895-21

Report Date:

Figure:

Log of Sub-surface Exploration

Boring B-4

Std. Pen	Drive Wt: Drop:	USCS Letter		Equipment Type: 7700		Boring # B-4
		Graphic		Diameter: 5"	Logged by: Y.K.	Date: 1/3/21
Bulk/Bag	c/s	Laboratory		Depth: 12 feet	G.water: - feet	Backfilled: Y
Ring		Moisture	Dry Reading			
Elev. (feet)	N					
-				SM	Brown fine to coarse grained silty sand, sand and gravel, damp and dense	
-		7.1	113.5	SP	Gray, light brown fine to gravelly sand, rounded bedrock fragments, pebbles with some silt. Damp and dense.	
5		5.4	115.4			
-				GW	Light brown, gravelly sand with some pebbles fragments, dense and damp.	
10		4.0	117.3		End of subsurface exploration 12 feet.	
-						
15						
-						
20						
-						
25						
-						
30						
-						
35						
-						
40						

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.

Geotechnical and Environmental Services

Project Name: 935 S Lilac Avenue, Rialto, California

Project Number: A-8895-21

Report Date:

Figure:

APPENDIX B

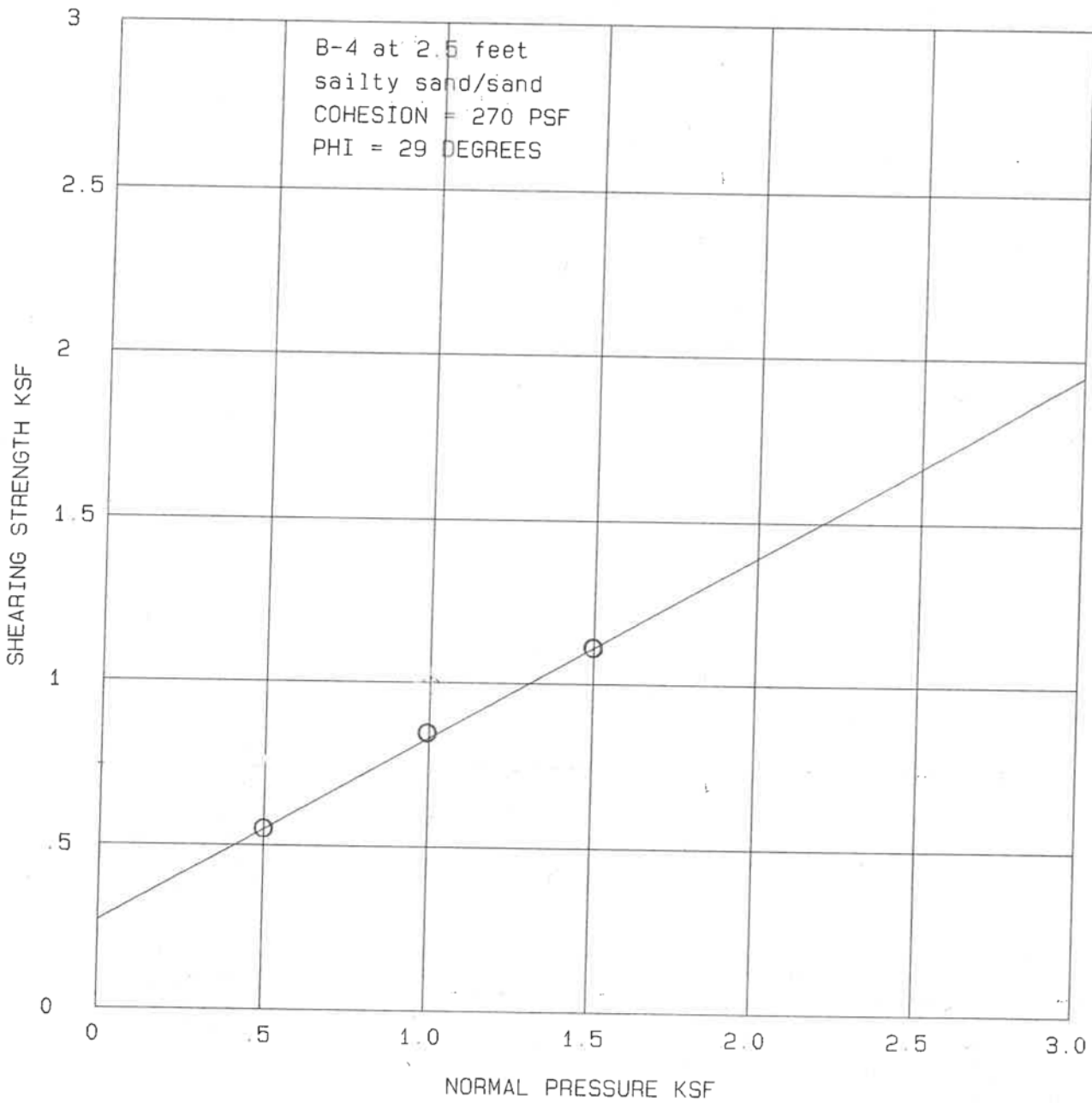
Laboratory

APPENDIX

SHEAR TEST DIAGRAM

J.O. A-8895-22

DATE 1/8/22



PLATE

APPENDIX

BEARING VALUE ANALYSIS

J.O. A-8895-22

DATE 1/8/22

COHESION = 270 PSF GAMA = 120 PCF PHI = 29 DEGREES

DEPTH OF FOOTING = 2 FEET

BREADTH OF FOOTING = 1.5 FEET

FOOTING TYPE = CONTINUOUS

<u>BEARING CAPACITY FACTORS</u>		
Nc = 27.9	Nq = 16.4	Ng = 15.6
<u>FOOTING COEFFICIENTS</u>		
K1 = 1	K2 = .5	

REFERENCE: TERZAGHI & PECK; 1967; 'SOIL MECHANICS IN ENGINEERING PRACTICE'; PAGES 217 TO 225.
FORMULA
ULTIMATE BEARING = $(K1 * Nc * C) + (K2 * GA * Ng * B) + (Nq * GA * D) = 12875.3$
ALLOWABLE BEARING = $\frac{\text{ULTIMATE BEARING}}{3} = 4291.8$

THE ALLOWABLE BEARING VALUE SHOULD NOT EXCEED
4291.8 PSF. DESIGN SHOULD CONSIDER EXPANSION INDEX.

APPENDIX

BEARING VALUE ANALYSIS

J.O. A-8895-22

DATE 1/8/22

COHESION = 270 PSF

GAMA = 120 PCF

PHI = 29 DEGREES

DEPTH OF FOOTING = 2 FEET

BREADTH OF FOOTING = 2 FEET

FOOTING TYPE = SQUARE

BEARING CAPACITY FACTORS		
Nc = 27.9	Nq = 16.4	Ng = 15.6
FOOTING COEFFICIENTS		
K1 = 1.2	K2 = .4	

REFERENCE: TERZAGHI & PECK; 1967; 'SOIL MECHANICS
IN ENGINEERING PRACTICE'; PAGES 217 TO 225.

FORMULA

$$\text{ULTIMATE BEARING} = (K1 * Nc * C) + (K2 * GA * Ng * B) + (Nq * GA * D) = 14473.5$$

$$\text{ALLOWABLE BEARING} = \frac{\text{ULTIMATE BEARING}}{3} = 4824.5$$

3

THE ALLOWABLE BEARING VALUE SHOULD NOT EXCEED
4824.5 PSF. DESIGN SHOULD CONSIDER EXPANSION INDEX.

PLATE

APPENDIX

TEMPORARY BACKCUT STABILITY

J.O. A-8895-22

DATE 1/8/22

COHESION = 270 PSF

GAMA = 120 PCF

PHI = 29 DEGREES

CUT HEIGHT = 4 FEET

SOIL TYPE = Sand and gravel

BACKFILL ASSUMED TO BE LEVEL

PORE PRESSURE NOT CONSIDERED

FORMULA

$$\text{SAFETY FACTOR} = \frac{(C * L) + (GA * \text{AREA} * \cos(Z) * \tan(\text{PHI}))}{GA * \text{AREA} * \sin(Z)} = 2.9$$

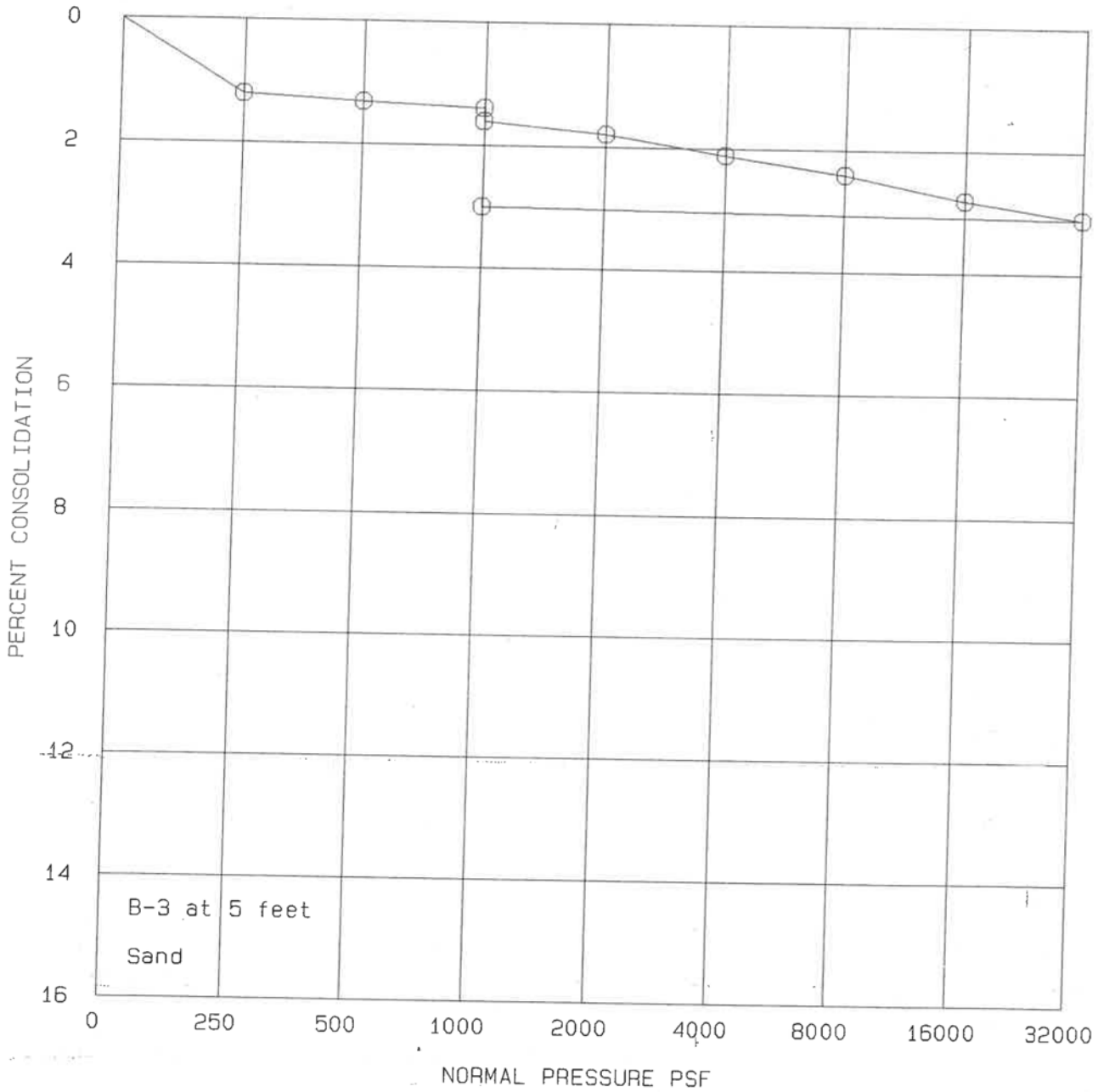
$$Z = 45 + (\text{PHI}/2)$$

SINCE THE SAFETY FACTOR OF 2.9 IS GREATER THAN THE REQUIRED 1.25, THE TEMPORARY EXCAVATION IS CONSIDERED TO BE STABLE. THIS IS WITH A LEVEL AREA EQUAL TO THE LENGTH OF THE VERTICAL CUT ABOVE THE CUT.

CONSOLIDATION PRESSURE CURVE

J.O. A-8895-22

DATE 1/8/22



PLATE

Earth Pressure Calculations

Soil Strength Parameters:

$$\phi := 29$$

$$\gamma := 120$$

Active :

$$K_a := \tan \left[\left(45 - \frac{\phi}{2} \right) \cdot \left(\frac{\pi}{180} \right) \right]^2$$

Active earth Pressure

$$K_a = 0.347$$

$$P_a := K_a \cdot \gamma$$

slope angle range, degrees

$$P_a = 41.637$$

LEVEL BACKFILL BEHIND WALL

$$P_a = 41.637$$

$$P_{a18} := P_a \cdot 1.08$$

5:1 BACKFILL BEHIND WALL

$$P_{a18} = 44.968$$

$$P_{a18} := P_a \cdot 1.22$$

3:1 BACKFILL BEHIND WALL

$$P_{a18} = 50.797$$

$$P_{a39} := P_a \cdot 1.48$$

2:1 BACKFILL BEHIND WALL

$$P_{a39} = 61.623$$

Passive

$$K_p := \tan \left[\left(45 + \frac{\phi}{2} \right) \cdot \left(\frac{\pi}{180} \right) \right]^2$$

$$K_p = 2.882$$

Passive Earth Pressure

$$P_p := K_p \cdot \gamma$$

$$P_p = 345.847$$

Atrest

$$K_{at} := 1 - \sin \left(\phi \cdot \frac{\pi}{180} \right)$$

$$K_{at} = 0.515$$

$$P_{at} := K_{at} \cdot \gamma$$

$$P_{at} = 61.823$$

Seismic lateral earth pressure Free standing Wall

$\phi := 29\text{-deg}$ angle of internal friction of soil

$\delta := 17\text{-deg}$ angle of friction between soil and wall, (concrete or masonry)

$PGAm := .81$

$h := 8$ Height of wall

$$kh := \left[\left(\frac{2}{3} \right) PGAm \right] \cdot \frac{1}{2}$$

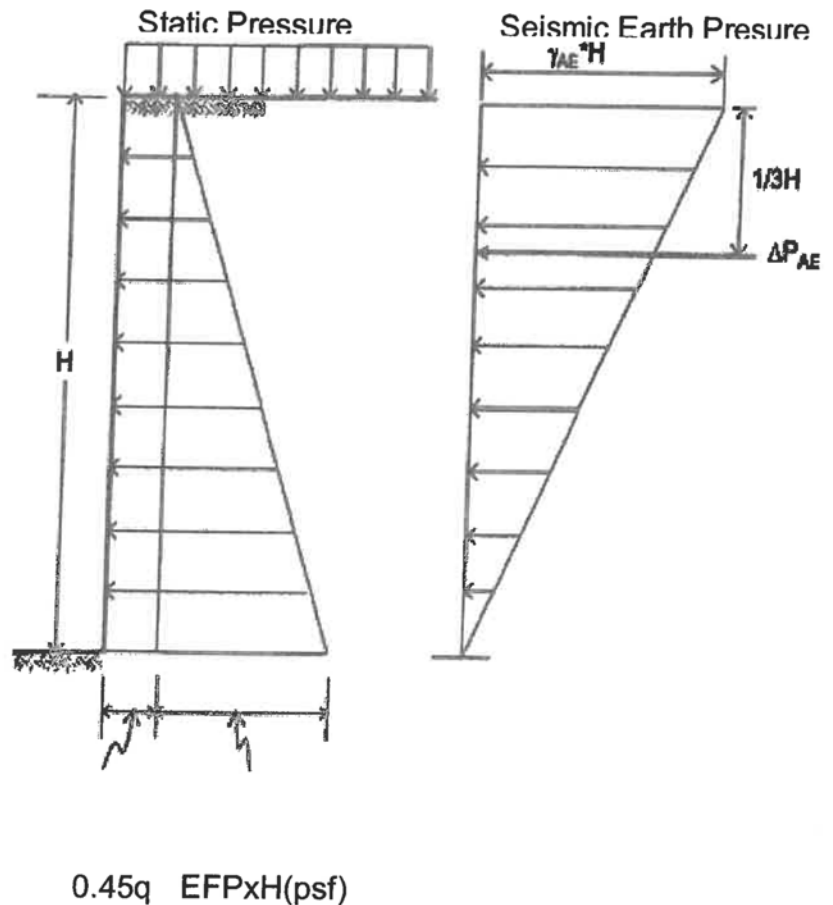
$kh = 0.27$

$\gamma := 120$ Soil Unit Weight

$$PaE := \frac{3}{8} \cdot \gamma \cdot h^2 \cdot kh$$

$PaE = 777.6$ PLF

$$EFPs := 2 \cdot \frac{PaE}{h^2}$$



$EFPs = 24.3$ PCF seismic Lateral Force (retaining wall in excess of 6 feet)

$q := 0$ Surcharge Load should be added by structural justification

Porchet Method, Aka Inverse Borehole Method B-2

$\Delta T := 20$ Time Interval 10 Minutes

$D_0 := 05$ Initial Depth to Water, (inch)

$D_f := 140$ Final Depth to Water, (inch)

$D_r := 144$ Total Depth of the Test Hole

$r := 4$ Test Hole Radius, Inch

$H_0 := D_r - D_0$ Initial height of water at the selected time interval

$H_0 = 139$

$H_f := D_r - D_f$ Final height of water at the selected time interval

$H_f = 4$

$\Delta H := H_0 - H_f$ $\Delta H = \Delta D$ Change in height over the time interval

$\Delta H = 135$

$$H_{avg} := \frac{(H_0 + H_f)}{2}$$

$H_{avg} = 71.5$

The Conversion Equation is used:

$$IR := \frac{\Delta H \cdot (60 \cdot r)}{\Delta T \cdot (r + 2H_{avg})}$$

$IR = 11.02$ inch /Hour Infiltration rate without including factor of safety

Factor of safety 3

$IR_{safe} := \frac{IR}{3}$ $IR_{safe} := 3.6$ Design rate inches/hour

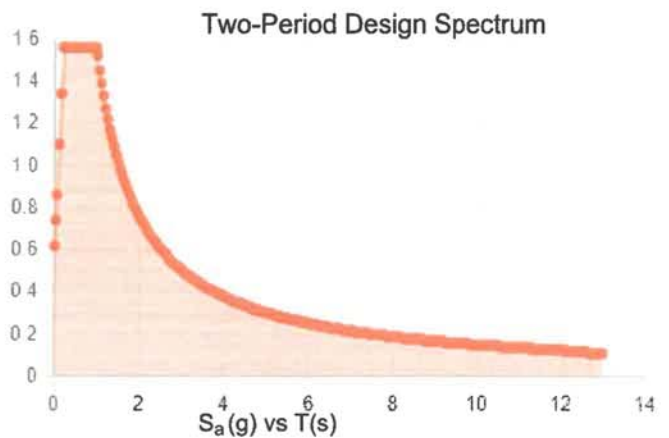
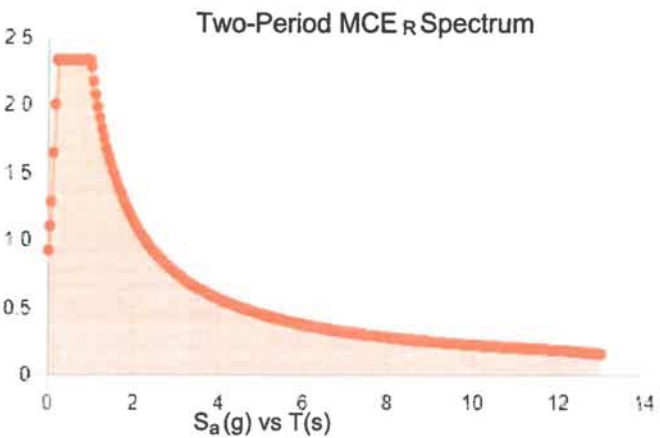
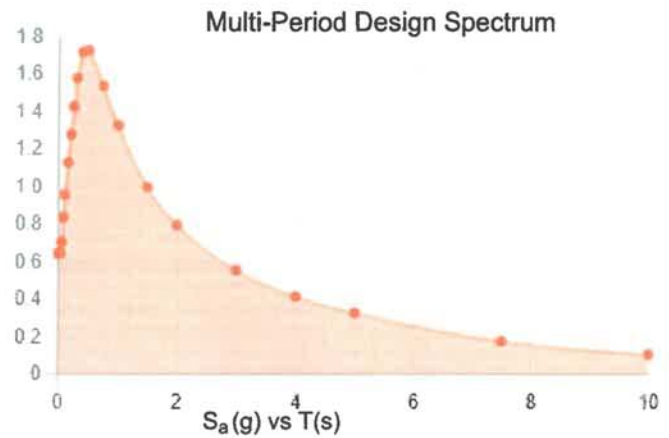
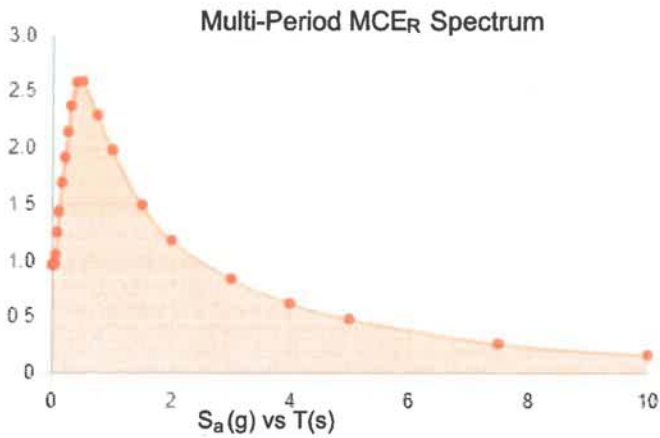
APPENDIX C

References

Site Soil Class:

Results:

PGA _M :	0.81	T _L :	12
S _{MS} :	2.34	S _S :	2.32
S _{M1} :	2.29	S ₁ :	0.86
S _{DS} :	1.56	S _{DC} :	
S _{D1} :	1.52	V _{S30} :	260



MCE_R Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.



Data Accessed: Sat Jan 08 2022

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-22 and ASCE/SEI 7-22 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-22 Ch. 21 are available from USGS.

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APPENDIX D

General Grading Specifications

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1. GENERAL INTENT

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installation of subdrains, and excavations. The recommendations contained in the geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations of the geotechnical report.

2. EARTHWORK OBSERVATION AND TESTING

Prior to the commencement of grading, a qualified geotechnical consultant (soils engineer and engineering geologist, and their representatives) shall be employed for the purpose of observing earthwork and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the consultant provide adequate testing and observation so that he may determine that the work was accomplished as specified. It shall be the responsibility of the contractor to assist the consultant and keep him apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If in the opinion of the consultant, unsatisfactory conditions, such as questionable soil, poor moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the consultant will be empowered to reject the work and recommend that construction be topped until the conditions are rectified. Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society of Testing and Materials tests method ASTM D 1557-00.

3.0 PREPARATION OF AREAS TO BE FILLED

3.1 Clearing and Grubbing: All brush, vegetation and debris shall be removed or piled and otherwise disposed of.

3.2 Processing: The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.

3.3 Overexcavation: Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such a depth that the surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the consultant.

3.4 Moisture Conditioning: Overexcavated and processed soils shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near optimum.

3.5 Recomposition: Overexcavated and processed soils which have been properly mixed and moisture- conditioned shall be recomposed to a minimum relative compaction of 90 percent.

3.6 Benching: Where fills are to be placed on ground with slopes steeper than 5: 1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm material, and shall be approved by the consultant. Other benches shall be excavated in firm material for a minimum width of 4 feet. Ground sloping flatter than 5 : 1 shall be benched or otherwise overexcavated when considered necessary by the consultant.

3.7 Approval: All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be approved by the consultant prior to fill placement.

4.0 FILL MATERIAL

4.1 General: Material to be placed as fill shall be free of organic matter and other deleterious substances, and shall be approved by the consultant. Soils of poor gradation, expansion, or strength characteristics shall be placed in areas designated by consultant or shall be mixed with other soils to serve as satisfactory fill material.

4.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically approved by the consultant. Oversize disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the consultant.

4.3 Import: If importing of fill material is required for grading, the import material shall meet the requirements of Section 4. 1.

5.0 FILL PLACEMENT AND COMPACTION

5.1 Fill Lifts: Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.2 Fill Moisture: Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture-conditioning and mixing of fill layers shall continue until the fill material is at a uniform moisture content or near optimum.

5.3 Compaction of Fill: After each layer has been evenly spread, moisture conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 Fill Slopes: Compaction of slopes shall be accomplished, in addition to normal compacting procedures, by backfilling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet in fill elevation gain, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent.

5.5 Compaction Testing: Field tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, the tests will be taken at an interval not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment.

6.0 SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the consultant. The consultant, however, may recommend and upon approval, direct changes in subdrain line, grade or material. All subdrains should be surveyed for line and grade after installation, and sufficient time shall be allowed for the surveys, prior to commencement of filling over the subdrains.

7.0 EXCAVATION

Excavation and cut slopes will be examined during grading. If directed by the consultant, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut slopes shall be performed. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall be made and approved by the consultant prior to placement of materials for construction of the fill portion of the slope.

8.0 TRENCH BACKFILLS

8.1 Supervision: Trench excavations for the utility pipes shall be backfilled under engineering supervision.

8.2 Pipe Zone: After the utility pipe has been laid, the space under and around the pipe shall be backfilled with clean sand or approved granular soil to a depth of at least one foot over the top of the pipe. The sand backfill shall be uniformly jetted into place before the controlled backfill is placed over the sand.

8.3 Fill Placement: The onsite materials, or other soils approved by the engineer, shall be watered and mixed as necessary prior to placement in lifts over the sand backfill.

8.4 Compaction: The controlled backfill shall be compacted to at least 90 percent of the maximum laboratory density as determined by the ASTM compaction method described above.

8.5 Observation and Testing: Field density tests and inspection of the backfill procedures shall be made by the soil engineer during backfilling to see that the proper moisture content and uniform compaction is being maintained. The contractor shall provide test holes and exploratory pits as required by the soil engineer to enable sampling and testing.

APPENDIX C

APPENDIX D



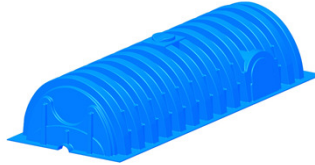
CULTEC Stormwater Design Calculator

Date:	February 15, 2023
Project Information:	
Proposed Commercial Building 935 S Lilac Avenue Rialto California USA	

Calculations Performed By:	
RR	

RECHARGER 180HD

Recharger 180HD Chamber Specifications		
Height	20.5	inches
Width	36.0	inches
Length	7.33	feet
Installed Length	6.33	feet
Bare Chamber Volume	21.84	cu. feet
Installed Chamber Volume	45.94	cu. feet



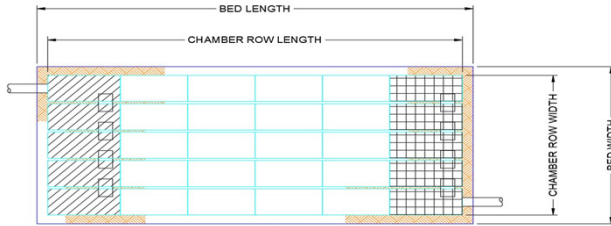
Breakdown of Storage Provided by Recharger 180HD Stormwater System		
Within Chambers	2,772.35	cu. feet
Within Feed Connectors	6.83	cu. feet
Within Stone	3,354.20	cu. feet
Total Storage Provided	6,133.4	cu. feet
Total Storage Required	6013.08	cu. feet

Materials List

Recharger 180HD		
Total Number of Chambers Required	126	pieces
Starter Chambers	6	pieces
Intermediate Chambers	114	pieces
End Chambers	6	pieces
HVLV FC-24 Feed Connectors	10	pieces
CULTEC No. 410 Non-Woven Geotextile	1050	sq. yards
CULTEC No. 4800 Woven Geotextile	48	feet
Stone	311	cu. yards

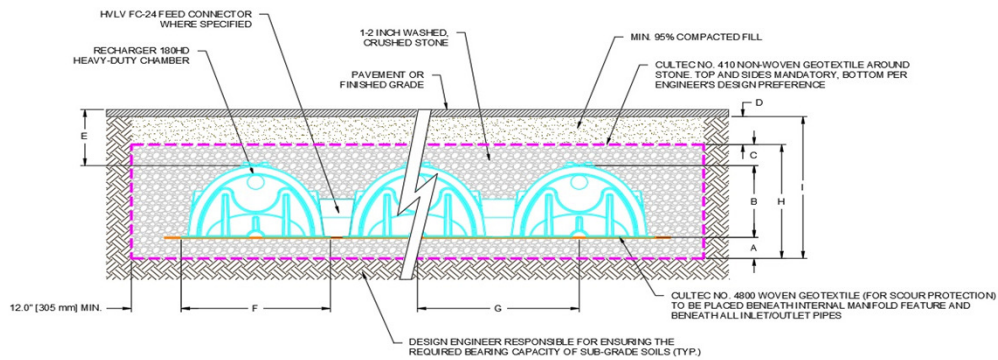
Based on 2 Internal Manifolds

Bed Detail



Bed Layout Information		
Number of Rows Wide	6	pieces
Number of Chambers Long	21	pieces
Chamber Row Width	21.75	feet
Chamber Row Length	133.93	feet
Bed Width	23.75	feet
Bed Length	135.93	feet
Bed Area Required	3228.34	sq. feet
Length of Separator Row	N/A	feet

Bed detail for reference only. Not project specific. Not to scale.



Conceptual graphic only. Not job specific.

Cross Section Table Reference		
A	Depth of Stone Base	9.0 inches
B	Chamber Height	20.5 inches
C	Depth of Stone Above Units	12.0 inches
D	Depth of 95% Compacted Fill	8.0 inches
E	Max. Depth Allowed Above the Chamber	12.00 feet
F	Chamber Width	36.0 inches
G	Center to Center Spacing	3.75 feet
H	Effective Depth	3.46 feet
I	Bed Depth	4.13 feet

Worksheet H: Factor of Safety and Design Infiltration Rate Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	3	0.75
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			
B	Design	Tributary area size	0.25	1	0.25
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	3	0.75
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{Total} = S_A \times S_B$				1.5X1.5=3.0	
Measured Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)				5.2	
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{observed}/S_{Total}$				1.73 in/hr	

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

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



NOAA Atlas 14, Volume 6, Version 2
Location name: Rialto, California, USA*
Latitude: 34.0844°, Longitude: -117.3785°
Elevation: 1143.3 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	0.118 (0.098-0.143)	0.153 (0.127-0.185)	0.199 (0.165-0.242)	0.237 (0.195-0.291)	0.290 (0.230-0.369)	0.331 (0.258-0.430)	0.374 (0.283-0.498)	0.419 (0.308-0.574)	0.481 (0.340-0.689)	0.531 (0.362-0.787)
10-min	0.169 (0.141-0.205)	0.219 (0.182-0.266)	0.285 (0.236-0.347)	0.340 (0.280-0.417)	0.416 (0.330-0.528)	0.475 (0.369-0.617)	0.536 (0.406-0.714)	0.600 (0.442-0.823)	0.690 (0.487-0.987)	0.761 (0.518-1.13)
15-min	0.204 (0.170-0.248)	0.265 (0.220-0.321)	0.345 (0.286-0.420)	0.411 (0.338-0.505)	0.503 (0.399-0.639)	0.574 (0.447-0.746)	0.648 (0.491-0.863)	0.726 (0.535-0.995)	0.834 (0.589-1.19)	0.920 (0.627-1.37)
30-min	0.303 (0.252-0.367)	0.393 (0.327-0.477)	0.512 (0.424-0.623)	0.610 (0.502-0.749)	0.746 (0.593-0.948)	0.852 (0.663-1.11)	0.962 (0.729-1.28)	1.08 (0.794-1.48)	1.24 (0.873-1.77)	1.37 (0.930-2.03)
60-min	0.437 (0.364-0.530)	0.566 (0.471-0.687)	0.737 (0.612-0.898)	0.879 (0.723-1.08)	1.08 (0.854-1.37)	1.23 (0.955-1.60)	1.39 (1.05-1.85)	1.55 (1.14-2.13)	1.78 (1.26-2.55)	1.97 (1.34-2.92)
2-hr	0.636 (0.530-0.772)	0.818 (0.681-0.994)	1.06 (0.877-1.29)	1.25 (1.03-1.54)	1.52 (1.21-1.94)	1.73 (1.35-2.25)	1.95 (1.48-2.59)	2.17 (1.60-2.98)	2.48 (1.75-3.55)	2.72 (1.85-4.03)
3-hr	0.793 (0.661-0.962)	1.02 (0.846-1.24)	1.31 (1.09-1.60)	1.55 (1.27-1.90)	1.88 (1.49-2.39)	2.13 (1.66-2.77)	2.39 (1.81-3.18)	2.66 (1.96-3.65)	3.03 (2.14-4.33)	3.32 (2.26-4.92)
6-hr	1.12 (0.935-1.36)	1.44 (1.20-1.75)	1.85 (1.53-2.25)	2.18 (1.80-2.68)	2.64 (2.10-3.35)	2.98 (2.32-3.88)	3.34 (2.53-4.45)	3.70 (2.73-5.08)	4.20 (2.96-6.01)	4.59 (3.13-6.80)
12-hr	1.51 (1.25-1.83)	1.93 (1.61-2.35)	2.49 (2.06-3.03)	2.93 (2.41-3.60)	3.53 (2.81-4.49)	3.99 (3.10-5.19)	4.45 (3.38-5.93)	4.93 (3.63-6.76)	5.57 (3.93-7.97)	6.07 (4.13-8.99)
24-hr	2.02 (1.78-2.32)	2.61 (2.31-3.01)	3.37 (2.97-3.90)	3.98 (3.49-4.65)	4.80 (4.07-5.79)	5.43 (4.50-6.67)	6.05 (4.90-7.62)	6.69 (5.27-8.66)	7.54 (5.71-10.2)	8.20 (6.00-11.4)
2-day	2.45 (2.17-2.83)	3.23 (2.86-3.73)	4.24 (3.74-4.90)	5.06 (4.42-5.90)	6.16 (5.22-7.43)	7.01 (5.82-8.62)	7.87 (6.37-9.91)	8.75 (6.90-11.3)	9.94 (7.52-13.4)	10.9 (7.95-15.2)
3-day	2.61 (2.31-3.00)	3.49 (3.09-4.03)	4.66 (4.11-5.39)	5.62 (4.92-6.56)	6.94 (5.88-8.37)	7.97 (6.61-9.80)	9.02 (7.31-11.4)	10.1 (7.97-13.1)	11.6 (8.79-15.7)	12.8 (9.36-17.8)
4-day	2.79 (2.47-3.21)	3.77 (3.34-4.36)	5.09 (4.49-5.88)	6.17 (5.40-7.20)	7.68 (6.50-9.25)	8.86 (7.35-10.9)	10.1 (8.16-12.7)	11.3 (8.94-14.7)	13.1 (9.92-17.7)	14.5 (10.6-20.2)
7-day	3.17 (2.81-3.66)	4.33 (3.83-5.00)	5.88 (5.18-6.80)	7.16 (6.27-8.35)	8.95 (7.58-10.8)	10.4 (8.59-12.7)	11.8 (9.57-14.9)	13.3 (10.5-17.3)	15.5 (11.7-20.9)	17.2 (12.6-24.0)
10-day	3.45 (3.05-3.97)	4.73 (4.18-5.46)	6.44 (5.68-7.46)	7.87 (6.89-9.18)	9.86 (8.35-11.9)	11.4 (9.49-14.1)	13.1 (10.6-16.5)	14.8 (11.7-19.2)	17.2 (13.0-23.2)	19.1 (14.0-26.7)
20-day	4.18 (3.70-4.82)	5.79 (5.12-6.68)	7.95 (7.01-9.19)	9.76 (8.54-11.4)	12.3 (10.4-14.8)	14.3 (11.9-17.6)	16.4 (13.3-20.7)	18.7 (14.7-24.2)	21.8 (16.5-29.5)	24.4 (17.8-34.0)
30-day	4.94 (4.38-5.70)	6.86 (6.06-7.91)	9.44 (8.33-10.9)	11.6 (10.2-13.6)	14.7 (12.4-17.7)	17.1 (14.2-21.1)	19.7 (16.0-24.8)	22.5 (17.7-29.1)	26.4 (20.0-35.6)	29.5 (21.6-41.2)
45-day	5.88 (5.21-6.78)	8.14 (7.20-9.39)	11.2 (9.88-13.0)	13.8 (12.1-16.1)	17.4 (14.8-21.0)	20.4 (16.9-25.0)	23.5 (19.0-29.5)	26.8 (21.1-34.7)	31.5 (23.8-42.5)	35.4 (25.9-49.4)
60-day	6.86 (6.07-7.90)	9.43 (8.34-10.9)	12.9 (11.4-15.0)	15.9 (13.9-18.5)	20.1 (17.0-24.2)	23.4 (19.5-28.8)	27.0 (21.9-34.0)	30.9 (24.3-39.9)	36.3 (27.5-49.0)	40.8 (29.9-57.0)

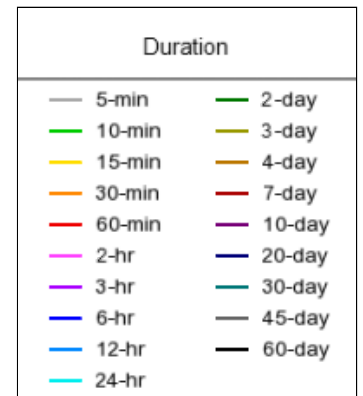
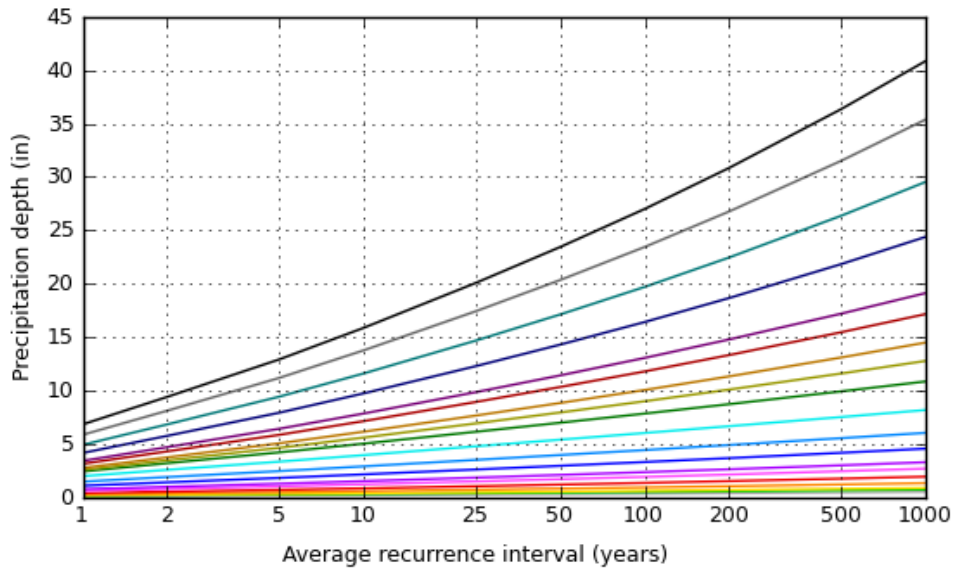
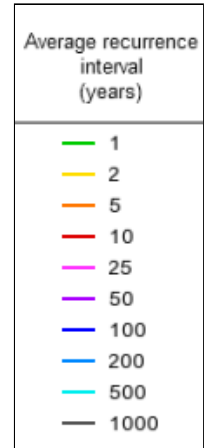
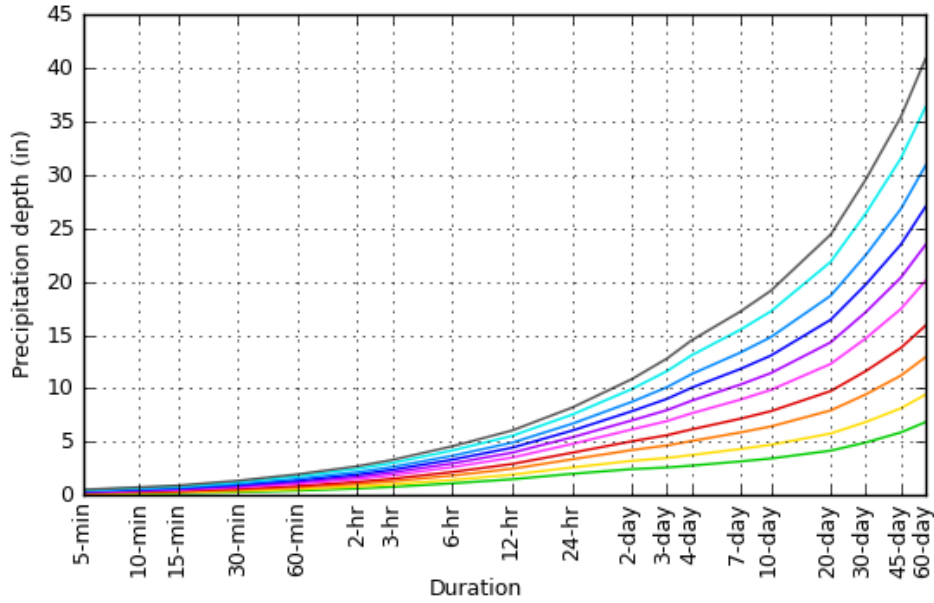
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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

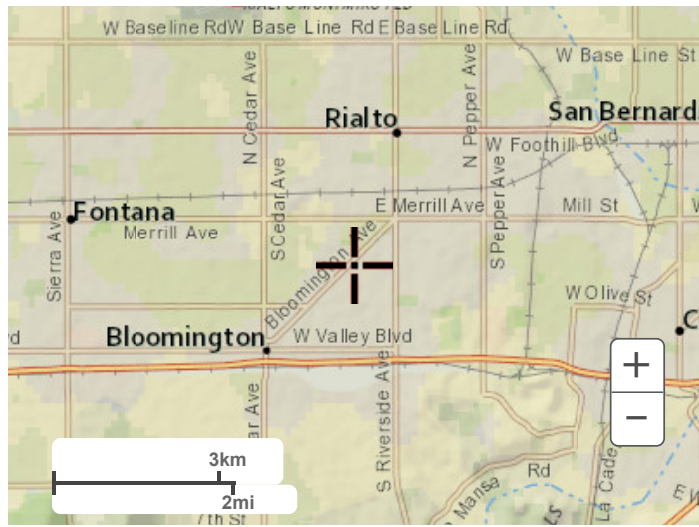
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Maps & aerials

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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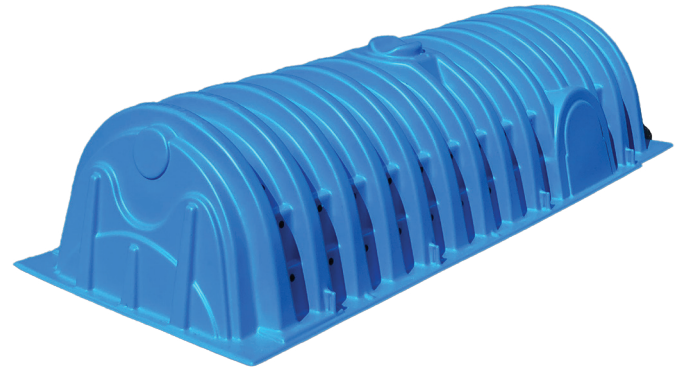
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APPENDIX E



CULTEC Recharger® 180HD Stormwater Chamber

The Recharger® 180HD is a 20.5" (521 mm) tall, mid-size chamber and is typically used for installations with depth restrictions or when a larger infiltrative area is required. The Recharger® 180HD has the side portal internal manifold feature. HVLV® FC-24 Feed Connectors are inserted into the side portals to create the internal manifold.



Size (L x W x H)	7.33' x 36" x 20.5" 2.23 m x 914 mm x 521 mm
Installed Length	6.33' 1.93 m
Length Adjustment per Run	1' 0.30 m
Chamber Storage	3.45 ft³/ft 0.32 m³/m 21.81 ft³/unit 0.62 m³/unit
Min. Installed Storage	5.59 ft³/ft 0.52 m³/m 35.37 ft³/unit 1.00 m³/unit
Min. Area Required	20.57 ft² 1.91 m²
Chamber Weight	45.0 lbs 20.41 kg
Shipping	40 chambers/skid 1,905 lbs/skid 16 skids/48' flatbed
Min. Center to Center Spacing	3.25' 0.99 m
Max. Allowable Cover	12' 3.66 m
Max. Inlet Opening in Endwall	15" HDPE, PVC 375 mm HDPE, PVC
Max. Allowable O.D. in Side Portal	10" HDPE, 12" PVC 250 mm HDPE, 300 mm PVC
Compatible Feed Connector	HVLV FC-24 Feed Connector

Calculations are based on installed chamber length.
All above values are nominal.
Min. installed storage includes 6" (152 mm) stone base, 6" (152 mm) stone above crown of chamber and typical stone surround at 39"(991 mm) center-to-center spacing.

	Stone Foundation Depth		
	6" 152 mm	12" 305 mm	18" 457 mm
Chamber and Stone Storage Per Chamber	35.37 ft³ 1.00 m³	39.49 ft³ 1.12 m³	43.60 ft³ 1.23 m³
Min. Effective Depth	2.71' 0.83 m	3.21' 0.98 m	3.71' 1.13 m
Stone Required Per Chamber	1.26 yd³ 0.96 m³	1.64 yd³ 1.25 m³	2.02 yd³ 1.54 m³

Calculations are based on installed chamber length.
Includes 6" (305 mm) stone above crown of chamber and typical stone surround at 39"(991 mm) center-to-center spacing and stone foundation as listed in table.
Stone void calculated at 40%.

Recharger® 180HD Bare Chamber Storage Volumes

Elevation		Incremental Storage Volume				Cumulative Storage	
in.	mm	ft³/ft	m³/m	ft³	m³	ft³	m³
20.5	521	0.000	0.000	0.000	0.000	21.818	0.618
20	508	0.233	0.022	1.476	0.042	21.818	0.618
19	483	0.222	0.021	1.406	0.040	20.343	0.576
18	457	0.222	0.021	1.406	0.040	18.937	0.536
17	432	0.221	0.021	1.400	0.040	17.531	0.496
16	406	0.220	0.020	1.393	0.039	16.131	0.457
15	381	0.216	0.020	1.368	0.039	14.738	0.417
14	356	0.209	0.019	1.324	0.037	13.370	0.379
13	330	0.206	0.019	1.305	0.037	12.046	0.341
12	305	0.202	0.019	1.279	0.036	10.741	0.304
11	279	0.198	0.018	1.254	0.036	9.462	0.268
10	254	0.193	0.018	1.222	0.035	8.208	0.232
9	229	0.181	0.017	1.146	0.032	6.986	0.198
8	203	0.171	0.016	1.083	0.031	5.839	0.165
7	178	0.161	0.015	1.020	0.029	4.756	0.135
6	152	0.150	0.014	0.950	0.027	3.737	0.106
5	127	0.135	0.013	0.855	0.024	2.787	0.079
4	102	0.117	0.011	0.741	0.021	1.932	0.055
3	76	0.090	0.008	0.570	0.016	1.191	0.034
2	51	0.060	0.006	0.380	0.011	0.621	0.0318
1	25	0.038	0.004	0.241	0.007	0.241	0.007
Total		3.445	0.320	21.818	0.618	21.818	0.618

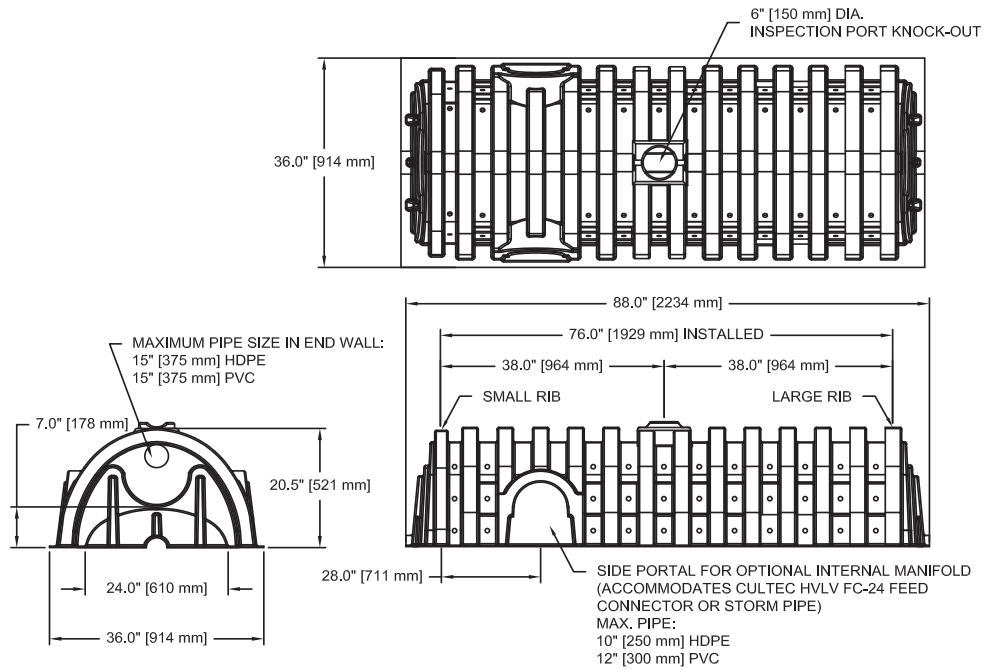
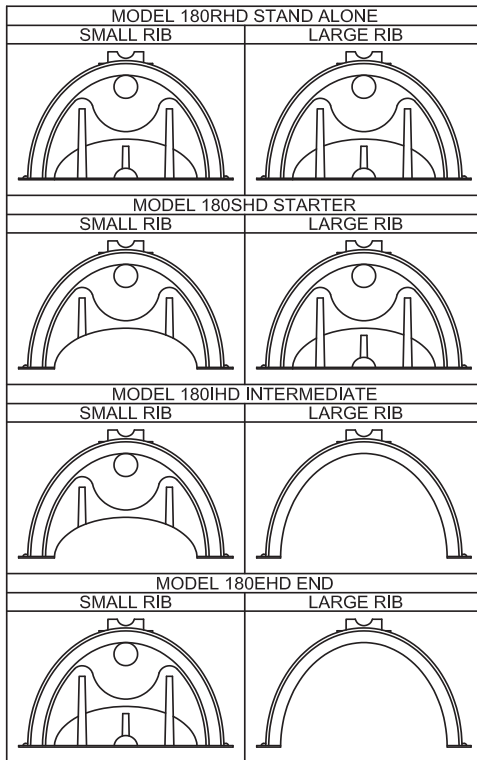
Calculations are based on installed chamber length.

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.



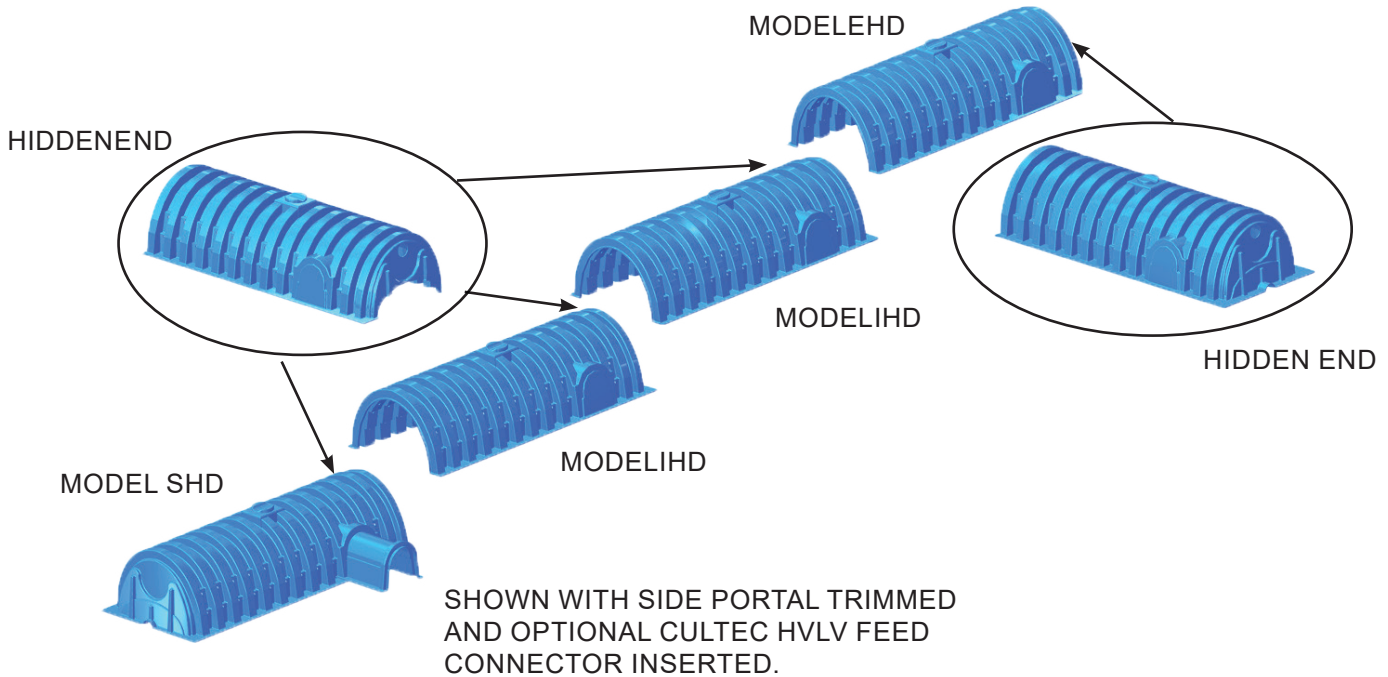
CULTEC Recharger® 180HD Stormwater Chamber

Three View Drawing



CULTEC RECHARGER 180HD CHAMBER STORAGE = 3.445 FT³ / FT (0.32 M³ / M)
INSTALLED LENGTH ADJUSTMENT = 1.0' [306 mm]

Typical Interlock Installation

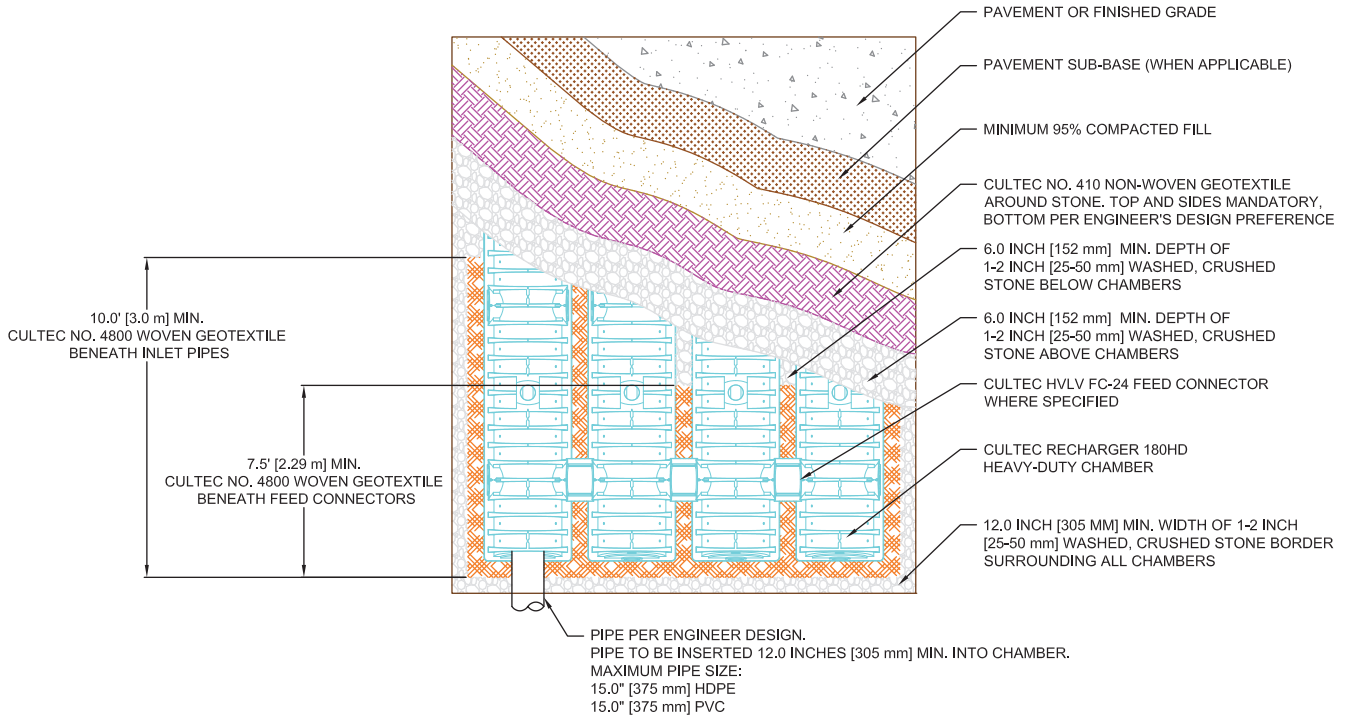


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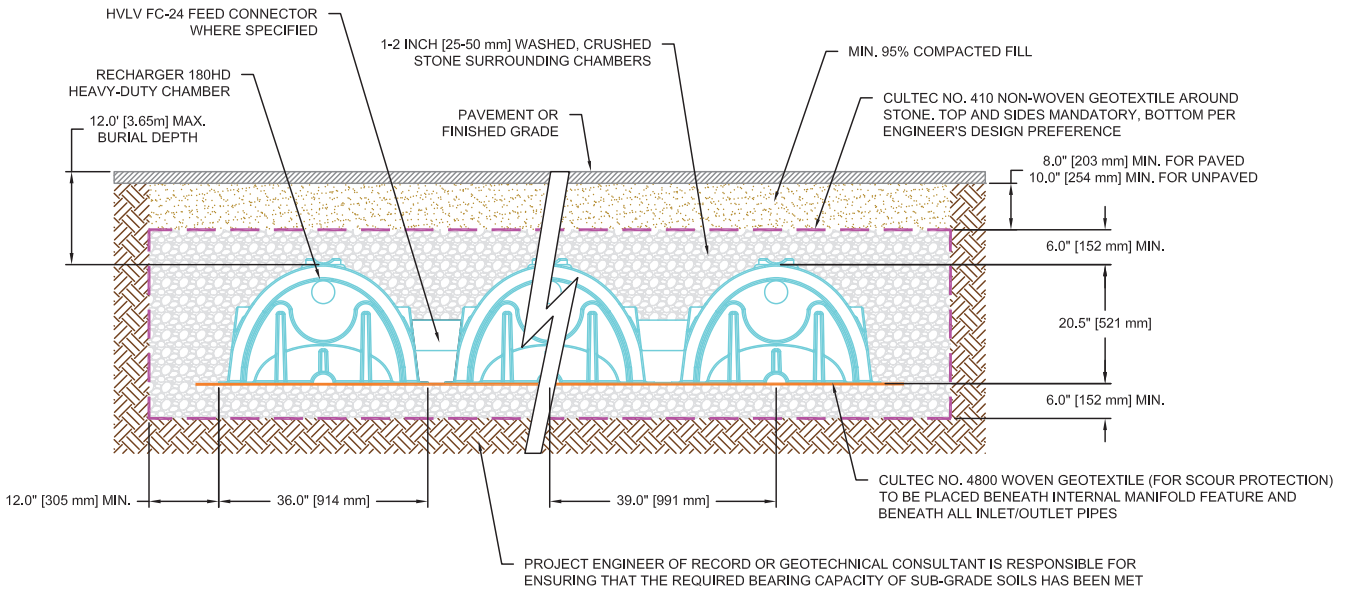


CULTEC Recharger® 180HD Stormwater Chamber

Plan View Drawing



Typical Cross Section for Traffic Application



For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.



CULTEC Recharger® 180HD Specifications

GENERAL

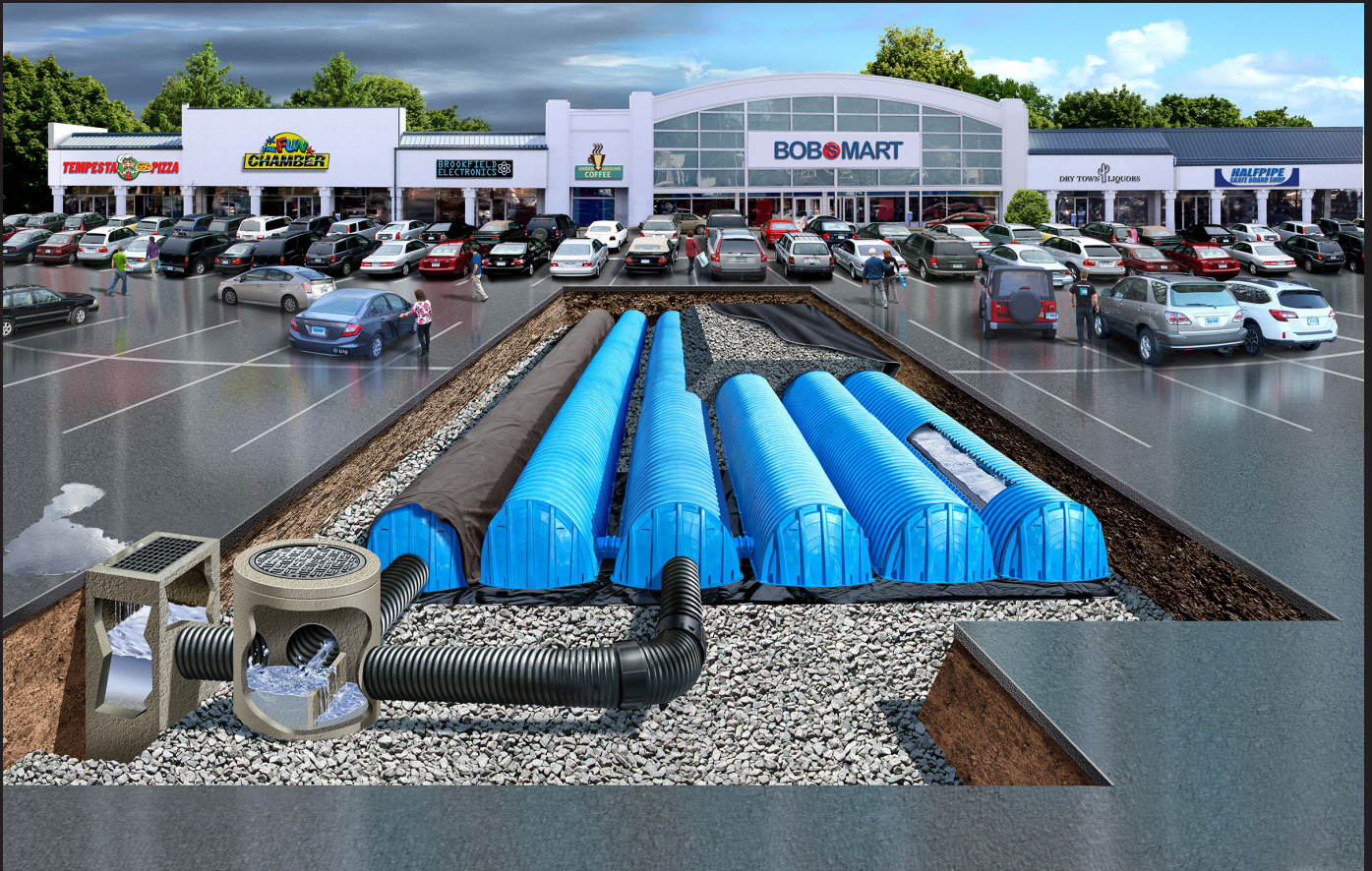
CULTEC Recharger® 180HD chambers are designed for underground stormwater management. The chambers may be used for retention, recharging, detention or controlling the flow of on-site stormwater runoff.

CHAMBER PARAMETERS

1. The chambers will be manufactured in the U.S.A. by CULTEC, Inc. of Brookfield, CT (cultec.com, 203-775-4416).
2. The chamber shall be vacuum thermoformed of polyethylene with a black interior and blue exterior.
3. The chamber will be arched in shape.
4. The chamber will be open-bottomed.
5. The chamber will be joined using an interlocking overlapping rib method. Connections must be fully shouldered overlapping ribs, having no separate couplings or separate end walls.
6. The nominal chamber dimensions of the CULTEC Recharger® 180HD shall be 20.5 inches (521 mm) tall, 36 inches (914 mm) wide and 7.33 feet (2.23 m) long. The installed length of a joined Recharger® 180HD shall be 6.33 feet (1.93 m).
7. Maximum inlet opening on the chamber endwall is 15 inches (375 mm) HDPE.
8. The chamber will have two side portals to accept CULTEC HVLV® FC-24 Feed Connectors to create an internal manifold. Maximum allowable O.D. in the side portal is 10 inches (250 mm) HDPE and 12 inches (300 mm) PVC.
9. The nominal chamber dimensions of the CULTEC HVLV® FC-24 Feed Connector shall be 12 inches (305 mm) tall, 16 inches (406 mm) wide and 24.2 inches (614 mm) long.
10. The nominal storage volume of the Recharger® 180HD chamber will be 3.445 ft³ / ft (0.32 m³ / m) - without stone. The nominal storage volume of a single Recharger 180RHD Stand Alone unit shall be 25.25 ft³ (0.72 m³) - without stone. The nominal storage volume of a joined Recharger® 180IHD Intermediate unit shall be 21.81 ft³ (0.62 m³) - without stone. The nominal storage volume of the length adjustment amount per run shall be 3.445 ft³ (0.32 m³) - without stone. The nominal storage volume of the HVLV® FC-24 Feed Connector will be 0.913 ft³ / ft (0.085 m³ / m) - without stone.
11. The Recharger® 180HD chamber will have seventy-eight discharge holes bored into the sidewalls of the unit's core to promote lateral conveyance of water.
12. The Recharger® 180HD chamber shall have 14 corrugations.
13. The endwall of the chamber, when present, will be an integral part of the continuously formed unit. Separate end plates cannot be used with this unit.
14. The Recharger® 180RHD Stand Alone/Starter unit must be formed as a whole chamber having two fully formed integral endwalls and having no separate end plates or separate end walls.
15. The Recharger® 180SHD Starter unit must be formed as a whole chamber having one fully formed integral end wall and one partially formed integral end wall with a lower transfer opening of 7 inches (178 mm) high x 24 inches (610 mm) wide.
16. The Recharger® 180IHD Intermediate unit must be formed as a whole chamber having one fully open end wall and one partially formed integral end wall with a lower transfer opening of 7 inches (178 mm) high x 24 inches (610 mm) wide.
17. The Recharger® 180EHD End unit must be formed as a whole chamber having one fully formed integral endwall and one fully open end wall and having no separate end plates or end walls.
18. The HVLV® FC-24 Feed Connector must be formed as a whole chamber having two open end walls and having no separate end plates or separate end walls. The unit will fit into the side portals of the Recharger® 180HD and act as cross feed connections.
19. Chambers must have horizontal stiffening flex reduction steps between the ribs.
20. The chamber will have a raised integral cap at the top of the arch in the center of each unit to be used as an optional inspection port or clean-out.
21. The units may be trimmed to custom lengths by cutting back to any corrugation on the large rib end.
22. The chamber shall be manufactured in an ISO 9001:2015 certified facility.
23. Maximum allowable cover over the top of the chamber shall be 12' (3.66 m).
24. The chamber shall be designed and manufactured to meet the material and structural requirements of IAPMO PS 63-2019, including resistance to AASHTO H-10 highway live loads, when installed in accordance with CULTEC's installation instructions.
25. The chamber will be designed to withstand traffic loads when installed according to CULTEC's recommended installation instructions.

CONTACTOR® & RECHARGER®

STORMWATER MANAGEMENT SOLUTIONS



OPERATION & MAINTENANCE GUIDELINES FOR CULTEC STORMWATER MANAGEMENT SYSTEMS



OPERATIONS AND MAINTENANCE GUIDELINES

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For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

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Doc ID: CLT057 01-20

January 2020

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC. All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings. Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

- A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.
- B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.
 1. **Manhole Access**
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. StormFilter Access

Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

- C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

- A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.
- B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.
- C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.
- D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance

The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance

The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	<ul style="list-style-type: none"> Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	<ul style="list-style-type: none"> Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	<ul style="list-style-type: none"> Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	<ul style="list-style-type: none"> Clean stormwater management chambers and feed connectors of any debris. Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	<ul style="list-style-type: none"> Clean stormwater management chambers and feed connectors of any debris. Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. Attain the appropriate approvals as required. Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1 st year	<ul style="list-style-type: none"> Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	<ul style="list-style-type: none"> Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	<ul style="list-style-type: none"> Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

WQMP Operation & Maintenance (O&M) Plan

Project Name: _____

Prepared for:

Project Name: _____

Address: _____

City, State Zip: _____

Prepared on:

Date: _____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer’s maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11" by 17" colored sheets, as long as legible.

Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Month 1	Date:	
<input type="checkbox"/> Month 2	Date:	
<input type="checkbox"/> Month 3	Date:	
<input type="checkbox"/> Month 4	Date:	
<input type="checkbox"/> Month 5	Date:	
<input type="checkbox"/> Month 6	Date:	
<input type="checkbox"/> Month 7	Date:	
<input type="checkbox"/> Month 8	Date:	
<input type="checkbox"/> Month 9	Date:	
<input type="checkbox"/> Month 10	Date:	
<input type="checkbox"/> Month 11	Date:	
<input type="checkbox"/> Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
<input type="checkbox"/> Year 1	Date:	
<input type="checkbox"/> Year 4	Date:	
<input type="checkbox"/> Year 7	Date:	
<input type="checkbox"/> Year 10	Date:	
<input type="checkbox"/> Year 13	Date:	
<input type="checkbox"/> Year 16	Date:	
<input type="checkbox"/> Year 19	Date:	
<input type="checkbox"/> Year 22	Date:	

Major Maintenance

Frequency		Action
Inlets and Outlets	Every 3 years	
	Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.	
	Notes	
	<input type="checkbox"/> Year 1	Date:
	<input type="checkbox"/> Year 4	Date:
	<input type="checkbox"/> Year 7	Date:
	<input type="checkbox"/> Year 10	Date:
	<input type="checkbox"/> Year 13	Date:
	<input type="checkbox"/> Year 16	Date:
	<input type="checkbox"/> Year 19	Date:
	<input type="checkbox"/> Year 22	Date:
	Spring and Fall	
	Check inlet and outlets for clogging and remove any debris, as required.	
	Notes	
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
	<input type="checkbox"/> Spring	Date:
	<input type="checkbox"/> Fall	Date:
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
<input type="checkbox"/> Spring	Date:	
<input type="checkbox"/> Fall	Date:	
CULTEC Stormwater Chambers	2 years after commissioning	
	<input type="checkbox"/> Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. <input type="checkbox"/> Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.	
Notes		
<input type="checkbox"/> Year 2	Date:	

Major Maintenance

Frequency		Action	
CULTEC Stormwater Chambers	9 years after commissioning every 9 years following		
	<ul style="list-style-type: none"> <input type="checkbox"/> Clean stormwater management chambers and feed connectors of any debris. <input type="checkbox"/> Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. <input type="checkbox"/> Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended. 		
	Notes		
	<input type="checkbox"/> Year 9	Date:	
	<input type="checkbox"/> Year 18	Date:	
	<input type="checkbox"/> Year 27	Date:	
	<input type="checkbox"/> Year 36	Date:	
45 years after commissioning			
<ul style="list-style-type: none"> <input type="checkbox"/> Clean stormwater management chambers and feed connectors of any debris. <input type="checkbox"/> Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. <input type="checkbox"/> Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. <input type="checkbox"/> Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. <input type="checkbox"/> Attain the appropriate approvals as required. <input type="checkbox"/> Establish a new operation and maintenance schedule. 			
Notes			
<input type="checkbox"/> Year 45	Date:		

Major Maintenance

Frequency		Action	
Surrounding Site	Monthly in 1st year		
	<input type="checkbox"/> Check for depressions in areas over and surrounding the stormwater management system.		
	Notes		
	<input type="checkbox"/> Month 1	Date:	
	<input type="checkbox"/> Month 2	Date:	
	<input type="checkbox"/> Month 3	Date:	
	<input type="checkbox"/> Month 4	Date:	
	<input type="checkbox"/> Month 5	Date:	
	<input type="checkbox"/> Month 6	Date:	
	<input type="checkbox"/> Month 7	Date:	
	<input type="checkbox"/> Month 8	Date:	
	<input type="checkbox"/> Month 9	Date:	
	<input type="checkbox"/> Month 10	Date:	
	<input type="checkbox"/> Month 11	Date:	
	<input type="checkbox"/> Month 12	Date:	
	Spring and Fall		
	<input type="checkbox"/> Check for depressions in areas over and surrounding the stormwater management system.		
	Notes		
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	<input type="checkbox"/> Spring	Date:	
	<input type="checkbox"/> Fall	Date:	
	Yearly		
	<input type="checkbox"/> Confirm that no unauthorized modifications have been performed to the site.		
Notes			
<input type="checkbox"/> Year 1	Date:		
<input type="checkbox"/> Year 2	Date:		
<input type="checkbox"/> Year 3	Date:		
<input type="checkbox"/> Year 4	Date:		
<input type="checkbox"/> Year 5	Date:		
<input type="checkbox"/> Year 6	Date:		
<input type="checkbox"/> Year 7	Date:		



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RETENTION • DETENTION • INFILTRATION • WATER QUALITY



Art Credit: Margie Winter

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

Objectives

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

Targeted Constituents

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



Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

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

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- 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” stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of “as-built” piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory

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

Review Infield Piping

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

Smoke Testing

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

Dye Testing

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

TV Inspection of Drainage System

- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post “No Dumping” signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

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

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.
- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.
- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.
- Cost for containment and disposal is borne by the discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- 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

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a “non-stormwater” discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

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

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

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

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

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

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

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

Spill Prevention, Control & Cleanup SC-11



Photo Credit: Geoff Brosseau

Objectives

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

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

Targeted Constituents

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



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- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- If consistent illegal dumping is observed at the facility:
 - Post “No Dumping” signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
 - Landscaping and beautification efforts may also discourage illegal dumping.
 - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.
- Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.
- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.
- Routine maintenance:
 - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
 - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site’s spill control plan and/or proper spill cleanup procedures.
 - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

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- Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.
- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:
 - Types and quantities (in some cases) of wastes
 - Patterns in time of occurrence (time of day/night, month, or year)

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- Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

Training

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
 - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
 - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

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

Requirements

Costs (including capital and operation & maintenance)

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

Maintenance (including administrative and staffing)

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

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Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

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

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

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

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

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from

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tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

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

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

Spill Prevention, Control & Cleanup SC-11

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.
- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always 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.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. 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.

SC-11 Spill Prevention, Control & Cleanup

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
 - Cover fueling area if possible.
 - Use a perimeter drain or slope pavement inward with drainage to a sump.
 - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage “topping-off” of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

Spill Prevention, Control & Cleanup SC-11

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

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

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

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

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

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



Photo Credit: Geoff Brosseau

Description

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

Approach

Pollution Prevention

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

Objectives

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

Targeted Constituents

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



Suggested Protocols*General*

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

Controlling Litter

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

Waste Collection

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. 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 added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

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

Good Housekeeping

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

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

Run-on/Runoff Prevention

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

Inspection

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.

- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training

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

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
 - Vehicles equipped with baffles for liquid waste
 - Trucks with sealed gates and spill guards for solid waste

Other Considerations (Limitations and Regulations)

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

Requirements***Costs***

Capital and O&M costs for these programs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance

- None except for maintaining equipment for material tracking program.

Supplemental Information***Further Detail of the BMP******Land Treatment System***

Minimize runoff of polluted stormwater from land application by:

- Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, and there is a closed drainage system

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water
- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site
- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)
- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins
- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples

The port of Long Beach has a state-of-the-art database for identifying potential pollutant sources, documenting facility management practices, and tracking pollutants.

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>

Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety. Harvard University. 2002.

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

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/>



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.

Objectives

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

Targeted Constituents

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



SC-41 Building & Grounds Maintenance

- 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.

SC-41 Building & Grounds Maintenance

- 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/>



Description

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

Approach

Pollution Prevention

- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practical.
- Buy recycled products to the maximum extent practical.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Recycle

Targeted Constituents

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



SC-42 Building Repair and Construction

- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Suggested Protocols

Repair & Remodeling

- Follow BMPs identified in Construction BMP Handbook.
- Maintain good housekeeping practices while work is underway.
- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Cover materials of particular concern that must be left outside, particularly during the rainy season.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store materials properly that are normally used in repair and remodeling such as paints and solvents.
- Sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout if when repairing roofs, small particles have accumulated in the gutter. 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 vac truck, and clean the catch basin sump where you placed the plug.
- Properly store and dispose waste materials generated from construction activities. See Construction BMP Handbook.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.
- 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 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% effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.

- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is significant risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Training

Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Limitations

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more requirements for larger projects. The companion "Construction Best Management Practice Handbook" contains specific guidance and best management practices for larger-scale projects.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.

SC-42 Building Repair and Construction

Requirements

Costs

These BMPs are generally low to modest in cost.

Maintenance

N/A

Supplemental Information

Further Detail of the BMP

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice 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 or 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. See Treatment Control Fact Sheet TC-20 Wet Pond/Basin in Section 5 of the New Development and Redevelopment Handbook regarding design criteria. Include in the catch basin a “turn-down” elbow or similar device to trap floatables.

References and Resources

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

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

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

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

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

Parking/Storage Area Maintenance SC-43



Description

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

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage 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.

Pollution Prevention

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

Objectives

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

Targeted Constituents

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



SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

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

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, 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.
- 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.
 - Dispose of parking lot sweeping debris and dirt at a landfill.
- 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.

Parking/Storage Area Maintenance SC-43

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- 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, etc. Leave covers in place until job is complete 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, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

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

Training

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

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

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

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>

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

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

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

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



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Approach

Pollution Prevention

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 system functions properly hydraulically to avoid flooding.

Suggested Protocols

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% full. Catch basins should be cleaned as frequently as needed to meet this standard.
 - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

Targeted Constituents

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



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. Clean and repair 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 properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect 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 removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Stream or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:
 - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of 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” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly 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.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Allow only properly trained individuals to handle hazardous materials/wastes.
- Have staff involved in detection and removal of illicit connections trained in the following:
 - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- 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.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.
- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:
 - Purchase and installation of signs.
 - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.
 - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.
 - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vacuor 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.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in 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 drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby 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 may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

SC-44 Drainage System Maintenance

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>

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

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

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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



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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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



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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

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.

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.

Design Objectives

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



- 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.

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APPENDIX F