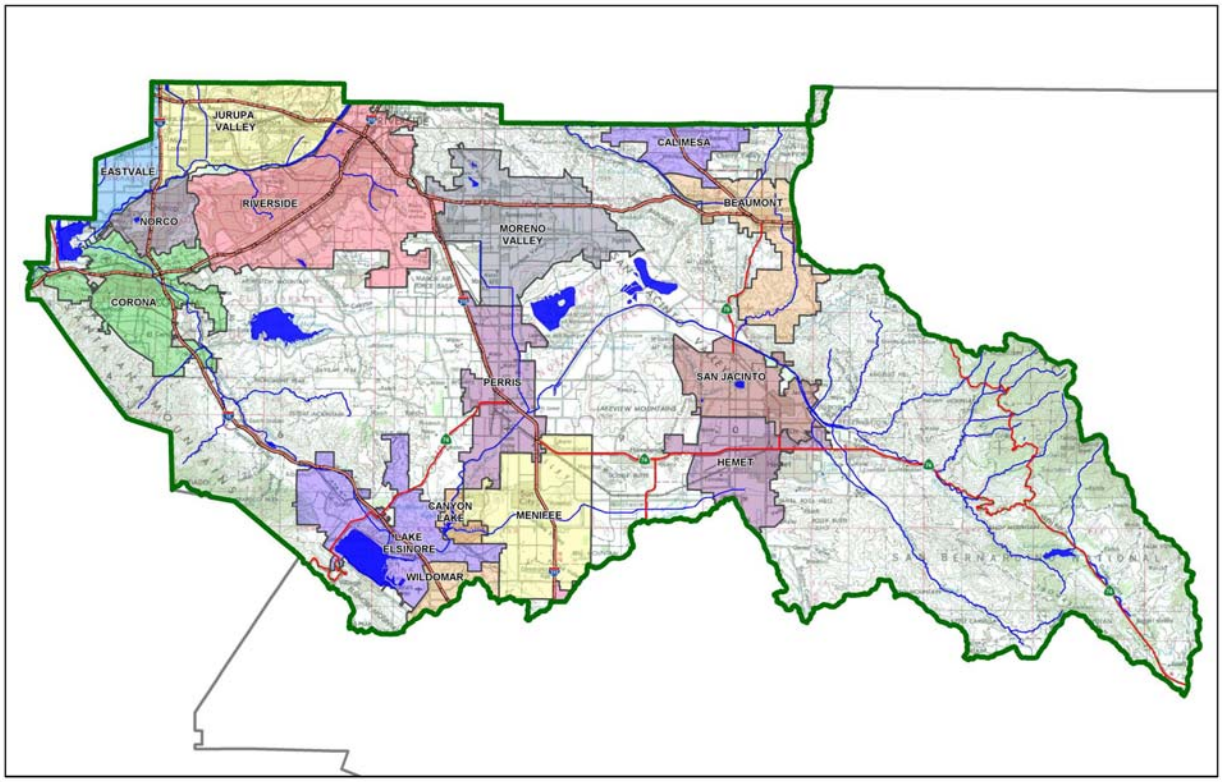
Project Specific Water Quality Management Plan

*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: Moreno Valley Vogel Industrial

Development No:

Design Review/Case No: PA16-0002



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☐ **Preliminary**
☒ **Final**

Original Date Prepared: 08/15/2016

Revision Date(s):

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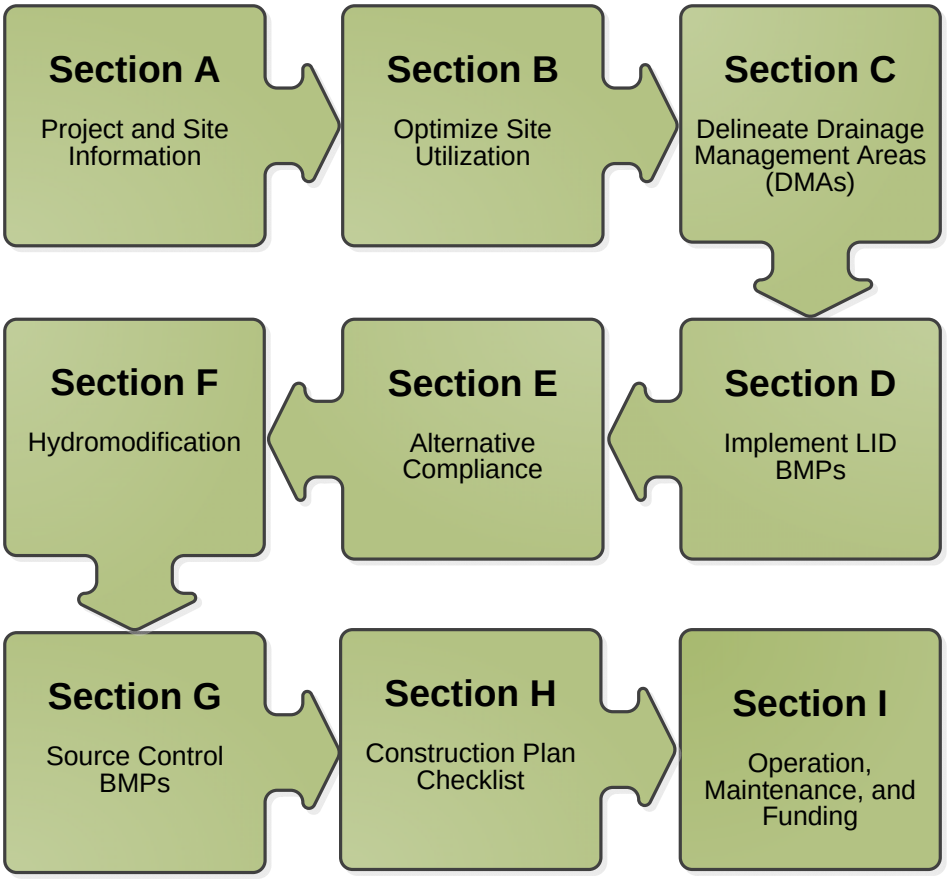
Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**

A Brief Introduction

This Project-Specific WQMP Template for the **Santa Ana Region** has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your "how-to" manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Sares Regis Group by Huitt-Zollars, Inc. for the Moreno Valley Vogel Industrial project.

This WQMP is intended to comply with the requirements of City of Moreno Valley for APN: 316-210-19, 20, 57 and 77 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under City of Moreno Valley Water Quality Ordinance (Municipal Code Section 8.10).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature	JULY 25, 2016 Date
PATRICK RUSSELL Owner's Printed Name	VICE PRESIDENT Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

Preparer's Signature	7-27-16 Date
DAVID WHITE Preparer's Printed Name	PROJECT MANAGER Preparer's Title/Position

Preparer's Licensure:

REGISTERED PROFESSIONAL ENGINEER
DAVID L. WHITE
NO. C52921
EXP. 12-31-~~12~~ 16
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STATE OF CALIFORNIA

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT **CIVIL CODE § 1189**

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

State of California)
County of Orange)
On July 25, 2016 before me, Bridgit Lauri Brannon-Terpening, Notary Public
Date *Here Insert Name and Title of the Officer*
personally appeared Patrick Russell
Name(s) of Signer(s)

who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

BRIDGIT LAURI BRANNON-TERPENING
Commission # 2068054
Notary Public - California
Orange County
My Comm. Expires May 12, 2018

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal.

Signature Bridgit Lauri Brannon-Terpening
Signature of Notary Public

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Industrial
Planning Area:	850,829 SF (~19.6 Acres)
Community Name:	Moreno Vogel Valley Industrial
Development Name:	Moreno Valley Vogel Industrial
	The project is a new development of an industrial warehouse facility located at the southwest corner of Indian Street and Grove View Road, in the City of Moreno Valley. The proposed building is approximately 446,350 square feet in size on approximately 19.6 acres of an undeveloped land. New curb, gutter and commercial driveway entrances will be installed along Indian Street. The existing site is vacant and slopes gently from northwest to southeast. Runoff is collected in a headwall along Indian Street and conveyed to the Perris Valley Channel via the Indian Street storm drain.
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°51'42.76"N & 117°14'13.48"W	
Project Watershed and Sub-Watershed: Santa Ana Watershed & San Jacinto Watershed	
APN(s): APN: 316-210-19, 20, 57 and 77	
Map Book and Page No.: Thomas Bros. Map, Page 747	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Industrial
Proposed or Potential SIC Code(s)	4225
Area of Impervious Project Footprint (SF)	743,934
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	743,934
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	0
Is the project located within any MSHCP Criteria Cell? (see next page)	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	N/A
What is the Water Quality Design Storm Depth for the project?	0.63"

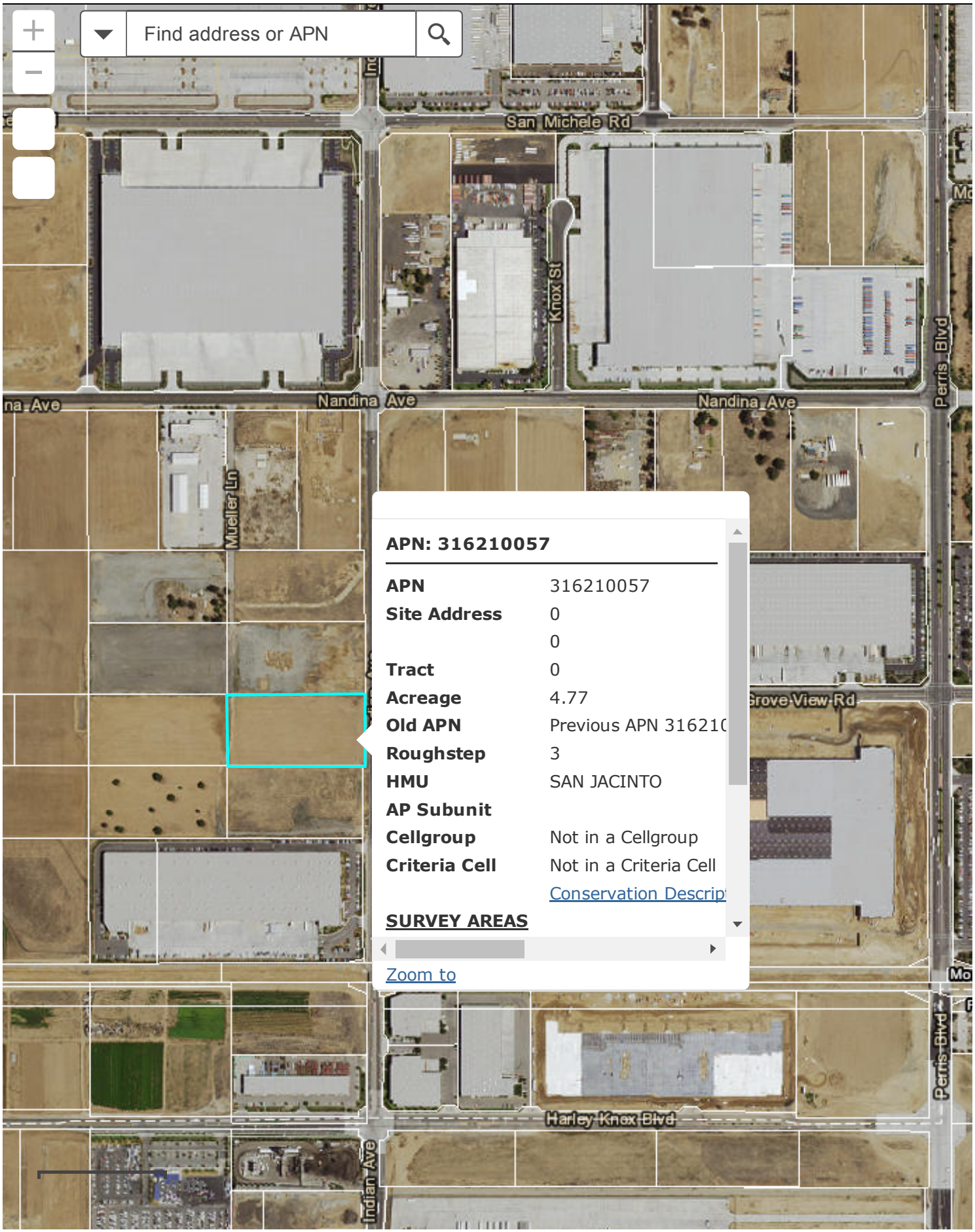
A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling

RCA MSHCP Information App

with Web AppBuilder for ArcGIS



Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
San Jacinto River Reach 3, HU#802.11	NONE	AGR, GWR, REC1, REC2, WARM, WILD	Not designated as RARE
Canyon Lake (Railroad Canyon Reservoir), HU#802.11, 802.12	Nutrients, Pathogens	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not designated as RARE
San Jacinto River Reach 1, HU#802.32,802.31	NONE	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not designated as RARE
Lake Elsinore HU#802.31	Nutrients, Organic Enrichment/Low Dissolved Oxygen, PCB's, Sedimentation/Siltation, Unknown Toxicity	MUN, REC1, REC2, WARM, WILD	Not designated as RARE

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* City of Moreno Valley Building & Grading Permits Riverside County FCD – Connection Permit to public storm drain in Indian Street	☒ Y	☐ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, constraints might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. Opportunities might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

Yes. The site mimics the existing topography by draining from northwest to southeast.

Did you identify and protect existing vegetation? If so, how? If not, why?

No. The site has no existing vegetation to protect. The planting of new vegetation will be occur throughout the site.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

Yes. Natural infiltration capacity was identified by the soil (infiltration) report, however it is below the minimum rate.

Did you identify and minimize impervious area? If so, how? If not, why?

No. The developer has chosen to maximize the building and parking footprint.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Yes. Runoff will be directed to proposed bioretention basins 1, 2, & 3 on the east and southeast corner of the project site.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA A	Mixed Surface Types	358,418	D
DMA B	Mixed Surface Types	492,411	D

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*

Table C.2 Type 'A', Self-Treating Areas (N/A)

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)

Table C.3 Type 'B', Self-Retaining Areas (N/A)

Self-Retaining Area				**Type 'C' DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas (N/A)

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Runoff factor	Product	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA A	Bioretention Basin 1 & 2 (Basins are linked by a 18" RCP)
DMA B	Bioretention Basin 3

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site. If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	X	
If Yes, list affected DMAs:	DMA A & B	
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies*:*

- ☒ Reclaimed water will be used for the non-potable water demands for the project.
- ☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).
- ☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If neither of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: Insert Area (Acres)

Type of Landscaping (Conservation Design or Active Turf): List Landscaping Type

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: EIATIA Factor

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: Insert Area (Acres)

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)
Insert Area (Acres)	Insert Area (Acres)

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users: Number of daily Toilet Users

Project Type: Enter 'Residential', 'Commercial', 'Industrial' or 'Schools'

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-1 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: TUTIA Factor

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: Required number of toilet users

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
Insert Area (Acres)	Insert Area (Acres)

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

Insert text here describing how each included Site Design BMP will be implemented.

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand: Projected Average Daily Use (gpd)

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: Insert Area (Acres)

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-3 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-3: Enter Value

Step 4: Multiply the unit value obtained from Step 4 by the total of impervious areas from Step 3 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: Minimum use required (gpd)

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
Minimum use required (gpd)	Projected Average Daily Use (gpd)

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment, unless a site-specific analysis has been completed that demonstrates technical infeasibility as noted in D.3 below.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

■ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA A	☐	☐	☒	☐	☐
DMA B	☐	☐	☒	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

Base on the information provided in Section D, bioretention LID BMP will be utilized for the entire site.

1. According to the Riverside County WQMP Guidance (attached in the next page) and the Soil Infiltration Study by NorCal Engineering (see Appendix 3), the recommended infiltration design rate is 0.5 in/hr (<1.6 in/hr), therefore these DMAs are not feasible for Infiltration BMP.

2. Reclaimed water will be used for the non-potable water demands for the project; therefore, Harvest and Use is not a required BMP.

3. Design infiltration rate is 0.5 in/hr which is less than 1.6 in/hr but more than 0.3 in/hr, so use Bioretention BMP.

See Appendix 1 Post-Construction BMP Site Map for bioretention basin detail.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First**,** calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet) [A]	Post-Project Surface Type	Effective Impervious Fraction, I_f [B]	DMA Runoff Factor [C]	DMA Areas x Runoff Factor [A] x [C]	*Enter BMP Name / Identifier Here*		
						Design Storm Depth (in)	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA A	*358,418*	*Mixed Surface Types*	*0.88*	*0.70*	*251,535*			
DMA B	*492,411*	*Mixed Surface Types*	*0.87*	*0.69*	*338,776*			
	$A_T = \Sigma[A]$	***850,829***			Σ= 590,311	[D] 0.63	$[F] = \frac{[D] \times [E]}{12}$ 30,991	[G] 32,272

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document

[E] is obtained from Exhibit A in the WQMP Guidance Document

[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

■ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☐ Attached Residential Development	P	N	P	P	N	P	P	P(2)
☒ Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐ Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐ Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐ Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☐ Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☐ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☒	☒	☒	☒	☒	☒	☒	☒

P = Potential
N = Not Potential
(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected
(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected
(3) A potential Pollutant is land use involving animal waste
(4) Specifically petroleum hydrocarbons
(5) Specifically solvents
(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
N/A	
Total Credit Percentage[1]	

[1]*Cannot Exceed 50%*
[2]*Obtain corresponding data from Table 3-8 in the WQMP Guidance Document*

E.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	**DMA Area (square feet)** [A]	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f** [B]	**DMA Runoff Factor** [C]	**DMA Area x Runoff Factor** [A] x [C]			***Enter BMP Name / Identifier Here***	
						Design Storm Depth (in)	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
	A_T = Σ[A]				Σ= [D]	[E]	$[F] = \frac{[D] \times [E]}{[G]}$	[F] X (1-[H])	[I]

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
Bioretention Basin	Bacteria, Metals, Nutrients, Pesticides, Toxic Organic Compounds, Sediments, Trash & Debris, and Oil & Grease	High (per Riverside Flood Control LID BMP Design Handbook Appendix E, see Appendix 6).

[1] *Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.*
[2] *Cross Reference Table E.1 above to populate this column.*
[3] *As documented in a Co-Permittee Approved Study and provided in Appendix 6.*

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration	INSERT VALUE	INSERT VALUE	INSERT VALUE
Volume (Cubic Feet)	INSERT VALUE	INSERT VALUE	INSERT VALUE

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

Does the project qualify for this HCOC Exemption? ☒ Y ☐ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

All the runoff from the project site will be directed to public storm drain in Indian Street and convey to Lake Elsinore, Santa Ana River, and then to Pacific Ocean.

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources*:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit*:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative*:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-Site Storm Drain Inlet	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	• Maintain and periodically repaint or replace inlet markings. • Provide stormwater pollution prevention information to new site owners, lessees, or operators. • See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com • Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."

Loading Docks		• Move loaded and unloaded items indoors as soon as possible. See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Fire Sprinkler Test Water		• Provide a means to drain fire sprinkler test water to the sanitary sewer.
Plazas, sidewalks, and parking lots.		• Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

Information will be provided after the Conceptual Grading Plan gets approved.

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: Insert text here describing how each included Site Design BMP will be implemented.

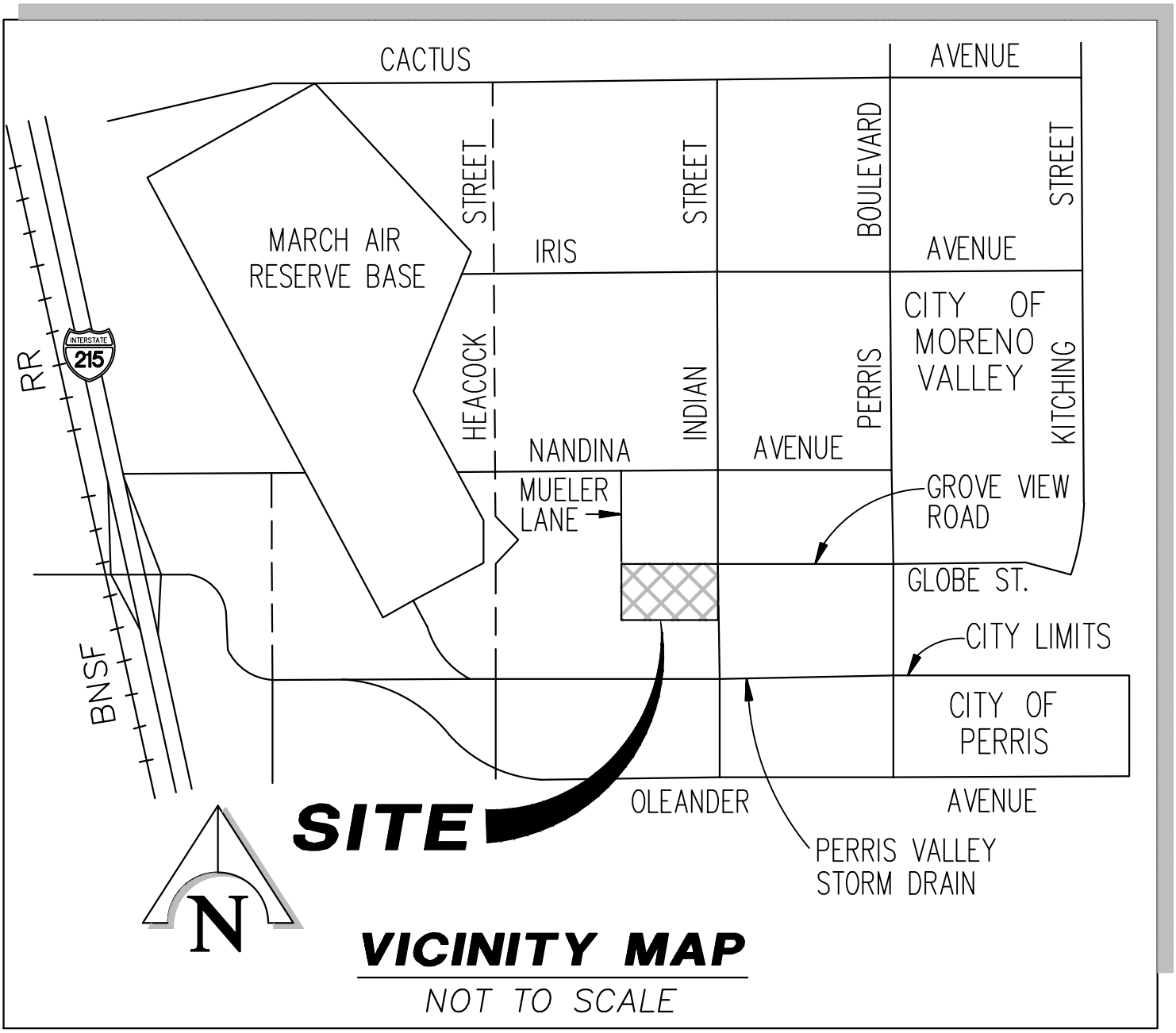
Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☐ Y ☒ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

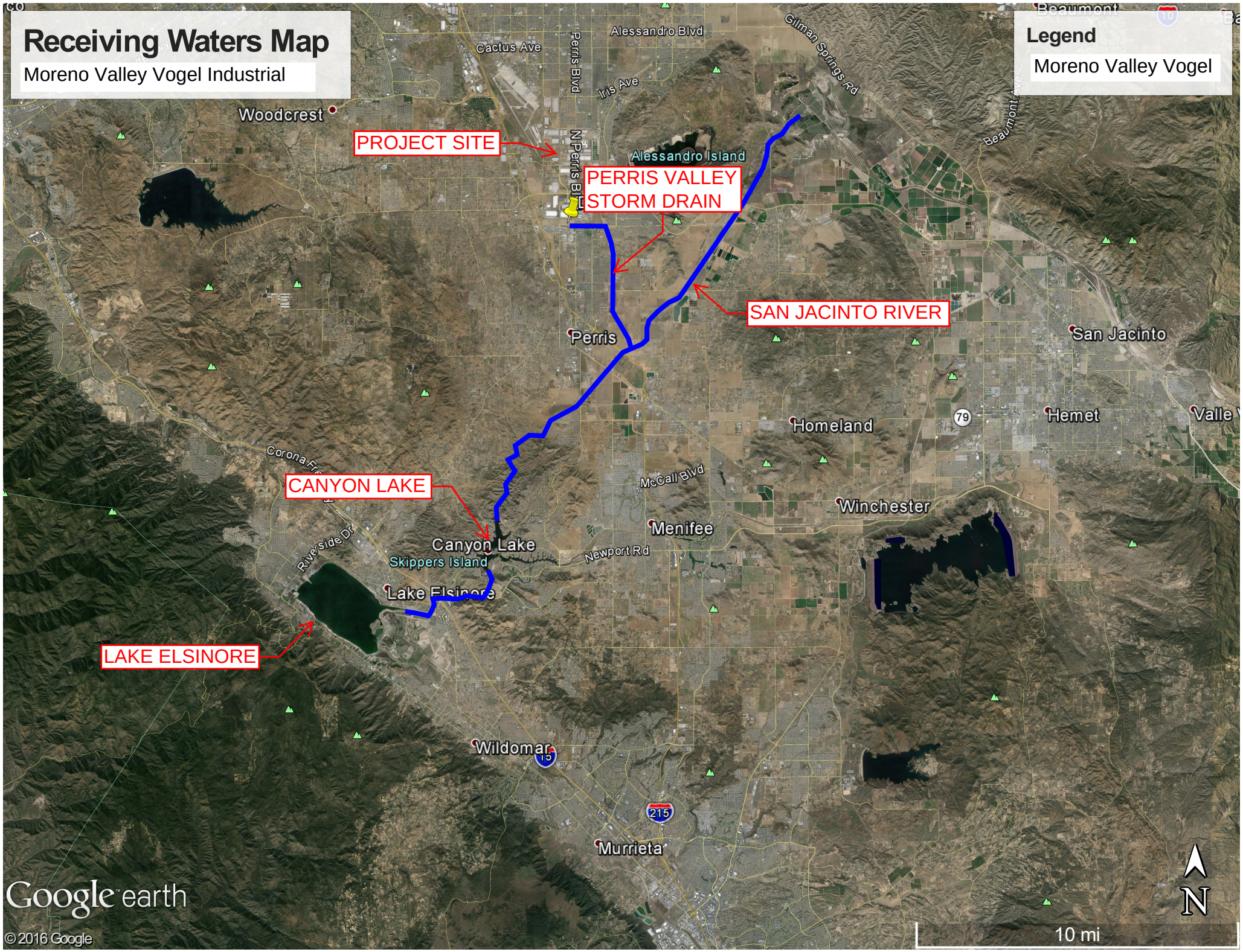


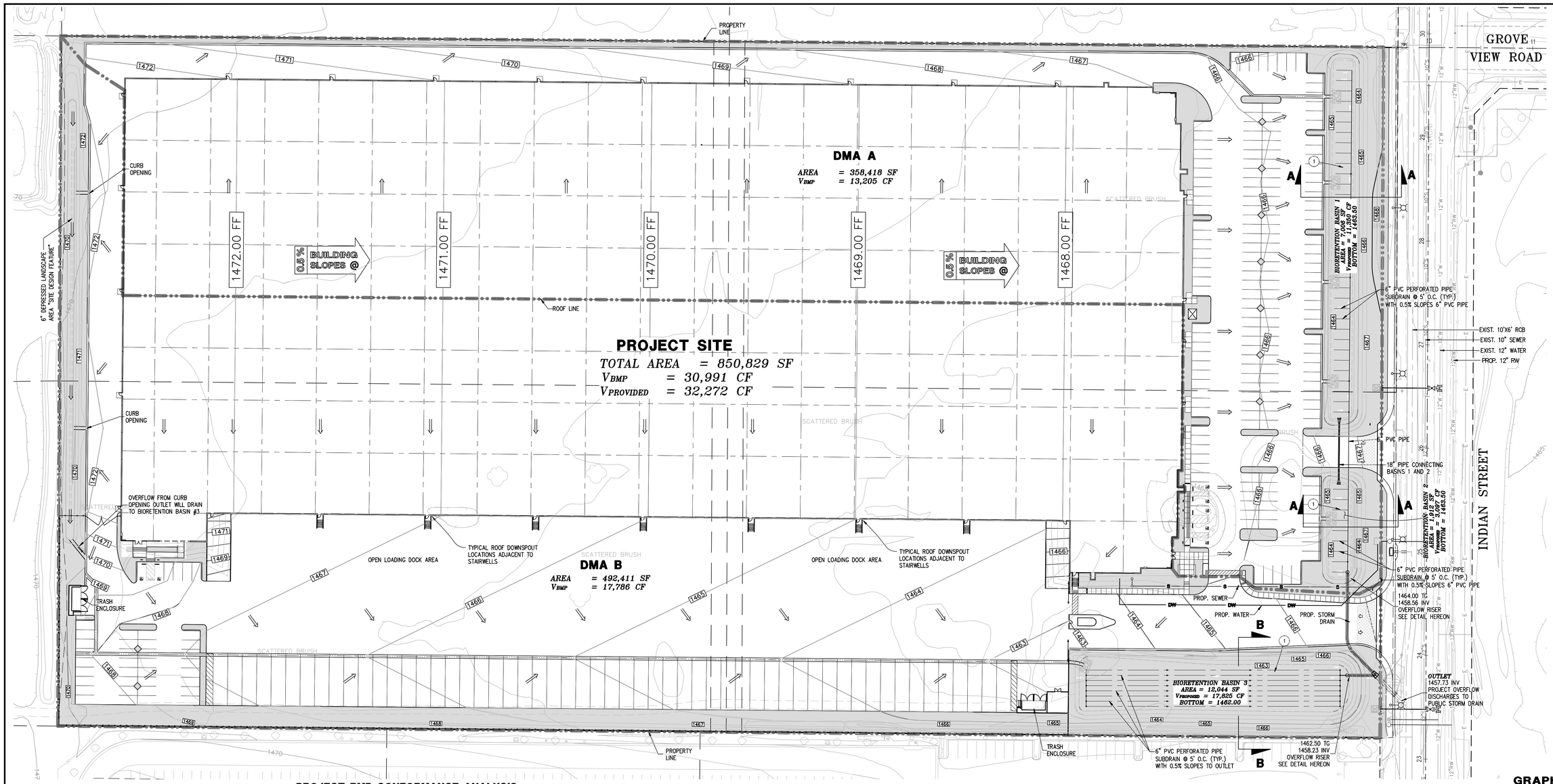
VICINITY MAP

NOT TO SCALE

Receiving Waters Map

Moreno Valley Vogel Industrial





WQMP BMP NOTES

(1) BIORETENTION BASIN, SEE DETAIL HEREON

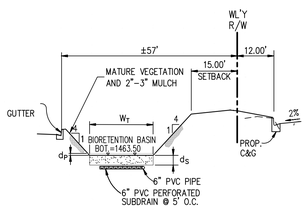
LEGEND

- SD — PROPOSED STORM DRAIN
- WQMP BOUNDARY
- PROPOSED CURB OPENING INLET W/ FILTER INSERT
- PROPOSED LANDSCAPING AREA
- CB — CATCH BASIN
- TG — TOP OF GRATE
- FLOW DIRECTION

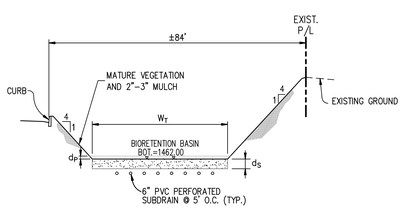
PROJECT BMP CONFORMANCE ANALYSIS

NAME	AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	i	C	V_{BMP} (CF)	BMP	$A_{PROVIDE}$ (SF)	$V_{PROVIDE}$ (CF)
DMA A	358,418	315,832	42,586	0.88	0.70	13,205	*BIORETENTION BASIN 1 & 2	7,006+1,912 = 8,918	11,350+3,097 = 14,447
DMA B	492,411	428,102	64,309	0.87	0.69	17,786	BIORETENTION BASIN 3	12,044	17,825

*THE BIORETENTION BASIN 1 AND 2 ARE LINKED TOGETHER BY A 18" RCP



SECTION A-A (TYP.)
N.T.S.

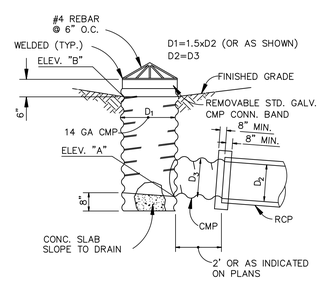


SECTION B-B
N.T.S.

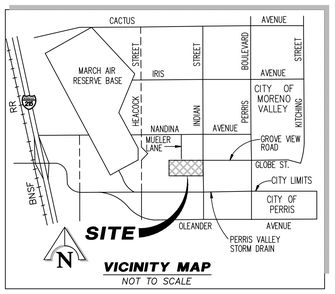
NAME	d_P (FT)	d_S (FT)	W_T (FT)	d_E (FT)	$A_{PROVIDE}$ (SF)	$V_{PROVIDE}$ (CF)
*BIORETENTION BASIN 1	0.50	2.5	20	1.62	7,006	11,350
*BIORETENTION BASIN 2	0.50	2.5	20	1.62	1,912	3,097
BIORETENTION BASIN 3	0.50	2.0	40	1.48	12,044	17,825

*THE BIORETENTION BASIN 1 AND 2 ARE LINKED TOGETHER BY A 18" RCP

BIORETENTION BASIN
N.T.S.



OVERFLOW RISER DETAIL
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

EFFECTIVE AREA

BUILDING AREA (SF)	PROJECT AREA (SF)	FAR = FLOOR AREA RATIO	EFFECTIVE AREA (%)	EFFECTIVE AREA FOR BMP (SF)		EFFECTIVE AREA PROVIDE (SF)
446,350	850,829	446,350/850,829 = 0.52	10%	85,083	<	106,895

PROJECT AREA BREAKDOWN

PROJECT TOTAL AREA:	850,829 SF
PROJECT ROOF AREA:	436,292 SF
PROJECT PAVEMENT AREA:	307,642 SF
PROJECT LANDSCAPE AREA:	106,895 SF

BENCH MARK	BASIS OF BEARING
RIVERSIDE COUNTY FLOOD CONTROL BENCHMARK NO. M-31. ELEVATION 1474.674 (NGVD29) LOCATION 3 1/4" ALUMINUM DISK STAMPED "RIV. CO. BENCHMARK M-31 RESET APRIL 1996", FLUSH AT S.W. CORNER OF BRIDGE ON TOP OF SIDEWALK NEAR FACE OF CURB LOCATED AT THE CROSSING OF PERRIS BLVD. AND R.C.F.C. CHANNEL (PERRIS LATERAL "A") 43 FT WEST OF THE CENTERLINE OF PERRIS BLVD. AND 4.5 FT EAST OF CONCRETE BRIDGE BARRIER	BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN CORS STATION PPBF AND CORS STATION MUFP BEING NORTH 53°20'18" WEST PER RECORDS ON FILE WITH THE CALIFORNIA SPATIAL REFERENCE CENTER (CSRC).

REGISTERED PROFESSIONAL ENGINEER — MAURICE H. MURAD — NO. 33366 — EXPIRATION 6-30-2018 — CIVIL — STATE OF CALIFORNIA

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

PREPARED UNDER THE SUPERVISION OF:

MAURICE H. MURAD — DATE
R.C.E. NO. 33366 EXP. 6/30/18

CITY OF MORENO VALLEY

WATER QUALITY MANAGEMENT PLAN

MORENO VALLEY VOGEL INDUSTRIAL

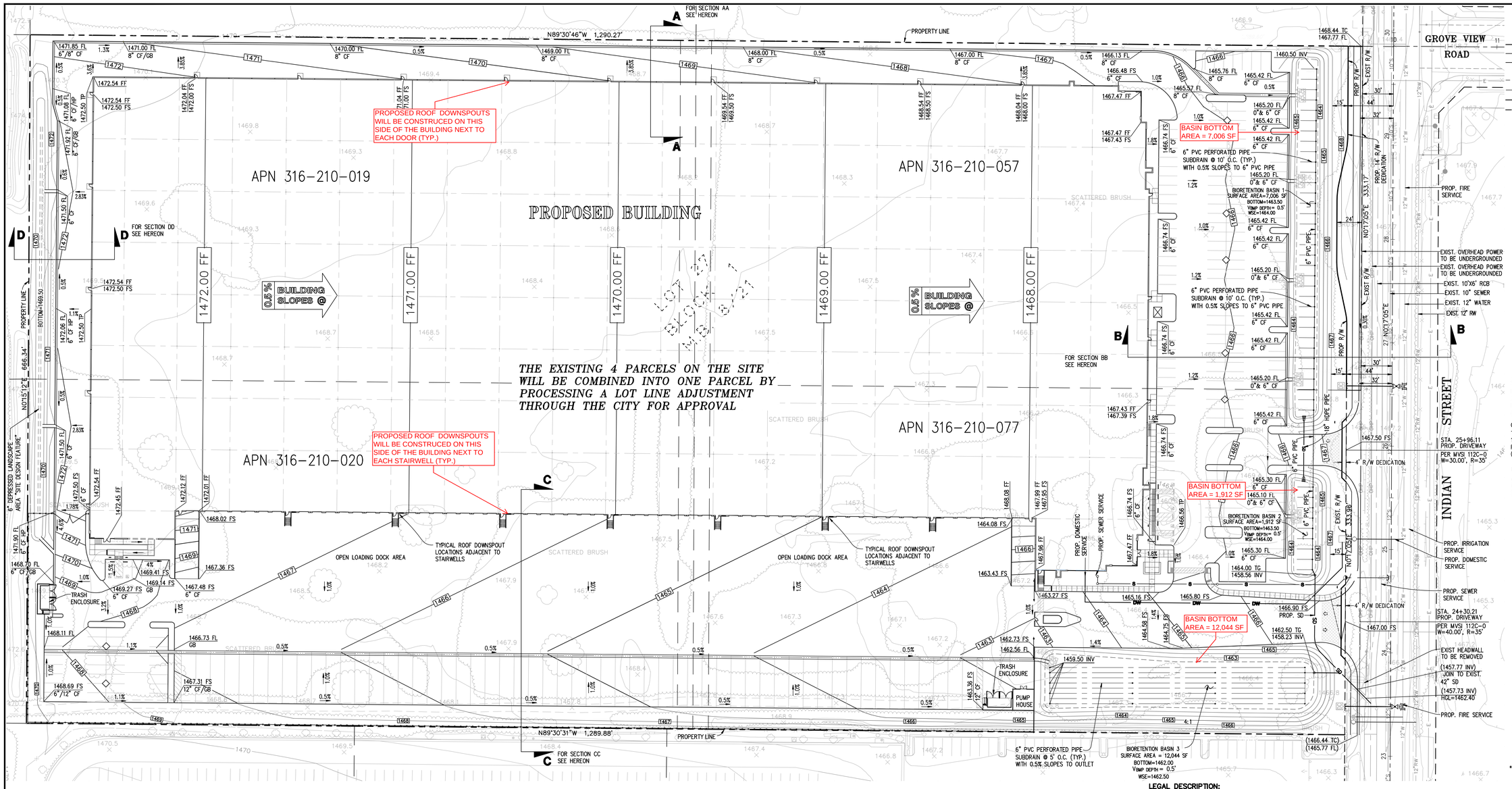
SHEET 1 NO. 1

GRAPHIC SCALE
40 0 40 80 120
(IN FEET)
1"=40'

Appendix 2: Construction Plans

Conceptual Grading, Drainage and Utility Plan
Grading and Drainage Plans (In progress)

Construction Plans in progress and will be provided in the next submittal.



LEGEND

- SD — PROPOSED STORM DRAIN
- S — PROPOSED SEWER SERVICE
- DW — PROPOSED DOMESTIC WATER SERVICE
- GB — PROPOSED GRADE BREAK LINE
- PROPOSED CENTERLINE
- PROPOSED R/W
- EXISTING R/W

BC	BEGIN CURVE
CF	CURB FACE
CB	CATCH BASIN
C&G	CURB & GUTTER
CL	CENTERLINE
DW	DOMESTIC WATER
DWY	DRIVEWAY
EC	END CURVE
EXIST.	EXISTING
FF	PROPOSED FINISH FLOOR ELEVATION
FS	FINISHED SURFACE
FL	FLOWLINE
GB	GRADE BREAK
MVSI	MORENO VALLEY STANDARD PLAN INDEX
PL	PROPERTY LINE
PROP.	PROPOSED
RW	RECYCLED WATER
R/W	RIGHT-OF-WAY
SD	STORM DRAIN
SW	SIDEWALK
STL	STREET LIGHT
TP	TOP OF PAVEMENT
TC	TOP OF CURB
P.I.P.	PROTECT IN PLACE

UTILITY PROVIDERS

SEWER/WATER
EASTERN MUNICIPAL WATER DISTRICT
2270 TRUMBLE ROAD
PERRIS, CA 92571
(951) 928-3777

GAS
THE GAS COMPANY
1981 W. LUGONIA
REDLANDS, CA 92374
(909) 335-7955

ELECTRIC
MORENO VALLEY UTILITIES
14177 FREDERICK ST.
(951) 413-3500

TELEPHONE
VERIZON
150 S. JUANITA
HEMET, CA 92543
(951) 658-7305

CABLE - TV
TIME WARNER
1500 AUTO CENTER DR.
ONTARIO, CA 91761
(951) 975-3380

DEVELOPER

SARES REGIS GROUP
18802 BARDEEN AVENUE
IRVINE, CA 92612

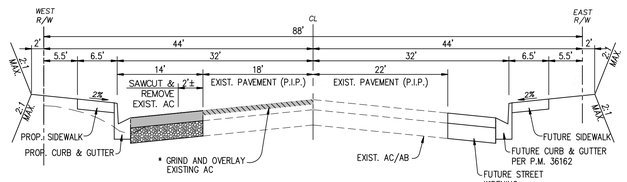
CIVIL ENGINEER

HUITT-ZOLLARS, INC.
3990 CONCOURS, SUITE 330
ONTARIO, CALIFORNIA 91764
PHONE: (909) 941-7799

EARTHWORK VOLUMES

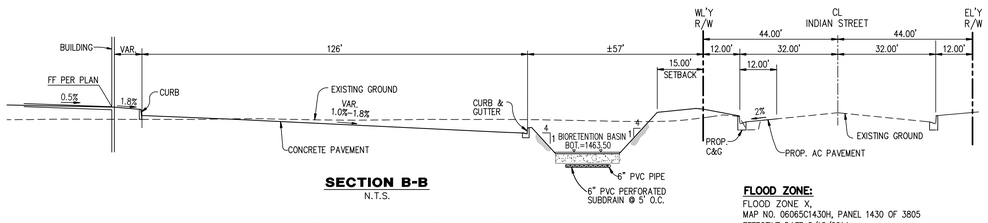
	CUT (CY)	FILL (CY)
RAW*	28,689	23,685

* ALL EARTHWORK VOLUMES SHOWN HERE ARE RAW AND SHRINKAGE AND SUBSIDENCE ANALYSIS ARE NOT APPLIED. ACTUAL ESTIMATED NET IMPORT WILL BE SHOWN ON THE ROUGH GRADING PLAN



INDIAN STREET – TYPICAL SECTION
N.T.S.
(PER CITY OF MORENO VALLEY STD. NO. 105A)

* CORE SAMPLES FOR EXISTING AC PAVEMENT IS REQUIRED



SECTION B-B
N.T.S.

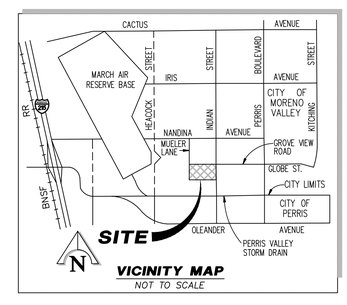
FLOOD ZONE:
FLOOD ZONE X,
MAP NO. 06065C1430H, PANEL 1430 OF 3805
EFFECTIVE DATE 8/18/2014

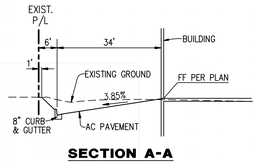
AREA
GROSS AREA = 19.64 ACRES

TOPO
SOURCE: RJL (ROBERT J. LUNG AND ASSOCIATES)
DATE: 10-3-14

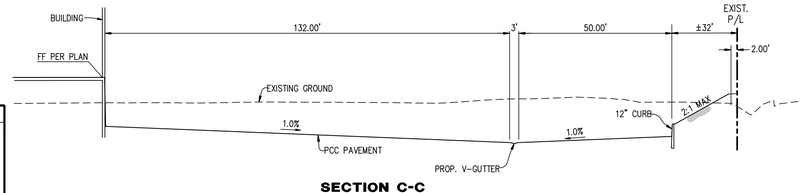
LEGAL DESCRIPTION:

PARCEL A: PARCEL 1:
THE SOUTH 1/2 OF THE WEST 1/2 OF LOT 27 IN BLOCK 10F RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.
PARCEL 2:
A NON-EXCLUSIVE EASEMENT OVER THE NORTHERLY 10 FEET OF THE SOUTH 1/2 OF THE EAST 1/2 OF LOT 27 IN BLOCK 10F RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA, FOR UTILITY PURPOSES.
APN: 316-210-020-5
PARCEL B:
THE NORTH HALF OF THE EAST HALF OF LOT 27, BLOCK 10F RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA, FOR UTILITY PURPOSES.
EXCEPTING THEREFROM THE EAST 10.00 FEET THEREOF, CONVEYED TO THE MARCH JOINT POWERS AUTHORITY, A BODY POLITIC BY DEEDS RECORDED JULY 23, 2001, AS INSTRUMENT NOS. 2001-339627 AND 2001-339628, BOTH OF OFFICIAL RECORDS.
APN: 316-210-057-9
PARCEL C:
THE NORTH 1/2 OF THE WEST 1/2 OF LOT 27, BLOCK 10F RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.
APN: 316-210-019-5
PARCEL D:
ALL THAT CERTAIN REAL PROPERTY SITUATED IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:
THE SOUTH HALF OF THE EAST HALF OF LOT 27, IN BLOCK 1 OF RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STAT OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 8, PAGE(S) 21 PF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.
EXCEPTING THEREFROM THE EAST 10.00 FEET OF SAID LAND, AS CONVEYED TO THE MARCH JOINT POWERS AUTHORITY, A BODY POLITIC BY GRANT DEEDS RECORDED FEBRUARY 2, 2004, AS INSTRUMENT NOS. 2004-0074786, OF OFFICIAL RECORDS.
APN: 316-210-077-7

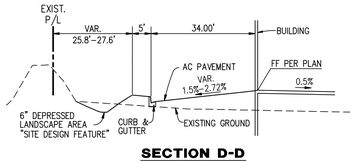




SECTION A-A
N.T.S.



SECTION C-C
N.T.S.



SECTION D-D
N.T.S.

BENCH MARK	BASIS OF BEARING
RIVERSIDE COUNTY FLOOD CONTROL BENCHMARK NO. M-31. ELEVATION 1474.674 (NGVD29) LOCATION 3 1/4" ALUMINUM DISK STAMPED "RIV. CO. BENCHMARK M-31 RESET APRIL 1996', FLUSH AT S.W. CORNER OF BRIDGE ON TOP OF SIDEWALK NEAR FACE OF CURB LOCATED AT THE CROSSING OF PERRIS BLVD. AND R.C.F.C. CHANNEL (PERRIS LATERAL "A") 43 FT WEST OF THE CENTERLINE OF PERRIS BLVD. AND 4.5 FT EAST OF CONCRETE BRIDGE BARRIER	BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN CORS STATION PPBF AND CORS STATION MLFP BEING NORTH 53°20'18" WEST PER RECORDS ON FILE WITH THE CALIFORNIA SPATIAL REFERENCE CENTER (CSRC).

GRAPHIC SCALE
40 0 40 80 120
(IN FEET)
1"=40'

REGISTERED PROFESSIONAL ENGINEER MAURICE H. MURAD NO. 33366 EXPIRATION 6-30-2018 CIVIL STATE OF CALIFORNIA

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

PREPARED UNDER THE SUPERVISION OF:
MAURICE H. MURAD
R.C.E. NO. 33366 EXP. 6/30/18
DATE

CITY OF MORENO VALLEY

CONCEPTUAL GRADING , DRAINAGE AND UTILITY PLAN
SARES REGIS MORENO VALLEY INDUSTRIAL
PA 16-0002

SHEET 1 NO. 1

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

LGC Geotechnical, Inc.

January 11, 2015 Project No. 15208-01

Mr. Patrick Russel
Sares-Regis
18802 Bardeen Avenue
Irvine, CA 92612-1521

Subject: ***Geotechnical Summary and Recommendations Report for the Proposed Warehouse Development Located at the Southwest Corner of Indian Street and Grove View Road, City of Moreno Valley, California***

In accordance with your request, LGC Geotechnical, Inc. has prepared this geotechnical summary and recommendations report for the proposed warehouse development located at the southwest corner of Indian Street and Grove View Road in the City of Moreno Valley, California. This report summarizes our findings, conclusions, and preliminary geotechnical design recommendations relative to the proposed development.

Should you have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully,

LGC Geotechnical, Inc.

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY LAWSON
No. 2626
EXP. 6/30/17
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
TIMOTHY LAWSON
NO. 1821
CERTIFIED
ENGINEERING
GEOLOGIST
EXP. 2/29/16
STATE OF CALIFORNIA

Tim Lawson, GE 2626, CEG 1821

KAD/TJL/aca

Distribution: (4) Addressee (3 wet signed copies and 1 electronic)

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Appendix B – Boring and Test Pit Logs
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Appendix D – General Earthwork and Grading Specifications

1.0 INTRODUCTION

LGC Geotechnical has prepared this geotechnical summary and recommendations report for the proposed warehouse development located at the southwest corner of Indian Avenue and Grove View Road, in the City of Moreno Valley, California (Figure 1). This report is based on our review of the available geotechnical reports by NorCal Engineering (2014a & 2014b), readily available published literature, and a site visit completed on December 23, 2015. This report summarizes our findings, conclusions, and preliminary geotechnical design recommendations relative to the proposed development.

1.1 Site Description

The approximately 20 acre rectangular shaped site is located on the southwest corner of Indian Street and Grove View Road. The project site is bounded to the north and west by vacant land, to the east by Indian Street, and to the south by an existing tilt-up building with associated improvements. The site is currently vacant with low vegetation and some trees in the western portion of the property. A north trending dirt/gravel road splits the property into an east and west half while another dirt/gravel road borders and parallels the southern property line. The project site is relatively level with sheet flow generally directed to the southeast.

1.2 Background

Historical aerial photographs show that the project site was previously used for farming as far back as the 1960's. Sometime during the late 1960's or early 1970's, three small structures were constructed on the eastern portion of the property. Around 2008-2009 the buildings were demolished, and it appears that the land has remained vacant ever since.

1.3 Proposed Development

According to the Conceptual Site Plan prepared by Herdman Rierson Architecture and Design (2015), the proposed development will include construction of a new concrete tilt-up 433,951 square feet warehouse/distribution building. In addition, a parking area is planned along the eastern side and a truck docking/trailer parking area is planned along the southern side of the warehouse. Approximately 3 bioretention basins are proposed for the eastern portion of the site adjacent to the parking areas.

2.0 SITE CONDITIONS

2.1 Regional Geology

The property is regionally located in the Peninsular Ranges geomorphic province which extends from the Los Angeles Basin south to Baja California. The province is characterized by numerous southeast trending mountain ranges and valleys that are geologically controlled by a series of major active faults. More specifically, the site is located in the northern portion of the Perris block which is bordered to the northeast by the San Jacinto Fault Zone and to the southwest by the Chino/Elsinore Fault Zone.

2.2 Site-Specific Geology

The site is situated on an alluvial flood plain near the western edge of the Moreno Valley. Based on the Geologic Map of the 7.5' Perris Quadrangle (CGS, 2003) the site is underlain by Very Old Alluvial Fan Deposits of the late Pleistocene. These materials generally form the large area flanking the Perris Valley and the west side of the San Jacinto River Valley.

A subsurface investigation performed by Norcal (2014b) consisted of two exploratory hollow stem auger borings with 6-inch outside diameter continuous flight augers and seventeen exploratory test pits by backhoe. Borings were excavated to a maximum depth of 51.5 feet below current ground elevations and backhoe excavations extended to a maximum depth of approximately 16 feet. Logs for the borings and exploratory test pits are included in Appendix B. Descriptions of the soils encountered onsite during the subsurface investigation are presented below.

2.2.1 Disturbed Topsoils/Artificial Fill

The upper approximately 1 to 2 feet of soil across the site consists of disturbed topsoils and minor amounts of artificial fill soils. In general, the soils are classified as sandy, clayey silt with some gravel. Rootlets and minor debris were encountered in isolated areas to depths up to approximately 2 feet below existing surface. These soils were noted to be soft and damp (NorCal, 2014b) at the time they were encountered.

2.2.2 Quaternary Very Old Alluviall Fan Deposits

In general, the very old alluvial deposits consist of sandy, clayey silts. These soils were noted to be medium stiff to stiff and damp to moist. Sand, silt, and clay content varied slightly with the depth of exploration (NorCal, 2014b).

2.3 Groundwater Levels

Groundwater was not encountered to the maximum explored depth of approximately 51.5 feet below existing grade during the subsurface evaluation performed by NorCal Engineering (2014). Based upon nearby groundwater well data as researched on California department of water resources database http://www.water.ca.gov/waterdatalibrary/, historic high groundwater in the vicinity is on the order of 30 feet below ground surface.

Seasonal fluctuations of groundwater elevations should be expected over time. In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present due to local seepage caused by irrigation and/or recent precipitation. Local perched groundwater conditions or surface seepage may develop once site development is completed.

2.4 Seismicity

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2013 California Building Code (CBC). Representative site coordinates of latitude 33.861822 degrees and longitude -117.236989 degrees were utilized in our analyses. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class D are provided in Table 1 below.

TABLE 1

Seismic Design Parameters

Selected Parameters from 2013 CBC, Section 1613 - Earthquake Loads	**Seismic Design Values**
Site Class per Chapter 20 of ASCE 7	D
Risk-Targeted Spectral Acceleration for Short Periods (S_S)*	1.500g
Risk-Targeted Spectral Accelerations for 1-Second Periods (S_1)*	0.600g
Site Coefficient F_a per Table 1613.3.3(1)	1.000
Site Coefficient F_v per Table 1613.3.3(2)	1.500
Site Modified Spectral Acceleration for Short Periods (S_{MS}) for Site Class C [Note: $S_{MS} = F_aS_S$]	1.500g
Site Modified Spectral Acceleration for 1-Second Periods (S_{M1}) for Site Class C [Note: $S_{M1} = F_vS_1$]	0.900g
Design Spectral Acceleration for Short Periods (S_{DS}) for Site Class C [Note: $S_{DS} = (^2/_3)S_{MS}$]	1.000g
Design Spectral Acceleration for 1-Second Periods (S_{D1}) for Site Class C [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.600g
Mapped Risk Coefficient at 0.2 sec Spectral Response Period, C_{RS} (per ASCE 7)	1.062
Mapped Risk Coefficient at 1 sec Spectral Response Period, C_{R1} (per ASCE 7)	1.029

* From USGS, 2015

Section 1803.5.12 of the 2013 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for geotechnical evaluations such as liquefaction potential. The PGA_M for the site is equal to 0.5g (USGS, 2015).

A deaggregation of the PGA based on a 2,475-year average return period indicates that an earthquake magnitude of 7.58 at a distance of approximately 12.5 km from the site would contribute the most to this ground motion (USGS, 2008).

2.5 Faulting

California is located on the boundary between the Pacific and North American Lithospheric Plates. The average motion along this boundary is on the order of 50-mm/yr in a right-lateral sense. The majority of the motion is expressed at the surface along the northwest trending San Andreas Fault Zone with lesser amounts of motion accommodated by sub-parallel faults located predominantly west of the San Andreas including the Elsinore, Newport-Inglewood, Rose Canyon, and Coronado Bank Faults. Within Southern California, a large bend in the San Andreas Fault north of the San Gabriel Mountains has resulted in a transfer of a portion of the right-lateral motion between the plates into left-lateral displacement and vertical uplift. Compression south and west of the bend has resulted in folding, left-lateral, reverse thrust faulting, and regional uplift creating the east-west trending Transverse Ranges and several east-west trending faults. Further south within the Los Angeles Basin, "blind thrust" faults are believed to have developed below the surface also as a result of this compression, which have resulted in earthquakes such as the 1994 Northridge event along faults with little to no surface expression.

Prompted by damaging earthquakes in Northern and Southern California, State legislation and policies concerning the classification and land-use criteria associated with faults have been developed. Their purpose was to prevent the construction of urban developments across the trace of active faults. The result is the Alquist-Priolo Earthquake Fault Zoning Act, which was most recently revised in 1997 (Hart, 1997). According to the State Geologist, an active fault is defined as one, which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). A potentially active fault is defined as any fault, which has had surface displacement during Quaternary time (last 1,600,000 years), but not within the Holocene. Earthquake Fault Zones have been delineated along the traces of active faults within California. Where developments for human occupation are proposed within these zones, the state requires detailed fault investigations be performed so that engineering geologists can mitigate the hazards associated with active faulting by identifying the location of active faults and allowing for a setback from the zone of previous ground rupture.

The subject site is not located within an Alquist-Priolo Earthquake Fault Zone and no faults were identified on the site during our site evaluation. The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching and shallow ground rupture, soil liquefaction, dynamic settlement, seiches, and tsunamis. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependant on the distance between the site and causative fault and the onsite geology. The closest major active faults that could produce these secondary effects are associated with the Chino/Elsinore Fault Zone and San Jacinto Fault Zone. A discussion of these secondary effects is provided in the following sections.

2.5.1 Liquefaction and Dynamic Settlement

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose to medium dense, near-surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction, depending on their plasticity and moisture content (Bray & Sancio, 2006). Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Dynamic settlement of dry loose sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

The site is mapped by the County of Riverside as having a "Low" to "Moderate" potential for liquefaction (RCTLMA, 2014). Based on our review of the data provided by Norcal, we concur with their findings that liquefaction potential is very low, and seismically induced settlement as a result of a major earthquake is on the order of 1 to 2 inches across the site. Differential seismically induced ground settlement once the site has been properly developed is estimated to be on the order of one-half inch vertically in 40 feet horizontally.

2.5.2 Lateral Spreading

Lateral spreading is a type of liquefaction induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

The potential for lateral spreading is considered very low due to the site being relatively level and the lack of an adjacent free face to drive lateral spreading.

2.6 Infiltration Testing

Onsite infiltration testing was performed by NorCal Engineering utilizing the double ring infiltration test method per ASTM D3385. Testing was performed in seven locations with depths ranging from approximately 2 to 6 feet below existing ground surface. The infiltration results are provided in Table 2 below.

TABLE 2

Summary of Field Infiltration Testing (NorCal, 2014a)

Boring/Infiltration Location	Approx. Depth Below EG (ft)	Soil Type	Infiltration Rate		Design Rate
			cm/hr	in/hr	
Area 1, T-1	2	sandy, clayey SILT	1.7	0.68	0.5
Area 1, T-2	2	sandy, clayey SILT	0.9	0.35	
Area 2, T-3	6	sandy, clayey SILT	0.4	0.15	0.5
Area 2, T-4	6	sandy, clayey SILT	2.1	0.85	
Area 3, T-5	6	sandy, clayey SILT	0.3	0.12	0.15
Area 3, T-6	6	sandy, clayey SILT	0.2	0.08	
Area 3, T-6	6	sandy, clayey SILT	0.6	0.24	

Please note that the design rates provided by NorCal Engineering (2014a) do not include the minimum factor of safety of 3 set forth by Appendix A of the Riverside County – Low Impact Development BMP Design Handbook (2011). In addition, the project engineer should apply any additional factors of safety they deem appropriate when designing any onsite infiltration systems.

3.0 CONCLUSIONS

Based on the results of our geotechnical review of the previous geotechnical reports and conceptual site plan, it is our opinion that the proposed development is feasible from a geotechnical standpoint, provided that the recommendations contained in the following sections are incorporated during site grading and construction. A summary of our geotechnical conclusions are as follows:

- The site is underlain by very old alluvial fan deposits which is covered by topsoil and minor amounts of artificial fill soils to depths of approximately 1 to 2 feet below existing ground.
- Groundwater was not encountered during previous subsurface investigations and is unlikely to be encountered during site grading and construction.
- The main seismic hazard that may affect the site is ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life. Section 1803.5.12 of the 2013 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for geotechnical evaluations such as liquefaction potential. The PGA_M for the site is equal to 0.5g (USGS, 2013).
- Based on the proposed development, the site will predominately consist of compacted fill over dense older alluvium. Therefore, the potential for post construction liquefaction and liquefaction-induced dynamic settlement is considered low.
- Tested infiltration rates are considered low which is in congruence with what would be anticipated for the soil types encountered. Please note that the design rates provided by NorCal Engineering (2014a) do not include the minimum factor of safety of 3 set forth by Appendix A of the Riverside County – Low Impact Development BMP Design Handbook (2011). In addition, the project engineer should apply any additional factors of safety they deem appropriate when designing any onsite infiltration systems.
- Based on preliminary laboratory test results, the onsite soils are anticipated to have a Low expansion potential. Final design expansion potential must be determined at the completion of grading. Mitigation measures are required for planned foundations and site improvements, such as concrete flatwork, to minimize the impacts of expansive soils.

4.0 PRELIMINARY RECOMMENDATIONS

The following recommendations are to be considered preliminary, and should be confirmed upon the completion of grading and earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, and/or the owner.

It should be noted that the following geotechnical recommendations are intended to provide sufficient information to develop the site in general accordance with the 2013 CBC requirements. With regard to the possible occurrence of potentially catastrophic geotechnical hazards such as fault rupture, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level." The "acceptable level" of risk is defined by the California Code of Regulations as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed improvement may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development, the recommendations contained herein are intended as a reasonable protection against the potential damaging effects of geotechnical phenomena such as expansive soils, fill settlement, groundwater seepage, etc. It should be understood, however, that our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions, but cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

The geotechnical recommendations contained herein must be confirmed to be suitable or modified based on the actual as-graded conditions.

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of the completion of rough grading followed by the construction of retaining walls, utilities, foundations, and parking lot improvements. We recommend that earthwork onsite be performed in accordance with the following recommendations, 2013 CBC requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix D. In case of conflict, the following recommendations shall supersede all previous recommendations and those included as part of Appendix D. The following recommendations should be considered preliminary and may be revised by the geotechnical consultant based on the actual conditions encountered during site grading.

4.1.1 Site Preparation

Prior to grading, the areas to be developed should be stripped of any vegetation and cleared of all debris. Vegetation and debris should be removed and properly disposed of offsite. It is our understanding that the larger trees located in the western portion of the site will be removed prior to grading. We recommend that the roots of any such trees be removed in their entirety. Holes resulting from the removal of buried obstructions or trees, which extend below proposed removal bottoms, should be replaced with properly compacted fill material.

4.1.2 Removal and Over-Excavation Depths

All unsuitable compressible materials not removed by design cuts should be excavated to competent material and replaced with compacted fill soils. In general, existing artificial fill, topsoil, and weathered very old alluvial fan deposits should be removed to competent dense old alluvial deposits. For planning purposes, in building areas removals should extend to a minimum depth of 2 feet below design footings, or 2 feet below existing grade, which ever is greater. Since a detailed cut/fill map was not available to us at the time of our review we cannot provide an accurate determination of which of these two recommendations governs in the area of the proposed structure. However, it would appear that based on design grades this will result in an average removal of approximately 4.5 feet below existing grades. The removals should extend laterally approximately 5 feet outside of the proposed building footprint.

Proposed pavement areas should be over-excavated a minimum of 2 feet below design subgrade and be replaced by compacted fill. Over-excavations should extend laterally a minimum of 2 feet outside of the proposed improvement footprint.

Local conditions may be encountered which could require additional removals beyond the estimated depths depicted. The actual depth and lateral extents of removals should be determined by the geotechnical consultant based on subsurface conditions encountered during grading.

4.1.3 Temporary Excavations

We anticipate temporary slopes required for removals, over-excavations and haul roads to be grossly stable at 1.5:1 (horizontal: vertical) or flatter; however, excavations must be made in accordance with Cal OSHA and OSHA requirements. Vehicular traffic, stockpiles, and equipment storage should be set back from the perimeter of the excavations a minimum distance equivalent to a 1:1 projection from the bottom of the excavation.

The contractor must request observation of temporary excavations by a representative of LGC Geotechnical, not only to confirm the geotechnical conditions, but to also help provide early warning of potential failures. Based on observed conditions, flatter inclinations may be required. The majority of site soils are anticipated to be OSHA Type “B” soils. The contractor will be responsible for providing the “competent person” required by Cal/OSHA standards to evaluate soil conditions. Close coordination with the geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Excavation safety is the sole responsibility of the contractor.

Once an excavation has been initiated, it should be backfilled as soon as practical. Prolonged exposure of temporary excavations may result in some localized instability. Excavations should be planned so that they are not initiated without sufficient time to shore/fill them prior to weekends, holidays, or forecasted rain.

4.1.4 Subgrade Preparation

In general, over-excavation and removal bottom areas should be scarified to a minimum depth of 6 to 8 inches, brought to a near-optimum moisture condition, and re-compacted per project recommendations. Over-excavation and removal bottoms should be observed and accepted by the geotechnical consultant prior to subsequent fill placement.

4.1.5 Material for Fill

From a geotechnical perspective, the onsite soils are generally considered suitable for use as compacted fill, provided they are screened of organic materials and construction debris. Any oversized material (material larger than 8 inches in maximum dimension) encountered must be appropriately handled as outlined in Appendix D.

Retaining wall backfill should consist of granular free draining soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a "Very Low" expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris and any material greater than 3 inches. The site contains soils that are not suitable for retaining wall backfill due to their clay content and expansion potential, therefore import or select grading and stockpiling of onsite soils will be required by the contractor for obtaining suitable retaining wall backfill soil. The contractor should anticipate the importing of soils for the required retaining wall backfill.

From a geotechnical viewpoint, any required import soils (except retaining wall backfill) should consist of clean, relatively granular soils of Very Low to Low expansion potential (expansion index 50 or less based on ASTM D4829) and no particles larger than 3 inches in greatest dimension. Required import for retaining wall backfill should meet the criteria outlined in the paragraph above. Source samples of planned importation should be provided to the geotechnical consultant for laboratory testing a minimum of 3 working days prior to any planned importation.

Aggregate base (crushed aggregate base or crushed miscellaneous base) should conform to the requirements of Section 200-2 of the Standard Specifications for Public Works Construction ("Greenbook") for untreated base materials (except processed miscellaneous base) or Caltrans Class 2 aggregate base.

4.1.6 Fill Placement and Compaction

Material to be placed as fill should be brought to near optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and recompacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading

ordinances and under the observation and testing performed by the geotechnical consultant. Any oversized material, as previously defined, encountered must be appropriately handled (Appendix D).

Aggregate base material (crushed aggregate base and crushed miscellaneous base) should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction at or slightly above optimum moisture content per ASTM D1557.

4.1.7 Shrinkage and Subsidence

For earthwork volume estimating purposes, an average shrinkage of 10 percent may be assumed for the approximate upper 4 feet of the site soils. It should be stressed that these values are only estimates and that an actual shrinkage factors would be extremely difficult to predetermine. These values are estimates only and exclude losses due to removal of vegetation or debris. The effective shrinkage of onsite soils will depend primarily on the type of compaction equipment and method of compaction used onsite by the contractor and accuracy of the initial topographic survey. Contingencies should be made for balancing earthwork quantities based on actual shrinkage that occurs during grading.

Subsidence is the settlement of in-place subgrade soils caused by loads generated by large earthmoving equipment, or the settlement of native material due to the imposed load of new fills. Subsidence at the site is considered "negligible" due to the shallow fills assumed for site development.

4.1.8 Trench and Retaining Wall Backfill and Compaction

The onsite soils may generally be suitable as trench backfill, provided the soils are screened of rocks and other material greater than 6 inches in diameter and organic matter. If trenches are shallow or the use of conventional equipment may result in damage to the utilities, free draining sand having a sand equivalent (SE) of 30 or greater (per California Test Method [CTM] 217) may be used to bed and shade the pipes. Sand backfill within the pipe bedding zone may be densified by jetting or flooding and then tamped to ensure adequate compaction. Subsequent trench backfill should be compacted in uniform thin lifts by mechanical means to at least the recommended minimum relative compaction (per ASTM D1557).

Retaining wall backfill should consist of sandy soils as outlined in the previous Section 4.1.5. The limits of select sandy backfill should extend a minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater, refer to Figure 2 (rear of text). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

A representative from LGC Geotechnical should observe and test the backfill to verify compliance with the project recommendations.

4.2 Provisional Foundation Recommendations

The proposed structure may be supported on spread or continuous footings, provided the soils are prepared in accordance with the recommendations given in this report. All footings should be supported on properly compacted fill.

The foundation design must be performed by the structural engineer based on the following geotechnical parameters and minimum values provided.

4.2.1 Foundation Design Parameters

Spread and continuous footings may be designed with a maximum net allowable soil bearing pressure of 2,500 pounds per square foot (psf). These allowable bearing pressures are applicable for level ground (slope equal to or flatter than 5:1) conditions only. Bearing values indicated are for total dead and frequently applied live loads and may be increased by ⅓ for short duration loading (i.e., wind or seismic loads).

Minimum wall and column footing widths are to be 14 inches and 24 inches, respectively. It is recommended that a minimum of two No. 5 rebars be placed in the top and bottom (4 total) of strip footings in order to provide longitudinal reinforcement.

Minimum foundation embedment is to extend a minimum 12 inches into suitable compacted fill soils and at least 24 inches below the adjacent exterior grade. Interior column footings may be placed 12 inches beneath the floor slab.

In addition, it is recommended that the perimeter building foundations be continuous across all exterior doorways to reduce moisture migration beneath the slab. Any adjoining hardscape should be doweled into the perimeter foundations in a manner acceptable to the structural engineer.

4.2.2 Foundation Construction

The foundation is to be excavated into competent compacted artificial fill placed during grading operations. It is recommended that the foundation subgrade soils be evaluated by the geotechnical engineer prior to steel and/or concrete placement.

It is recommended that subgrade soils be moisture conditioned in order to maintain the recommended moisture content up to the time of concrete placement. The recommended moisture should be approximately at 4 percent above optimum moisture content to a minimum depth of 12 inches. In addition, this moisture content should be maintained around the immediate perimeter of the slab during construction and up to occupancy of the building structures.

The geotechnical parameters provided herein assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage and adequately maintained so that ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation

and/or incorrect landscape design. Plants should only be provided with sufficient irrigation for life and not overwatered to saturate subgrade soils. Sunken planters placed adjacent to the foundation should either be designed with an efficient drainage system or liners to prevent moisture infiltration below the foundation.

4.2.3 Slab Design and Construction

A minimum slab thickness of 6 inches and 4 inches is recommended for new slabs in the warehouse and office areas, respectively. Slabs are to be supported on compacted fill soils properly prepared in accordance with the recommendations provided in this report. Minimum slab reinforcement should be determined by the structural engineer based on the imposed loading and crack control.

It is recommended that subgrade soils below slabs be moisture conditioned in order to maintain the recommended moisture content up to the time of concrete placement. The recommended moisture should be approximately at 4 percent above optimum moisture content to a minimum depth of 12 inches.

Some post-construction moisture migration should be expected below the foundation. The following recommendations should be applied for office areas and/or other portions of the proposed warehouse that may be sensitive to nuisance moisture migrating through the slab from the subgrade soils. The following recommendations are for informational purposes only, as they are unrelated to the geotechnical performance of the foundation. Post-construction soil moisture must be anticipated below the foundation. The following recommendations may be superseded by the foundation engineer and/or owner.

In general, interior floor slabs with moisture sensitive floor coverings should be underlain by a minimum 15 mil thick vapor retarder, which has a water vapor transmission rate (permeance) of less than 0.3 perms, as determined by ASTM E 96, and meets the applicable code requirements (ASTM E 1745).

It is the responsibility of the contractor to ensure that the moisture/vapor retarder systems are properly installed in accordance with the project plans and manufacturers specifications, and that the moisture/vapor retarder materials are free of tears and punctures prior to and as a result of concrete placement. Additional moisture reduction and/or prevention measures may be needed, depending on the performance requirements of future interior floor coverings.

The foundation/structural engineer should determine whether the use of a capillary break (sand or gravel layer) in conjunction with the vapor retarder is necessary or required by code. Sand layer thickness and location (above and/or below vapor retarder) should also be determined by the foundation/structural engineer. Sand layers should be installed, where applicable, in accordance with ACI Publication 302 – "Guide for Concrete Floor and Slab Construction."

4.2.4 Lateral Load Resistance

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.3 may be assumed with dead-load forces. An ultimate passive lateral earth pressure of 300 psf per foot of depth (or pcf) to a maximum of 2,500 psf may be used for the sides of footings poured against properly compacted fill. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. We recommend that the upper foot of passive resistance be neglected if finished grade will not be covered with concrete or asphalt. The provided passive resistance value is an ultimate value, so appropriate safety factors (i.e., minimum of 1.5) should be applied by the structural designer.

4.3 Retaining Wall Recommendations (Including Loading Docks)

The following sections provide the specific geotechnical parameters for wall design. Contained in the following sections are alternate design parameters for the chosen backfill material, wall type and wall location. The structural engineer must carefully select the appropriate design parameters dependent upon these factors and clearly show on the plans the proposed backfill material and drainage details.

4.3.1 Lateral Earth Pressures and Retaining Wall Design Considerations (Level Ground in Front of Wall)

Lateral earth pressures are provided as equivalent fluid unit weights, in pound per square foot (psf) per foot of depth or pcf. These values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of soil over the wall footing.

Presented on Table 3 are the lateral earth pressures for sandy soils (free draining) with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) D421/422 and an expansion index of less than 20. Retaining wall backfill should also be limited to fill material not exceeding 3 inches in greatest dimension. The limits of select sandy backfill should extend one-half the height of the retaining wall or the width of the heel, whichever is greater, refer to Figure 4. The upper 12 to 18 inches of the retaining walls should be backfilled with onsite fill (non-select) soils to finish grade. Retaining wall backfill soils should be compacted in relatively uniform thin lifts to a minimum of 90 percent relative compaction (based on ASTM Test Methods D2922 and D3017). Jetting or flooding of retaining wall backfill materials should not be permitted. The retaining wall designer should clearly indicate on the retaining wall plans the required select sandy soil backfill and drainage details, (see Figure 4, rear of text).

TABLE 3

Lateral Earth Pressures – Select Import Sand Backfill

Condition	**Equivalent Fluid Weight (pcf) for Level Backfill with Approved Backfill Material**
Active	35
At Rest	65

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. This would include 90-degree corners of retaining walls and building basement walls. Such walls should be designed for "at-rest." The equivalent fluid pressure values assume free-draining conditions and a drainage system will be installed and maintained to prevent the build-up of hydrostatic pressures. Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. To reduce, but not eliminate, the potential of saturation of soils in front of the retaining walls, the subdrain may be lowered behind the footing and below finish grade as long as it is properly outletted and connects with the free-draining backfill. The outlet pipe should drain to a suitable outlet. In general, we do not recommend retaining wall outlet pipes be connected to area drains. If subdrains are connected to area drains, special care and information should be provided to homeowners to maintain these drains. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water containing soluble salts migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Surcharge loading effects from any adjacent structures should be evaluated by the retaining wall designer. In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed retaining wall footing will surcharge the proposed retaining structure. Uniform surcharges may be estimated using the applicable coefficient of lateral earth pressure using a rectangular distribution. A factor of 0.5 and 0.33 may be used for at-rest and active conditions, respectively. The retaining wall designer should contact the geotechnical engineer for any required geotechnical input in estimating any applicable surcharge loads.

If required, the retaining wall designer may use a seismic lateral earth pressure increment of 5 pcf for a level backfill condition and 12 pcf for 2:1 sloping backfill. This increment should be applied in addition to the provided static lateral earth pressure using a "normal" triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). When analyzing short duration seismic loading for the restrained, at-rest condition, the seismic increment may be added to the applicable active lateral earth pressure (in lieu of the at-rest lateral earth pressure). Per Section 1803.5.12 of the 2013 CBC, the seismic earth pressure is applicable to "structures assigned to Seismic Design

Category D, E, or F in accordance with Section 1613." This seismic lateral earth pressure is estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010). The provided seismic lateral earth pressure is for a level backfill, if a sloping backfill condition is proposed LGC Geotechnical should be contacted for specific seismic lateral earth pressure increments based on the planned configuration of the retaining walls.

4.4 Control of Surface Water and Drainage Control

From a geotechnical perspective, positive drainage of surface water away from structures is very important. Water should not be allowed to pond adjacent to buildings or to flow freely down a graded slope. Per the 2013 CBC, positive drainage may be accomplished by providing drainage away from buildings at a gradient of at least 5 percent for earthen surfaces for a distance of at least 10 feet away from the face of building. If a distance of 10 feet cannot be achieved, an alternative of a gradient of at least 5 percent to an area drain or swale having a gradient of 2 percent is acceptable. Where necessary, drainage paths may be shortened by use of area drains and collector pipes. Eave gutters are recommended and should reduce water infiltration into the subgrade soils if the downspouts are properly connected to appropriate outlets. Ultimately surface drainage and code compliance is the purview of the Project Civil Engineer.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.5 Preliminary Asphalt Concrete Pavement Sections

Laboratory testing performed by NorCal Engineering (2014b) resulted in a R-values of 5 for the onsite soils. Provisional minimum street sections are provided below for Traffic Indices from 5.0 to 8.0 to be utilized in the design of the auto and truck parking/circulation areas. Pavement sections are based on Caltrans Highway Design Manual (Caltrans, 2008). These recommendations must be confirmed with R-value testing of representative near-surface soils at the completion of grading and after underground utilities have been installed and backfilled. Final street sections should be confirmed by the project civil engineer based upon the projected design Traffic Index. If requested, LGC Geotechnical will provide sections for alternate TI values.

TABLE 4

Paving Section Options

Assumed Traffic Index	5.0	6.0	7.0	8.0
R-Value Subgrade	5	5	5	5
AC Thickness	4.0 inches	4.0 inches	5.0 inches	6.0 inches
Base Thickness	10.0 inches	13.5 inches	15.0 inches	17.0 inches

The thicknesses shown are for minimum thicknesses. Increasing the thickness of any or all of the above layers will reduce the likelihood of the pavement experiencing distress during its service life. The above recommendations are based on the assumption that proper maintenance and irrigation of

the areas adjacent to the roadway will occur through the design life of the pavement. Failure to maintain a proper maintenance and/or irrigation program may jeopardize the integrity of the pavement.

Aggregate base material (crushed aggregate base and crushed miscellaneous base) should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction at or slightly above optimum moisture content per ASTM D1557.

4.6 Soil Corrosivity to Concrete and Metal

Although not corrosion engineers (LGC Geotechnical is not a corrosion consultant), several governing agencies in Southern California require the geotechnical consultant to determine the corrosion potential of soils to buried concrete and metal facilities. We therefore present the results of previous testing with regard to corrosion for the use of the client and other consultants, as they determine necessary.

Previous corrosion testing (pH, resistivity, chloride and soluble sulfate content) was performed to estimate the corrosion potential of onsite soils (NorCal, 2014b). The results for corrosion potential indicated a minimum resistivity value of 2,403 ohm-centimeters, a pH value of 7.8, a soluble solfate concentration of 0.0038 percent, and a chloride concentration of 225 parts per million (ppm). Caltrans defines a corrosive area where any of the following conditions exist: the soil contains more than 500 ppm of chlorides, more than 2,000 ppm (0.2 percent) of sulfates, or a pH of 5.5 or less (Caltrans, 2012).

Based on preliminary laboratory sulfate test results, site soils should be considered to have a severity categorization of “Not Applicable” and are designated to a class “S0”, per ACI 318, Table 4.2.1 and Table 4.3.1, respectively. This must be verified based on as-graded conditions.

4.7 Nonstructural Concrete Flatwork

Nonstructural concrete flatwork (such as walkways, patio areas, etc.) has a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the minimum guidelines outlined in Table 5 below. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints, but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress. Please note that these are preliminary recommendations that will need to be confirmed and/or modified based on as-graded conditions at the completion of grading.

TABLE 5

Minimal Guidelines for Nonstructural Concrete Flatwork

	Sidewalks	**Patios**
Minimum Thickness (in.)	4 (nominal)	4 (full)
Presoaking	Wet down prior to placing	Wet down prior to placing
Reinforcement	—	No. 3 at 24 inches on centers
Thickened Edge (in.)	—	—
Crack Control Joints	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness
Maximum Joint Spacing	5 feet	6 feet
Aggregate Base Thickness (in.)	—	—

5.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. The samples taken and submitted for laboratory testing, the observations made and the in-situ field testing performed are believed representative of the entire project; however, soil and geologic conditions revealed by excavation may be different than our preliminary findings. If this occurs, the changed conditions must be evaluated by the project soils engineer and geologist and design(s) adjusted as required or alternate design(s) recommended.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and/or project engineer and incorporated into the plans, and the necessary steps are taken to see that the contractor and/or subcontractor properly implements the recommendations in the field. The contractor and/or subcontractor should notify the owner if they consider any of the recommendations presented herein to be unsafe.

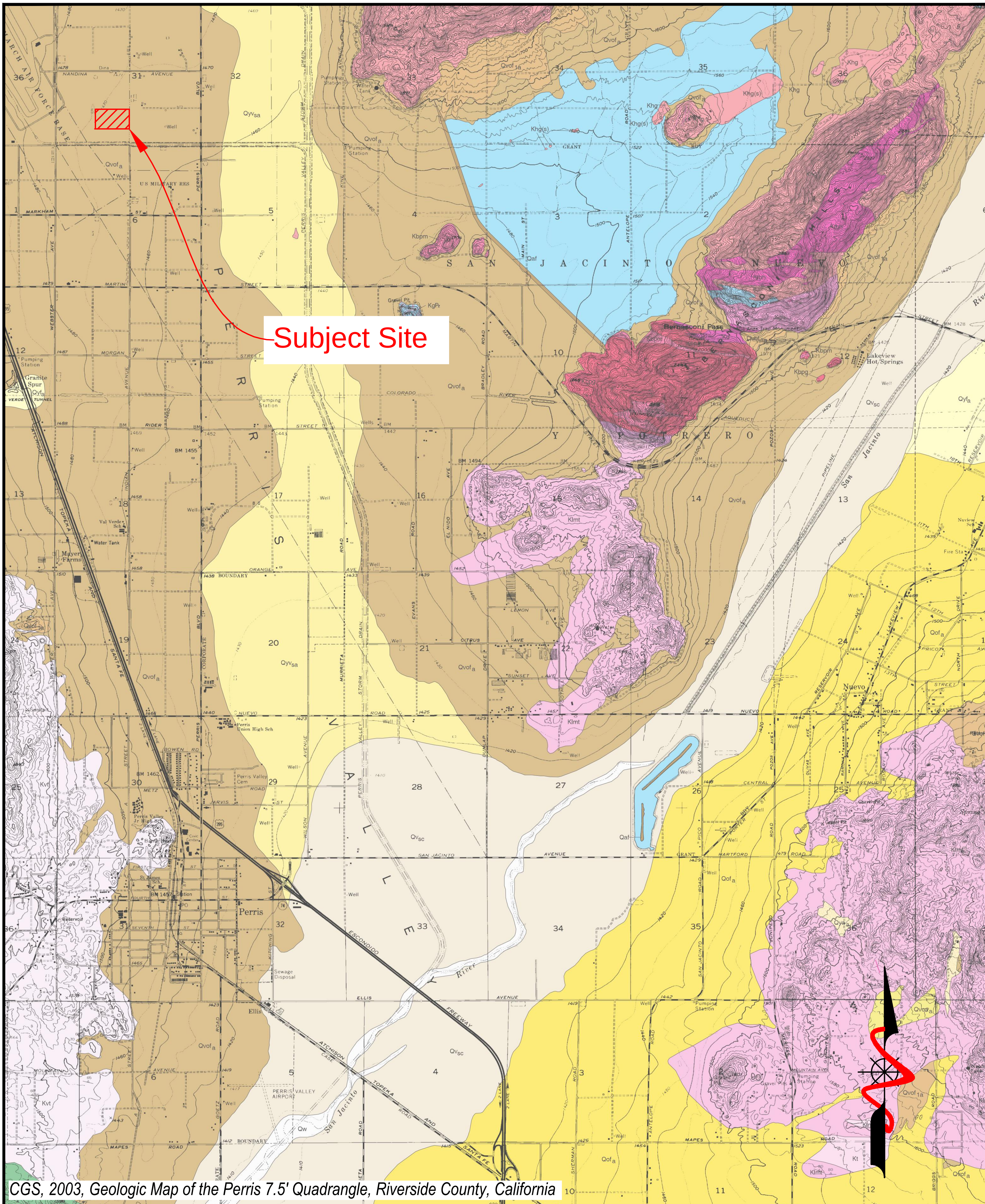
The findings of this report are valid as of the present date. However, changes in the conditions of a property can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. Therefore, the findings, conclusions, and recommendations presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification, and should not be relied upon after a period of 3 years.

LGC Geotechnical, Inc.

FIGURE 1
Site Location Map

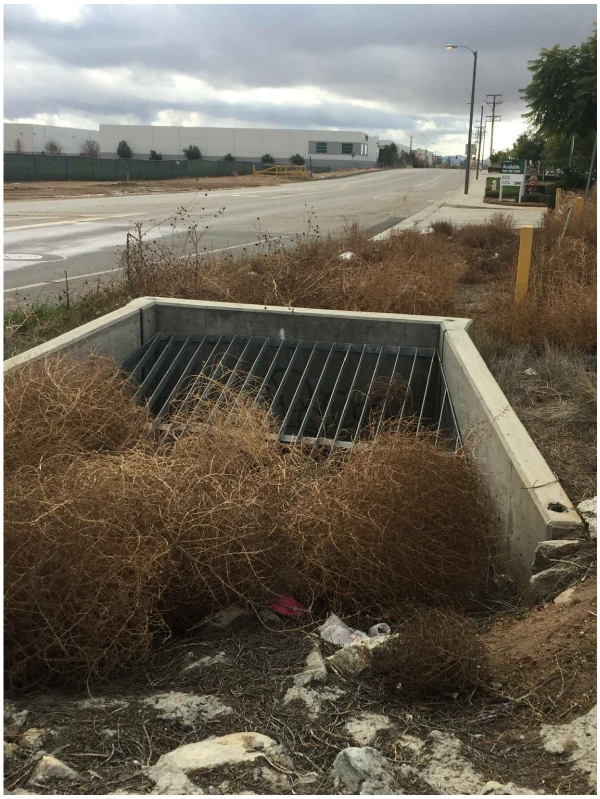
PROJECT NAME	Sares Regis - Moreno Valley
PROJECT NO.	15208-01
ENG. / GEOL.	TJL
SCALE	Not to Scale
DATE	January 2016



LGC Geotechnical, Inc.

FIGURE 2
Regional Geology Map

PROJECT NAME	Sares Regis - Moreno Valley
PROJECT NO.	15208-01
ENG. / GEOL.	TJL
SCALE	Not to Scale
DATE	January 2016



Photograph 1 - Storm drain inlet on southeast corner of property

Photograph 2 - Existing warehouse along southern boundary

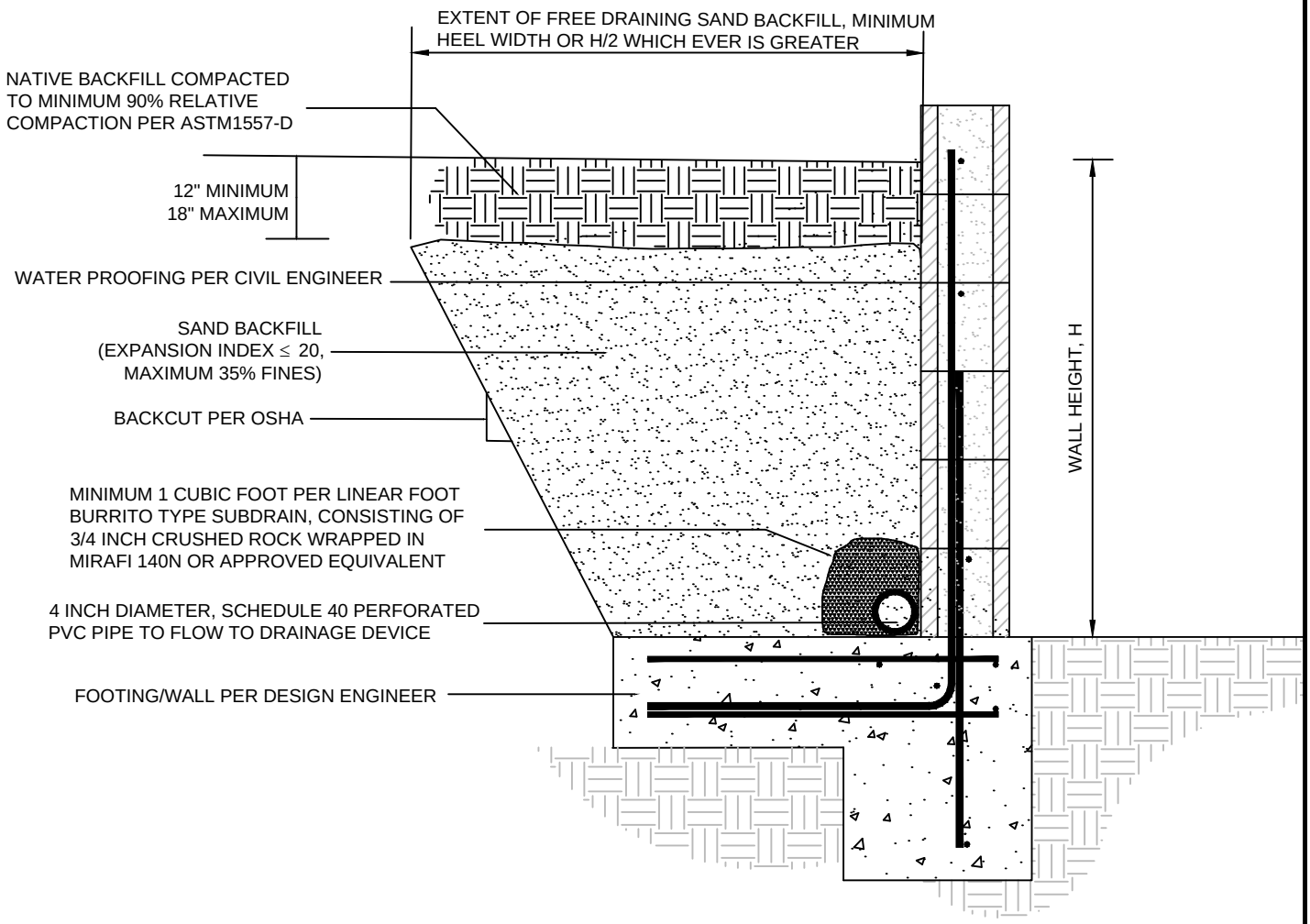
Photograph 3 - Eastern boundary as viewed from the southeast corner

Photograph 4 - Trees on the west half of property as seen from the southeast corner

LGC Geotechnical, Inc.

FIGURE 3
Site Photographs

PROJECT NAME	Sares Regis - Moreno Valley
PROJECT NO.	15208-01
ENG. / GEOL.	TJL
SCALE	Not to Scale
DATE	January 2016



NOTE:
PLACEMENT OF SUBDRAIN AT BASE OF WALL WILL NOT PREVENT SATURATION OF SOILS BELOW AND / OR IN FRONT OF WALL

LGC Geotechnical, Inc.

FIGURE 4
Retaining Wall Detail - Select Sandy Backfill

PROJECT NAME	Sares Regis - Moreno Valley
PROJECT NO.	15208-01
ENG. / GEOL.	TJL
SCALE	Not to Scale
DATE	January 2016

Appendix A
References

APPENDIX A

References

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Appendix B
Boring and Test Pit Logs

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

- ■ Indicates 2.5-inch Inside Diameter. Ring Sample.
- ☒ Indicates 2-inch OD Split Spoon Sample (SPT).
- ⧅ Indicates Shelby Tube Sample.
- ◫ Indicates No Recovery.
- ◧ Indicates SPT with 140# Hammer 30 in. Drop.
- ⊠ Indicates Bulk Sample.
- ◪ Indicates Small Bag Sample.
- ◨ Indicates Non-Standard
- ⧗ Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Vogel Properties
17549-14

Log of Boring B-1

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Hollowstem Auger	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		DISTURBED TOP SOILS Loose, dry to damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5		Clayey SAND Brown, dense, damp	X	21/18/17	6.2		37
10		Sandy clayey SILT Brown, stiff, moist	X	11/13/10	11.5		45
15			X	10/19/15	13.7		50
20			X	10/9/8	15.2		58
25			X	10/10/11	14.1		56
30			X	10/9/11	15.6		56
35							

GWT not encountered

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NorCal Engineering

Vogel Properties 17549-14	Log of Boring B-1

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Hollowstem Auger	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
35		Clayey SAND Brown, dense, moist	X	9/12/9	12.9		42
40			X	11/11/13	16.6		44
45		Silty SAND Brown, dense, moist	X	24/16/14	14.9		16
50		Sandy SILT with clay Brown, stiff, moist	X	21/16/14	12.8		45
		Boring completed at depth of 51.5'					
55							
60							
65							
70							

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Vogel Properties
17549-14

Log of Boring B-2

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Hollowstem Auger	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		FILL SOILS Sandy clayey SILT with rootlets Brown, soft, dry					
		NATURAL SOILS Sandy clayey SILT Brown, stiff, damp to moist					
5			X	24/26/15	6.0		54
10		Clayey SAND Brown, very dense, damp	X	35/50+/--	7.9		39
15		Sandy clayey SILT Brown, stiff, moist	X	12/15/19	17.2		55
20			X	16/17/15	14.0		62
25			X	12/14/17	13.1		62
30			X	12/14/18	14.3		64
35							

GWT not encountered

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Vogel Properties 17549-14	Log of Boring B-2

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Hollowstem Auger	
Hammer Weight: 140 lbs	Drop: 30"
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
35		Clayey SAND Brown, very dense, moist	X	25/26/24	13.8		47
40		Silty SAND Brown, dense, moist	X	17/17/19	7.8		28
45		Clayey sandy SILT Brown, very stiff, moist	X	24/26/22	13.6		62
50			X	20/18/16	12.7		55
		Boring completed at depth of 51.5'					
55							
60							
65							
70							

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NorCal Engineering

Vogel Properties 17549-14	Log of Trench T-1

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5		Boring completed at depth of 2'					
10							
15							
20							
25							
30							
35							

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NorCal Engineering

Vogel Properties 17549-14	Log of Trench T-2

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5		Boring completed at depth of 2'					
10							
15							
20							
25							
30							
35							

GWT not encountered

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Vogel Properties 17549-14	Log of Trench T-3

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties 17549-14	Log of Trench T-4

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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NorCal Engineering

Vogel Properties 17549-14	Log of Trench T-5

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties 17549-14	Log of Trench T-6

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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NorCal Engineering

Vogel Properties 17549-14	Log of Trench T-7

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties 17549-14	Log of Trench T-8

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp	■		6.5	107.4	
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp	■		7.6	107.9	
5							
			■		9.0	100.9	
10		Clayey SAND Brown, dense, moist	■		6.2	104.9	
		Boring completed at depth of 12.5'					
15							
20							
25							
30							
35							

GWT not encountered

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NorCal Engineering

Vogel Properties 17549-14	Log of Trench T-9

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5		Clayey SAND Brown, dense, damp	■		5.8	118.8	
			■		7.1	112.4	
10		Boring completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

File: C:\Superlog4\PROJECT\17549-14 si.log Date: 7/16/2014

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Vogel Properties 17549-14	Log of Trench T-10

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp	■		10.2	116.7	
5			■		10.9	118.6	
		Boring completed at depth of 8'					
10							
15							
20							
25							
30							
35							

GWT not encountered

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Vogel Properties 17549-14	Log of Trench T-11

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		Boring completed at depth of 5'					
10							
15							
20							
25							
30							
35							

GWT not encountered

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Vogel Properties
17549-14

Log of Trench T-12

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		DISTURBED TOP SOILS Sandy clayey SILT with occasional roots Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp			6.9	110.4	
5					8.3	117.8	
10		Silty SAND Brown, dense, damp			10.5	116.3	
		Clayey SILT with some sand Brown, stiff, moist					
15		Clayey SAND Brown, dense, damp			5.9	123.3	
		Boring completed at depth of 16'					
20							
25							
30							
35							

GWT not encountered

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Vogel Properties 17549-14	Log of Trench T-13

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		DISTURBED TOP SOILS Sandy clayey SILT with occasional roots Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5			■		11.3	111.2	
10		Clayey SAND Brown, dense, moist	■		9.4	117.9	
		Boring completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

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Vogel Properties 17549-14	Log of Trench T-14

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		DISTURBED TOP SOILS Sandy clayey SILT with occasional roots Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		Boring completed at depth of 5'					
10							
15							
20							
25							
30							
35							

GWT not encountered

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Vogel Properties 17549-14	Log of Trench T-15

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist	■		5.5	103.2	
5			■		10.4	108.9	
		Boring completed at depth of 9'					
10							
15							
20							
25							
30							
35							

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Vogel Properties 17549-14	Log of Trench T-16

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5			■		8.0	118.8	
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties 17549-14	Log of Trench T-17

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp	■		8.8	104.4	
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist	■		6.1	111.8	
5							
			■		13.0	104.8	
10							
			■		13.7	109.9	
		Boring completed at depth of 14'					
15							
20							
25							
30							
35							

GWT not encountered

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Appendix C
Laboratory Test Results

TABLE I
MAXIMUM DENSITY TESTS
(ASTM: D-1557-07)

Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
T-12 @ 2-4'	sandy, clayey SILT	10.0	113.9

TABLE II
EXPANSION INDEX TESTS
(ASTM: D-4829-07)

Sample	Classification	Expansion Index
T-12 @ 2-4'	sandy, clayey SILT	27

TABLE III
ATTERBERG LIMITS
(ASTM: D-4318-05)

Sample	Liquid Limit	Plastic Limit	Plasticity Index
T-12 @ 2-4'	29	19	10
B-2 @ 15'	31	20	11

TABLE IV
SOLUBLE SULFATE TESTS
(CT 417)

Sample	Sulfate Concentration (%)
T-10 @ 1-2'	.0038

TABLE V
pH TESTS

Sample	pH
T-10 @ 1-2'	7.8

TABLE VI
RESISTIVITY TESTS
(CT 643)

Sample	Resistivity (ohm-cm)
T-10 @ 1-2'	2,403

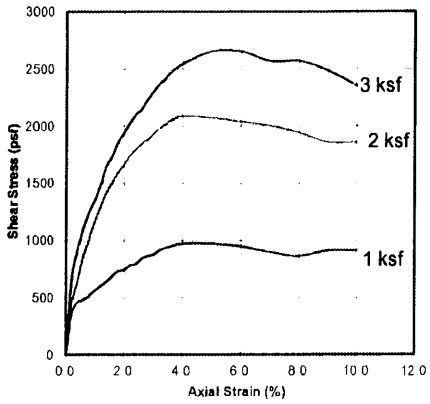
TABLE VII
CHLORIDE TESTS
(CT 422))

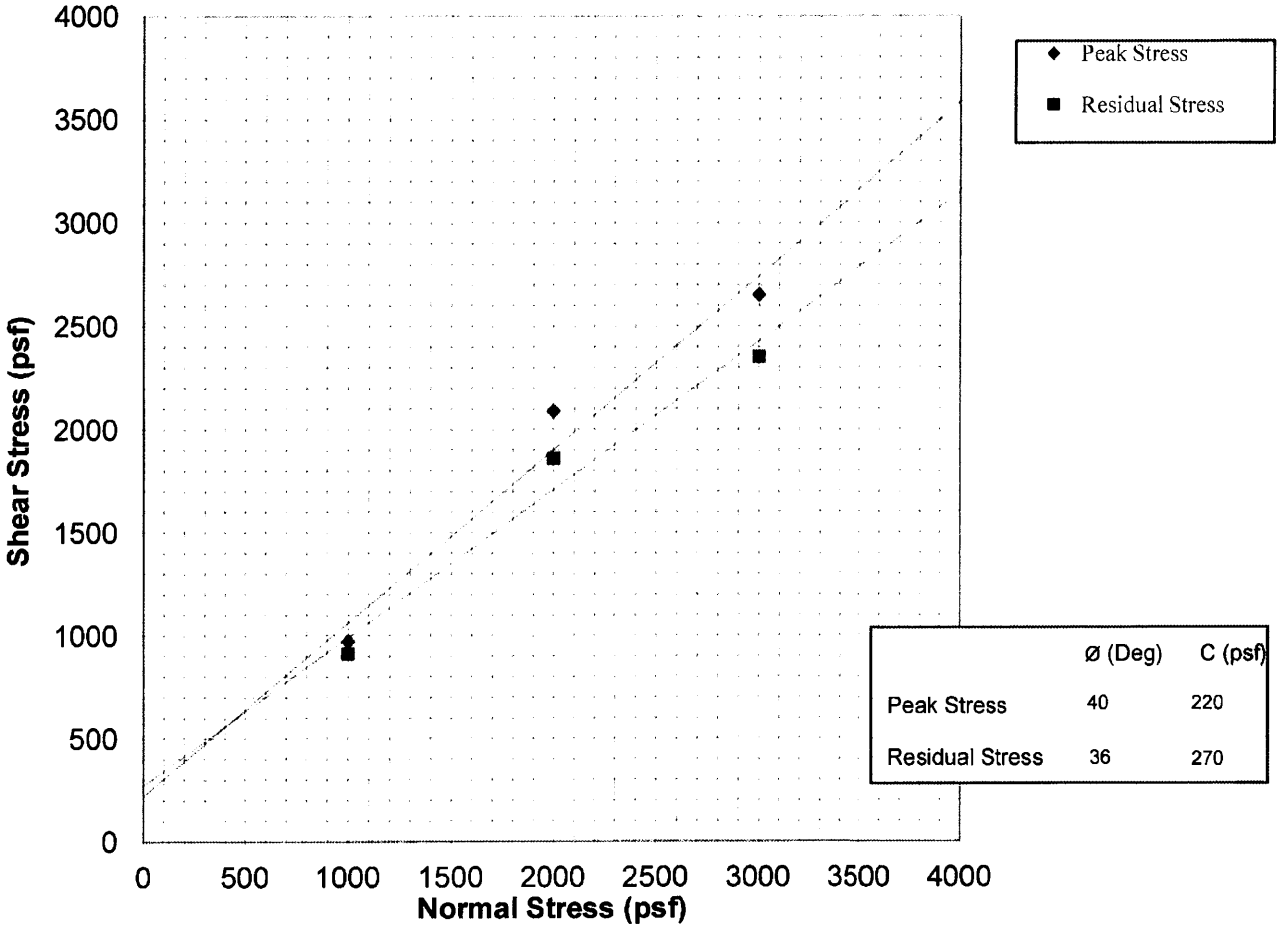
Sample	Concentration (ppm)
T-10 @ 1-2'	225

TABLE VIII
RESISTANCE 'R' VALUE TESTS
(CA 301))

Sample	'R' Value
T-1 @ 1-2'	5

Sample No		T9@5'		
Sample Type:		Undisturbed/Saturated		
Soil Description:		Silty Fine-Very Coarse Grained Sand w/ Some Small Gravel (DG)		
		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	972	2088	2652
Displacement	(in.)	0.100	0.100	0.125
Residual Stress	(psf)	912	1860	2352
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	118.8	118.8	118.8
In Situ Water Content	(%)	5.8	5.8	5.8
Saturated Water Content	(%)	15.4	15.4	15.4
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	40	220
Residual Stress	36	270

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Vogel Properties, In.c

PROJECT NUMBER: 17549-14 DATE: 7/22/2014

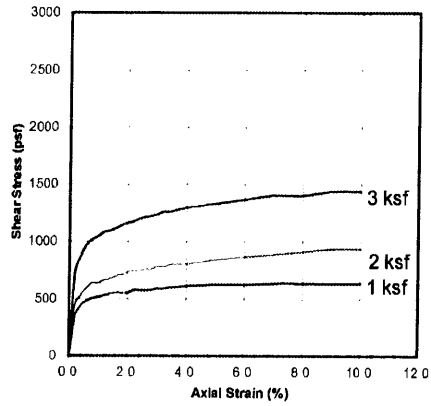
DIRECT SHEAR TEST

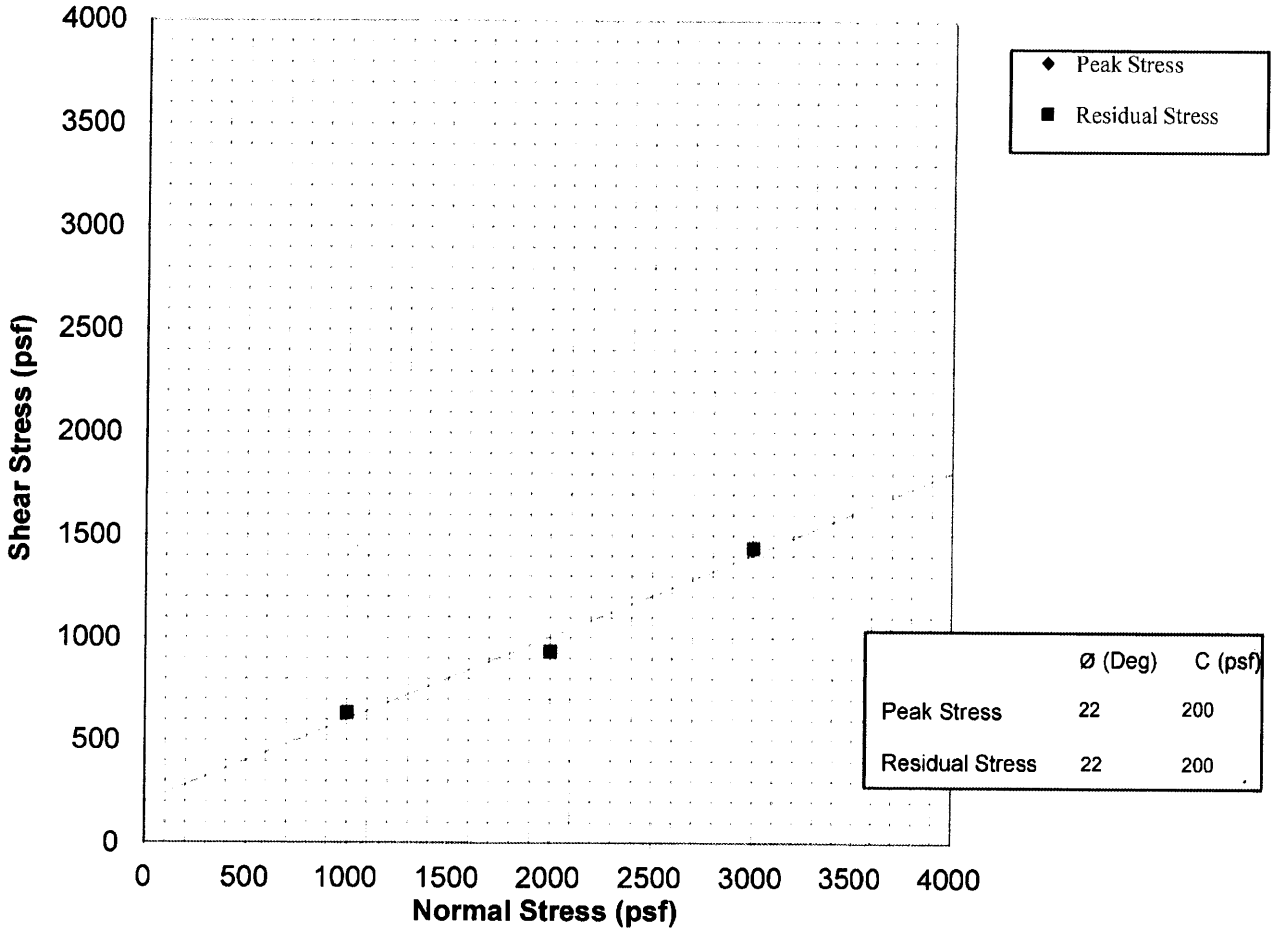
ASTM D3080

Plate A

Sample No.	T12@2'
Sample Type:	Remolded/Saturated
Soil Description:	Silty Clay w/ Some Sand

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	636	936	1440
Displacement	(in)	0.175	0.225	0.225
Residual Stress	(psf)	636	936	1440
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	113.9	113.9	113.9
In Situ Water Content	(%)	10.0	10.0	10.0
Saturated Water Content	(%)	17.8	17.8	17.8
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	22	200
Residual Stress	22	200

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Vogel Properties, In.c

PROJECT NUMBER: 17549-14 DATE: 7/22/2014

DIRECT SHEAR TEST

ASTM D3080

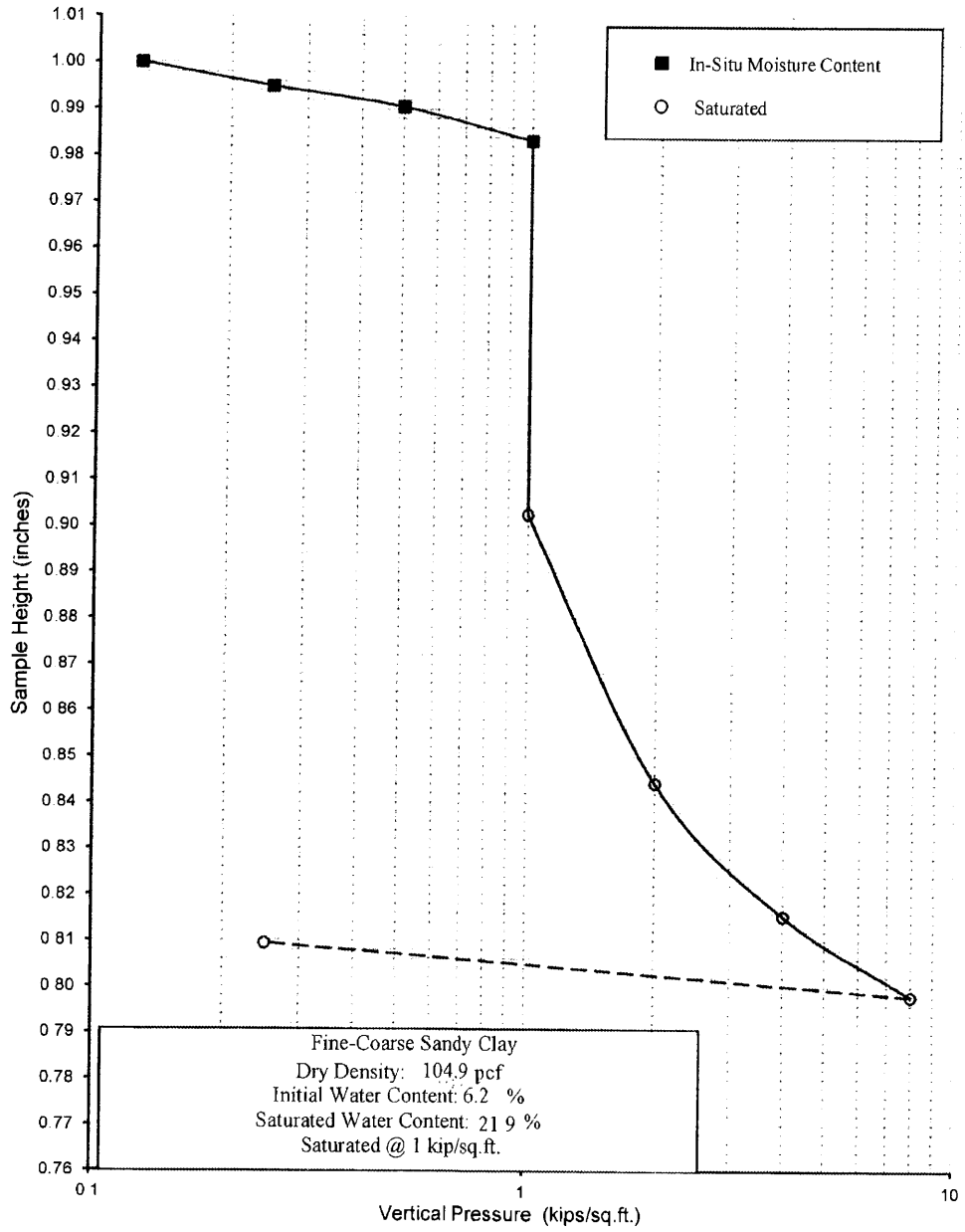
Plate B

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9949	0.5
0.5	0.9905	0.9
1	0.9831	1.7
1	0.9024	9.8
2	0.8442	15.6
4	0.8154	18.5
8	0.7979	20.2
0.25	0.8094	19.1

Saturated

Date Tested: 7/18/2014
Sample: T8
Depth: 12'

Sample No.	T8	Depth	12'	Date	7/22/2014



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Vogel Properties, In.c

PROJECT NUMBER: 17549-14 DATE: 7/22/2014

CONSOLIDATION TEST

ASTM D2435

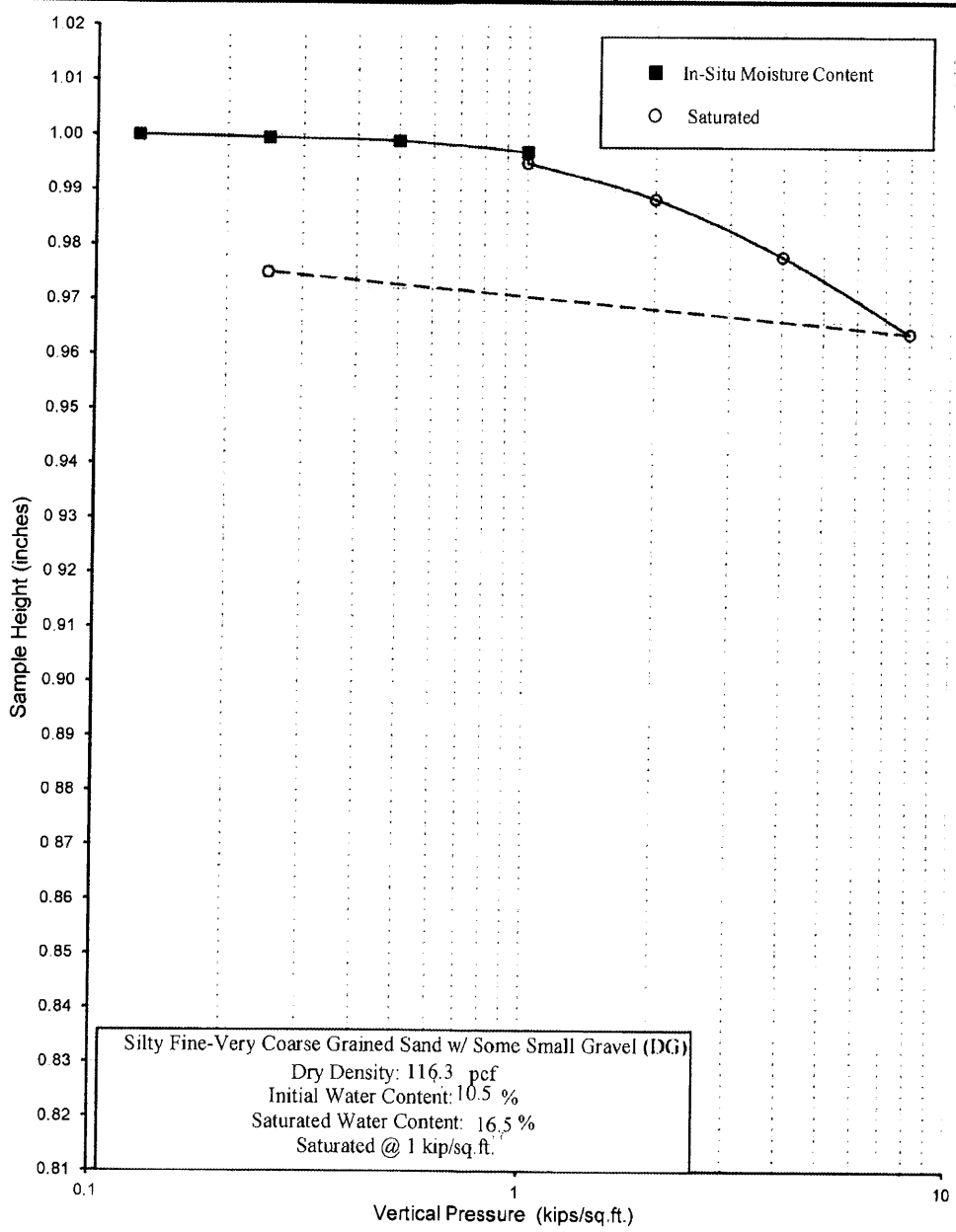
Plate C

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9995	0.0
0.5	0.9990	0.1
1	0.9970	0.3
1	0.9950	0.5
2	0.9885	1.2
4	0.9780	2.2
8	0.9640	3.6
0.25	0.9750	2.5

Saturated

Date Tested: 7/21/2014
Sample: T12
Depth: 10'

Sample No.	T12	Depth	10'	Date	7/22/2014



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SOILS AND GEOTECHNICAL CONSULTANTS

Vogel Properties, In.c

PROJECT NUMBER: 17549-14 DATE: 7/22/2014

CONSOLIDATION TEST

ASTM D2435

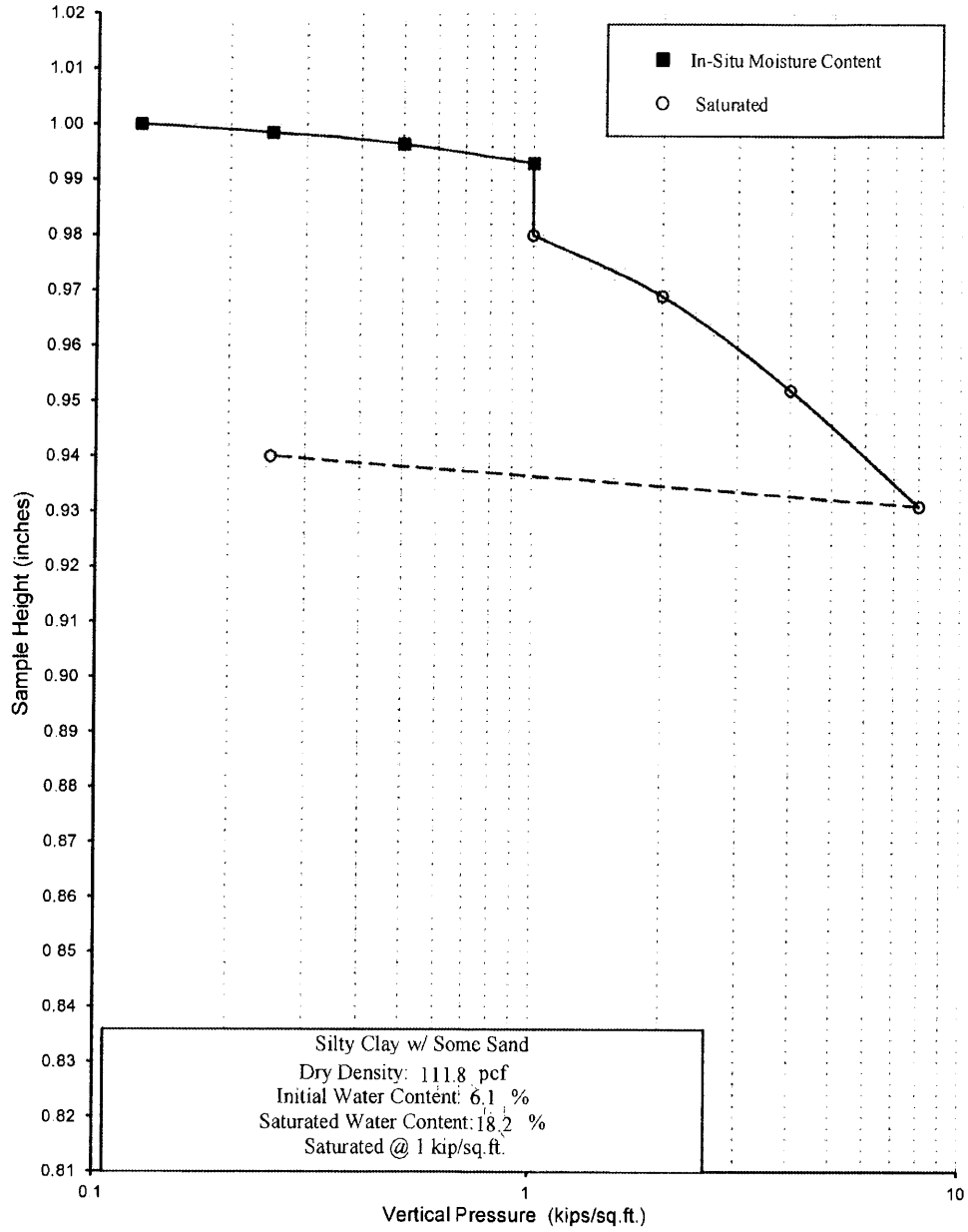
Plate D

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9985	0.2
0.5	0.9965	0.4
1	0.9930	0.7
1	0.9800	2.0
2	0.9690	3.1
4	0.9520	4.8
8	0.9310	6.9
0.25	0.9400	6.0

Saturated

Date Tested: 7/21/2014
Sample: T17
Depth: 4'

Sample No.	T17	Depth	4'	Date	7/22/2014



NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Vogel Properties, In.c

PROJECT NUMBER: 17549-14 DATE: 7/22/2014

CONSOLIDATION TEST

ASTM D2435

Plate E

Appendix D
General Earthwork and Grading Specifications

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of “equipment” of work and the estimated quantities of daily earthwork

contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the
Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be over-excavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Over-excavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 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. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of the geotechnical consultant. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 ***Frequency of Compaction Testing***

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 ***Compaction Test Locations***

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than
5 feet apart from potential test locations shall be provided.

5.0 ***Subdrain Installation***

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 ***Excavation***

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 ***Trench Backfills***

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over

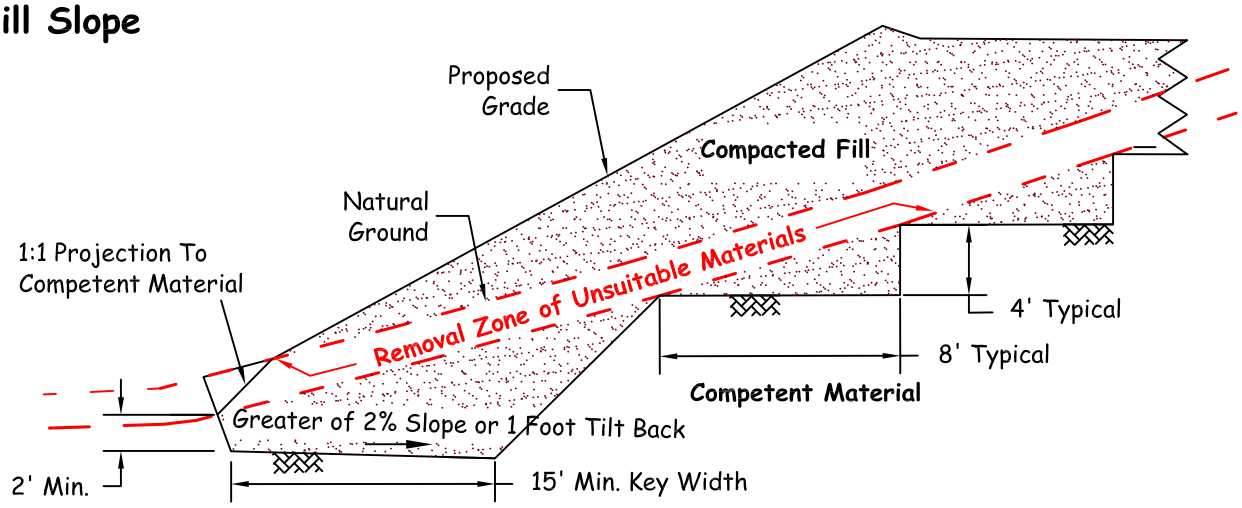
the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

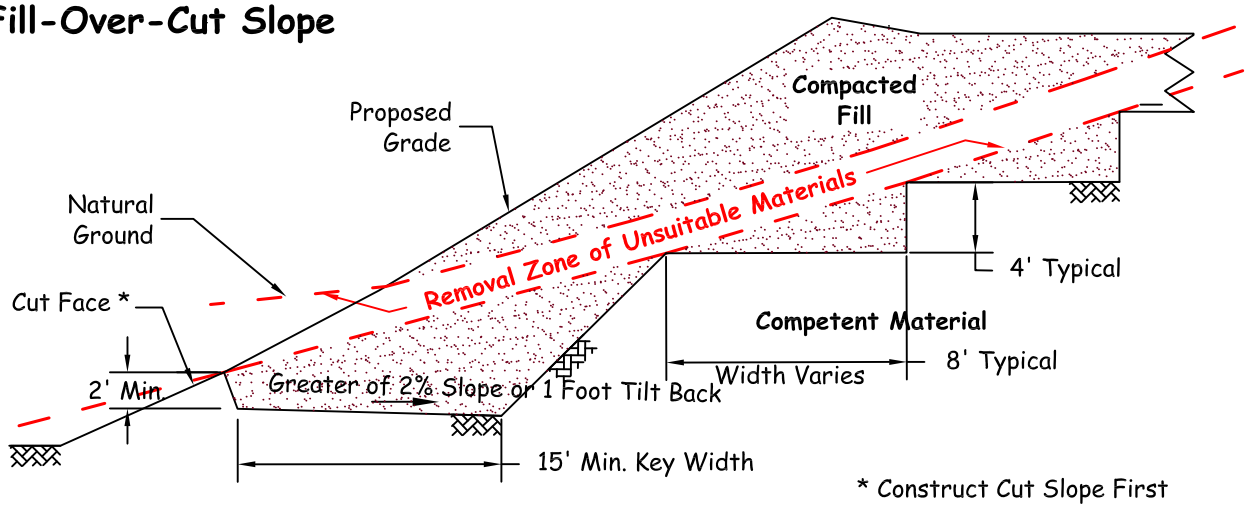
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

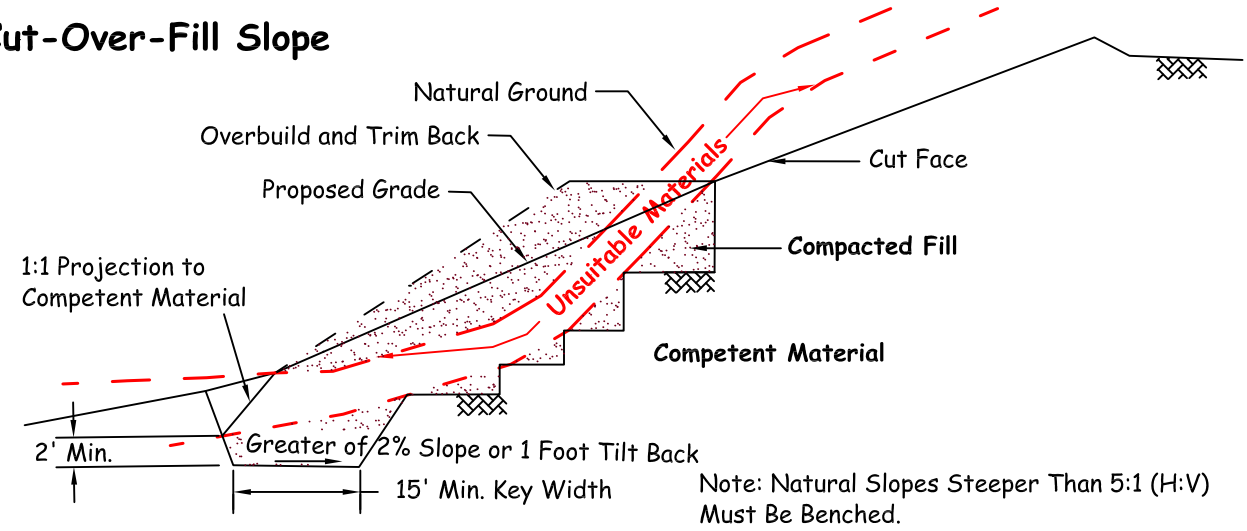
Fill Slope



Fill-Over-Cut Slope



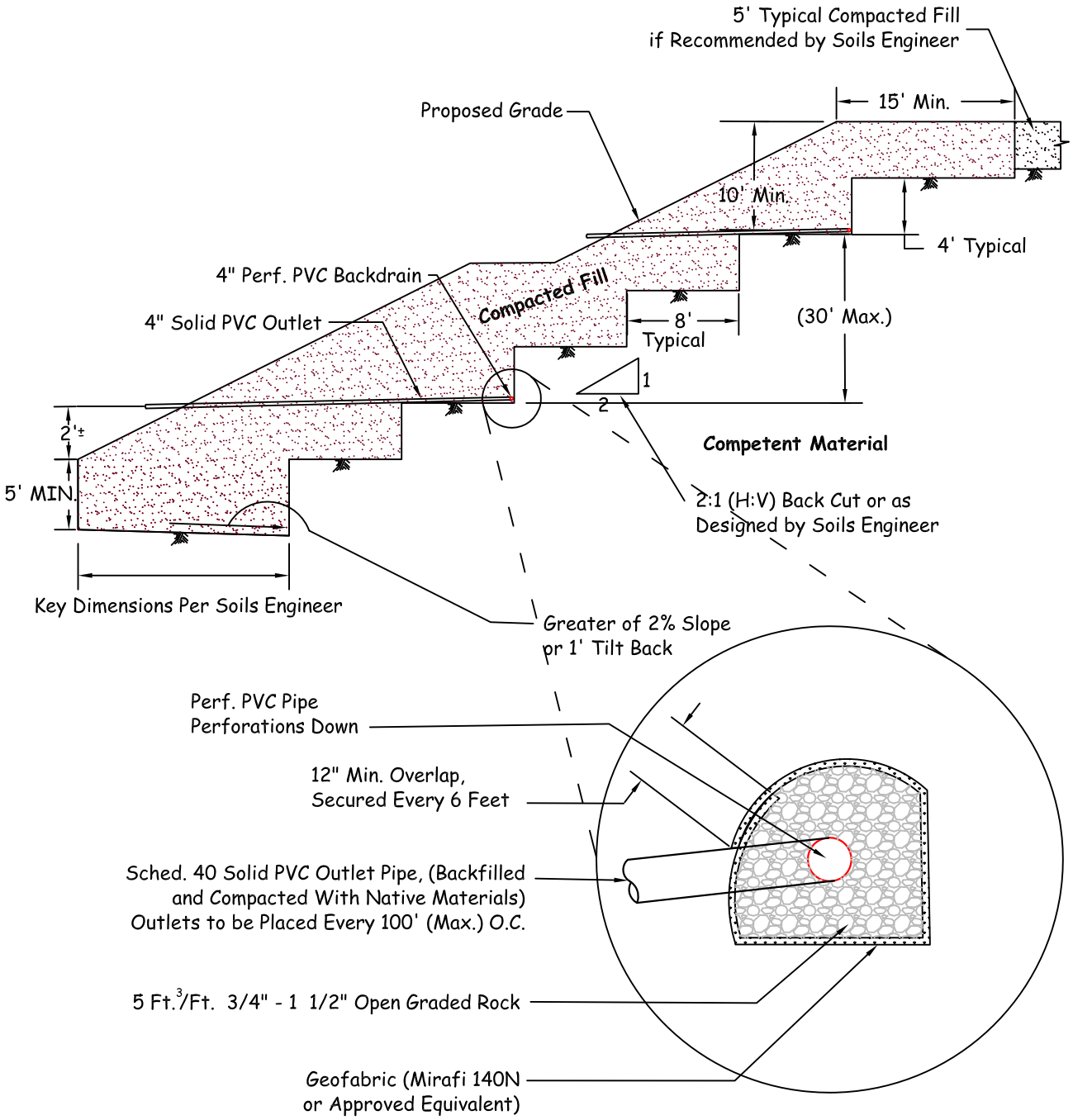
Cut-Over-Fill Slope



Note: Natural Slopes Steeper Than 5:1 (H:V) Must Be Benched.

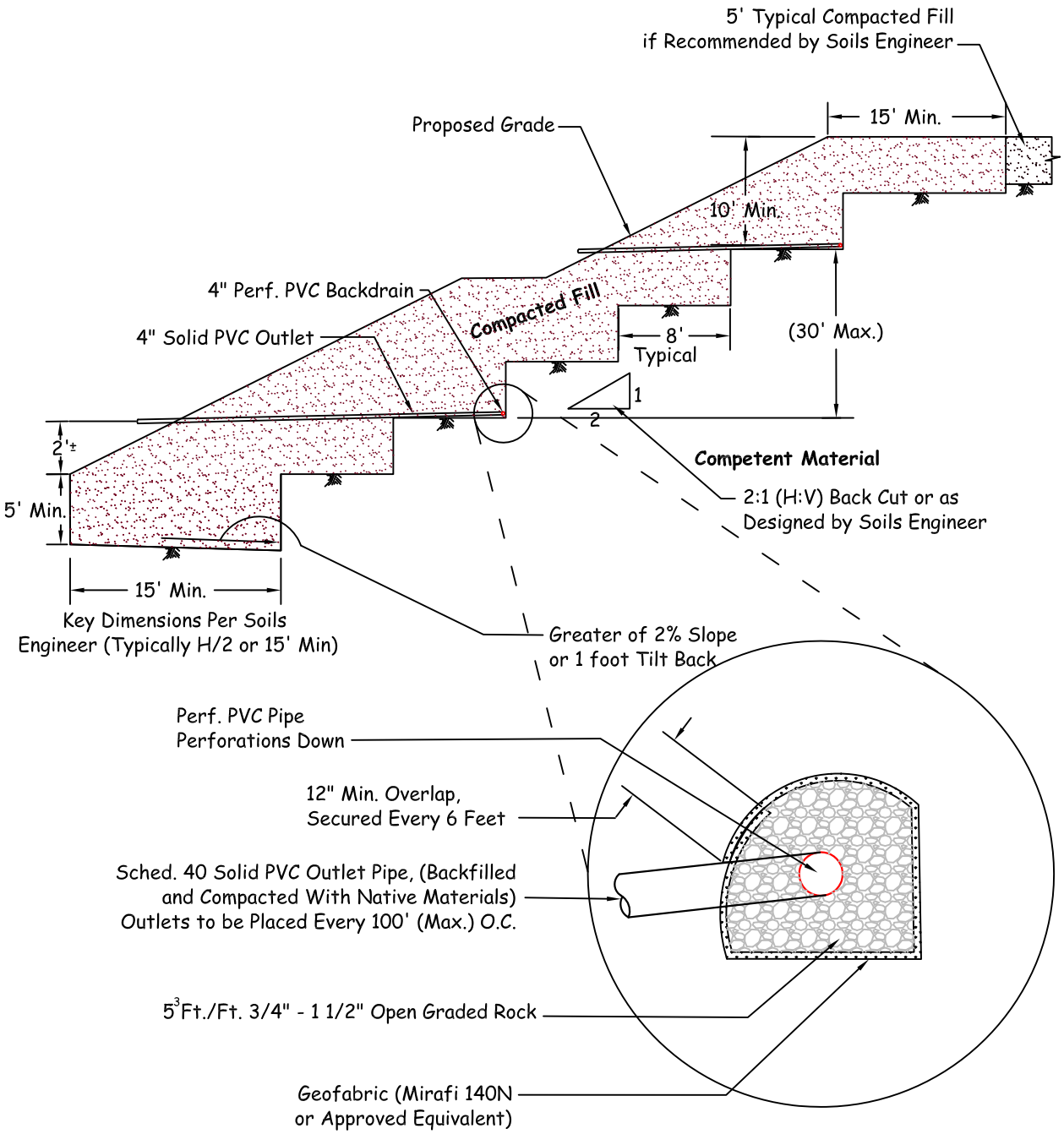
LGC Geotechnical, Inc.

KEYING AND BENCHING



LGC Geotechnical, Inc.

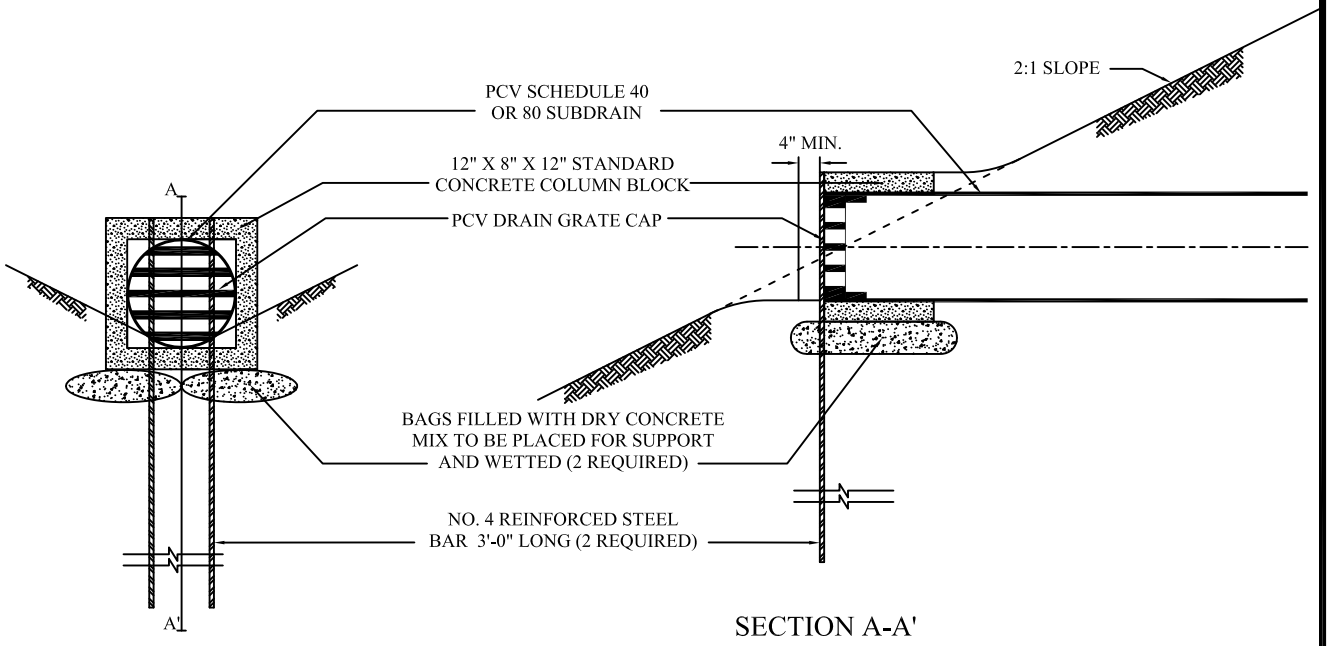
TYPICAL BUTTRESS DETAIL



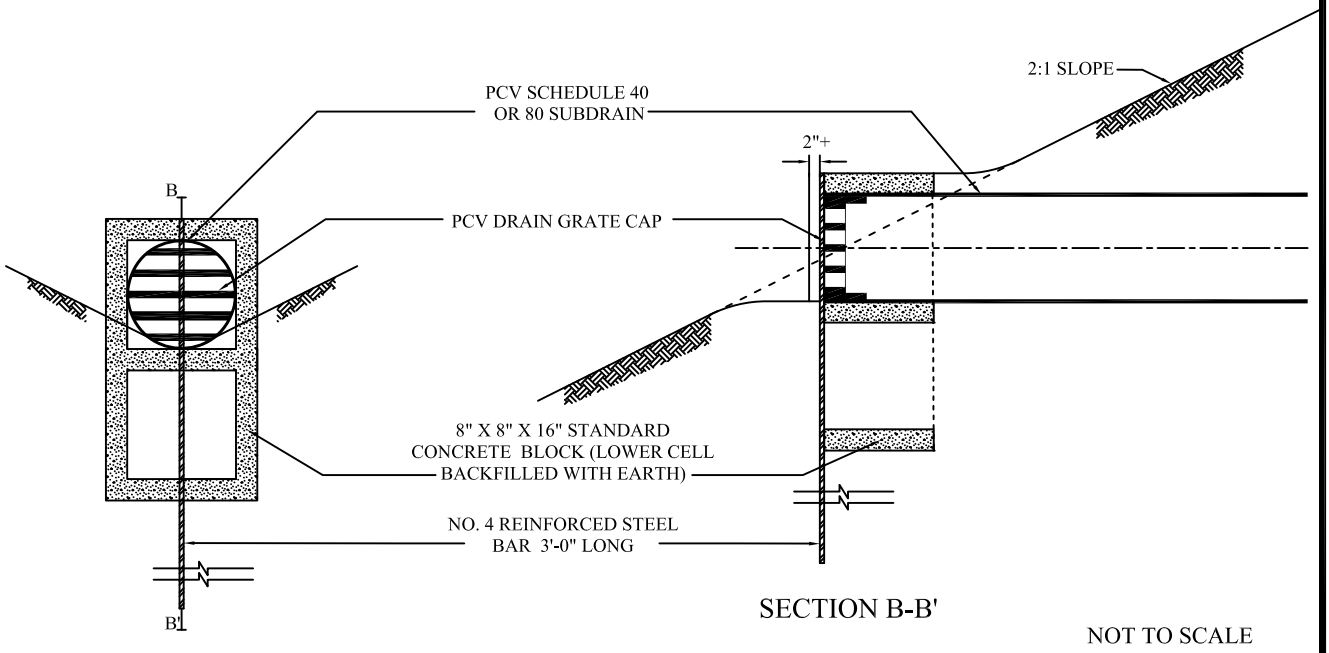
LGC Geotechnical, Inc.

TYPICAL STABILIZATION FILL DETAIL

SUBDRAIN OUTLET MARKER -6" & 8" PIPE



SUBDRAIN OUTLET MARKER -4" PIPE



NOT TO SCALE

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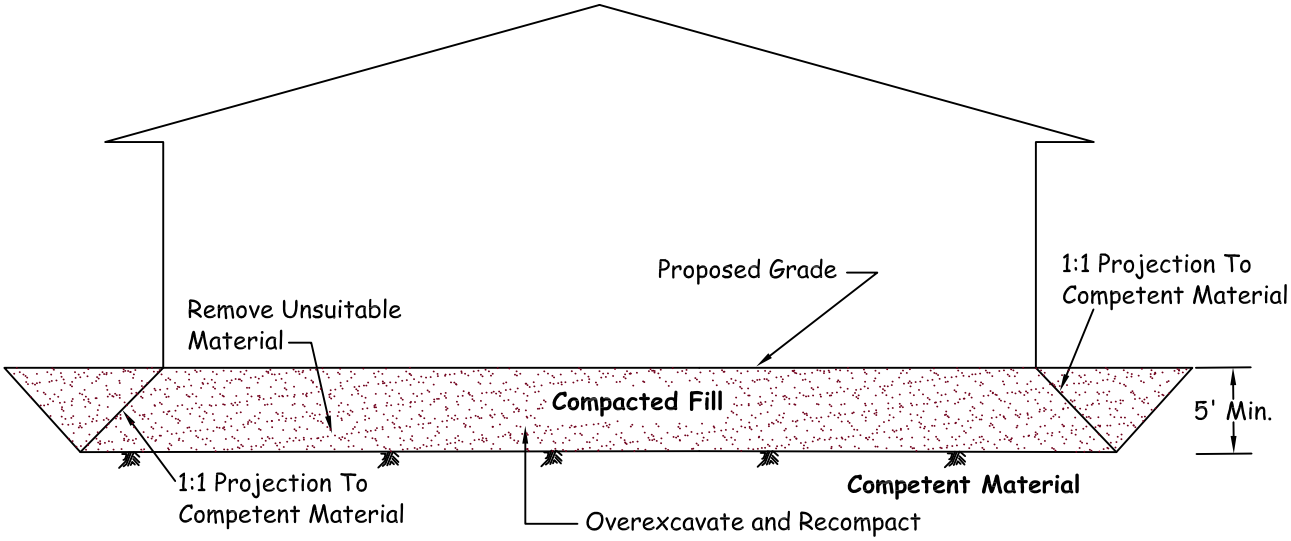
SUBDRAIN OUTLET MARKER DETAIL

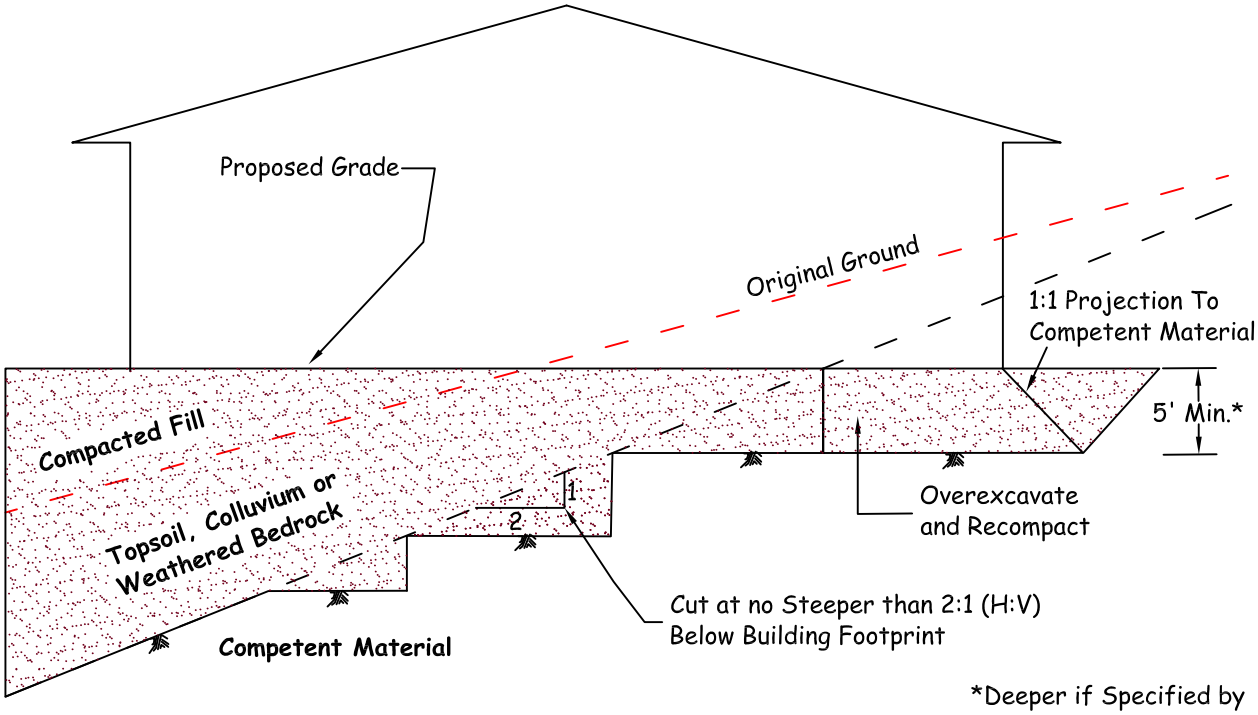
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

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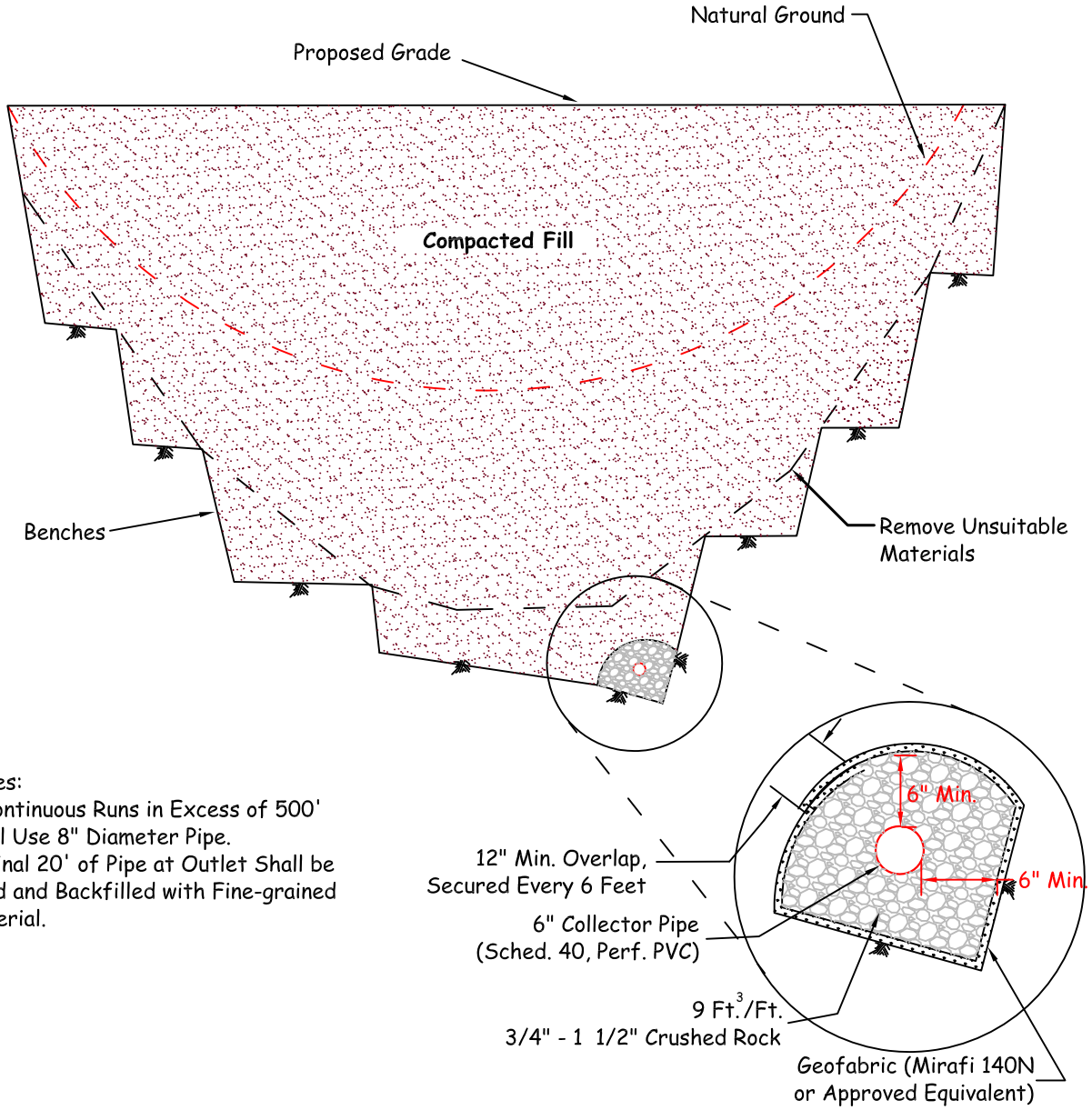
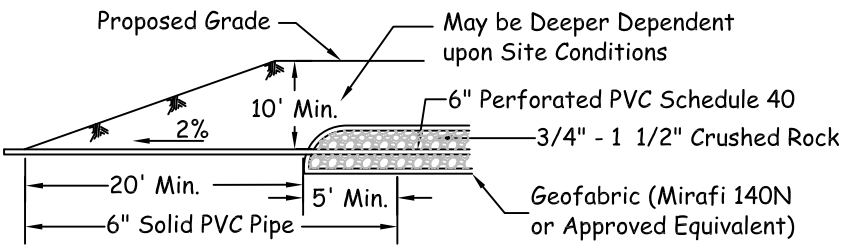
CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



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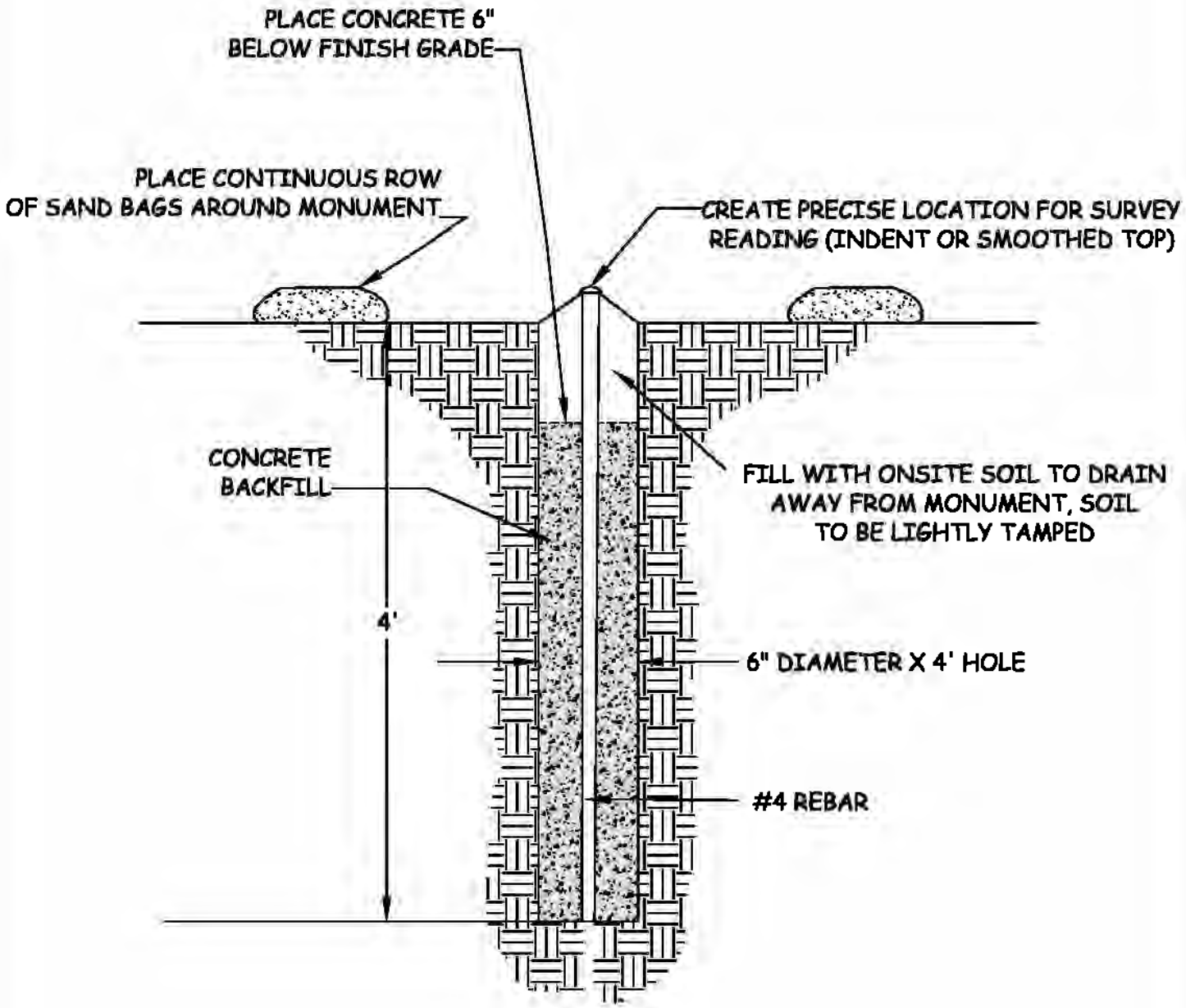
CANYON SUBDRAINS

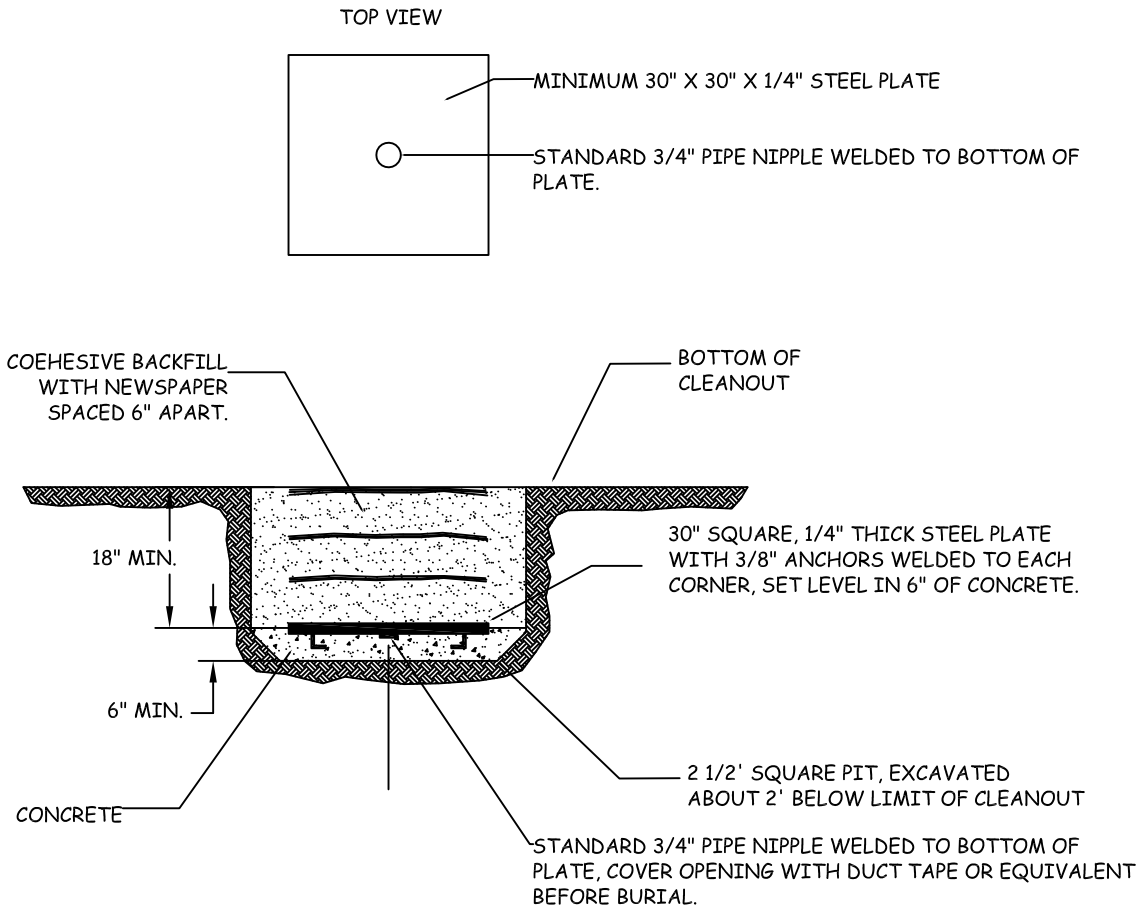


NO CONSTRUCTION EQUIPMENT WITHIN 25 FEET
OF ANY INSTALLED SETTLEMENT MONUMENTS

Revised 11/15

LGC Geotechnical, Inc.

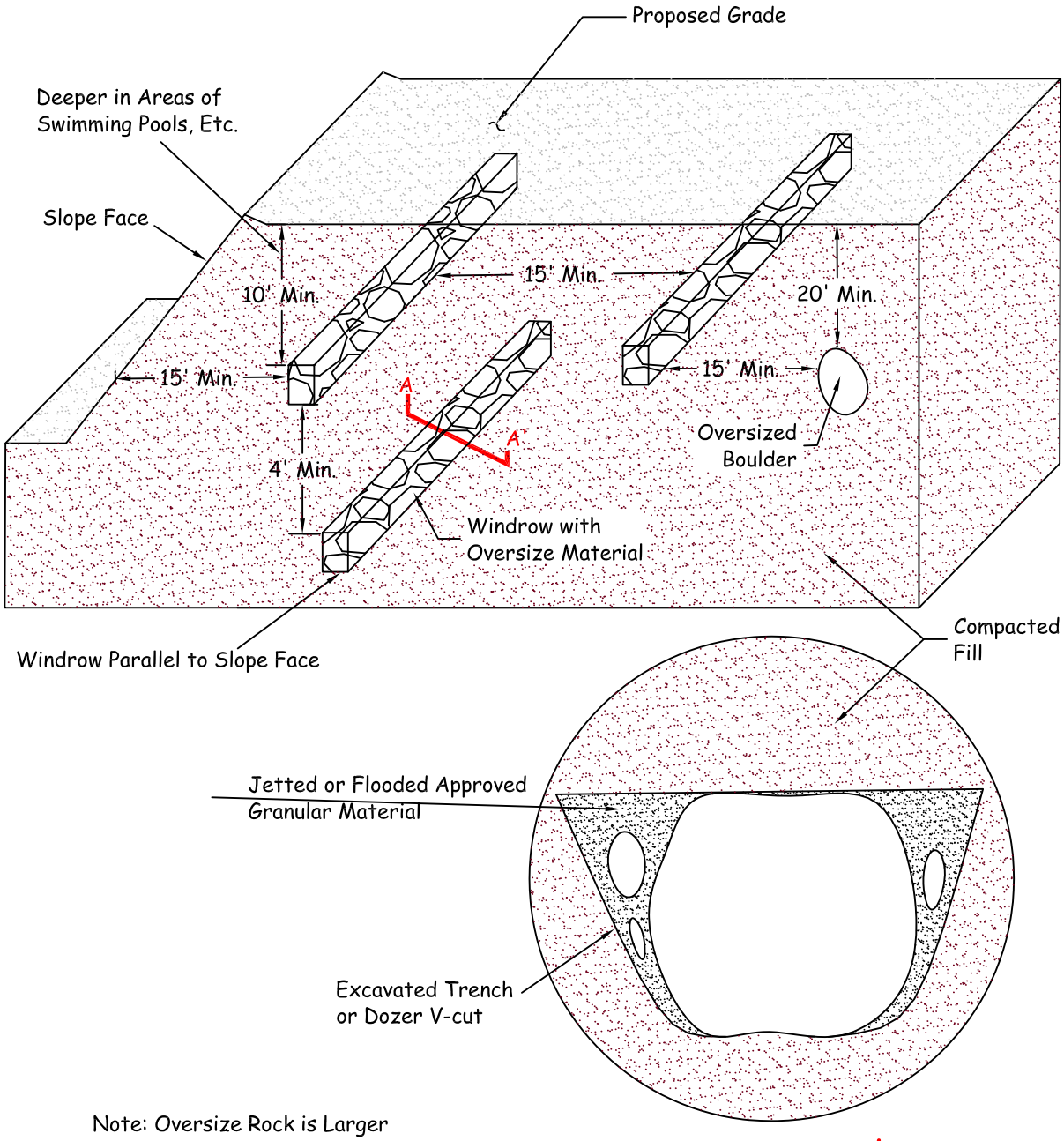
TYPICAL SURFACE SETTLEMENT MONUMENT



1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

LGC Geotechnical, Inc.

TYPICAL SETTLEMENT PLATE AND RISER



Note: Oversize Rock is Larger than 8" in Maximum Dimension.

Section A-A'

LGC Geotechnical, Inc.

OVERSIZE ROCK DISPOSAL DETAIL

NorCal Engineering

Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

July 16, 2014 Project Number 17549-14

Vogel Properties, Inc.
300 Paseo Tesoro
Walnut, California 91789

Attn: Bill Vogel

RE: **SOIL INFILTRATION STUDY** - Proposed Warehouse Development - Located at the Southwest Corner of Indian Avenue and Grove View Road, in the City of Moreno Valley, California

Dear Mr. Vogel:
Pursuant to your request, this firm has performed a Soil Infiltration Study for the above referenced project. The purpose of this study is to evaluate the feasibility of on-site drainage disposal systems at various locations on the subject lots. The scope of current work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration; 3) double ring infiltration testing at seventeen locations; 4) engineering analysis of field test data; and 5) preparation of this report.

It is proposed to install three detention/infiltration basins to dispose of on-site water runoff. Herdman Rierson Architecture and Design provided us with locations and depths of tests on their Site Plan – Scheme 2, dated May 8, 2014.

Site Description

The rectangular shaped parcel is located west of Indian Street and south of the proposed Grove View Road extension, in the City of Moreno Valley as shown on the attached Figure 1. Vacant land is located further to the north and to the west of the site while an existing concrete tilt-up building with associated pavement borders to the south.

The property is currently vacant. Low vegetation and occasional trees cover much of the site and a gravel/dirt road extends along the south property line. The site is relatively level with sheetflow directed in an easterly direction toward the roadway.

Field Exploration

The excavations were completed on June 28, 2014 and testing was completed on that day and on July 1st. The testing consisted of using the double ring infiltrometer at all seven locations to determine the infiltration rate of the proposed retention/infiltration basins. The locations of the tests are shown on the attached Figure 2. The test locations were excavated by extension backhoe to depths ranging from 2 to 6 feet below existing ground surface (bgs). Excavations were trimmed at 1:1 (horizontal to vertical) inclinations in order to provide safe entry into the deeper excavations. No significant caving occurred to the depths of these test excavations. Detailed description of the subsurface soils is shown on the attached test excavations logs in Appendix B. The excavations were backfilled at the conclusion of testing with the soil cuttings and tamped, but were *not* compacted to 90% relative compaction.

In general, the test areas were found to be underlain by minor amounts of surficial fill and native soils. The soils at test locations consisted of sandy, clayey SILTS. These soils were noted to be medium stiff to stiff and damp to moist. Sand, silt and clay content varied slightly with depth of explorations.

Groundwater

Test borings placed as a part of Geotechnical Investigation (report not issued at this date) extended to a maximum depth of 51.5 feet below grade. Groundwater was not encountered in *any* of our test explorations and is not expected to be a factor in site development. Based upon nearby groundwater well data, historic high groundwater in the vicinity has been encountered on the order of 30 feet bgs.

Infiltration Test Procedure and Results

The infiltration test consisted of the double ring infiltration test per ASTM Method D 3385. The double ring infiltrometer method consists of driving two open cylinders, one inside the other, into the ground, partially filling the ring with water or other liquid, and then maintaining the liquid at a constant level. The volume of liquid added to the inner ring, to maintain the liquid level constant is the measure of the volume of liquid that infiltrates into the soil.

The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually expressed in centimeters per hour or inches per hour and plotted verses elapsed time. The maximum-steady state or average incremental infiltration velocity, depending on the purpose/application of the test is equivalent to the infiltration rate.

Along the bottom of the infiltration test pits, dual infiltration rings were inserted 7 cm vertically into the soil by an impact-absorbing hammer. Guelph tubes, also referred to as bubblers were installed to maintain constant water level in each of the rings. Water levels were maintained at a constant level in both the inner ring and annular space between rings throughout the test, to prevent flow of water from one ring to the other.

The volume of liquid used during each measured time interval was converted into an incremental infiltration velocity of both the inner ring in the annular space using the following equations:

For the inner ring calculated as follows:

$Vir = \Delta Vir/(Air\Delta t)$

where:

Vir = inner ring incremental infiltration velocity, cm/hr

ΔVir = volume of water used during time interval to maintain constant head in the inner ring, cm^3

Air = internal area of the inner ting, cm^2

Δt = time interval, hr

The last reading obtained was used for design purposes in each of the basin. The testing data sheets are attached in Appendix B and summarized in the *Discussion of Results* section below.

Discussion of Results

The use of on-site disposal system by means of retention/infiltration basins appears to be geotechnically feasible for future development provided the very low rates given below are utilized in the basin design. Based upon the results of our testing, the following design rates should be used in the infiltration areas:

Test No.	Depth (feet bgs)	Soil Type	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)	Design (in/hr)
Area 1					
T-1	2.0	sandy, clayey SILT	1.7	0.68	0.5
T-2	2.0	sandy, clayey SILT	0.9	0.35	
Area 2					
T-3	6.0	sandy, clayey SILT	0.4	0.15	0.5
T-4	6.0	sandy, clayey SILT	2.1	0.85	
Area 3					
T-5	6.0	sandy, clayey SILT	0.3	0.12	0.15
T-6	6.0	sandy, clayey SILT	0.2	0.08	
T-7	6.0	sandy, clayey SILT	0.6	0.24	

It is our opinion that the site is suitable for stormwater infiltration without increasing the potential of settlement of proposed and existing structures or adversely affecting retaining/basement walls located either on or adjacent to the subject site. In addition, the potential for hydro-consolidation and the susceptibility for any ground settlements are considered low. All systems shall meet the California Regional Water Quality Control Board (CRWQCB) requirements.

Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. This firm should have the opportunity to review the final plans to verify that all our recommendations are incorporated.

This report and all conclusions are subject to the review of the controlling authorities for the project. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This infiltration study has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. All work was performed under the supervision of the Geotechnical Engineer. No other warranty, expressed or implied is made. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/14
GEOTECHNICAL
STATE OF CALIFORNIA

Mark A. Burkholder
Project Manager

List of Appendices
(in order of appearance)

Appendix A

Vicinity Map – Figure 1

Locations of Test Excavations – Figure 2

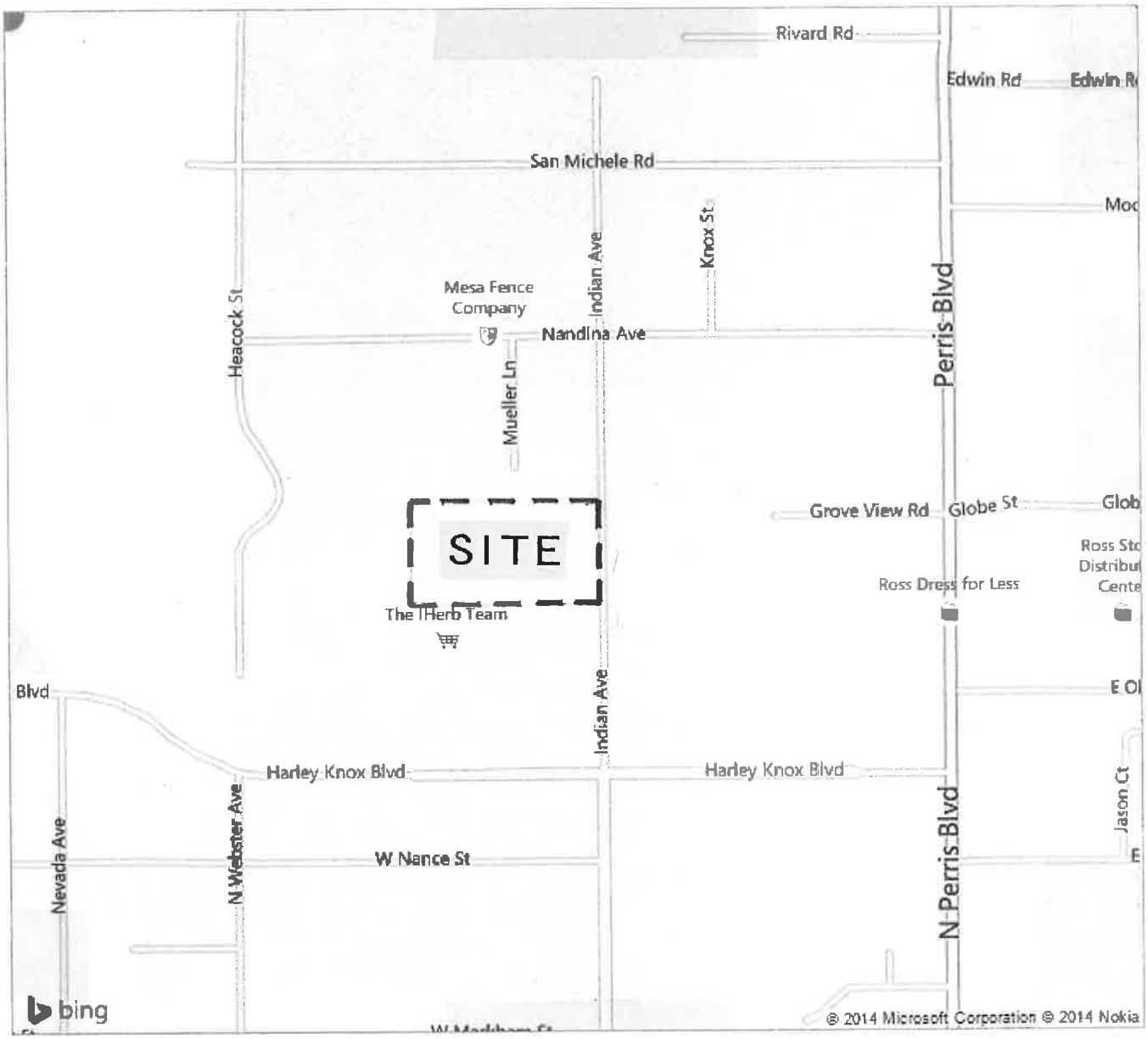
Appendix B

Logs of Test Pits T-1 to T-7

Field Test Data

Calculations

Appendix A



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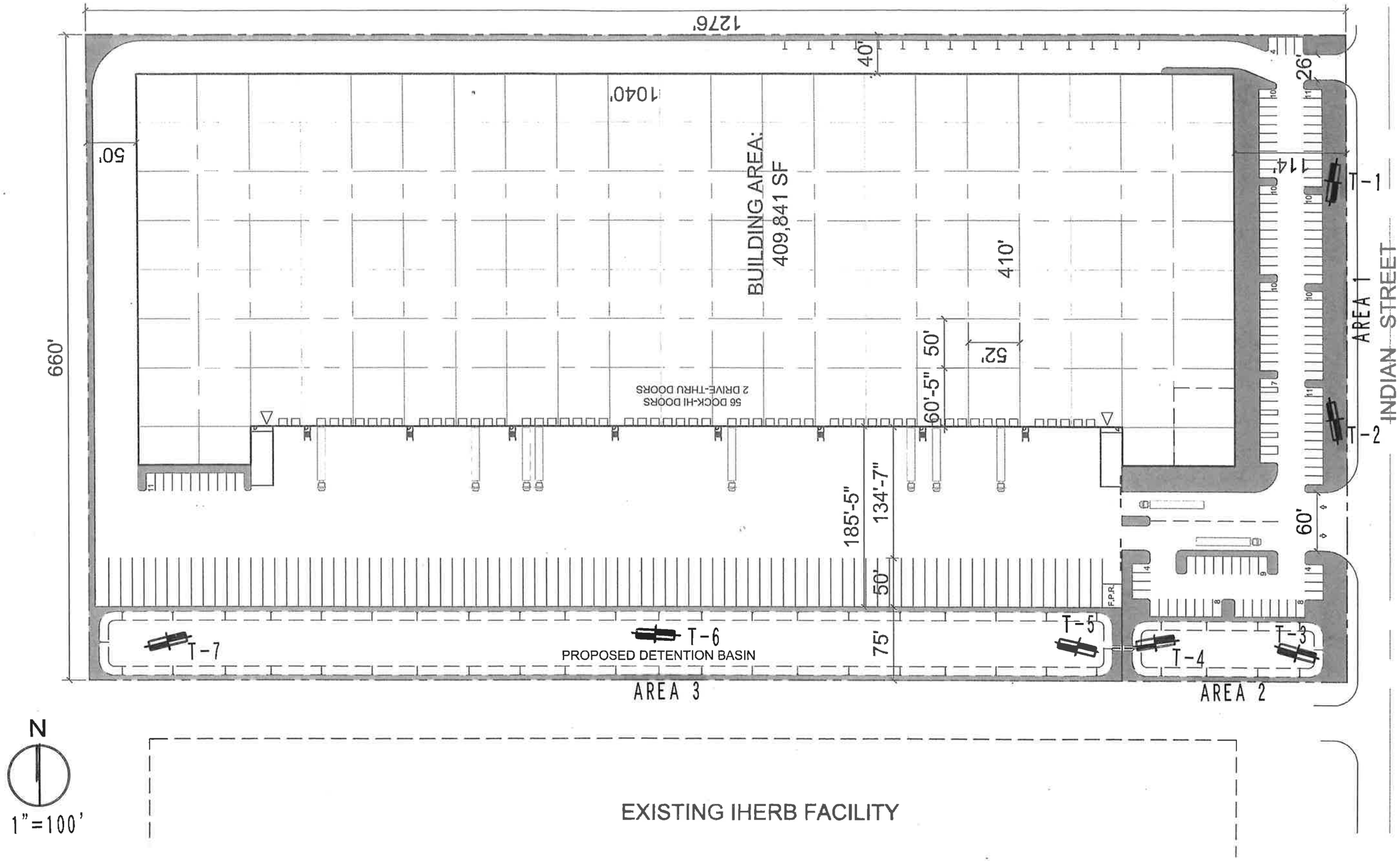
VICINITY MAP

FIGURE 1

PROJECT 17549-14

DATE JULY 2014



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PROJECT 17549-14 | DATE JULY 2014

APPROXIMATE LOCATIONS OF SOIL BORINGS

FIGURE 2

Appendix B

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

- ■ Indicates 2.5-inch Inside Diameter. Ring Sample.
- ☒ Indicates 2-inch OD Split Spoon Sample (SPT).
- ⧅ Indicates Shelby Tube Sample.
- ◫ Indicates No Recovery.
- ◧ Indicates SPT with 140# Hammer 30 in. Drop.
- ✉ Indicates Bulk Sample.
- ◪ Indicates Small Bag Sample.
- ◨ Indicates Non-Standard
- ⧗ Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Vogel Properties, Inc.
17549-14

Log of Trench T-1

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5		Boring completed at depth of 2'					
10							
15							
20							
25							
30							
35							

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Vogel Properties, Inc. 17549-14	Log of Trench T-2

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp					
5		Boring completed at depth of 2'					
10							
15							
20							
25							
30							
35							

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NorCal Engineering

Vogel Properties, Inc.
17549-14

Log of Trench T-3

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5							
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties, Inc. 17549-14	Log of Trench T-4

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties, Inc.
17549-14

Log of Trench T-5

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5							
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties, Inc. 17549-14	Log of Trench T-6

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel Brown, soft, damp					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		GWT not encountered					
		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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Vogel Properties, Inc. 17549-14	Log of Trench T-7

Boring Location: Indian & Grove, Moreno Valley	
Date of Drilling: 6/28/14	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: % Passing 200 Sieve
0		SURFICIAL FILL SOILS Sandy clayey SILT with occasional gravel, roots, minor debris Brown, soft, damp					
		GWT not encountered					
		NATURAL SOILS Sandy clayey SILT Brown, medium stiff to stiff, damp to moist					
5		Boring completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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SOILS AND GEOTECHNICAL CONSULTANTS
10641 HUMBOLT STREET LOS ALAMITOS, CA 90720
(562)799-9469 FAX (562)799-9459

Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-1
Depth: 2'
Tested By: D.R.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	8:30			137.2			260.2					
	8:37	7	7	138.0	0.8		261.1	0.9				
2	8:37			138.0			261.1					
	8:44	7	14	138.5	0.5		261.5	0.4				
3	8:44			136.7			259.8					
	8:51	7	21	137.1	0.4		260.3	0.5				
4	8:51			137.1			260.3					
	8:58	7	28	137.5	0.4		260.6	0.3				
5	8:58			137.5			260.6					
	9:05	7	35	137.9	0.4		260.9	0.3				
6	9:05			137.9			260.9					
	9:12	7	42	138.1	0.2		261.2	0.3		1.7	2.6	
7	9:12			138.1			261.2					
	9:19	7	49	138.3	0.2		261.5	0.3		1.7	2.6	
8	9:19			138.3			261.5					
	9:26	7	56	138.5	0.2		261.7	0.2		1.7	1.7	
9	9:26			136.1			259.8					
	9:33	7	63	136.3	0.2		260.0	0.2		1.7	1.7	
10	9:33			136.3			260.0					
	9:40	7	70	136.5	0.2		260.2	0.2		1.7	1.7	
11	9:40			136.5			260.2					
	9:47	7	77	136.7	0.2		260.4	0.2		1.7	1.7	
12	9:47			136.7			260.4					
	9:54	7	84	136.9	0.2		260.6	0.2		1.7	1.7	

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Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-2
Depth: 2'
Tested By: D.R.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	6:42			130.6			254.2					
	6:49	7	7	131.3	0.7		254.8	0.6				
2	6:49			131.3			254.8					
	6:56	7	14	131.5	0.2		255.2	0.4				
3	6:56			131.5			255.2					
	7:03	7	21	131.8	0.3		255.5	0.3				
4	7:03			131.8			255.5					
	7:10	7	28	131.8	0.0		255.7	0.2				
5	7:10			131.8			255.7					
	7:17	7	35	131.9	0.1		255.9	0.2				
6	7:17			131.9			255.9					
	7:24	7	42	132.0	0.1		256.1	0.2		0.9	1.7	
7	7:24			132.0			256.1					
	7:31	7	49	132.1	0.1		256.2	0.1		0.9	0.9	
8	7:31			132.1			256.2					
	7:38	7	56	132.2	0.1		256.3	0.1		0.9	0.9	
9	7:38			132.2			256.3					
	7:45	7	63	132.3	0.1		256.5	0.2		0.9	1.7	
10	7:45			132.3			256.5					
	7:52	7	70	132.4	0.1		256.7	0.2		0.9	1.7	
11	7:52			132.4			256.7					
	7:59	7	77	132.5	0.1		256.8	0.1		0.9	0.9	
12	7:59			132.5			256.8					
	8:06	7	84	132.6	0.1		256.9	0.1		0.9	0.9	

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Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-3
Depth: 6'
Tested By: D.R.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	10:20			136.7			259.7					
	10:27	7	7	136.9	0.2		260.3	0.6				
2	10:27			136.9			260.3					
	10:34	7	14	137.0	0.1		260.5	0.2				
3	10:34			137.0			260.5					
	10:41	7	21	137.0	0.1		260.8	0.3				
4	10:41			137.0			260.8					
	10:48	7	28	137.1	0.1		261.0	0.2				
5	10:48			137.1			261.0					
	10:55	7	35	137.1	0.0		261.2	0.2				
6	10:55			137.1			261.2					
	11:02	7	42	137.1	0.0		261.4	0.2		0.0	1.7	
7	11:02			137.1			261.4					
	11:09	7	49	137.2	0.1		261.7	0.3		0.9	2.6	
8	11:09			137.2			261.7					
	11:16	7	56	137.2	0.0		261.9	0.2		0.0	1.7	
9	11:16			137.2			261.9					
	11:23	7	63	137.3	0.1		262.1	0.2		0.9	1.7	
10	11:23			137.3			262.1					
	11:30	7	70	137.3	0.0		262.2	0.1		0.0	0.9	
11	11:30			137.3			262.2					
	11:37	7	77	137.4	0.1		262.3	0.1		0.9	0.9	
12	11:37			137.4			262.3					
	11:44	7	84	137.4	0.0		262.3	0.0		0.0	0.0	

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10641 HUMBOLT STREET LOS ALAMITOS, CA 90720
(562)799-9469 FAX (562)799-9459

Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-4
Depth: 6'
Tested By: D.R.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	12:26			138.0			260.3					
	12:33	7	7	138.7	0.7		260.9	0.6				
2	12:33			138.7			260.9					
	12:40	7	14	139.0	0.3		261.3	0.4				
3	12:40			137.9			259.8					
	12:47	7	21	138.2	0.3		260.1	0.3				
4	12:47			138.2			260.1					
	12:54	7	28	138.4	0.2		260.4	0.3				
5	12:54			138.4			260.4					
	1:01	7	35	138.7	0.3		260.7	0.3				
6	1:01			138.7			260.7					
	1:08	7	42	139.0	0.3		261.0	0.3		2.6	2.6	
7	1:08			139.0			261.0					
	1:15	7	49	139.3	0.3		261.2	0.2		2.6	1.7	
8	1:15			139.3			261.2					
	1:22	7	56	139.5	0.2		261.5	0.3		1.7	2.6	
9	1:22			139.5			261.5					
	1:29	7	63	139.8	0.3		261.8	0.3		2.6	2.6	
10	1:29			139.8			261.8					
	1:36	7	70	140.0	0.2		262.0	0.2		1.7	1.7	
11	1:36			140.0			262.0					
	1:43	7	77	140.2	0.2		262.2	0.2		1.7	1.7	
12	1:43			140.2			262.2					
	1:50	7	84	140.4	0.2		262.4	0.2		1.7	1.7	

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS
10641 HUMBOLT STREET LOS ALAMITOS, CA 90720
(562)799-9469 FAX (562)799-9459

Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-5
Depth: 6'
Tested By: J.S.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	6:19			138.0			260.5					
	6:29	10	10	138.4	0.4		261.0	0.5				
2	6:29			138.4			261.0					
	6:39	10	20	138.8	0.4		261.4	0.4				
3	6:39			138.8			261.4					
	6:49	10	30	138.8	0.0		261.4	0.0				
4	6:49			138.8			261.4					
	6:59	10	40	138.8	0.0		261.4	0.0				
5	6:59			138.8			261.4					
	7:09	10	50	139.0	0.2		261.8	0.4				
6	7:09			139.0			261.8					
	7:19	10	60	139.2	0.2		262.0	0.2		1.2	1.2	
7	7:19			139.2			262.0					
	7:29	10	70	139.2	0.0		262.2	0.2		0.0	1.2	
8	7:29			139.2			262.2					
	7:39	10	80	139.2	0.0		262.4	0.2		0.0	1.2	
9	7:39			139.2			262.4					
	7:49	10	90	139.2	0.0		262.4	0.0		0.0	0.0	
10	7:49			129.5			262.4					
	7:59	10	100	139.2	0.0		262.4	0.0		0.0	0.0	
11	7:59			139.2			262.4					
	8:09	10	110	139.2	0.0		262.4	0.0		0.0	0.0	
12	8:09			139.2			262.4					
	8:19	10	120	139.3	0.1		262.5	0.1		0.6	0.6	

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(562)799-9469 FAX (562)799-9459

Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-6
Depth: 6'
Tested By: J.S.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	8:37			134.8			256.3					
	8:47	10	10	135.2	0.4		257.0	0.7				
2	8:47			135.2			257.0					
	8:57	10	20	135.2	0.0		257.2	0.2				
3	8:57			135.4			257.2					
	9:07	10	30	135.4	0.2		257.4	0.2				
4	9:07			135.8			257.4					
	9:17	10	40	135.8	0.4		257.8	0.4				
5	9:17			135.8			257.8					
	9:27	10	50	135.8	0.0		257.8	0.0				
6	9:27			135.8			257.8					
	9:37	10	60	135.8	0.0		258.0	0.2		0.0	1.2	
7	9:37			135.8			258.0					
	9:47	10	70	135.9	0.1		258.2	0.2		0.6	1.2	
8	9:47			135.9			258.2					
	9:57	10	80	136.0	0.1		258.4	0.2		0.6	1.2	
9	9:57			136.0			258.4					
	10:07	10	90	136.0	0.0		258.4	0.0		0.0	0.0	
10	10:07			136.0			258.4					
	10:17	10	100	136.0	0.0		258.4	0.0		0.0	0.0	
11	10:17			136.0			258.4					
	10:27	10	110	136.0	0.0		258.4	0.0		0.0	0.0	
12	10:27			136.0			258.4					
	10:37	10	120	136.0	0.0		258.4	0.0		0.0	0.0	

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Project: Vogel Properties
Project No.: 17549-14
Date: 6/28/14

Test No.: T-7
Depth: 6'
Tested By: J.S.

	Time (hr/min)	Change Time (min)	Cumulative Time (min)	Inner Ring Reading (cm)	Inner Ring Change (cm)	Inner Ring Flow (cc)	Outer Ring Reading (cm)	Outer Ring Change (cm)	Outer Ring Flow (cc)	Inner Ring Inf Rate (cm/hr)	Outer Ring Inf Rate (cm/hr)	Inner Ring Inf Rate (ft/hr)
1	10:55			136.9			260.0					
	11:10	15	15	137.3	1.0		261.0	1.0				
2	11:10			137.3			261.0					
	11:25	15	30	137.7	0.5		261.5	0.5				
3	11:25			137.7			261.5					
	11:40	15	45	138.0	0.5		262.0	0.5				
4	11:40			138.0			262.0					
	11:55	15	60	138.0	0.2		262.2	0.2				
5	11:55			138.0			262.2					
	12:10	15	75	138.2	0.2		262.4	0.2				
6	12:10			138.2			262.4					
	12:25	15	90	138.4	0.4		262.8	0.4				
7	12:25			138.4			262.8					
	12:40	15	105	138.6	0.1		262.9	0.1		0.4	0.4	
8	12:40			138.6			262.9					
	12:55	15	120	138.6	0.1		263.0	0.1		0.4	0.4	
9	12:55			137.0			260.2					
	1:10	15	135	137.2	0.2		260.4	0.2		0.8	0.8	
10	1:10			137.2			260.4					
	1:25	15	150	137.3	0.1		260.5	0.1		0.4	0.4	
11	1:25			137.3			260.5					
	1:40	15	165	137.5	0.2		260.7	0.2		0.8	0.8	
12	1:40			137.5			260.7					
	1:55	15	180	137.7	0.2		260.9	0.2		0.8	0.8	

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment Page 13-14

the site. Based on the historical land uses at the site, there is a low likelihood that former occupants have contributed to the groundwater issues.

5 HISTORICAL LAND USE

Ardent conducted a historical land use record search for both the site and surrounding areas. This included a review of one or more of the following sources that were found to be both reasonably

ascertainable and useful for the purposes of this Phase I ESA: historical aerial photographs, historical fire insurance maps, historical city directories, building permits and plans, topographic maps, property tax records, zoning/land use records, and a review of prior environmental assessment reports regarding the site. Copies of historical data are provided in Appendix C.

5.1 Summary of Historical Land Use of the Property

The site was vacant land from at least 1938 through the 1960s with possible agricultural usage during the 1930's. From at least 1978 to 2008, the southeastern parcel was occupied by a single-family residence. A prior Phase I ESA reported that the southwestern and two northern parcels were used as a sod farm in 2004. The southeastern parcel was briefly used to store truck trailers during the mid-2000's.The residential building demolition in 2008included the removal of a septic tank. From 2008 to present-day, the site has remained avacant lot.

5.2 Summary of Historical Land Use of Adjoining Properties

The site vicinity was largely used for agricultural purposes or vacant land from at least 1938through the mid-1980's. Scattered single-family residential buildings were constructed in the site vicinity during the late-1970's to mid-1980's. From the early-2000's to at least 2012, the property adjoining north was used to store modular homes, trucks and trailers. This property was vacant land during the current site reconnaissance. The commercial warehouse building adjoining south of the site was constructed by 2006.

5.3 Fire Insurance Rate Maps

Historical Sanborn Fire Insurance Rate Maps (Sanborn maps) were requested from Environmental Data Resources Inc. (EDR) of Milford, Connecticut. According to EDR, there are no Sanborn maps available for the site.

5.4 Historical Aerial Photographs

Historical aerial photographs for selected years between 1938 and 2012 were provided by EDR. The following presents a summary of our review.

- **1938, 1953, 1961 and 1967 –** The site was vacant land. The site vicinity appeared to be used for agricultural purposes or vacant land. A water retention pond observed during the current site reconnaissance was first visible off-site near the northwestern corner of the site in the 1953 photo.

- **1978 and 1985** – By 1978, small single-family residence was visible on the southeastern parcel. A "pond" observed on-site during the current site reconnaissance was visible in the aerial photos adjoining west of the residence. By 1978, a single-family residence was constructed on the property adjoining north of the site, and by 1985 a single-family residence was constructed on the property adjoining south of the site.

- **1989, 1994, 2002, 2005, 2006, 2009, 2010 and 2012** – In the 2006 aerial photos, the site was used for storage of truck trailers. By 2009, the single-family residence was demolished. The prior Phase I ESA reported the use of the southwestern and two northern parcels as a sod farms. The presence of the sod farm usage were not obvious in the aerial photos. From 1989 to 2012, the property adjoining north appeared to be used as a storage yard for truck trailers. The prior Phase I ESA also reported the storage of modular homes at this property. The property adjoining north of the site was vacant land during the current site reconnaissance.

5.5 Building Permits

Building permits were reviewed at the City of Moreno Valley Building Department (MVBD) using the APNs associated with the site. The MVBD provided copies of a 2008 asbestos survey and demolition permit associated with the southeastern parcel. The asbestos survey was conducted prior to the demolition of the single-family residence. No asbestos was detected in the 14 samples collected. The building was demolished in July 2008 and included the removal of a septic system. The MVBD reported that there were no building records for the remaining parcels.

Appendix 5: LID Infeasibility (N/A)

LID Technical Infeasibility Analysis

Reference page 59 form Riverside County WQMP Guidance

TABLE 3-4. LID BMP Applicability

LID BMP Hierarchy	A	B	C	D
	K_{SAT}> 1.6"/hr., and no restrictions on infiltration	Are Harvest and Use BMPs feasible?	0.3"/hr. < K_{SAT} < 1.6"/hr., or unpredictable or unknown	K_{SAT} < 0.3"/hr.
LID Infiltration BMPs*	✓			
Harvest and Use BMPs		✓		✓
LID Bioretention	✓		✓	✓
LID Biotreatment				✓

Notes for Table 3-5:

See also *Figure 3-6 for guidance in selecting appropriate BMPs*

Column A: *Selections from this column may be used in locations where the infiltration rate of underlying soils is at least 1.6" per hour and no restrictions on infiltration apply to these locations.*

Column B: *Harvest and Use BMPs may be used where it can be shown that there is sufficient demand for harvested water and where LID Infiltration BMPs are not feasible.*

Column C: *Selections in this column may be used in locations where the measured infiltration rate of underlying soils is between 0.3" and 1.6" per hour or where, in accordance with recommendations of a licensed geotechnical engineer, the post-development saturated hydraulic conductivity is uncertain or unknown or cannot be reliably predicted because of soil disturbance or fill, anisotropic soil characteristics, presence of clay lenses, or other factors.*

Column D: *Selections in this column may be used in locations where the infiltration rate of underlying soils is 0.3" per hour or less. See Chapter 2 for more information.*

** Permeable Pavement, when designed with a maximum of a 2:1 ratio of impervious area to pervious pavement areas, or less, is considered a self-retaining area, and is not considered an LID BMP for the purposes of this table. This table focuses on the 'special case' included in the discussion of 'areas draining to self-retaining areas' above, where a project proponent can choose to design the pervious pavement as a LID BMP in accordance with an approved design, such as the LID BMP Design handbook, and in return drain additional impervious area onto the pervious pavement beyond the 2:1 ratio.*

3.4.2.a. Laying out your LID BMPs

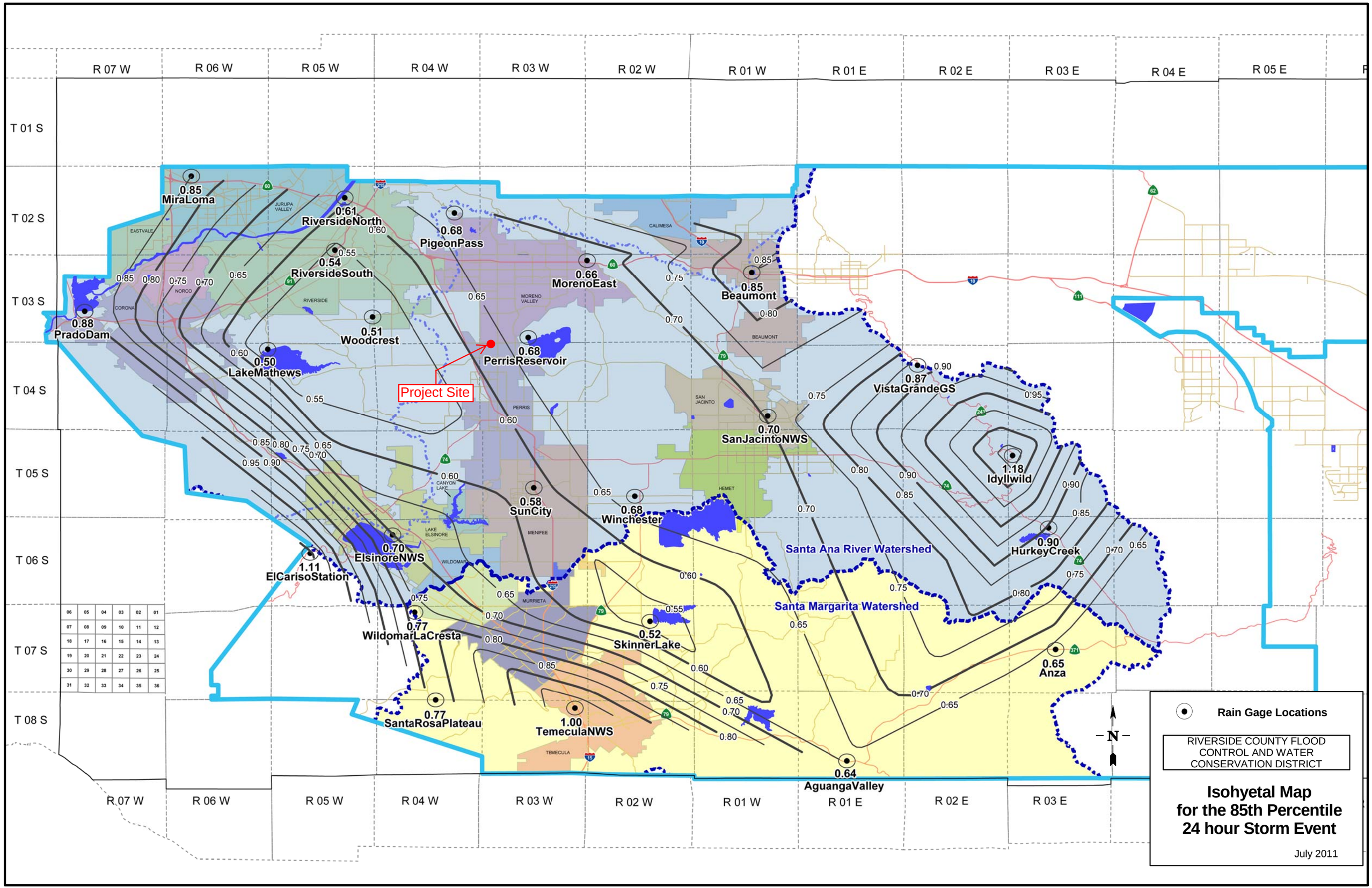
Finding the right location for LID BMPs on your site involves a careful and creative integration of several factors:

- ✓ To make the most efficient use of the site and to maximize aesthetic value, **integrate BMPs with site landscaping**. Many local zoning codes may require landscape setbacks or buffers, or may specify that a minimum portion of the site be landscaped. It may be possible to locate some or all of your site's Stormwater BMPs within this same area, or within utility easements or other non-buildable areas.

- ✓ Bioretention BMPs must be **level or nearly level** all the way around. When configured in a linear fashion (similar to swales) bioretention BMPs may be gently sloped end to end, but opposite sides must be at the same

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation


R 07 W
R 06 W
R 05 W
R 04 W
R 03 W
R 02 W
R 01 W
R 01 E
R 02 E
R 03 E
R 04 E
R 05 E
T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S
0.85 MiraLoma
0.61 RiversideNorth
0.68 PigeonPass
0.54 RiversideSouth
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.68 PerrisReservoir
0.50 LakeMathews
Project Site
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.90 HurkeyCreek
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley
Santa Ana River Watershed
Santa Margarita Watershed
EASTVALE
JURUPA VALLEY
CORONA
NORCO
RIVERSIDE
MORENO VALLEY
CALIMESA
BEAUMONT
SAN JACINTO
PERRIS
HEMET
CANYON LAKE
LAKE ELSINORE
WILDOMAR
MENIFEE
MURRIETA
TEMECULA
N
Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Huitt-Zollars, Inc	Date	3/29/2016
Designed by	Ryan Peng	Case No	
Company Project Number/Name	R304806.01 - Moreno Valley Vogel Industrial		

BMP Identification

BMP NAME / ID

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.63 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA A	*358418*	*Mixed Surface Types*	*0.88*	*0.70*	*251534.5*			
DMA B	*492411*	*Mixed Surface Types*	*0.87*	*0.69*	*338775.6*			
	850829		***Total***		**590310.1**	**0.63**	***30991.3***	***32,272***

Notes:

3.5 Bioretention Facility

Type of BMP	LID – Bioretention
Treatment Mechanisms	Infiltration, Evapotranspiration, Evaporation, Biofiltration
Maximum Drainage Area	This BMP is intended to be integrated into a project's landscaped area in a distributed manner. Typically, contributing drainage areas to Bioretention Facilities range from less than 1 acre to a maximum of around 10 acres.
Other Names	Rain Garden, Bioretention Cell, Bioretention Basin, Biofiltration Basin, Landscaped Filter Basin, Porous Landscape Detention

Description

Bioretention Facilities are shallow, vegetated basins underlain by an engineered soil media. Healthy plant and biological activity in the root zone maintain and renew the macro-pore space in the soil and maximize plant uptake of pollutants and runoff. This keeps the Best Management Practice (BMP) from becoming clogged and allows more of the soil column to function as both a sponge (retaining water) and a highly effective and self-maintaining biofilter. In most cases, the bottom of a Bioretention Facility is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate. When the infiltration rate of the underlying soil is exceeded, fully biotreated flows are discharged via underdrains. Bioretention Facilities therefore will inherently achieve the maximum feasible level of infiltration and evapotranspiration and achieve the minimum feasible (but highly biotreated) discharge to the storm drain system.

Siting Considerations

These facilities work best when they are designed in a relatively level area. Unlike other BMPs, Bioretention Facilities can be used in smaller landscaped spaces on the site, such as:

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

Landscaped areas on the site (such as may otherwise be required through minimum landscaping ordinances), can often be designed as Bioretention Facilities. This can be accomplished by:

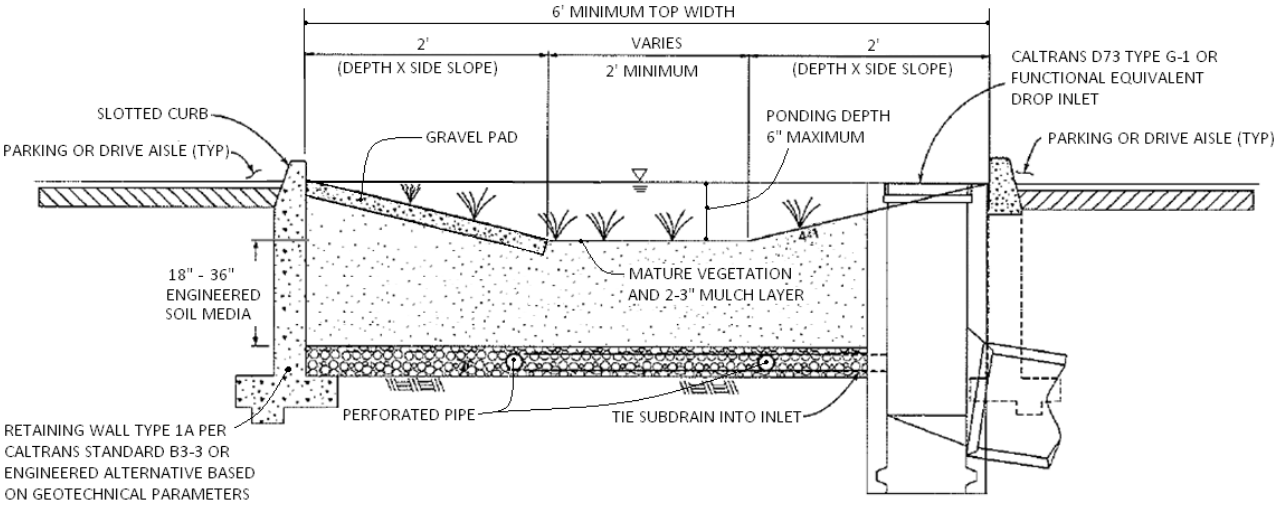
- *Depressing* landscaped areas below adjacent impervious surfaces, rather than elevating those areas
- Grading the site to direct runoff from those impervious surfaces *into* the Bioretention Facility, rather than away from the landscaping
- Sizing and designing the depressed landscaped area as a Bioretention Facility as described in this Fact Sheet

Bioretention Facilities should however not be used downstream of areas where large amounts of sediment can clog the system. Placing a Bioretention Facility at the toe of a steep slope should also be avoided due to the potential for clogging the engineered soil media with erosion from the slope, as well as the potential for damaging the vegetation.

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

- Vegetated area
- 18' minimum depth of engineered soil media
- 12' minimum gravel layer depth with 6' perforated pipes (added flow control features such as orifice plates may be required to mitigate for HCOC conditions)



While the 18-inch minimum engineered soil media depth can be used in some cases, it is recommended to use 24 inches or a preferred 36 inches to provide an adequate root zone for the chosen plant palate. Such a design also provides for improved removal effectiveness for nutrients. The recommended ponding depth inside of a Bioretention Facility is 6 inches; measured from the flat bottom surface to the top of the water surface as shown in Figure 1.

Because this BMP is filled with an engineered soil media, pore space in the soil and gravel layer is assumed to provide storage volume. However, several considerations must be noted:

- Surcharge storage above the soil surface (6 inches) is important to assure that design flows do not bypass the BMP when runoff exceeds the soil's absorption rate.
- In cases where the Bioretention Facility contains engineered soil media deeper than 36 inches, the pore space within the engineered soil media can only be counted to the 36-inch depth.
- A maximum of 30 percent pore space can be used for the soil media whereas a maximum of 40 percent pore space can be use for the gravel layer.

Figure 1: Standard Layout for a Bioretention Facility

Engineered Soil Media Requirements

The engineered soil media shall be comprised of 85 percent mineral component and 15 percent organic component, by volume, drum mixed prior to placement. The mineral component shall be a Class A sandy loam topsoil that meets the range specified in Table 1 below. The organic component shall be nitrogen stabilized compost[1], such that nitrogen does not leach from the media.

Table 1: Mineral Component Range Requirements

Percent Range	Component
70-80	Sand
15-20	Silt
5-10	Clay

The trip ticket, or certificate of compliance, shall be made available to the inspector to prove the engineered mix meets this specification.

Vegetation Requirements

Vegetative cover is important to minimize erosion and ensure that treatment occurs in the Bioretention Facility. The area should be designed for at least 70 percent mature coverage throughout the Bioretention Facility. To prevent the BMP from being used as walkways, Bioretention Facilities shall be planted with a combination of small trees, densely planted shrubs, and natural grasses. Grasses shall be native or ornamental; preferably ones that do not need to be mowed. The application of fertilizers and pesticides should be minimal. To maintain oxygen levels for the vegetation and promote biodegradation, it is important that vegetation not be completely submerged for any extended period of time. Therefore, a maximum of 6 inches of ponded water shall be used in the design to ensure that plants within the Bioretention Facility remain healthy.

A 2 to 3-inch layer of standard shredded aged hardwood mulch shall be placed as the top layer inside the Bioretention Facility. The 6-inch ponding depth shown in Figure 1 above shall be measured from the top surface of the 2 to 3-inch mulch layer.

Curb Cuts

To allow water to flow into the Bioretention Facility, 1-foot-wide (minimum) curb cuts should be placed approximately every 10 feet around the perimeter of the Bioretention Facility. Figure 2 shows a curb cut in a Bioretention Facility. Curb cut flow lines must be at or above the V_{BMP} water surface level.

[1] For more information on compost, visit the US Composting Council website at: http://compostingcouncil.org/

Figure 2: Curb Cut located in a Bioretention Facility

To reduce erosion, a gravel pad shall be placed at each inlet point to the Bioretention Facility. The gravel should be 1- to 1.5-inch diameter in size. The gravel should overlap the curb cut opening a minimum of 6 inches. The gravel pad inside the Bioretention Facility should be flush with the finished surface at the curb cut and extend to the bottom of the slope.

In addition, place an apron of stone or concrete, a foot square or larger, inside each inlet to prevent vegetation from growing up and blocking the inlet. See Figure 3.

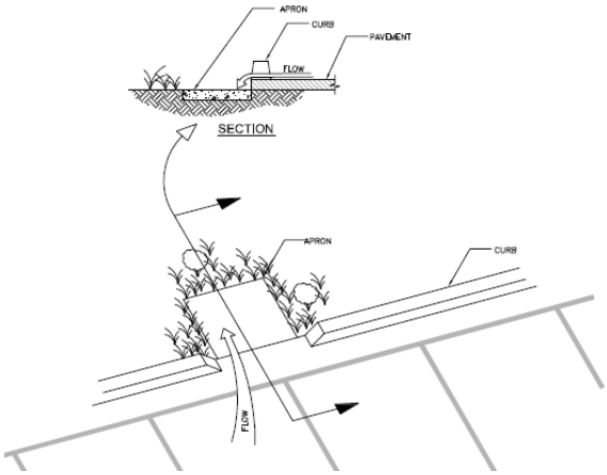


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

It is recommended that Bioretention Facilities be level. In the event the facility site slopes and lacks proper design, water would fill the lowest point of the BMP and then discharge from the basin without being treated. To ensure that the water will be held within the Bioretention Facility on sloped sites, the BMP must be terraced with nonporous check dams to provide the required storage and treatment capacity.

The terraced version of this BMP shall be used on non-flat sites with no more than a 3 percent slope. The surcharge depth cannot exceed 0.5 feet, and side slopes shall not exceed 4:1. Table 2 below shows the spacing of the check dams, and slopes shall be rounded up (i.e., 2.5 percent slope shall use 10' spacing for check dams).

Table 2: Check Dam Spacing

6” Check Dam Spacing	
Slope	**Spacing**
1%	*25'*
2%	*15'*
3%	*10'*

Roof Runoff

Roof downspouts may be directed towards Bioretention Facilities. However, the downspouts must discharge onto a concrete splash block to protect the Bioretention Facility from erosion.

Retaining Walls

It is recommended that Retaining Wall Type 1A, per Caltrans Standard B3-3 or equivalent, be constructed around the entire perimeter of the Bioretention Facility. This practice will protect the sides of the Bioretention Facility from collapsing during construction and maintenance or from high service loads adjacent to the BMP. Where such service loads would not exist adjacent to the BMP, an engineered alternative may be used if signed by a licensed civil engineer.

Side Slope Requirements

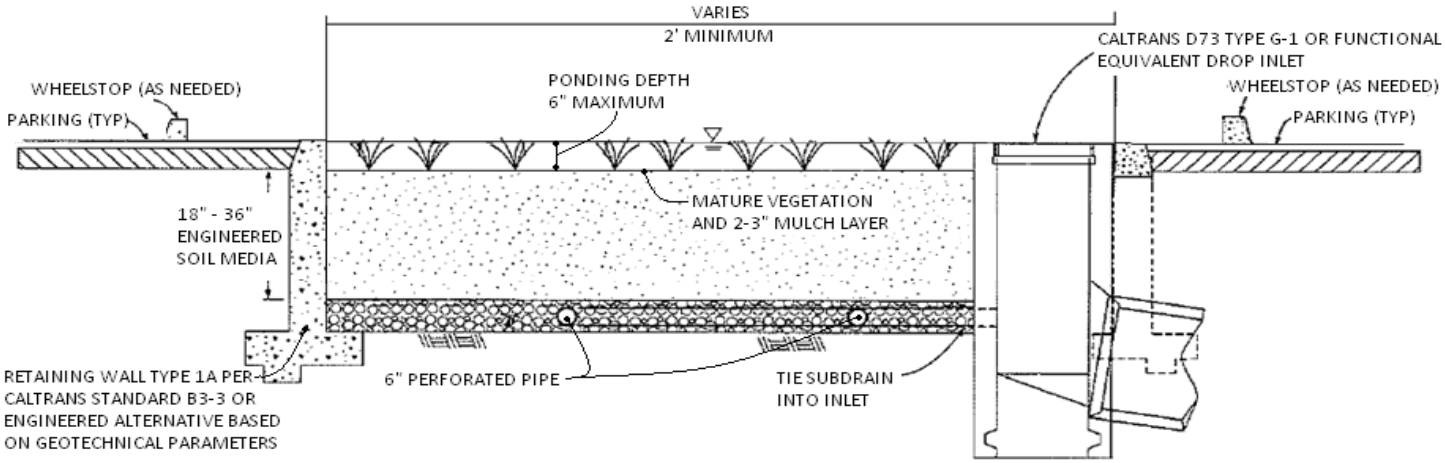
Bioretention Facilities Requiring Side Slopes

The design should assure that the Bioretention Facility does not present a tripping hazard. Bioretention Facilities proposed near pedestrian areas, such as areas parallel to parking spaces or along a walkway, must have a gentle slope to the bottom of the facility. Side slopes inside of a Bioretention Facility shall be 4:1. A typical cross section for the Bioretention Facility is shown in Figure 1.

Bioretention Facilities Not Requiring Side Slopes

Where cars park perpendicular to the Bioretention Facility, side slopes are not required. A 6-inch maximum drop may be used, and the Bioretention Facility must be planted with trees and shrubs to prevent pedestrian access. In this case, a curb is not placed around the Bioretention Facility,

but wheel stops shall be used to prevent vehicles from entering the Bioretention Facility, as shown in Figure 4.



Planter Boxes

Bioretention Facilities can also be placed above ground as planter boxes. Planter boxes must have a minimum width of 2 feet, a maximum surcharge depth of 6 inches, and no side slopes are necessary. Planter boxes must be constructed so as to ensure that the top surface of the engineered soil media will remain level. This option may be constructed of concrete, brick, stone or other stable materials that will not warp or bend. Chemically treated wood or galvanized steel, which has the ability to contaminate stormwater, should not be used. Planter boxes must be lined with an impermeable liner on all sides, including the bottom. Due to the impermeable liner, the inside bottom of the planter box shall be designed and constructed with a cross fall, directing treated flows within the subdrain layer toward the point where subdrain exits the planter box, and subdrains shall be oriented with drain holes oriented down. These provisions will help avoid excessive stagnant water within the gravel underdrain layer. Similar to the in-ground Bioretention Facility versions, this BMP benefits from healthy plants and biological activity in the root zone. Planter boxes should be planted with appropriately selected vegetation.

Figure 5: Planter Box
Source: LA Team Effort

Overflow

An overflow route is needed in the Bioretention Facility design to bypass stored runoff from storm events larger than V_{BMP} or in the event of facility or subdrain clogging. Overflow systems must connect to an acceptable discharge point, such as a downstream conveyance system as shown in Figure 1 and Figure 4. The inlet to the overflow structure shall be elevated inside the Bioretention Facility to be flush with the ponding surface for the design capture volume (V_{BMP}) as shown in Figure 4. This will allow the design capture volume to be fully treated by the Bioretention Facility, and for larger events to safely be conveyed to downstream systems. The overflow inlet shall **not** be located in the entrance of a Bioretention Facility, as shown in Figure 6.

Underdrain Gravel and Pipes

An underdrain gravel layer and pipes shall be provided in accordance with Appendix B – Underdrains.

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Bioretention Facility should be minimized.

Schedule	Activity
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Bioretention Facility Design Procedure

1) Enter the area tributary, A_T, to the Bioretention Facility.

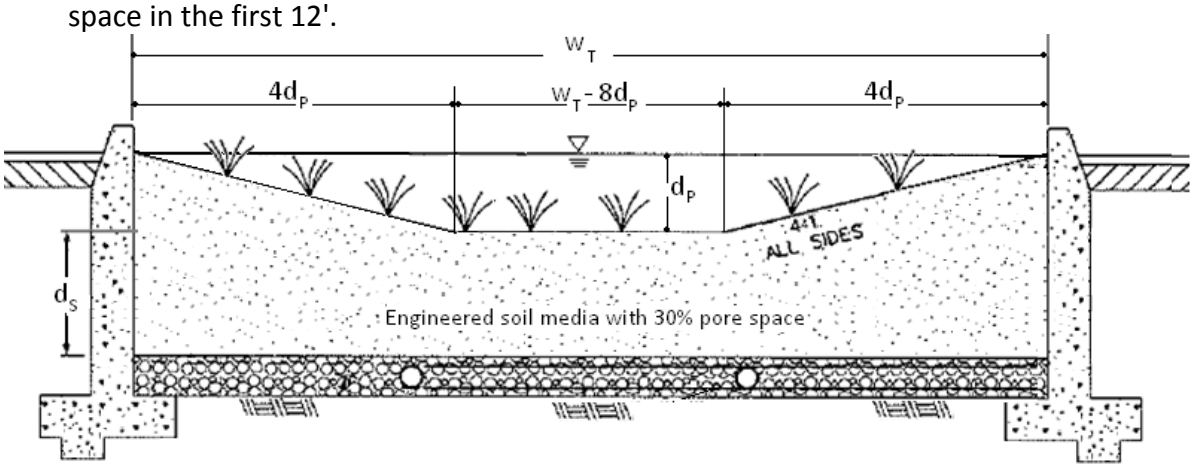
2) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.

3) Select the type of design used. There are two types of Bioretention Facility designs: the standard design used for most project sites that include side slopes, and the modified design used when the BMP is located perpendicular to the parking spaces or with planter boxes that do not use side slopes.

4) Enter the depth of the engineered soil media, d_S. The minimum depth for the engineered soil media can be 18' in limited cases, but it is recommended to use 24' or a preferred 36' to provide an adequate root zone for the chosen plant palette. Engineered soil media deeper than 36' will only get credit for the pore space in the first 36'.

5) Enter the top width of the Bioretention Facility.

6) Calculate the total effective depth, d_E, within the Bioretention Facility. The maximum allowable pore space of the soil media is 30% while the maximum allowable pore space for the gravel layer is 40%. Gravel layer deeper than 12' will only get credit for the pore space in the first 12'.



a. For the design with side slopes the following equation shall be used to determine the total effective depth. Where, d_P is the depth of ponding within the basin.

$$d_E(\text{ft}) = \frac{0.3 \times \left[\left(w_T(\text{ft}) \times d_S(\text{ft})\right) + 4\left(d_P(\text{ft})\right)^2\right] + 0.4 \times 1(\text{ft}) + d_P(\text{ft})\left[4d_P(\text{ft}) + \left(w_T(\text{ft}) - 8d_P(\text{ft})\right)\right]}{w_T(\text{ft})}$$

This above equation can be simplified if the maximum ponding depth of 0.5' is used. The equation below is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = (0.3 \times d_S(\text{ft}) + 0.4 \text{ x } 1(\text{ft})) - \left(\frac{0.7\ (\text{ft}^2)}{w_T(\text{ft})}\right) + 0.5(\text{ft})$$

b. For the design without side slopes the following equation shall be used to determine the total effective depth:

$$d_E(\text{ft}) = d_P(\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

The equation below, using the maximum ponding depth of 0.5', is used on the worksheet to find the minimum area required for the Bioretention Facility:

$$d_E(\text{ft}) = 0.5\ (\text{ft}) + [(0.3) \times d_S(\text{ft}) + (0.4) \times 1(\text{ft})]$$

7) Calculate the minimum surface area, A_M, required for the Bioretention Facility. This does not include the curb surrounding the Bioretention Facility or side slopes.

$$A_M(\text{ft}^2) = \frac{V_{BMP}(\text{ft}^3)}{d_E\ (\text{ft})}$$

8) Enter the proposed surface area. This area shall not be less than the minimum required surface area.

9) Verify that side slopes are no steeper than 4:1 in the standard design, and are not required in the modified design.

10) Provide the diameter, minimum 6 inches, of the perforated underdrain used in the Bioretention Facility. See Appendix B for specific information regarding perforated pipes.

11) Provide the slope of the site around the Bioretention Facility, if used. The maximum slope is 3 percent for a standard design.

12) Provide the check dam spacing, if the site around the Bioretention Facility is sloped.

13) Describe the vegetation used within the Bioretention Facility.

Bioretention Facility - Design Procedure	BMP ID For DMA A	Legend:	Required Entries / Calculated Cells

Company Name:	Huitt-Zollars, Inc	Date:	6/8/2016
Designed by:	Ryan L. Peng	County/City Case No.:	PA16-0002

Design Volume

Enter the area tributary to this feature	A_T=	8.23	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	13,206	ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	20.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.62	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	8,178	ft^2
Proposed Surface Area	A=	8,918	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: 1. The bioretention basin 1 and 2 are linked together by a 18" RCP along the Indian Street of the project site.

2. This Calculation is based on the total area of basin 1 and basin 2 with the same design criteria applied.

Bioretention Facility - Design Procedure	BMP ID For DMA B	Legend:	Required Entries / Calculated Cells

Company Name:	Huitt-Zollars, Inc	Date:	6/8/2016
Designed by:	Ryan L. Peng	County/City Case No.:	PA16-0002

Design Volume

Enter the area tributary to this feature	A_T=	11.3	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	17,786	ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	2.0	ft
Top Width of Bioretention Facility, excluding curb	w_T =	40.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.48	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	11,998	ft^2
Proposed Surface Area	A=	12,044	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet
Describe Vegetation:			

Notes: This calculation is for bio-retention basin 3.

APPENDIX E

BMP Pollutant Removal Effectiveness

APPENDIX E
BMP POLLUTANT REMOVAL EFFECTIVENESS

BMP Pollutant Removal Effectiveness (1)

Pollutant of Concern	Harvest and Use (8)	Infiltration BMPs (3)	Bioretention	Extended Detention Basins (2)	Sand Filter Basin (7)
Sediment	H	H	H	M	H
Nutrient	H	H	(5)	M (4)	L (6)
Trash	H	H	H	H	H
Metal	H	H	H	M	M
Bacteria	H	H	H	M	M
Oil & Grease	H	H	H	M	H
Organic Compounds	H	H	H	M	H
Pesticides	H	H	H	U	U

Abbreviations:

L: Low removal efficiency M: Medium removal efficiency H: High removal efficiency U: Unknown

Notes:

(1) Periodic performance assessment and updating of this table may be performed based on updated information from studies from the District, CASQA, Caltrans or others. These effectiveness ratings are based on the specific BMP designs incorporated into this manual.

(2) Effectiveness based upon total 72-hour drawdown time.

(3) Includes infiltration basins, infiltration trenches, and permeable pavements.

(4) Medium for soil types A & B only. Low for soil types C & D.

(5) Removal rating is dependent on the soil media depth. L=Min. 18” deep, M= Min. 24” deep, H=Max. 30"-36" deep.

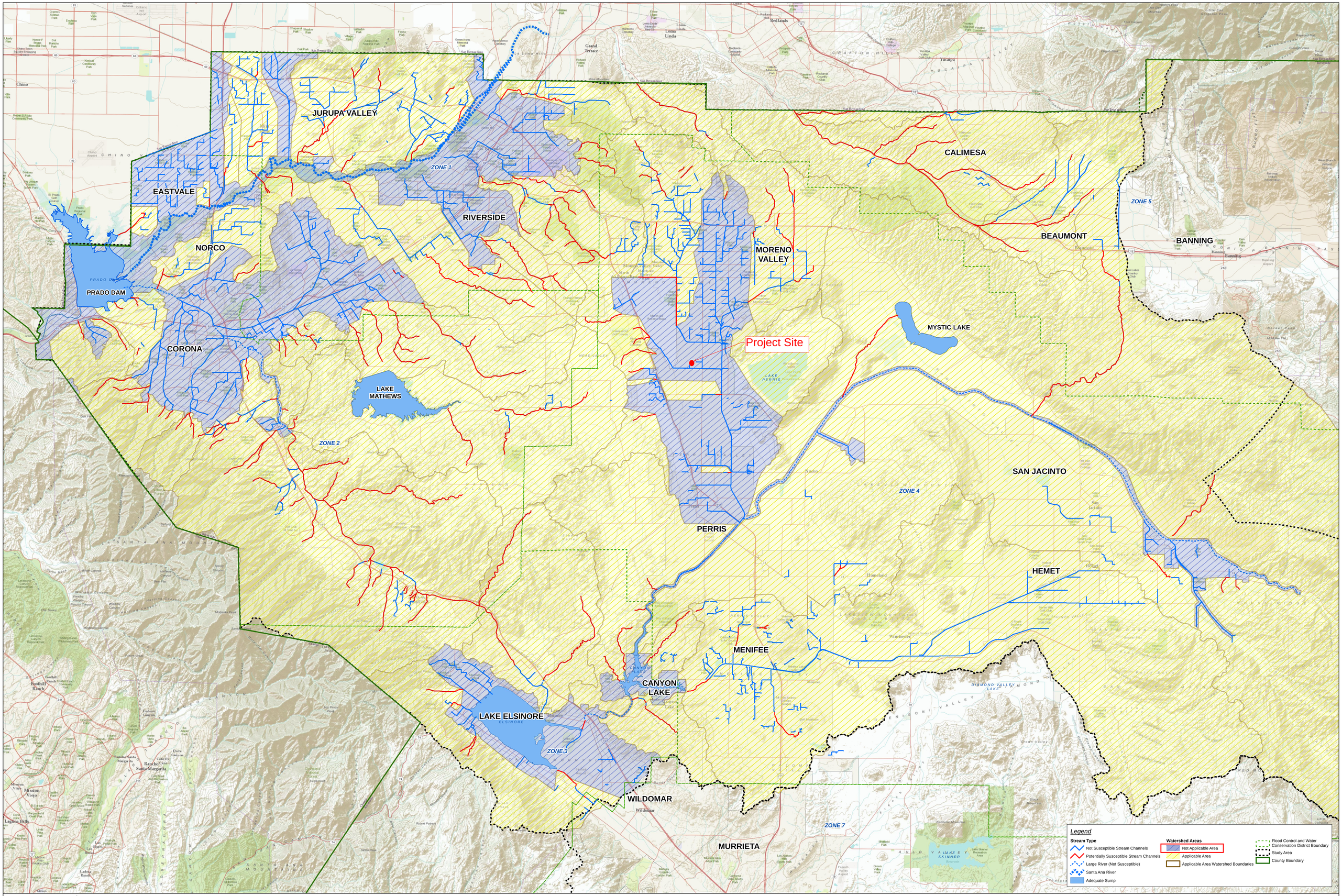
(6) Medium where sand filter layer is increased to 36”.

(7) Considered to be a Treatment Control BMP. See the WQMP to determine if this BMP can be used.

(8) Cisterns, when associated with an adequate and reliable (year-round) demand for non-potable use of captured storm water (see the applicable WQMP for any specific requirements), have a High effectiveness at removing all pollutants from stormwater runoff. If there is inadequate demand to reliably drain the cistern through a non-potable use throughout the year, pollutant removal effectiveness will be Low.

Appendix 7: Hydromodification (N/A)

Supporting Detail Relating to Hydrologic Conditions of Concern



HCOC Applicability Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

Map 2

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
■ A. **On-site storm drain inlets**	■ **Locations of inlets.**	■ **Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.**	■ **Maintain and periodically repaint or replace inlet markings.** ■ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ■ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ■ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
❑ B. **Interior floor drains and elevator shaft sump pumps**		❑ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	❑ **Inspect and maintain drains to prevent blockages and overflow.**
❑ C. **Interior parking garages**		❑ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	❑ **Inspect and maintain drains to prevent blockages and overflow.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ D1. **Need for future indoor & structural pest control**		❑ **Note building design features that discourage entry of pests.**	❑ **Provide Integrated Pest Management information to owners, lessees, and operators.**
❑ D2. **Landscape/ Outdoor Pesticide Use**	❑ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ❑ **Show self-retaining landscape areas, if any.** ❑ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** ❑ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ❑ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ❑ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ❑ **Consider using pest-resistant plants, especially adjacent to hardscape.** **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	❑ **Maintain landscaping using minimum or no pesticides.** ❑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at http://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ❑ **Provide IPM information to new owners, lessees and operators.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ E. **Pools, spas, ponds, decorative fountains, and other water features.**	❑ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)**	**If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	❑ **See applicable operational BMPs in** "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
❑ F. **Food service**	❑ **For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.** ❑ **On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.**	❑ **Describe the location and features of the designated cleaning area.** ❑ **Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.**	❑ **See the brochure, "**The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ **Provide this brochure to new site owners, lessees, and operators.**
❑ G. **Refuse areas**	❑ **Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.** ❑ **If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.** ❑ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	❑ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** ❑ **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	❑ **State how the following will be implemented:** **Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at** www.cabmphandbooks.com

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ H. **Industrial processes.**	❑ **Show process area.**	❑ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	❑ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	❑ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ❑ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ❑ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	**Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** **www.cchealth.org/groups/hazmat/**	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ J. **Vehicle and Equipment Cleaning**	❑ **Show on drawings as appropriate:** **(1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.** **(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use).** **(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.** **(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.**	❑ **If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.**	**Describe operational measures to implement the following (if applicable):** ❑ **Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.** Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ❑ **Car dealerships and similar may rinse cars with water only.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ K. **Vehicle/Equipment Repair and Maintenance**	❑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ❑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	❑ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ❑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ❑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ❑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ❑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ❑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

[6] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
■ M. **Loading Docks**	■ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ■ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ■ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		■ **Move loaded and unloaded items indoors as soon as possible.** ■ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
■ N. **Fire Sprinkler Test Water**		■ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	■ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ❑ **Boiler drain lines** ❑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ❑ **Roofing, gutters, and trim.** ❑ **Other sources**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ❑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ❑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** **Include controls for other sources as specified by local reviewer.**	

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
■ P. **Plazas, sidewalks, and parking lots.**			■ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M (Owner's signature for the O&M will be provided in Final Project-Specific WQMP Approval)

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Owner's signature for the Operations & Maintenance (O&M) Plan will be provided in Final Project-Specific WQMP Approval

RECORDING REQUESTED BY
AND WHEN RECORDED MAIL TO:

CITY CLERK
CITY OF MORENO VALLEY
PO BOX 88005
14177 FREDERICK STREET
MORENO VALLEY, CA 92552-0805

EXEMPT FROM FEE PER G.C. Section 6103

SPACE ABOVE THIS LINE FOR RECORDER'S USE

STORMWATER TREATMENT DEVICE AND CONTROL MEASURE ACCESS AND MAINTENANCE COVENANT

THIS INSTRUMENT is made and entered into this _____ day of _____, by and between Sares Regis Group, hereinafter referred to as "Owner/Lessee," and the City of Moreno Valley, a municipal corporation, hereinafter referred to as "City."

RECITALS

WHEREAS, the Owner/Lessee owns/is leasing real property ("Property") in the City specifically described in Exhibit "A," which is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of approval of the development project known as Sares Regis Moreno Valley Industrial (the "Project") for the Property, the City required the Project to employ on-site storm water and non-storm water control measures to mitigate the Project impacts to water quality and minimize pollutants in urban storm water runoff; and

WHEREAS, the City and Owner/Lessee, its successors, and assigns, agree that the health, safety and welfare of the residents of the City, require that on-site storm water and non-storm water management control measures be constructed and implemented and adequately maintained on the Property; and

WHEREAS, the Owner/Lessee has chosen to install bio-retention basin, hereinafter referred to as the "Device" and other control measures all as described in the Final Water Quality Management Plan (WQMP) to minimize pollutants in urban storm water and non-storm water runoff; and

WHEREAS, the Device and other control measures have been installed and/or implemented in accordance with the WQMP, project plans and specifications approved by the City; and

WHEREAS, the Device and other control measures, being installed on private property and draining only private property are private facilities with all maintenance or replacement therefore being the sole responsibility of the Owner/Lessee; and

WHEREAS, the Owner/Lessee is aware that periodic and continuous maintenance including, but not necessarily limited to, filter material replacement and sediment removal is required to assure discharges from the Device, other control measures and the Project are in compliance with the City's Municipal Code for storm water and non-storm water discharges and that such maintenance activity will require compliance with all Federal, State and local laws and

regulations, including those pertaining to confined space and waste disposal methods in effect at the time such maintenance occurs;

NOW, THEREFORE, in consideration of City's approval of the Project and the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the City and Owner/Lessee agree as follows:

1. The Owner/Lessee hereby provides the City and its designees with full right of access to the Device and other control measures and the immediate vicinity of the property at any time, upon reasonable notice; or in the event of emergency, as determined by City's Public Works Director/City Engineer or designees, no advance notice; for the purpose of inspection, sampling and testing of the Device and other control measures, and in cases of emergency, where the public health, safety, or welfare is compromised, such emergency shall be declared a "nuisance" as defined in the Municipal Code. Such conditions that created the emergency shall be abated as provided for in the Municipal Code and at the Owner's/Lessee's expense as provided for in Section 3, below.

2. The Owner/Lessee shall diligently maintain the Device and other control measures in a manner assuring all discharges from the Device, other control measures and the Project are in compliance with the Municipal Code for storm water and non-storm water discharges at all times. All reasonable precautions shall be exercised by the Owner/Lessee and the Owner's/Lessee's representatives in the removal and extraction of materials from the Device and other control

measures, and the ultimate disposal of the materials in a manner consistent with all applicable laws. As may be requested from time to time by the City, the Owner/Lessee shall provide the City with documentation identifying the materials removed, the quantity and the recycle of disposal destinations, as appropriate.

3. In the event the Owner/Lessee fails to perform the necessary maintenance contemplated by this Instrument, within five (5) days of being given written notice by the City, the lack of maintenance shall be considered a public health and safety concern and declared a "nuisance", the City shall take all necessary actions as provided in the Municipal Code, to abate the nuisance and charge the entire cost and expense to the Owner/Lessee, including administrative costs, attorneys' fees and interest thereon at the maximum rate authorized by law from the date of the notice of expense until paid in full. Additionally, any discharge as a result from the lack of maintenance prescribed herein from the Device to the City's maintained Municipal Separate Storm Sewer System shall be considered an illegal discharge and considered a violation of the Municipal Code and shall cease immediately. Such cessation may include a yellow or red tag issued to the Project.

4. This Instrument shall be recorded in the Official Records of the County of Riverside at the expense of the Owner/Lessee and shall constitute notice to all successors and assigns to the title to the Property of the obligations herein set forth. This Instrument shall also constitute a lien against the Property in such amount as will fully reimburse the City, including interest as herein above set

forth, subject to foreclosure in event of default in payment.

5. It is the intent of the Owner/Lessee that the burdens and benefits herein undertaken shall constitute covenants that run with the Property and shall constitute a lien against the Property.

6. This covenant imposes no liability of any kind whatsoever on the City and the Owner/Lessee agrees to hold the City harmless from any liability in the event the Device and other control measures fail to operate in accordance with the plans and specification submitted to the City.

7. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the Owner/Lessee hereto. The term "Owner"/ "Lessee" shall include not only the Owner/Lessee, but also its heirs, successors, executors, administrators, lessees and assigns. The Owner/Lessee shall notify any successor to title of all or part of the Property about the existence of this Instrument. The Owner/Lessee shall provide such notice prior to such successor obtaining an interest in all or part of the Property. The Owner/Lessee shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

8. Time is of the essence in the performance of this Instrument.

9. Any notice to a party required or called for in this Instrument shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address

set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change notice address only by providing written notice thereof to the other party.

CITY:	OWNER/LESSEE:
Public Works Director/City Engineer	Name: Patrick Russell
City of Moreno Valley	Company: Sares Regis Group
PO Box 88005	Address: 18802 Bardeen Avenue
14177 Frederick Street	City/State/ZIP: Irvine, CA 92612
Moreno Valley, CA 92552-0805	

10. This Instrument represents the entire Covenant of the parties hereto as to the matters contained herein and supersedes any and all prior written or verbal agreements between the parties as to the subject matter hereof.

11. This Instrument shall be governed by and construed in accordance with the laws of the State of California.

12. No amendment to this Instrument shall be made without prior written approval by the City.

APPROVED AS TO FORM:

_____
Suzanne Bryant, City Attorney

OWNER/LESSEE:

_____
(Name, Title)

CITY:

CITY OF MORENO VALLEY

By:_____
City Manager

EXHIBIT "A"

Legal Description

THE DESCRIPTIONS SHOWN BELOW HAVE BEEN EXTRACTED FROM A PRELIMINARY TITLE REPORT PREPARED BY FIRST AMERICAN TITLE INSURANCE COMPANY COMMITMENT NO.: NCS-732600-SA1, COMMITMENT DATEAUGUST 17, 2015 AND WAS NOT PREPARED BY THE SURVEYOR INDICATED HEREON. THESE DESCRIPTIONS HAVE BEEN SHOWN HEREON AT THE REQUEST OF THE LENDER. REFERENCE IS MADE TO SAID PRELIMINARY TITLE REPORT FOR A TRUE COPY.

PARCEL 1:

THE NORTH 1/2 OF THE WEST 1/2 OF LOT 27, BLOCK 1 OF RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

PARCEL 2:

THE NORTH HALF OF THE EAST HALF OF LOT 27, BLOCK 1 OF RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA, FOR UTILITY PURPOSES.

EXCEPTING THEREFROM THE EAST 10.00 FEET THEREOF, CONVEYED TO THE MARCH JOINT POWERS AUTHORITY, A BODY POLITIC BY DEEDS RECORDED JULY 23, 2001, AS INSTRUMENT NOS.: 2001-339627 AND 2001-339628, BOTH OF OFFICIAL RECORDS.

PARCEL 3:

THE SOUTH 1/2 OF THE WEST 1/2 OF LOT 27 IN BLOCK 1 OF RIVERSIDE ALFALFA ACRES, IN THE CITY OF MORENO VALLEY, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 8, PAGE 21, OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

PARCEL 4:

THE SOUTH HALF OF THE EAST HALF OF LOT 27, BLOCK 1 OF RIVERSIDE ALFALFA ACRES, AS PER MAP RECORDED IN BOOK 8, PAGE 21, OF MAPS, IN THE OFFICE OF THE COUNTY OF RECORDER OF SAID COUNTY.

EXCEPTING THEREFROM THE EAST 10.00 FEET OF SAID LAND AS CONVEYED TO MARCH JOINT POWERS AUTHORITY, A BODY POLITIC BY DEEDS RECORDED FEBRUARY 2, 2004, AS INSTRUMENT NOS.: 2004-0074786 OF OFFICIAL RECORDS.

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

Drain Inserts MP-52

Description

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

California Experience

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

Advantages

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

Limitations

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

Design and Sizing Guidelines

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

Design Considerations

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

Targeted Constituents

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

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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

Construction/Inspection Considerations

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

Performance

Few products have performance data collected under field conditions.

Siting Criteria

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

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

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

Cost

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

References and Sources of Additional Information

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

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

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

Manufacturers literature

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

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

Outdoor Loading/Unloading SC-30

Objectives

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

Description

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

Targeted Constituents

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

Approach

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

Pollution Prevention

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

Suggested Protocols

Loading and Unloading – General Guidelines

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations (Limitations and Regulations)

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

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

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

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

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

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

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

References and Resources

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

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

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

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

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

Building & Grounds Maintenance SC-41

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

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

Landscaping Activities

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

Building Repair, Remodeling, and Construction

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

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

Mowing, Trimming, and Planting

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

Fertilizer and Pesticide Management

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

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

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

References and Resources

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

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

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

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

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

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

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

Site Design & Landscape Planning SD-10

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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Designing New Installations

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

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

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

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

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

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

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

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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

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

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

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

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

Designs of maintenance bays should consider the following:

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

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

- Other features may be comparable and equally effective.

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

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

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

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

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

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

Additional Information

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

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

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

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.

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Street Sweeping and Vacuuming SE-7

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

Legend:

☑ **Primary Objective**

☒ **Secondary Objective**

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

Potential Alternatives

None

Description and Purpose

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

Suitable Applications

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

Limitations

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

Implementation

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

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

Costs

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

Inspection and Maintenance

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

References

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

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

Infiltration Basin TC-11

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

Description

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

California Experience

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

Advantages

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

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

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

Limitations

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

Design and Sizing Guidelines

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

Construction/Inspection Considerations

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

Performance

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

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

Siting Criteria

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

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

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

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

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

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

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

Secondary Screening Based on Site Geotechnical Investigation

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

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

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

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

Additional Design Guidelines

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

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

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

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

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

where A = Basin invert area (m^2)

WQV = water quality volume (m^3)

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

t = drawdown time (48 hr)

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

Maintenance

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

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

Cost

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

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

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

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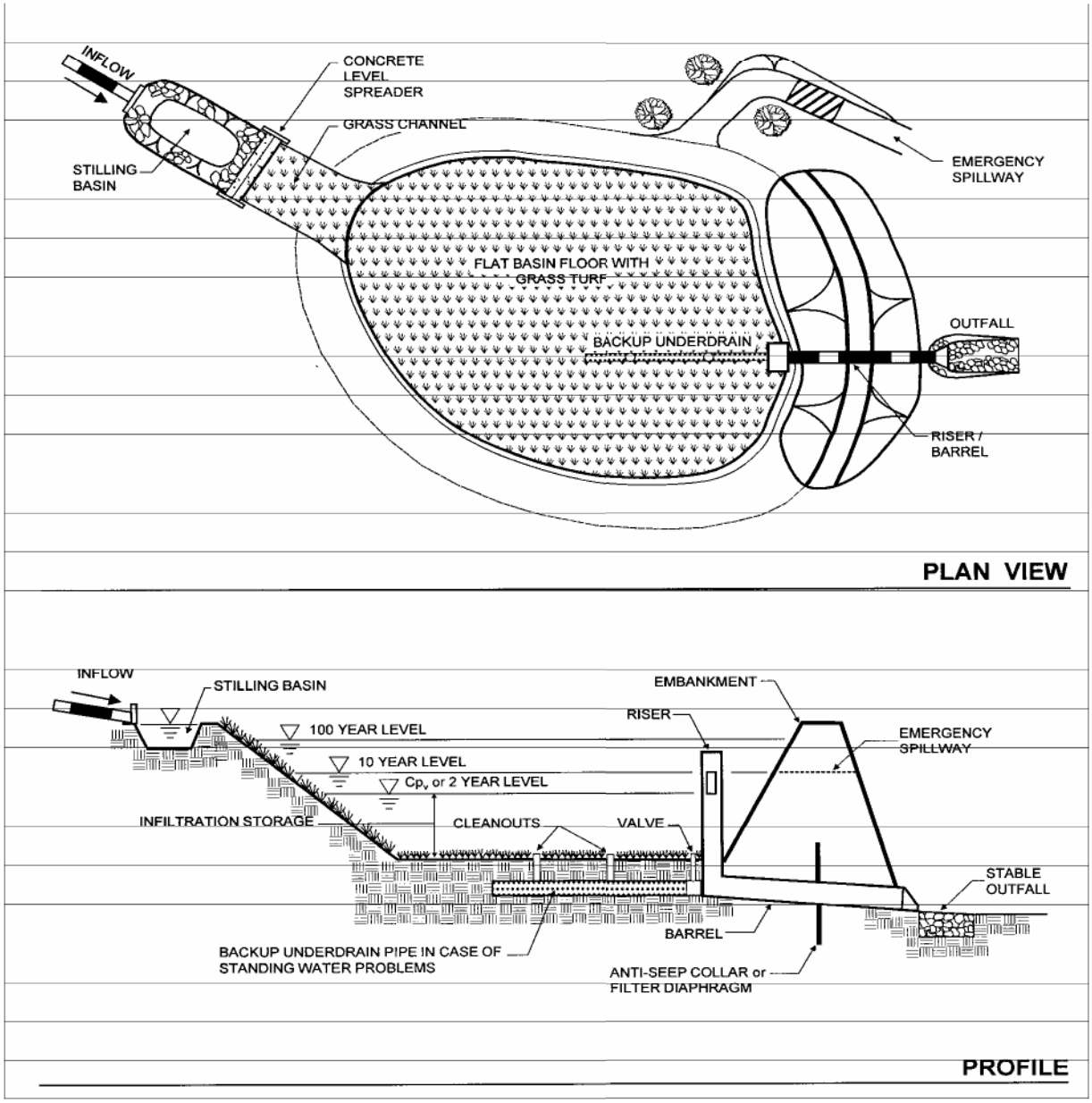

INFLOW
CONCRETE LEVEL SPREADER
GRASS CHANNEL
STILLING BASIN
EMERGENCY SPILLWAY
FLAT BASIN FLOOR WITH GRASS TURF
OUTFALL
BACKUP UNDERDRAIN
RISER / BARREL
PLAN VIEW
INFLOW
STILLING BASIN
EMBANKMENT
RISER
100 YEAR LEVEL
EMERGENCY SPILLWAY
10 YEAR LEVEL
Cpv or 2 YEAR LEVEL
INFILTRATION STORAGE
CLEANOUTS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

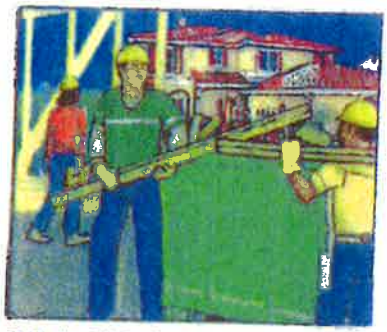
Pollution Prevention STORMWATER

CONSTRUCTION

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

Store Materials Safely

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



Ordering Materials & Recycling Waste

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

Cleaning & Preventing Spills

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

Preventing Erosion

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

Maintaining Vehicles & Equipment

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

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

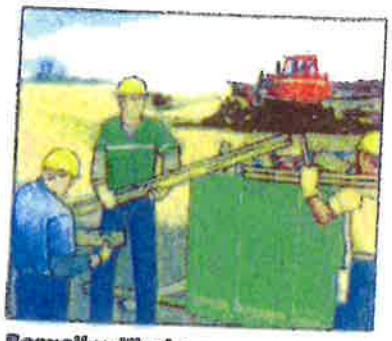
1 (800) CLEANUP

www.1800cleanup.org

Stormwater Pollution Prevention

EXCAVATION AND GRADING

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



Recycling Waste

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

Maintaining Vehicles & Equipment

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

Cleaning & Preventing Spills

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

Storing Materials

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

Preventing Erosion

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

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

1 (800) CLEANUP

www.1800cleanup.org

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.

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

1 (800) CLEANUP

www.1800cleanup.org

Pollution Prevention STORMWATER

ROADWORK AND PAVING

Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.

Preventing Erosion

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

During Construction

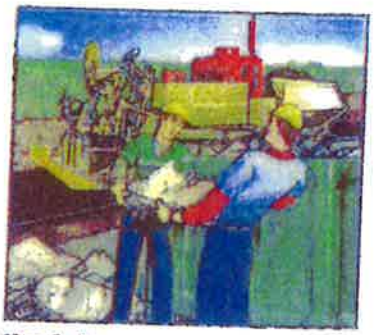
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.

Maintaining Vehicles & Equipment

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

Asphalt & Concrete Removal

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



Cleaning & Preventing Spills

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

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

1 (800) CLEANUP

www.1800cleanup.org

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 & GARDEN

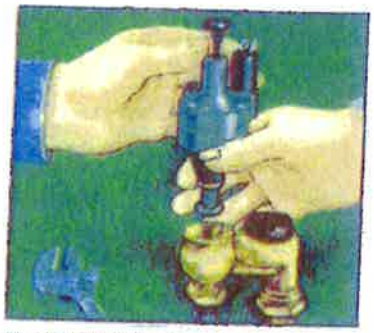
Yard waste and household toxics like paints and pesticides often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow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

Prevención de Contaminación del Desagüe

TRABAJO DE CARRETERAS & PAVIMENTO

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

Previniendo Erosiones

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

Durante Construcción

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

Mantenimiento de Vehiculos & Herramientas

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

Removiendo Asfalto & Concreto

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

Limpiando & Previniendo Derrames

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

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

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

PINTURA

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

Pinturas de Agua

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

Removiendo Pintura

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

Limpiando Pintura

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

Removiendo Pintura en Exteriores

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

Reciclando Pintura

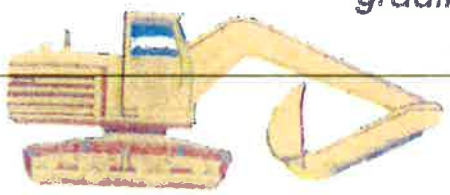
Recicla la pintura que sobra en un lugar de colección de materiales peligrosos, guardala para re-toques or regalala a alguien que la use, como a un teatro, a la escuela, una oraganizacion de la ciudad o de la comunidad.

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

1 (800) CLEANUP

www.1800cleanup.org

EXCAVATION & GRADING OPERATIONS

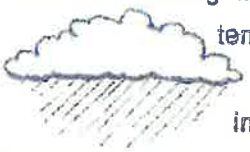


Sediment, cement wash, asphalt, and motor oil from soil excavation and grading operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe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

Follow these practices to help prevent stormwater pollution...

Erosion Prevention...

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



General Business Practices...

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

Recycling...

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

Equipment Maintenance...

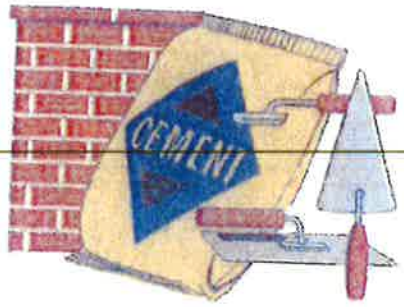
Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site. Finally, use gravel approaches where truck traffic is frequent to reduce soil compaction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

Spills...

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

For more information, call your city's stormwater representative

FRESH CONCRETE & MORTAR APPLICATION



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

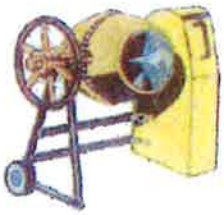
Follow these practices to help prevent stormwater pollution...

General Business Practices...

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

During Construction...

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



Handling Materials & Wastes...

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

Cleaning up...

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

For more information, call your city's stormwater representative

GENERAL CONSTRUCTION

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

Follow these practices to help prevent stormwater pollution...

General Business Practices...

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

Erosion Prevention...

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

Equipment Maintenance...

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

Handling Materials & Waste...

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

Spills...

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

For more information, call your city's stormwater representative

HOME & GARDEN

Yard waste and household toxics such as paints, solvents, and pesticides often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

In Your Home...

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

Fertilizers and Pesticides...

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

Trimmin' the Garden...

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

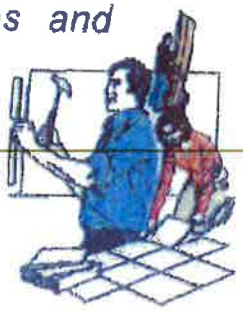
Planting In The Yard

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

For more information, call your city's stormwater representative

HOME REPAIR & REMODELING

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



Follow these practices to help prevent stormwater pollution...

Household Hazardous Wastes...

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

Construction...

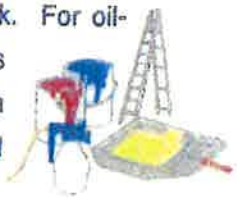
Keep all construction debris away from the street, gutter and storm drain, and if possible, schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of asphalt, sand, etc. with plastic tarps, and prevent erosion by planting fast-growing annual and perennial grasses,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

Landscape & Gardening...

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

Painting...

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



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

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

Concrete & Masonry...

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

For more information, call your city's stormwater representative

PAINTING

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

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Keep all paint products and wastes away from the street, gutter, and storm drains. Reuse paint thinner by setting used thinner aside in a closed, labeled jar to settle out paint particles, and then pouring off the clear liquid for future use. Wrap dried paint residue in newspaper and dispose of it in the trash.

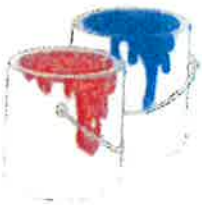
Water-Based Paints...

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

Recycle or Reuse Paints...

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

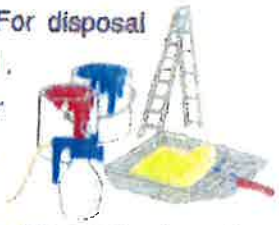
Paint Cleanup...



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

Paint Removal...

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



For more information, call your city's stormwater representative

ROADWORK & PAVING

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

Follow these practices to help prevent stormwater pollution...

During Construction...

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

Asphalt & Concrete Removal...

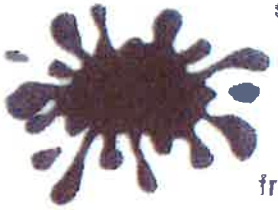
Barricade storm drain openings during saw-cutting, and after breaking up paving, be sure to remove all chunks and pieces and recycle them at a crushing company. For recycling information, call 386-8401.

Equipment Maintenance...

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

Spills...

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



General Business Practices...

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

For more information, call your city's stormwater representative

RURAL HOMES

Pesticides, fertilizers, septic system overflows, soil, and animal manure from rural homes often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

Protecting Your Well...

Since old, uncapped and abandoned wells can serve as direct conduits to our groundwater, it s important to maintain these areas. Keep all livestock confinement areas away from wells, and keep septic drain fields and chemical storage areas down slope from wells. Install anti-siphoning devices between your well and water pipes to prevent backflow of pollutants and drinking water contamination. REMEMBER: Never dispose of anything in wells.

Fertilizers and Pesticides...

Avoid buying and mixing more pesticide than you need, and never apply more than the recommended amount. Consider spot treatments, rather than spraying pesticides everywhere. REMEMBER: Don t dispose of excess chemicals by dumping them on the ground, pouring them down a well, or draining them into ditches, sewers, drains or septic systems. Call 1-800-OILY-CAT for disposal information. Finally, store chemicals in a covered area, with an impermeable lined floor to prevent contact with rainwater.

That Rural Landscape...

Reduce soil erosion by covering parking areas with gravel, and by covering other exposed soils with vegetation. Gravel and vegetation will not only improve the appearance of your home, but will also assist in filtering out pollutants from water. For information on reducing erosion, call 799-7407.

Autos & Other Equipment...

Repair vehicles and other equipment away from wells, ditches and drains. Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. For recycling information, call 1-800-OILY-CAT

Septic Systems

Septic systems should never be piped into a road ditch, storm sewer, stream or farm drain tile system. Also, avoid washing or flushing grease, alcohol, or strong chemicals into your septic system; these substances kill the bacteria needed to break down wastes.

For more information, call your city s stormwater representative