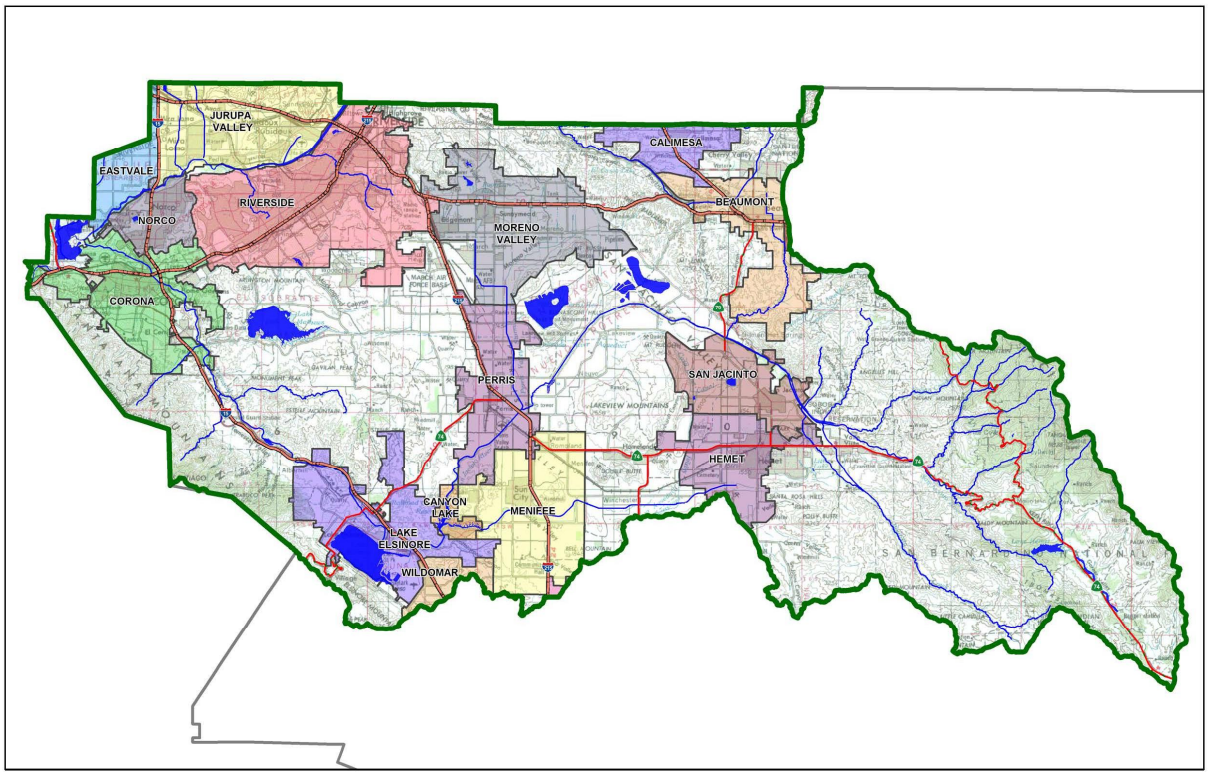
Preliminary Project Specific Water Quality Management Plan

Projects located within the Santa Ana Watershed Region of Riverside County

Project Title: **Riverside Hauling Yard**

Development No: Burrtec Waste Industries

Design Review/Case No:



☒ Preliminary

☐ Final

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

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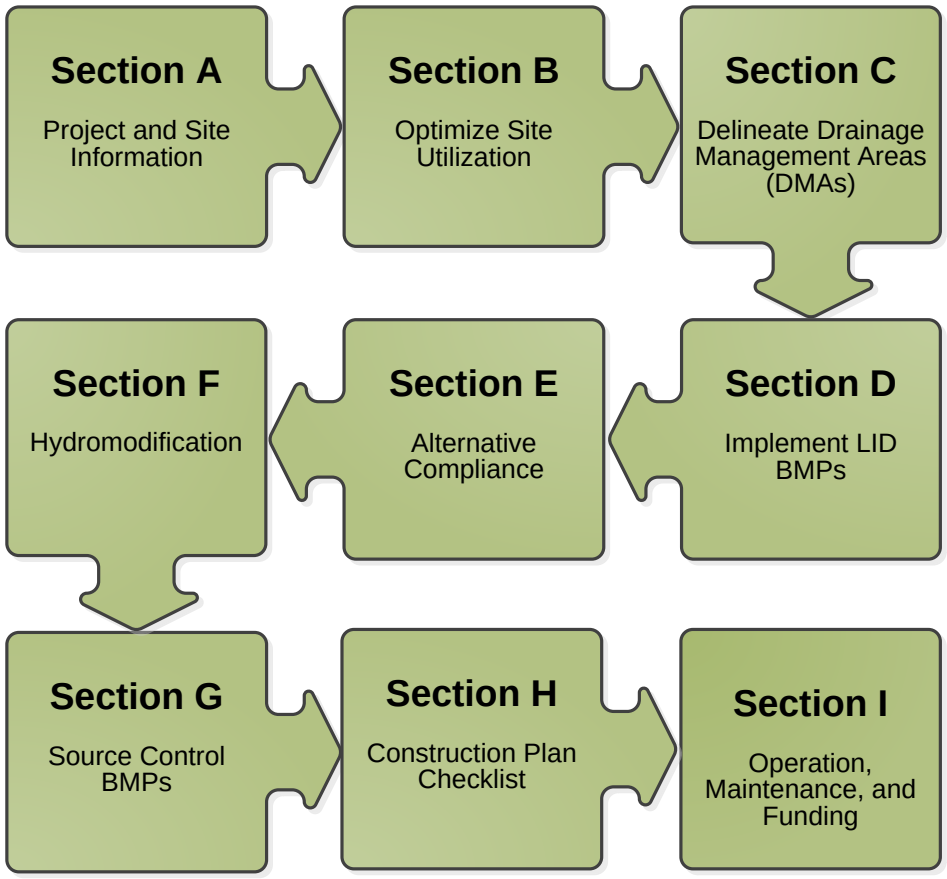
INTRODUCTION

This Project-Specific **Riverside Hauling Yard WQMP** for the **Santa Ana Region** has been prepared to help guide in documenting compliance for this project. Below is a flowchart for the layout of this WQMP that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This *Preliminary* Project-Specific Water Quality Management Plan (PWQMP) has been prepared for Burrtec Waste Industries, Inc. by K&A Engineering, Inc. for the Riverside Hauling Yard Development project.

This WQMP is intended to comply with the requirements of City of Jurupa Valley, County of Riverside for Ordinance No. 754.2 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 Jurupa Valley, County of Riverside Water Quality Ordinance (Municipal Code Section 754.2).

"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	Date
Owner's Printed Name	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	Date
Farris N. Haddad, P.E.	VP of Operations
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Commercial
Planning Area:	
Community Name:	Aqua Mansa
Development Name:	Riverside Hauling Yard
PROJECT LOCATION	
Latitude & Longitude (DMS): 33.0205°N, 117.3835°W	
Project Watershed and Sub-Watershed: Santa Ana River Watershed, East Etiwanda Creek Sub-Watershed.	
APN(s): 175-180-012 & 175-180-016	
Map Book and Page No.:	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Commercial
Proposed or Potential SIC Code(s)	
Area of Impervious Project Footprint (SF)	Total Project: gross 9.82 ac net 8.88 ac
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	Commercial 339,715 sf Landscape 46,960 sf Building: 29,412 sf Parking areas 310,303 sf
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 sf undeveloped
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	
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	Soil Type B
What is the Water Quality Design Storm Depth for the project?	D85 = 0.66 inches

The proposed project consists of several buildings, parking lots, and landscape areas, on approximately gross area of 9.82-acre parcel located northeast of Wilson Street and Aqua Mansa Road. The project site is bounded by Wilson Street to the south, Aqua Mansa Road to the west, existing commercial site to the east and to the north.

The proposed project includes the following buildings:

- Office – 10,275 sf
- Maintenance Building – 19,137 sf
- AC paved area – 300,250 sf
- PCC paved area – 10,053 sf
- Landscape area – 46,960 sf

The only routinely conducted outdoor activities will include the in and out parking and maintenance necessary for the daily management of business. All materials and products will be loaded and unloaded only at the other designated loading areas. There will be no outdoor storage of materials or potentially hazardous materials.

Landscaping will comprise of approximately 10 percent of the site. Landscaped areas will be located throughout the parking area and around the buildings. Native drought tolerant plants will be chosen for efficient irrigation purposes.

In the proposed condition, runoff generated from building and parking lots will drain into several inlets and thru storm drain system into the Underground perforated pipes with gravel BMP in the parking area. The CDS units will be installed prior into the Underground perforated pipes for pre-treatment BMP. Overflow from Underground perforated pipes will connect to existing off-site storm drain system. Underground perforated pipes with gravel BMP is unlined, which also provides an opportunity for infiltration to the extent the underlying onsite soil can accommodate.

There will be access to the project site via four driveways off of Wilson Street.

Following is a list of potential wastes/pollutants that may be generated on this site based upon the described use;

- Bacterial Indicators
- Metals
- Nutrients
- Possible pesticides, fertilizers from landscape maintenance activities.
- Toxic Organic Compounds
- Sediments
- Trash and debris
- Oil and grease

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
☐ Hillside Development (>5,000 ft²)	P	N	P	P	N	P	P	P
☒ Parking Lots (>5,000 ft²)	P(6)	P	P(1)	P(1)	P(4)	P(1)	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

A.1 Maps and Site Plans

Appendix 1 of this Project-Specific PWQMP, includes a map of the local vicinity and existing site.

Also in addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans (will be included in Final WQMP) in Appendix 2.

The WQMP Site Plan included as part of Appendix 1 depicts the following project features:

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

A.2 Identify Receiving Waters

Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. 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.

See the receiving waters map in Appendix 1 and below this following table:

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Aqua Mansa Storm Drain	None	None	Not a RARE water body
Santa Ana River Reach 4 (HU# 802.12)	Pathogens, Salinity/TSD/Chlorides	MUN, GWR, REC1, REC2, WARM, WILD	Not a RARE water body

2010 Integrated Report | Map | 303(d) List | References | Data Download | Draft Reports | Contact Us

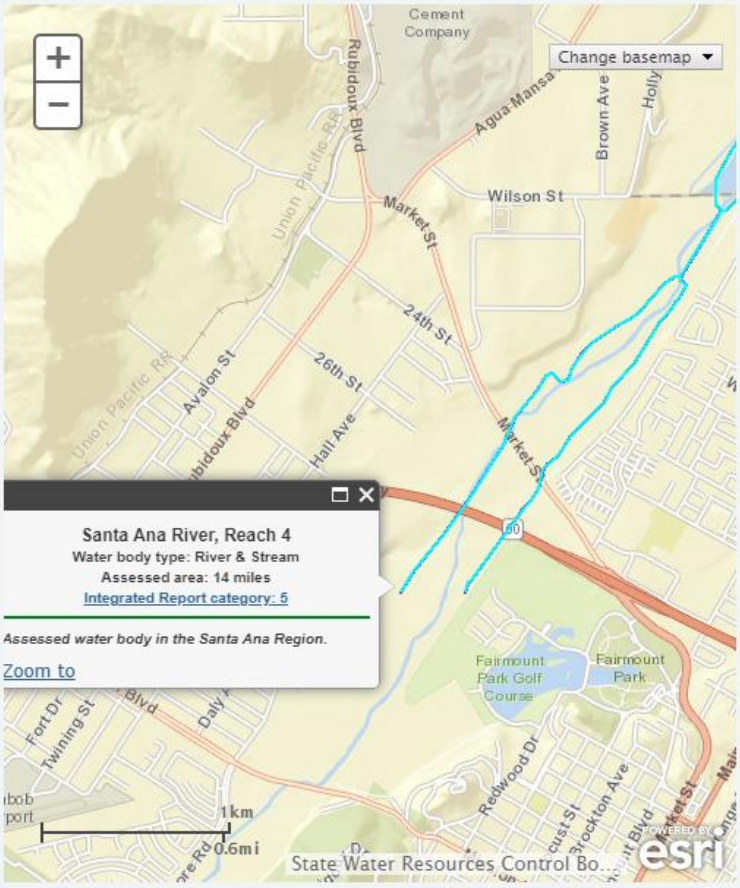
2010 INTEGRATED REPORT — ALL ASSESSED WATERS

Zoom to county: All
Show county

Zoom to Regional Board: All
Show Regional Board

Map Help

Zoom to water body: *(Filter: All)*
Filter list by: | Reset list



Santa Ana River, Reach 4
Water body type: River & Stream
Assessed area: 14 miles
Integrated Report category: 5

Assessed water body in the Santa Ana Region.

Zoom to

Santa Ana River, Reach 4 Close
Pollutant assessments

Pollutants	Listing Decision
	Report Link
	Potential Sources
	Schedule
	Comments
Pathogens	List on 303(d) list (TMDL required list)
	20514
	n/a
	Est. TMDL completion: 2019

This Webinar walks the user through the Integrated Report and its geospatial information system

- **Geographical Information Systems (GIS) Files**
  Update 12/23/11: The information presented on this map reflects the final USEPA-approved 2010 303(d) list. If you have any questions regarding the Integrated Report data and information, please email Lori Webber or call 916-341-5736. For any GIS-related questions, please email Nirmal Sandhar or call (916)341-5571.

REGION	WATER BODY NAME	WATER TYPE	WATERSHED • CALWATER/ • USGS HUC	• POLLUTANT • POTENTIAL SOURCES	ESTIMATED AREA ASSESSED	FIRST YEAR LISTED	TMDL REQUIREMENT STATUS	DATE
8	Santa Ana River, Reach 4	River & Stream	80127000 / 18070203	• Pathogens Nonpoint Source	14 Miles	1994	5A	2019
8	Santiago Creek, Reach 4	River & Stream	80112000 / 18070203	• Salinity/TDS/Chlorides Source Unknown	9.8 Miles	1996	5A	2019

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 *(2009-0009-DWQ as amended by 2010-0014-DWQ)*	☒ Y	☐ N
Statewide Industrial General Permit Coverage *(Order No. 1997-0003-DWQ)*	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)* Grading Permit, Building Permit and Construction Permit	☒ 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.

All applicable permits will be included in the Final WQMP.

Section B: Optimize Site Utilization (LID Principles)

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

In addition to requiring implementation of LID BMPs, the MS4s Permit also prioritizes which LID BMPs should be used first.

1. Infiltrate,
2. Harvest and Use,
3. Evapotranspire,
4. Bio-Treatment and/or Bio-Retention

Within the permits it is recognized that LID principles are not universally applicable throughout Riverside County and that they are dependent on factors such as:

1. Soil conditions including soil compaction and permeability,
2. Groundwater levels,
3. Soil contaminants (Brownfield development),
4. Space restrictions (in-fill projects, redevelopment projects, high density development),
5. Highest and best use of Urban Runoff (to support downstream uses)

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document.

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

The project site is currently in partially graded condition – as such no existing "natural" drainage courses are present on site. The drainage course starts along site's frontage at Wilson Street and flows north where it collects into the existing soft bottom basins. There are two (2) soft bottom basins located along the north side of the site. Basin one, smaller of the two, is located on the north-west side and basin two is located at the north-center side of the site. During a rain event, the collected storm flows gets stored in the basins and then infiltrates into the surrounding ground. In the event that the storm volume exceeds available basin storage volume, the water will overtop the basins and continue flowing north to the adjacent dirt ditch that is located between the site's fence and existing railroad tracks. At this point the drainage will collect and pond a couple of feet in depth before leaving the site via existing culvert located at the north west side of the site adject to Agua Mansa Road.

The grading and drainage design of Riverside Hauling Yard project has been developed to maintain the master planned drainage discharge patterns as much as practical.

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

The project site is in partially graded condition and used for parking, there is no existing natural vegetation on site that can be protected.

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

Per Riverside County Flood Control soils mapping the total project site is majority on Type B soil, potentially good or moderate infiltration rate. Geo Tek, Inc. performed Percolation Test Infiltration testing at two locations at I-1 and I-2 (Boring I-1 and Boring I-2) in the project site (dated 9-9-2020). The result tests were confirmed that this project area produced good Infiltration Rate of 8.0 and 10.6 in/hr.

Based on LID BMP Prioritization, for alternate BMPs situated in sites with good infiltration rates; Infiltration BMP (Underground perforated pipes with gravel) was selected as the most appropriate treatment BMPs.

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

The project hard-scape was designed to support parking, emergency vehicle access, and vehicle parking that has been minimized to the maximum practical extent. Remaining portions of the site have been set aside for landscaping that includes the proposed BMP's. Approximately 10% of project site of area will be Landscaped.

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

The proposed on-site drainage plan disperses runoff into an Underground perforated pipes with gravel Infiltration/Detention Basin BMP as structural BMP and the storm drain outflow will joining to the existing drainage system.

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, the Table C.1 below was completed to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. 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 Area A-1	Commercial (including building roof) site areas	45,738 (1.05 Ac)	"D", to BMP-1
DMA Area A-2	Commercial (including building roof) site areas	48,787 (1.12 Ac)	"D", to BMP-1
DMA Area A-3	Commercial (including building roof) site areas	131,987 (3.03 Ac)	"D", to BMP-1
DMA Area A-4	Commercial (parking area) site areas	31,363 (0.72 Ac)	"D", to BMP-1
DMA Area A-5	Commercial (parking area) site areas	108,464 (2.49 Ac)	"D", to BMP-1

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

Table C.2 Type 'A', Self-Treating Areas

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

Table C.3 Type 'B', Self-Retaining Areas

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

N/A						

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

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

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

Composite Runoff Factor

The sizing of both Volume-Based BMPs and Flow-Based BMPs is based on determination of a composite runoff factor, which varies depending on the land use covers tributary to the BMP. This composite runoff factor, C, is determined using the following equation

$$C = 0.858 \cdot {I_f}^3 - 0.78 \cdot {I_f}^2 + 0.774 * I_f + 0.04$$

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

DMA Name or ID	BMP Name or ID
DMA Area A-1	BMP-1: Underground perforated pipes with gravel
DMA Area A-2	BMP-1: Underground perforated pipes with gravel
DMA Area A-3	BMP-1: Underground perforated pipes with gravel
DMA Area A-4	BMP-1: Underground perforated pipes with gravel
DMA Area A-5	BMP-1: Underground perforated pipes with gravel

<u>Note</u>: 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.

Table 2-1: Impervious Fraction Based on Various Land Use Covers

Surface Type	Effective Impervious Fraction, I_f
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40

Effective Impervious Fraction for mixed surfaces Riverside Hauling Yard:

Use average Effective Impervious Fraction, EIF = 0.9 for Commercial Site areas, and Parking areas EIF = 0.95 consistent with Impervious Fraction for hydrology calculations.

See Impervious Cover table from Hydrology Manual below:

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD
HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE D-5.6

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: **Test results are indicative of the total site**		
…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: *Per Riverside County Flood Control soils mapping the total project site is all on Type B soil, potentially yielding a good or moderate infiltration rate. Geo Tek, Inc. performed Percolation Test Infiltration testing at two locations at I-1 and I-2 (Boring I-1 and Boring I-2) in the project site (dated 9-9-2020). The result tests were confirmed that this*		

project area produced good Infiltration Rate of 8.0 and 10.6 in/hr.		

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. There is an existing 8" reclaimed water line within Opportunity Way adjacent to the project site.
- Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermitee).

X 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

The total Riverside Hauling Yard Design Capture Volume will be addressed using Underground Infiltration BMP, therefore Harvest and Use BMPs need not be assessed.

Toilet Use Feasibility

The total Riverside Hauling Yard Design Capture Volume will be addressed using Underground Infiltration BMP, therefore Harvest and Use BMPs need not be assessed.

Other Non-Potable Use Feasibility

The total Riverside Hauling Yard Design Capture Volume will be addressed using Underground Infiltration BMP, therefore Harvest and Use BMPs need not be assessed.

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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:

X 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.

The 2010 SAR MS4 Permit further requires that LID Retention BMPs (Infiltration or Harvest and Use) be used unless it can be shown that those BMPs are infeasible.

Based on LID BMP Prioritization, for alternate BMPs situated in sites with good infiltration rates; Underground Infiltration BMP was selected as the most appropriate treatment BMPs.

The total Riverside Hauling Yard Design Capture Volume will be addressed using Underground Infiltration BMP, therefore Harvest and Use BMPs need not be assessed.

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	
Area A-1	☒	☐	☐	☐	☐
Area A-2	☒	☐	☐	☐	☐
Area A-3	☒	☐	☐	☐	☐
Area A-4	☒	☐	☐	☐	☐
Area A-5	☒	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

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.

DMA Area A-1, 1.05 acres – Commercial Site including building roof areas drain to proposed BMP-1, Underground Infiltration BMP.

DMA Area A-2, 1.12 acres – Commercial Site including building roof areas drain to proposed BMP-1, Underground Infiltration BMP.

DMA Area A-3, 3.03 acres – Commercial Site including building roof areas drain to proposed BMP-1, Underground Infiltration BMP.

DMA Area A-4, 0.72 acres – Commercial Site, parking areas drain to proposed BMP-1, Underground Infiltration BMP.

DMA Area A-5, 2.49 acres – Commercial Site, parking areas drain to proposed BMP-1, Underground Infiltration BMP.

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)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Areas x Runoff Factor**	***Enter BMP Name / Identifier Here***		
	[A]		[B]	[C]	[A] x [C]			
see	*Appendix 6*					*Design Storm Depth (in)*	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{12}$	[G]

[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

See complete calculations 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).

- ✓ 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.

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

For Drainage Area Total Site: (Similar for other drainage areas – will be provided in the final WQMP)

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Peak Runoff			
Volume (Acre Feet)			

[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.

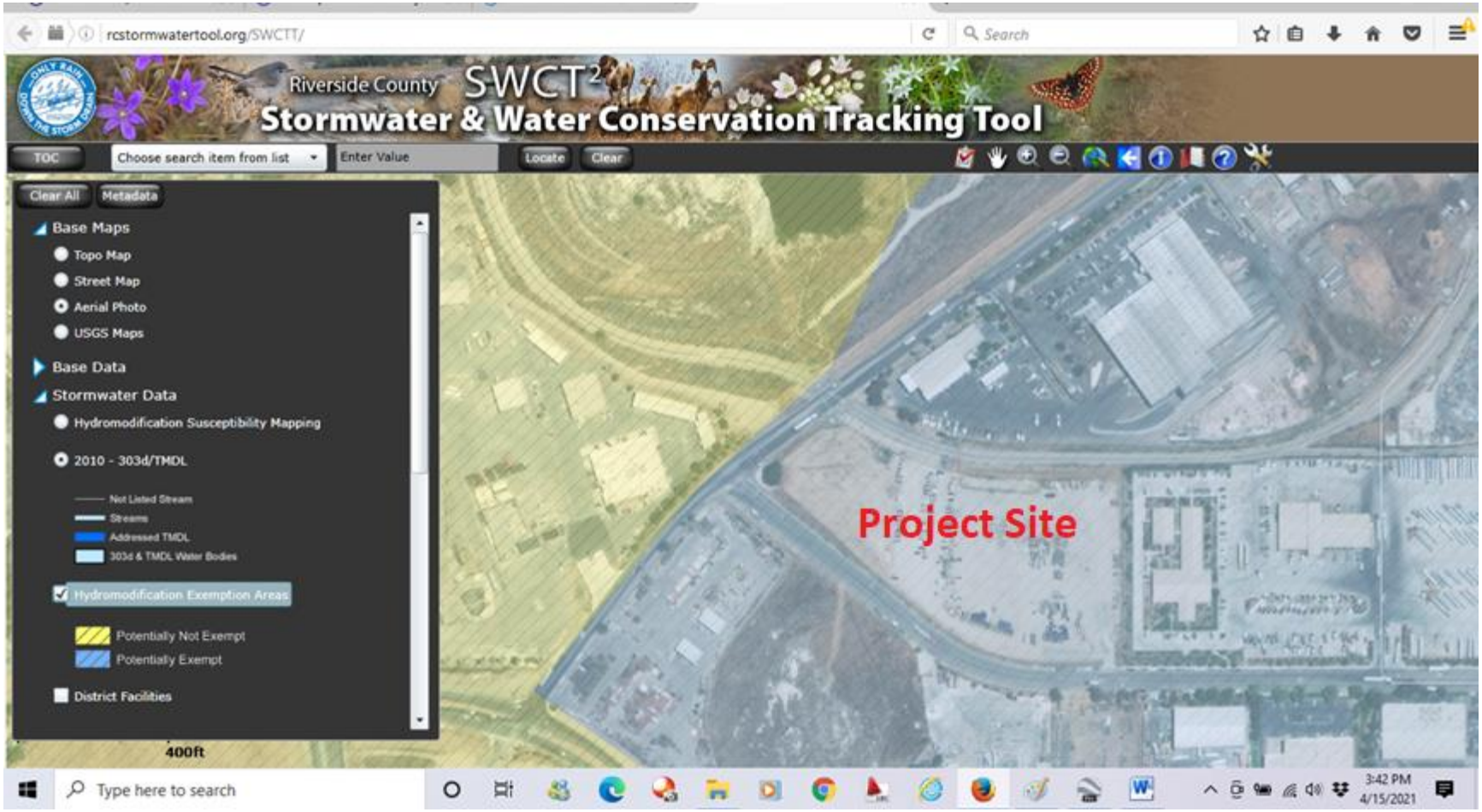
HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design 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:

Project Site is in Hydromodification Exemption Areas (see Map in the following page).

Total project site is within the **NOT Applicable Area** per the HCOC Applicable Map, **therefore HCOC mitigation were not provided.**



Project Site is in Hydromodification Exemption Areas

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.

Table 0.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Rooftop Equipment Roofing, gutters, and trim.	Rooftop equipment with potential to produce pollutants will be roofed and/or have secondary containment. Roofing, gutters, and trim will not be made of copper or other unprotected metals that may leach into runoff.	
On-site storm drain catch basins and grated inlets. Locations are shown on PWQMP BMPs Site Map in Appendix 1.	On-site storm drain signage will utilize language, "No Dumping Drains to River", or equally approved text that is consistent with the CITY' requirements. Landscape area drains surrounded by vegetation will not be signed. The signs will be located at storm drain inlets in impervious areas and will be either stenciled or placarded.	Inspect the signage once per year. Repair or replace when the signage becomes unreadable. The original owner or developer will be responsible for the first stenciling of the storm drain system. Thereafter when the property is sold, the new owner will assume the responsibility for inspection, maintenance, and funding. See CASQA SD-13 BMP Fact Sheet in Appendix 10 for additional information
	On-site drainage facility inspection and maintenance. On-site drainage structures, including all storm drain clean outs, area drains, inlets, catch basins, inlet & outlet structures, forebays, & water treatment control basins shall be inspected and maintained on a regular basis to insure their operational adequacy. See CASQA SC-44 BMP Fact Sheet in Appendix 10 for additional information.	Inspect at a minimum, once before the onset of the rainy season (Oct 1 to May 1), once during the rainy season, and once after the rainy season. Maintenance should include removal of trash, debris, & sediment and the repair of any deficiencies or damage that may impact water quality. The property owner will assume the responsibility for all on-site drainage facility inspection, maintenance, and funding.
Landscape Design, Maintenance, and Pesticide Use.	Irrigation systems and landscape design should follow as a guide the specifications and recommendations of the Water	Performed during design phase.

	Conservation Act of 2006, AB1881 (Laird) and conform to the standards and requirements of the City' landscape requirements. Irrigation systems shall employ control systems and be designed to conserve water. The landscape design shall incorporate native and drought tolerant vegetation with low irrigation requirements. See CASQA SD-10 and SD-12 BMP Fact Sheets in and other landscape literature in Appendix 10 for additional information.	
	Irrigation and landscape maintenance should be performed on a regular basis throughout the year. See CASQA SC-41 or SD-10 and SD-12BMP Fact Sheets in Appendix 10 for additional information.	Inspect landscape areas twice annually (before and after the rainy season) and the irrigation system quarterly for proper functioning. Maintenance should be performed every 2 weeks or as needed. Landscape maintenance should include mowing, weeding, trimming, removal of trash & debris, repair of erosion, re-vegetation, and removal of cut & dead vegetation. Irrigation maintenance should include the repair of leaky or broken sprinkler heads, the maintaining of timing apparatus accuracy, and the maintaining of shut off valves in
	Pesticide usage should be at a necessary minimum and be consistent with the instructions contained on product labels and with the regulations administered by the State Department of Pesticide Regulation. Pesticides should be used at an absolute minimum or not at all in the retention/infiltration basin. If used, it should not be applied in close proximity to the rainy season.	
Refuse and Trash Storage Areas. Locations are shown on PWQMP BMPs Site Map in Appendix 1.	Trash container storage areas shall be paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements from the surrounding area, and screened or walled to prevent off-site transport of trash. Trash dumpsters (containers) shall be leak proof and have attached	Inspect monthly. Check weekly and have trash containers emptied when full and hauled away on a regular basis. Maintain trash receptacles and enclosures in good working order. Post "No Hazardous Materials" signs. Inspect and pick up litter and debris on a daily basis. See CASQA SD-32 BMP Fact Sheets in Appendix 10 for

	covers or lids. Trash enclosures shall be roofed per City standards and the details on the PWQMP Exhibit in Appendix 1. Trash compactors shall be roofed and set on a concrete pad per CITY standards. The pad shall be a minimum of one foot larger all around than the trash compactor and sloped to drain to a sanitary sewer line. Connection of trash area drains to the MS4 is prohibited. See CASQA SD-32 BMP Fact Sheets in Appendix 10 for additional information.	additional information. Clean up spills immediately. See CASQA SC-10 BMP Fact Sheets and Emergency Response/Contingency Plan in Appendix 10 for additional information.
Plazas, sidewalks, and parking lots		Plazas, sidewalks, and parking lots will be swept regularly to prevent accumulation or litter and debris. Debris from pressure washing will be collected to prevent entry into the storm drain. Washwater containing any cleaning agent or degreaser will be collected and discharge to the sanitary sewer not to a storm drain.

See additional information on Source Control BMPs and their operation and maintenance in Appendix 8 and Appendix 9.

Section G: Construction Plan Checklist

Table G.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)
BMP-1	Underground perforated pipes with gravel Infiltration BMP	BMP Site Plan (Construction Plan will be included in the Final WQMP)

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 H: 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:

With the project site being in the City of Jurupa Valley, the Property Owner will have ongoing maintenance responsibilities. Site design and treatment BMPs have been designed to keep maintenance efforts in line with Riverside Hauling Yard project maintenance activities.

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

☐ Y ☒ N

Will maintain by Property Owner.

TREATMENT CONTROL BMPS

Underground Infiltration/Detention BMP

- Construction and Initial Funding until acceptance will be provided by the project Contractor.
- After acceptance of the Riverside Hauling Yard projects by Burrtec Waste Industries is anticipated that the Operation and Maintenance of the Underground Infiltration and pre-treatment BMPs will be the responsibility of the Property Owner. All landscape of common areas and parking areas will be maintained by the Property Owner.

Project owner:

Burrtec Waste Industries, Inc.
9820 Cherry Avenue
Fontana, CA 92335
Telephone: (909) 429-4200

Contact person: Gary Koontz

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

Identify Pollutants of Concern

Following is a list of potential wastes/pollutants that may be generated on this site based upon the described use;

- Bacterial Indicators
- Metals
- Nutrients
- Possible pesticides, fertilizers from landscape maintenance activities.
- Toxic Organic Compounds
- Sediments
- Trash and debris
- Oil and grease

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.

Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
N/A		

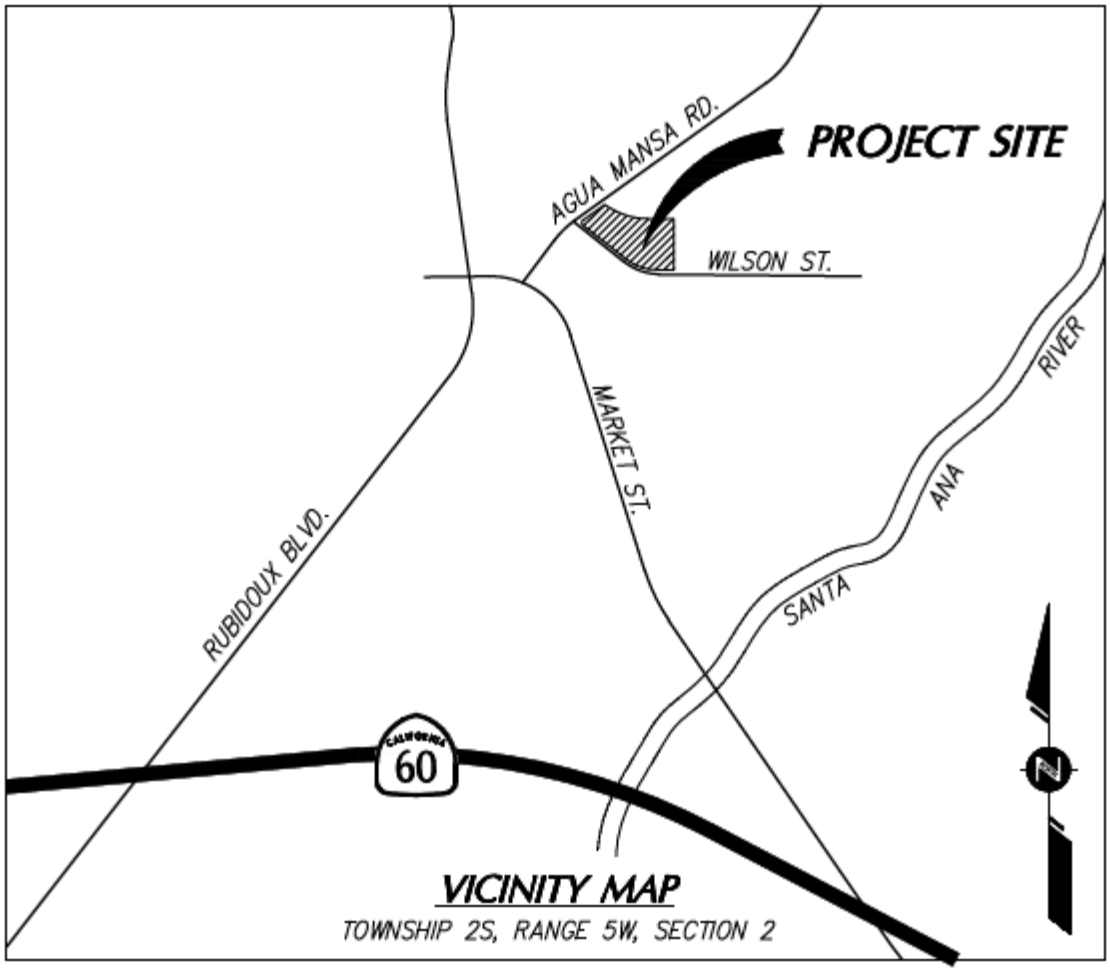
[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.

[2] Cross Reference Table E.1 above to populate this column.

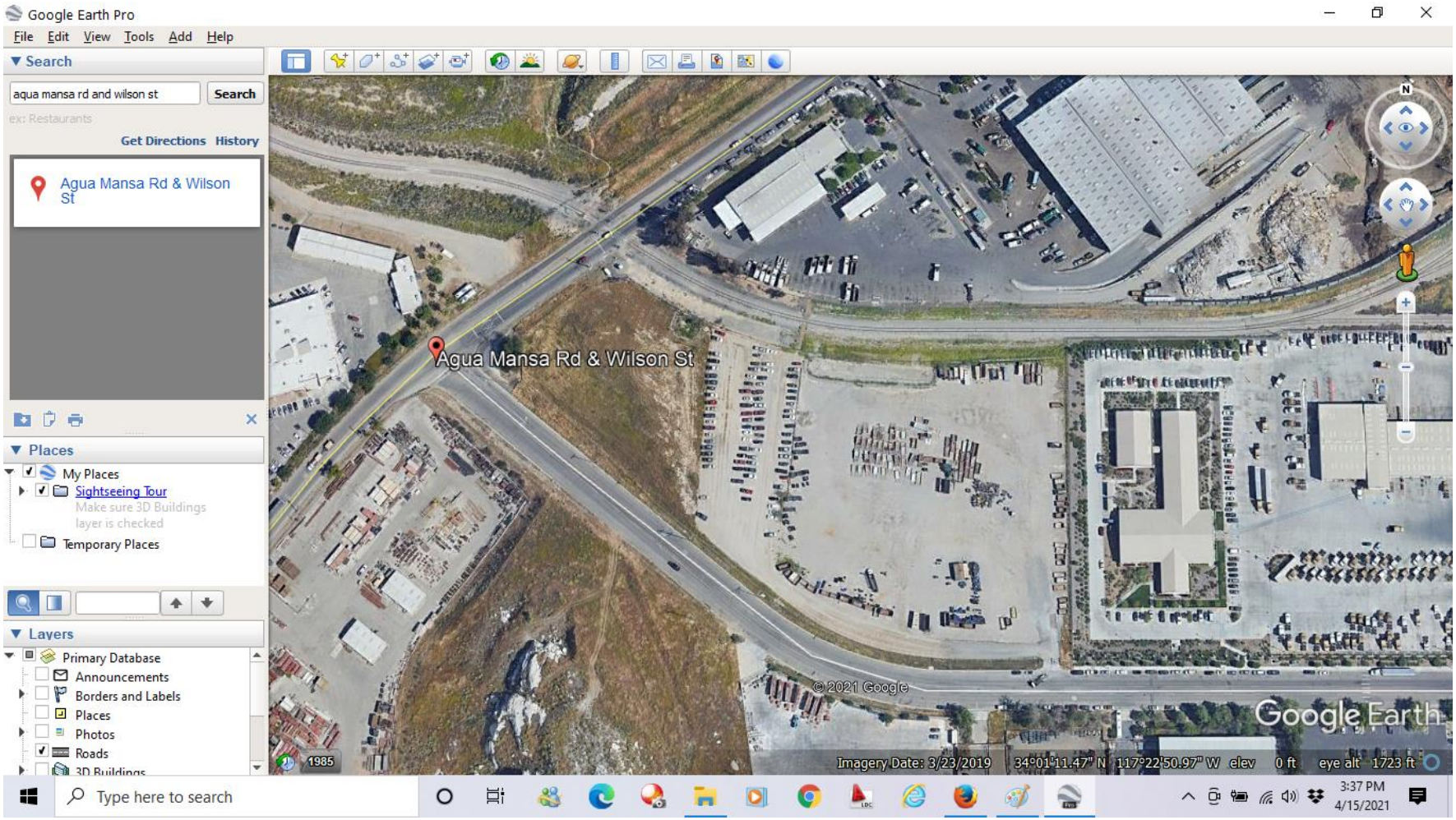
[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Appendix 1: Maps and Site Plans

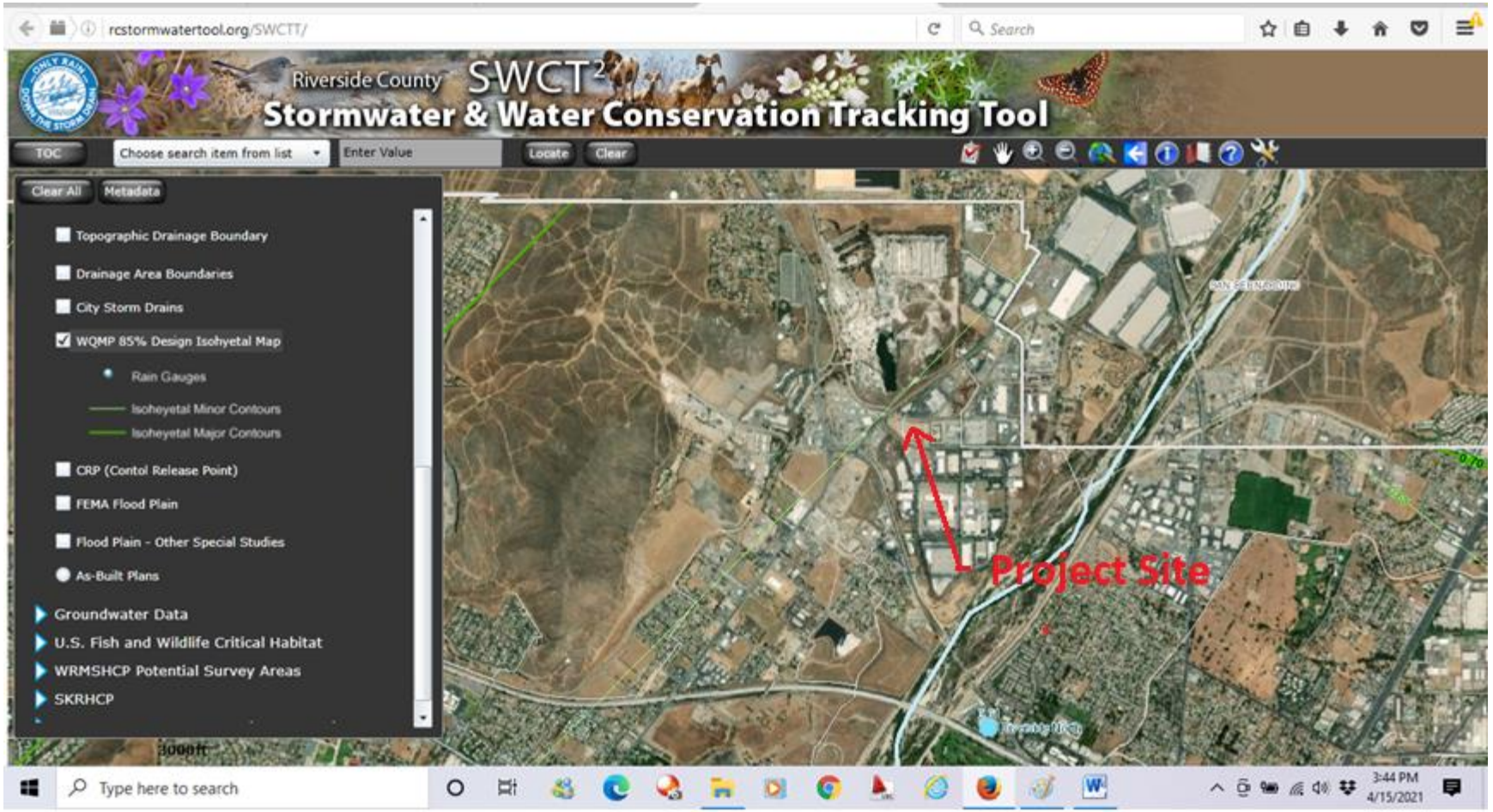
Location Map, WQMP Site Plan and Receiving Waters Map

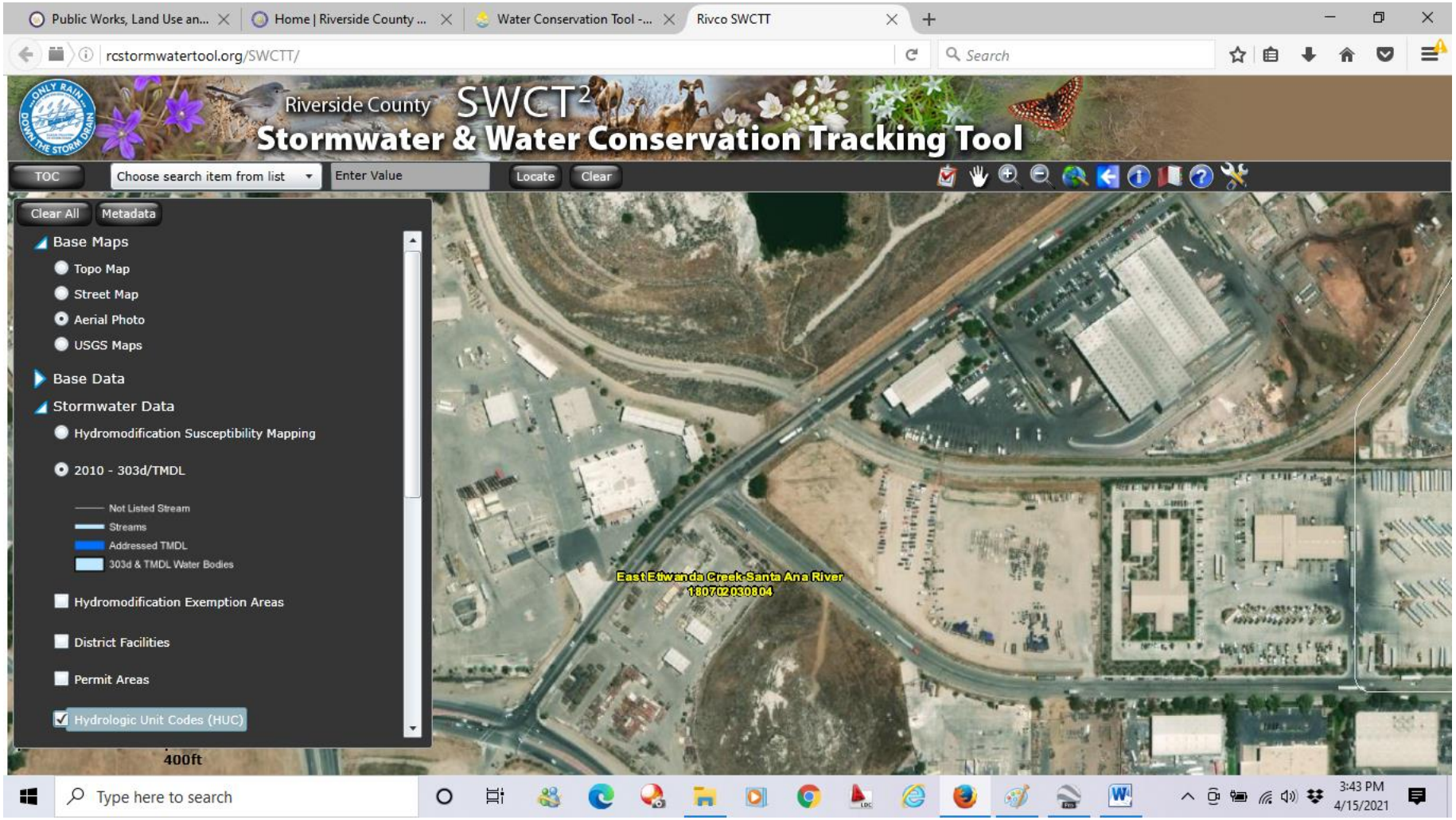


Vicinity Map

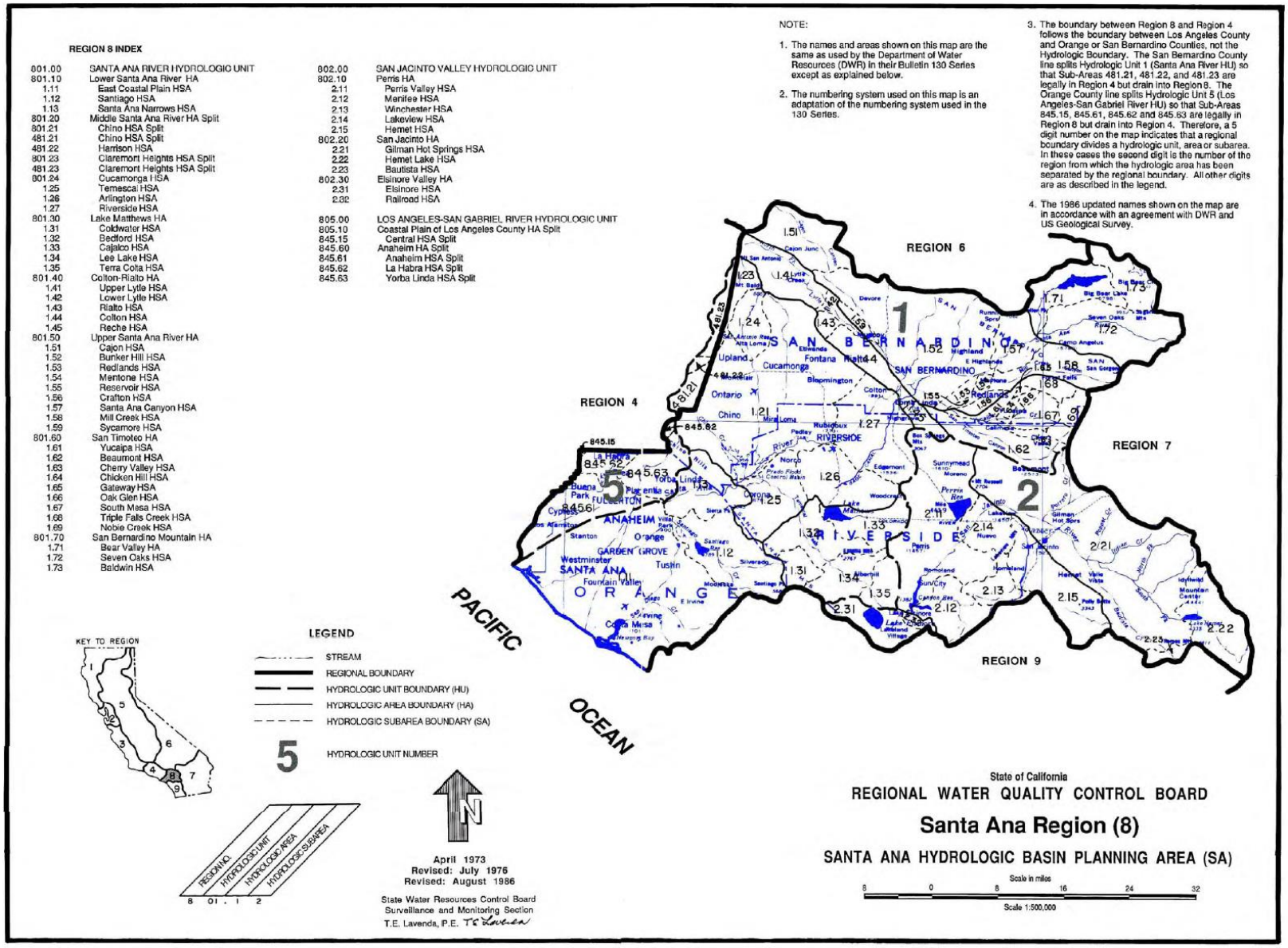


Location Map

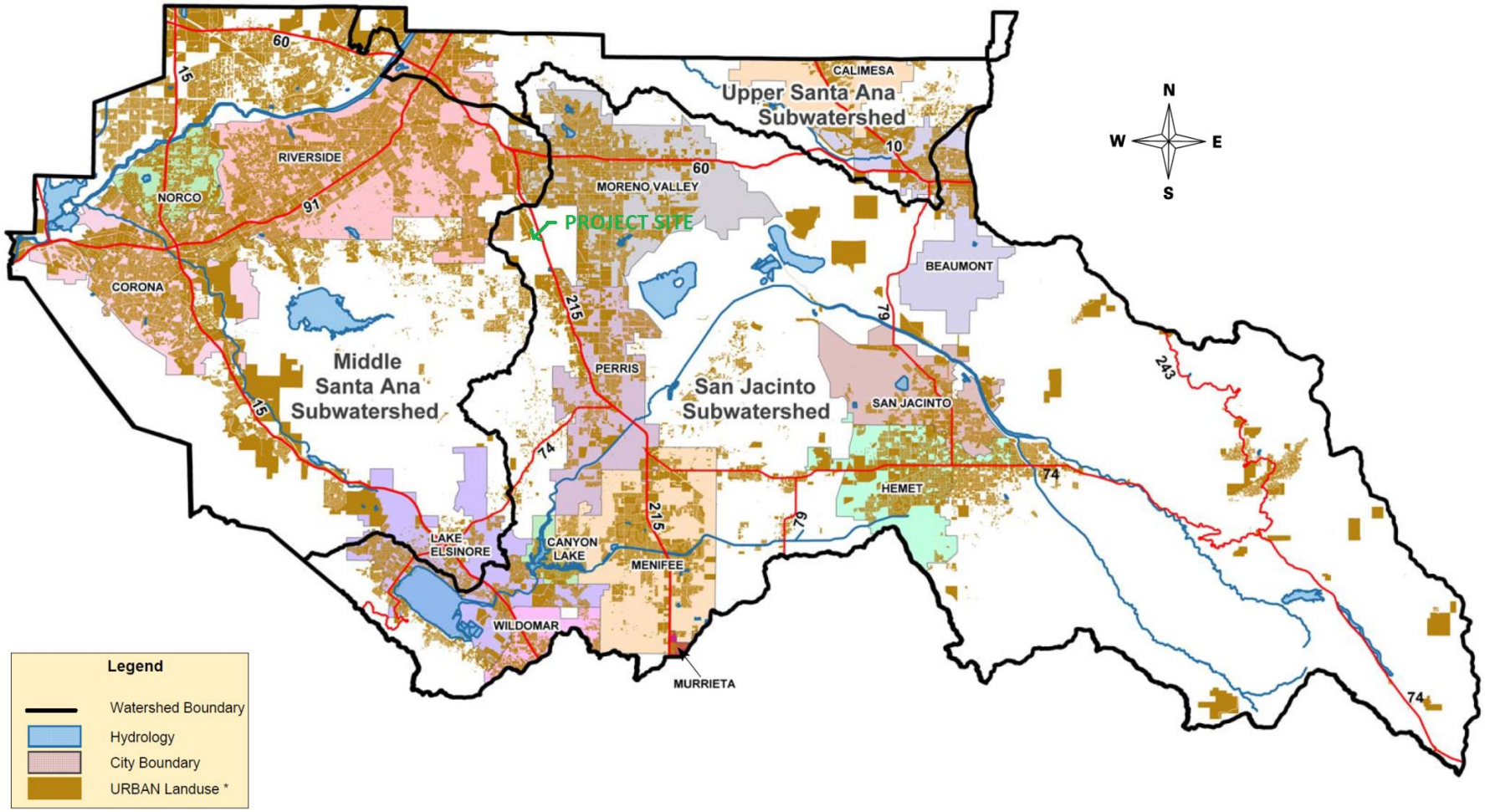

rcstormwatertool.org/SWCTT/
Search
Riverside County SWCT²
Stormwater & Water Conservation Tracking Tool
TOC
Choose search item from list
Enter Value
Locate
Clear
Clear All
Metadata
Topographic Drainage Boundary
Drainage Area Boundaries
City Storm Drains
WQMP 85% Design Isohyetal Map
Rain Gauges
Isohyetal Minor Contours
Isohyetal Major Contours
CRP (Contol Release Point)
FEMA Flood Plain
Flood Plain - Other Special Studies
As-Built Plans
Groundwater Data
U.S. Fish and Wildlife Critical Habitat
WRMSHCP Potential Survey Areas
SKRHCP
Project Site
3000ft
Type here to search
3:44 PM
4/15/2021



Isohyetal Map



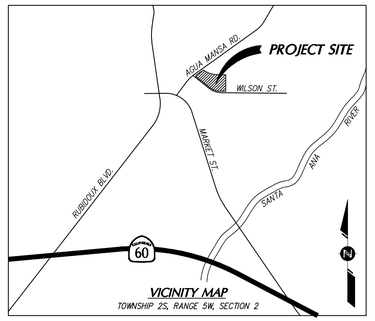
Receiving Water Map



* Areas not in URBAN: Agricultural, State, Federal, Tribal, Preserves & Open Space, Rural-Residential, Highways/Freeways

WQMP Site Plan

RIVERSIDE HAULING YARD
CITY OF JURUPA VALLEY



PROJECT INFORMATION:

APPLICANT: BURRTEC WASTE INDUSTRIES INC.
LOCATION: WILSON ST. JURUPA VALLEY CA
APN: 175-180-012 & 175-180-016
ZONING: M-H

SITE SUMMARY:

OFFICE: 10,275 S.F.
MAINTENANCE BUILDING: 19,137 S.F.
AC PAVED AREA: 300,250 S.F.
PCC PAVED AREA: 10,053 S.F.
LANDSCAPE AREA: 46,960 S.F.
TOTAL DISTURBED AREA: 386,675 S.F. (8.88 AC)

TOTAL SITE AREA: 427,611 S.F. (9.82 AC)

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	K&A Engineering, Inc.	Date	6/1/2021
Designed by	JY	Case No	
Company Project Number/Name	Burrtec Waste Industries		

BMP Identification

BMP NAME / ID: BMP-A, Drainage Area = 8.41 Ac (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}= 0.66 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 Impervious Fraction, I_a	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)
A-1 (1.05 Ac)	45738	Mixed Surface Types	0.9	0.73	33401.6			
A-2 (1.12 Ac)	48787	Mixed Surface Types	0.9	0.73	35628.3			
A-3 (3.03 Ac)	131987	Mixed Surface Types	0.9	0.73	96387.7			
A-4 (0.72 Ac)	31363	Mixed Surface Types	0.95	0.81	25309.2			
A-5 (2.49 Ac)	108464	Mixed Surface Types	0.95	0.81	87528			
	366339	Total			278254.8	0.66	15304	15304

The underground pipes storage is size for 25-year 24-hour storm runoff volume >>>

LEGEND

- EXISTING RIGHT OF WAY
- EXISTING CENTER LINE
- EXISTING PL
- EXISTING FENCE
- EXISTING GROUND CONTOUR
- EXISTING WATER & SIZE
- EXISTING SEWER & SIZE
- EXISTING FORCE MAIN & SIZE
- EXISTING STORM DRAIN & SIZE
- EXISTING OVERHEAD LINE
- EXISTING ELEVATION

C – CONSTRUCT
P – PROTECT IN PLACE
R – REMOVE

- NUMBER OF PARKING STALLS
- GROUND CONTOUR
- DAYLIGHT LINE
- GRADE
- POTABLE WATER
- SEWER
- FIRE PROTECTION
- STORM DRAIN
- CHAINLINK FENCE
- TUBE STEEL FENCE
- CMU WALL
- AC PAVEMENT
- PCC PAVEMENT
- LANDSCAPE

BMP-1 = Underground Infiltration BMP

SEE ATTACHED PLAN FROM MANUFACTURE – CONTECH

The infiltration rates are presented in the following table, after the water levels had stabilized.

Exploration No.	Infiltration Rate (inches per hour)	Depth of Test (feet)
Boring I-1	8.0	5
Boring I-2	10.6	5

ABBREVIATIONS

TC – TOP OF CURB
FL – FLOW LINE
FS – FINISH SURFACE
DDCA – DOUBLE DETECTOR CHECK ASSEMBLY
FS – FINISH SURFACE
INV. – INVERT ELEVATION
R/W – RIGHT-OF-WAY
℄ – PROPERTY LINE
OH – OVERHEAD
WTR. – WATER
SWR. – SEWER

DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA Area A-1	Commercial (including building roof) site areas	45,738 (1.05 Ac)	"D", to BMP-1
DMA Area A-2	Commercial (including building roof) site areas	48,787 (1.12 Ac)	"D", to BMP-1
DMA Area A-3	Commercial (including building roof) site areas	131,987 (3.03 Ac)	"D", to BMP-1
DMA Area A-4	Commercial (parking area) site areas	31,363 (0.72 Ac)	"D", to BMP-1
DMA Area A-5	Commercial (parking area) site areas	108,464 (2.49 Ac)	"D", to BMP-1

OTHER PROJECT BMPs LIST:

- VEGETATION BUFFER ALONG BMP INLETS
- CATCH BASIN – MS4 STENCILING AND SIGNAGE
- LANDSCAPE AND IRRIGATION SYSTEM
- OPEN SPACE, REFUSE AREAS
- STREET TREES AND PARKWAY

LID PRACTICES TO BE IMPLEMENTED FOR THIS PROJECT:
- CONSERVATION DESIGN
- RUNOFF CONVEYANCE
- ROOF DOWNSPOUT DISCONNECTION
- EFFICIENT / LOW IMPACT LANDSCAPING
- NON STORMWATER DISCHARGES

SCALE: 1"=40'

NO WORK SHALL BE DONE ON THIS SITE UNTIL BELOW AGENCY IS NOTIFIED OF INTENTION TO GRADE OR EXCAVATE.
Underground Service Alert
Call: TOLL FREE
1-800
422-4133
TWO WORKING DAYS BEFORE YOU DIG

8930 LIMONITE AVE.
JURUPA VALLEY, CA 92509
TEL: (951) 332-6464
EMAIL: ENGINEERING@JURUPAVALLEY.ORG

IMPORTANT NOTE:
THE GRADING AND/OR IMPROVEMENT PLANS ARE APPROVED FOR A PERIOD OF TWO (2) YEARS FROM THE DATE SIGNED BY THE CITY ENGINEER. AFTER THE TWO (2) YEAR PERIOD HAS LAPSED, THE ENGINEER OF RECORD MAY BE REQUIRED TO SUBMIT AND PROCESS FOR CITY ENGINEER APPROVAL, UPDATED PLANS THAT COMPLY WITH THE MOST CURRENT CITY STANDARDS, PRACTICES, AND POLICIES.

MARK	DATE	INITIAL	DESCRIPTION	REC.	APPR	DATE
		E.O.R.	REVISION			

BENCHMARK:
SEE SHEET 1

BASIS OF BEARING:
SEE SHEET 1

ENGINEER OF RECORD'S SEAL
REGISTERED PROFESSIONAL ENGINEER
KEITH G. OSBORN
No. 36996
CIVIL
STATE OF CALIFORNIA

K&A Engineering, Inc.
ENGINEERING
LAND PLANNING
SURVEYING
357 N. SHERIDAN STREET
SUITE 117
CORONA, CALIFORNIA 92880
TEL. (951) 279-1800
FAX (951) 279-4380

PLANS PREPARED UNDER THE SUPERVISION OF:

KEITH G. OSBORN
R.C.E. #36996 (EXP. / /)
DATE

CITY OF JURUPA VALLEY
BURRTEC WASTE INDUSTRIES INC.
RIVERSIDE HAULING YARD
WQMP - SITE PLAN

ACCT. NO.

SHEET 1 OF ___

FOR:
W.O
CITY I. D. NO.

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Appendix 2: Construction Plans

Grading and Drainage Plans

Will be included in FINAL WQMP

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GEOTECHNICAL EVALUATION AND INFILTRATION STUDY
PROPOSED INDUSTRIAL HAULING YARD
APNS 175-180-012 AND -016
EAST OF AGUA MANSA ROAD AND NORTH OF WILSON STREET
JURUPA VALLEY, RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR

BURRTEC WASTE INDUSTRIES, INC.
9890 CHERRY AVENUE
FONTANA, CALIFORNIA 92355

PREPARED BY

GEOTEK, INC.
1548 N. MAPLE STREET
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PROJECT NO. 2484-CR **OCTOBER 9, 2020**

GEOTEK

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October 9, 2020
Project No. 2484-CR

Burrtec Waste Industries, Inc.
9890 Cherry Avenue
Fontana, California 92355

Attention: Mr. Gary Koontz

Subject: Geotechnical Evaluation and Infiltration Study
Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
East of Agua Mansa Road and North of Wilson Street
Jurupa Valley, Riverside County, California

Dear Mr. Koontz:

We are pleased to provide the results of our geotechnical evaluation and infiltration study for the subject site located in the city of Jurupa Valley, Riverside County, California. This report presents a discussion of our evaluation and provides preliminary geotechnical recommendations for earthwork and construction. In our opinion, the planned improvements appear feasible from a geotechnical viewpoint provided that the recommendations included in this report are incorporated into the design and construction phases of site development.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

Edward H. LaMont
CEG 1892, Exp. 07/31/22
Principal Geologist

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Project Engineer

Distribution: (1) Addressee

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ENCLOSURES

Figure 1 – Site Location Map
Figure 2 – Exploration Location Map

Appendix A – Logs of Exploratory and Infiltration Test Borings
Appendix B – Laboratory Test Results
Appendix C – Infiltration Test Results and Calculations
Appendix D – Seismic Settlement Analysis
Appendix E – General Grading Guidelines

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to complete an geotechnical evaluation and infiltration study for the currently proposed improvements at the project site. Services provided for this study included the following:

- Research and review of available geologic and geotechnical data, and general information pertinent to the site,
- Site reconnaissance,
- Site exploration consisting of the excavation and logging of six exploratory test pits and two infiltration test borings,
- Infiltration testing of the on-site materials,
- Review and evaluation of site seismicity and seismic settlement potential, and
- Compilation of this geotechnical report which presents our recommendations for site development.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The approximately 9.6-acre project site is located east of Agua Mansa Road and north of Wilson Street in the city of Jurupa Valley, Riverside County, California (see Figure 1). At the time of our site reconnaissance and field investigation, the site is currently vacant with no structural developments. There are several roll-off storage containers on the central and eastern portions of the site that are stored over a layer of crushed aggregate base. Additionally, there appears to be a stormwater detention basin near the northern property boundary. The site can be considered as having relatively flat terrain with site elevations ranging from approximately 895 feet above mean sea level (msl) in the southeast to 885 feet above msl in the northwest.

The property is bounded by railroad tracks, followed by a recycling center beyond to the north; Agua Mansa Road, followed by industrial developments beyond to the west; Wilson Street, followed by vacant land and industrial developments beyond to the south; and industrial developments to the east.

2.2 PROPOSED DEVELOPMENT

Based on email correspondence with a representative of Burrtec Waste Industries, Inc., the proposed construction will consist of a new hauling yard and water quality basin (assuming surface retention for a 25-year, 24-hour storm). The location of the anticipated water quality basin was not known at the time of our field investigation. Structural improvements may be associated with this development in the future. Although structural information has not been provided, we have assumed that the buildings will be supported by conventional shallow spread footings and will most likely include conventional slab-on-grade floor systems.

The proposed improvements are anticipated to exert relatively light foundation loads on the underlying soils. Proposed grades for the improvements are anticipated to be near existing grades. Due to the relatively flat topography of the site, retaining walls are not planned for development.

If site development differs from these assumptions, the recommendations included in this report should be subject to further review and evaluation. Site development plans should be reviewed by GeoTek when they become available. Additional geotechnical field exploration, analyses and recommendations may be necessary upon review of site development plans.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

Our field exploration was conducted on September 9, 2020. GeoTek observed and logged the excavations of six exploratory borings throughout the site to depths ranging from approximately 6.5 feet to 51.5 feet below existing ground surface (bgs). Additionally, two infiltration test borings were excavated within the anticipated stormwater infiltration area with a truck-mounted hollow-stem auger drill rig, to a maximum depth of approximately five feet bgs. A registered geologist from GeoTek logged the explorations. The two test borings were subsequently prepared and utilized for infiltration testing. The approximate locations of the field explorations

are shown on the Exploration Location Map (Figure 2). Logs of the excavations are included in Appendix A.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The subject property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. It extends approximately 975 miles south of the Transverse Ranges geomorphic province to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the property, this is an area geologically mapped to be underlain by alluvium (Dibblee, T.W. and Minch, J.A., 2003). The nearest zoned fault is the San Jacinto Fault, located approximately five miles to the northeast. No faults are presently shown in the immediate site vicinity on the maps reviewed for the area.

4.2 GENERAL SOIL/GEOLOGIC CONDITIONS

A brief description of the earth materials encountered below the site and within the area of anticipated construction is presented in the following section. Based on our field explorations, the area of anticipated improvements is underlain by relatively minor amounts of organic material and undocumented artificial fill underlain by alluvium.

4.2.1 Undocumented Fill and Crushed Aggregate Base

A layer of crushed aggregate base (CAB) was observed to be present overlying alluvium within three of our borings (B-3, B-4 and B-6), ranging in thickness from three inches to six inches. Although undocumented fill materials were not encountered in the borings excavated, localized areas of undocumented fill and/or CAB may be present in areas of the site not explored.

4.2.2 Alluvium

Alluvial material was encountered in all of the exploratory borings excavated on the site. In general, these materials typically consist of medium dense to very dense sand with varying amounts of silt, and stiff to hard silt with varying amounts of sand and the occasional trace of caliche stringers. The alluvial materials were observed to be slightly oxidized. Within the exploratory boring B-4, a mostly cohesive silty clay material was encountered between depths of approximately 29.5 feet and 44.5 feet.

4.3 SURFACE AND GROUNDWATER

4.3.1 Surface Water

Surface water was not observed on the site during our subsurface investigation nor the site reconnaissance. If encountered during the earthwork construction, surface water on this site is the result of precipitation or surface run-off from surrounding sites. Overall area drainage in the area is most generally directed to the west. Provisions for surface drainage should be accounted for by the project civil engineer.

4.3.2 Groundwater

Groundwater was not encountered in any of our borings explored. Based on data collected from a well located approximately 0.3-mile south of the site, groundwater was reported to be encountered at a depth of approximately 75 feet below ground surface in 2005 (http://www.geotracker.waterboards.ca.gov/).

It is possible that seasonal variations (temperature, rainfall, etc.) will cause fluctuations in the groundwater level. The groundwater levels presented in this report are the levels that were measured at the time of our field activities. It is recommended that the contractor determine the actual groundwater levels at the site at the time of the construction activities to determine the impact, if any, on the construction procedures.

4.4 INFILTRATION TESTING

As part of our field investigation and within the anticipated stormwater infiltration area at the northwestern corner of the site, two infiltration tests were conducted in test borings I-1 and I-2 at depths of five feet bgs. The exploratory borings excavated and logged throughout the site, B-1 through B-6, verify that at least five feet of permeable materials are present below the

bottom of the future infiltration system and that there is at least 10 feet between the bottom of the system and a seasonal high groundwater level.

Subsequent to pre-soaking the test holes in general conformance with the referenced document (County of Riverside, 2011), percolation testing was performed in the bottom 20 inches of the percolation test boring by a registered geologist from our firm. The percolation testing was conducted in general conformance with the referenced document from the County of Riverside. The percolation rates were converted to infiltration rates utilizing the Porchet Method.

The infiltration rates are presented in the following table, after the water levels had stabilized.

Exploration No.	Infiltration Rate (inches per hour)	Depth of Test (feet)
Boring I-1	8.0	5
Boring I-2	10.6	5

Copies of the percolation data sheets and infiltration conversion sheets (Porchet Method) are included in Appendix C. The reported infiltration rates are the measured rates without any factors of safety applied. Over the lifetime of the infiltration areas, the infiltration rates may be affected by silt build up and biological activities, as well as local variations in near surface soil conditions. A suitable factor of safety should be applied to the field rate in designing the infiltration system.

It should be noted that the infiltration rates provided above were performed in relatively undisturbed on-site soils. Infiltration rates will vary and are mostly dependent on the underlying consistency of the site soils and relative density. Infiltration rates may be impacted by weight of equipment travelling over the soils, placement of engineered fill and other various factors. GeoTek assumes no responsibility or liability for the ultimate design or performance of the storm water facility.

4.5 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is located in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone. The site has not been mapped by the State of California for potential seismic hazards such as liquefaction or landslides. The County of Riverside

indicates that the site is "not in a fault zone," "not in a fault line," has a "low" liquefaction potential and is "susceptible" to subsidence.

4.5.1 Seismic Design Parameters

The site is located at approximately 34.0204° Latitude and -117.3834° Longitude. Site spectral accelerations (S_S and S_1), for 0.2 and 1.0 second periods for a Class "D" site, was determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. As noted using the ASCE 7-16 option on the SEAOC/OSHPD website, the values for S_{M1} and S_{D1} are reported as "null-See Section 11.4.8 (of ASCE 7-16). As noted in ASCE 7-16, Section 11.4.8, a site-specific ground motion procedure is recommended for Site Class D when the value S_1 exceeds 0.2. The value S_1 for the subject site exceeds 0.2.

For a site Class D, an exception to performing a site-specific ground motion analysis is allowed in ASCE 7-16 where S_1 exceeds 0.2 provided the value of the seismic response coefficient, Cs, is conservatively calculated by Eq 12.8-2 of ASCE 7-16 for values of $T \leq 1.5T_S$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5T_S$ or Eq. 12.8-4 for $T > T_L$.

Assuming that the C_S value calculated by and used by the structural engineer allows for the exclusion per ASCE 7-16, noted above, then a site-specific ground motion analysis is not required. For this assumption and condition, the following seismic design parameters, based on the 2015 National Earthquake Hazards Reduction Program (NEHRP), are presented on the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.5g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.6g
Site Coefficient for Site Class "D," F_a	1.0
Site Coefficient for Site Class "D," F_v	1.7
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.5g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	1.02g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.0g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.658g

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

4.5.2 Surface Fault Rupture

The site is in a seismically active region; however, no active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone (Bryant and Hart, 2007). The nearest known active fault is located approximately five mils to the northeast. The potential for surface rupture at the site is considered to be nil.

4.5.3 Seismic Settlement Analysis

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless and some low-plastic soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are most susceptible to liquefaction are loose, saturated granular soils and some low plasticity silts and clays under low confining pressures. The site is mapped by Riverside County as possessing a low potential for liquefaction. However, the depth to groundwater at the site is estimated to be greater than 50 feet below grade.

GeoTek utilized a methodology to evaluate liquefaction as presented by Idriss and Boulanger, 2008. The USGS website (https://earthquake.usgs.gov/hazards/interactive/) was used to deaggregate the seismic hazards (faults) contributing to the site's seismic ground motion potential. Considering an exceedance probability of 2 percent in 50 years (i.e. 2,475-year return period), a magnitude weighted (Mw) earthquake of Mw=6.98 was determined for use in the liquefaction analysis.

GeoTek evaluated the liquefaction potential at the site using the computer program LiquefyPro Version 5.8n and the results of Boring B-4 to determine seismic settlement potential. An earthquake magnitude of M6.98 and an acceleration of 0.658g were used in the analyses. Since the historical high regional groundwater level is in excess of 50 feet below the ground surface,

liquefaction is not a consideration in the design of the buildings. Since groundwater is relatively deep, a dry seismic settlement analysis was conducted. As recommended by the State of California Special Publication 117, our seismic settlement analysis has incorporated a safety factor of 1.3.

Using the information presented in Table 3 of Page 73 of the referenced publication by Idriss and Boulanger, an analysis was conducted to determine the sampler correction factor C_S. The SPT sampler is machined to fit liners, therefore a correction factor of 1.0 may not be appropriate. Throughout the test borings, a calculation was performed at each 12-inch interval to determine the value of C_S based on the $(N_1)_{60}$ values between or equal to 10 and 30. A C_S value of 1.3 was used where $(N_1)_{60}$ was greater than or equal to 30. Using an average of all the $(N_1)_{60}$ values throughout the depth of the borings, a C_S value of 1.3 was utilized in our LiquefyPro calculation.

Based on the interior diameter of the flight-auger of 4.3 inches, the value for C_B that was used in our analysis was 1.0.

Our analyses revealed seismic-induced settlement potential of approximately 0.5-inch in Boring B-4. The results of this evaluation are shown in Appendix D.

The total settlement will occur over a large area and will not affect local buried utilities. We would estimate the differential dynamic settlement to be approximately 0.25-inch over a distance of 40 feet. A maximum angular distortion of 1/1,846 is calculated, which is within tolerable limits. It is our opinion that neither liquefaction nor dynamic settlement should be a consideration in the design of the structure.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. The subject property does not lie within an earthquake induced landslide zone.

The potential for secondary seismic hazards such as a seiche or tsunami is considered negligible due to site elevation and distance to an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date are properly incorporated into the design of the project. Final site development and grading plans should be reviewed by GeoTek when they become available.

5.2 EARTHWORK CONSIDERATIONS

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Jurupa Valley/County of Riverside, the 2019 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix E outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the test of this report should supersede those contained in Appendix E.

5.2.1 Site Clearing

In areas of planned grading or improvements, the site should be cleared of vegetation, roots, existing flatwork, trash and debris, and properly disposed of offsite. Voids resulting from removing any materials should be replaced with engineered fill materials with expansion characteristics similar to the on-site materials.

5.2.2 Removals and Overexcavations

Any undocumented fill and CAB should be removed below all areas to receive improvements, including any footings, pavement, and hardscape areas. The soils below proposed improvements should be observed by a representative of this firm. Areas anticipated to be subject to structural loading should be overexcavated a minimum of one foot below the deepest foundation element, whichever is deeper.

All undocumented fill should also be removed beneath flatwork improvement areas. A minimum of 12 inches of engineered fill should be provided below asphaltic concrete pavement and Portland cement concrete hardscape areas. The horizontal extent of removals should extend at least two feet beyond the edge of hardscape.

The overexcavation should extend a minimum of five feet outside of the foundation perimeter or extend down and away from foundation elements at a 1:1 (horizontal to vertical) projection to the recommended removal depth, whichever is greater.

A representative of this firm should observe the bottom of all excavations. In areas where loose soil is present in the bottom of the excavations, the removals should continue until competent natural materials are encountered. Competent materials are defined as relatively uniform and not visibly porous natural soils with an in-place relative compaction of at least 85 percent.

Development plans should be reviewed by this firm when available. Depending on actual field conditions encountered during grading, locally deeper areas of removal may be recommended.

5.2.4 Preparation of Excavation Bottoms

A representative of this firm should observe the bottom of all excavations. Upon approval, the exposed soils and all soils in areas to receive engineered fill should be scarified to a depth of approximately eight inches, moistened to at least above the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557). If no additional fill placement is necessary subsequent to the completion of removals, or if additional cut is required to achieve design grades, the final pavement subgrade should be processed to a minimum depth of eight inches in-place, moisture conditioned to at least above the optimum moisture content and compacted to a minimum compaction of at least 90 percent (ASTM D 1557).

5.2.5 Engineered Fill

The on-site soils are generally considered suitable for reuse as engineered fill provided that they are free from vegetation, debris, roots, and other deleterious material. Rock fragments greater than six inches in maximum dimension should not be incorporated in engineered fill. Engineered fill should be placed in loose lifts with a thickness of eight inches or less, moisture conditioned to at least two percent above the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

5.2.6 Excavation Characteristics

Processing/excavations into the on-site soil materials is expected to be feasible using heavy-duty grading equipment in good operating conditions.

5.2.7 Trench Excavations and Backfill

Temporary trench excavations within the on-site materials should be stable at 1:1 inclinations for short durations during construction and where cuts do not exceed 10 feet in height. We anticipate that temporary cuts to a maximum height of four feet can be excavated vertically.

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined per ASTM D 1557). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. On-site materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than six inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.2.8 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities, as well as the accuracy of topography.

Shrinkage is primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of up to 15 percent may be considered for the materials requiring removal and/or recompaction. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of earthwork construction. Subsidence on the order of up to 0.10 foot may be anticipated for areas to receive fill.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2019 CBC, are presented below. Based on laboratory test results of the soils during our field

investigation, the expansion potential of the on-site soils near subgrade may be classified as "very low" (EI≤20) per ASTM D 4829.

Additional expansion index and soluble sulfate testing of the soils should be performed during construction to evaluate the as-graded conditions. Final recommendations should be based upon the as-graded soils conditions.

A summary of our foundation design recommendations is presented in the following table:

MINIMUM FOUNDATION DESIGN RECOMMENDATIONS

Design Parameter	"Very Low" Expansion Potential
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	12
Minimum Foundation Width (Inches)*	12
Minimum Slab Thickness (actual)	4 – Actual
Minimum Slab Reinforcing	6" x 6" – W1.4/W1.4 welded wire fabric placed in middle of slab, or No. 3 reinforcing bars spaced 24 inches on-center, each way, in the middle of the slab
Minimum Footing Reinforcement	Two No. 4 reinforcing bars, one placed near the top and one near the bottom
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum of 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

* Code minimums per Table 1809.7 of the 2019 CBC.

It should be noted that the criteria provided are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

The following criteria for design of foundations are preliminary and should be re-evaluated based on the results of additional laboratory testing of samples obtained near finish pad grade.

An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 200 pounds per square foot for each additional 12 inches in depth and 100 pounds per square foot for each additional 12 inches in width to a maximum value of 3,000 psf. An increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

Structural foundations may be designed in accordance with the 2019 CBC, and to withstand a total settlement of one inch and maximum differential settlement of one-half of the total settlement over a horizontal distance of 40 feet.

The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 3,000 psf for footings founded on engineered fill. A coefficient of friction between soil and concrete of 0.30 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these are provided in the 2019 California Green Building Standards Code (CALGreen) Section 4.505.2, the 2019 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E 1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the vapor retarder placed on the underlying aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a 6-mil vapor retarder membrane, a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeability) to achieve the desired performance level.

Moisture retarders can reduce, but not eliminate, moisture vapor rise from the underlying soils up through the slab. Moisture retarder systems should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Concrete Institute, ASTM and California Building Code requirements and guidelines.

GeoTek recommends that a qualified person, such as a flooring contractor, structural engineer, architect, and/or other experts specializing in moisture control within the buildings be consulted to evaluate the general and specific moisture and vapor transmission paths and associated potential impact on the proposed construction. That person should provide recommendations relative to the slab moisture and vapor retarder systems and for migration of potential adverse impact of moisture vapor transmission on various components of the structures, as deemed appropriate.

In addition, the recommendations in this report and our services in general are not intended to address mold prevention, since we, along with geotechnical consultants in general, do not practice in the area of mold prevention. If specific recommendations addressing potential mold issues are desired, then a professional mold prevention consultant should be contacted.

We recommend that control joints be placed in two directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 Miscellaneous Foundation Recommendations

To minimize moisture penetration beneath the slab-on-grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.3 Foundation Set Backs

Minimum setbacks for all foundations should comply with the 2019 CBC or City of Jurupa Valley/County of Riverside requirements, whichever is more stringent. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movement and/or differential settlement. If large enough, these movements can compromise the integrity of the improvements.

- The outside top edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least five feet and need not exceed 40 feet.

- The bottom of any proposed foundations should be deepened so as to extend below a 1:1 upward projection from the bottom edge of the nearest excavation and the bottom edge of the closest footing.

5.3.4 Soil Corrosivity

Based on the chemical test results presented in Appendix B, the corrosivity test results indicate that the on-site soils are "highly corrosive" to buried ferrous metal. This corrosion classification is obtained from "Corrosion Basics: An Introduction," by Pierre R. Roberge, 2nd Edition, 2005. Recommendations for protection of buried ferrous metal should be provided by a corrosion engineer.

5.3.5 Soil Sulfate Content

Based on the chemical test results of a sample collected during our field investigation, the sulfate test results on samples obtained from the project site indicate soluble sulfate contents of less than 0.1 percent by weight should be expected. Soluble sulfate contents of this level would be in the range of "not applicable" (i.e. negligible) per Table 4.2.1 of ACI 318. Based on the test results and Table 4.3.1 of ACI 318, no special concrete mix design would be necessary to resist sulfate attack.

5.3.6 Import Soils

Import soils should have a "very low" expansion potential. GeoTek, Inc. also recommends that the proposed import soils be tested for expansion and corrosivity potential. GeoTek, Inc. should be notified a minimum of 72 hours prior to importing so that appropriate sampling and laboratory testing can be performed.

5.3.7 Asphalt Concrete Pavement Design

GeoTek utilized a bulk sample obtained from the field investigation for R-Value testing. The testing (by others) indicated an R-Value of 54. The R-Value test results are included in Appendix B.

Traffic Indices (TI) of 5.5 and 7.0 were assumed for preliminary pavement design. The traffic indices selected to determine the pavement section should be reviewed by a design engineer

when truck traffic loading is known. The table below provides the roadway area, TI, and the recommended minimum structural pavement sections.

MINIMUM RECOMMENDED ASPHALT CONCRETE PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Index	Design R-Value	Asphaltic Concrete (inches)	Aggregate Base (inches)
Light Duty (including parking stalls and drive aisles not subject to heavy truck traffic	5.5	54	3.0	3.0
Heavy Duty (including fire lanes, trash dumpster pads and approaches)	7.0	54	4.0	4.0

The pavement sections recommended are subject to review by the City of Jurupa Valley and/or the County of Riverside. Performance of the pavement sections will ultimately be based largely on construction methods, traffic loading and subgrade performance.

Additional laboratory testing should be completed during earthwork construction when pavement subgrade elevations are reached to confirm the sections presented above.

5.3.8 Portland Cement Concrete Pavement Design

It is anticipated that areas of the project site may be paved with Portland Cement Concrete (PCC) pavement. Heavy truck traffic is expected to exert loads on the concrete pavement.

The table below provides the street area/usage, associated TI, and the recommended minimum concrete pavement section for the subject project. An R-Value of 54 was correlated to a modulus of subgrade reaction, k-Value, of approximately 240 for design purposes.

MINIMUM RECOMMENDED CONCRETE PAVEMENT SECTIONS

Traffic Area	Assumed Traffic Category*	Design k-Value	PCC (inches)	Aggregate Base (inches)
Heavy Duty (including dock aprons, fire lanes, trash dumpster pads and approaches)	D	240	7.0	4.0

*Reference: *Guide for the Design and Construction of Concrete Parking Lots*, Reported by ACI Committee 330, ACI 330R-08, 2008.

The PCC pavement sections should incorporate appropriate steel reinforcement as designed by the project structural engineer. Crack control joints should be provided in the transverse direction spaced at horizontal intervals with a maximum spacing of 15 feet. The actual design should also be in accordance with design criteria specified by the governing jurisdiction.

The concrete should have a minimum modulus of rupture of 500 pounds per square inch (psi), and a minimum 28-day compressive strength of 2,500 psi. Concrete should incorporate one-inch maximum size aggregate and should be proportioned to achieve a maximum slump of four inches. Instead of increasing the water content, a plasticizing admixture may be utilized to increase the workability of the concrete. The concrete should be properly cured after placement. Concrete should not be placed during hot and windy weather.

The concrete pavement section is subject to the review and approval by the City of Jurupa Valley/County of Riverside. Performance of the pavement sections will ultimately be based largely on construction methods, traffic loading and subgrade performance.

5.3.9 Pavement Construction

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement of concrete and rolling of asphaltic concrete, should be done in accordance with the City of Jurupa Valley/County of Riverside specifications and under the observation and testing of GeoTek and a City inspector where required.

The aggregate base should consist of crushed rock with an R-Value and gradation in accordance with Crushed Aggregate Base (Section 200-2 of the "Greenbook"). Asphaltic concrete materials and construction should conform to Section 203 of the Greenbook. Minimum compaction requirements should be 95 percent for subgrade and 95 percent for aggregate base, as per ASTM D 1557. The upper 12 inches of subgrade should be moisture conditioned to at least two percent

above optimum. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

5.3.10 Concrete Flatwork

5.3.10.1 Exterior Concrete Slabs and Sidewalks

Any exterior concrete slabs and sidewalks that are not subject to heavy truck traffic should be designed using a minimum thickness of four inches. No specific reinforcement is required due to the non-structural nature. However, the use of some reinforcement should be considered. Recommendations can be provided upon request. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in residential construction.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented in this report.

Subgrade soils should be pre-moistened prior to placing concrete. The subgrade soils below exterior slabs, sidewalks, driveways, etc. at the subject site should be pre-saturated to a minimum of 100 percent of optimum moisture content to a depth of 12 inches.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Jurupa Valley/County of Riverside specifications, and under the observation and testing of GeoTek and a City/County inspector, if necessary.

5.3.10.2 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 1/8 inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is also subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but

are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two directions and located a distance apart roughly equal to 24 to 36 times the slab thickness.

Exterior concrete flatwork (walkways, driveways, etc.) is often some of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. We suggest that the same standards of care be applied to these features as to the structure itself.

5.4 POST CONSTRUCTION CONSIDERATIONS

5.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, which can be significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to screen wall foundations. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas.

5.4.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading plans and relevant project specifications be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading to check for proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trenches.
- Perform field density testing of the fill materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the boundaries of the subject parking lot. This review does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing

site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (P-0800220-CR) dated August 5, 2020 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

The materials observed on the project site appear to be representative of the area; however, soil and bedrock materials vary in character between excavations and natural outcrops or conditions exposed during site construction. Site conditions may vary due to seasonal changes or other factors. GeoTek, Inc. assumes no responsibility or liability for work, testing or recommendations performed or provided by others.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusion and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty is expressed or implied. Standards of practice are subject to change with time.

8. SELECTED REFERENCES

California Code of Regulations, Title 24, 2019 "California Building Code," 3 volumes.

California Geological Survey (CGS, formerly referred to as the Division of Mines and Geology), 1949, "Geologic Map of California."

Dibblee, T.W., and Minch, J.A., 2003, "Geologic Map of the Riverside East/South ½ of San Bernardino South Quadrangles, San Bernardino and Riverside County, California," Dibblee Geological Foundation Map DF-109, scale 1:24,000.

GeoTek, Inc., In-house proprietary information.

OSHPD Seismic Design Maps (https://seismicmaps.org/), accessed on October 8, 2020.

Riverside County Flood Control and Water Conservation District, 2011, "Design Handbook for Low Impact Development Best Management Practices, Appendix A – Infiltration Testing Guidelines," effective September 2011.

Riverside County Parcel Report for APNs 175-180-012 and 175-180-016, accessed on August 3, 2020.

Burrtec Waste Industries, Inc.
Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California

Project No. 2484-CR

GEOTEK

Figure 1

Site Location Map

Legend
(Locations are approximate)

B-6 Exploratory Boring

I-2 Infiltration Test

Site Limits

Burrtec Waste Industries, Inc.
Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California

Project No. 2484-CR

GEOTEK

Figure 2

Exploration Location Map

APPENDIX A

LOGS OF EXPLORATORY AND INFILTRATION TEST BORINGS

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

Bulk Sample (Large)
These sample are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

B – BORING/TRENCH LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
……..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
———	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the log of borings)

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B- 1 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				ML	**Alluvium** Sandy SILT, tan, light brown, slightly moist, stiff			RV
5		13 17 20	R1	SP	F SAND, tan to light brown, slightly moist, medium dense, friable	3.3	112.2	
10		10 18 29	R2	ML	Sandy SILT, grayish brown, slightly moist, very stiff, trace caliche and oxidation staining	6.5	105.6	
15		22 50/6	R3		Becoming moist, hard and slightly mottled at 15'	18.2	99.9	
20		15 34 41	R4	SM	Silty f SAND, olive, slightly moist, dense	7.3	115.4	
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				ML	**Alluvium** Sandy SILT, brown, slightly moist, very stiff, trace pinhole pores and caliche			
		10 19 28	R1			3.7	116.0	
5								
		13 17 17	R2		Becoming slightly moist with oxidation staining at 7'	6.6	97.5	
10		14 22 29	R3	SM-ML	Silty f SAND to Sandy SILT, grayish brown, dry, dense to hard, trace pinhole pores	6.1	109.5	
15		10 20 29	R4	SP	F SAND with some interbedded f-m SAND, tan, light grayish brown, slightly moist, medium dense, slightly friable	3.8	104.0	
					BORING TERMINATED AT 16.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 3

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					3" Crushed Aggregate Base			
				SM-ML	**Alluvium** Silty f SAND to Sandy SILT, brown, slightly moist, medium dense to very stiff, trace caliche stringers and pinhole pores			
5		14 15 20	R1			7.3	115.3	
10		19 25 40	R2	ML	Sandy SILT, olive brown, moist, hard, caliche stringers	11.2	117.0	
15		13 26 32	R3	SP	F-m SAND, tan, slightly moist, dense, friable	1.0	105.2	
		12 18 29	R4	SM	Silty f SAND, tan, slightly moist, medium dense	3.1	105.0	
20		14 22 30	R5	SM-ML	Silty f SAND to Sandy SILT, olive brown, slightly moist, dense to hard, caliche stringers	9.7	108.4	
25					**BORING TERMINATED AT 21.5 FEET** No groundwater encountered Boring backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 4 Sheet 1 of 2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					4" Crushed Aggregate Base			
5		9 12 15	R1	SP	**Alluvium** F SAND, tan, light brown, slightly moist, medium dense, slightly friable	3.6	106.5	MD, EI, SH, SR
10		10 21 29	R2	SM-ML	Silty f SAND to Sandy SILT, light brown, slightly moist, dense to hard, trace caliche stringers	5.9	109.5	
15		17 24 26	R3	SP	F SAND, grayish brown, slightly moist, dense	3.9	107.4	
20		13 27 33	R4	ML	SILT, brown, moist, hard, caliche stringers	14.1	120.5	
25		9 18 46	R5			17.5	112.8	
30		12 18 20	S1	CL	Silty CLAY, olive, moist to wet, hard, mottled and oxidized, trace carbon, minor seepage			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B-4 Sheet 2 of 2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
35		15 9 13	S2	CL	Becoming moist and very stiff, abundant caliche, mottled at 35'			LL = 46, PI = 20
40		6 10 12	S3		Laminated bedding observed at 40'			
45		10 15 25	S4	SP	F SAND, tan, light brown, slightly moist, dense, friable			
50		13 18 37	S5		Becoming moist and very dense at 50'			
					BORING TERMINATED AT 51.5 FEET No groundwater encountered Boring backfilled with soil cuttings			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

BORING NO.: B- 5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM-ML	**Alluvium** Silty f SAND to Sandy SILT, orangish brown, slightly moist, medium dense to very stiff, caliche stringers			
		8 12 14	R1			6.8	117.2	
5		7 16 19	R2			5.4	117.9	
10		10 19 23	R3	SM	Silty f SAND, orangish brown, moist, medium dense	10.8	101.4	
15		8 23	R4					
		26		ML	Sandy SILT, olive, moist to wet, very stiff, slightly mottled, caliche	23.7	101.0	
20		14 27 36	R5		Becoming moist, hard and micaceous at 20'	11.2	113.5	
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: B- 6 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					3" Crushed Aggregate Base			
				ML	**Alluvium** Sandy SILT, tan, light brown, dry to slightly moist, stiff			
5		11 19 27	R1	SM	Silty f SAND, orangish brown, slightly moist, medium dense, caliche stringers	2.1	117.1	
10		10 19 27	R2	ML	Sandy SILT, olive, slightly moist, very stiff, caliche stringers	9.0	119.7	
15		17 20 33	R3		Becoming hard with pinhole pores locally observed at 15'	5.1	102.8	
20		10 21 29	R4	SM-ML	Silty f SAND to Sandy SILT, olive, slightly moist, dense to hard	5.0	106.4	
25					**BORING TERMINATED AT 21.5 FEET** No groundwater encountered Boring backfilled with soil cuttings			
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: I-1 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Alluvium** Silty f SAND, light brown, dry, loose to medium dense			
					Becoming slighty moist at 2'			
				SP	F SAND, tan, slightly moist, medium dense			
5					**BORING TERMINATED AT 5 FEET**			
					No groundwater encountered			
					Boring subsequently prepared for infiltration testing (pvc pipe, filter sock, gravel)			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Burrtec Waste Industries, Inc.	**DRILLER:**	2R Drilling	**LOGGED BY:**	KM
PROJECT NAME:	Agua Mansa and Wilson Street	**DRILL METHOD:**	Hollow-Stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2484-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	Track Rig
LOCATION:	See Exploration Location Map			**DATE:**	9/9/2020

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	BORING NO.: I-2 / MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
				SM	**Alluvium** Silty f SAND, light brown, dry, loose to medium dense Becoming slighty moist at 2'			
				SP	F SAND, tan, dry to slightly moist, medium dense			
5					**BORING TERMINATED AT 5 FEET** No groundwater encountered Boring subsequently prepared for infiltration testing (pvc pipe, filter sock, gravel)			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

LABORATORY TEST RESULTS

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification

Soils were classified visually in general accordance with the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of exploratory borings in Appendix A.

In-Situ Moisture and Density

The natural water content was determined in accordance with ASTM D 2216 on samples of the materials recovered from the subsurface exploration. In addition, in-place dry density determinations (ASTM D 2937) were performed on relatively undisturbed samples to measure the unit weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths in Appendix A.

Moisture-Density Relationship

Laboratory testing was performed on a sample collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM D 1557. The results are presented in the table below.

Boring No.	Depth (ft.)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture (%)
B-4	0-5	Fine sand	126.5	9.5

Direct Shear

Direct shear testing was performed on remolded samples of the surficial soils according to ASTM D 3080. The results of these tests are presented in Appendix B.

Expansion Index

The expansion potential of the soils was determined by performing expansion index testing on a sample in general accordance with ASTM D 4829. The result of the testing is provided below.

Boring No.	Depth (ft.)	Soil Type	Expansion Index	Classification
B-4	0-5	Fine sand	3	Very Low

Atterberg Limits

Laboratory testing to determine the liquid and plastic limits of a select sample was performed in general accordance with ASTM D4318. The results of the testing are included on the boring logs in Appendix A.

Sulfate Content, Resistivity and Chloride Content

Testing to determine the water-soluble sulfate content was performed by others on a sample collected during the subsurface exploration. The results are presented in the table below.

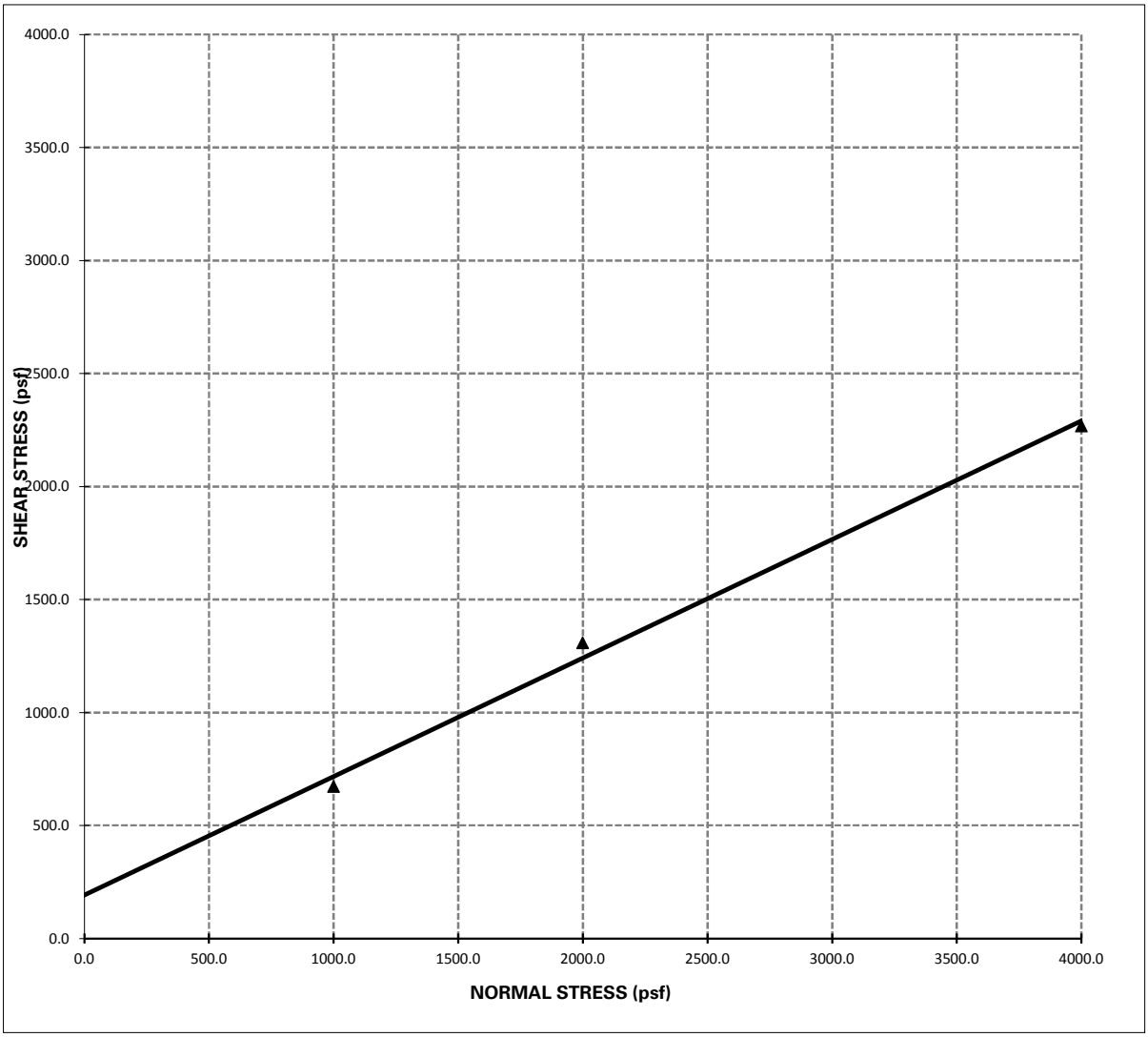
Boring No.	Depth (ft.)	pH ASTM D 4972	Chloride ASTM D 4327 (ppm)	Sulfate ASTM D 4327 (% by weight)	Resistivity ASTM G187 (ohm-cm)
B-4	0-5	8.74	14.5	0.0053	2,479

R-Value

Testing to determine the resistance value for pavement design was performed by others in accordance with California Test Method 301, on a sample collected during the subsurface exploration. The results are presented in Appendix B.

DIRECT SHEAR TEST

Project Name:	Wilson St Hauling Yard	***Sample Location:***	B-4 @ 0 - 5
Project Number:	2484-CR	***Date Tested:***	9/28/2020



Shear Strength: Φ = **27.7** ° , **C = 192.00 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

• ANALYSIS
• DESIGN

LaBelle • Marvin

PROFESSIONAL PAVEMENT ENGINEERING
A CALIFORNIA CORPORATION

• SOILS, ASPHALT TECHNOLOGY

September 22, 2020

Ms. Anna Scott
GeoTek Inc.
1548 North Maple Street
Corona, California 92880

Project No. 46447

Attention: Ms. Scott

Laboratory testing of the bulk soil sample delivered to our laboratory on 9/18/2020 has been completed.

Reference:	W.O. # 2484-CR
Project:	Burrtec Hauling Yard, Jurupa Valley
Sample:	B-1 @ 0'-5'

Data sheets are transmitted herewith for your use and information. Any untested portion of the samples will be retained for a period of sixty (60) days prior to disposal. The opportunity to be of service is appreciated, and should you have any questions, kindly call.

Very truly yours,

Steven R. Marvin
RCE 30659

SRM:mm
Enclosures

2700 S. GRAND AVENUE • SANTA ANA, CA 92705-5404 • (714) 546-3468 • FAX (714) 546-5841
INFO@LABELLEMARVIN.COM

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 46447

DATE: 9/22/2020

BORING NO. B-1 @ 0'-5'

Burrtec Hauling Yard, Jurupa Valley

W.O.# 2484-CR

SAMPLE DESCRIPTION: Brown Silty Sand

R-VALUE TESTING DATA | CA TEST 301			
	SPECIMEN ID		
	a	b	c
Mold ID Number	1	2	3
Water added, grams	85	65	56
Initial Test Water, %	12.2	10.3	9.5
Compact Gage Pressure,psi	65	255	350
Exudation Pressure, psi	194	554	732
Height Sample, Inches	2.65	2.57	2.55
Gross Weight Mold, grams	3114	3097	3100
Tare Weight Mold, grams	1954	1946	1958
Sample Wet Weight, grams	1160	1151	1142
Expansion, Inches x 10exp-4	0	16	41
Stability 2,000 lbs (160psi)	37 / 69	19 / 38	18 / 37
Turns Displacement	5.78	4.49	4.35
R-Value Uncorrected	36	64	66
R-Value Corrected	40	66	66
Dry Density, pcf	118.2	123.0	124.0

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0	4.0	4.0
G.E. by Stability	0.61	0.35	0.35
G. E. by Expansion	0.00	0.53	1.37

Equilibrium R-Value	54 by EXUDATION	Examined & Checked: 9 /22/ 20
REMARKS:	Gf = 1.25 0.2% Retained on the 3/4" Sieve.	Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

LaBelle Marvin

R-VALUE GRAPHICAL PRESENTATION

PROJECT NO. 46447

DATE: 9 /22/ 2020

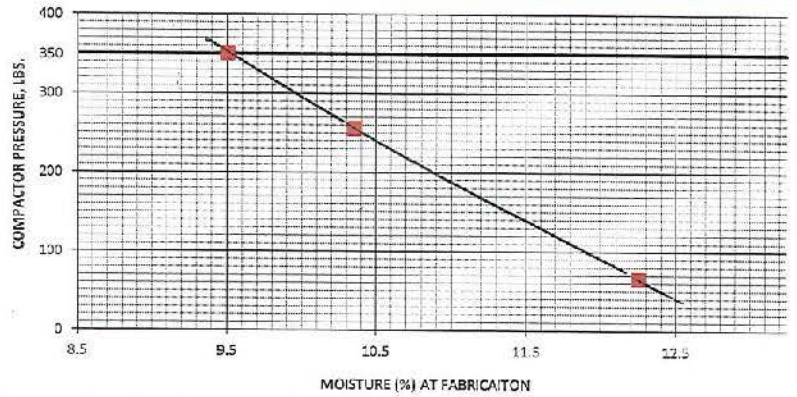
REMARKS:

BORING NO. B-1 @ 0'-5'

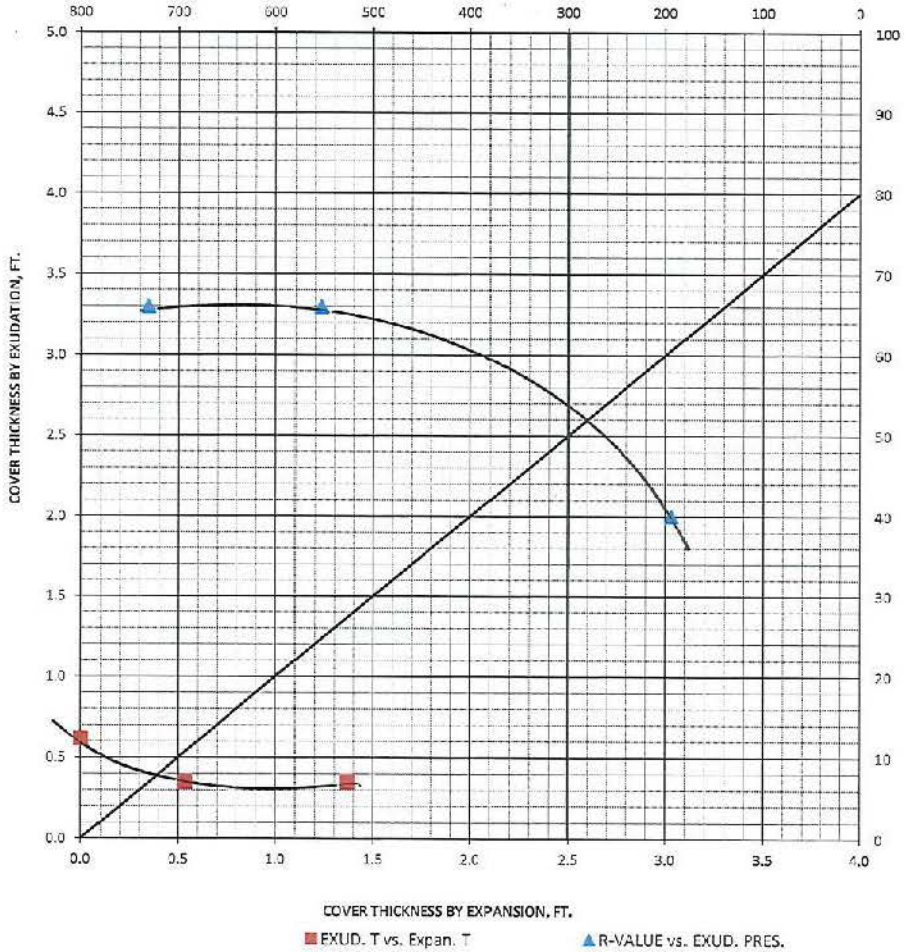
Burrtec Hauling Yard, Jurupa Valley

W.O.# 2484-CR

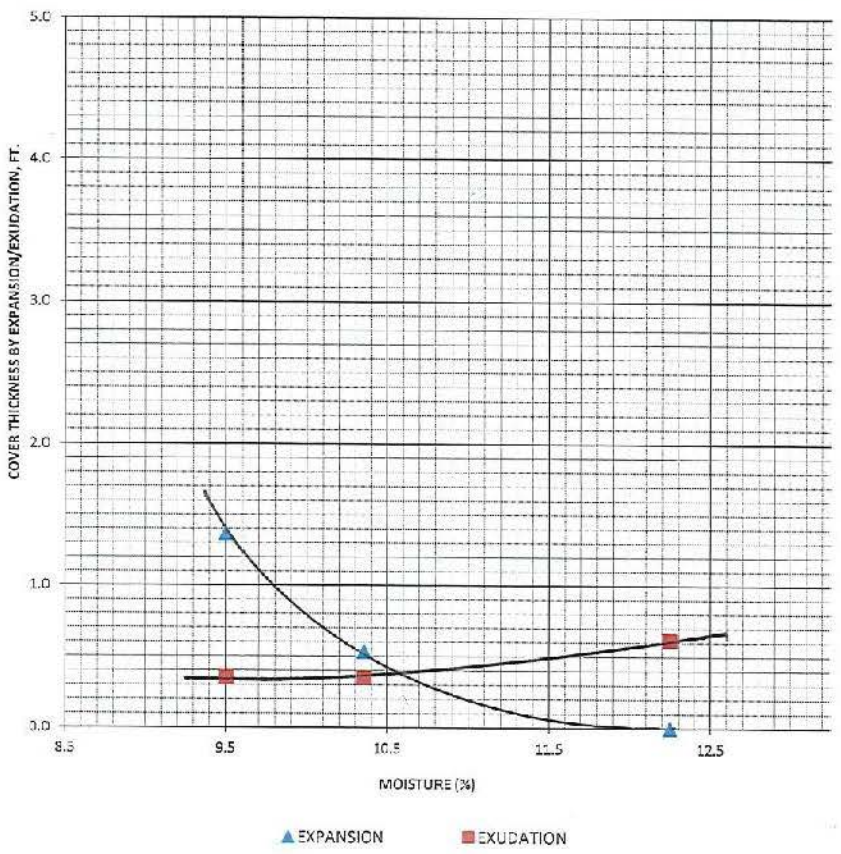
COMPACTOR PRESSURE vs MOISTURE %



COVER THICKNESS BY EXUDATION vs COVER THICKNESS BY EXPANSION



COVER THICKNESS vs MOISTURE %



APPENDIX C

INFILTRATION TEST RESULTS AND CALCULATIONS

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

GEOTEK

Percolation Test Data Sheet

Project: Burrtec - Agua Mansa & Wilson St. Job No.: 2484-CR

Test Hole No.: I-1 Date Excavated: 9/9/20

Depth of Test Hole (ft): 5 Soil Description: SM

Percolation Test By: KRM Date: 9/10/20 Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Water Depth, from top Initial (inch)	Final (inch)	Λ (inch)	Percolation Rate (min/inch)
8:30 8:55	25	25	20	0	720	
8:56 9:21	25	51	20	0	720	
9:22 9:32	10	62	20	10	10	
9:34 9:40	10	74	20	9 1/2	10 1/2	
9:46 9:56	10	86	20	10 1/2	9 1/2	
9:58 10:08	10	98	20	10 3/4	9 1/4	
10:10 10:20	10	110	20	11	9	
10:22 10:32	10	122	20	11	9	
10:34 10:44	10	134	20	11	9	1.11

END TEST

Design Percolation Rate: **min/inch**

Percolation Test Data Sheet

Project: Borrego - [illegible] [illegible] & Wilson St. Job No.: 2484-CR

Test Hole No.: I-2 Date Excavated: 9/9/20

Depth of Test Hole (ft): 5 Soil Description: SM

Percolation Test By: KRM Date: 9/10/20 Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Water Depth, from top: Initial (inch)	Water Depth, from top: Final (inch)	Water Depth, from top: Δ (inch)	Percolation Rate (min/inch)
8:31 8:56	25	25	20	6	14	
8:57 9:22	25	51	20	6 1/4	13 3/4	
9:23 9:33	10	62	20	13	7	
9:35 9:45	10	74	20	14	6	
9:47 9:57	10	86	20	13 1/2	6 1/2	
9:59 10:09	10	98	20	13 1/4	6 3/4	
10:11 10:21	10	110	20	13 1/2	6 1/2	
10:23 10:33	10	122	20	13 1/2	6 1/2	
10:35 10:45	10	134	20	13 1/2	6 1/2	1.54

END TEST

Design Percolation Rate: **min/inch**

GeoTek, Inc.

PERCOLATION TESTING

Shallow Percolation Test (<10 ft)

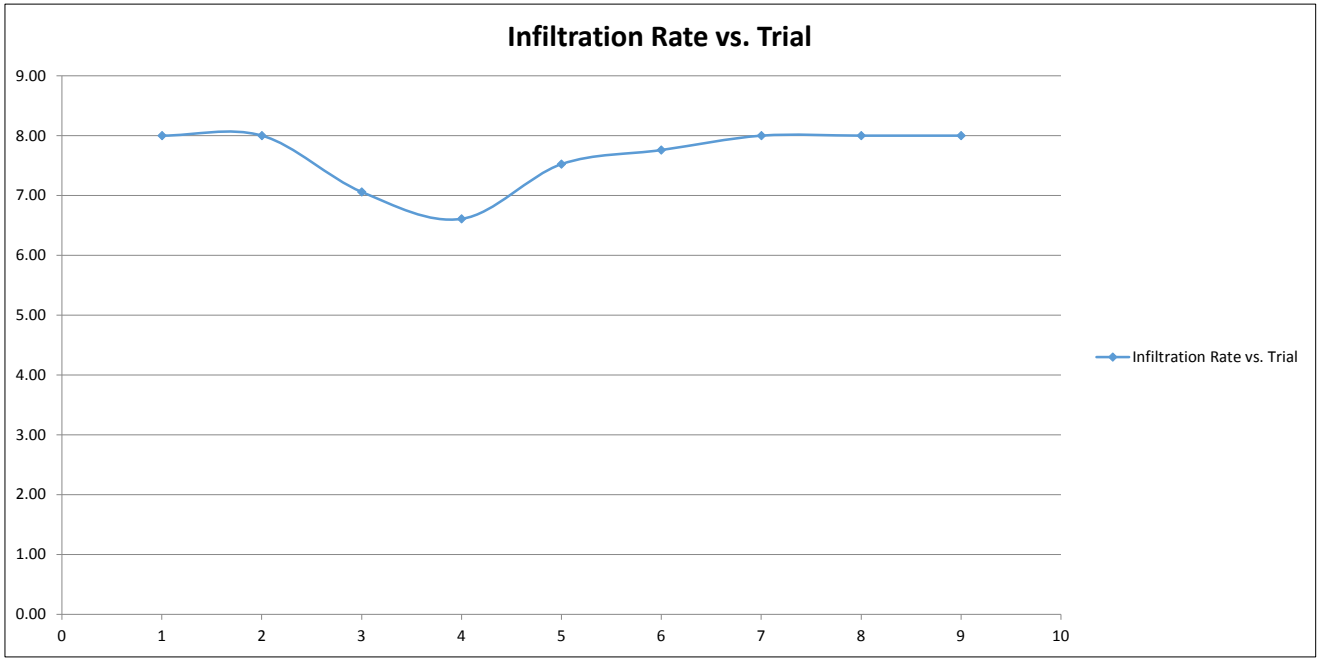
Test No. I-1

2484-CR

Depth of Hole (D_T) in.	60
Boring Radius, in.	4

Trial No.	Time Interval (ΔT) Min.	Initial Depth (D_0) in.	Final Depth (D_f) in.	Change In Level (ΔD) in.	Perc Rate (min/in)	Infiltration Rate (in/hr)
Sandy Soil	25	40.00	60.00	20.00	0.80	8.00
Sandy Soil	25	40.00	60.00	20.00	0.80	8.00
1	10	40.00	50.00	10.00	1.00	7.06
2	10	40.00	49.50	9.50	0.95	6.61
3	10	40.00	50.50	10.50	1.05	7.52
4	10	40.00	50.75	10.75	1.08	7.76
5	10	40.00	51.00	11.00	1.10	8.00
6	10	40.00	51.00	11.00	1.10	8.00
7	10	40.00	51.00	11.00	1.10	8.00

Initial Height (H_0)	Final Height (H_f)	Height Change (ΔH)	Height Average (H_{avg})
20	0	20	10
20	0	20	10
20	10	10	15
20	10.5	9.5	15.25
20	9.5	10.5	14.75
20	9.25	10.75	14.625
20	9	11	14.5
20	9	11	14.5
20	9	11	14.5



GeoTek, Inc.
PERCOLATION TESTING

Shallow Percolation Test (<10 ft)

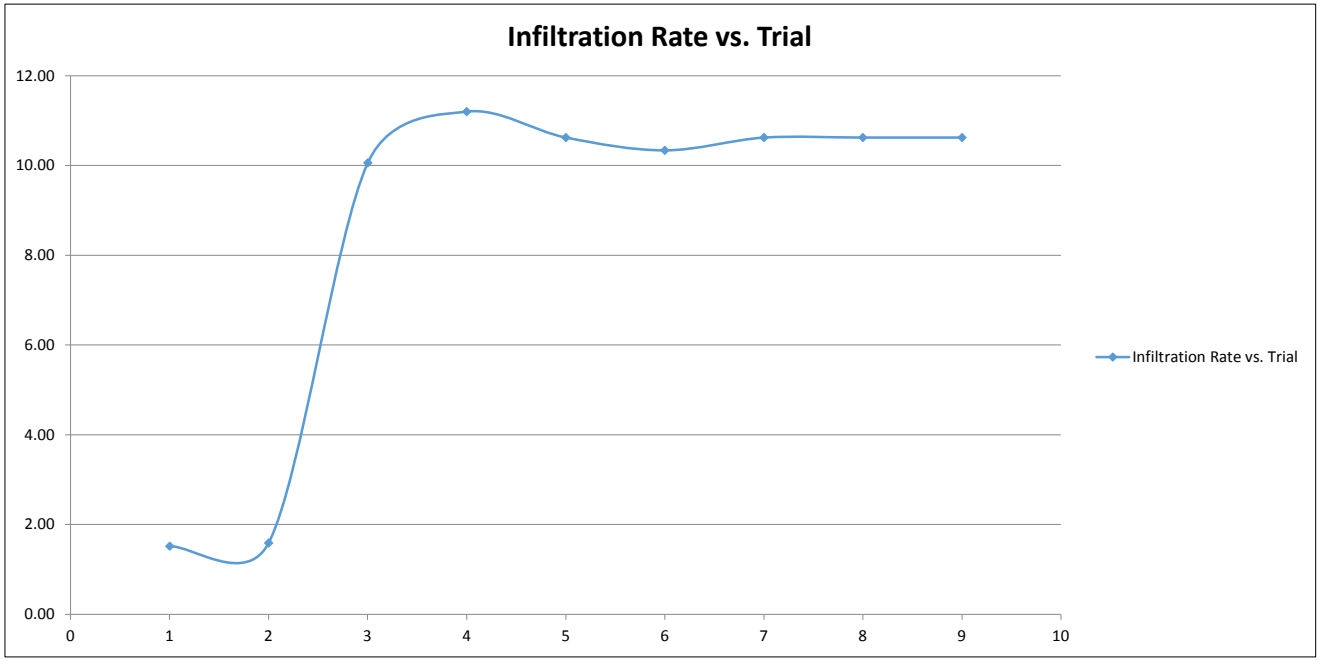
Test No. I-2

2484-CR

Depth of Hole (D_T) in.	60
Boring Radius, in.	4

Trial No.	Time Interval (ΔT) Min.	Initial Depth (D_0) in.	Final Depth (D_f) in.	Change In Level (ΔD) in.	Perc Rate (min/in)	Infiltration Rate (in/hr)
Sandy Soil	25	40.00	46.00	6.00	0.24	1.52
Sandy Soil	25	40.00	46.25	6.25	0.25	1.59
1	10	40.00	53.00	13.00	1.30	10.06
2	10	40.00	54.00	14.00	1.40	11.20
3	10	40.00	53.50	13.50	1.35	10.62
4	10	40.00	53.25	13.25	1.33	10.34
5	10	40.00	53.50	13.50	1.35	10.62
6	10	40.00	53.50	13.50	1.35	10.62
7	10	40.00	53.50	13.50	1.35	10.62

Initial Height (H_0)	Final Height (H_f)	Height Change (ΔH)	Height Average (H_{avg})
20	14	6	17
20	13.75	6.25	16.875
20	7	13	13.5
20	6	14	13
20	6.5	13.5	13.25
20	6.75	13.25	13.375
20	6.5	13.5	13.25
20	6.5	13.5	13.25
20	6.5	13.5	13.25



APPENDIX D

SEISMIC SETTLEMENT ANALYSIS

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

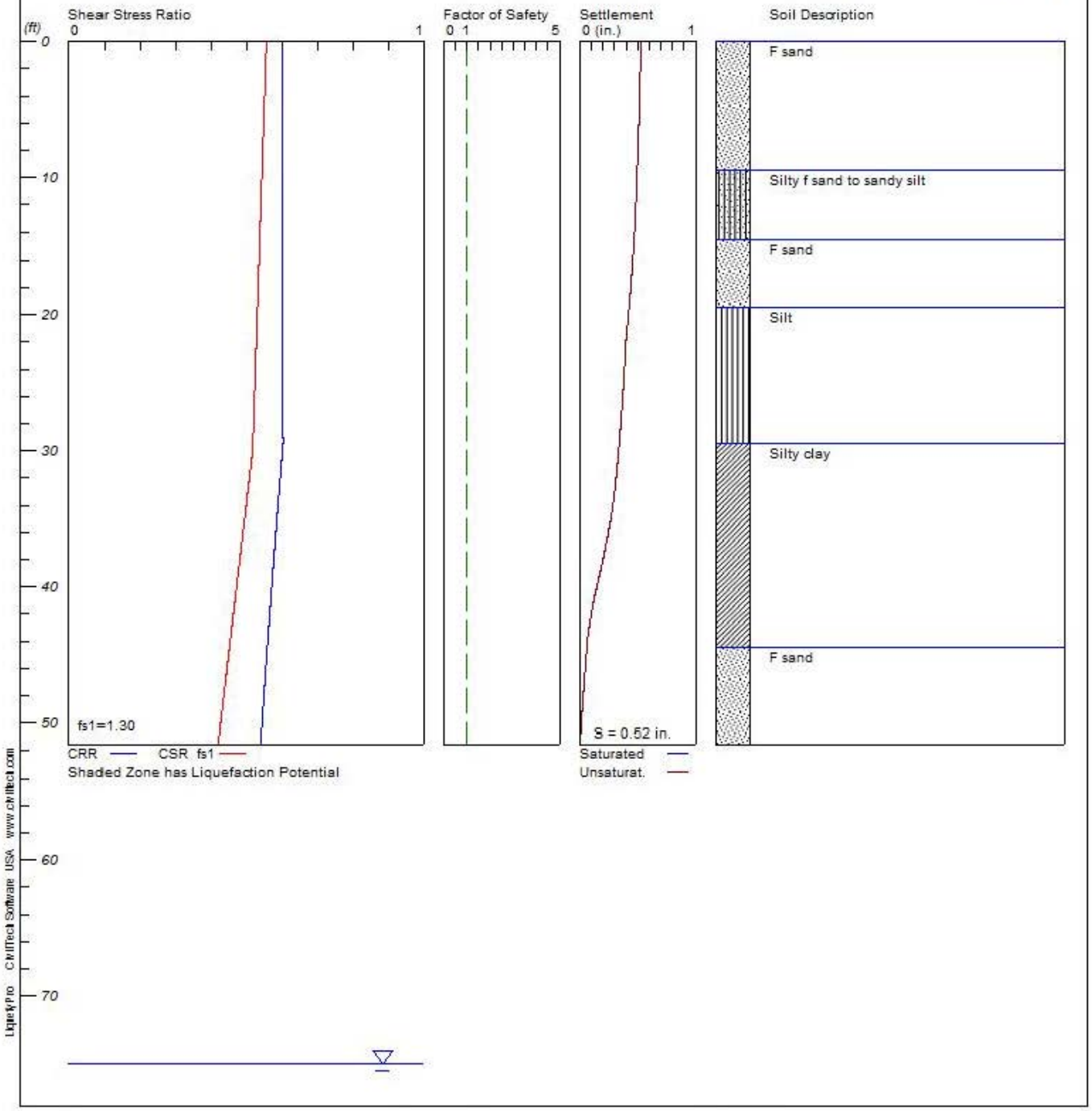
GEOTEK

LIQUEFACTION ANALYSIS

2484-CR Burrtec Hauling Yard

Hole No.=B-4 Water Depth=75 ft

Magnitude=6.98
Acceleration=0.658g



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LIQUEFACTION ANALYSIS CALCULATION DETAILS

****

Font: Courier New, Regular, Size 8 is recommended for this report.
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Input File Name: G:\Projects\2451 to 2500\2484CR Burrtec Waste Industries, Inc. Hauling Yard Development Jurupa Valley\Geo\Liquefaction\2484CR B-4.liq
Title: 2484-CR Burrtec Hauling Yard
Subtitle: Agua Mansa/Wilson, Jurupa Valley, California

Input Data:
Surface Elev.=
Hole No.=B-4
Depth of Hole=51.50 ft
Water Table during Earthquake= 75.00 ft
Water Table during In-Situ Testing= 75.00 ft
Max. Acceleration=0.66 g
Earthquake Magnitude=6.98
No-Liquefiable Soils: Based on Analysis
1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.4
7. Borehole Diameter, Cb= 1.0
8. Sampling Method, Cs= 1.3
9. User request factor of safety (apply to CSR) , User= 1.3
Plot one CSR curve (fs1=User)
10. Average two input data between two Depths: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	Gamma pcf	Fines %
0.00	18.00	113.00	20.00
5.50	18.00	113.00	20.00
10.50	33.00	115.00	45.00
15.50	33.00	113.00	20.00

20.50	39.00	110.00	90.00
25.50	42.00	110.00	90.00
30.50	38.00	110.00	90.00
35.50	22.00	110.00	90.00
40.50	22.00	110.00	90.00
45.50	40.00	113.00	20.00
50.50	55.00	113.00	20.00

Output Results:

Calculation segment, dz=0.050 ft

User defined Print Interval, dp=1.00 ft

Peak Ground Acceleration (PGA), a_max = 0.66g

CSR Calculation:

Depth	gamma	sigma	gamma'	sigma'	rd	mZ	a(z)	CSR	x fs1	=CSRfs
ft	pcf	atm	pcf	atm		g	g			
0.00	113.00	0.000	113.00	0.000	1.00	0.000	0.658	0.43	1.30	0.56
1.00	113.00	0.053	113.00	0.053	1.00	0.000	0.658	0.43	1.30	0.55
2.00	113.00	0.107	113.00	0.107	1.00	0.000	0.658	0.43	1.30	0.55
3.00	113.00	0.160	113.00	0.160	0.99	0.000	0.658	0.42	1.30	0.55
4.00	113.00	0.214	113.00	0.214	0.99	0.000	0.658	0.42	1.30	0.55
5.00	113.00	0.267	113.00	0.267	0.99	0.000	0.658	0.42	1.30	0.55
6.00	113.20	0.320	113.20	0.320	0.99	0.000	0.658	0.42	1.30	0.55
7.00	113.60	0.374	113.60	0.374	0.98	0.000	0.658	0.42	1.30	0.55
8.00	114.00	0.428	114.00	0.428	0.98	0.000	0.658	0.42	1.30	0.55
9.00	114.40	0.482	114.40	0.482	0.98	0.000	0.658	0.42	1.30	0.54
10.00	114.80	0.536	114.80	0.536	0.98	0.000	0.658	0.42	1.30	0.54
11.00	114.80	0.590	114.80	0.590	0.97	0.000	0.658	0.42	1.30	0.54
12.00	114.40	0.644	114.40	0.644	0.97	0.000	0.658	0.42	1.30	

0.54										
	13.00	114.00	0.698	114.00	0.698	0.97	0.000	0.658	0.41	1.30
0.54										
	14.00	113.60	0.752	113.60	0.752	0.97	0.000	0.658	0.41	1.30
0.54										
	15.00	113.20	0.806	113.20	0.806	0.97	0.000	0.658	0.41	1.30
0.54										
	16.00	112.70	0.859	112.70	0.859	0.96	0.000	0.658	0.41	1.30
0.54										
	17.00	112.10	0.912	112.10	0.912	0.96	0.000	0.658	0.41	1.30
0.53										
	18.00	111.50	0.965	111.50	0.965	0.96	0.000	0.658	0.41	1.30
0.53										
	19.00	110.90	1.018	110.90	1.018	0.96	0.000	0.658	0.41	1.30
0.53										
	20.00	110.30	1.070	110.30	1.070	0.95	0.000	0.658	0.41	1.30
0.53										
	21.00	110.00	1.122	110.00	1.122	0.95	0.000	0.658	0.41	1.30
0.53										
	22.00	110.00	1.174	110.00	1.174	0.95	0.000	0.658	0.41	1.30
0.53										
	23.00	110.00	1.226	110.00	1.226	0.95	0.000	0.658	0.40	1.30
0.53										
	24.00	110.00	1.278	110.00	1.278	0.94	0.000	0.658	0.40	1.30
0.52										
	25.00	110.00	1.330	110.00	1.330	0.94	0.000	0.658	0.40	1.30
0.52										
	26.00	110.00	1.382	110.00	1.382	0.94	0.000	0.658	0.40	1.30
0.52										
	27.00	110.00	1.434	110.00	1.434	0.94	0.000	0.658	0.40	1.30
0.52										
	28.00	110.00	1.486	110.00	1.486	0.93	0.000	0.658	0.40	1.30
0.52										
	29.00	110.00	1.538	110.00	1.538	0.93	0.000	0.658	0.40	1.30
0.52										
	30.00	110.00	1.590	110.00	1.590	0.93	0.000	0.658	0.40	1.30
0.52										
	31.00	110.00	1.642	110.00	1.642	0.92	0.000	0.658	0.39	1.30
0.51										
	32.00	110.00	1.694	110.00	1.694	0.91	0.000	0.658	0.39	1.30
0.51										
	33.00	110.00	1.746	110.00	1.746	0.91	0.000	0.658	0.39	1.30
0.50										
	34.00	110.00	1.798	110.00	1.798	0.90	0.000	0.658	0.38	1.30
0.50										
	35.00	110.00	1.850	110.00	1.850	0.89	0.000	0.658	0.38	1.30
0.49										
	36.00	110.00	1.902	110.00	1.902	0.88	0.000	0.658	0.38	1.30

0.49									
	37.00	110.00	1.954	110.00	1.954	0.87	0.000	0.658	0.37	1.30
0.49									
	38.00	110.00	2.006	110.00	2.006	0.86	0.000	0.658	0.37	1.30
0.48									
	39.00	110.00	2.058	110.00	2.058	0.86	0.000	0.658	0.37	1.30
0.48									
	40.00	110.00	2.109	110.00	2.109	0.85	0.000	0.658	0.36	1.30
0.47									
	41.00	110.30	2.162	110.30	2.162	0.84	0.000	0.658	0.36	1.30
0.47									
	42.00	110.90	2.214	110.90	2.214	0.83	0.000	0.658	0.36	1.30
0.46									
	43.00	111.50	2.266	111.50	2.266	0.82	0.000	0.658	0.35	1.30
0.46									
	44.00	112.10	2.319	112.10	2.319	0.82	0.000	0.658	0.35	1.30
0.45									
	45.00	112.70	2.372	112.70	2.372	0.81	0.000	0.658	0.35	1.30
0.45									
	46.00	113.00	2.426	113.00	2.426	0.80	0.000	0.658	0.34	1.30
0.44									
	47.00	113.00	2.479	113.00	2.479	0.79	0.000	0.658	0.34	1.30
0.44									
	48.00	113.00	2.532	113.00	2.532	0.78	0.000	0.658	0.34	1.30
0.44									
	49.00	113.00	2.586	113.00	2.586	0.78	0.000	0.658	0.33	1.30
0.43									
	50.00	113.00	2.639	113.00	2.639	0.77	0.000	0.658	0.33	1.30
0.43									
	51.00	113.00	2.693	113.00	2.693	0.76	0.000	0.658	0.32	1.30
0.42									

CSR is based on water table at 75.00 during earthquake

CRR Calculation from SPT or BPT data:

Depth	SPT	Cebs	Cr	sigma'	Cn	(N1)60	Fines	d(N1)60	(N1)60f	CRR7.5
ft				atm			%			
0.00	18.00	1.82	0.75	0.000	1.70	41.77	20.00	6.93	48.70	0.50
1.00	18.00	1.82	0.75	0.053	1.70	41.77	20.00	6.93	48.70	0.50
2.00	18.00	1.82	0.75	0.107	1.70	41.77	20.00	6.93		

48.70	0.50								
	3.00	18.00	1.82	0.75	0.160	1.70	41.77	20.00	6.93
48.70	0.50								
	4.00	18.00	1.82	0.75	0.214	1.70	41.77	20.00	6.93
48.70	0.50								
	5.00	18.00	1.82	0.75	0.267	1.70	41.77	20.00	6.93
48.70	0.50								
	6.00	19.50	1.82	0.75	0.320	1.70	45.25	22.50	8.37
53.62	0.50								
	7.00	22.50	1.82	0.75	0.374	1.64	50.22	27.50	11.26
61.48	0.50								
	8.00	25.50	1.82	0.75	0.428	1.53	53.22	32.50	14.18
67.40	0.50								
	9.00	28.50	1.82	0.85	0.482	1.44	63.52	37.50	17.70
81.23	0.50								
	10.00	31.50	1.82	0.85	0.536	1.37	66.57	42.50	18.31
84.88	0.50								
	11.00	33.00	1.82	0.85	0.590	1.30	66.45	42.50	18.29
84.74	0.50								
	12.00	33.00	1.82	0.85	0.644	1.25	63.60	37.50	17.72
81.32	0.50								
	13.00	33.00	1.82	0.85	0.698	1.20	61.09	32.50	15.56
76.66	0.50								
	14.00	33.00	1.82	0.85	0.752	1.15	58.87	27.50	12.42
71.29	0.50								
	15.00	33.00	1.82	0.95	0.806	1.11	63.57	22.50	10.14
73.71	0.50								
	16.00	33.60	1.82	0.95	0.859	1.08	62.68	27.00	12.65
75.32	0.50								
	17.00	34.80	1.82	0.95	0.912	1.05	63.00	41.00	17.60
80.60	0.50								
	18.00	36.00	1.82	0.95	0.965	1.02	63.36	55.00	17.67
81.03	0.50								
	19.00	37.20	1.82	0.95	1.018	0.99	63.76	69.00	17.75
81.51	0.50								
	20.00	38.40	1.82	0.95	1.070	0.97	64.19	83.00	17.84
82.03	0.50								
	21.00	39.30	1.82	0.95	1.122	0.94	64.15	90.00	17.83
81.98	0.50								
	22.00	39.90	1.82	0.95	1.174	0.92	63.67	90.00	17.73
81.41	0.50								
	23.00	40.50	1.82	0.95	1.226	0.90	63.25	90.00	17.65
80.90	0.50								
	24.00	41.10	1.82	0.95	1.278	0.88	62.86	90.00	17.57
80.44	0.50								
	25.00	41.70	1.82	0.95	1.330	0.87	62.52	90.00	17.50
80.03	0.50								
	26.00	41.60	1.82	0.95	1.382	0.85	61.19	90.00	17.24

78.43	0.50								
	27.00	40.80	1.82	0.95	1.434	0.84	58.91	90.00	16.78
75.70	0.50								
	28.00	40.00	1.82	1.00	1.486	0.82	59.73	90.00	16.95
76.67	0.50								
	29.00	39.20	1.82	1.00	1.538	0.81	57.53	90.00	16.51
74.04	0.50								
	30.00	38.40	1.82	1.00	1.590	0.79	55.43	90.00	16.09
71.52	0.50								
	31.00	36.40	1.82	1.00	1.642	0.78	51.71	90.00	15.34
67.05	0.50								
	32.00	33.20	1.82	1.00	1.694	0.77	46.43	90.00	14.29
60.72	0.50								
	33.00	30.00	1.82	1.00	1.746	0.76	41.33	90.00	13.27
54.59	0.50								
	34.00	26.80	1.82	1.00	1.798	0.75	36.38	90.00	12.28
48.66	0.50								
	35.00	23.60	1.82	1.00	1.850	0.74	31.58	90.00	11.32
42.90	0.50								
	36.00	22.00	1.82	1.00	1.902	0.73	29.04	90.00	10.81
39.84	0.50								
	37.00	22.00	1.82	1.00	1.954	0.72	28.65	90.00	10.73
39.38	0.50								
	38.00	22.00	1.82	1.00	2.006	0.71	28.27	90.00	10.65
38.93	0.50								
	39.00	22.00	1.82	1.00	2.058	0.70	27.91	90.00	10.58
38.50	0.50								
	40.00	22.00	1.82	1.00	2.109	0.69	27.57	90.00	10.51
38.08	0.50								
	41.00	23.80	1.82	1.00	2.162	0.68	29.46	83.00	10.89
40.35	0.50								
	42.00	27.40	1.82	1.00	2.214	0.67	33.51	69.00	11.70
45.22	0.50								
	43.00	31.00	1.82	1.00	2.266	0.66	37.48	55.01	12.50
49.97	0.50								
	44.00	34.60	1.82	1.00	2.319	0.66	41.35	41.01	13.27
54.62	0.50								
	45.00	38.20	1.82	1.00	2.372	0.65	45.14	27.01	10.36
55.50	0.50								
	46.00	41.50	1.82	1.00	2.426	0.64	48.50	20.00	7.47
55.96	0.50								
	47.00	44.50	1.82	1.00	2.479	0.64	51.44	20.00	7.70
59.14	0.50								
	48.00	47.50	1.82	1.00	2.532	0.63	54.32	20.00	7.93
62.25	0.50								
	49.00	50.50	1.82	1.00	2.586	0.62	57.16	20.00	8.16
65.31	0.50								
	50.00	53.50	1.82	1.00	2.639	0.62	59.93	20.00	8.38

68.31 0.50
51.00 55.00 1.82 1.00 2.693 0.61 61.00 20.00 8.46
69.46 0.50

CRR is based on water table at 75.00 during In-Situ Testing

Factor of Safety, - Earthquake Magnitude= 6.98:

Depth ft	sigC' atm	CRR7.5	x Ksig	=CRRv	x MSF	=CRRm	CSRfs	F.S.=CRRm/CSRfs
0.00	0.00	0.50	1.00	0.50	1.20	0.60	0.56	5.00
1.00	0.03	0.50	1.00	0.50	1.20	0.60	0.55	5.00
2.00	0.07	0.50	1.00	0.50	1.20	0.60	0.55	5.00
3.00	0.10	0.50	1.00	0.50	1.20	0.60	0.55	5.00
4.00	0.14	0.50	1.00	0.50	1.20	0.60	0.55	5.00
5.00	0.17	0.50	1.00	0.50	1.20	0.60	0.55	5.00
6.00	0.21	0.50	1.00	0.50	1.20	0.60	0.55	5.00
7.00	0.24	0.50	1.00	0.50	1.20	0.60	0.55	5.00
8.00	0.28	0.50	1.00	0.50	1.20	0.60	0.55	5.00
9.00	0.31	0.50	1.00	0.50	1.20	0.60	0.54	5.00
10.00	0.35	0.50	1.00	0.50	1.20	0.60	0.54	5.00
11.00	0.38	0.50	1.00	0.50	1.20	0.60	0.54	5.00
12.00	0.42	0.50	1.00	0.50	1.20	0.60	0.54	5.00
13.00	0.45	0.50	1.00	0.50	1.20	0.60	0.54	5.00
14.00	0.49	0.50	1.00	0.50	1.20	0.60	0.54	5.00
15.00	0.52	0.50	1.00	0.50	1.20	0.60	0.54	5.00
16.00	0.56	0.50	1.00	0.50	1.20	0.60	0.54	5.00
17.00	0.59	0.50	1.00	0.50	1.20	0.60	0.53	5.00
18.00	0.63	0.50	1.00	0.50	1.20	0.60	0.53	5.00
19.00	0.66	0.50	1.00	0.50	1.20	0.60	0.53	5.00
20.00	0.70	0.50	1.00	0.50	1.20	0.60	0.53	5.00
21.00	0.73	0.50	1.00	0.50	1.20	0.60	0.53	5.00
22.00	0.76	0.50	1.00	0.50	1.20	0.60	0.53	5.00
23.00	0.80	0.50	1.00	0.50	1.20	0.60	0.53	5.00
24.00	0.83	0.50	1.00	0.50	1.20	0.60	0.52	5.00
25.00	0.86	0.50	1.00	0.50	1.20	0.60	0.52	5.00
26.00	0.90	0.50	1.00	0.50	1.20	0.60	0.52	5.00
27.00	0.93	0.50	1.00	0.50	1.20	0.60	0.52	5.00
28.00	0.97	0.50	1.00	0.50	1.20	0.60	0.52	5.00
29.00	1.00	0.50	1.00	0.50	1.20	0.60	0.52	5.00
30.00	1.03	0.50	1.00	0.50	1.20	0.60	0.52	5.00
31.00	1.07	0.50	1.00	0.50	1.20	0.60	0.51	5.00
32.00	1.10	0.50	0.99	0.50	1.20	0.59	0.51	5.00
33.00	1.13	0.50	0.99	0.49	1.20	0.59	0.50	5.00
34.00	1.17	0.50	0.98	0.49	1.20	0.59	0.50	5.00

35.00	1.20	0.50	0.97	0.49	1.20	0.59	0.49	5.00
36.00	1.24	0.50	0.97	0.48	1.20	0.58	0.49	5.00
37.00	1.27	0.50	0.96	0.48	1.20	0.58	0.49	5.00
38.00	1.30	0.50	0.96	0.48	1.20	0.58	0.48	5.00
39.00	1.34	0.50	0.96	0.48	1.20	0.57	0.48	5.00
40.00	1.37	0.50	0.95	0.48	1.20	0.57	0.47	5.00
41.00	1.40	0.50	0.95	0.47	1.20	0.57	0.47	5.00
42.00	1.44	0.50	0.94	0.47	1.20	0.57	0.46	5.00
43.00	1.47	0.50	0.94	0.47	1.20	0.56	0.46	5.00
44.00	1.51	0.50	0.93	0.47	1.20	0.56	0.45	5.00
45.00	1.54	0.50	0.93	0.46	1.20	0.56	0.45	5.00
46.00	1.58	0.50	0.92	0.46	1.20	0.55	0.44	5.00
47.00	1.61	0.50	0.92	0.46	1.20	0.55	0.44	5.00
48.00	1.65	0.50	0.91	0.46	1.20	0.55	0.44	5.00
49.00	1.68	0.50	0.91	0.45	1.20	0.55	0.43	5.00
50.00	1.72	0.50	0.91	0.45	1.20	0.54	0.43	5.00
51.00	1.75	0.50	0.90	0.45	1.20	0.54	0.42	5.00

* F.S.<1: Liquefaction Potential Zone. (If above water table: F.S.=5)
^ No-liquefiable Soils or above Water Table.
(F.S. is limited to 5, CRR is limited to 2,   CSR is limited to 2)

CPT convert to SPT for Settlement Analysis:
Fines Correction for Settlement Analysis:

Depth ft	Ic	qc/N60	qc1 atm	(N1)60	Fines %	d(N1)60	(N1)60s
0.00	-	-	-	48.70	20.00	0.00	48.70
1.00	-	-	-	48.70	20.00	0.00	48.70
2.00	-	-	-	48.70	20.00	0.00	48.70
3.00	-	-	-	48.70	20.00	0.00	48.70
4.00	-	-	-	48.70	20.00	0.00	48.70
5.00	-	-	-	48.70	20.00	0.00	48.70
6.00	-	-	-	53.62	22.50	0.00	53.62
7.00	-	-	-	61.48	27.50	0.00	61.48
8.00	-	-	-	67.40	32.50	0.00	67.40
9.00	-	-	-	81.23	37.50	0.00	81.23
10.00	-	-	-	84.88	42.50	0.00	84.88
11.00	-	-	-	84.74	42.50	0.00	84.74
12.00	-	-	-	81.32	37.50	0.00	81.32
13.00	-	-	-	76.66	32.50	0.00	76.66
14.00	-	-	-	71.29	27.50	0.00	71.29
15.00	-	-	-	73.71	22.50	0.00	73.71
16.00	-	-	-	75.32	27.00	0.00	75.32
17.00	-	-	-	80.60	41.00	0.00	80.60
18.00	-	-	-	81.03	55.00	0.00	81.03
19.00	-	-	-	81.51	69.00	0.00	81.51

20.00	-	-	-	82.03	83.00	0.00	82.03
21.00	-	-	-	81.98	90.00	0.00	81.98
22.00	-	-	-	81.41	90.00	0.00	81.41
23.00	-	-	-	80.90	90.00	0.00	80.90
24.00	-	-	-	80.44	90.00	0.00	80.44
25.00	-	-	-	80.03	90.00	0.00	80.03
26.00	-	-	-	78.43	90.00	0.00	78.43
27.00	-	-	-	75.70	90.00	0.00	75.70
28.00	-	-	-	76.67	90.00	0.00	76.67
29.00	-	-	-	74.04	90.00	0.00	74.04
30.00	-	-	-	71.52	90.00	0.00	71.52
31.00	-	-	-	67.05	90.00	0.00	67.05
32.00	-	-	-	60.72	90.00	0.00	60.72
33.00	-	-	-	54.59	90.00	0.00	54.59
34.00	-	-	-	48.66	90.00	0.00	48.66
35.00	-	-	-	42.90	90.00	0.00	42.90
36.00	-	-	-	39.84	90.00	0.00	39.84
37.00	-	-	-	39.38	90.00	0.00	39.38
38.00	-	-	-	38.93	90.00	0.00	38.93
39.00	-	-	-	38.50	90.00	0.00	38.50
40.00	-	-	-	38.08	90.00	0.00	38.08
41.00	-	-	-	40.35	83.00	0.00	40.35
42.00	-	-	-	45.22	69.00	0.00	45.22
43.00	-	-	-	49.97	55.01	0.00	49.97
44.00	-	-	-	54.62	41.01	0.00	54.62
45.00	-	-	-	55.50	27.01	0.00	55.50
46.00	-	-	-	55.96	20.00	0.00	55.96
47.00	-	-	-	59.14	20.00	0.00	59.14
48.00	-	-	-	62.25	20.00	0.00	62.25
49.00	-	-	-	65.31	20.00	0.00	65.31
50.00	-	-	-	68.31	20.00	0.00	68.31
51.00	-	-	-	69.46	20.00	0.00	69.46

(N1)60s has been fines corrected in liquefaction analysis, therefore d(N1)60=0.

Fines=NoLiq means the soils are not liquefiable.

Settlement of Saturated Sands:

Settlement Analysis Method: Ishihara / Yoshimine

Depth	CSRsf	/ MSF*	=CSRm	F.S.	Fines	(N1)60s	Dr	ec	dsz	dsp	S
ft					%		%	%	in.	in.	in.

No Settlement of Saturated Sands

Settlement of Saturated Sands=0.000 in.
qc1 and (N1)60 is after fines correction in liquefaction analysis
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Settlement of Unsaturated Sands:

Depth	sigma'	sigC'	(N1)60s	CSRsf	Gmax	g*Ge/Gm	g_eff	ec7.5	Cec	ec	dsz	dsp	S
ft	atm	atm			atm			%		%	in.	in.	in.
51.45	2.72	1.77	69.17	0.42	2436.02	4.7E-4	0.1101	0.0348	0.92	0.0321	3.86E-4	0.000	0.000
51.00	2.69	1.75	69.46	0.42	2428.63	4.7E-4	0.1099	0.0347	0.92	0.0321	3.85E-4	0.003	0.004
50.00	2.64	1.72	68.31	0.43	2391.06	4.7E-4	0.1115	0.0352	0.92	0.0325	3.90E-4	0.008	0.012
49.00	2.59	1.68	65.31	0.43	2331.61	4.8E-4	0.1155	0.0365	0.92	0.0337	4.04E-4	0.008	0.020
48.00	2.53	1.65	62.25	0.44	2270.88	4.9E-4	0.1199	0.0379	0.92	0.0350	4.20E-4	0.008	0.028
47.00	2.48	1.61	59.14	0.44	2208.73	4.9E-4	0.1247	0.0394	0.92	0.0364	4.37E-4	0.009	0.036
46.00	2.43	1.58	55.96	0.44	2145.01	5.0E-4	0.1301	0.0412	0.92	0.0380	4.56E-4	0.009	0.045
45.00	2.37	1.54	55.50	0.45	2115.44	5.0E-4	0.1307	0.0413	0.92	0.0381	4.58E-4	0.009	0.055
44.00	2.32	1.51	54.62	0.45	2080.51	5.1E-4	0.1320	0.0417	0.92	0.0385	4.62E-4	0.009	0.064
43.00	2.27	1.47	49.97	0.46	1996.66	5.2E-4	0.2522	0.0798	0.92	0.0736	8.83E-4	0.015	0.079
42.00	2.21	1.44	45.22	0.46	1908.77	5.4E-4	0.2835	0.0897	0.92	0.0828	9.93E-4	0.019	0.098
41.00	2.16	1.40	40.35	0.47	1815.96	5.6E-4	0.3262	0.1032	0.92	0.0952	1.14E-3	0.021	0.119
40.00	2.11	1.37	38.08	0.47	1759.70	5.7E-4	0.3495	0.1259	0.92	0.1163	1.40E-3	0.027	0.146
39.00	2.06	1.34	38.50	0.48	1744.17	5.6E-4	0.3401	0.1192	0.92	0.1100	1.32E-3	0.027	0.173
38.00	2.01	1.30	38.93	0.48	1728.40	5.6E-4	0.3305	0.1125	0.92	0.1038	1.25E-3	0.026	0.199
37.00	1.95	1.27	39.38	0.49	1712.37	5.5E-4	0.3205	0.1057	0.92				

0.0976	1.17E-3	0.024	0.223							
	36.00	1.90	1.24	39.84	0.49	1696.08	5.5E-4	0.3103	0.0989	0.92
0.0913	1.10E-3	0.023	0.246							
	35.00	1.85	1.20	42.90	0.49	1714.42	5.3E-4	0.2770	0.0876	0.92
0.0808	9.70E-4	0.021	0.267							
	34.00	1.80	1.17	48.66	0.50	1762.54	5.1E-4	0.2332	0.0738	0.92
0.0681	8.17E-4	0.018	0.284							
	33.00	1.75	1.13	54.59	0.50	1804.72	4.9E-4	0.2007	0.0635	0.92
0.0586	7.03E-4	0.015	0.299							
	32.00	1.69	1.10	60.72	0.51	1841.73	4.7E-4	0.1755	0.0555	0.92
0.0512	6.15E-4	0.013	0.312							
	31.00	1.64	1.07	67.05	0.51	1874.12	4.5E-4	0.1554	0.0491	0.92
0.0454	5.44E-4	0.012	0.324							
	30.00	1.59	1.03	71.52	0.52	1884.28	4.4E-4	0.1429	0.0452	0.92
0.0417	5.00E-4	0.010	0.334							
	29.00	1.54	1.00	74.04	0.52	1874.74	4.3E-4	0.1328	0.0420	0.92
0.0388	4.65E-4	0.010	0.344							
	28.00	1.49	0.97	76.67	0.52	1864.33	4.1E-4	0.1235	0.0391	0.92
0.0360	4.33E-4	0.009	0.353							
	27.00	1.43	0.93	75.70	0.52	1823.65	4.1E-4	0.1199	0.0379	0.92
0.0350	4.20E-4	0.009	0.362							
	26.00	1.38	0.90	78.43	0.52	1811.53	4.0E-4	0.1114	0.0352	0.92
0.0325	3.90E-4	0.008	0.370							
	25.00	1.33	0.86	80.03	0.52	1789.13	3.9E-4	0.1048	0.0331	0.92
0.0306	3.67E-4	0.008	0.377							
	24.00	1.28	0.83	80.44	0.52	1756.80	3.8E-4	0.0999	0.0316	0.92
0.0291	3.50E-4	0.007	0.384							
	23.00	1.23	0.80	80.90	0.53	1723.95	3.7E-4	0.0950	0.0300	0.92
0.0277	3.33E-4	0.007	0.391							
	22.00	1.17	0.76	81.41	0.53	1690.56	3.7E-4	0.0902	0.0285	0.92
0.0263	3.16E-4	0.006	0.398							
	21.00	1.12	0.73	81.98	0.53	1656.58	3.6E-4	0.1694	0.0536	0.92
0.0494	5.93E-4	0.010	0.408							
	20.00	1.07	0.70	82.03	0.53	1618.01	3.5E-4	0.1549	0.0490	0.92
0.0452	5.42E-4	0.011	0.419							
	19.00	1.02	0.66	81.51	0.53	1574.69	3.4E-4	0.1426	0.0451	0.92
0.0416	4.99E-4	0.010	0.429							
	18.00	0.97	0.63	81.03	0.53	1530.48	3.4E-4	0.1308	0.0414	0.92
0.0382	4.58E-4	0.010	0.439							
	17.00	0.91	0.59	80.60	0.53	1485.32	3.3E-4	0.1195	0.0378	0.92
0.0349	4.19E-4	0.009	0.448							
	16.00	0.86	0.56	75.32	0.54	1409.31	3.3E-4	0.1173	0.0371	0.92
0.0342	4.11E-4	0.008	0.456							
	15.00	0.81	0.52	73.71	0.54	1354.99	3.2E-4	0.1081	0.0342	0.92
0.0316	3.79E-4	0.008	0.464							
	14.00	0.75	0.49	71.29	0.54	1294.67	3.1E-4	0.1005	0.0318	0.92
0.0293	3.52E-4	0.008	0.472							
	13.00	0.70	0.45	76.66	0.54	1278.04	2.9E-4	0.0828	0.0262	0.92

0.0242	2.90E-4	0.006	0.478							
	12.00	0.64	0.42	81.32	0.54	1252.05	2.8E-4	0.0697	0.0220	0.92
0.0203	2.44E-4	0.005	0.483							
	11.00	0.59	0.38	84.74	0.54	1214.85	2.6E-4	0.0598	0.0189	0.92
0.0175	2.10E-4	0.005	0.488							
	10.00	0.54	0.35	84.88	0.54	1158.25	2.5E-4	0.0771	0.0244	0.92
0.0225	2.70E-4	0.004	0.492							
	9.00	0.48	0.31	81.23	0.54	1082.20	2.4E-4	0.0646	0.0204	0.92
0.0189	2.26E-4	0.005	0.497							
	8.00	0.43	0.28	67.40	0.55	958.36	2.4E-4	0.0661	0.0209	0.92
0.0193	2.31E-4	0.004	0.501							
	7.00	0.37	0.24	61.48	0.55	869.08	2.4E-4	0.0574	0.0181	0.92
0.0167	2.01E-4	0.004	0.505							
	6.00	0.32	0.21	53.62	0.55	768.59	2.3E-4	0.0518	0.0164	0.92
0.0151	1.82E-4	0.004	0.509							
	5.00	0.27	0.17	48.70	0.55	679.48	2.2E-4	0.0445	0.0141	0.92
0.0130	1.56E-4	0.003	0.513							
	4.00	0.21	0.14	48.70	0.55	607.75	1.9E-4	0.0515	0.0163	0.92
0.0150	1.80E-4	0.004	0.516							
	3.00	0.16	0.10	48.70	0.55	526.33	1.7E-4	0.0364	0.0115	0.92
0.0106	1.28E-4	0.003	0.519							
	2.00	0.11	0.07	48.70	0.55	429.75	1.4E-4	0.0257	0.0081	0.92
0.0075	9.02E-5	0.002	0.521							
	1.00	0.05	0.03	48.70	0.55	303.90	9.7E-5	0.0192	0.0061	0.92
0.0056	6.71E-5	0.002	0.523							
	0.00	0.00	0.00	48.70	0.56	4.16	1.3E-6	0.0010	0.0003	0.92
0.0003	3.56E-6	0.001	0.524							

Settlement of Unsaturated Sands=0.524 in.
dsz is per each segment, dz=0.05 ft
dsp is per each print interval, dp=1.00 ft
S is cumulated settlement at this depth

Total Settlement of Saturated and Unsaturated Sands=0.524 in.
Differential Settlement=0.262 to 0.346 in.

Units: Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

---

1 atm (atmosphere) = 1.0581 tsf(1 tsf = 1 ton/ft2 = 2 kip/ft2)
1 atm (atmosphere) = 101.325 kPa(1 kPa = 1 kN/m2 = 0.001 Mpa)
SPT Field data from Standard Penetration Test (SPT)
BPT Field data from Becker Penetration Test (BPT)
qc Field data from Cone Penetration Test (CPT) [atm (tsf)]

fs	Friction from CPT testing [atm (tsf)]
Rf	Ratio of fs/qc (%)
gamma	Total unit weight of soil
gamma'	Effective unit weight of soil
Fines	Fines content [%]
D50	Mean grain size
Dr	Relative Density
sigma	Total vertical stress [atm]
sigma'	Effective vertical stress [atm]
sigC'	Effective confining pressure [atm]
rd	Acceleration reduction coefficient by Seed
a_max.	Peak Ground Acceleration (PGA) in ground surface
mZ	Linear acceleration reduction coefficient X depth
a_min.	Minimum acceleration under linear reduction, mZ
CRRv	CRR after overburden stress correction, CRRv=CRR7.5 * Ksig
CRR7.5	Cyclic resistance ratio (M=7.5)
Ksig	Overburden stress correction factor for CRR7.5
CRRm	After magnitude scaling correction CRRm=CRRv * MSF
MSF	Magnitude scaling factor from M=7.5 to user input M
CSR	Cyclic stress ratio induced by earthquake
CSRfs	CSRfs=CSR*fs1 (Default fs1=1)
fs1	First CSR curve in graphic defined in #9 of Advanced page
fs2	2nd CSR curve in graphic defined in #9 of Advanced page
F.S.	Calculated factor of safety against liquefaction F.S.=CRRm/CSRsf
Cebs	Energy Ratio, Borehole Dia., and Sampling Method Corrections
Cr	Rod Length Corrections
Cn	Overburden Pressure Correction
(N1)60	SPT after corrections, (N1)60=SPT * Cr * Cn * Cebs
d(N1)60	Fines correction of SPT
(N1)60f	(N1)60 after fines corrections, (N1)60f=(N1)60 + d(N1)60
Cq	Overburden stress correction factor
qc1	CPT after Overburden stress correction
dqc1	Fines correction of CPT
qc1f	CPT after Fines and Overburden correction, qc1f=qc1 + dqc1
qc1n	CPT after normalization in Robertson's method
Kc	Fine correction factor in Robertson's Method
qc1f	CPT after Fines correction in Robertson's Method
Ic	Soil type index in Suzuki's and Robertson's Methods
(N1)60s	(N1)60 after settlement fines corrections
CSRm	After magnitude scaling correction for Settlement calculation CSRm=CSRsf / MSF*
CSRfs	Cyclic stress ratio induced by earthquake with user inputed fs
MSF*	Scaling factor from CSR, MSF*=1, based on Item 2 of Page C.
ec	Volumetric strain for saturated sands
dz	Calculation segment, dz=0.050 ft

dsz	Settlement in each segment, dz
dp	User defined print interval
dsp	Settlement in each print interval, dp
Gmax	Shear Modulus at low strain
g_eff	gamma_eff, Effective shear Strain
g*Ge/Gm	gamma_eff * G_eff/G_max, Strain-modulus ratio
ec7.5	Volumetric Strain for magnitude=7.5
Cec	Magnitude correction factor for any magnitude
ec	Volumetric strain for unsaturated sands, ec=Cec * ec7.5
NoLiq	No-Liquefy Soils

References:

1. NCEER Workshop on Evaluation of Liquefaction Resistance of Soils. Youd, T.L., and Idriss, I.M., eds., Technical Report NCEER 97-0022.

SP117. Southern California Earthquake Center. Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California. University of Southern California. March 1999.

2. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING AND SEISMIC SITE RESPONSE EVALUATION, Paper No. SPL-2, PROCEEDINGS: Fourth International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, San Diego, CA, March 2001.

3. RECENT ADVANCES IN SOIL LIQUEFACTION ENGINEERING: A UNIFIED AND CONSISTENT FRAMEWORK, Earthquake Engineering Research Center, Report No. EERC 2003-06 by R.B Seed and etc. April 2003.

Note: Print Interval you selected does not show complete results. To get complete results, you should select 'Segment' in Print Interval (Item 12, Page C).

APPENDIX E

GENERAL GRADING GUIDELINES

Proposed Industrial Hauling Yard
APNs 175-180-012 and -016
Jurupa Valley, Riverside County, California
Project No. 2484-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the California Building Code, CBC (2016) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).

2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

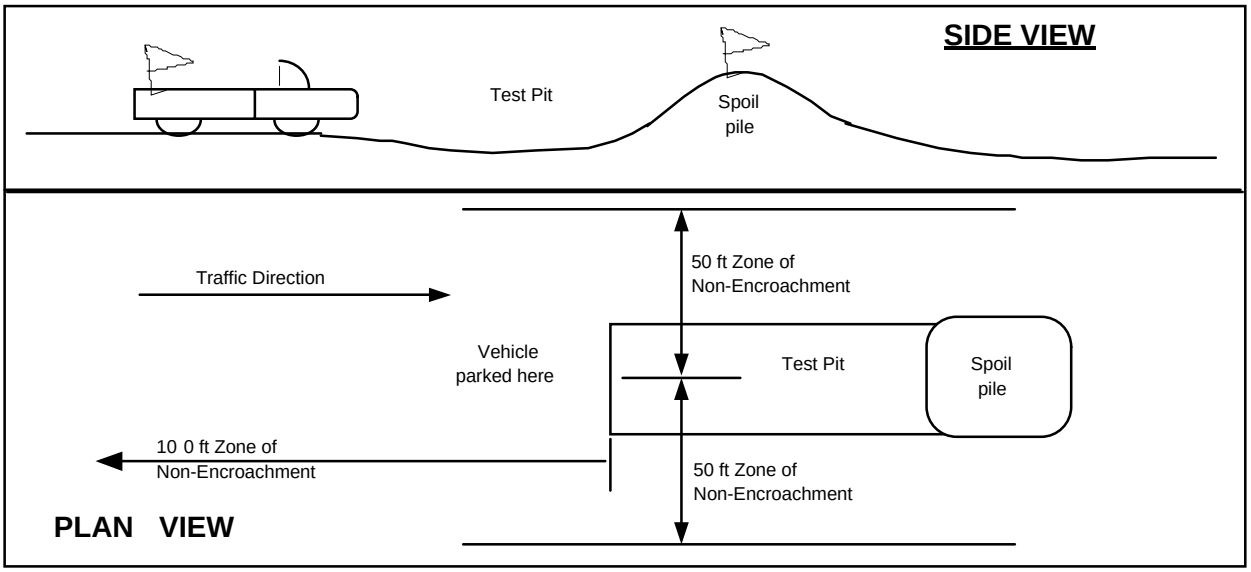
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

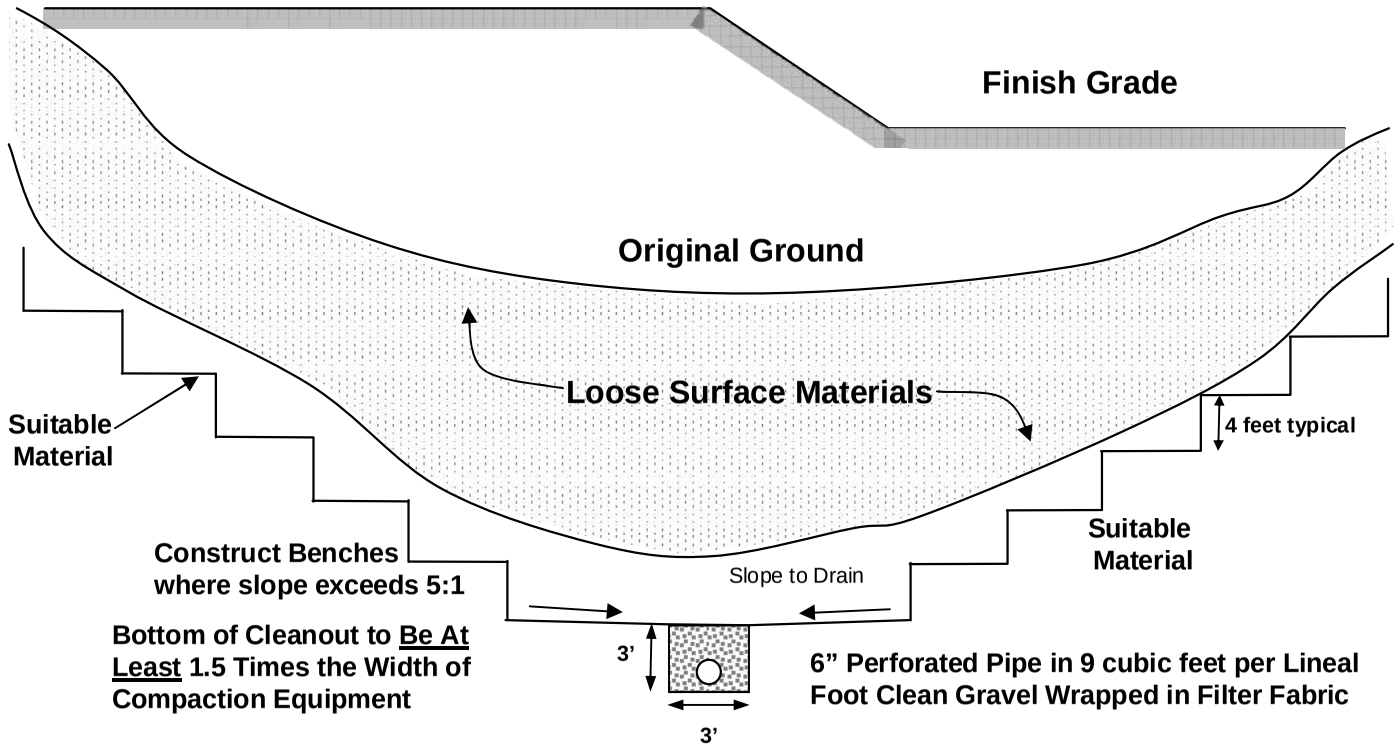
In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

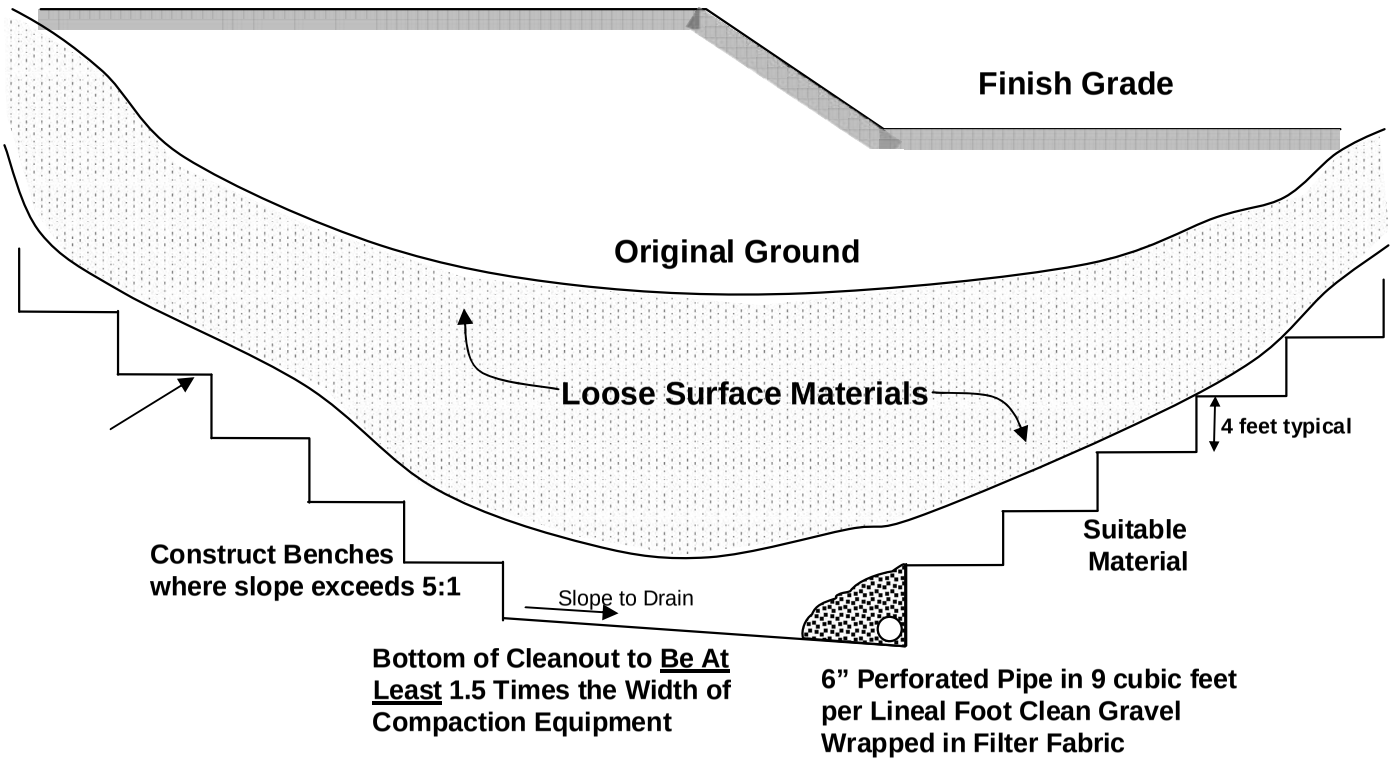
In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

ALTERNATES





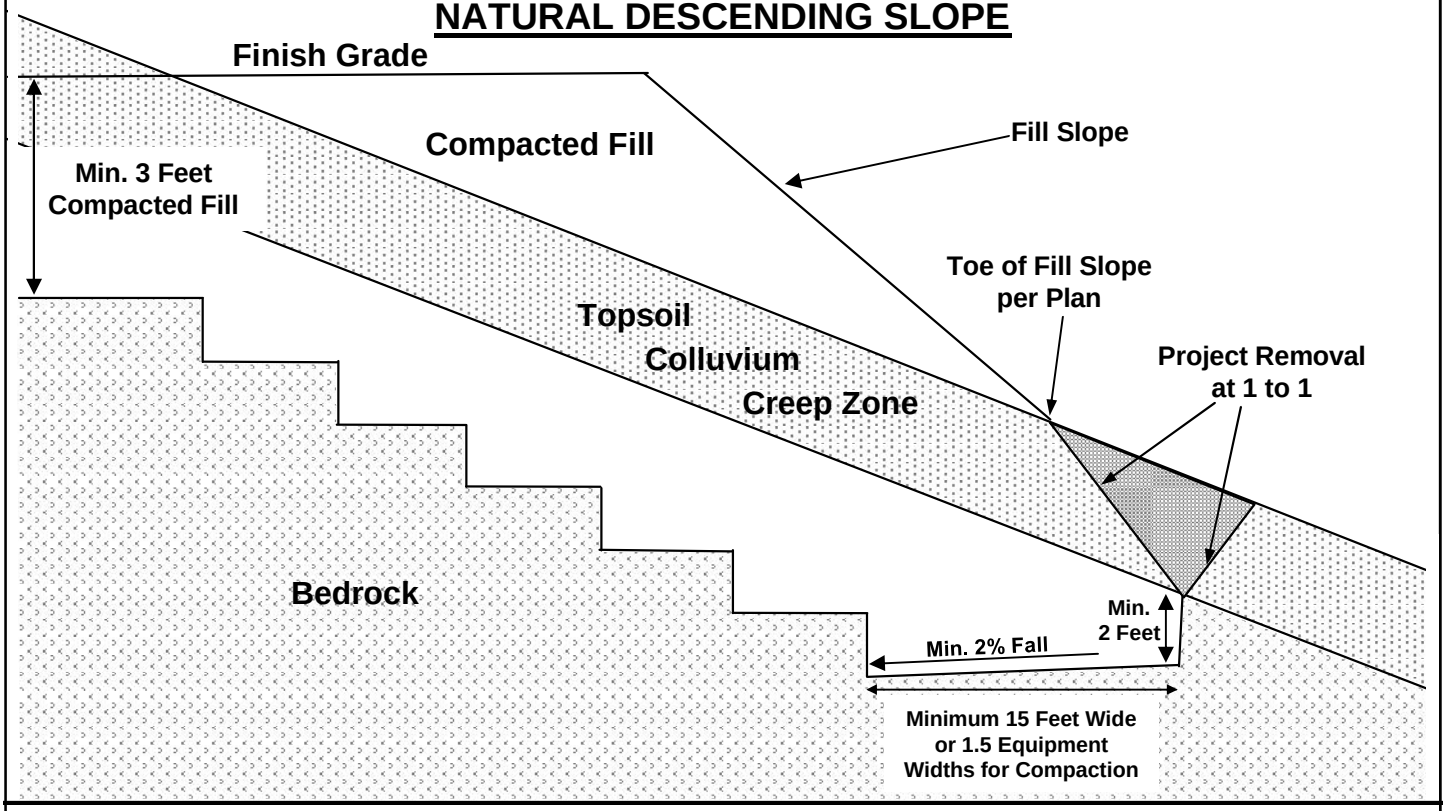
GEOTEK
1548 North Maple Street
Corona, California 92880

TYPICAL CANYON CLEANOUT

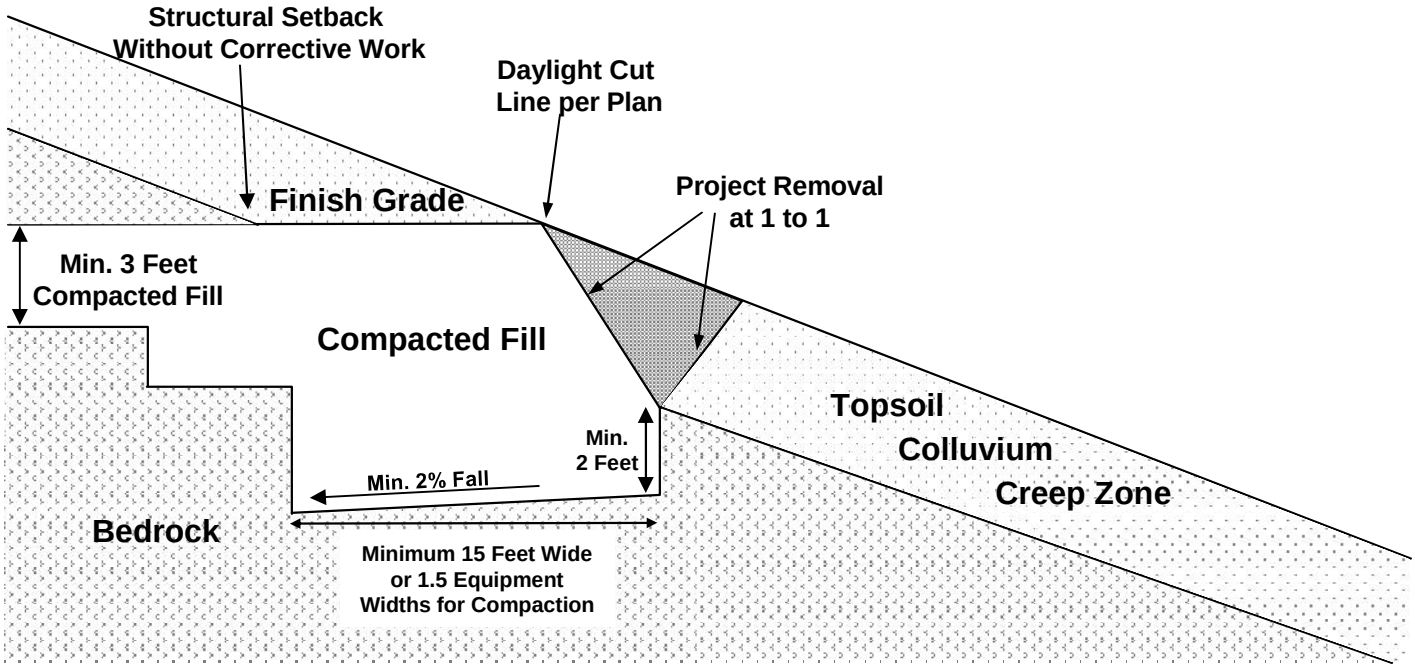
STANDARD GRADING GUIDELINES

PLATE G-1

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE



DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE



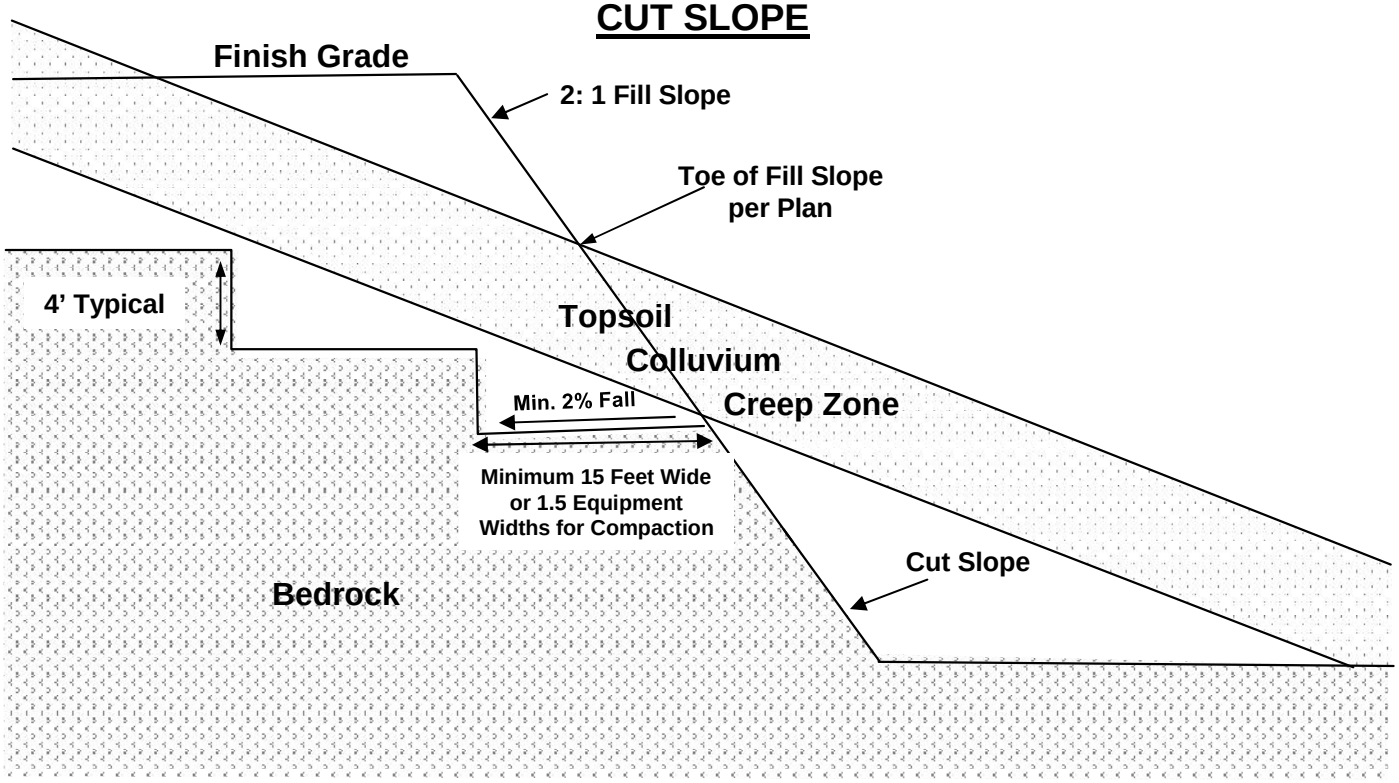
GEOTEK
1548 North Maple Street
Corona, California 92880

TREATMENT ABOVE NATURAL SLOPES

STANDARD GRADING GUIDELINES

PLATE G-2

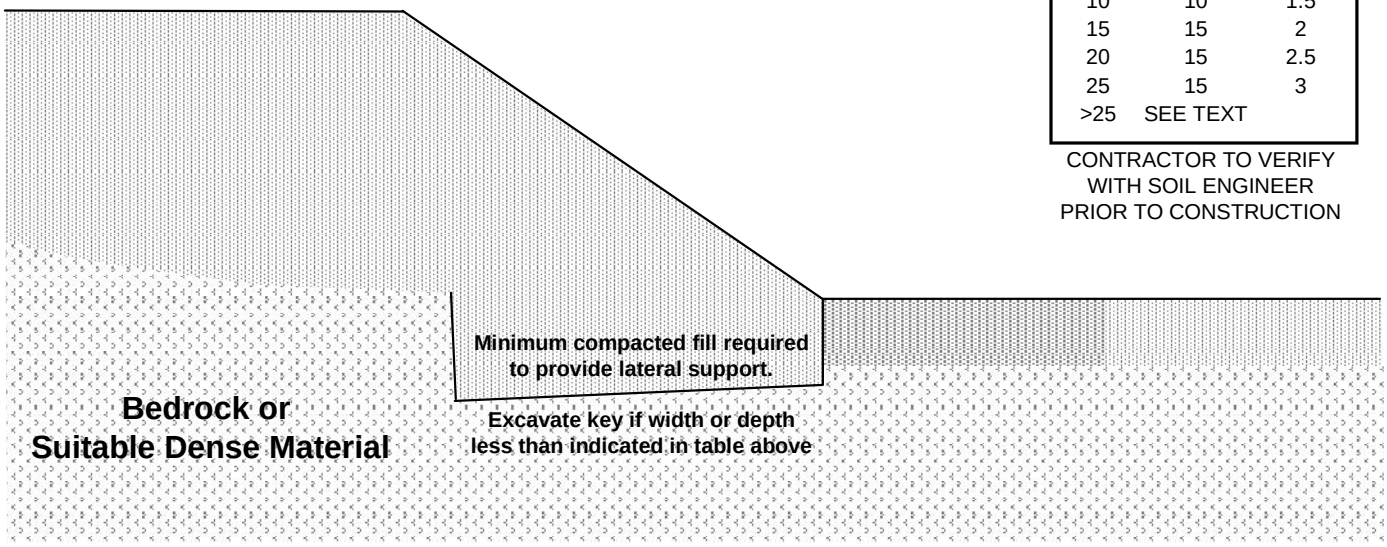
TYPICAL FILL SLOPE OVER CUT SLOPE



TYPICAL FILL SLOPE

SLOPE HEIGHT	MIN. KEY WIDTH	MIN. KEY DEPTH
5	7	1
10	10	1.5
15	15	2
20	15	2.5
25	15	3
>25	SEE TEXT	

CONTRACTOR TO VERIFY WITH SOIL ENGINEER PRIOR TO CONSTRUCTION



GEOTEK

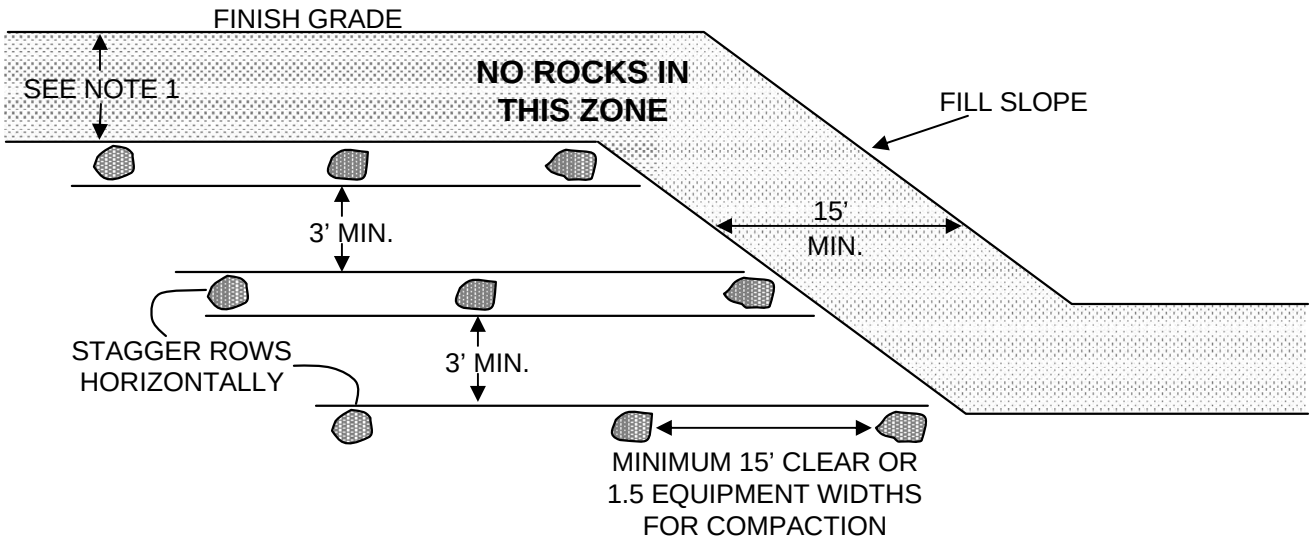
1548 North Maple Street
Corona, California 92880

COMMON FILL SLOPE KEYS

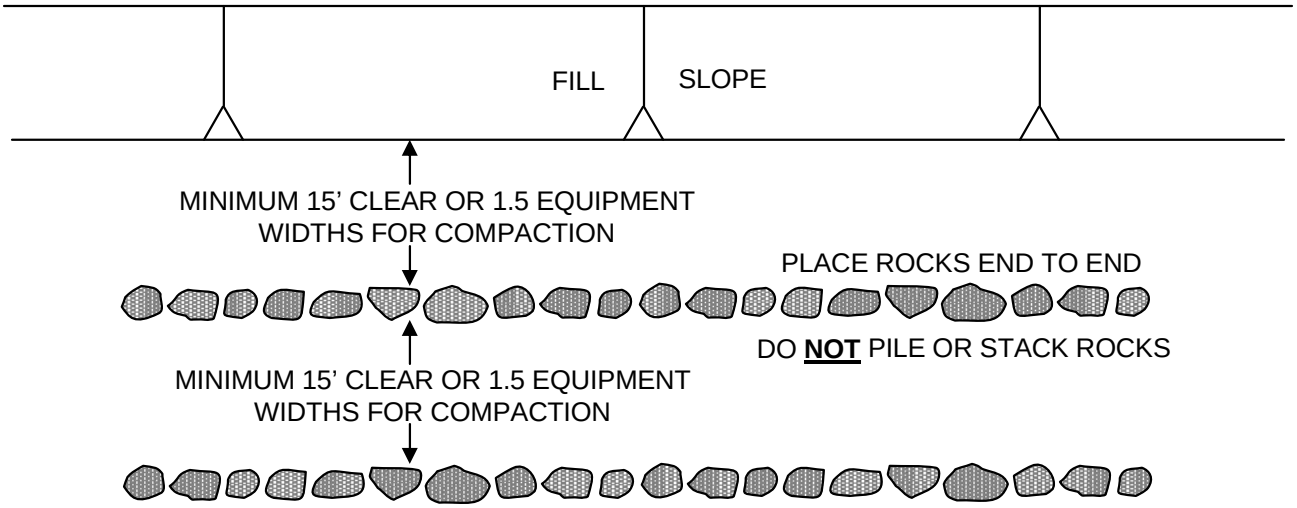
STANDARD GRADING GUIDELINES

PLATE G-3

CROSS SECTIONAL VIEW



PLAN VIEW



NOTES:

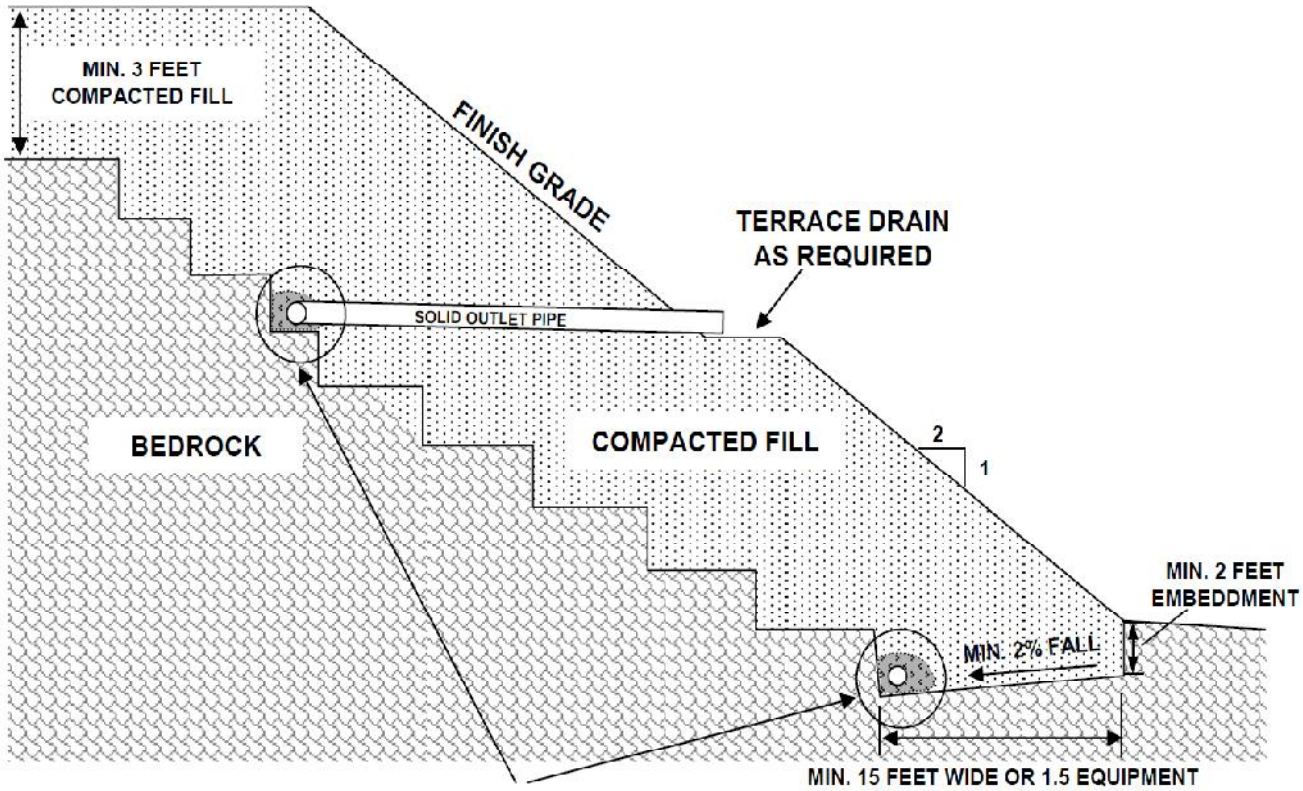
1) SOIL FILL OVER WINDROW SHOULD BE 7 FEET OR PER JURISDUICTIONAL STANDARDS AND SUFFICIENT FOR FUTURE EXCAVATIONS TO AVOID ROCKS
2) MAXIMUM ROCK SIZE IN WINDROWS IS 4 FEET IN DIAMETER
3) SOIL AROUND WINDROWS TO BE SANDY MATERIAL SUBJECT TO SOIL ENGINEER ACCEPTANCE
4) SPACING AND CLEARANCES MUST BE SUFFICIENT TO ALLOW FOR PROPER COMPACTION
5) INDIVDUAL LARGE ROCKS MAY BE BURIED IN PITS.

GEOTEK
1548 North Maple Street
Corona, California 92880

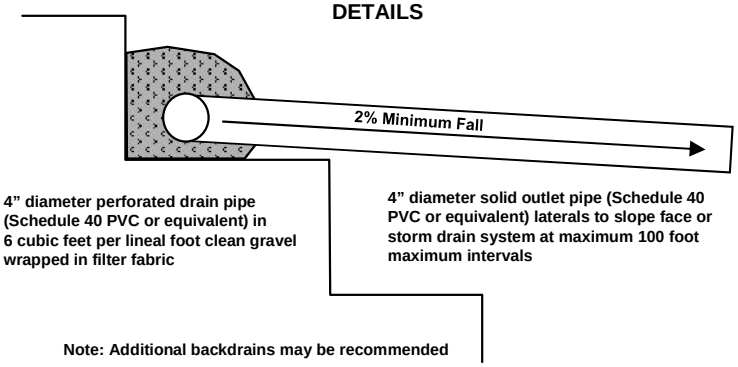
ROCK BURIAL DETAILS

STANDARD GRADING GUIDELINES

PLATE G-4



BACKDRAIN DETAILS



4" diameter perforated drain pipe (Schedule 40 PVC or equivalent) in 6 cubic feet per lineal foot clean gravel wrapped in filter fabric

4" diameter solid outlet pipe (Schedule 40 PVC or equivalent) laterals to slope face or storm drain system at maximum 100 foot maximum intervals

Note: Additional backdrains may be recommended

HEEL DRAIN DETAILS

6" diameter perforated drain pipe in 6 cubic feet per lineal foot clean gravel wrapped in filter fabric, outlet pipe to gravity flow with 2% minimum fall

GEOTEK	1548 North Maple Street Corona, California 92880	TYPICAL BUTTRESS AND STABILIZATION FILL	STANDARD GRADING GUIDELINES PLATE G-5

Appendix 4: Historical Site Conditions

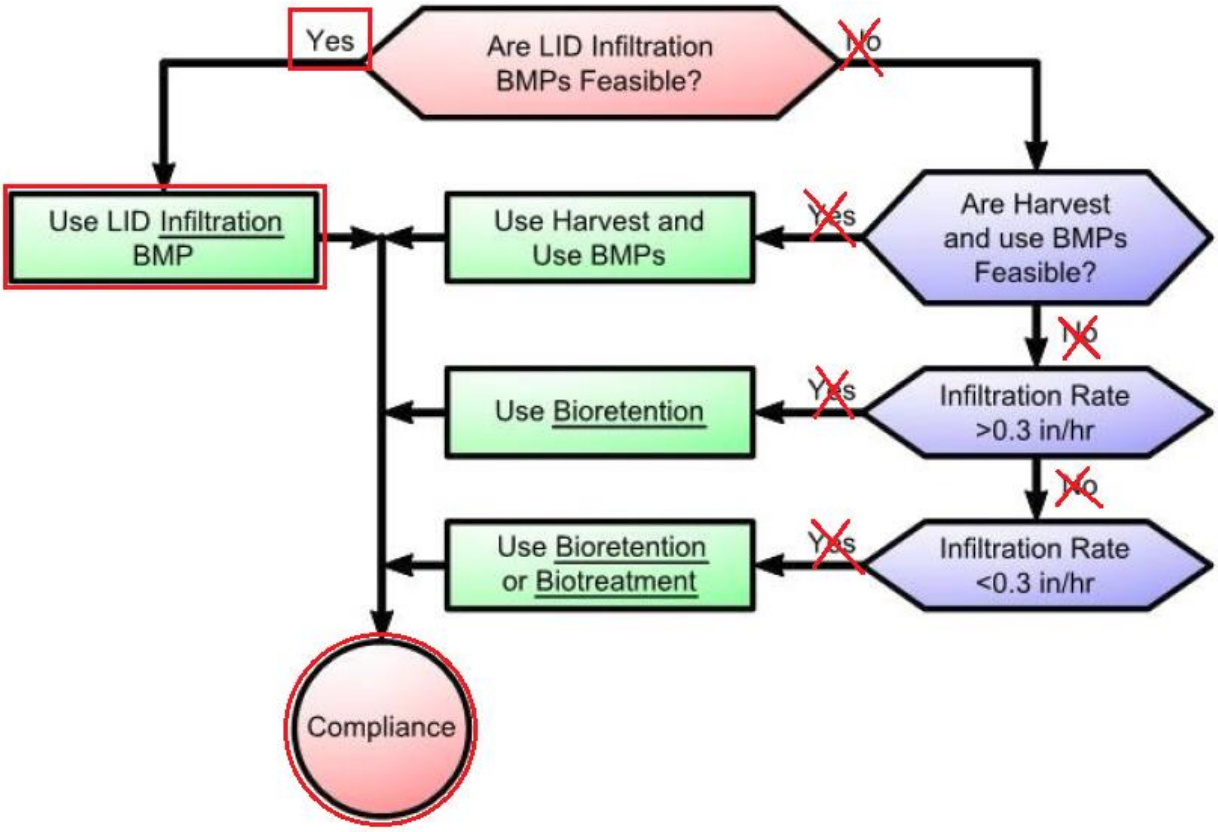
Phase I Environmental Site Assessment or Other Information on Past Site Use

N/A

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

The 2010 SAR MS4 Permit further requires that LID Retention BMPs (Infiltration or Harvest and Use) be used unless it can be shown that those BMPs are infeasible.



LID BMP Feasibility Flow Chart

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

PROJECT DESCRIPTION

The Riverside Hauling Yard project is located along Wilson Street and at the intersection between Wilson Street and Agua Mansa Road in the City of Jurupa, County of Riverside. It is located within Section 2 of Township 2 South, Range 5 West, Riverside County and being Assessor Parcels 175-180-012 and 175-180-016.

The proposed approximately 9.8-acre Riverside Hauling Yard project. The proposed project includes the following buildings:

- Office – 10,275 sf
- Maintenance Building – 19,137 sf
- AC paved area – 300,250 sf
- PCC paved area – 10,053 sf
- Landscape area – 46,960 sf

The Riverside Hauling Yard project is located along Wilson Street and at the intersection between Wilson Street and Agua Mansa Road in the City of Jurupa, County of Riverside. It is located within Section 2 of Township 2 South, Range 5 West, Riverside County.

The current, approximate 9.8 acres site, is a vacant and unpaved site with the natural drainage flowing North. The natural drainage course starts along site's frontage at Wilson Street and flows north where it collects into the existing soft bottom basins. There are two (2) soft bottom basins located along the north side of the site. Basin one, smaller of the two, is located on the north-west side and basin two is located at the north-center side of the site. During a rain event, the collected storm flows gets stored in the basins and then infiltrates into the surrounding ground. In the event that the storm volume exceeds available basin storage volume, the water will overtop the basins and continue flowing north to the adjacent dirt ditch that is located between the site's fence and existing railroad tracks. At this point the drainage will collect and pond a couple of feet in depth before leaving the site via existing culvert located at the north west side of the site adject to Agua Mansa Road.

There is an existing catch basin and storm drain pipes, 18-inch and 24-inch, in Wilson Street. The existing 24-inch storm drain enters the site and is terminated about 50-feet into the site. It appears that the 24-inch storm drain was build for the purpose of providing drainage outlet of future development.

The proposed site improvements will consist of erecting an employee office building and a cover maintenance building that will house a mechanic office, several maintenance and repair bays, paint booth and wash bay. Additionally, the site will also have a outside paved truck storage parking, a Natural Gas truck fueling station, and paved employee parking. The total square footage of proposed impervious improvements is approximately 7.8 acres.

The proposed drainage pattern will maintain the original drainage pattern and drain north where it then will be picked up by multiple catch basins which are designed to intersect and capture the 100-yr flow. Once the flow gets captured by the site's catch basins it will then be routed, via pipe, to a hydrodynamic

separator unit, followed by underground storage where it will infiltrate into the surrounding soil. The underground storage, per site owner's request, has been sized to capture and store a 25-yr 24-hr storm event.

In the event that the storm flow volume would exceed the underground storage capacity, the excess flow will spill into the proposed 24-inch storm drain and convey the flow to an existing 24-inch storm drain pipe that is located at the south-east side of the site.

In the unlikely scenario that the rain storm event would exceed the site's proposed drainage system or if the system will unable to perform as designed due to unforeseen failure, the storm water will pond along the north side of the site followed by overtopping the proposed curb and gutter and continuing to spill north into the existing earth ditch. From this point on the flow will follow existing drainage course as described in previous section.

Tabulation and Sizing Calculations

BMPs Sizing Calculation:

These calculations are based on approved methodologies within the currently active Municipal Separate Storm Sewer System (MS4) permits for Santa Ana River Watershed regions of Riverside County. All BMP designs are sized based on the design capture volume, V_{BMP}. However, there may be circumstances when flow based Treatment Control BMPs are utilized and therefore this section also includes method for calculating the design flow rate, Q_{BMP}.

Calculating V_{BMP}:

Volume based BMPs, including all of the BMPs in this report, are sized to capture and treat the design capture volume, V_{BMP}. As the method for calculating and documenting the design capture volume varies by watershed, the designer must first know which watershed the proposed project is within, and then follow the corresponding guidelines below. The watershed a particular project is within can be determined from the 'Locate my Watershed' tool available at: www.rcflood.org/npdes/

In order to meet Regional Water Quality Control Board (RWQCB) requirements, in the Santa Ana River Watershed the design capture volume (V_{BMP}) is based on capturing the volume of runoff generated from an 85th percentile, 24-hour storm event. Follow the steps using worksheet provided in the Handbook to calculate V_{BMP} in the Santa Ana River Watershed.

The Design Storm Depth (D_{85}) by locating the project site on the Isohyetal Map for the 85th Percentile 24-hour Storm Event is 0.66 inches.

See Isohyetal Map in Appendix 1.

Santa Ana Watershed

V_{BMP} and Q_{BMP} worksheets

These worksheets are to be used to determine the required

Design Capture Volume (V_{BMP})
or the
Design Flow Rate (Q_{BMP})

for BMPs in the Santa Ana Watershed

To verify which watershed your project is located within, visit

www.rcflood.org/npdes

and use the 'Locate my Watershed' tool

If your project is not located in the Santa Ana Watershed,

Do not use these worksheets! Instead visit

www.rcflood.org/npdes/developers.aspx

To access worksheets applicable to your watershed

Use the tabs across the bottom
to access the worksheets for the Santa Ana Watershed

Table 2-1: Impervious Fraction Based on Various Land Use Covers

Surface Type	Effective Impervious Fraction, I_f
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40

Effective Impervious Fraction for mixed surfaces Riverside Hauling Yard:

Use average Effective Impervious Fraction, EIF = 0.9 for Commercial Site areas, and Parking areas EIF = 0.95, consistent with Impervious Fraction for hydrology calculations.

See below Impervious cover table from Hydrology Manual:

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. (½ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas.

3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.

RCFC & WCD
HYDROLOGY MANUAL

IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE D-5.6

DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA – Area A1	Commercial (including building roof) site areas	94,525 (2.17 Ac)	"D", to BMP-A1
DMA – Area A2	Commercial (including building roof) site areas	51,401 (1.18 Ac)	"D", to BMP-A2
DMA – Area A3	Commercial (including building roof) site areas	38,333 (0.88 Ac)	"D", to BMP-A3
DMA – Area A4	Commercial (including building roof) site areas	378,101 (8.68 Ac)	"D", to BMP-A4

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: K&A Engineering, Inc. Date: 6/1/2021
Designed by: JY Case No:
Company Project Number/Name: Burrtec Waste Industries

BMP Identification

BMP NAME / ID: BMP-A, Drainage Area = 8.41 Ac

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} = 0.66 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)
A-1 (1.05 Ac)	45738	Mixed Surface Types	0.9	0.73	33401.6			
A-2 (1.12 Ac)	48787	Mixed Surface Types	0.9	0.73	35628.3			
A-3 (3.03 Ac)	131987	Mixed Surface Types	0.9	0.73	96387.7			
A-4 (0.72 Ac)	31363	Mixed Surface Types	0.95	0.81	25309.2			
A-5 (2.49 Ac)	108464	Mixed Surface Types	0.95	0.81	87528			
	366339	Total			278254.8	0.66	15304	15304

Notes:

The underground pipes storage is size for 25-year 24-hour storm runoff volume >>> DCV.

Infiltration Basin - Design Procedure (Rev. 03-2012)		BMP ID		Legend:	Required Entries / Calculated Cells	
Company Name:	K&A Engineering, Inc				Date:	6/3/2021
Designed by:	JY				County/City Case No.:	Burrtec

Design Volume

a) Tributary area (BMP subarea)	A_T =	8.41	acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	15,304	ft^3

Maximum Depth

a) Infiltration rate	I =	9.3	in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)	FS =	3	
c) Calculate D_1 $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times FS}$	D_1 =	18.6	ft
d) Enter the depth of freeboard (at least 1 ft)		1	ft
e) Enter depth to historic high ground water (measured from **top** of basin)		75	ft
f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin)		100	ft
g) D_2 is the smaller of: Depth to groundwater - (10 ft + freeboard) and Depth to impermeable layer - (5 ft + freeboard)	D_2 =	64.0	ft
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet	D_{MAX} =	18.6	ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1)	z =	4	:1
b) Proposed basin depth (excluding freeboard)	d_B =	4	ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)	A_S =	3826	ft^2
d) Proposed Design Surface Area	A_D =	24245	ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP})	Volume =	77	ft^3
b) Forebay depth (height of berm/splashwall. 1 foot min.)	Depth =	1	ft
c) Forebay surface area (minimum)	Area =	77	ft^2
d) Full height notch-type weir	Width (W) =	2.0	in

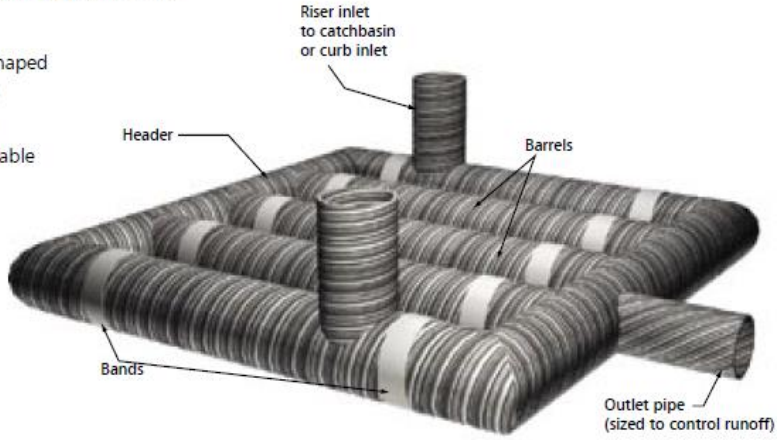
Notes:

Corrugated Metal Pipe

CMP Detention Systems

CONTECH CMP detention systems store stormwater runoff exceeding a site's allowable discharge rate and releases it slowly over time. These detention systems work as an integral part of the storm sewer system, and are designed to meet specific water quantity requirements.

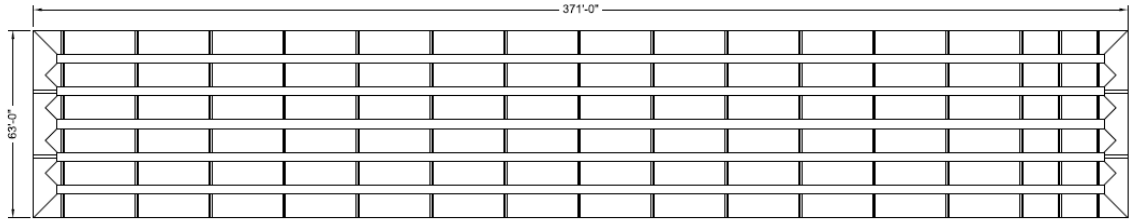
CONTECH's CMP detention systems are sized and shaped to fit a site's footprint and storage needs. They are installed below-grade to maximize property usage and lower development costs. The systems are available in all AASHTO M-36 Types.



WQ/Detention Basin Infiltration:

The infiltration rates are presented in the following table, after the water levels had stabilized.

Exploration No.	Infiltration Rate (inches per hour)	Depth of Test (feet)
Boring I-1	8.0	5
Boring I-2	10.6	5



DYO7381 Burrtec - Riverside
Underground Storage and Infiltration
Corona, CA
DETENTION SYSTEM

STORAGE SUMMARY

- STORAGE VOLUME REQUIRED = 113,300 cf.
- PIPE STORAGE VOLUME = 113,399 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 113,399 cf.

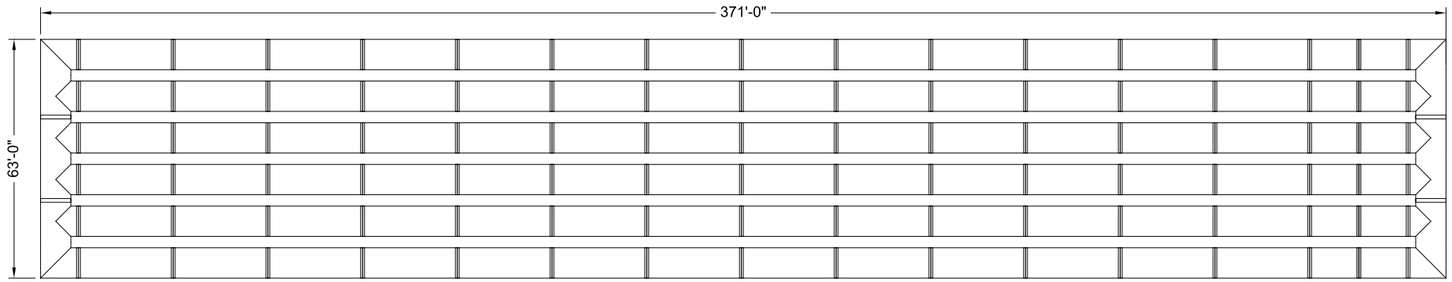
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20 & HS25
- APPROX. LINEAR FOOTAGE = 2,256 lf.

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 113,300 cf.
- PIPE STORAGE VOLUME = 113,399 cf.
- BACKFILL STORAGE VOLUME = 0 cf.
- TOTAL STORAGE PROVIDED = 113,399 cf.

PIPE DETAILS
- DIAMETER = 96 IN.
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = Perforated
- BARRELL SPACING = 36 IN.

BACKFILL DETAILS
- WIDTH AT ENDS = 12 IN.
- ABOVE PIPE = 0 IN.
- WIDTH AT SIDES = 12 IN.
- BELOW PIPE = 0 IN.



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 40'

DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH® CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO7381 Burrtec - Riverside
Underground Storage and Infiltration
Corona, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
4606	7381	4/28/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D1		

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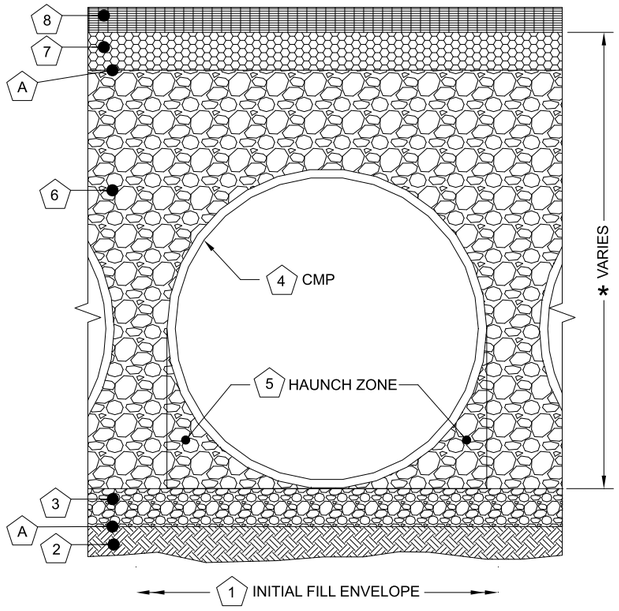


Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
Material Location	Description	Material Designation	Designation
8 Rigid or Flexible Pavement (if applicable)			
7 Road Base (if applicable			
A Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration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

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

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

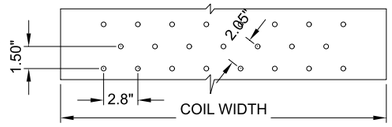
BACKFILL

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

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

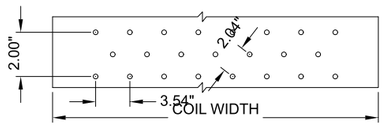
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

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



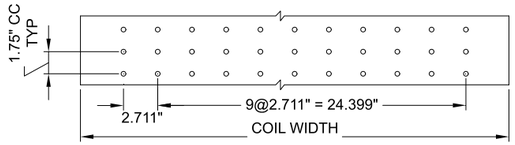
OPEN AREA = 3.76 SQ IN/SQ FT

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



OPEN AREA = 4.16 SQ IN/SQ FT

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



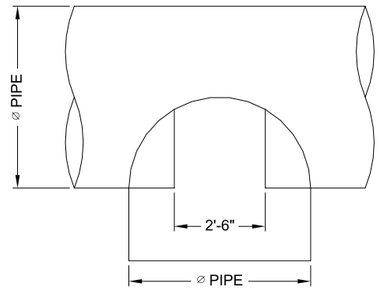
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES:

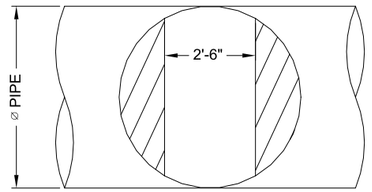
1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES ⌀3/8".

TYPICAL PERFORATION DETAIL

SCALE: N.T.S.



PLAN

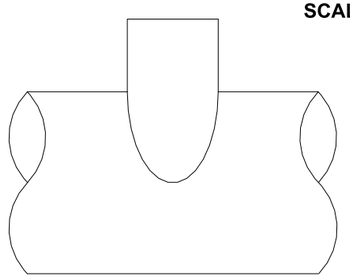


FRONT

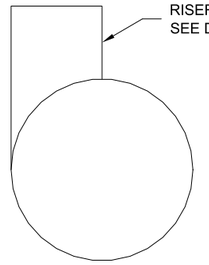
TYPICAL MANWAY DETAIL

SCALE: N.T.S.

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



ELEVATION

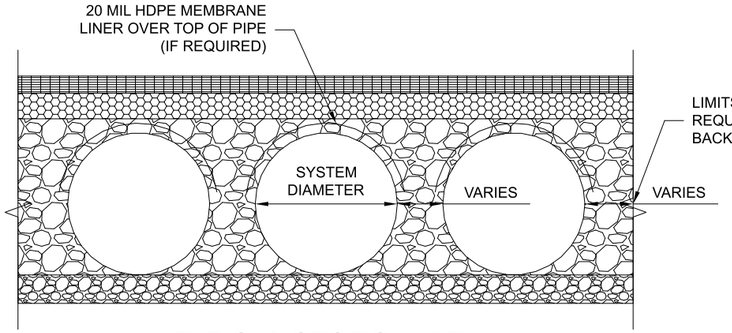


END

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

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

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

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CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO7381 Burrtec - Riverside
Underground Storage and Infiltration
Corona, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
4606	7381	4/28/2021
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D2		

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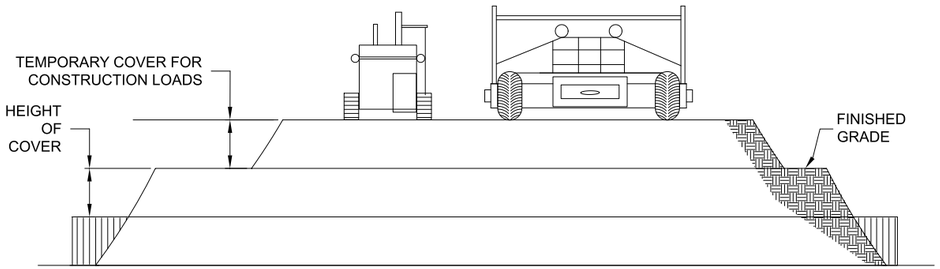


CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

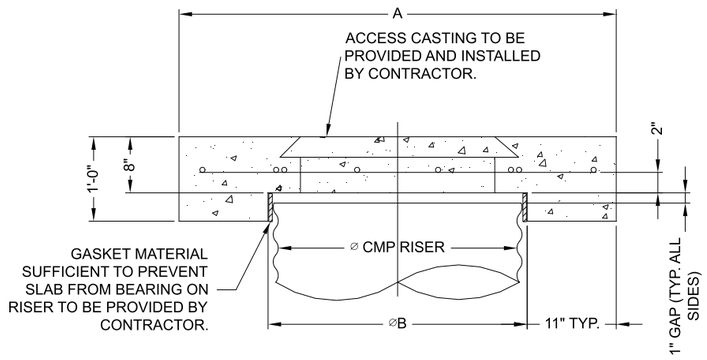
APPLICABLE POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

APPLICABLE
HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.
REQUIREMENTS
INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

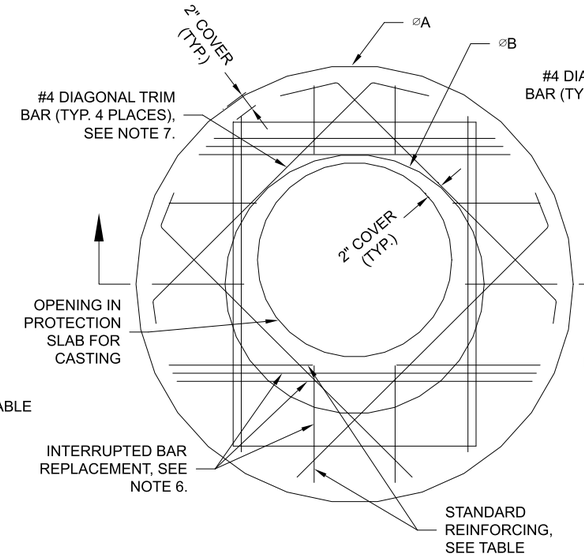
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



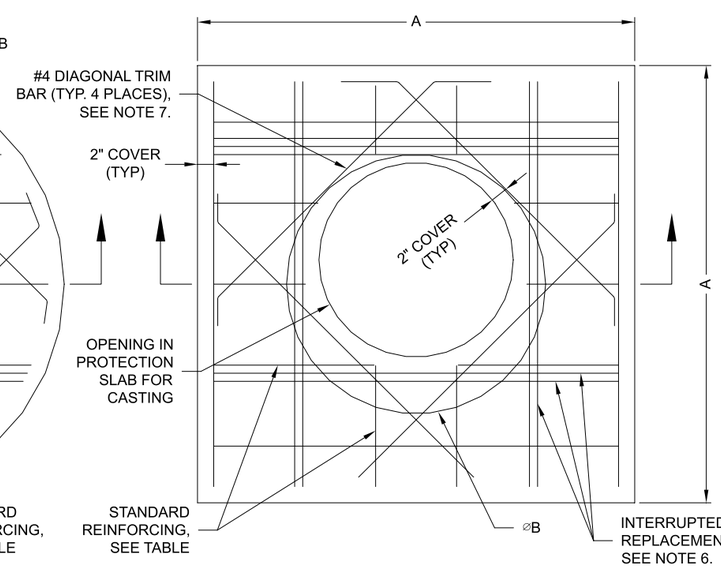
SECTION VIEW

REINFORCING TABLE				
⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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SHEET NO.: D3		

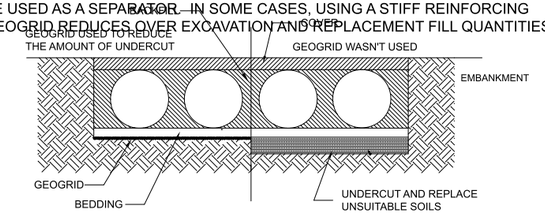
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

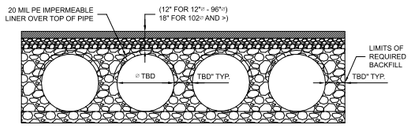


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING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

GEOMEMBRANE BARRIER

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

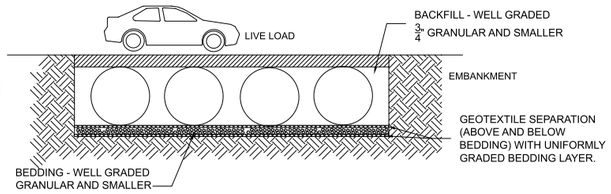
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE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



IN-SITU TRENCH WALL

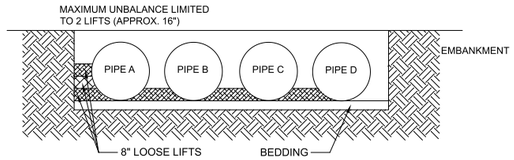
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION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

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



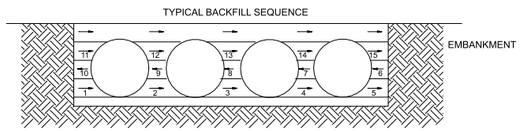
BACKFILL PLACEMENT

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

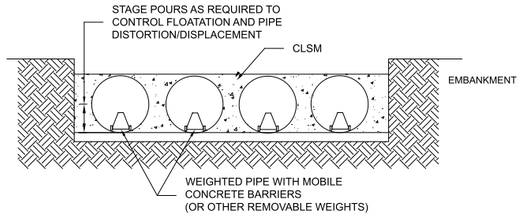


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE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

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

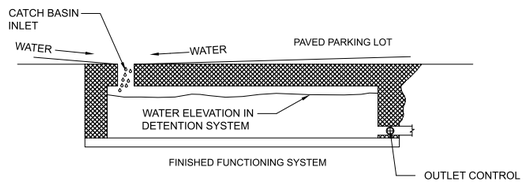


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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DYO7381 Burrtec - Riverside
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CHECKED: DYO	APPROVED: DYO	
SHEET NO.: D4		

Santa Ana Watershed - BMP Design Flow Rate, Q_{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	K&A Engineering, Inc.	Date	6/1/2021
Designed by	JY	Case No	
Company Project Number/Name	Burrtec Waste Industries		

BMP Identification

BMP NAME / ID: BMP A-1 thru A-3, Drainage Area = 5.20 Ac

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Rainfall Intensity (in/hr)	Design Flow Rate (cfs)	Proposed Flow Rate (cfs)
A-1 (1.05 Ac)	45738	Mixed Surface Types	0.9	0.73	33401.6			
A-2 (1.12 Ac)	48787	Mixed Surface Types	0.9	0.730282	35628.3			
A-3 (3.03 Ac)	131987	Mixed Surface Types	0.9	0.730282	96387.7			
	226512	Total			165417.6	0.20	0.8	0.8

Santa Ana Watershed - BMP Design Flow Rate, Q_{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: K&A Engineering, Inc. Date: 6/1/2021
Designed by: JY Case No:
Company Project Number/Name: Burrtec Waste Industries

BMP Identification

BMP NAME / ID: BMP A-4 and A-5, Drainage Area = 3.21 Ac

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Rainfall Intensity (in/hr)	Design Flow Rate (cfs)	Proposed Flow Rate (cfs)
A-4 (0.72 Ac)	31363	Mixed Surface Types	0.95	0.81	25309.2			
A-5 (2.49 Ac)	108464	Mixed Surface Types	0.95	0.80698	87528			
	139827	Total			112837.2	0.20	0.5	0.5

Pre-treatment BMP:

CDS® Models and Capacities

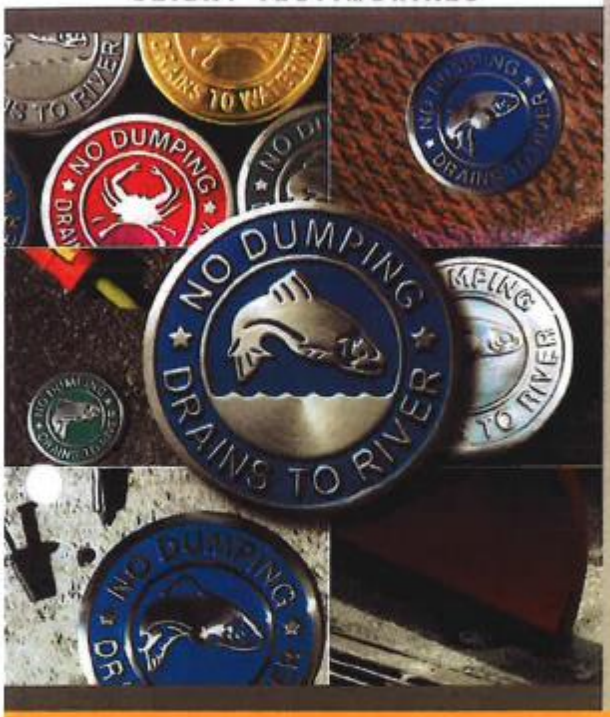
	CDS MODEL	Treatment Flow Rates[1]			Estimated Maximum Peak Conveyance Flow[3] (cfs)/(L/s)	Minimum Sump Storage Capacity[4] (yd^3)/(m^3)	Minimum Oil Storage Capacity[4] (gal)/(L)
		75 microns (cfs)/(L/s)	125 microns[2] (cfs)/(L/s)	Trash & Debris (cfs)/(L/s)			
PRECAST	CDS2015-4	0.5 (14.2)	0.7 (19.8)	1.0 (28.3)	10 (283)	0.9 (0.7)	61 (232)
	CDS2015-5	0.5 (14.2)	0.7(19.8)	1.0 (28.3)	10 (283)	1.5 (1.1)	83 (313)
	CDS2020-5	0.7 (19.8)	1.1 (31.2)	1.5 (42.5)	14 (396)	1.5 (1.1)	99 (376)
	CDS2025-5	1.1 (31.2)	1.6 (45.3)	2.2 (62.3)	14 (396)	1.5 (1.1)	116 (439)
	CDS3020-6	1.4 (39.6)	2.0 (56.6)	2.8 (79.3)	20 (566)	2.1 (1.6)	184 (696)
	CDS3025-6	1.7 (48.1)	2.5 (70.8)	3.5 (99.2)	20 (566)	2.1 (1.6)	210 (795)
	CDS3030-6	2.0 (56.6)	3.0 (85.0)	4.2 (118.9)	20 (566)	2.1 (1.6)	236 (895)
	CDS3035-6	2.6 (73.6)	3.8 (106.2)	5.3 (150.0)	20 (566)	2.1 (1.6)	263 (994)
	CDS4030-8	3.1 (87.7)	4.5 (127.4)	6.3 (178.3)	30 (850)	5.6 (4.3)	426 (1612)
	CDS4040-8	4.1 (116.1)	6.0 (169.9)	8.4 (237.8)	30 (850)	5.6 (4.3)	520 (1970)
	CDS4045-8	5.1 (144.4)	7.5 (212.4)	10.5 (297.2)	30 (850)	5.6 (4.3)	568 (2149)
	CDS5640-10	6.1 (172.7)	9.0 (254.9)	12.6 (356.7)	50 (1416)	8.7 (6.7)	758 (2869)
	CDS5653-10	9.5 (268.9)	14.0 (396.5)	19.6 (554.8)	50 (1416)	8.7 (6.7)	965 (3652)
	CDS5668-10	12.9 (365.1)	19.0 (538.1)	26.6 (752.9)	50 (1416)	8.7 (6.7)	1172 (4435)
	CDS5678-10	17.0 (481.2)	25.0 (708.0)	35.0 (990.7)	50 (1416)	8.7 (6.7)	1309 (4956)
	CDS9280-12	27.2 (770.2)	40.0 (1132.7)	56.0 (1585.7)	Offline	16.8 (12.8)	N/A
	CDS9290-12	35.4 (1002.4)	52.0 (1472.5)	72 (2038.8)		16.8 (12.8)	
	CDS92100-12	42.8 (1212.0)	63.0 (1783.9)	88 (2491.9)		16.8 (12.8)	
CE	CDS150134-22	100.7 (2851.5)	148.0 (4190.9)	270 (7645.6)		56.3 (43.0)	

A-4 & A-5

A-1 thru A-3

STORM DRAIN MARKERS

CLIENT TESTIMONIALS



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- JOSH WINTERS
MACTEC FEDERAL PROGRAMS INC.

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Almetek's Markers last a lifetime and are cost effective

Our attractive 4" Disc, 3-D embossed, metal, Storm Drain Markers will last for decades. They may even last a lifetime. These markers are so strong that they are virtually indestructible.

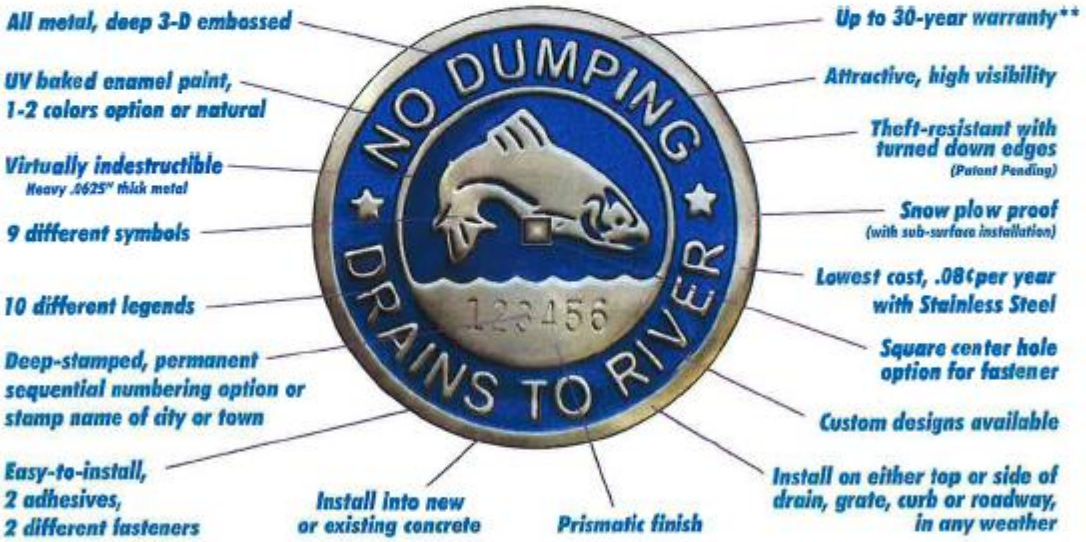
The Perfect Marker!
Almetek's metal markers have been engineered to perfection. They install easily, quickly and will remain permanently in place. Our patent pending sub-surface mounting installation with the turned down edges will ensure against theft and snow plow displacement. Our markers can be installed on the roadway, curb, storm drain grate or head. We are so sure of this product and its installation process that we will replace any missing marker with a brand new one, totally **FREE OF CHARGE.***

The Price is Right!
The price for stainless is less expensive than you think. A plastic marker may be pennies less initially, but in the long term, it will be more than three times expensive. Look at the facts.

Plastic isn't as durable as stainless steel. The estimated life of a domed marker is approximately 7 1/2 years and some customers are telling us that the plastic markers are failing after two years. During the span of 30 years, with a domed marker, you may need to replace it, at least, 4 times. The typical cost of a domed marker of $1.95 and replacing 4 times, will cost you, without inflation and re-installation cost, $7.80. Our stainless steel marker will only cost $2.39 (500 order) and no replacement cost for 30-years. The final fact: you will save at least $5.40 per marker with Almetek's Stainless Steel Marker.

Now you know the facts.
Go ahead and compare our Storm Drain Marker's advantages.

Our Storm Drain Marker's Advantages



Patent pending sub-surface mounting.
See back page for all installation options.

BACK VIEW
Back has cavities for better adhesion.

CUSTOM IMPRINT
Optional: Engrave your City or Town or GPS location

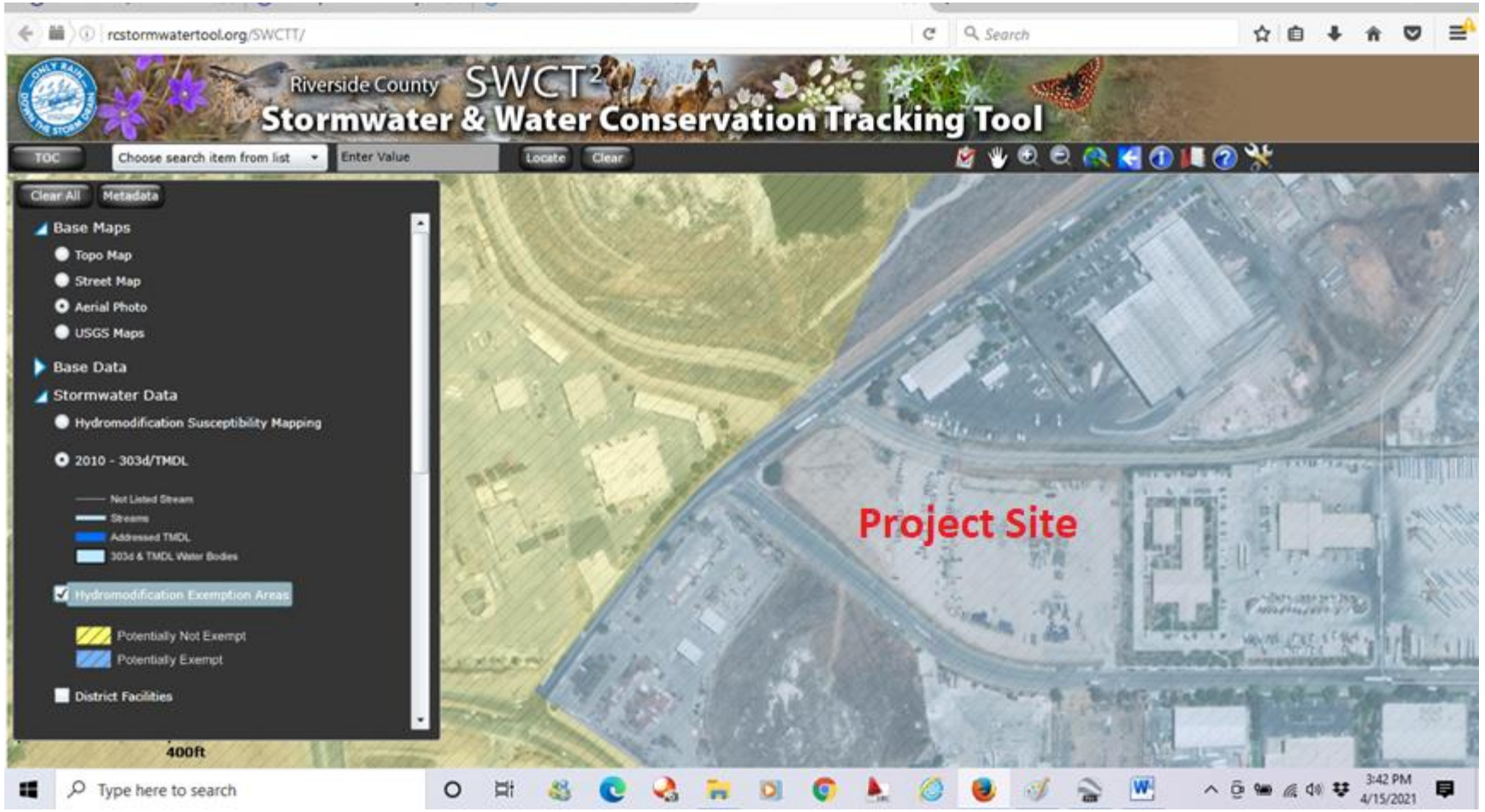
* Provided that you have purchased our fasteners, adhesive & sub-surface installation tool and followed all installation instructions.
** Stainless & Brass- 30-years, Aluminum and Anodized Aluminum, 15-years. Call for Almetek's Metal Storm Drain Warranty Certificate.

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Project Site is in Hydromodification Exemption Areas (see Map in the following page).

Total project site is within the **NOT Applicable Area** per the HCOC Applicable Map, **therefore HCOC mitigation were not provided.**


rcstormwatertool.org/SWCTT/
Search
Riverside County SWCT²
Stormwater & Water Conservation Tracking Tool
TOC
Choose search item from list
Enter Value
Locate
Clear
Clear All
Metadata
Base Maps
Topo Map
Street Map
Aerial Photo
USGS Maps
Base Data
Stormwater Data
Hydromodification Susceptibility Mapping
2010 - 303d/TMDL
Not Listed Stream
Streams
Addressed TMDL
303d & TMDL Water Bodies
Hydromodification Exemption Areas
Potentially Not Exempt
Potentially Exempt
District Facilities
400ft
Project Site
Type here to search
3:42 PM
4/15/2021

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

Source Control BMPs

Potential Sources of Runoff Pollutants	Permanent Controls—Show on WQMP Drawings	Permanent Controls—List in WQMP Table and Narrative	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.
☐ 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	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	☒ Maintain landscaping using minimum or no pesticides. ☒ See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at

	landscape areas, if any. ☒ Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)	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.	http://rcflood.org/stormwater/Error! Hyperlink reference not valid. ☒ Provide IPM information to new owners, lessees and operators.
☐ 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	☐ 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.

	discharging to the sanitary sewer.		
☒ 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 runon 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
☐ 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/
☐ 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 runon or run-off from area. ☐ Storage of non-hazardous liquids shall be covered by a	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	☐ 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

	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.	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/	
☐ 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 shutoff 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.	☐ 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.

	(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.		
☒ 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/
☐ 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.		☐ 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
☐ 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		☐ 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

	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.		
☐ 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.	
☒ 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

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

Maintenance Responsibility

With the project site being in the City limits, the Property Owner will have ongoing maintenance responsibilities. Site design and treatment BMPs have been designed to keep maintenance efforts in line with Riverside Hauling Yard project maintenance activities.

Property Owner Maintenance Responsibilities: CDS Pre-treatment and Underground perforated pipes with gravel Infiltration BMPs, Landscape maintenance of common areas, landscape and parking areas within the project.

General Operation and Maintenance Activities

Operation and maintenance (O&M) activities are described below. The categories of O&M activities are "routine" and "major" where routine refer to activity conducted on a regular schedule, whereas major refers to infrequent activities triggered mainly by need. Each category and its respective activities are described in the following sections.

<u>Routine Operation and Maintenance Activities</u>
O&M responsibility, initially by Developer/Builder until the establishment of Property Owner. O&M, normally performed by Property Owner maintenance crews as part of normal/scheduled maintenance activities.

Site Inspection
The storm drain inlets will be inspected on a regular, scheduled basis to ensure that the facility is operating properly, to record observations, and to initiate any actions that may be required. While the frequency of site inspections may vary depending on the season, it will typically be on a monthly basis.

Trash & Debris Removal
Litter may be picked up at any time during site visits for other purposes. Regular, scheduled trash/debris removal will be performed at all sites on a quarterly basis and/or after storm events that result in heavy trash accumulations.

Minor Vegetation Removal/Thinning
Vegetation growth will be inspected annually, and removed or thinned as necessary. Vegetation at inlets and outlets will be manually or mechanically removed if vegetation is found to be clogging or otherwise affecting the operation of the facility. Access roads will remain clear of vegetation and obstructions. Significant vegetation removal is covered under the major maintenance activities section below.

Snag Removal
This work typically includes the removal of sticks, dead branches, brush, and small trees that block water flow or otherwise interfere with the operations. This work may be performed as needed on a quarterly basis.

Minor Sediment Removal
It is expected that there will be a minor amount of sediment deposition at points within the storm drain inlet, primarily in forebay(s) near the inlet(s). When such deposits obstruct water flow, the deposits will be removed.

Major Operation and Maintenance Activities

Operation and maintenance (O&M) requirements for all Source Control and Treatment Control BMPs shall be identified within this report. The O&M shall include the following:

- Description and Schedule
- Inspection & Monitoring requirements
- Identification of Responsible Parties

The owner of the property, and its successors and assigns is responsible for implementation of this WQMP or BMPs for the project site.

O&M MAINTENANCE/FREQUENCY MATRIX		
BEST MANAGEMENT PRACTICES (BMPs)	**INSPECTION FREQUENCY**	**MAINTENANCE REPAIR PROGRAM**
Source Control BMPs		
1. Education For Property owner, tenants and occupants, Maintenance staffs, contracted maintenance crews.	Training and education program must be provided within 6 months of hire date and annually thereafter. Materials are included in the Project WQMP.	Educational materials and training will be provided to Property owner, tenants and occupants, Maintenance staff members, and contracted maintenance crews if any, including education materials and restrictions to reduce pollutants from reaching the storm drain system.
2. Activity Restriction	Daily activity of Operation	The project will establish the following policies prohibiting activities during operations: - Prohibit discharge of fertilizer, pesticide, or animal waste to street or storm drain. - Prohibit blowing or sweeping of debris (leaf litter, grass clippings, litter, etc.) into street or storm drain. - Require dumpster lid to be closed at all times. - Prohibit discharge of paint or masonry waste to street or storm drain. - Prohibit vehicle washing, maintenance or repair on premises.
3. Common Area Landscape Management	Quarterly, as seasonal changes.	The PO management shall direct maintenance staff to employ landscaping practices be consistent with the City requirements for use of fertilizer, pesticides, and County ordinances for

		water conservation.
4. Drainage Facility Inspection and Maintenance	Inspect semiannually for beginning (October) and end of the wet season (April).	Maintenance personnel shall remove debris/sediments if necessary within the inlet area. .
5. MS4 Stenciling and Signage	As needed to clearly depict signage.	Replace or repaint as needed.
6. Protect Slopes and Channels	Inspect semiannually and before and after storm events.	Repair BMP and slopes as needed.
Treatment Control BMPs		
7. CDS Units – Pre-treatment BMPs	Inspect semiannually for beginning (October) and end of the wet season (April).	Maintenance personnel shall repair trench surface as needed and remove debris/sediments if necessary.
8. Underground perforated pipes with gravel by Contech - Infiltration BMP	Inspect semiannually for beginning (October) and end of the wet season (April).	Maintenance personnel shall repair trench surface as needed and remove debris/sediments if necessary.

Inspection and Maintenance Forms (sample):

Basin Site Inspection Summary Form

General Information

Date: Time: Inspector Name:

Sediment and Erosion Control Information		**Maintenance Required?**
What is the sediment depth, in inches?		
Does this exceed 18 inches or 10% of the basin volume?	❒Yes ❒No	❒Yes ❒No
What is the sediment type and location (where is the sediment accumulation located? (Inlet/outlet?))		
Is there standing water (more than 72-hours after storm event)? If answer is yes, immediate maintenance is required.	❒Yes ❒No	❒Yes ❒No
If yes, how deep is the water, in inches? Where is it located? Inlet/outlet?		
Is there any evidence of erosion? If yes, maintenance is required.	❒Yes ❒No	❒Yes ❒No
Is there any evidence of embankment slumping or cracking? If yes, maintenance is required.	❒Yes ❒No	❒Yes ❒No

Vegetation Information		**Maintenance Required?**
Is there vegetation greater than 18 inches high? If yes, maintenance may be required.	❒Yes ❒No	❒Yes ❒No
Does vegetation cover the entire floor and/or all slopes of the basin? If no, revegetation may be required.	❒Yes ❒No	❒Yes ❒No
Do the irrigation valves function properly and water adequately?	❒Yes ❒No	❒Yes ❒No
Is there dead or dying vegetation on the bottom of the basin? If yes, maintenance is required.	❒Yes ❒No	❒Yes ❒No

Structural Information		**Maintenance Required?**
Are the rocks and riprap clear of sediment? (These are located at both the basin pipe inlets and basin pipe outlet). If no, maintenance is required.	❒Yes ❒No	❒Yes ❒No
Does the CDS Unit need to be cleaned?	❒Yes ❒No	❒Yes ❒No
Any blockage or sediment in outlet structure? If yes, maintenance is required.	❒Yes ❒No	❒Yes ❒No
Is there evidence of concrete scour or cracking of structural parts? If yes, and considered major, maintenance is required.	❒Yes ❒No	❒Yes ❒No
In what condition are the fences and locks?	❒OK ❒Not OK ❒Not applicable	❒Yes ❒No
Basin access road accessible? If not, repair or maintenance is required.	❒OK ❒Not OK ❒Not applicable	❒Yes ❒No
Are there any other general maintenance concerns?		

Aesthetic Concerns		**Maintenance Required?**
Is there any non-trash debris? If so, maintenance may be required.	❒Yes ❒No	❒Yes ❒No
Is there any trash? If so, maintenance may be required.	❒Yes ❒No	❒Yes ❒No
Is there any graffiti? If so, maintenance may be required.	❒Yes ❒No	❒Yes ❒No

Non-Storm Water Concerns		**Maintenance Required?**
Are there any non-storm water discharges to the basin? If persistent, investigate upstream of the basin is repairs are needed (i.e., broken sprinklers).	❒Yes ❒No	❒Yes ❒No

Basin Maintenance Summary Form

General Information		
Date:	**Time:**	**Inspector Name:**

Sediment and Erosion Control Information	
Was sediment removal or sediment management performed?	❒Yes ❒No
Was erosion repair (including vegetative stabilization performed)?	❒Yes ❒No
Was embankment/slope repair performed?	❒Yes ❒No
Was any other maintenance performed? *(Describe)*	❒Yes ❒No

Vegetation Information	
Was basin grass mowing/trimming performed?	❒Yes ❒No
Was vegetation trimming/tree pruning performed?	❒Yes ❒No
Was basin vegetation replanting performed?	❒Yes ❒No
Was weed control performed?	❒Yes ❒No

Structural Information	
Were any structural repairs performed? *(Describe)*	❒Yes ❒No
Was the CDS Unit cleaned?	❒Yes ❒No

Aesthetic Concerns	
Was debris and trash removal performed?	❒Yes ❒No
Was graffiti removal performed?	❒Yes ❒No
Was any other maintenance performed? *(Describe)*	❒Yes ❒No

Basin Maintenance Log

Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Date: **Inspector Name:** **Basin:**

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Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Date: **Inspector Name:** **Basin:**

Maintenance Performed:

Appendix 10: Educational Materials

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

The Ocean Begins at Your Front Door

Never allow pollutants to enter the street, gutter or storm drain!

Follow these simple steps to help reduce water pollution:

Household Activities

- Do not rinse spills with water. Use dry cleanup methods such as applying cat litter or another absorbent material, sweep and dispose of in the trash. Take items such as used or excess batteries, oven cleaners, automotive fluids, painting products and cathode ray tubes, like TVs and computer monitors, to a Household Hazardous Waste Collection Center (HHWCC).
- For a HHWCC near you call (714) 834-6752 or visit www.oclandfills.com.
- Do not hose down your driveway, sidewalk or patio to the street, gutter or storm drain. Sweep up debris and dispose of it in the trash.

Automotive

- Take your vehicle to a commercial car wash whenever possible. If you wash your vehicle at home, choose soaps, cleaners, or detergents labeled non-toxic, phosphate- free or biodegradable. Vegetable and citrus-based products are typically safest for the environment.
- Do not allow washwater from vehicle washing to drain into the street, gutter or storm drain. Excess washwater should be disposed of in the sanitary sewer (through a sink or toilet) or onto an absorbent surface like your lawn.
- Monitor your vehicles for leaks and place a pan under leaks. Keep your vehicles well maintained to stop and prevent leaks.
- Never pour oil or antifreeze in the street, gutter or storm drain. Recycle these substances at a service station, a waste oil collection center or used oil recycling center. For the nearest Used Oil Collection Center call 1-800-CLEANUP or visit www.1800cleanup.org.

Pool Maintenance

- Pool and spa water must be dechlorinated and free of excess acid, alkali or color to be allowed in the street, gutter or storm drain.
- When it is not raining, drain dechlorinated pool and spa water directly into the sanitary sewer.
- Some cities may have ordinances that do not allow pool water to be disposed of in the storm drain. Check with your city.

Landscape and Gardening

- Do not over-water. Water your lawn and garden by hand to control the amount of water you use or set irrigation systems to reflect seasonal water needs. If water flows off your yard onto your driveway or sidewalk, your system is over-watering. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of waste by composting, hauling it to a permitted landfill, or as green waste through your city's recycling program.
- Follow directions on pesticides and fertilizer, (measure, do not estimate amounts) and do not use if rain is predicted within 48 hours.
- Take unwanted pesticides to a HHWCC to be recycled. For locations and hours of HHWCC, call (714) 834-6752 or visit www.oclandfills.com.

Trash

- Place trash and litter that cannot be recycled in securely covered trash cans.
- Whenever possible, buy recycled products.
- Remember: Reduce, Reuse, Recycle.

Pet Care

- Always pick up after your pet. Flush waste down the toilet or dispose of it in the trash. Pet waste, if left outdoors, can wash into the street, gutter or storm drain.
- If possible, bathe your pets indoors. If you must bathe your pet outside, wash it on your lawn or another absorbent/permeable surface to keep the washwater from entering the street, gutter or storm drain.
- Follow directions for use of pet care products and dispose of any unused products at a HHWCC.

Common Pollutants

Home Maintenance

- Detergents, cleaners and solvents
- Oil and latex paint
- Swimming pool chemicals
- Outdoor trash and litter

Lawn and Garden

- Pet and animal waste
- Pesticides
- Clippings, leaves and soil
- Fertilizer

Automobile

- Oil and grease
- Radiator fluids and antifreeze
- Cleaning chemicals
- Brake pad dust

Did You Know?

- Most people believe that the largest source of water pollution in urban areas comes from specific sources such as factories and sewage treatment plants. In fact, the largest source of water pollution comes from city streets, neighborhoods, construction sites and parking lots. This type of pollution is sometimes called "non-point source" pollution.
- There are two types of non-point source pollution: stormwater and urban runoff pollution.
- Stormwater runoff results from rainfall. When rainstorms cause large volumes of water to rinse the urban landscape, picking up pollutants along the way.
- Urban runoff can happen any time of the year when excessive water use from irrigation, vehicle washing and other sources carries trash, lawn clippings and other urban pollutants into storm drains.

Where Does It Go?

- Anything we use outside homes, vehicles and businesses – like motor oil, paint, pesticides, fertilizers and cleaners – can be blown or washed into storm drains.
- A little water from a garden hose or rain can also send materials into storm drains.
- Storm drains are separate from our sanitary sewer systems; unlike water in sanitary sewers (from sinks or toilets), water in storm drains is not treated before entering our waterways.

Sources of Non-Point Source Pollution

- Automotive leaks and spills.
- Improper disposal of used oil and other engine fluids.
- Metals found in vehicle exhaust, weathered paint, rust, metal plating and tires.
- Pesticides and fertilizers from lawns, gardens and farms.
- Improper disposal of cleaners, paint and paint removers.
- Soil erosion and dust debris from landscape and construction activities.
- Litter, lawn clippings, animal waste, and other organic matter.
- Oil stains on parking lots and paved surfaces.

The Effect on the Ocean

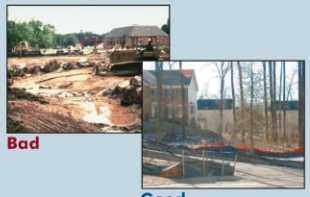
Non-point source pollution can have a serious impact on water quality in Orange County. Pollutants from the storm drain system can harm marine life as well as coastal and wetland habitats. They can also degrade recreation areas such as beaches, harbors and bays.

Stormwater quality management programs have been developed throughout Orange County to educate and encourage the public to protect water quality, monitor runoff in the storm drain system, investigate illegal dumping and maintain storm drains.

Support from Orange County residents and businesses is needed to improve water quality and reduce urban runoff pollution. Proper use and disposal of materials will help stop pollution before it reaches the storm drain and the ocean.

Stormwater and the Construction Industry

Protect Natural Features



Bad

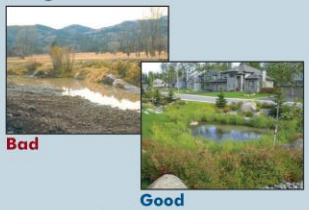
Good

- Minimize clearing.
- Minimize the amount of exposed soil.
- Identify and protect areas where existing vegetation, such as trees, will not be disturbed by construction activity.
- Protect streams, stream buffers, wild woodlands, wetlands, or other sensitive areas from any disturbance or construction activity by fencing or otherwise clearly marking these areas.

Construction Phasing

- Sequence construction activities so that the soil is not exposed for long periods of time.
- Schedule or limit grading to small areas.
- Install key sediment control practices before site grading begins.
- Schedule site stabilization activities, such as landscaping, to be completed immediately after the land has been graded to its final contour.

Vegetative Buffers



Bad

Good

- Protect and install vegetative buffers along waterbodies to slow and filter stormwater runoff.
- Maintain buffers by mowing or replanting periodically to ensure their effectiveness.

Silt Fencing

Bad

Good

- Inspect and maintain silt fences after each rainstorm.
- Make sure the bottom of the silt fence is buried in the ground.
- Securely attach the material to the stakes.
- Don't place silt fences in the middle of a waterway or use them as a check dam.
- Make sure stormwater is not flowing around the silt fence.

Maintain your BMPs!

IN RIVERSIDE COUNTY....Call 1-800-506-2555
TO REPORT ILLEGAL STORMDRAIN DISPOSAL

E-mail: Flood.fcnpdes@co.riverside.ca.us
Visit our website: www.floodcontrol.co.riverside.ca.us

Brought to you by the Storm Water/Clean Water Pollution Protection Program.....
REMEMBER, ONLY RAIN IN THE STORMDRAIN!

Site Stabilization

Bad

Good

- Vegetate, mulch, or otherwise stabilize all exposed areas as soon as land alterations have been completed.

Construction Entrances

Bad

Good

- Remove mud and dirt from the tires of construction vehicles before they enter a paved roadway.
- Properly size entrance BMPs for all anticipated vehicles.
- Make sure that the construction entrance does not become buried in soil.

Slopes

Bad

Good

- Rough grade or terrace slopes.
- Break up long slopes with sediment barriers, or under drain, or divert stormwater away from slopes.

Dirt Stockpiles

Bad

Good

- Cover or seed all dirt stockpiles.

Storm Drain Inlet Protection

Bad

Good

- Use rock or other appropriate material to cover the storm drain inlet to filter out trash and debris.
- Make sure the rock size is appropriate (usually 1 to 2 inches in diameter).
- If you use inlet filters, maintain them regularly.

www.epa.gov/npdes/menuofbmps

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.

- 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

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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

– 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.

Non-Stormwater Discharges SC-10

Objectives

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

Description

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

Targeted Constituents

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

Approach

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

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Pollution Prevention

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

Suggested Protocols

Recommended Complaint Investigation Equipment

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

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

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

Visual Inspection and Inventory

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

Review Infield Piping

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

Smoke Testing

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

Dye Testing

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

TV Inspection of Drainage System

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

Illegal Dumping

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

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

Once a site has been cleaned:

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

Inspection

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

Reporting

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

Training

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

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

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

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

Requirements

Costs (including capital and operation & maintenance)

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

Maintenance (including administrative and staffing)

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

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes
- Patterns in time of occurrence (time of day/night, month, or year)
- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
- Responsible parties

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

What constitutes a "non-stormwater" discharge?

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

Permit Requirements

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

Performance Evaluation

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

References and Resources

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

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

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

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

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

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Description

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

Targeted Constituents

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

Approach

Pollution Prevention

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

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

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

Pump Stations

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

Open Channel

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

Illicit Connections and Discharges

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

- Are there any odors associated with the drainage system?
- Record locations of apparent illegal discharges/illicit connections?
- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- Eliminate the discharge once the origin of flow is established.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

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

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

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.
- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

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

Requirements

Costs

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

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

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

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

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

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

References and Resources

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

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http://www.co.clark.wa.us/pubworks/bmpman.pdf

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