Thienes Engineering, Inc.
CIVIL ENGINEERING ● LAND SURVEYING

PROJECT SPECIFIC PRELIMINARY WATER QUALITY MANAGEMENT PLAN
(P-WQMP)

FOR:
PEN20-0162 / LWQ20-0026
LDC - ALESSANDRO
NORTHEAST CORNER OF ALESSANDRO BOULEVARD AND DAY STREET
MORENO VALLEY, CA 92553
APNs: 291-191-04, -07, -08, -09, -10, -11, -12, -13, -25, -26, -27, -28 & -29

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AUGUST 11, 2020
DECEMBER 28, 2020

JOB NO. 3846

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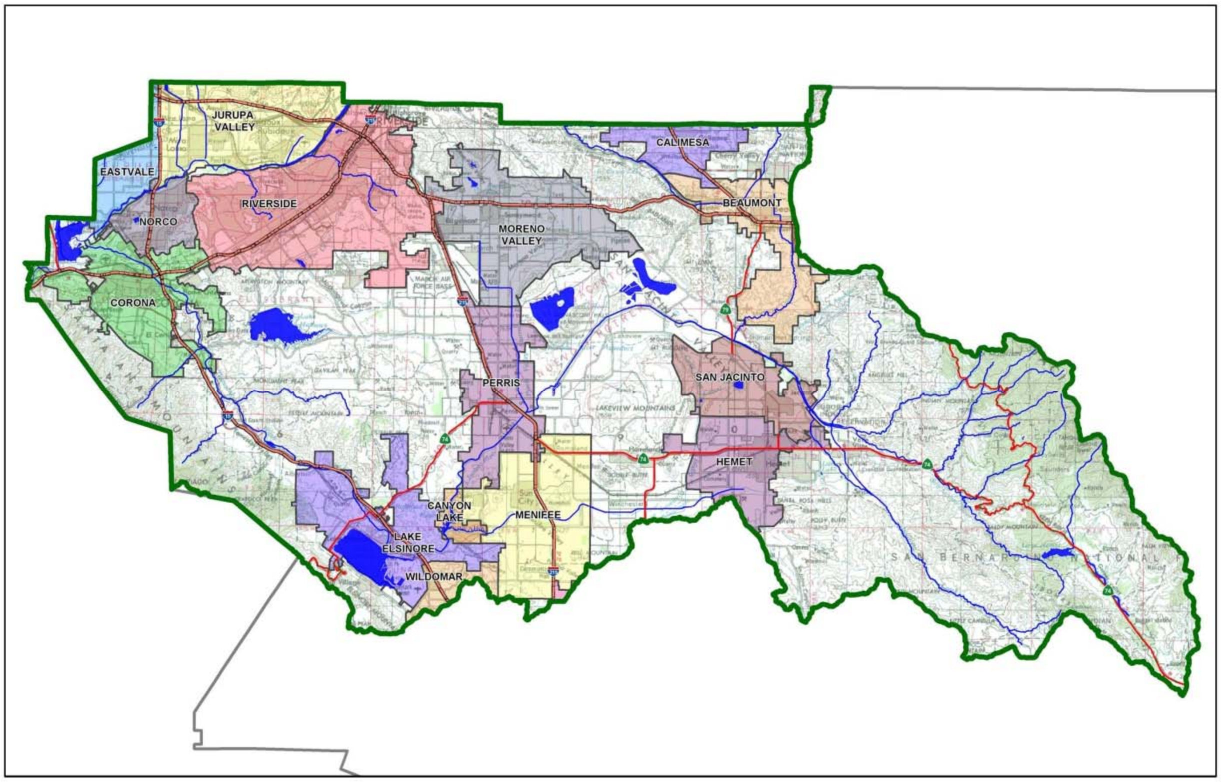
Project Specific Water Quality Management Plan

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

Project Title: LDC - Alessandro

Development No: 291-191-04, -07, -08, -09, -10, -11, -12, -13, -25, -26, -27, -28 & -29

Design Review/Case No: PEN20-0162/ LWQ20-0026



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☒ **Preliminary**
☐ **Final**

Original Date Prepared: August 11, 2020

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

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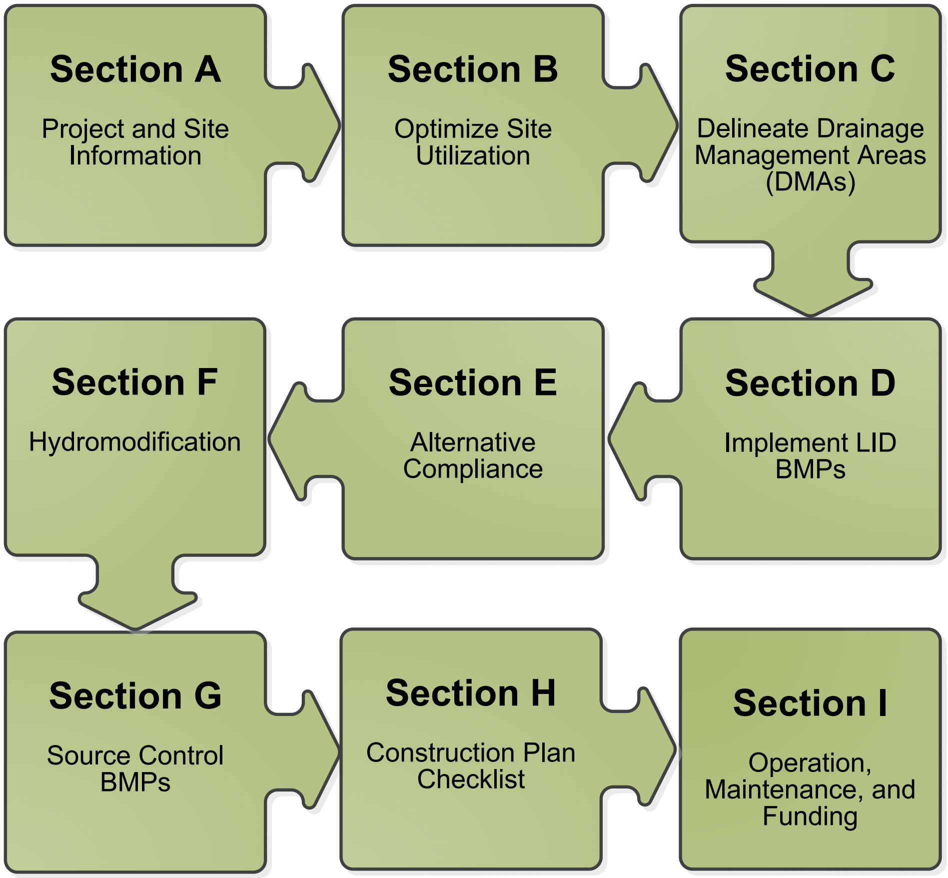
A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for **LDC Industrial Realty, LLC** by Thienes Engineering, Inc. for the **LDC - Alessandro** project.

This WQMP is intended to comply with the requirements of Moreno Valley for Riverside County Ordinance No. 827 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 Moreno Valley Water Quality Ordinance (Municipal Code Section 8.10).

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

Owner's Signature

Date

TBD
Owner's Printed Name

[title]
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

Reinhard Stenzel
Preparer's Printed Name

Director of Engineering
Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION

Type of Project:	Light Industrial
Planning Area:	Industrial/Business Park
Community Name:	N/A
Development Name:	LDC - Alessandro

PROJECT LOCATION

Latitude & Longitude (DMS): 33.917883, -117.277729

Project Watershed and Sub-Watershed: Santa Ana River & San Jacinto

APN(s): 291-191-04, -07, -08, -09, -10, -11, -12, -13, -25, -26, -27, -28 & -29

Map Book and Page No.: Assessor's Map BK.291 PG.19

PROJECT CHARACTERISTICS

Proposed or Potential Land Use(s)	Light Industrial
Proposed or Potential SIC Code(s)	4225
Area of Impervious Project Footprint (SF)	327,571*
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	327,571*
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

*Only includes impervious areas from DMA A1 (onsite) and DMA B1 (offsite).

EXISTING SITE CHARACTERISTICS

Total area of existing Impervious Surfaces within the project limits (SF)	0
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	Not A Part
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	Types C
What is the Water Quality Design Storm Depth for the project?	0.62

PROJECT DESCRIPTION

Proposed improvements to the site consist of the construction of one warehouse type building with an area of 161,660 square feet.

The overall project encompasses approximately 8.57 acres of improvements which includes 8.05 acres of onsite work and 0.52 acres of offsite work along Alessandro Boulevard. There will be a truck yard on the west side of the building and vehicle parking lot along the north and east sides of the building. A set of underground chambers, servicing the entire site, is located in the truck yard. The remainder of the site will be reserved for landscaping.

In addition, the disturbed area along Alessandro Boulevard will drain to three bioretention facilities located within the right-of-way. Treated flows will be conveyed via a proposed storm drain to the back of the proposed public catch basin in Alessandro Boulevard.

Existing Conditions

The entire project site (onsite) is currently an undeveloped dirt lot (8.05 acres) with no impervious areas. The site can be divided into two drainage zones. The northwestern portion of the site sheet flows onto Day Street. The remaining southeastern portion of the site sheet flows onto Alessandro Boulevard.

Proposed Conditions

Runoff from the easterly portion of the building and the easterly vehicle parking lot will drain to a catch basin in the vehicle parking lot. Runoff is then conveyed westerly via a proposed onsite storm drain (easterly storm drain). A proposed diversion manhole structure will direct the DCV to the underground chambers in the truck yard. Once the DCV is met, additional flows will continue to drain westerly.

Runoff from the westerly portion of the building, the northerly vehicle parking lot and the truck yard will drain to several catch basins in the northerly vehicle parking lot and truck yard. Runoff will then be conveyed southerly via another proposed onsite storm drain (westerly storm drain). Another proposed diversion manhole will direct the DCV to the same underground chambers in the truck yard. Once the DCV is met, additional flows will continue to drain southerly.

Runoff from both proposed onsite storm drains confluence near the southwest corner of the site before discharging offsite into the proposed public storm drain in Day Street.

Approximately 0.65 acres of landscaped areas (and driveway approaches) fronting Day Street and Alessandro Boulevard will sheet flow offsite. The landscaped areas are considered self-treating areas.

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Perris Valley Storm Drain	None	N/A	Not classified as a RARE waterbody.
San Jacinto River, Reach 3	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Canyon Lake (aka San Jacinto River, Reach 2)	Nutrients	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
San Jacinto River, Reach 1	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Lake Elsinore	DDT (Dichlorodiphenyltrichloroethane), Nutrients, Organic Enrichment/Low Dissolved Oxygen, PCBs (Polychlorinated biphenyls), Toxicity	MUN, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Temescal Creek, Reach 6	Indicator Bacteria	MUN, GWR, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Temescal Creek, Reach 5	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD, RARE	27 miles
Temescal Creek, Reach 4	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD, RARE	33 miles
Temescal Creek, Reach 3 (aka Lee Lake)	None	MUN, AGR, IND, GWR, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Temescal Creek, Reach 2	None	MUN, AGR, IND, GWR, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Temescal Creek, Reach 1	None	MUN, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Santa Ana River, Reach 3	Copper, Indicator Bacteria and Lead	MUN, AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN	50 miles
The Prado Basin Management Zone	pH	MUN, REC1, REC2, WARM, WILD, RARE	50 miles
Santa Ana River, Reach 2	None	MUN, AGR, GWR, REC1, REC2, WARM, WILD, RARE	55 miles

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Santa Ana River, Reach 1	None	MUN, REC1, REC2, WARM, WILD	Not classified as a RARE waterbody.
Tidal Prism of Santa Ana River and Newport Slough	Indicator Bacteria	MUN, REC1, REC2, COMM, WILD, RARE, MAR	81 miles
Pacific Ocean Near shore Zone	None	MUN, IND, NAV, REC1, REC2, COMM, WILD, RARE, SPWN, MAR, SHEL	81 miles
Pacific Ocean Offshore Zone	None	MUN, IND, NAV, REC1, REC2, COMM, WILD, RARE, SPWN, MAR	82 miles

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

Table A.2 Other Applicable Permits

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

Section B: Optimize Site Utilization (LID Principles)

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

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

Site Optimization

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

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

- *There are no creeks, wetlands, or riparian habitats nearby.*
- *Existing drainage patterns flow to Day Street and Alessandro Boulevard. Proposed condition drainage will drain to the proposed public storm drains in these streets.*

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

- *Not applicable, there are no sensitive areas.*
- *Ground surface cover consists of exposed soils with sparse to moderate amounts of native weed and grass growth.*

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

- *Infiltration type BMPs proposed to maximize natural infiltration rates.*

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

- *Impervious area on the site has been minimized to City standards.*
- *Due to the nature of the project site (large trucks), substitution of pavement for landscaping is not feasible. The project does not propose overflow parking where substitution of pavement for landscaping would be optimal. Landscaping has been provided wherever applicable and to the maximum extent practicable.*
- *The entire Design Capture Volume (DCV) is handled by the underground chambers. Permeable pavement is not needed to meet the DCV.*

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

- *Roof runoff is directed to the proposed infiltration type BMPs for treatment.*
- *The site is not on a hillside.*
- *All stormwater runoff will be piped or sheet flow towards the underground chambers.*

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	Area (Acres)	DMA Type
A1	Roofs/Conc/Asphalt	307,098	7.05	Type D
A2	Ornamental Landscaping	15,246	0.35	Type D
B1	Concrete or Asphalt	20,473	0.47	Type D
B2	Ornamental Landscaping	2,178	0.05	Type D
C	Ornamental Landscaping	13,068	0.30	Type A
D	Ornamental Landscaping	15,246	0.35	Type A

[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)
C	13,068	Drought Tolerant	Timed Sprinklers
D	15,246	Drought Tolerant	Timed Sprinklers

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) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]
N/A	N/A	N/A	N/A	N/A	N/A	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)	Post-project surface type	Runoff factor	Product		Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]	DMA name /ID	[D]	[C]/[D]
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

DMA Name or ID	BMP Name or ID
A1	STC "A"
A2	STC "A"
B1	STREET BIO "B"
B2	STREET BIO "B"

<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.

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:		
…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 identifies other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		
…have areas of known soil or groundwater contamination (unless with written authorization from the Regional Board Executive Officer)		X
If yes, list affected DMAs:		

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

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐ Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☒ The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

☐ None of the above

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: N/A

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

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

Total Area of Impervious Surfaces: N/A

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

Enter your EIATIA factor: N/A

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

Minimum required irrigated area: N/A

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

Minimum required irrigated area (Step 4)	**Available Irrigated Landscape (Step 1)**
N/A	N/A

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users: N/A (# of parking stalls)

Project Type: Industrial

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

Total Area of Impervious Surfaces: N/A

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

Enter your TUTIA factor: N/A

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

Minimum number of toilet users: N/A

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

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
N/A	N/A

Other Non-Potable Use Feasibility

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

N/A

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

Average Daily Demand: N/A

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

Total Area of Impervious Surfaces: N/A

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

Enter the factor from Table 2-3: N/A

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

Minimum required use: N/A

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

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
N/A	N/A

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

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

☐ Not applicable

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				Alternative Compliance (Type A, B, C)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
A	☒	☐	☐	☐	☐
B	☐	☐	☒	☐	☐

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

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	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	[A]		[B]	[C]	[A] x [C]			
A1	307,098	Roofs/Conc/Asphalt	*1.00*	*0.89*	*273,931.4*	*0.62*	*14153.1*	*42,085*
A2	15,246	Ornamental Landscaping	*0.10*	*0.11*	*1,684.0*	*0.62*	*87*	
B1	20,473	Concrete or Asphalt	*1.00*	*0.89*	*18,262.1*	*0.62*	*943.5*	*1,244*
B2	2,178	Ornamental Landscaping	*0.10*	*0.11*	*240.6*	*0.62*	*12.4*	
	344,995				*294,118*	0.62	15,196.0	*43,329*

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

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

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

Section E: Alternative Compliance (LID Waiver Program)

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

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

- *Or-*

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

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides (PCBs)	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☐ Attached Residential Development	P	N	P	P	N	P	P	P(2)
☒ Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐ Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐ Restaurants (>5,000 ft²)	P	N	N	N	N	N	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
☐ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☒	☒	☐	☐	☒	☐	☐	☐

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

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

[1] *Cannot Exceed 50%*

[2] *Obtain corresponding data from Table 3-8 in the WQMP Guidance Document*

E.3 Sizing Criteria

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

Table E.3 Treatment Control BMP Sizing

DMA Type/ ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imp Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor	*Design Storm Depth (in)*	*Minimum Design Capture Volume (cubic feet)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
	[A]		[B]	[C]	[A] x [C]				
N/A	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*				

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

E.4 Treatment Control BMP Selection

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

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

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

Table E.4 Treatment Control BMP Selection

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

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

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

If Yes, HCOC criteria do not apply.

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

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

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

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

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration (min)	20.24	10.63	53%
Volume (Cubit Feet)	5,554	49,967	900%

---

[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.

To meet HCOC requirements, the mitigation volume must be achieved by using LID and hydromodification mitigation BMPs. The mitigation volume required is approximately 41,915 cu-ft ([49,967 cu-ft x 0.95] – 5,554 cu-ft). The underground retention system will retain a total of 42,085 cu-ft; where 14,241 cu-ft is to meet the DCV and the remaining 27,844 cu-ft is used to mitigate HCOCs. As a result, HCOCs will be addressed by the proposed underground retention system. Since the mitigation volume has been met, it is physically impossible for the project to avoid increasing the time of concentration and reducing peak runoff by more than five percent of pre-development conditions.

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:

F.2 HCOC Mitigation

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

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

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

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

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

Section G: Source Control BMPs

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

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

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

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	• Mark all inlets with the words "Only Rain Down the Storm Drain" or similar.	• Maintain and periodically repaint or replace inlet markings annually. • Provide stormwater pollution prevention information to new site owners, lessees, or operators upon occupancy and annually thereafter. • See CASQA fact sheet SC-44 for "Drainage System Maintenance," included in Appendix of this document. • Include the following lease agreements: "Tenant shall not allow anyone to discharge anything to storm drain or to store or deposit materials so as to create a potential discharge to storm drains."

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
B. Interior floor drains and elevator shaft sump pumps	• Interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	• Inspect and maintain drains semi-annually to prevent blockages and overflow.
D2. Landscape / Outdoor Pesticide Use	• Landscape plans will minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. • Pest-resistant plants will be used adjacent to hardscape. • The landscape plans will consider plants appropriate to the site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	• Maintain landscaping only using minimum pesticides, when needed. • See Appendix 10 for "Landscape and Gardening" brochure by RCFlood. • Provide Integrated Pest Management (IPM) information to new owners, lessees and operators upon occupancy and annually thereafter. IPM is an effective and environmentally sensitive approach to pest management.
G. Refuse Areas	• Site refuse will be handled by contractor on a weekly basis. • Signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	• A minimum of two receptacles will be provided and locate indoors. Receptacles are to be inspected daily and repairs or replacements to leaky receptacles will be completed immediately. Receptacles are to remain covered when not in use. Dumping of liquid or hazardous wastes is prohibited. A "no hazardous materials" sign will be posted. Spills will be cleaned immediately upon discovery. Spill control materials will be available onsite. See Appendix 10 for CASQA fact sheet SC-34 for "Waste Handling and Disposal."
H. Industrial processes	• All process activities to be performed indoors. No processes to drain to exterior or to storm drain system.	• See Appendix 10 for CASQA fact sheet SC-10 for "Non-Stormwater Discharges"
M. Loading Docks	• Spills will be cleaned up immediately and disposed of properly.	• Move loaded and unloaded items indoors as soon as possible. • See Appendix 10 for CASQA fact sheet SC-30 for "Outdoor Loading and Unloading"
P. Plazas, sidewalks, and parking lots	•	Sweep plazas, sidewalks, and parking lots monthly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

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

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	Latitude	Longitude
A	On-site storm drain inlets	WQMP Site Map	---	---
B	Interior floor drains and elevator shaft sump pumps	N/A	---	---
D2	Landscape / Outdoor Pesticide Use	On-site Landscape Improvement Plans	---	---
G	Refuse Areas	WQMP Site Map	---	---
H	Industrial processes	WQMP Site Map (indoors, if any)	---	---
M	Loading Docks	WQMP Site Map	---	---
P	Plazas, sidewalks, and parking lots	N/A	---	---
STC "A"	Perforated CMP	WQMP Site Map	33.91771	-117.278446
STREET BIO "B"	Bioretention	WQMP Site Map	33.917072 33.917064 33.917062	-117.278077 -117.277698 -117.277226

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

Section I: Operation, Maintenance and Funding

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

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

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

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

Maintenance Mechanism: City of Moreno Valley:

STORMWATER TREATMENT DEVICE AND CONTROL MEASURE ACCESS AND MAINTENANCE COVENANT

The maintenance mechanism mentioned above will be executed by the owner and will be tied to the property. The maintenance mechanism will ensure that all structural BMPs and other control measures specified in this WQMP receive periodic and continuous maintenance as per the Operation and Maintenance Plan (O&M Plan) included in Appendix 9. Funding required to maintain the BMPs will be provided by the owner stated below.

Owner:
LDC Industrial Realty, LLC
555 N. El Camino Real, #A456
San Clemente, CA 92672
Phone: (949) 797-7034
Contact: Larry D. Cochrun, [title]

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

☐ Y ☒ N

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

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

"VICINITY MAP"

FOR

NORTHEAST CORNER OF ALESSANDRO BLVD. AND DAY ST.

Last Update: 8/10/20
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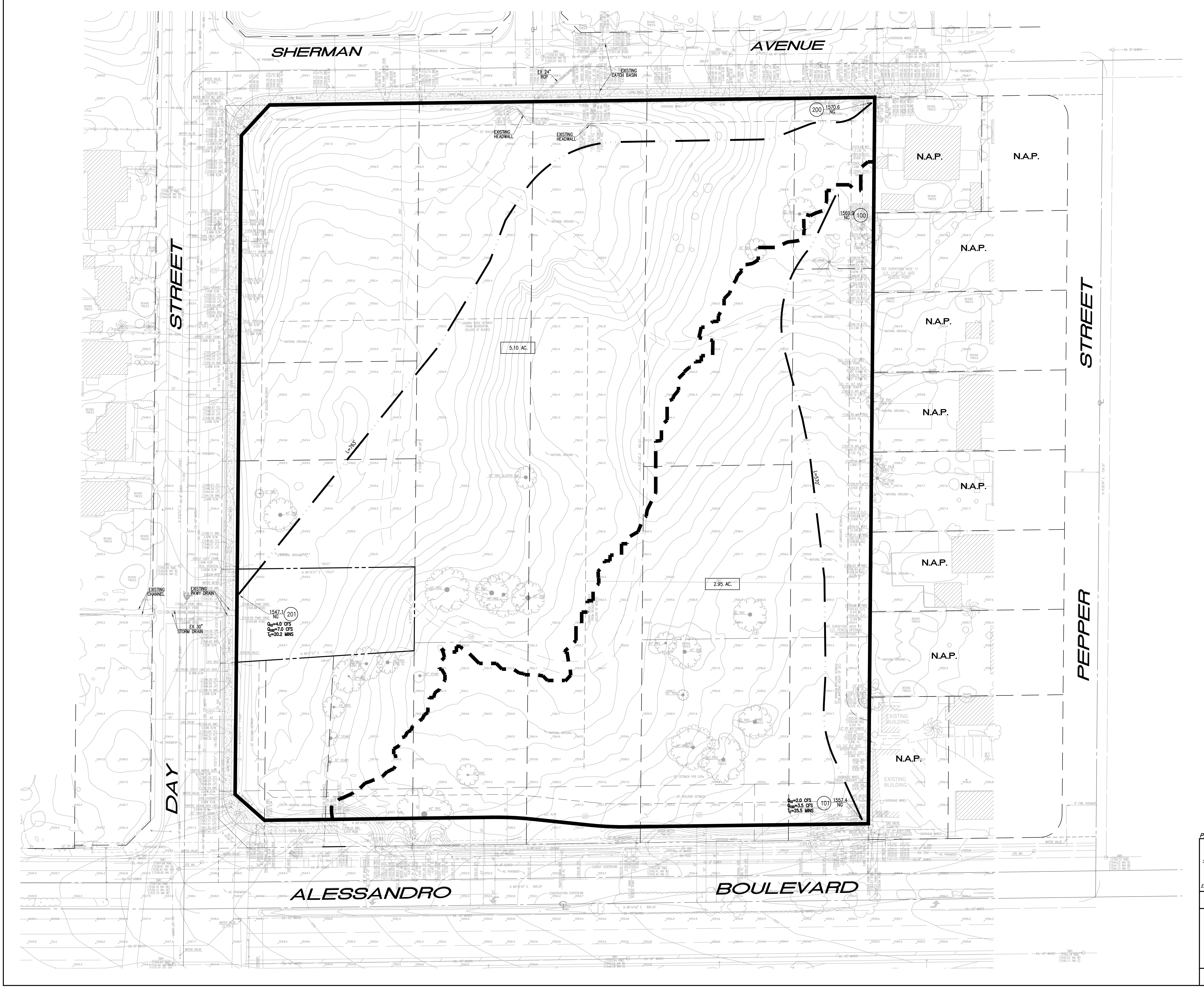
"RECEIVING WATERS MAP"

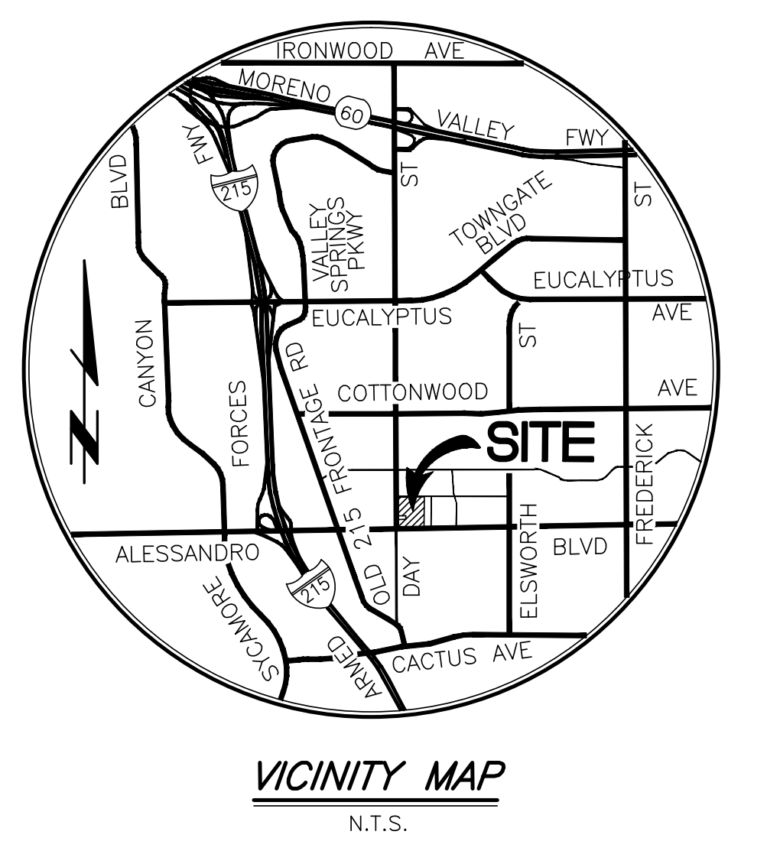
FOR

NORTHEAST CORNER OF ALESSANDRO BLVD. AND DAY ST.

FLOW
←

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173





VICINITY MAP
N.T.S.

LEGEND

▬▬▬	PROJECT BOUNDARY
▬ ▬ ▬	SUBAREA BOUNDARY
─ ··· ─	FLOW PATH
1.00 AC.	SUBAREA AREA
(101)	NODE NUMBER
L	LENGTH OF FLOW PATH
NG	NATURAL GROUND ELEVATION
T_C	TIME OF CONCENTRATION
Q_{100}	DISCHARGE (CUBIC FEET PER SECOND) NUMBER DESIGNATE YEAR OF FREQUENCY

0 15 30 60 90
SCALE:1"=30'

Last Update: 12/21/20
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PEN20-0162

OWNER:

LDC INDUSTRIAL REALTY
555 N EL CAIMNO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
TEL: 949-226-4601
EMAIL: LCOCHRUN@LDCINDUSTRIAL.COM

ENGINEER:

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
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PH.(714)521-4811 FAX(714)521-4173
EMAIL: CESAR@THIENESENG.COM

CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

EXISTING CONDITION HYDROLOGY MAP
PEN20-0162 / LST20-0025
LDC - ALESSANDRO
NORTHEAST CORNER
OF
ALESSANDRO BLVD. AND DAY ST.
MORENO VALLEY, CALIFORNIA

JN 3846

1 of 1 Sheets

PLOT DATE: 12/28/2020

Last Update: 12/22/2020
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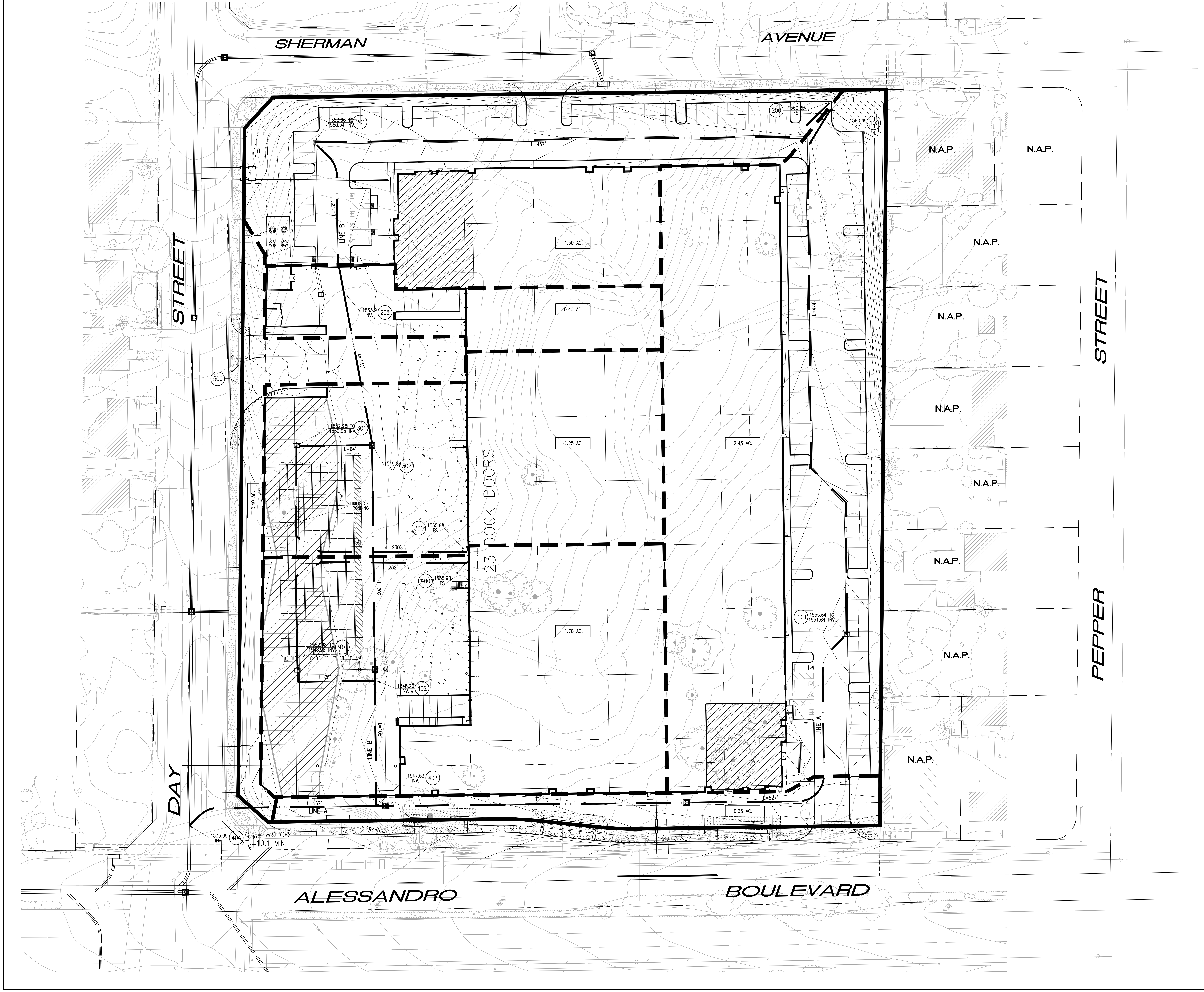

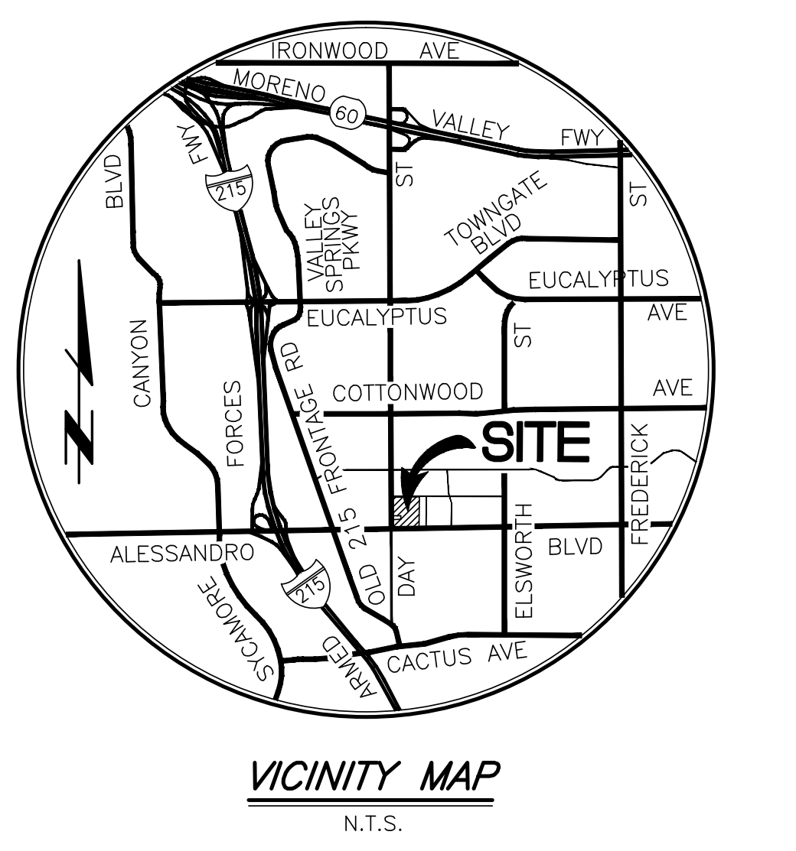

VICINITY MAP

N.T.S.

LEGEND

▬▬▬	PROJECT BOUNDARY
▬ ▬ ▬	SUBAREA BOUNDARY
▬ ¦ ¦ ¦ ▬	FLOW PATH
1.00 AC.	SUBAREA AREA
(101)	NODE NUMBER
L	LENGTH OF FLOW PATH
FS	FINISHED SURFACE ELEVATION
INV.	INVERT ELEVATION
T_C	TIME OF CONCENTRATION
Q_{100}	DISCHARGE (CUBIC FEET PER SECOND) NUMBER DESIGNATE YEAR OF FREQUENCY
▨	APPROXIMATE LIMITS OF 100-YEAR PONDING

0 15 30 60 90

SCALE:1"=30'

PEN20-0162

Last Update: 12/9/20
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OWNER:

LDC INDUSTRIAL REALTY
555 N EL CAIMNO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
TEL: 949-226-4601
EMAIL: LCOCHRUN@LDCINDUSTRIAL.COM

ENGINEER:

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PH.(714)521-4811 FAX(714)521-4173
EMAIL: CESAR@THIENESENG.COM

CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

PROPOSED CONDITION HYDROLOGY MAP
PEN20-0162 / LST20-0025
LDC - ALESSANDRO
NORTHEAST CORNER
OF
ALESSANDRO BLVD. AND DAY ST.
MORENO VALLEY, CALIFORNIA

JN 3846

1 of 1 Sheets

PLOT DATE: 12/28/2020

Last Update: 12/24/2020
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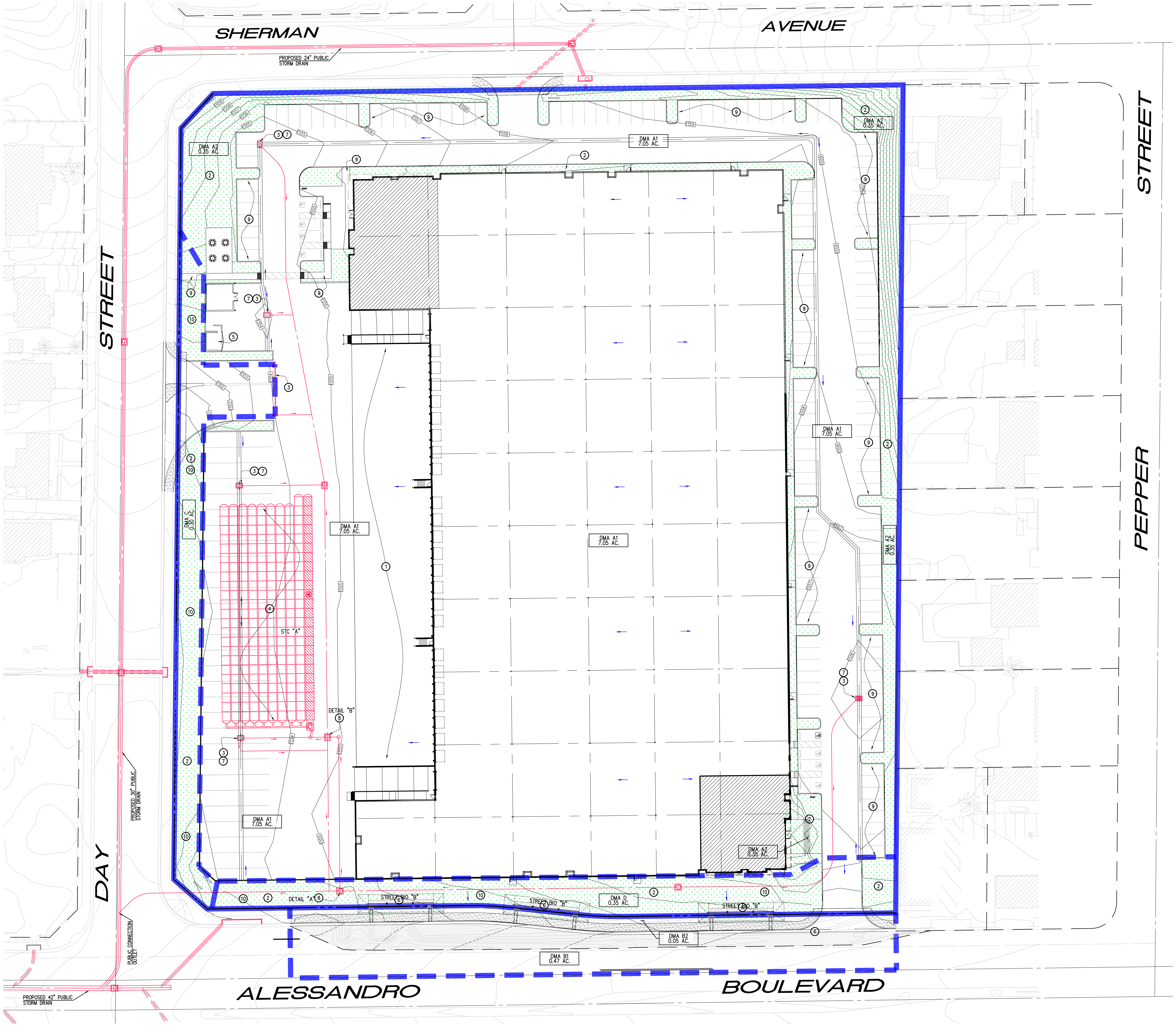
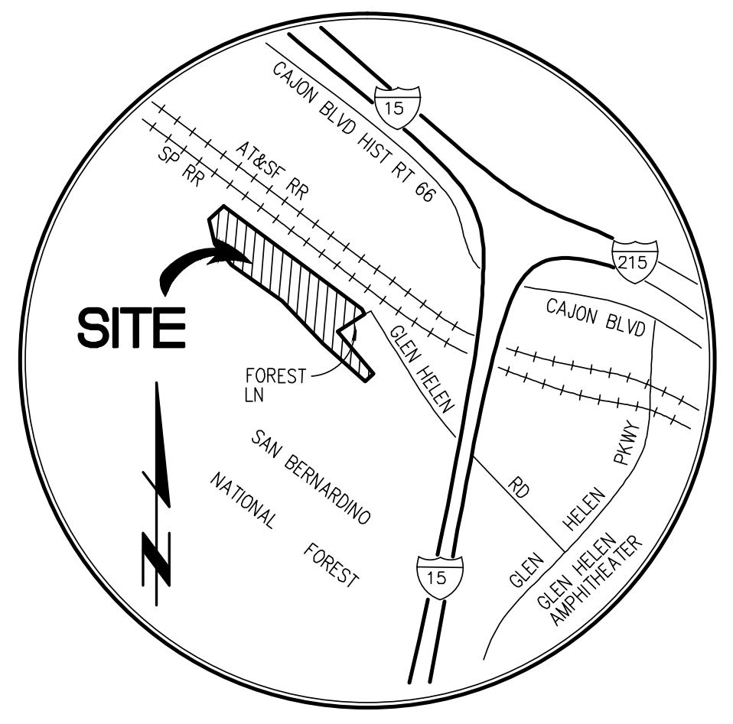




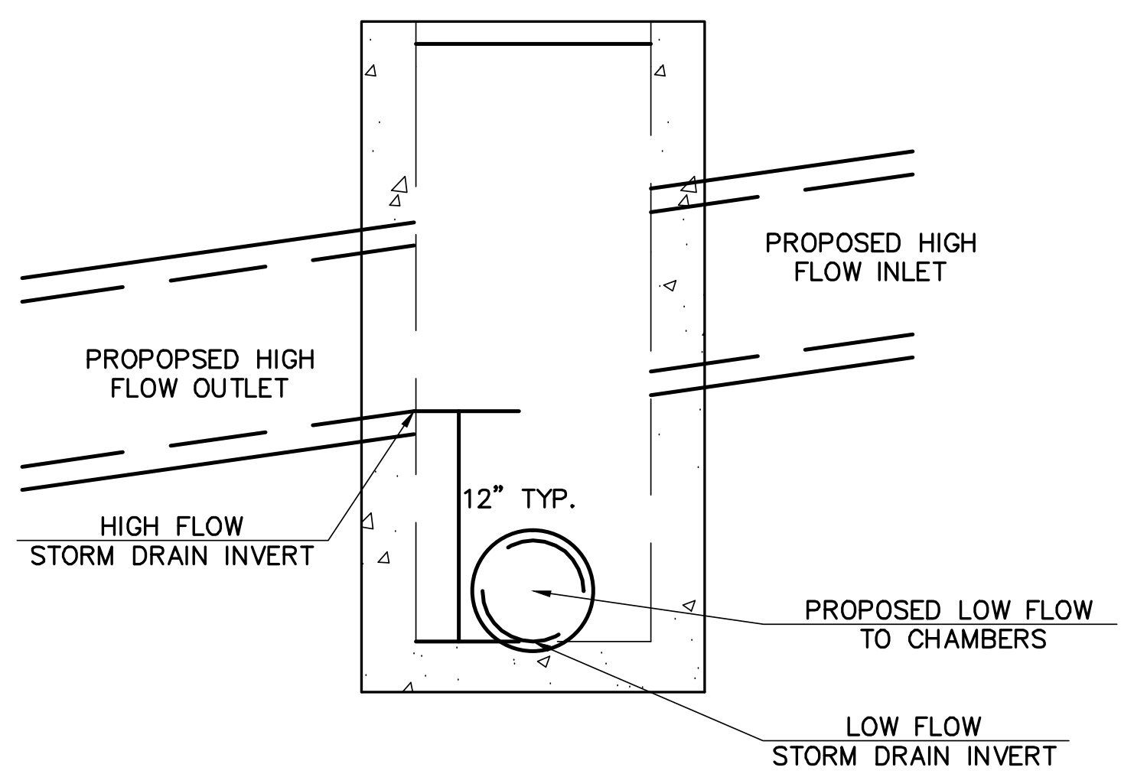
VICINITY MAP
N.T.S.

LEGEND

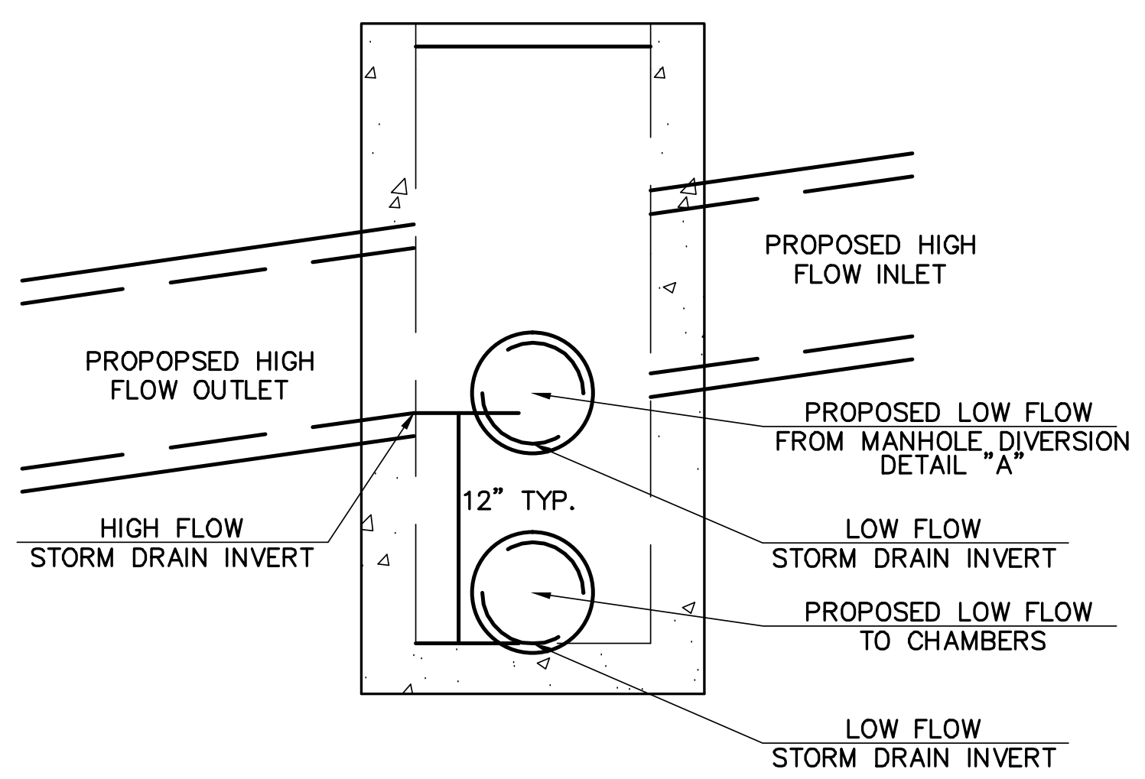
① SC-M: LOADING DOCKS
② SC-D2: LANDSCAPE/OUTDOOR PESTICIDE USE
③ SC-A: ON-SITE STORM DRAIN INLETS MARKED WITH "ONLY RAIN DOWN THE STORM DRAIN"
④ MC-3500 STORMTECH CHAMBERS – INFILTRATION
⑤ SC-F: REFUSE AREAS
⑥ STREET BMP – BIORETENTION
⑦ DRAIN INSERT(S)
⑧ MANHOLE WITH DIVERSION
⑨ SC-P: PLAZAS, SIDEWALKS AND PARKING LOTS
⑩ SELF-TREATING AREAS

NOTE:

STC	STORMTECH CHAMBERS
BIO	BIORETENTION
DMA	DRAINAGE MANAGEMENT AREA
RD	ROOF DRAIN
━━━	BOUNDARY
━ ━	SUBAREAS
←	FLOW LINE
←	SD FLOW LINE
🟩	LANDSCAPING



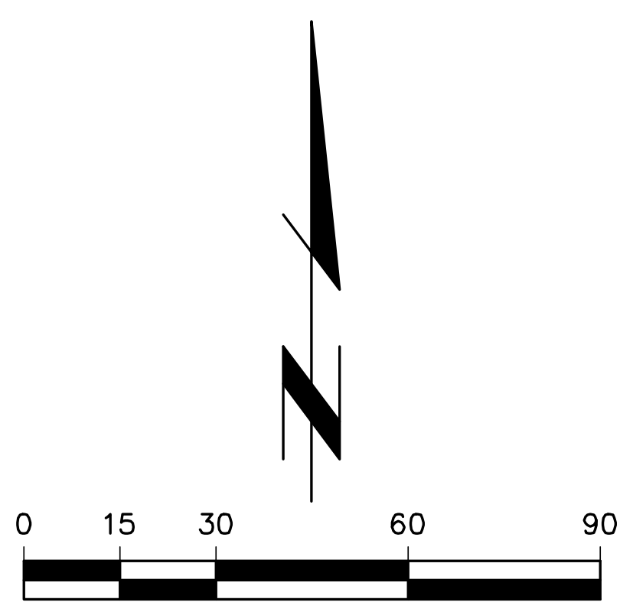
MANHOLE DIVERSION DETAIL "A"
N.T.S.



MANHOLE DIVERSION DETAIL "B"
N.T.S.

SAMPLE STENCIL TO BE USED NEAR GRATE AND CURB OPENING INLETS

STORM DRAIN STENCILING
N.T.S.



SCALE: 1"=30'

DMA ID	PERVIOUS AREA (AC.)	IMPERVIOUS AREA (AC.)	TOTAL AREA (AC.)	BMP ID	MINIMUM AREA REQUIRED (SF)	AREA PROVIDED (SF)	BMP VOLUME REQUIRED (CU-FT)	BMP VOLUME PROVIDED (CU-FT)
DMA A	0.35	7.05	7.40	STC "A"	3,200	12,368	14,241	42,085
DMA B	0.05	0.47	0.52	STREET BIO "B"	671	875	956	1,244
TOTAL	0.40	7.52	7.92		3,871	13,243	15,197	43,329

Last Update: 12/28/20
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OWNER:

LDC INDUSTRIAL REALTY, LLC
555 N EL CAMINO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
TEL: 949-226-4601

ENGINEER:

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

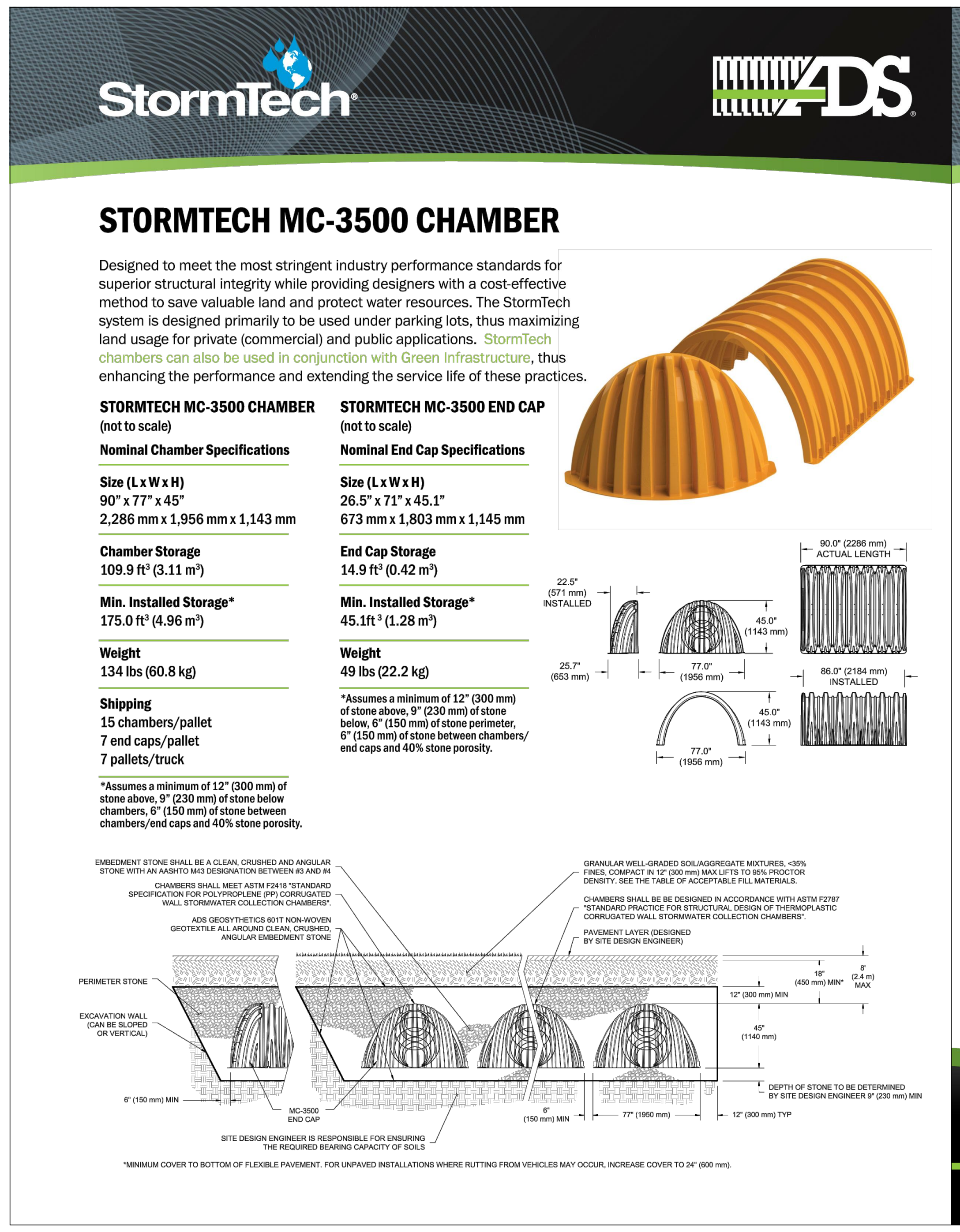
WQMP SITE MAP

LDC - ALESSANDRO

NORTHEAST CORNER OF
ALESSANDRO BLVD. AND DAY ST.

JN 3846

1 of 2 Sheets



StormTech

STORMTECH MC-3500 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.

STORMTECH MC-3500 CHAMBER
(not to scale)

Nominal Chamber Specifications

Size (L x W x H)
90" x 77" x 45"
2,286 mm x 1,956 mm x 1,143 mm

Chamber Storage
109.9 ft³ (3.11 m³)

Min. Installed Storage*
175.0 ft³ (4.96 m³)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 6" (150 mm) of stone between chambers/end caps and 40% stone porosity.

STORMTECH MC-3500 END CAP
(not to scale)

Nominal End Cap Specifications

Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

End Cap Storage
14.9 ft³ (0.42 m³)

Min. Installed Storage*
45.1ft ³ (1.28 m³)

Weight
49 lbs (22.2 kg)

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 6" (150 mm) of stone between chambers/end caps and 40% stone porosity.

EMBEDMENT STONE SHALL BE A CLEAN, CRUSHED AND ANGULAR STONE WITH AN AASHTO M43 DESIGNATION BETWEEN #3 AND #4

CHAMBERS SHALL MEET ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".

ADS GEOSYTHETICS 601T NON-WOVEN GEOTEXTILE ALL AROUND CLEAN, CRUSHED, ANGULAR EMBEDMENT STONE

GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES, COMPACT IN 12" (300 mm) MAX LIFTS TO 95% PROCTOR DENSITY. SEE THE TABLE OF ACCEPTABLE FILL MATERIALS.

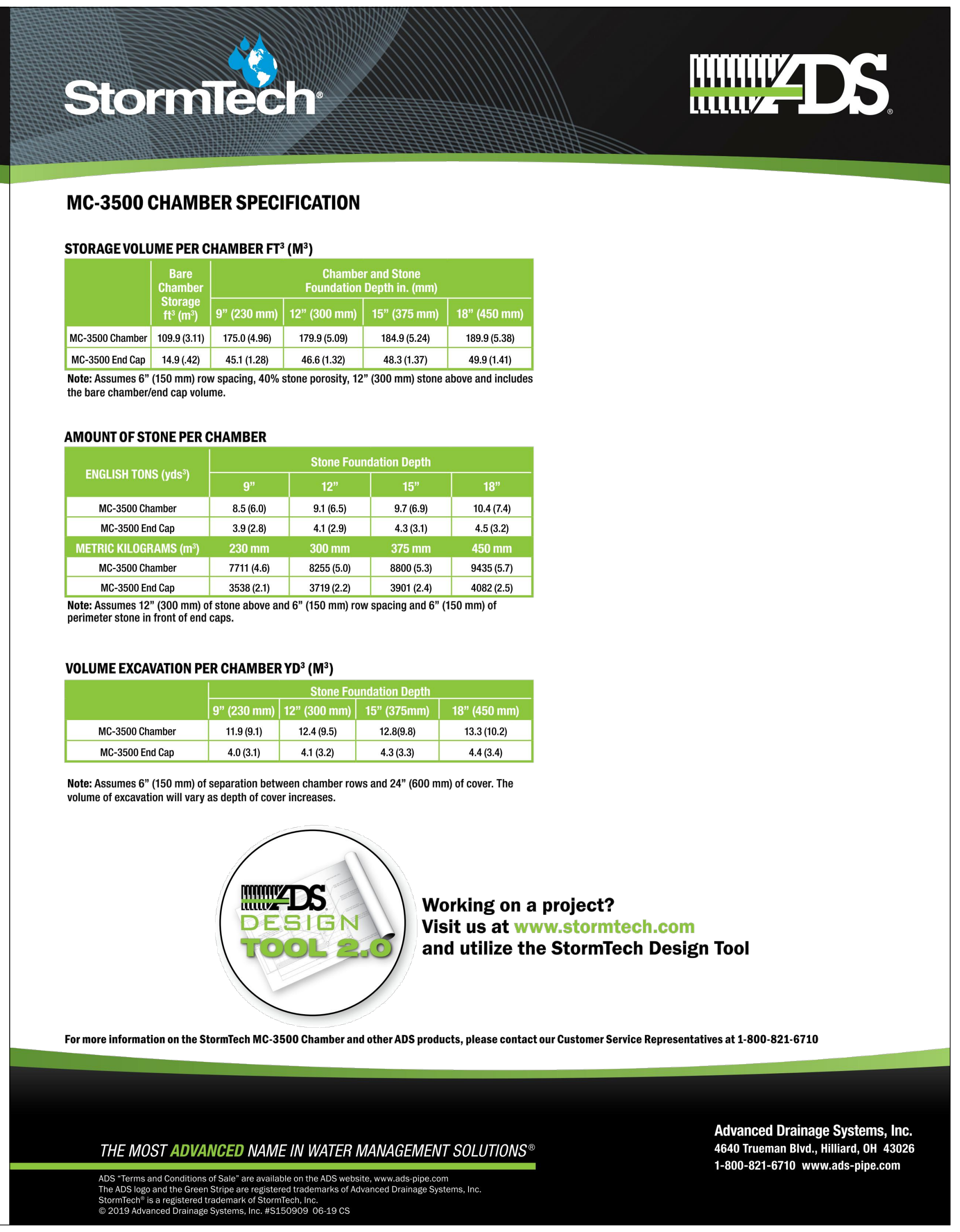
CHAMBERS SHALL BE BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".

PAVEMENT LAYER (DESIGNED BY SITE DESIGN ENGINEER)

DEPTH OF STONE TO BE DETERMINED BY SITE DESIGN ENGINEER 9" (230 mm) MIN

SITE DESIGN ENGINEER IS RESPONSIBLE FOR ENSURING THE REQUIRED BEARING CAPACITY OF SOILS

*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).



StormTech

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-3500 Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
MC-3500 End Cap	14.9 (.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500 Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
MC-3500 End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
METRIC KILOGRAMS (m³)	230 mm	300 mm	375 mm	450 mm
MC-3500 Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
MC-3500 End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-3500 Chamber	11.9 (9.1)	12.4 (9.5)	12.8(9.8)	13.3 (10.2)
MC-3500 End Cap	4.0 (3.1)	4.1 (3.2)	4.3 (3.3)	4.4 (3.4)

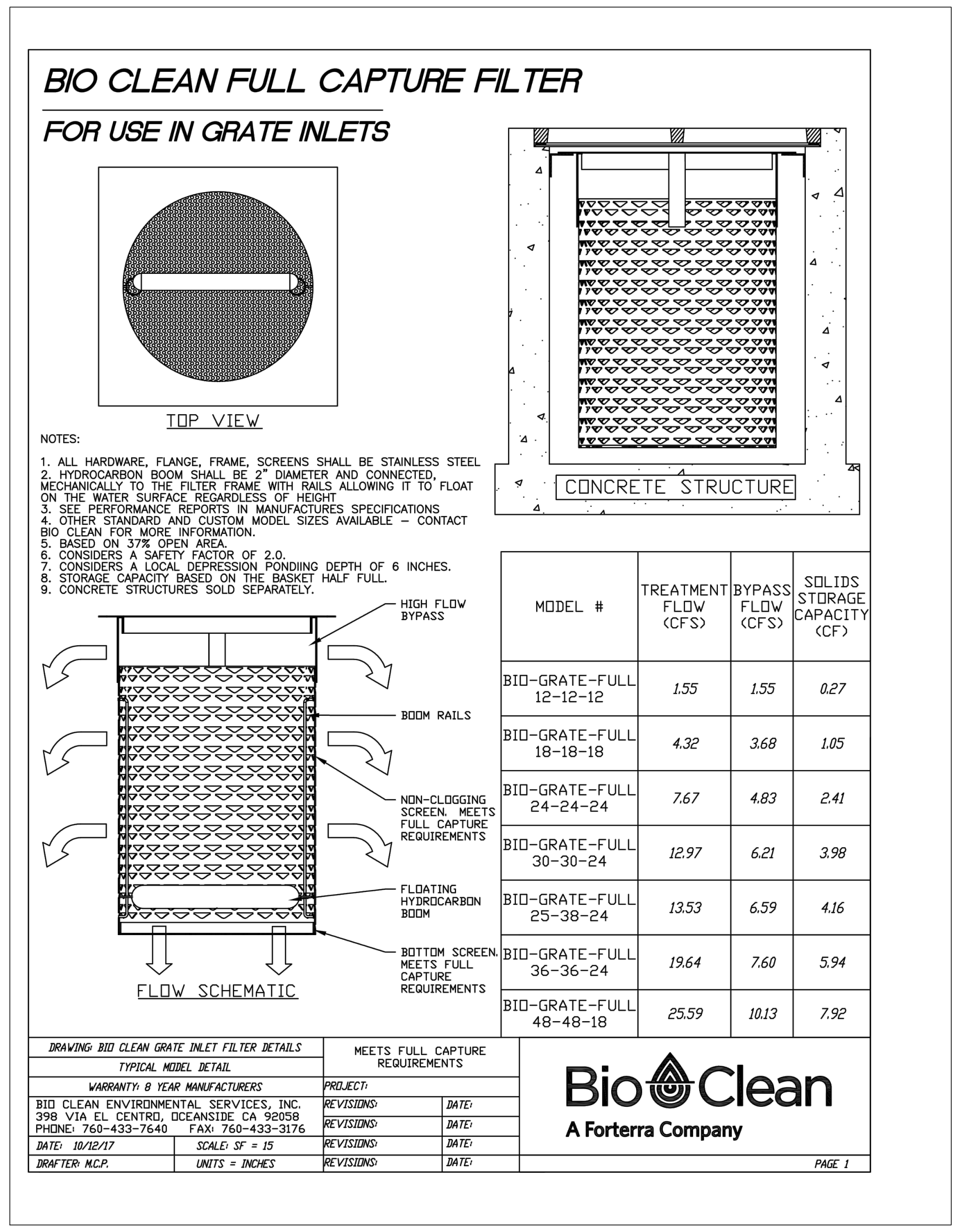
Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech MC-3500 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS®

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com



BIO CLEAN FULL CAPTURE FILTER

FOR USE IN GRATE INLETS

NOTES:

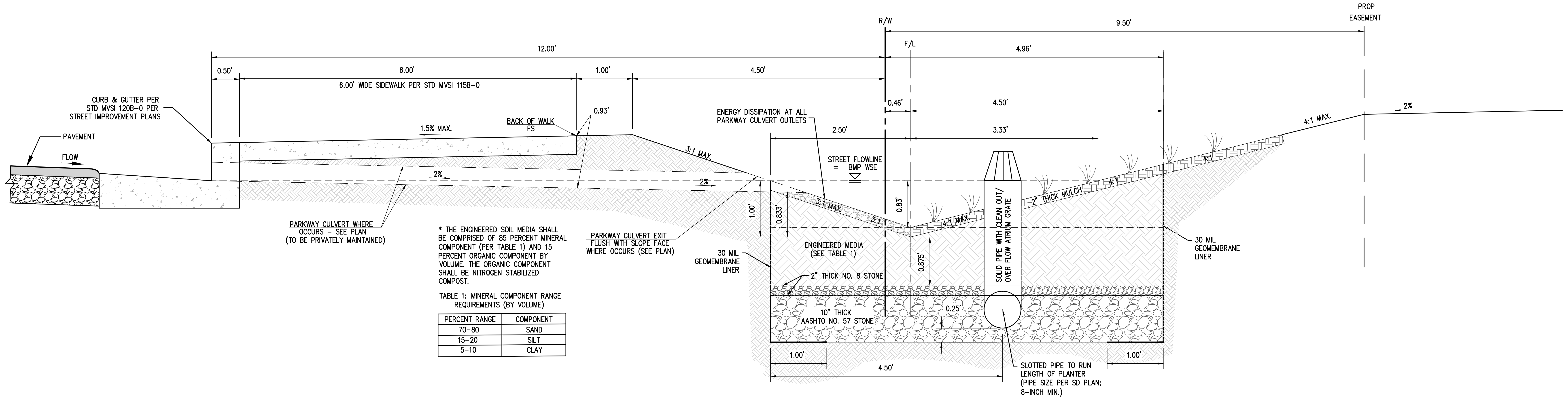
1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL
2. HYDROCARBON BOOM SHALL BE 2" DIAMETER AND CONNECTED, MECHANICALLY TO THE FILTER FRAME WITH RAILS ALLOWING IT TO FLOAT ON THE WATER SURFACE REGARDLESS OF HEIGHT
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDIING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.

MODEL #	TREATMENT FLOW (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.55	1.55	0.27
BIO-GRATE-FULL 18-18-18	4.32	3.68	1.05
BIO-GRATE-FULL 24-24-24	7.67	4.83	2.41
BIO-GRATE-FULL 30-30-24	12.97	6.21	3.98
BIO-GRATE-FULL 25-38-24	13.53	6.59	4.16
BIO-GRATE-FULL 36-36-24	19.64	7.60	5.94
BIO-GRATE-FULL 48-48-18	25.59	10.13	7.92

DRAWING: BIO CLEAN GRATE INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TYPICAL MODEL DETAIL			
WARRANTY: 8 YEAR MANUFACTURERS		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/17	SCALE: SF = 15	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

Bio Clean
A Forterra Company

PAGE 1



* THE ENGINEERED SOIL MEDIA SHALL BE COMPRISED OF 85 PERCENT MINERAL COMPONENT (PER TABLE 1) AND 15 PERCENT ORGANIC COMPONENT BY VOLUME. THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST.

TABLE 1: MINERAL COMPONENT RANGE REQUIREMENTS (BY VOLUME)

PERCENT RANGE	COMPONENT
70–80	SAND
15–20	SILT
5–10	CLAY

STREET BMP - BIORETENTION AREA
N.T.S.

Last Update:12/20/20
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OWNER:

LDC INDUSTRIAL REALTY, LLC
555 N EL CAMINO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
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LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

WQMP SITE MAP

LDC - ALESSANDRO

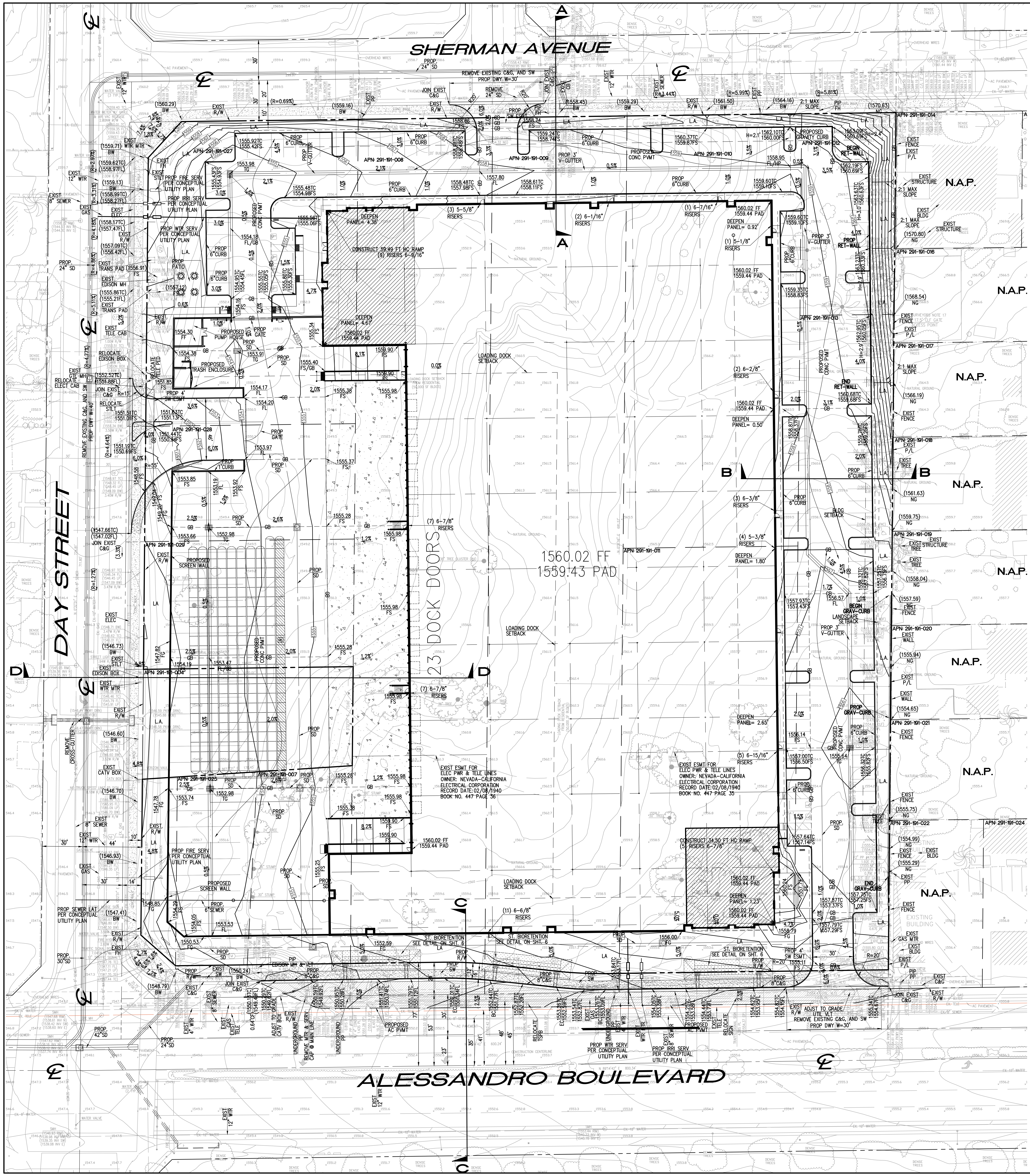
NORTHEAST CORNER OF
ALESSANDRO BLVD. AND DAY ST.

JN 3846

2 of 2 Sheets

Appendix 2: Construction Plans

Grading and Drainage Plans

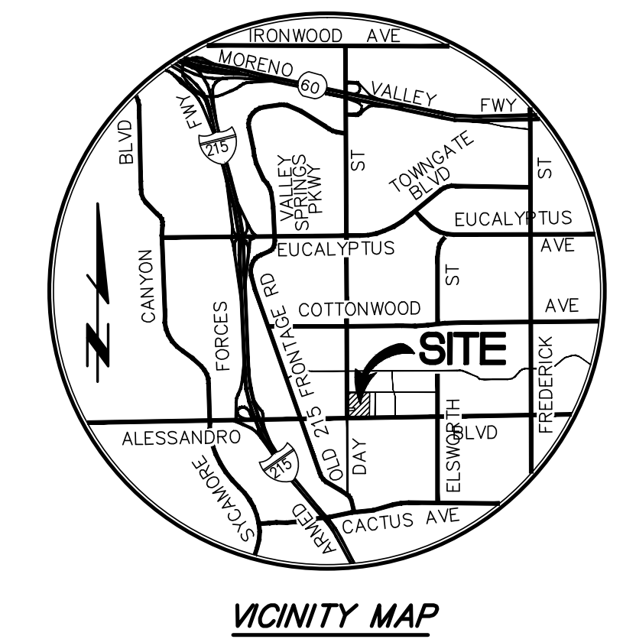


LEGEND

FH	EXIST. FIRE HYDRANT
WM □	EXIST. WATER METER
WV ●	EXIST. WATER VALVE
GAS V. ○	EXIST. GAS VALVE
— — →	GUY WIRE/DEADMAN
PP	EXIST. POWER POLE
	EXIST. TRAFFIC SIGNAL
	EXIST. CROSSWALK SIGNAL
SLB □	STREET LIGHTING BOX
	EXIST. STREET LIGHT
SDMH	EXIST. STORMDRAIN MANHOLE
SMH	EXIST. SEWER MANHOLE
VLT. □	EXIST. VAULT
	EXIST. SIGN
	TREE
TSB □	EXIST. TRAFFIC SIGNAL BOX
GM □	EXIST. GAS METER
MB □	EXIST. MAIL BOX
TMH	EXIST. TELEPHONE MANHOLE
X 1854.69	EXIST. GRADE ELEVATION
— — —CATV— — —	EXIST. CABLE TV CONDUIT
	EXIST. EDGE OF A.C. PAVEMENT
═ ═ ═ ═	EXIST. CURB AND GUTTER
——S8"——	EXIST. SANITARY SEWER
24" SD	EXIST. STORM DRAIN
——G3"——	EXIST. GAS LINE
——T——	EXIST. TELEPHONE CONDUIT
——W10"——	EXIST. WATER LINE
(1800)	EXIST. CONTOUR
——	NEW PIPE LINE
—— - - ——	PROPERTY LINE
	NEW FIRE HYDRANT
□	NEW WATER METER
●	NEW WATER VALVE
◁	NEW THRUST BLOCK
○	NEW SEWER MANHOLE
○	NEW SEWER CLEAN OUT
◎	NEW SEWER MANHOLE
▤	NEW CATCH BASIN
1800	PROPOSED CONTOUR
—○—○—○—	CUT AND FILL LINE/DAYLIGHT LINE

ABBREVIATIONS:

AB	—AGGREGATE BASE
AC	—ASPHALT CONCRETE
ARCH	—ARCHITECTURAL
BCR	—BEGIN OF CURB RETURN
BW	—BACK OF WALK
BOP	—BOTTOM OF PIPE
BOW	—BOTTOM OF WALL
BLDG	—BUILDING
CAB	—CRUSHED AGGREGATE BASE
C&G	—CURB AND GUTTER
CLF	—CHAIN LINK FENCE
CIP	—CAST IRON PIPE
CB	—CATCH BASIN
℄,C/L	—CENTERLINE
CF	—CURB FACE
CMB	—CRUSHED MISC. BASE
CO	—CLEAN OUT
CONC	—CONCRETE
CONST	—CONSTRUCT
DWY	—DRIVEWAY
DIA	—DIAMETER
DOM	—DOMESTIC
ECR	—END OF CURB RETURN
(0.00)	—EXISTING ELEVATION
EP	—EDGE OF PAVEMENT
EXIST	—EXISTING
FH	—FIRE HYDRANT
FG	—FINISH GRADE
FO	—FIBER OPTIC
FS	—FINISH SURFACE
FF	—FINISH FLOOR
FL	—FLOW LINE
FP	—FINISHED PAVEMENT
GB	—GRADE BREAK
HC	—HANDICAP
H	—HEIGHT OF RETAINING
HORIZ	—HORIZONTAL
HP	—HIGH POINT
INV	—INVERT
IRRI,IRR	—IRRIGATION
LF	—LINEAR FEET
LS	—LANDSCAPING
LP	—LOW POINT
MAX	—MAXIMUM
MH	—MANHOLE
MIN	—MINIMUM
NG	—NATURAL GRADE
NTS	—NOT TO SCALE
OC	—ON CURVE
PCC	—PORTLAND CEMENT CONCRETE
PVC	—POLYVINYLCHLORIDE
PP	—POWER POLE
ℙ, P/L	—PROPERTY LINE
PKWY	—PARKWAY
PROP	—PROPOSED
PT	—POINT
PVMT	—PAVEMENT
R/W	—RIGHT OF WAY
R	—RATE OF GRADE
RAD	—RADIUS
RD	—ROOF DRAIN
RCP	—REINFORCED CONCRETE PIPE
STLT	—STREET LIGHT
S =	—SLOPE
SCO	—SEWER CLEAN OUT
SD	—STORM DRAIN
SF	—SQUARE FEET
SW	—SIDEWALK
TC	—TOP OF CURB
TCO	—TOP OF CLEAN OUT
TS	—TOP OF CONCRETE SLAB
TOP	—TOP OF PIPE
TF	—TOP OF FOOTING
TW	—TOP OF WALL
TR	—TOP OF RAIL
TG	—TOP OF GRATE
TOP	—TOP OF SLOPE
TOE	—TOE OF SLOPE
TB	—TOP OF BERM
TRANS	—TRANSFORMER
TYP	—TYPICAL
UG	—UNDERGROUND
VAR	—VARIABLE
VERT	—VERTICAL
VCP	—VITRIFIED CLAY PIPE
W=	—WIDTH



VICINITY MAP
N.T.S.

NOTES:

F.E.M.A. FLOOD ZONE DESIGNATION

ZONE – X: AREA OF MINIMAL FLOOD HAZARD

GROSS AND NET DISTURBED AREAS

GROSS AREA: 8.212 ACRES
NET AREA: 7.778 ACRES

SCHOOL DISTRICT INFO

MORENO VALLEY UNIFIED SCHOOL DISTRICT
25634 ALESSANDRO BLVD. MORENO VALLEY, CA. 92553
PHONE NO. (951)–571–7500
FAX NO. (951)–571–7550

UTILITY PROVIDERS:

ELECTRIC:
RANCHO CUCAMONGA MUNICIPAL UTILITY
14331 FREDERICK ST. SUITE 2. P.O. BOX 88005
MORENO VALLEY, CA. 92552
PHONE: (951) 413–3513
ATTN: CLEMENT JIMENEZ

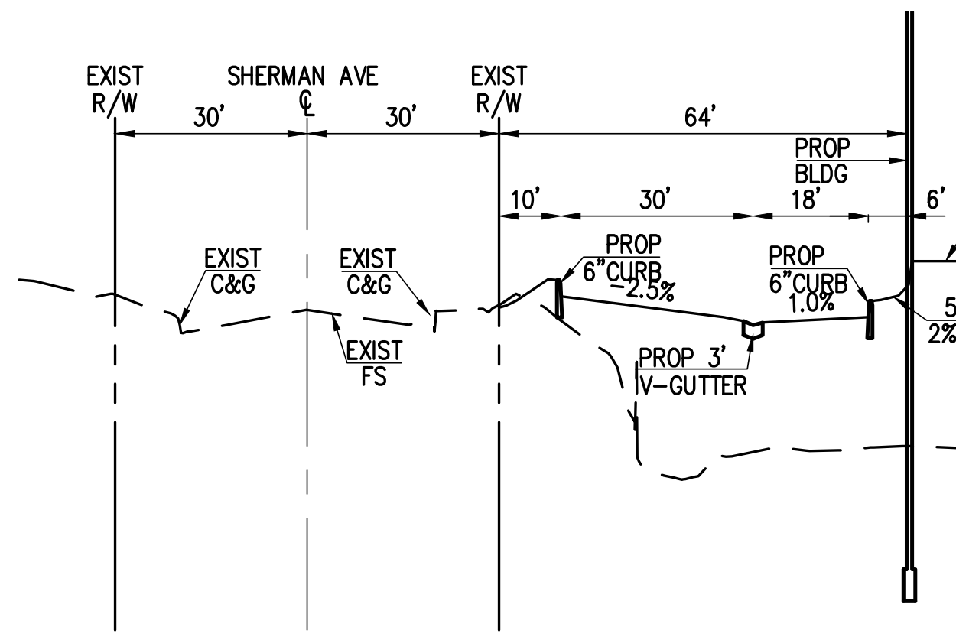
SEWER:
EDGEMONT COMMUNITY SERVICES DISTRICT
P.O. BOX 5436
RIVERSIDE, CA 92517
PHONE: (951) 784–2632
ATTN: JESSICA PFALMER

WATER:
BOX SPRINGS MUTUAL WATER COMPANY
21740 DRACAEA AVE.
MORENO VALLEY, CA. 92553
PHONE: (951) 653–6419
ATTN: MELISSA MARTINEZ

TELECOMMUNICATIONS:
CHARTER COMMUNICATIONS
17777 CENTER COURT DR. N., 8TH FL.
CERRITOS, CA 90703
PHONE: (562) 677–0259
ATTN: JUDY BOWERS

GAS:
SO. CALIF. GAS COMPANY
1981 WEST LUGONIA AVENUE
REDLANDS, CA 92374
PHONE: (800) 427–2200
ATTN: NICOLE KIYOHIRO

		EARTHWORK BALANCE CALCULATIONS	8/4/2020	
PROJECT:		LDC INDUSTRIAL REALTY - ALESSANDRO BLVD. (LEVEL FLOOR)		
JOB#		JN 3846 - CGP		
			QUANTITY	UNITS
	K.	SITE AREA:	351,222	SF
	L.	SUBSIDENCE FACTOR:	0.080	
	M.	SHRINKAGE FACTOR:	8.0	%
	N.	SITE STRIPING FACTOR:	0.1	
	O.	OVEREXCAVATION:	14,938	CY
	A.	CALCULATED CUT:	21,500	CY
		BLDG SLAB-7" THICK	498	CY
		FOOTING AND UTILITY SPOILS	**2,130**	CY
		RECYCLE MATERIAL	-	CY
		UGS-WQMP	**1,066**	CY
		TOTAL CUT: (A+B)	**25,193**	CY
	D.	CALCULATED FILL:	19,500	CY
	E.	LIGHT PAVING FILL:	-	CY
	F.	SUBSIDENCE: (LxK)/27=	1,041	CY
	G.	SHRINKAGE: (M/100)C=	2,015	CY
	H.	SITE STRIPING	1,431	CY
				CY
	I.	OVEREXCAVATION SHRINKAGE	1,195	CY
	J.	**TOTAL FILL: (D+E+F+G+H)=**	**25,182**	CY
	K.	**TOTAL (IMPORT) OR EXPORT:**	**11**	CY
		SITE ADJUSTMENT	0.00	



SECTION A-A

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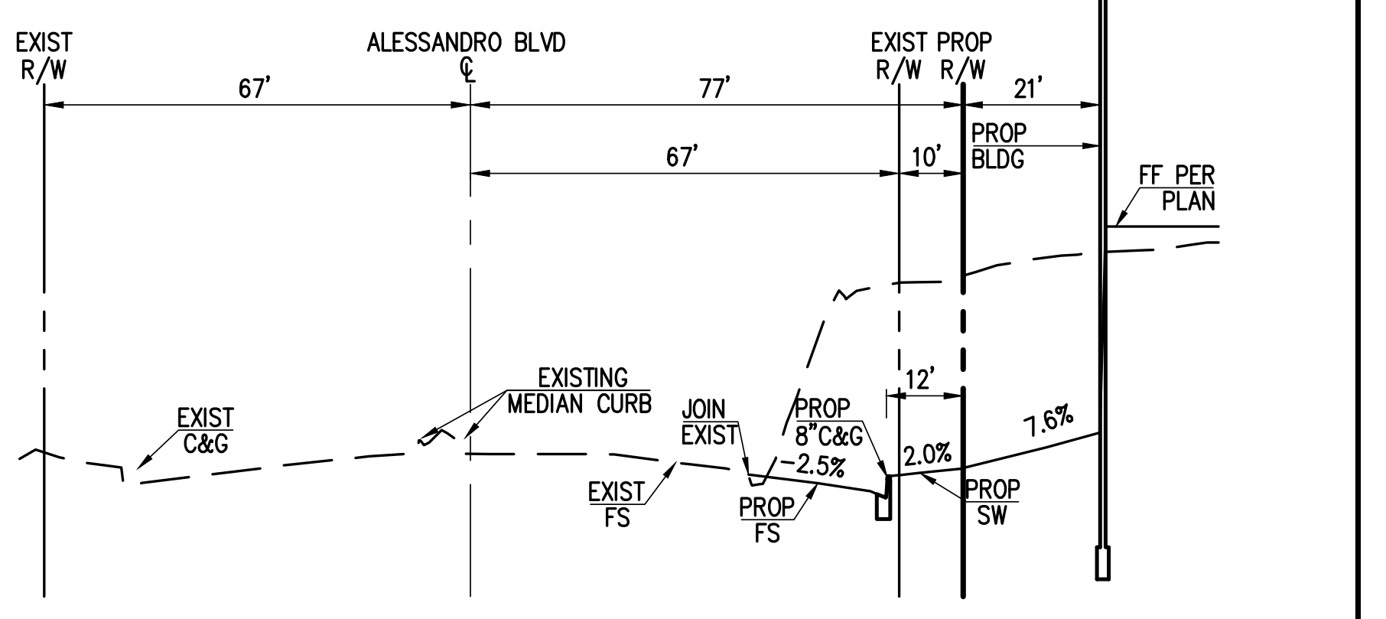
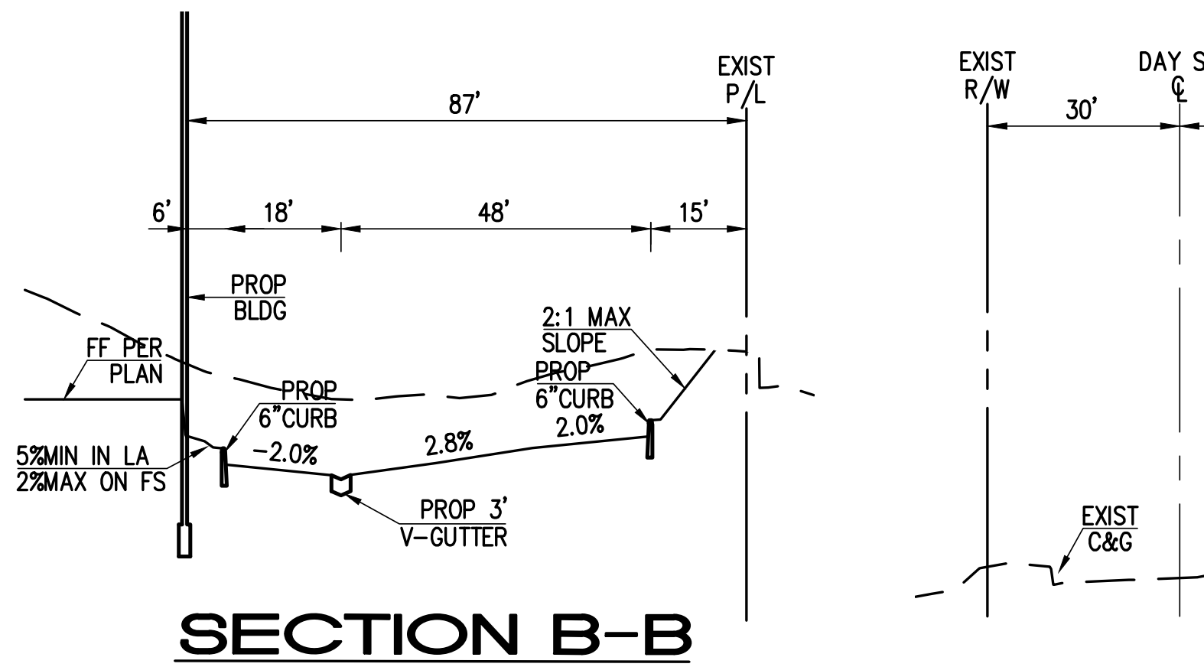


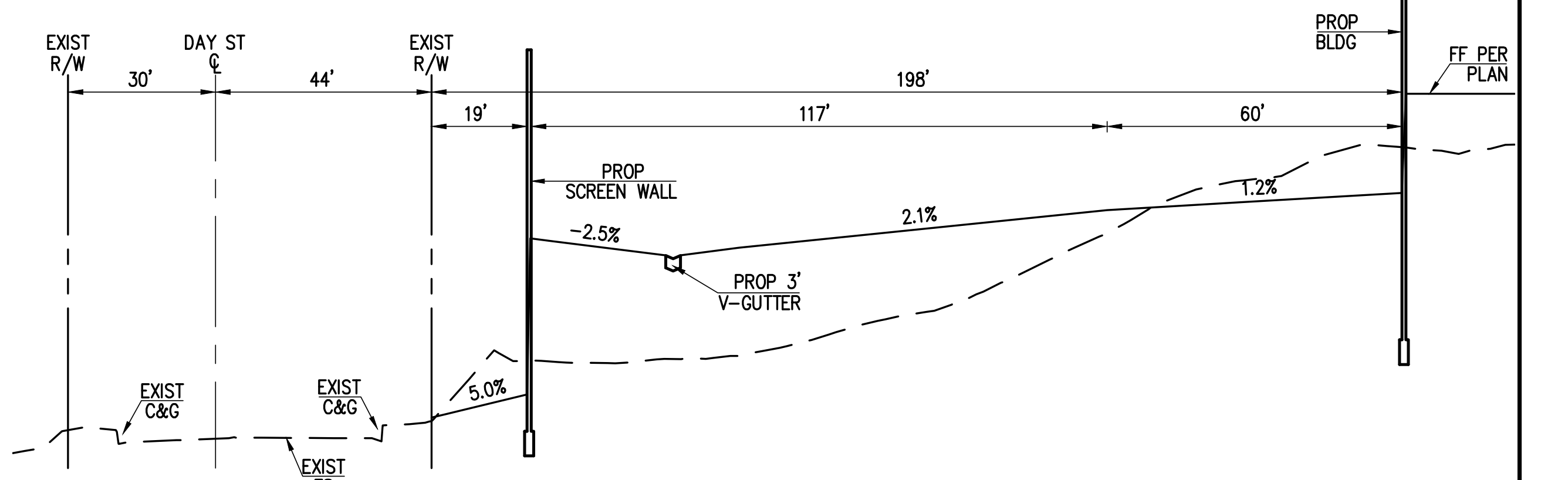
SECTION C-C

SCALE: N.T.S



SECTION B-B

SCALE: N.T.S



SECTION D-D

SCALE: N.T.S

PEN20–0162

OWNER:

LDC INDUSTRIAL REALTY
555 N EL CAIMNO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
TEL: 949–226–4601
EMAIL: LCOCHRUN@LDCINDUSTRIAL.COM

ENGINEER:

Thienes Engineering, Inc.
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EMAIL: CESAR@THIENESENG.COM

CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

PRELIMINARY GRADING PLAN - LEVEL FLOOR
LDC - ALESSANDRO
NORTHEAST CORNER
OF
ALESSANDRO BLVD. AND DAY ST.
MORENO VALLEY, CALIFORNIA

JN 3846

1 of 6 Sheets

PLOT DATE: 12/29/2020

Last Update: 11/04/2020
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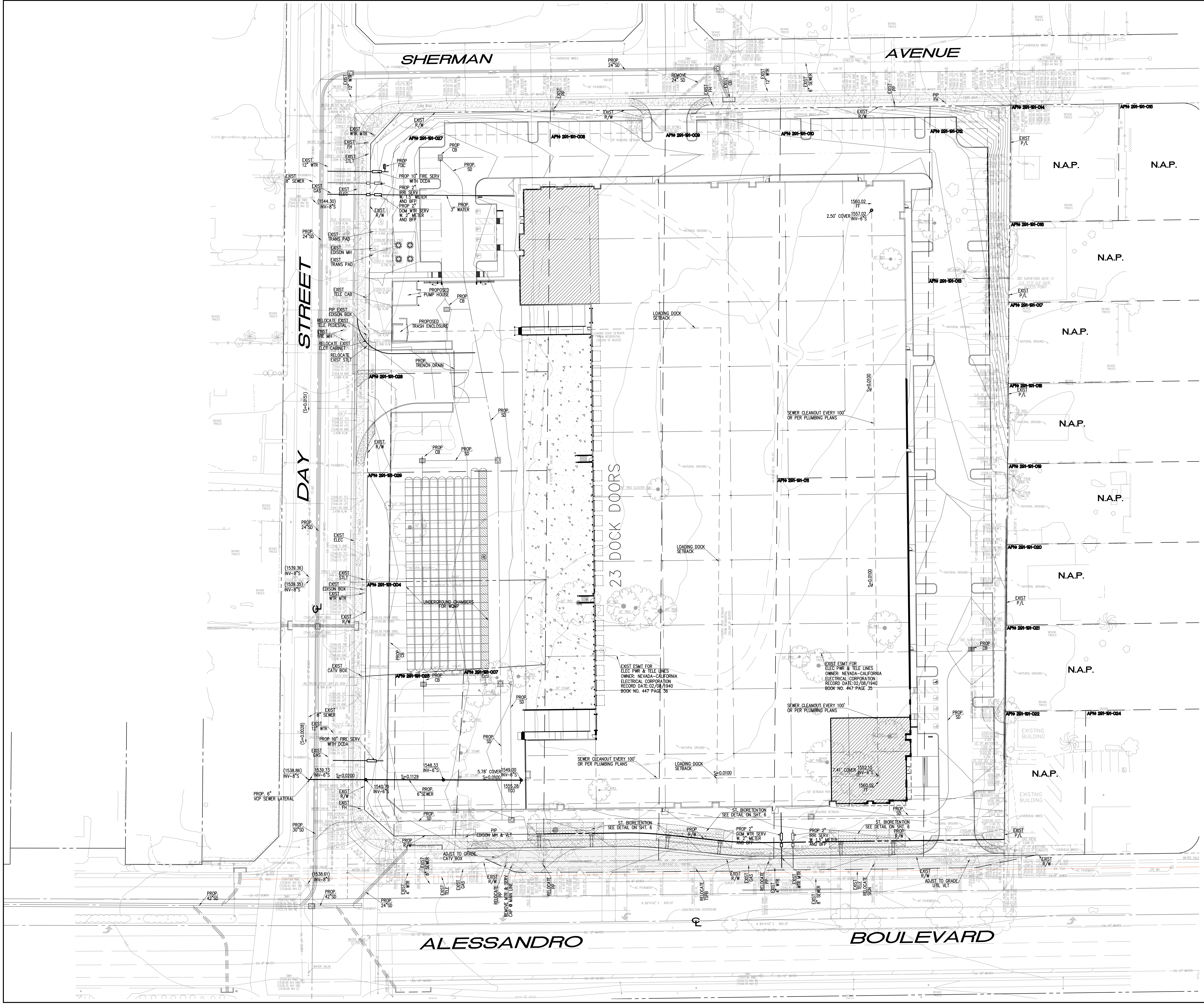
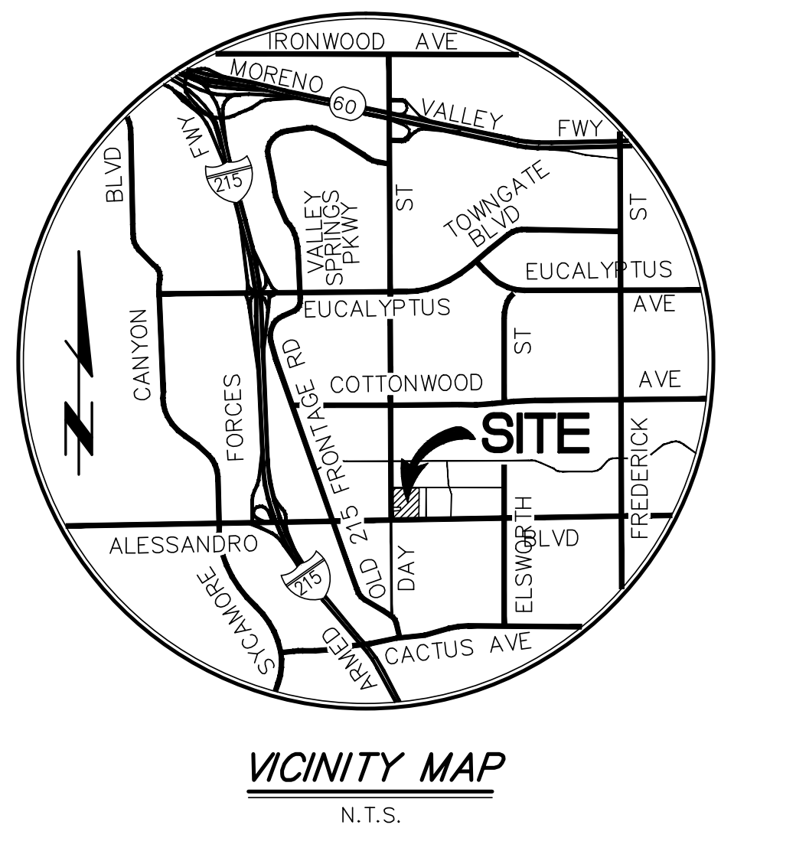
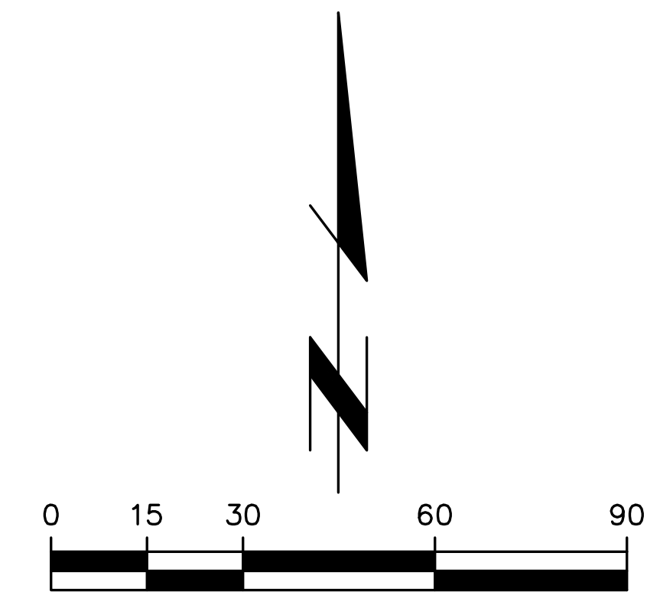




VICINITY MAP
N.T.S.



SCALE: 1"=30'

PEN20-0162

OWNER:

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555 N EL CAIMNO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
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CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

PRELIMINARY UTILITY PLAN
LDC - ALESSANDRO
NORTHEAST CORNER
OF
ALESSANDRO BLVD. AND DAY ST.
MORENO VALLEY, CALIFORNIA

JN 3846

2 of 6 Sheets

PLOT DATE: 12/29/2020

Last Update: 12/29/2020
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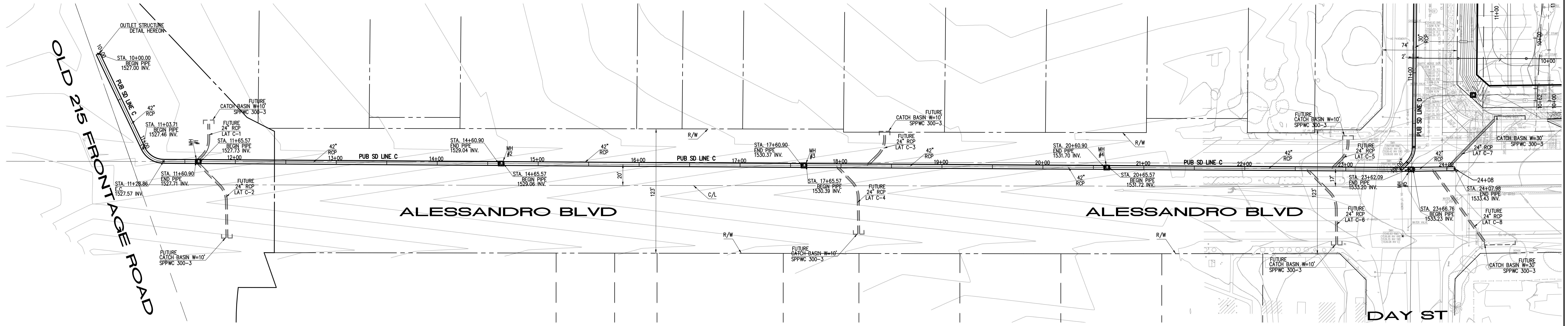
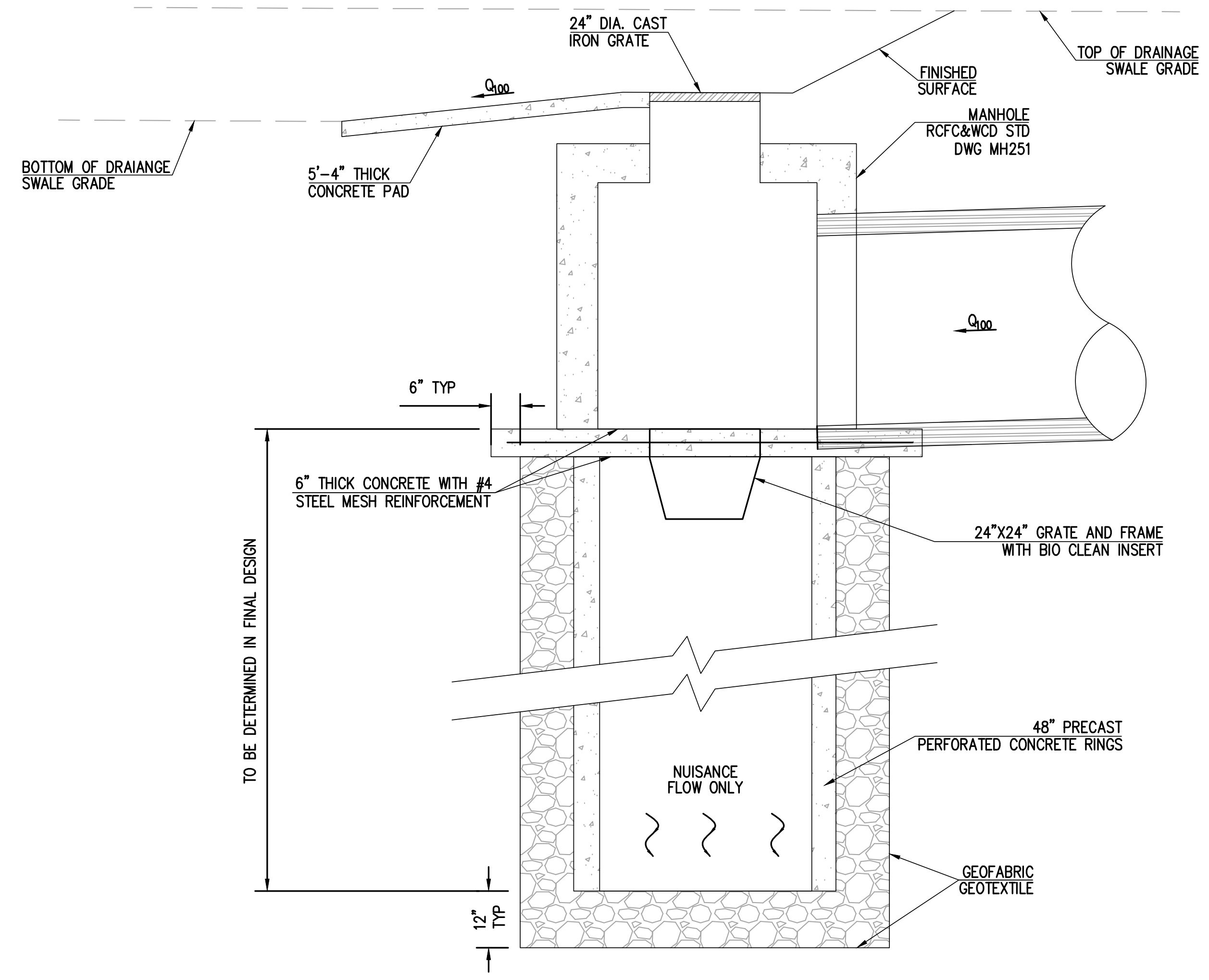
*CONTRACTOR TO VERIFY LOCATION AND INVERT ELEVATIONS OF EXISTING UTILITIES AND DRAINAGE SYSTEMS AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO ANY CONSTRUCTION.

PROFILE SCALE:
HORIZ. – 1" = 40'
VERT. – 1" = 4'





COMBINATION LOWFLOW /OVERFLOW CONVEYANCE STRUCTURE

OUTLET STRUCTURE DETAIL
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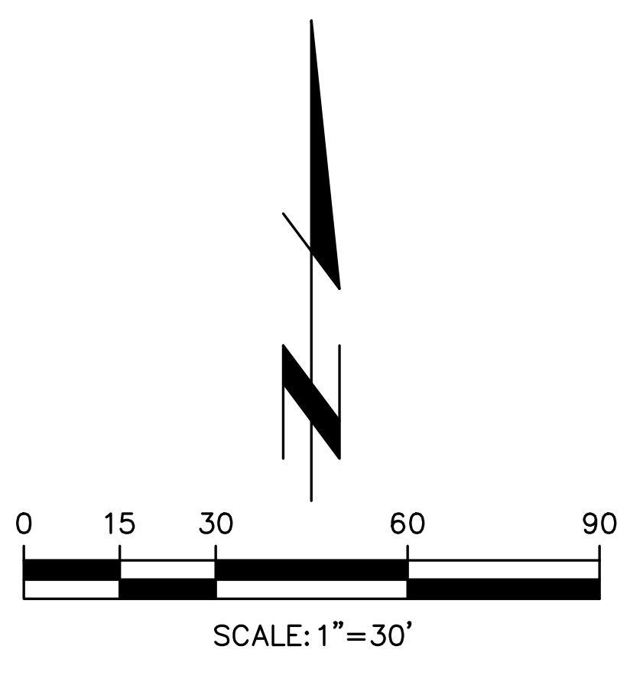

PEN20-0162

OWNER:

LDC INDUSTRIAL REALTY
555 N EL CAIMNO REAL, #A456
SAN CLEMENTE, CA 92672
LARRY D. COCHRUN
TEL: 949-226-4601
EMAIL: LCOCHRUN@LDCINDUSTRIAL.COM

ENGINEER:

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
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CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

PRELIMINARY PUBLIC STORM DRAIN PLAN
LDC - ALESSANDRO
NORTHEAST CORNER
OF
ALESSANDRO BLVD. AND DAY ST.
MORENO VALLEY, CALIFORNIA

JN 3846

3 of 6 Sheets

PLOT DATE: 12/30/2020
Last Update: 12/30/2020
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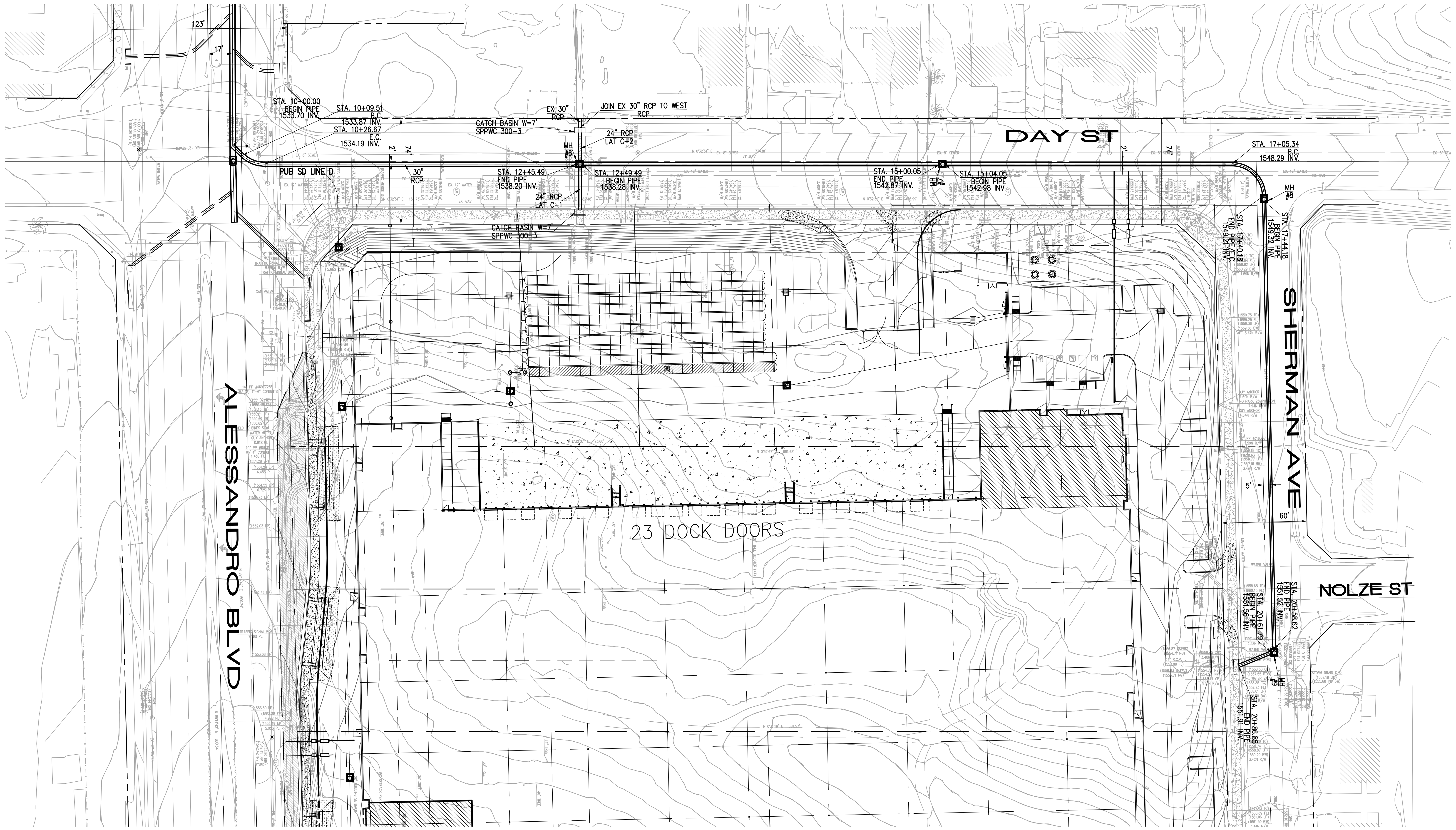

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SCALE: 1"=30'

PEN20–0162

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4 of 6 Sheets

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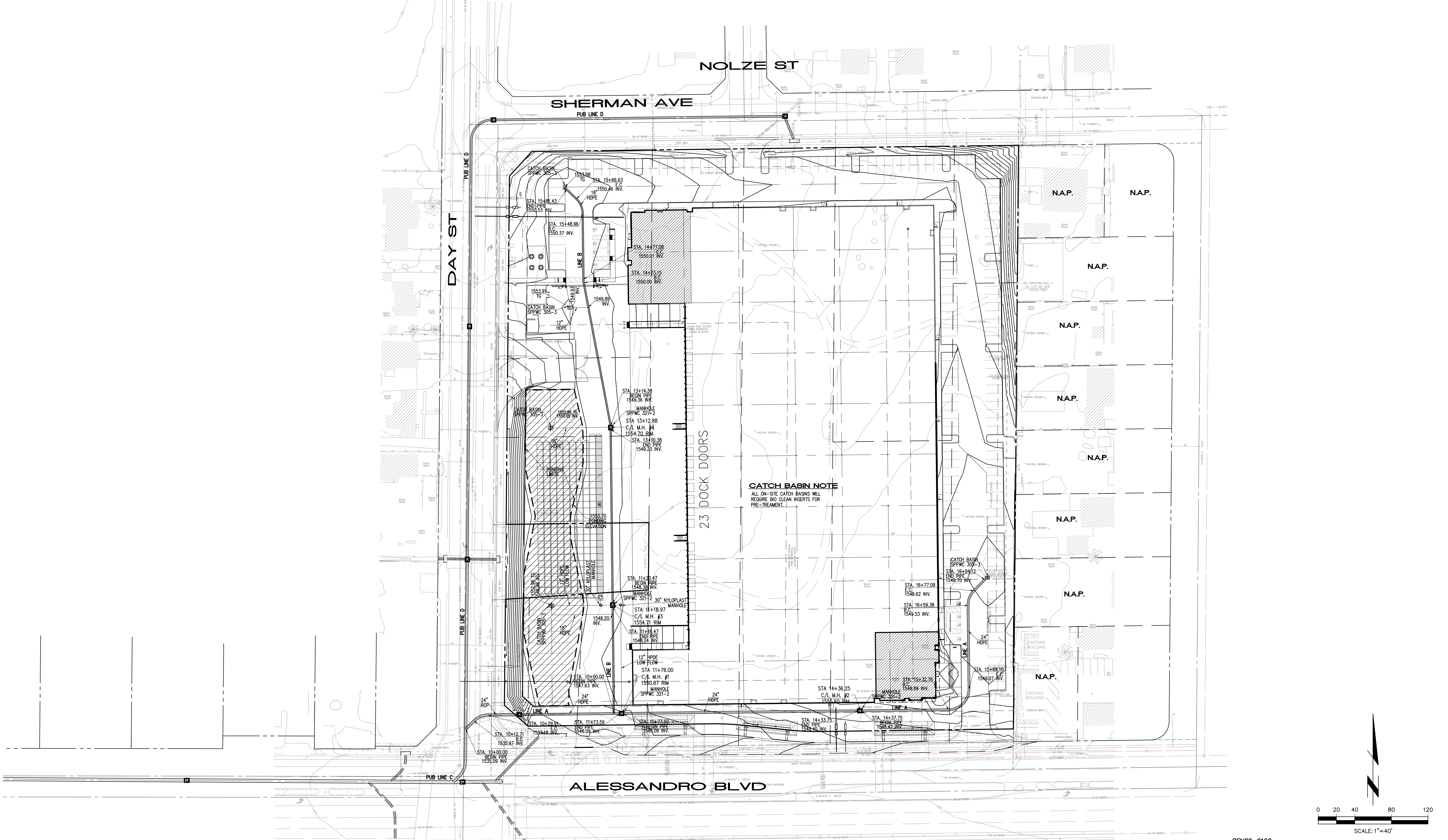

CATCH BASIN NOTE

ALL ON-SITE CATCH BASINS WILL REQUIRE BIO CLEAN INSERTS FOR PRE-TREAMENT.

PEN20-0162

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CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

PRELIMINARY PRIVATE STORM DRAIN PLAN
LDC - ALESSANDRO
NORTHEAST CORNER
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JN 3846

5 of 6 Sheets

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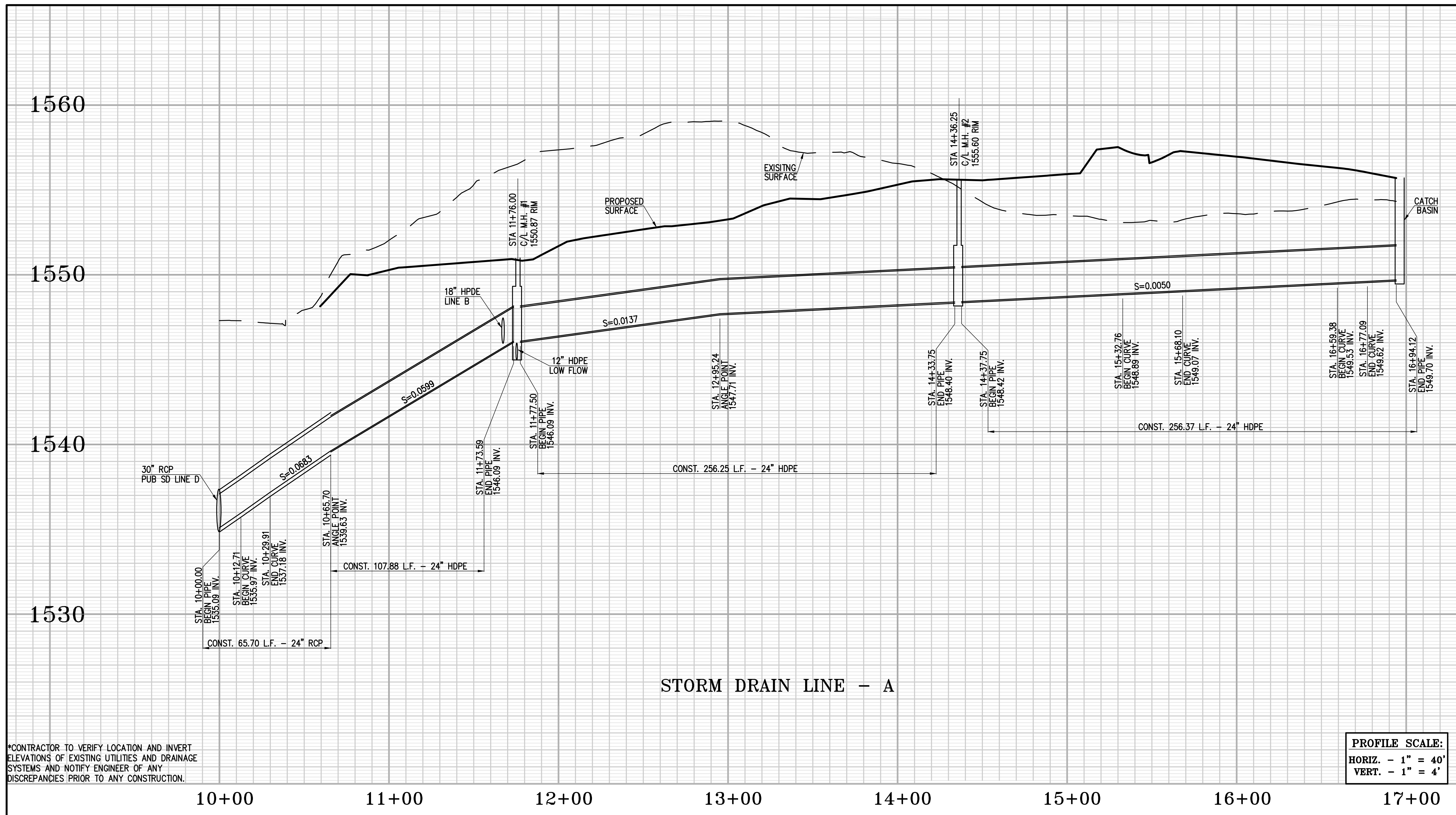

STORM DRAIN LINE – A

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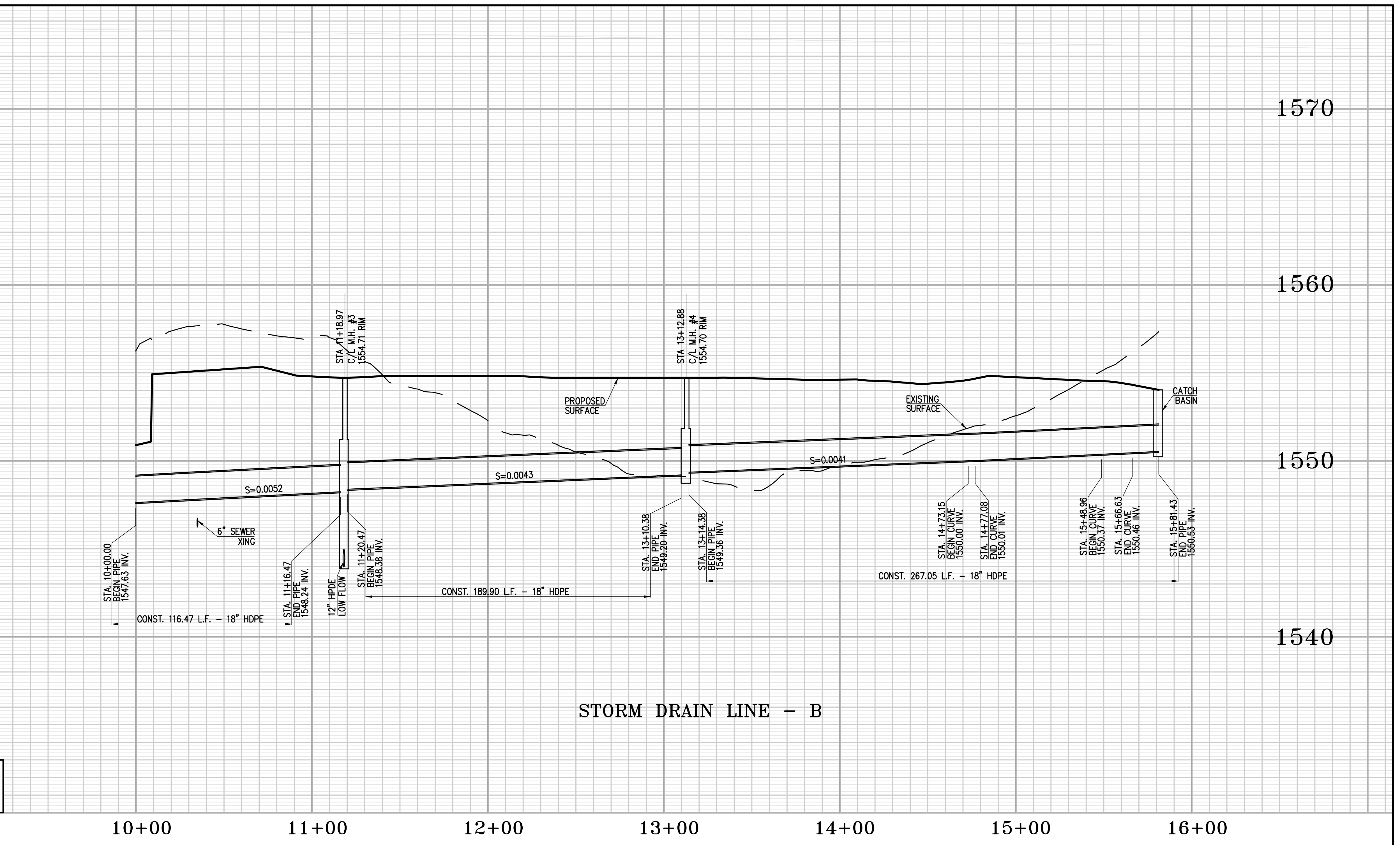
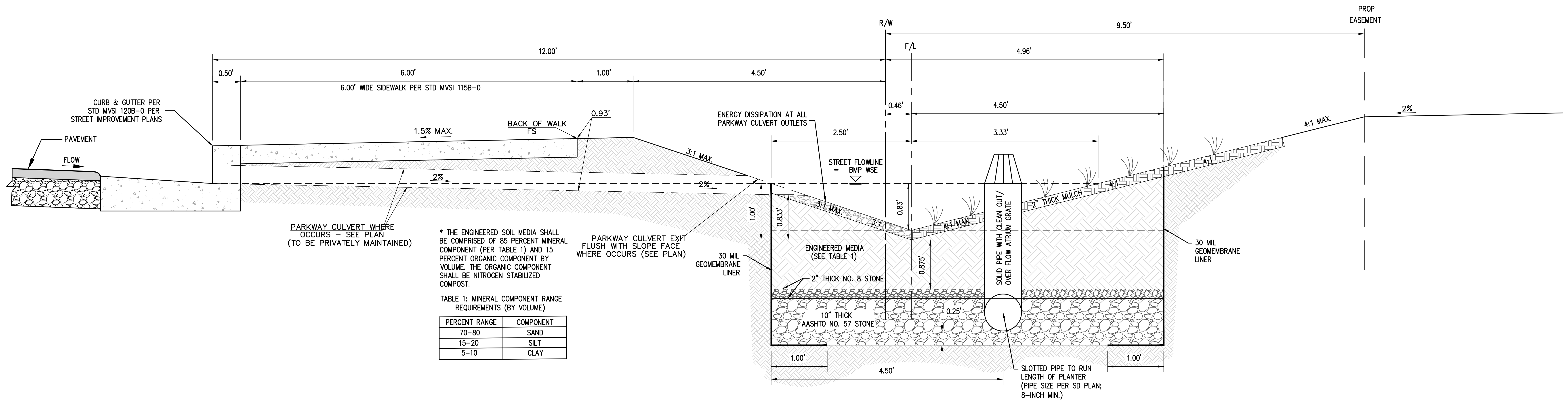


STORM DRAIN LINE – B



* THE ENGINEERED SOIL MEDIA SHALL BE COMPRISED OF 85 PERCENT MINERAL COMPONENT (PER TABLE 1) AND 15 PERCENT ORGANIC COMPONENT BY VOLUME. THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST.

TABLE 1: MINERAL COMPONENT RANGE REQUIREMENTS (BY VOLUME)

PERCENT RANGE	COMPONENT
70–80	SAND
15–20	SILT
5–10	CLAY

STREET BMP – BIORETENTION AREA

N.T.S.

PEN20–0162

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CITY OF MORENO VALLEY
PUBLIC WORKS DEPARTMENT

PRELIMINARY STORM DRAIN – PROFILES
LDC – ALESSANDRO
NORTHEAST CORNER
OF
ALESSANDRO BLVD. AND DAY ST.
MORENO VALLEY, CALIFORNIA

JN 3846

6 of 6 Sheets

PLOT DATE: 12/30/2020

Last Update: 12/29/2020
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Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GEOTECHNICAL INVESTIGATION
Proposed Warehouse Building Development
Northeast Corner Alessandro Boulevard and Day Street
Moreno Valley, California

LDC Industrial Realty, LLC
555 N. El Camino Real, A456
San Clemente, California 92672

Project Number 21551-19
December 23, 2019

NorCal Engineering

TABLE OF CONTENTS

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

December 23, 2019 Project Number 21551-19

LDC Industrial Realty, LLC
555 N. El Camino Real, A456
San Clemente, California 92672

Attn: Larry Cochrun

RE: **GEOTECHNICAL INVESTIGATION** - Proposed Warehouse Building Development - Located at the Northeast Corner of Alessandro Boulevard and Day Street, in the City of Moreno Valley, California

Dear Mr. Cochrun:

Pursuant to your request, this firm has performed this Geotechnical Investigation for the above referenced project. The purpose of this investigation is to evaluate the geotechnical conditions of subject property and to provide recommendations for the proposed development. This geotechnical engineering report presents the findings of our study along with conclusions and recommendations for development.

1.0 STRUCTURAL CONSIDERATIONS

1.1 Proposed Development

It is currently proposed to construct two new concrete tilt-up structures totaling 160,610 square feet on the 7.8-acre property. Asphaltic and concrete pavement areas and landscaping will also be installed. Grading for the development will include cut and fill procedures. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 SITE DESCRIPTION

2.1 **Location:** The rectangular shaped property is located at the northeast corner of Alessandro Boulevard and Day Street, in the City of Moreno Valley, as shown on the Vicinity Map, Figure 1. Sherman Avenue is located to the north.

2.2 **Existing Improvements:** The property is vacant and covered with light vegetation growth.

2.3 **Drainage:** The site topography is generally flat and drainage pattern is not readily discernible.

3.0 SEISMICITY EVALUATION

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered unlikely.

The following seismic design parameters are provided and are in accordance with the 2016 California Building Code (CBC) as determined using the ASCE 7 Hazard Tool (https://asce7hazardtool.online/) for the referenced project. Design map report from the website is included in Appendix A.

Seismic Design Parameters

Site Location – Region 1	Latitude	33.9179°
	Longitude	-117.2776°
Site Soil Class		D
Seismic Design Category		D
Risk Category		III
Maximum Spectral Response Acceleration	S_S	1.500g
	S_1	0.600g
Adjusted Maximum Acceleration	S_{MS}	1.500g
	S_{M1}	0.900g
Design Spectral Response Acceleration Parameters	S_{DS}	1.000g
	S_{D1}	0.600g

The San Jacinto (San Bernardino) Fault zone is located approximately 12 kilometers northeast of the site and is capable of producing a Magnitude 6.9 earthquake. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults.

4.0 FIELD INVESTIGATION

4.1 Site Exploration

The investigation consisted of the placement of one (1) subsurface exploratory boring by hollow-stem auger drill rig and fourteen (14) excavations by backhoe. Explorations extended to a maximum depth of 51.5 feet below current ground elevations. The explorations were placed at accessible locations throughout the site.

The explorations were visually classified and logged by a field engineer with locations of the subsurface excavations are shown on the attached Figure 2. Detailed descriptions of the subsurface conditions are listed on the logs in Appendix B. It should be noted that the transition from one soil type to another as shown on the excavation logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Fill/Disturbed Top Soils– Fill and disturbed top soils classifying as sandy CLAY with gravel, minor debris and roots were encountered in the explorations to depths ranging from 12 to 24 inches. These soils were noted to be soft to firm and damp.

Native Soils – Native soils classifying as sandy CLAY were encountered beneath the upper fill soils. These soils were noted to be medium stiff to stiff and damp to moist. Sand, silt and clay content varied with depth of exploration.

4.2 Groundwater

Groundwater was encountered at a depth of approximately 35 feet at the site.

5.0 LABORATORY TESTS

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils.

Bulk bag samples were obtained in the upper soils for expansion index tests, corrosion tests, resistance value and maximum density tests. Wall loadings on the order of 4,000 lbs./lin.ft. and maximum compression loads on the order of 100 kips were utilized for testing and design purposes. All test results are included in Appendix C, unless otherwise noted.

5.1 **Field moisture content** (ASTM:D 2216-10) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

5.2 **Maximum density tests** (ASTM: D-1557-12) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

5.3 **Expansion index tests** (ASTM: D-4829-11) were performed on remolded samples of the upper soils to determine the expansive characteristics and to provide any necessary recommendations for reinforcement of the slabs-on-grade and the foundations. Results of these tests are provided on Table II and are discussed later in this report.

5.4 **Sieve analyses** and the percent by weight of soil finer than the No. 200 sieve (ASTM: 1140-00) were performed on selected soil samples. These results are detailed later in this report along with discussion of the liquefaction potential at the site.

5.5 **Atterberg Limits** (ASTM: D 4318-10) consisting of liquid limit, plastic limit and plasticity index were performed on selected soil samples. Results are shown on Table III.

5.6 **Direct shear tests** (ASTM: D-3080-11) were performed on undisturbed and/or remolded samples of the subsurface soils. These tests were performed to determine parameters for the calculation of the allowable soil bearing capacity. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plates A - B.

5.7 **Consolidation tests** (ASTM: D-2435-11) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates C - E.

5.8 **Soluble sulfate, pH, Resistivity and Chloride tests** to determine potential corrosive effects of soils on concrete and metal structures were performed in the laboratory. Test results are given in Tables IV – VII and are discussed later in this report.

5.9 **Resistance 'R' Value tests** (CA 301) were conducted on a representative soil sample to determine preliminary pavement section design for the proposed pavement areas. Test results are provided in Table VIII and recommended pavement sections are provided later within the text of this report.

6.0 LIQUEFACTION EVALUATION

The property lies within areas mapped as potentially liquefiable by the County of Riverside Safety Element. The site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. Therefore, the liquefaction potential of the underlying soils has been evaluated with findings from our deep boring (B-1) which extended to a depth of 51.5 feet below grade. The boring encountered stiff/dense to very stiff/dense clays and sands at 5 feet and below. The SPT blowcounts were 45 blows/foot or greater from 10 to 50 feet.

Assuming a conservative historic high groundwater of 20 feet below grade in the area soil layers below that level are judged to be non-liquefiable and the seismic settlement would be less than ½ inch in these very dense clayey and sands using a PGA_M of 0.527g. These settlements should occur rather uniformly across the lot with differential settlements on the order of less than ¼ inch over a 30 feet (horizontal) distance in the building pad area.

Liquefaction calculations are included in Appendix D.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures and grading will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed grading and development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent land or structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the soils engineer may be necessary based upon the conditions encountered.

7.1 Site Grading Recommendations

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

Any vegetation and organic laden soils shall be removed and hauled from proposed grading areas prior to and during the grading operations if encountered. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill*.

7.1.1 **Removal and Recompaction Recommendations**

The upper existing fill soils (12 to 24 inches) shall be removed to competent native materials, the exposed surface scarified to a depth of 8 inches, brought to approximately 2% above optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557-12) prior to placement of any additional compacted fill soils and pavement. *The upper 12 inches of soils beneath building pad and concrete paving shall be compacted to a minimum of 95%.* Grading shall extend a minimum of 5 horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

Adequate drainage away from the structures, pavement and slopes should be provided at all times.

It is likely that isolated areas of undiscovered fill not described in this report or materials disturbed during demolition operations will be encountered on site; if found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction. Abandonment procedures will be provided once underground structures are encountered.

If placement of slabs-on-grade and pavement is not performed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

7.1.2 **Fill Blanket Recommendations**

Due to the potential for differential settlement of structures supported on both compacted fill and native soils, it is recommended that all foundations be underlain by a uniform compacted fill blanket at least 2 feet in thickness. The fill blanket shall extend a minimum of 5 horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

Building floor slabs should also be underlain by a minimum of 2 feet of compacted fill soils.

7.1.3 Shrinkage and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 4 to 8% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.08 feet due to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements or topographic approximations.

Although these values are only approximate, they represent our best estimate of shrinkage values which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing using the actual equipment and grading techniques should be conducted.

7.2 Temporary Excavations and Shoring Design

Temporary unsurcharged excavations less than 4 feet in height may be excavated at vertical inclinations. Excavations over 4 feet in height in the existing site materials may be trimmed at a 1 to 1 (horizontal to vertical) gradient for the entire height of the cut. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring, slot-cutting, or flatter excavations may be required.

The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction.

Temporary shoring design may utilize an active earth pressure of 25 pcf without any surcharge due to adjacent traffic, equipment or structures. The passive fluid pressures of 250 pcf may be doubled to 500 pcf for temporary design.

7.3 Foundation Design

All foundations may be designed utilizing the following allowable soil bearing capacities for an embedded depth of 18 inches into approved compacted fill materials with the corresponding widths. Footings shall not traverse from compacted fill to native soils due to the potential for differential settlement of structures.

\Allowable Soil Bearing Capacity (psf)

Width (ft)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2100	2600
4.0	2400	2900
6.0	2800	3300

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 18-inch minimum depth, up to a maximum of 4500 psf. Property line screen wall foundations where proper overexcavation and recompaction is not possible due to property line restrictions may be designed using a reduced allowable soil bearing capacity of 1,800 psf for foundations a minimum of 18 inches in depth *and* at least 8 inches into the underlying competent native soils. A one-third increase may be used when considering short term loading from wind and seismic forces.

All continuous foundations shall be reinforced with a minimum of 2 #4 steel bars top and bottom. Additional reinforcement may be necessary due to soil expansion or proposed loadings and shall be further evaluated by the project engineers and/or architect. A representative of this firm shall observe foundation excavations prior placement of steel reinforcement and concrete.

7.4 **Settlement Analysis**

Resultant pressure curves for the consolidation tests are shown on Plates C-E. Computations utilizing these curves and the recommended allowable soil bearing capacities reveal that the foundations will experience normal settlements on the order of ¾ inch and differential settlements of less than ¼ inch.

7.5 **Lateral Resistance**

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.40
Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.
Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native ground.

7.6 Retaining Wall Design Parameters

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical)	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system.

During a local Magnitude 6.9 earthquake along the San Jacinto fault zone, additional lateral pressures will occur along the back of walls retaining 6 feet or more of soil. The seismic-induced lateral soil pressure may be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H where H is the height of the retained soils above the wall footing should be used in final design of retaining walls.

Sliding resistance values and passive fluid pressure values given in our previous report may be increased by 1/3 during short-term wind and seismic loading conditions.

7.7 **Floor Slab Design**

Concrete floor slabs-on-grade shall be a minimum of 4 and 6 inches in thickness in office and warehouse areas, respectively, and may be placed upon fill soils compacted to a minimum of *95%* relative compaction. Slabs should be reinforced with a minimum of #3 steel bars, placed at 24 inches on-center in each direction, positioned mid-height in the slab. Concrete slabs (4000 psi) 8 inches in thickness with dowel baskets may delete the above reinforcement requirement. Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon soils expansion potential and proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect.

A vapor retarder should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed upon 4 inches of sand or gravel. The surface upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

All concrete slab areas to receive floor coverings should be moisture tested to meet all manufacturer requirements prior to placement.

7.8 Expansive Soil

The upper soils at the site are very low (Expansion Index = 0-20) in expansion potential. Sites with expansive soils (Expansion Index >20) require special attention during project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

7.9 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded and shaded with clean sand having a sand equivalency rating of 30 or more. This material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

7.10 Corrosion Design Criteria

Representative samples of the surficial soils revealed negligible sulfate concentrations and no special concrete design recommendations are deemed necessary at this time. It is recommended that additional sulfate tests be performed at the completion of rough grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Sulfate test results may be found on the attached Table IV.

Tests were also conducted on a random representative sample of soils to determine the potential corrosive effects on buried metallic structures. Tests for pH, resistivity and chloride are included on Tables V – VII. Soil pH indicates a slightly acidic condition. Resistivity is representative of corrosive soils and metallic structures should be protected as necessary. Chloride content measured 157 ppm.

7.11 Preliminary Pavement Design

The table below provides a preliminary pavement design based upon a tested R-Value of 10 for the proposed pavement areas. Final pavement design should be based on R-Value testing of the subgrade soils near the conclusion of rough grading to assure that the as-graded conditions are consistent with those used in this preliminary design.

On-Site Flexible (Asphaltic) Pavement Section Design

Type of Traffic	Traffic Index	Inches Asphalt	Inches Base
Auto Parking/Circulation	5.0	3.5	8.5
Truck	7.0*	4.5	9.0
Truck	8.0**	5.5	16.5

* Design assumes 26 80,000 lb. trucks per week over 20 years.
** Design assumes 80 80,000 lb. trucks per week over 20 years.

Subgrade soils to receive base material shall be compacted to a minimum of 90% relative compaction; base material shall be compacted to at least 95%. Any concrete slab-on-grade in pavement areas shall be a minimum of 7 inches in thickness and may be placed on subgrade soils compacted to at least 95% relative compaction. An increase in slab thickness and placement of steel reinforcement due to loading conditions and soil expansion may be necessary and should be reviewed by the structural engineer.

The above recommendations are based upon estimated traffic loadings. Client should submit anticipated traffic loadings for the pavement areas to the soils engineer, when available, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.

8.0 INFILTRATION TESTING

Three test locations (T-1, T-2 and T-3) were excavated to determine the infiltration rate of the proposed infiltration/bio-retention systems. The test locations were excavated by backhoe to depths of 9 to 13 feet below existing ground surface (bgs), as specified by project civil engineer. Excavations were trimmed at 1:1 (horizontal to vertical) inclinations in order to provide safe entry into the excavations. No significant caving occurred to the depths of these test excavations

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

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

Water levels were maintained at a constant level in both the inner ring and annular space between rings throughout the test, to prevent flow of water from one ring to the other.

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

For the inner ring calculated as follows:

Vir=ΔVir/(AirΔt)

where:

Vir = inner ring incremental infiltration velocity, cm/hr

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

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

Δt = time interval, hr

An average of the final readings obtained was used for design purposes in each of the basins. The testing data sheets are attached in Appendix E and summarized below.

The use of on-site disposal system by means of retention/infiltration basins appears to be geotechnically feasible for future development. The field infiltration rates given below may be utilized in the final basin design with a safety factor of 2.0 or greater.

			Infiltration Rate	
Test No.	Depth (feet bgs)	Soil Type	(cm/hr)	(in/hr)
T-7	13	sandy Clay	0.93	0.37
T-12	13	clayey Sand	6.7	2.7
T-14	9	sandy Clay	0.13	0.05

It is our opinion that the soils at locations T-7 and T-12 are generally suitable for stormwater infiltration without increasing the potential of settlement of proposed and existing structures located 10 feet or more away from the system or adversely affecting retaining/basement walls located either on or adjacent to the subject site. In addition, the potential for hydro-consolidation and the susceptibility for any ground settlements are considered low. *Soils at location T-7 are not suitable for infiltration due to very low tested rates.* All systems shall meet the California Regional Water Quality Control Board (CRWQCB) requirements.

9.0 CLOSURE

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

This firm should have the opportunity to review the final plans (72 hours for review required) to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

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

Respectfully submitted,
NORCAL ENGINEERING

Keith D Tucker

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

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/2020
GEOTECHNICAL
STATE OF CALIFORNIA

Mark A. Burkholder
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low-density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Soils Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-12).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure. Verification of elevations during grading operations will be the responsibility of the owner or his designated representative.

Material For Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Soils Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils

The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-12) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Soils Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Soils Engineering firm.

Grading Observations
The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Soils Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

EXPANSIVE SOIL GUIDELINES

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

*From Table 18A-I-B of California Building Code (1988)

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and "hairline" cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades of at least 3% should be designed and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any "ponding" of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

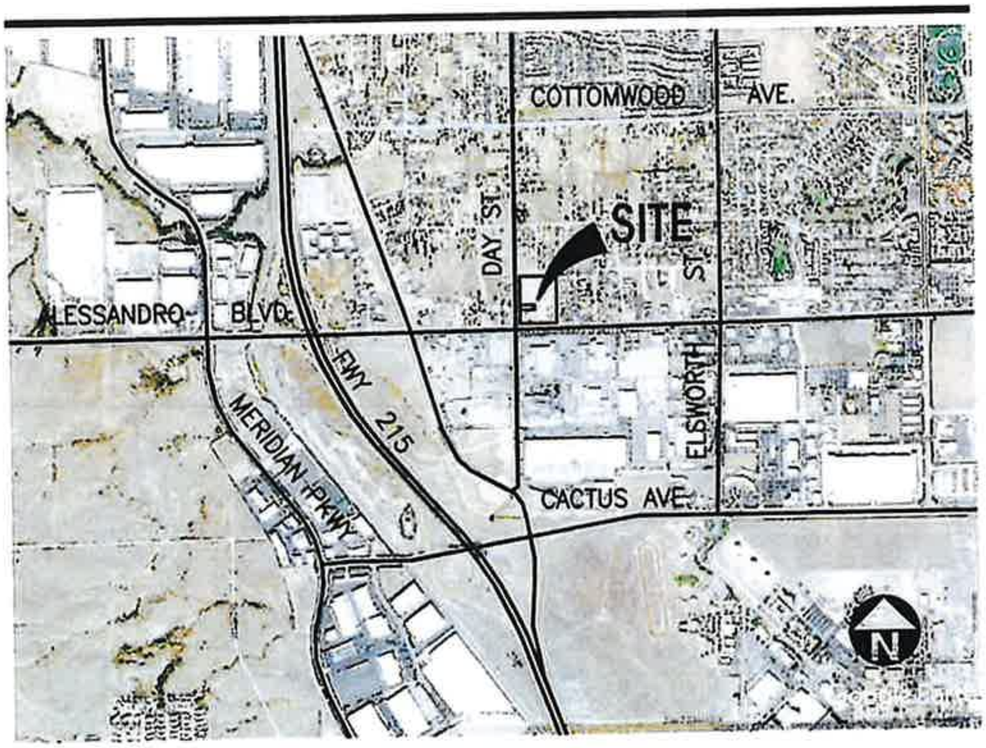
- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain a relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.



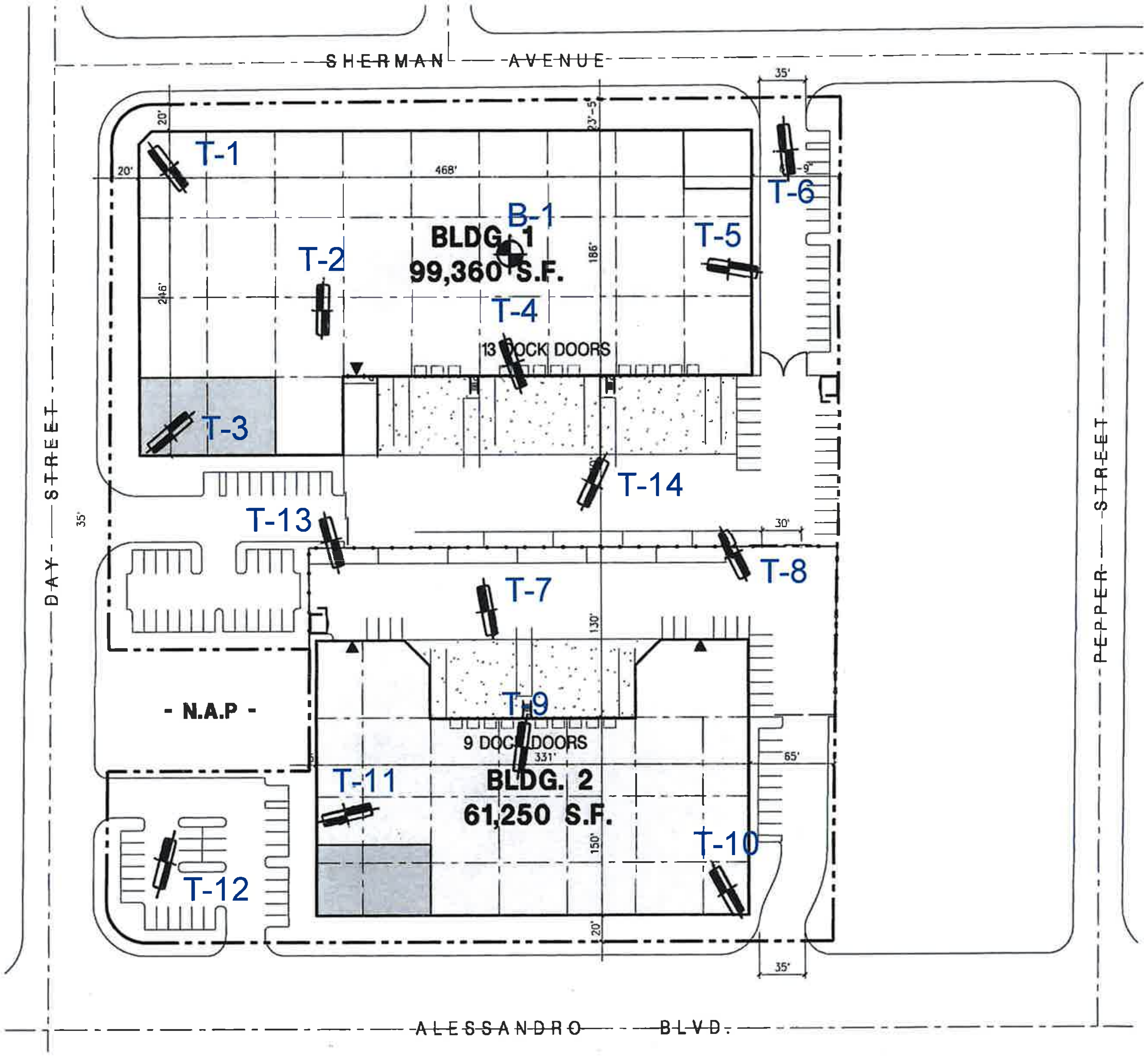
NorCal Engineering

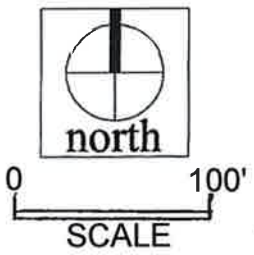
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 21551-19 **DATE** 12/2019

VICINITY MAP

FIGURE 1





Tabulation

	BLDG. 1	BLDG. 2	TOTAL
SITE AREA			
In s.f.	199,414	140,277	339,691 s.f
In acres	4.58	3.22	7.80 ac
BUILDING AREA			
Office - 1st floor	3,000	1,500	4,500 s.f
Office - 2nd floor	3,000	1,500	4,500 s.f
Warehouse	93,360	58,250	151,610 s.f.
TOTAL	99,360	61,250	160,610 s.f.
COVERAGE	49.8%	43.7%	47.3%
AUTO PARKING REQUIRED			
Office: 1/250 s.f.	24	12	36 stalls
Whse: 1st 20,000 @ 1/1,000 s.f.	20	20	40 stalls
2nd 20,000 @ 1/2,000 s.f.	10	10	20 stalls
above 40,000 @ 1/4,000 s.f.	14	5	19 stalls
TOTAL	68	47	115 stalls
AUTO PARKING PROVIDED			
Standard (9' x 18')	68	52	120 stalls
TRAILER PARKING REQUIRED			
Trailer: 1 per dock door	13	9	22 doors
TRAILER PARKING PROVIDED			
Trailer (12' x 53')	13	9	22 stalls

ZONING ORDINANCE FOR CITY

Zoning Designation - Business park (BP)

MAXIMUM BUILDING HEIGHT ALLOWED

Height - no height requirement

MAXIMUM FLOOR AREA RATIO

FAR - to be verified

SETBACKS

Building	Landscape
Front - 20'	Front / street - 10'
Side/Rear - 3'	
Street - 20'	

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 21551-19 **DATE** 12/2019

LOCATION OF FIELD EXPLORATIONS

FIGURE 2

APPENDICES

(In order of appearance)

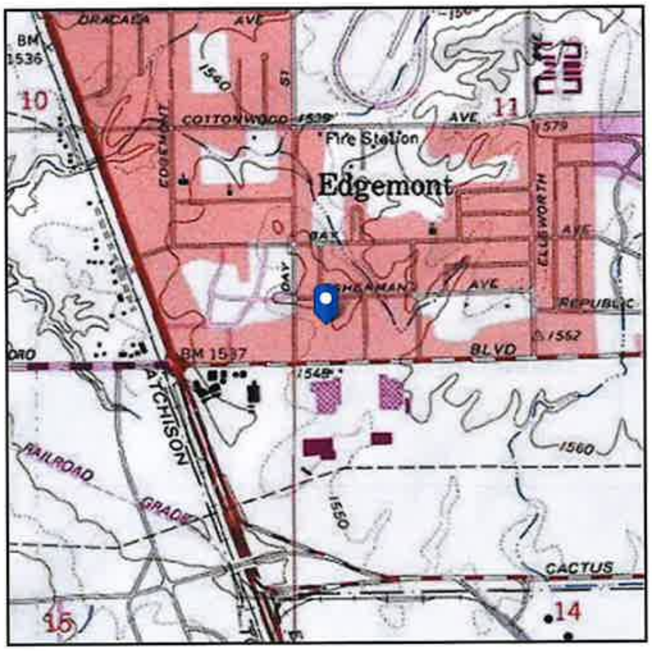
APPENDIX A

ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-10
Risk Category: III
Soil Class: D - Stiff Soil

Elevation: 1559.04 ft (NAVD 88)
Latitude: 33.9179
Longitude: -117.2776



Seismic

Site Soil Class: D - Stiff Soil

Results:

S_S :	1.5	S_{DS} :	1
S_1 :	0.6	S_{D1} :	0.6
F_a :	1	T_L :	8
F_v :	1.5	PGA :	0.527
S_{MS} :	1.5	PGA_M :	0.527
S_{M1} :	0.9	F_{PGA} :	1
		I_e :	1.25

Seismic Design Category D

Data Accessed: Fri Dec 20 2019

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

APPENDIX B

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

■ Indicates 2.5-inch Inside Diameter. Ring Sample.

⊠ Indicates 2-inch OD Split Spoon Sample (SPT).

⧅ Indicates Shelby Tube Sample.

◫ Indicates No Recovery.

◧ Indicates SPT with 140# Hammer 30 in. Drop.

🖂 Indicates Bulk Sample.

◩ Indicates Small Bag Sample.

◨ Indicates Non-Standard

⧗ Indicates Core Run.

COMPONENT PROPORTIONS

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

COMPONENT DEFINITIONS

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

MOISTURE CONTENT

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

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

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

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21551-19

Log of Boring B-1

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

Groundwater Depth: 35'

Drilling Method: Drill Rig

Hammer Weight: 140 lbs

Drop: 30"

Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	FILL SOILS Sandy CLAY with occasional gravel and rootlets Brown, soft, damp					
	▨	NATURAL SOILS Sandy CLAY Brown, stiff, damp to moist					
5	▨		☒	8/10/10		5.6	
10	▨		☒	15/32/36		14.2	
15	▨		☒	16/23/32		7.6	
20	▨		☒	18/19/26		16.1	
25	⁘	Clayey SAND Brown, very dense, moist	☒	18/23/30		12.5	
30	▨	Sandy CLAY Reddish-brown, very stiff, moist	☒	15/21/32		15.7	
35	▽						

NorCal Engineering

LDC Industrial Realty LLC
21551-19

Log of Boring B-1

Boring Location: Alessadro & Day St, Moreno Valley
Date of Drilling: 12/6/19
Groundwater Depth: 35'
Drilling Method: Drill Rig
Hammer Weight: 140 lbs
Drop: 30"
Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
35	▨	Clayey SAND Brown, very dense, moist	☒	18/30/38		15.5	
40	▨		☒	18/28/26		15.5	
	▥	Slightly clayey SAND with some gravel Brown, very dense, moist					
45	▥		☒	19/27/37		12.4	
50	▥		☒	25/37/48		12.9	
		Boring completed at depth of 51.5'					
55							
60							
65							
70							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21551-19.log Date: 12/20/2019

LDC Industrial Realty LLC
21551-19

Log of Trench T-1

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

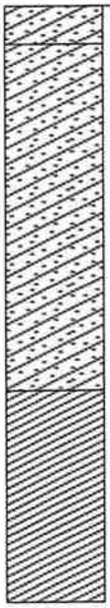
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL SOILS Clayey SAND with occasional gravel and roots Brown, medium dense, moist	☒				
		■		4.6	114.7	
	NATURAL SOILS Clayey SAND Brown, medium dense to dense, damp to moist					
5		■		8.2	111.7	
10	Sandy CLAY Brown, stiff, moist	■		10.3	110.7	
15		■		6.6	102.7	
	Trench completed at depth of 15.5'					
20						
25						
30						
35						

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21551-19

Log of Trench T-2

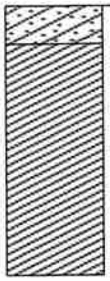
Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19 **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith- ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL SOILS Clayey SAND with occasional gravel and roots Brown, soft, moist	▽ ▽				
			NATURAL SOILS Sandy CLAY Brown, medium stiff, moist	■		6.8	119.9	
5				■		9.5	106.9	
			Trench completed at depth of 7'					
10								
15								
20								
25								
30								
35								

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NorCal Engineering

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21551-19

Log of Trench T-3

Boring Location: Alessadro & Day St, Moreno Valley
Date of Drilling: 12/6/19
Groundwater Depth: None Encountered
Drilling Method: Backhoe
Hammer Weight:
Drop:
Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	GWT not encountered	FILL SOILS Clayey SAND with occasional pieces of asphalt, glass and wood chips Brown, loose to medium dense, moist to very moist					
	▨			■		14.0	116.1	
5	▨							
	▨		NATURAL SOILS Sandy CLAY Brown, medium stiff, moist	■		12.6	106.8	
10			Trench completed at depth of 10'					
15								
20								
25								
30								
35								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21551-19.log Date: 12/20/2019

LDC Industrial Realty LLC
21551-19

Log of Trench T-4

Boring Location: Alessadro & Day St, Moreno Valley
Date of Drilling: 12/6/19
Groundwater Depth: None Encountered
Drilling Method: Backhoe
Hammer Weight:
Drop:
Surface Elevation: Not Measured

Depth (feet)	Lith- ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨	GWT not encountered	FILL SOILS Clayey SAND with occasional gravel and roots Brown, loose, damp	■		5.0	112.0	
	▨		NATURAL SOILS Silty clayey SAND Brown, dense, damp					
5				■		6.0	108.5	
			Trench completed at depth of 5.5'					
10								
15								
20								
25								
30								
35								

LDC Industrial Realty LLC
21551-19

Log of Trench T-5

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨ GWT not encountered	FILL SOILS Sandy CLAY with rootlets, occasional gravel Brown, soft, moist	■		6.2	107.6	
	▨	NATURAL SOILS Sandy CLAY Brown, medium stiff, moist					
5	▨						
	▨		■		9.4	116.0	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

LDC Industrial Realty LLC
21551-19

Log of Trench T-6

Boring Location: Alessadro & Day St, Moreno Valley
Date of Drilling: 12/6/19
Groundwater Depth: None Encountered
Drilling Method: Backhoe
Hammer Weight:
Drop:
Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	GWT not encountered	FILL SOILS Clayey SAND with occasional gravel and roots Brown, loose to medium dense, moist					
	▨		NATURAL SOILS Sandy CLAY Brown, stiff, moist					
5	▨		Clayey SAND with occasional gravel Brown, dense, moist					
			Trench completed at depth of 4'					
10								
15								
20								
25								
30								
35								

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LDC Industrial Realty LLC
21551-19

Log of Trench T-7

Boring Location: Alessadro & Day St, Moreno Valley
Date of Drilling: 12/6/19
Groundwater Depth: None Encountered
Drilling Method: Backhoe
Hammer Weight:
Drop:
Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨	GWT not encountered	FILL SOILS Sandy CLAY with rootlets, asphalt, brick, concrete pieces Brown, soft, moist					
	▨		NATURAL SOILS Sandy CLAY Brown, stiff, moist					
5	▨							
10	▨							
			Trench completed at depth of 13'	▯		7.3		
15								
20								
25								
30								
35								

LDC Industrial Realty LLC
21551-19

Log of Trench T-8

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

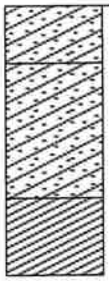
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL SOILS Clayey SAND with occasional gravel and roots Brown, loose, moist					
	NATURAL SOILS Clayey SAND Brown, dense, moist	■		9.7	112.9	
5	Sandy CLAY Brown, medium stiff, moist					
	Trench completed at depth of 7'	■		9.4	113.7	
10						
15						
20						
25						
30						
35						

LDC Industrial Realty LLC
21551-19

Log of Trench T-9

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19 **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	GWT not encountered	FILL SOILS Clayey SAND with occasional gravel and roots Brown, soft, moist	■		5.3	117.9	
	▨		NATURAL SOILS Sandy CLAY Brown, medium stiff, damp					
5				☒		5.9		
10	▨		Clayey SAND Brown, dense, moist	■		6.1	116.5	
15			Trench completed at depth of 15'	■		8.8	114.3	
20								
25								
30								
35								

LDC Industrial Realty LLC
21551-19

Log of Trench T-10

Boring Location: Alessadro & Day St, Moreno Valley
Date of Drilling: 12/6/19
Groundwater Depth: None Encountered
Drilling Method: Backhoe
Hammer Weight:
Drop:
Surface Elevation: Not Measured

Depth (feet)	Lith- ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	▨	GWT not encountered	FILL SOILS Clayey SAND with occasional gravel, brick pieces and roots Brown, loose, moist					
	▨		NATURAL SOILS Clayey SAND Brown, medium dense, damp	■		6.1	103.3	
5	▨							
	▨			■		3.7	107.3	
10			Trench completed at depth of 10'					
15								
20								
25								
30								
35								

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LDC Industrial Realty LLC
21551-19

Log of Trench T-11

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory Fines Content %
0		FILL SOILS Clayey SAND with concrete pieces, gravel brick, rootlets Brown, loose, damp to moist	■		6.1	122.6	
		NATURAL SOILS Sandy CLAY Brown, dense, moist					
5							
			■		8.8	114.2	
			■		9.4	120.1	
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

LDC Industrial Realty LLC

21551-19

Log of Trench T-12

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨ GWT not encountered	FILL SOILS Clayey SAND with rootlets and some concrete pieces Brown, loose, moist					
	▨	NATURAL SOILS Clayey SAND Brown, medium dense to dense, damp					
5	▨						
		Trench completed at depth of 9'	☒		6.3		
10							
15							
20							
25							
30							
35							

LDC Industrial Realty LLC
21551-19

Log of Trench T-13

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨	GWT not encountered	FILL SOILS Sandy CLAY with rootlets, gravel Brown, soft, moist					
	▨		NATURAL SOILS Sandy CLAY Brown, medium stiff, moist					
5			Trench completed at depth of 5'					
10								
15								
20								
25								
30								
35								

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LDC Industrial Realty LLC
21551-19

Log of Trench T-14

Boring Location: Alessadro & Day St, Moreno Valley

Date of Drilling: 12/6/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith- ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▨	GWT not encountered	FILL SOILS Sandy CLAY with rootlets Brown, soft, moist					
	▨		NATURAL SOILS Sandy CLAY Brown, medium stiff to stiff, moist					
5	▨							
10	▨							
			Trench completed at depth of 13'	☒		10.1		
15								
20								
25								
30								
35								

APPENDIX C

TABLE I
MAXIMUM DENSITY TESTS
(ASTM: D-1557-12)

Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
T-1 @ 2-4'	sandy CLAY	10.0	131.0

TABLE II
EXPANSION INDEX TESTS
(ASTM: D-4829-11)

Sample	Classification	Expansion Index
T-1 @ 2-4'	sandy CLAY	07

TABLE III
ATTERBERG LIMITS
(ASTM: D-4318-10)

Sample	Liquid Limit	Plastic Limit	Plasticity Index
T-1 @ 2-4'	22	17	5

TABLE IV
SOLUBLE SULFATE TESTS
(CT 417)

Sample	Sulfate Concentration (%)
T-1 @ 1-2'	0.0019

TABLE V
pH TESTS

Sample	pH
T-1 @ 1-2’	6.5

TABLE VI
RESISTIVITY TESTS
(CT 643)

Sample	Resistivity (ohm-cm)
T-1 @ 1-2’	2062

TABLE VII
CHLORIDE TESTS
(CT 422))

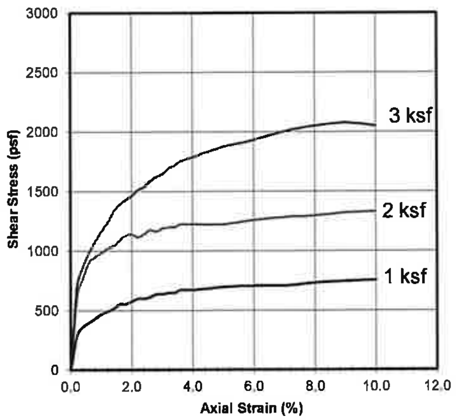
Sample	Concentration (ppm)
T-1 @ 1-2’	157

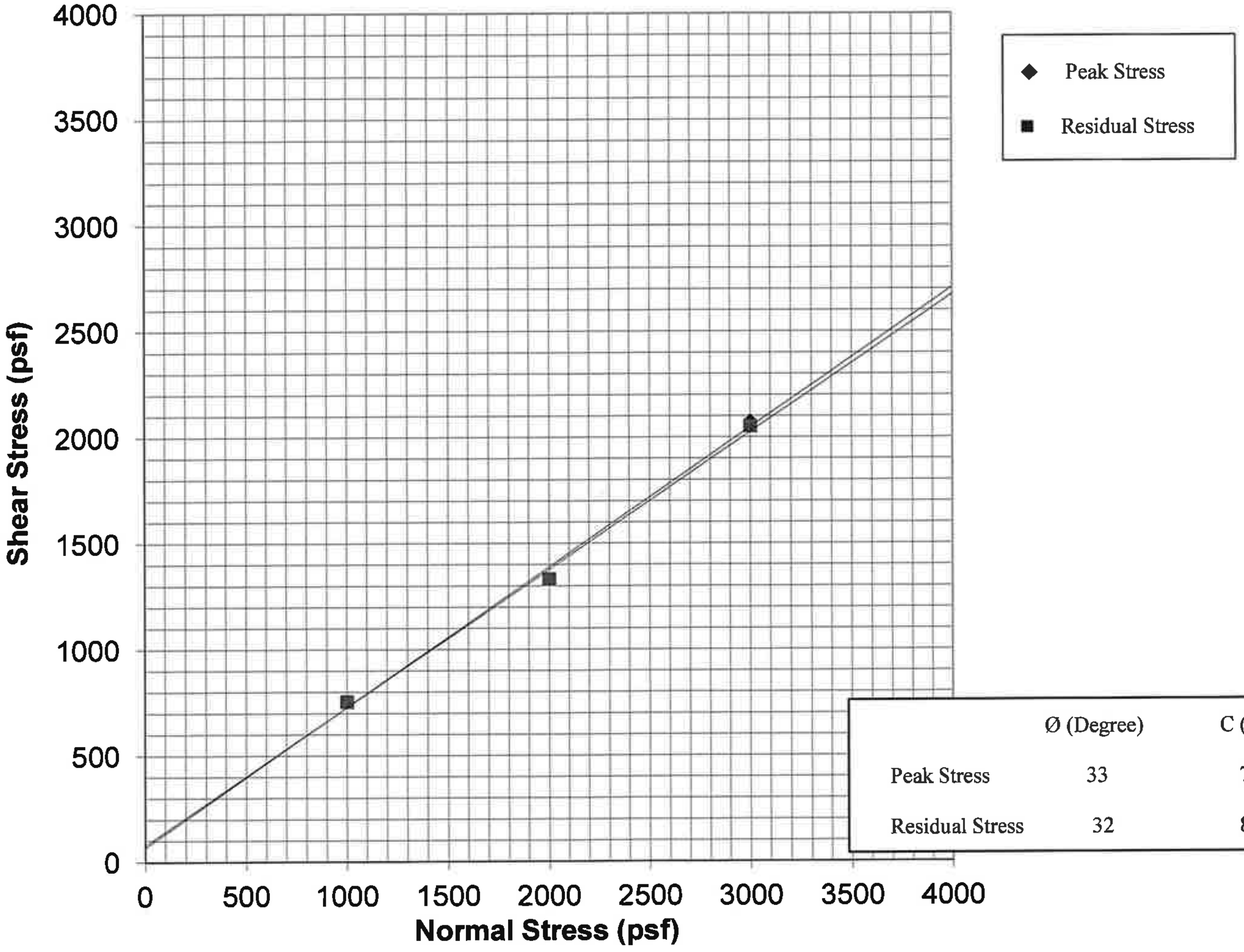
TABLE VIII
RESISTANCE ‘R’ VALUE TESTS
(CA 301))

Sample	‘R’ Value
T-2 @ 1-2’	10

Sample No. T1@1'
Sample Type: Remolded/Saturated
Soil Description: Silty Fine-Medium Grained Sand w/ Some Clay

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	756	1332	2076
Displacement	(in)	0.250	0.250	0.225
Residual Stress	(psf)	756	1332	2052
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	117.9	117.9	117.9
In Situ Water Content	(%)	10.0	10.0	10.0
Saturated Water Content	(%)	15.8	15.8	15.8
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	33	70
Residual Stress	32	80

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SOILS AND GEOTECHNICAL CONSULTANTS

LDC Industrial Realty, LLC

PROJECT NUMBER: 21551-19 DATE: 12/19/2019

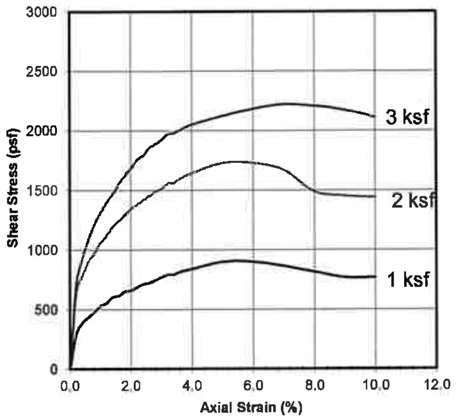
DIRECT SHEAR TEST

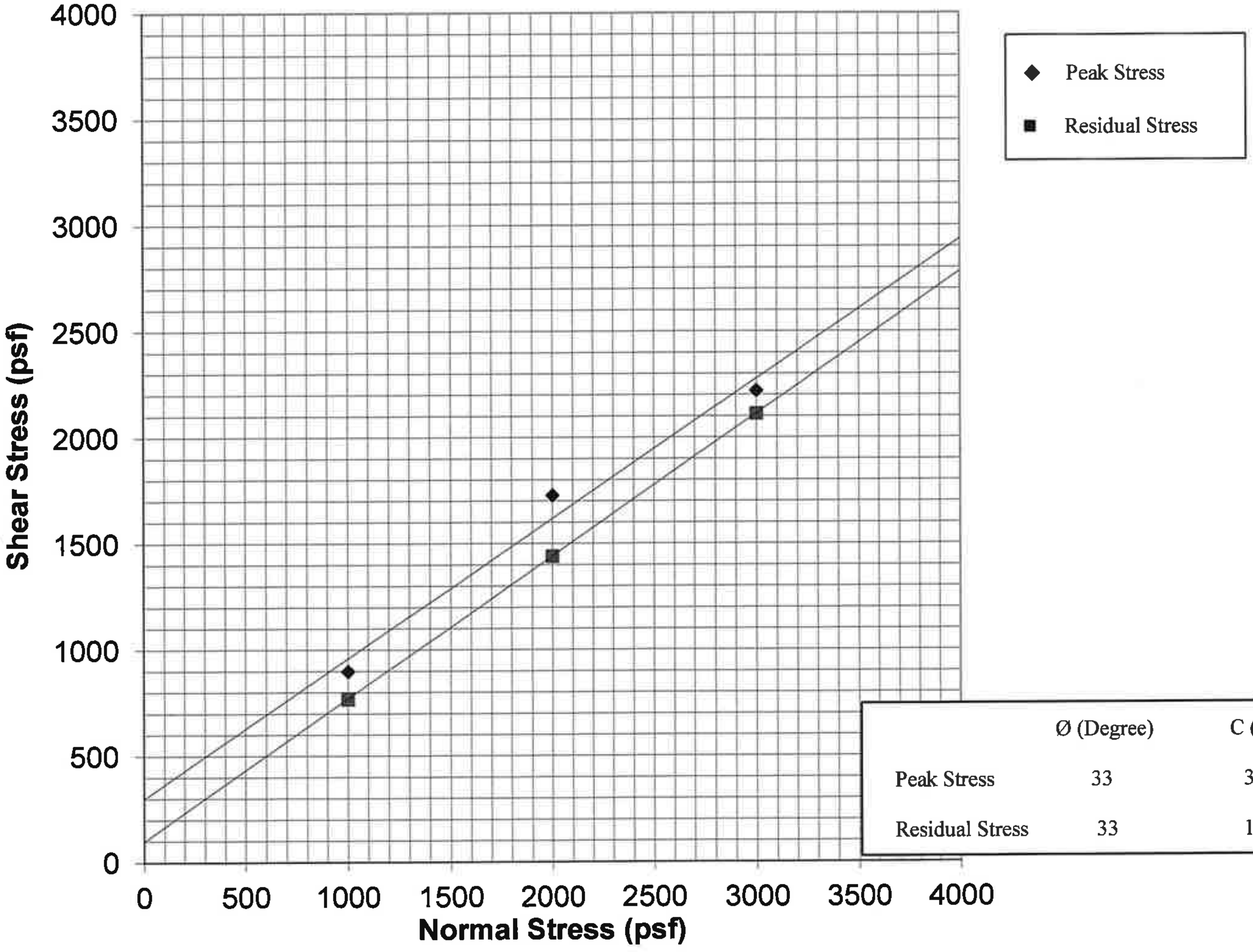
ASTM D3080

Plate A

Sample No. T3@4'
Sample Type: Undisturbed/Saturated
Soil Description: Silty Sand w/ Some Clay

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	900	1728	2220
Displacement	(in.)	0.125	0.125	0.175
Residual Stress	(psf)	768	1440	2112
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	116.1	116.1	116.1
In Situ Water Content	(%)	14.0	14.0	14.0
Saturated Water Content	(%)	16.7	16.7	16.7
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	33	300
Residual Stress	33	100

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LDC Industrial Realty, LLC
PROJECT NUMBER: 21551-19 DATE: 12/19/2019

DIRECT SHEAR TEST
ASTM D3080
Plate B

Sample No. T1

Depth 10'

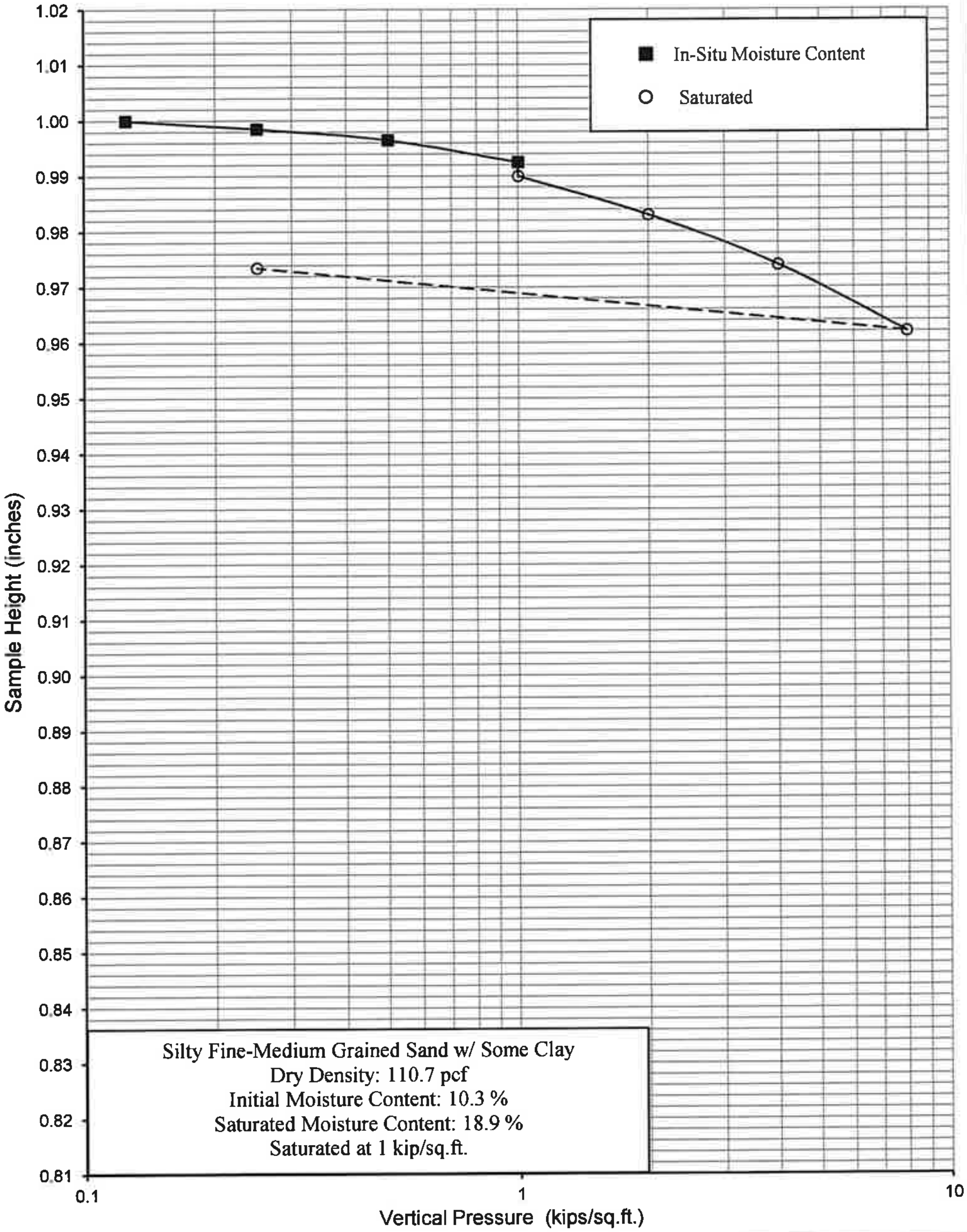
Date 12/19/2019

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	
0.125	1.0000	0.0	
0.25	0.9985	0.2	
0.5	0.9965	0.4	
1	0.9925	0.8	
1	0.9900	1.0	Saturated
2	0.9830	1.7	
4	0.9740	2.6	
8	0.9620	3.8	
0.25	0.9735	2.7	

Date Tested: 12/17/2019

Sample: T1

Depth: 10'



Silty Fine-Medium Grained Sand w/ Some Clay
Dry Density: 110.7 pcf
Initial Moisture Content: 10.3 %
Saturated Moisture Content: 18.9 %
Saturated at 1 kip/sq.ft.

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SOILS AND GEOTECHNICAL CONSULTANTS

LDC Industrial Realty, LLC

PROJECT NUMBER: 21551-19 DATE: 12/19/2019

CONSOLIDATION TEST

ASTM D2435

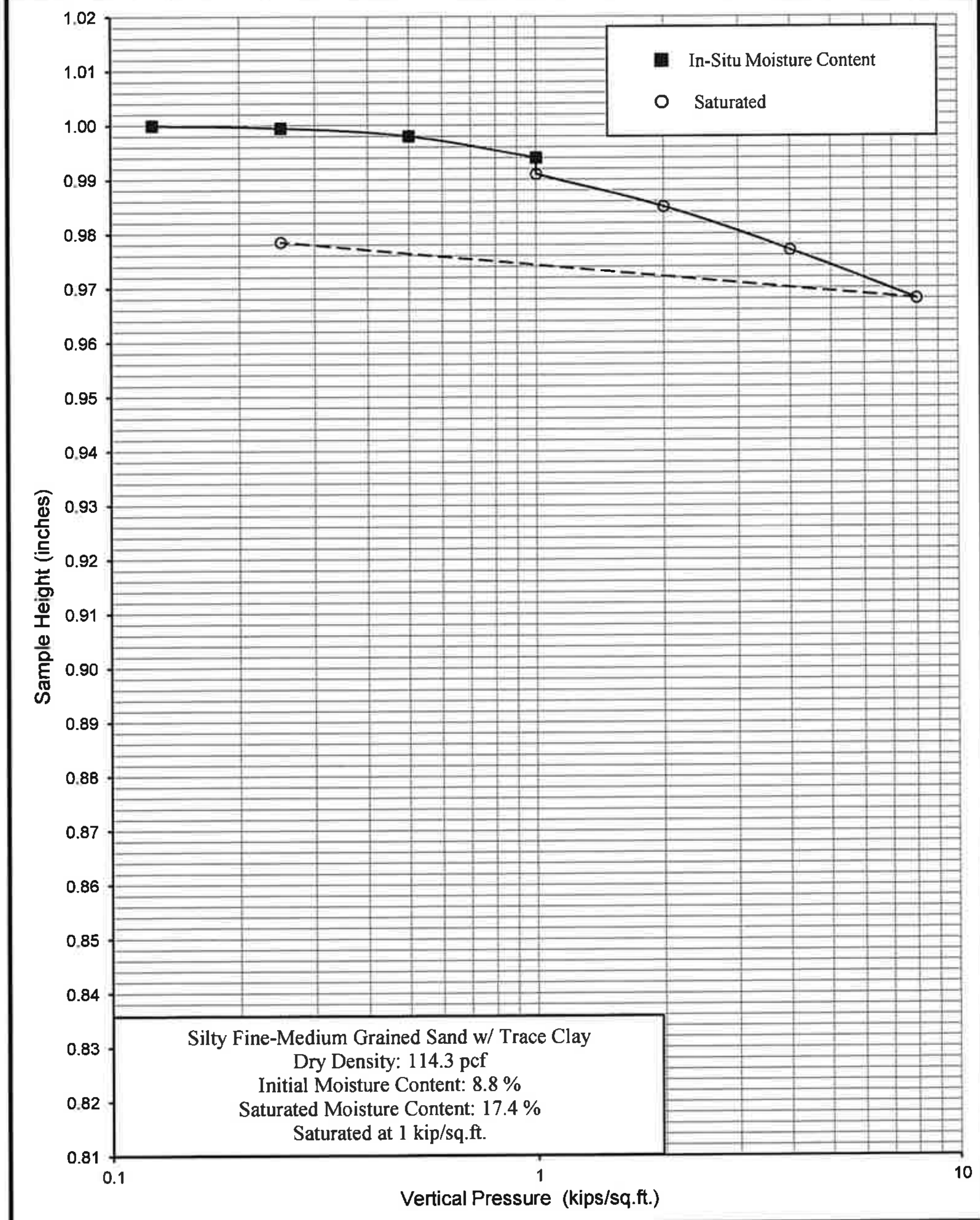
Plate C

Sample No. T9 | Depth 15' | Date 12/19/2019

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9995	0.0
0.5	0.9980	0.2
1	0.9940	0.6
1	0.9910	0.9
2	0.9850	1.5
4	0.9770	2.3
8	0.9680	3.2
0.25	0.9785	2.2

Saturated

Date Tested:	12/17/2019
Sample:	T9
Depth:	15'



Silty Fine-Medium Grained Sand w/ Trace Clay
Dry Density: 114.3 pcf
Initial Moisture Content: 8.8 %
Saturated Moisture Content: 17.4 %
Saturated at 1 kip/sq.ft.

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SOILS AND GEOTECHNICAL CONSULTANTS

LDC Industrial Realty, LLC

PROJECT NUMBER: 21551-19 DATE: 12/19/2019

CONSOLIDATION TEST

ASTM D2435

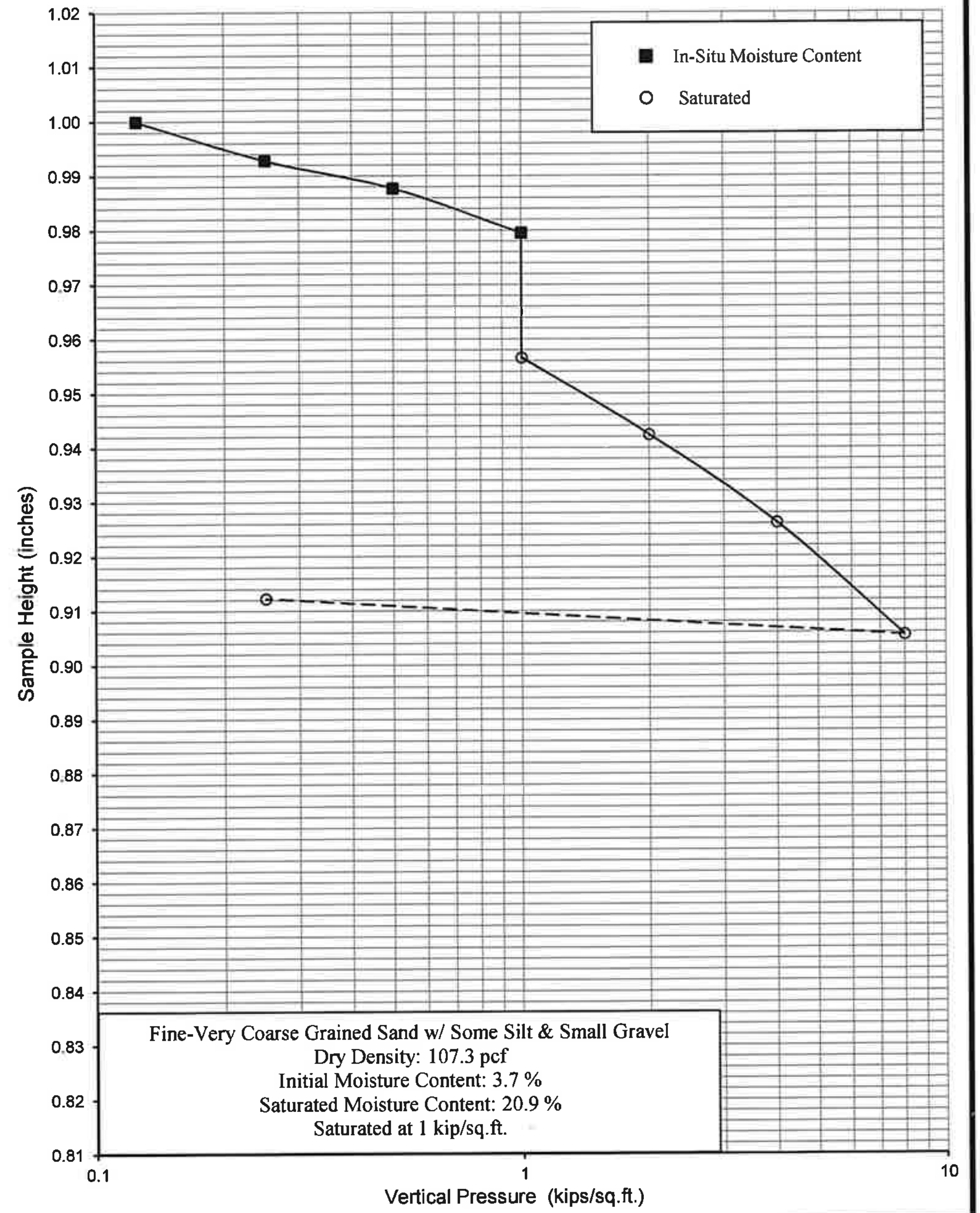
Plate D

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No.	T10	Depth 8'	Date 12/19/2019

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9928	0.7
0.5	0.9877	1.2
1	0.9795	2.1
1	0.9566	4.3
2	0.9424	5.8
4	0.9262	7.4
8	0.9055	9.5
0.25	0.9123	8.8

Saturated

Date Tested: 12/17/2019
Sample: T10
Depth: 8'



Fine-Very Coarse Grained Sand w/ Some Silt & Small Gravel
Dry Density: 107.3 pcf
Initial Moisture Content: 3.7 %
Saturated Moisture Content: 20.9 %
Saturated at 1 kip/sq.ft.

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SOILS AND GEOTECHNICAL CONSULTANTS
LDC Industrial Realty, LLC
PROJECT NUMBER: 21551-19 DATE: 12/19/2019

CONSOLIDATION TEST
ASTM D2435
Plate E

APPENDIX D

SITE LOCATION:
GEOTECHNICAL REPORT:
GEOLOGY REPORT:

DEPTH TO WATER TABLE = 20'
EARTHQUAKE MAGNITUDE = 6.9
PEAK GROUND ACCELERATION = 0.53g

DEPTH BELOW FINAL GRADE (FEET)	MOIST DENSITY (PCF)	σ_0 TOTAL STRESS (PSF)	$\bar{\sigma}_0$ EFFECTIVE STRESS (PSF)	$\sigma_0/\bar{\sigma}_0$ (-)	r_d (-)	① $\tau_h/\bar{\sigma}_0$ (-)	N VALUE (BLOWS/FT)	RELATIVE DENSITY (%)	C_N (-)	C_E (-)	C_B (-)	C_R (-)	C_S (-)	$(N_1)_{60}$ (Blows/ft)	FINES (%)	CRR M=7.5	MSF (-)	CRR M=	LIQ. F.S.
5	120	600	Same	1.00	0.99	0.34	20	>90	>1.6	1.00	1.05	0.70	1.20	>28	>35	>0.50	1.3	>0.65	>1.9
10	↓	1200	↓	↓	0.96	0.33	68	↓	1.25	↓	↓	0.75	↓	80	↓	↓	↓	↓	>2.0
15	↓	1800	↓	↓	0.92	0.32	55	↓	1.05	↓	↓	0.85	↓	62	↓	↓	↓	↓	>2.0
20	↓	2400	↓	↓	0.87	0.30	45	↓	0.92	↓	↓	0.90	↓	47	↓	↓	↓	↓	>2.1
25	↓	3000	2688	1.12	0.80	0.30	53	↓	0.90	↓	↓	0.95	↓	57	↓	↓	↓	↓	>2.1
30	↓	3600	2976	1.21	0.74	0.30	53	↓	0.85	↓	↓	1.00	↓	57	↓	↓	↓	↓	>2.1
35	↓	4200	3264	1.29	0.68	0.30	68	↓	0.82	↓	↓	↓	↓	70	↓	↓	↓	↓	>2.1
40	↓	4800	3552	1.35	0.64	0.29	54	↓	0.79	↓	↓	↓	↓	54	↓	↓	↓	↓	>2.2
45	↓	5400	3840	1.41	0.61	0.29	64	↓	0.76	↓	↓	↓	↓	61	↓	↓	↓	↓	>2.2
50	↓	6000	4128	1.45	0.58	0.29	85	↓	0.74	↓	↓	↓	↓	50	↓	↓	↓	↓	>2.2

① INDUCED CYCLIC STRESS RATIO = $\tau_{ave}/\bar{\sigma}_0 \approx 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_0}{\bar{\sigma}_0} \cdot r_d$

- C_E = Corr. – Energy Ratio = Energy Ratio/60%
- C_B = Corr. – Borehole Dia. = 1.15 for 8" dia. borehole
- C_R = Corr. – Rod Length
- C_S = Corr. – Sampling Method

Actual Energy Ratio = 0.67–1.17 (Safety Hammer)
= 0.50–1.00 (Donut Hammer)

Sampling Method = 1.0 Standard sampler
= 1.2 Sampler W/o liners

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 21551-19 DATE 12/2019

EVALUATION OF LIQUEFACTION POTENTIAL

APPENDIX E

NORCAL
ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: LDC Industrial Realty, LLC
Project No.: 21551-19
Date: 12/6/19
Test No. T-7
Depth: 13'
Tested By: J.S.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
7:10			105.7			47.4					
7:25	15	15	106.3	0.6		48.1	0.7				
7:25			106.3			48.1					
7:40	15	30	106.5	0.2		48.5	0.4				
7:40			106.5			48.5					
7:55	15	45	106.6	0.1		48.6	0.1				
7:55			106.6			48.6					
8:10	15	60	106.8	0.2		48.8	0.2				
8:10			106.8			48.8					
8:25	15	75	106.9	0.1		50.0	0.2				
8:25			106.9			50.0					
8:40	15	90	107.0	0.1		50.1	0.1				
8:40			107.0			50.1					
8:55	15	105	107.2	0.2		50.2	0.1		0.8	0.4	
8:55			98.7			44.0					
9:10	15	120	98.9	0.2		44.1	0.1		0.8	0.4	
9:10			98.9			44.1					
9:25	15	135	99.2	0.3		44.1	0.0		1.2	0.0	
9:25			99.2			44.1					
9:40	15	150	99.4	0.2		44.2	0.1		0.8	0.4	
9:40			99.4			44.2					
9:55	15	165	99.8	0.4		44.3	0.1		1.6	0.4	
9:55			99.8			44.3					
10:10	15	180	99.9	0.1		44.5	0.2		0.4	0.8	

Average = .93 / 0.4 cm/hr

Project: LDC Industrial Realty, LLC
Project No.: 21551-19
Date: 12/6/19
Test No. T-12
Depth: 9'
Tested By: J.S.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
10:10			73.4			43.5					
10:25	15	15	75.9	2.5		46.9	3.4				
10:25			75.9			46.9					
10:40	15	30	77.7	1.8		49.3	2.4				
10:40			77.7			49.3					
10:55	15	45	79.3	1.6		51.1	1.8				
10:55			72.4			45.8					
11:10	15	60	74.5	1.9		47.5	1.7				
11:10			74.5			47.5					
11:25	15	75	76.4	1.9		49.3	1.8				
11:25			76.4			49.3					
11:40	15	90	78.0	1.6		49.8	1.5				
11:40			78.0			49.8					
11:55	15	105	79.4	1.4		51.4	1.6		5.6	6.4	
11:55			70.9			43.0					
12:10	15	120	72.4	1.5		44.6	1.6		6.0	6.4	
12:10			72.4			44.6					
12:25	15	135	74.3	1.9		46.4	1.8		7.6	7.2	
12:25			74.3			46.4					
12:40	15	150	76.0	1.7		48.2	1.8		6.8	7.2	
12:40			76.0			48.2					
12:55	15	165	77.8	1.8		50.1	1.9		7.2	7.6	
12:55			77.8			50.1					
1:10	15	180	79.6	1.8		51.9	1.8		7.2	7.2	

Average = 6.7 / 7.0 cm/hr

Project: LDC Industrial Realty, LLC
Project No.: 21551-19
Date: 12/6/19
Test No. T-14
Depth: 13'
Tested By: J.S.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
7:00			74.7			41.3					
7:15	15	15	74.8	0.1		41.3	0.0				
7:15			74.8			41.3					
7:30	15	30	74.8	0.0		41.3	0.0				
7:30			74.8			41.3					
7:45	15	45	74.8	0.0		41.3	0.0				
7:45			74.8			41.3					
8:00	15	60	74.8	0.0		41.3	0.0				
8:00			74.8			41.3					
8:15	15	75	74.9	0.1		41.4	0.1				
8:15			74.9			41.4					
8:30	15	90	74.9	0.0		41.4	0.0				
8:30			74.9			41.4					
8:45	15	105	74.9	0.0		41.4	0.0		0.0	0.0	
8:45			74.9			41.4					
9:00	15	120	75.0	0.1		41.5	0.1		0.4	0.4	
9:00			75.0			41.5					
9:15	15	135	75.0	0.0		41.5	0.0		0.0	0.0	
9:15			75.0			41.5					
9:30	15	150	75.0	0.0		41.5	0.0		0.0	0.0	
9:30			75.0			41.5					
9:45	15	165	75.0	0.0		41.5	0.0		0.0	0.0	
9:45			75.0			41.5					
10:00	15	180	75.1	0.1		41.6	0.0		0.4	0.0	

Average = .13 / .07 cm/hr

Appendix 4: Historical Site Conditions

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

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

PHASE I ENVIRONMENTAL SITE ASSESSMENT
8.5± ACRES OF RESIDENTIAL PROPERTY
NEC ALESSANDRO BOULEVARD AND DAY STREET
APNs 291-191-004, -007 THROUGH -013, AND -025 THROUGH -029
MORENO VALLEY
RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 62522.21
JULY 31, 2018

Prepared For:

City of Moreno Valley
14177 Frederick Street
Moreno Valley, California 92552

Attention: Mr. Marshall Eyerman

6121 Quail Valley Court ▲ Riverside, CA 92507 ▲ (951) 653-1760 ▲ (951) 653-1741 (Fax) ▲ www.lorgeo.com

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

July 31, 2018

City of Moreno Valley
14177 Frederick Street
Moreno Valley, California 92552

Project No. 62522.21

Attention: Mr. Marshall Eyerman

Subject: Phase I Environmental Site Assessment, 8.5± Acres of Residential Property, NEC Alessandro Boulevard and Day Street, APNs 291-191-004, -007 through -013 and -025 through -029, Moreno Valley, Riverside County, California

Attached herewith is the Phase I Environmental Site Assessment (ESA) conducted by this firm for the subject site located at the northeast corner (NEC) of the intersection at Alessandro Boulevard and Day Street in Moreno Valley, California.

This Phase I ESA was planned and executed based upon a scope of services generally outlined in our Proposal dated June 11, 2018, and other written and verbal communication.

We appreciate the opportunity to provide this Phase I ESA for the subject site. If you have any questions or comments regarding this assessment, please do not hesitate to contact this firm at your convenience.

LOR Geotechnical Group, Inc.

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EXECUTIVE SUMMARY

This firm conducted a Phase I Environmental Site Assessment (ESA) for 8.5± acres of residential property located at the northeast corner of Alessandro Boulevard and Day Street in Moreno Valley, California. This Phase I ESA was conducted in conformance with American Society for Testing and Materials (ASTM) E1527-13 and All Appropriate Inquiries (AAI) set forth in 40 CFR (Code of Federal Regulations) part 312.

The subject site has been vacant or residential use dating back to at least 1938. The site is currently vacant land, with all single-family residences and associated structures and development removed around 2008.

No drums, buckets, or other containers, which might pose an adverse environmental impact to the parcel, were observed. No soil staining, chemical odor, or distressed vegetation were noted.

There are over a dozen sites listed in environmental regulatory databases within 1 mile of the subject site, none of which are located at the subject site. Based on the results of our Vapor Encroachment Screen (VES), Tier 1 and 2 (non-invasive) screening, a vapor encroachment condition (VEC) at the subject site cannot be ruled out. Based on groundwater sample data from an onsite groundwater monitoring well, MW-13, associated with an offsite former gasoline station (Flite Chief, Inc./Gas 4 Less) within 100 feet to the east of the south end of the subject site, there have been reportable concentrations of total petroleum hydrocarbons as gasoline (TPH-G), methyl tert-butyl ether (MtBE), and tert-butyl alcohol (tBA), which means a VEC previously existed, and may still exist.

This Phase I ESA has revealed no evidence of recognized environmental conditions (RECs), historical recognized environmental conditions (HRECs), or controlled recognized environmental conditions (CRECs) indicative of releases or threatened releases of hazardous substances on, at, in, or to the subject site, except for the reported groundwater contaminants in onsite groundwater monitoring well MW-13, which may represent a REC. The VEC that previously existed onsite, and may still exist, may or may not include impacted soil vapor high enough to preclude the planned residential development, but a subsurface soil vapor investigation should be conducted to confirm the environmental condition of the site with respect to potential gasoline contaminants in soil vapor in the southeast portion of the subject site near the east boundary.

INTRODUCTION

During June to July 2018, a Phase I ESA was conducted by this firm for 8.5± acres of residential property, Assessor's Parcel Number (APNs) 291-191-004, -007 through -013, and -025 through -029, located at the northeast corner of Alessandro Boulevard and Day Street in Moreno Valley, Riverside County, California. The subject site is currently vacant residential property planned for development with an apartment complex, including family and senior apartment buildings.

This firm previously prepared a Phase I ESA report, dated March 17, 2008 (LOR, 2008). This current Phase I ESA report is being prepared to provide an updated, comprehensive report, which will utilize elements from this previously prepared report.

This Phase I ESA was conducted in conformance with the Standard Practice for Environmental Site Assessments: Phase I ESA Process, ASTM E1527-13, and AAI set forth in 40 CFR Part 312. The purpose was to identify RECs, HRECs, and/or CRECs that may be associated with the subject site. A REC is defined as the presence or likely presence of any hazardous substance or petroleum products in, on, or at a property: (1) due to any release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment. A HREC is defined as a past release of any hazardous substances or petroleum products that has occurred in connection with the property, and has been addressed to the satisfaction of the applicable regulatory authority or meets the unrestricted use criteria established by a regulatory authority, without subjecting the property to any required controls (i.e., property use restrictions, activity and use limitations, institutional controls, or engineering controls, which would fall under a controlled recognized environmental condition or CREC). This does not include de minimis conditions, that generally, do not present a threat to human health or the environment, and generally would not be the subject of an enforcement action if brought to the attention of the appropriate government agency. Conditions determined to be de minimis are not RECs or CRECs.

The approximate location of the site within its regional setting is presented on an Index Map (Figure 1). The proposed onsite multi-family residential development is presented on a Schematic Site Plan (Figure 2).

The findings of our Phase I ESA, as well as our conclusions and recommendations, are presented in the following sections of this report.

NON-SCOPE CONSIDERATIONS

The following environmental issues are outside the scope of ASTM E1527-13 and 40 CFR Part 312, and may not have been addressed in this report:

- Lead in Drinking Water
- Lead-Based Paint
- Wetlands
- Methane
- Radon
- Cultural Land Historical Resources
- Industrial Hygiene
- Health and Safety
- Ecological Resources
- Endangered Species
- Indoor Air Quality
- Mold and Mildew
- Asbestos-Containing Materials
- Mineral Resources
- Regulatory Compliance
- Natural Hazards
- High Voltage Power Lines

METHODOLOGY AND PROCEDURES

Per ASTM E1527-13 and AAI, User provided information was evaluated with respect to site history, usage, and environmental concerns.

A general review of the physical setting of the subject site, including geology and groundwater hydrology, was performed. This review, in part, provides information regarding the potential for groundwater to be contaminated and the potential pathways for contaminant transport.

Historical maps, aerial photographs, and other records and information were researched and examined, as available, to investigate the use of the subject site and surrounding area.

As available, person(s) knowledgeable about the subject site were interviewed to obtain any known information regarding site usage and potential environmental concerns.

Concurrent with our public and governmental agency interviews and literature research, a site reconnaissance of the property was conducted. The site reconnaissance was conducted in order to determine current uses of the site and the potential for soil and/or possible groundwater contamination based on aboveground visual observation.

During this Phase I ESA, public regulatory agencies, potentially including environmental, building, etc. were contacted directly or online research was conducted for information regarding permits, underground storage tanks (USTs), hazardous materials incidents, and general information about the subject site and surrounding area to ascertain the past uses with respect to environmental concerns.

Federal, state, local, tribal, and proprietary lists and databases were reviewed to ascertain the presence of known environmentally impaired sites on the subject site or within the immediate area, and to determine their impact, if any, to the site.

As part of this Phase I ESA, a Vapor Encroachment Screen was conducted to determine if a vapor encroachment condition exists, based on the information obtained during the Phase I ESA.

CONCURRENT INVESTIGATIONS

A Preliminary Geotechnical Investigation (PGI) was conducted by this firm concurrently with this Phase I ESA. This investigation included the placement of six (6) exploratory soil borings ranging in depths from approximately 21 to 51.5 feet below the ground surface (bgs) across the subject site. Although done specifically to address the engineering properties of the onsite soils, no subsurface structures, unusual odors, or stained soils were noted. Fill/topsoil materials were observed in all six (6) exploratory borings at depths up to approximately 2 feet bgs. Bedrock was not encountered in any of the soil boring locations. Groundwater was encountered in two (2) of the soil boring locations at approximately 24 and 33 feet bgs. The detailed results and evaluation of our PGI will be submitted to the client under a separate report.

USER PROVIDED INFORMATION

ASTM E1527-13 defines a User as the party seeking to use Practice E1527 to complete an environmental site assessment of the property. A User may include, without limitation, a potential purchaser of property, a potential tenant of property, an owner of property, a lender, or a property manager.

Under ASTM E1527-13 and AAI, specific tasks are assigned to the User that will help identify the possibility of RECs in connection with the property. These tasks do not require the technical expertise of an environmental professional and are generally not performed by environmental professionals performing a Phase I ESA. The User may provide the information gathered from these tasks, including the following:

- Any environmental cleanup liens against the property that are filed or recorded under federal, tribal, state or local law;
- Any activity and land use limitations (AULs), such as engineering controls, land use restrictions, or institutional controls that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state, or local law;
- Specialized knowledge or experience (that is material to RECs in connection with the property) of the User related to the property or nearby properties (for example, is the User involved in the same line of business as the current or former occupants of the property or an adjoining property so that the User would have specialized knowledge of the chemicals and processes used by this type of business);
- Relationship of the purchase price to the fair market value of the property if it were not contaminated (reason for significantly lower purchase price, such as contamination is known or believed to be present at the property);
- Commonly known or reasonably ascertainable information about the property that would help the environmental professional to identify conditions indicative of releases or threatened releases (such as the past uses of the property, specific chemicals that are present or once were present at the property, spills or other chemical releases that have taken place at the property, and any environmental cleanups that have taken place at the property);
- Any obvious indicators that point to the presence or likely presence of contamination at the property, based on the knowledge and experience of the User related to the property; and
- Other information, including the reason why the Phase I ESA is required and/or is being performed, the type of property and type of property transaction (sale, purchase, exchange, etc.), the complete and correct address for the property, the scope of services desired for the Phase I ESA, identification of all parties who will rely on the Phase I ESA report, identification of the site contact and how the contact can be reached, any special terms and conditions which must be agreed upon by the environmental professional, and any other knowledge or experience with the

property that may be pertinent to the environmental professional (for example, copies of any available prior environmental site assessment reports, documents, correspondence, etc., concerning the property and its environmental condition).

A User Questionnaire was completed by the project engineer contracted by the User (client) for the proposed developed of the subject site. The information provided in the completed questionnaire does not suggest any CRECs, HRECs, or RECs are associated with the subject site. The purpose for conducting this assessment was indicated to be to determine if any public record exists of contaminants on the property, or if the presence of contaminants can be determined by a physical inspection. The client, City of Moreno Valley, is indicated to be the party who will rely on this Phase I ESA report.

A copy of the completed User Questionnaire is provided in Appendix A.

Environmental Cleanup Liens and Activity and Use Limitations

Under AAI and ASTM E1527-13, a search for environmental cleanup liens and AULs must be conducted, typically by the User. The subject site, whose researched historical use has been vacant and/or residential, did not appear in the state and/or federal liens, deed, or activity/use limitation databases in The Environmental Data Resources, Inc. (EDR) Radius Map™ Report with Geocheck® (Appendix H), and no records are on file with the County of Riverside Department of Environmental Health (CRDEH), which indicate there are no environmental cleanup liens or AULs associated with the subject site.

PHYSICAL SETTING

Regional Geologic Setting

The subject site is located within the northwestern portion of Moreno Valley, which in turn lies within the northern end of the Perris Valley, just south of the base of the Box Springs Mountains. This area is located on the Perris block within the northern Peninsular Ranges geologic province of southern California. While the Perris block is considered to be a relatively stable structural block, it is bounded by active faults. These include the Elsinore fault zone on the southwest, the San Jacinto fault zone on the east, and the Cucamonga fault zone on the north. The Perris block is underlain predominately by a very large mass of crystalline igneous rocks of Cretaceous age and older metasedimentary and metavolcanic rocks.

The Perris block has a series of erosional surfaces, marked by low topographic relief and capped with unconsolidated alluvial sediments stripped from the surrounding highlands, such as the Box Springs Mountains. The Perris Valley is a long and narrow alluviated valley which drains to the southeast. This region of and around the site was mapped by the California Division of Mines and Geology as being underlain by deposits of slightly to well consolidated to indurated older alluvium (Morton and Matti, 2001).

The nearest known active fault zone is the San Jacinto fault zone located approximately 6.8 miles to the northeast. Other major faults within the region include the San Andreas fault zone, located approximately 15.7 miles to the northeast, and the Elsinore fault zone, located approximately 15.9 miles to the southwest.

Site Geologic Conditions

The majority of the subject site is underlain by a relatively thin layer of fill/topsoil overlying older alluvial materials as encountered within our subsurface PGI exploratory borings. These units are described in further detail in the following sections:

Fill/topsoil: As noted within our exploratory borings, fill/topsoil materials were encountered at the surface to a maximum depth of approximately 2 feet beneath the existing ground surface. These materials typically consisted of silty sand. The fill materials were typically brown, dry, and loose. These are considered to be undocumented fill materials, mainly created as a result of weed abatement practices (discing). However, fill materials associated with previous onsite development cannot be completely ruled out.

Older Alluvium: Underlying the fill/topsoil soils, older alluvial materials were encountered within our exploratory borings. The older alluvium typically consisted of silty sand to sandy silt within the upper portions followed by lessor units of clayey sand, lean clay with sand, and well-graded sand. The finer-grained, older alluvial units were typically brown to red-brown, dry to damp, contained thin calcite stringers, and were in a very dense/very hard state. The coarser-grained, older alluvial materials were typically gray to red-brown, wet due to the presence of groundwater, and were in a very dense state.

Radon

The United States Geological Survey (USGS) publication, Geologic Radon Potential of EPA Region 9, Open File Report 93-292-I, dated 1993, indicates the potential for radon to exceed the USEPA (United States Environmental Protection Agency) action level of

4.0 picocuries per liter (pCi/L) in Riverside County is low. The current USEPA online Radon Zones map shows the average indoor radon concentrations for Riverside County predicted to be 2 to 4 pCi/L (USEPA, 2018).

According to the California Department of Public Health database of indoor radon test results by zip code, updated February 2016, the zip code 92553, in which the subject site is located, had thirteen tests conducted with none equal to or greater than 4.0 pCi/L. The maximum test result of these thirteen tests was 2.1 pCi/L (California Department of Public Health, 2016).

Groundwater Hydrology

On July 23, 2018, groundwater was encountered within two of our PGI exploratory borings, boring B-1 at a depth of approximately 24 feet bgs, and boring B-4 at a depth of approximately 33 feet bgs. A groundwater level at 25 feet bgs was measured on July 9, 2018 in monitoring well MW-13, associated with the assessment and monitoring of the offsite former gasoline station to the east. Groundwater well MW-13 is located in relative close proximity to our PGI boring B-1.

Records for nearby wells which were readily available from the State of California Department of Water Resources (DWR) online Water Data Library database (DWR, 2018), the Western Municipal Water District Cooperative Well Measurement Program (Watermaster Support Services et al., 2017), and the California State Water Resources Control Board (SWRCB) GeoTracker online database (SWRCB, 2018) were reviewed.

According to the State of California DWR online Water Data Library database, no groundwater wells lie at the subject site, nor in the immediate region.

Groundwater well data from the Cooperative Well Measuring Program, Spring 2017 indicates the nearest well as numerous monitoring wells for an ARCO gasoline station located approximately 0.4 mile to the west of the site. Data for these wells were available from 2003 to 2016. During that time, groundwater depths ranged from approximately 12 to 29 feet bgs. A measuring point elevation of approximately 1,530 feet above mean sea level (amsl) was provided.

The GeoTracker database has groundwater information for the adjacent property located to the east of the south end of the subject site. According to this data, numerous groundwater monitoring wells (13) are associated with a former gasoline station at the property, one of which (well MW-13) is located at the subject site. Groundwater was reported in these wells at an approximate elevation of 1,527 feet amsl in March of 2018. Reports indicate groundwater depths of approximately 33 to 57 feet bgs for these wells. Local groundwater flow direction, estimated using the groundwater monitoring wells associated with the former gasoline station, has been indicated to be variable, from west-northwest to southwest.

The lowest elevation of the subject site is approximately 1,550 feet amsl.

Based on the information above, groundwater is anticipated to lie at an elevation of approximately 1,535 to 1,520 feet above mean sea level or approximately 24 to 33 feet bgs at the subject site.

HISTORY OF SITE USAGE

To obtain a history of previous site usage, a search was conducted for historical Sanborn Fire Insurance and topographic maps, aerial photographs, County Assessor's parcel information, building records, and city directory information. The past owners and/or tenants of the parcels of the subject site were previously interviewed in 2008, and a recent interview was conducted with a representative of the current owner of most of the subject site.

Sanborn Fire Insurance Maps

No coverage of Sanborn Fire Insurance maps was available for the subject site. The Certified Sanborn® Map Report from EDR is provided in Appendix B.

Historical Topographic Maps

Historical topographic maps of the quadrangle that includes the subject site, at a scale of approximately 1"=2,200', provided by EDR from 1901, 1942, 1947, 1953, 1967, 1980, and 2012, were reviewed.

The 1901 map shows the subject site as vacant land surrounded by vacant land. Approximately 0.3 mile to the west is a north-northwest to south-southeast trending railroad track. Approximately 770 feet east of the subject site is a west terminus of Alessandro Boulevard, which intersects a northwest to southeast trending road.

The 1942 map shows the subject site with two residential structures along the west side near the southwest corner, with the rest still vacant. Alessandro Boulevard borders the subject site to the south as a major thoroughfare. Day Street borders to the west. South of Alessandro Boulevard is vacant land, but in all other directions from the subject site are residential structures, including two east of the south end of the site. The 395 Highway (present day 215 Freeway) is present as a road west of the subject site, situated along the east/northeast side of the railroad track.

The 1947 map shows the subject site and immediate surrounding properties essentially the same as on the 1942 map.

The 1953 map shows the subject site with around 15 residential structures. Sherman Avenue now borders to the north. A north-south road is shown along the east site boundary. Just east of this road is another north-south road, Pepper Street. Increased residential structures are shown in all directions from the subject site north of Alessandro Boulevard. The 395 Highway is now shown as a divided highway. March Field, east of the 395 Highway, part of March Air Force Base, is shown approximately 0.5 mile south of the subject site. The west part of the base, West March, is shown west of the 395 Highway, approximately 0.3 mile west-southwest of the subject site.

The 1967 map shows the subject site and surrounding properties north of Alessandro Boulevard in a light salmon colored shading, indicating dense development is present, with no indication of specific structures. The road previously shown along the east side of the site is absent. Southeast, south, and southwest of the subject site beyond Alessandro Boulevard are a handful of commercial and/or industrial buildings.

The 1980 map shows the subject site and surrounding properties largely the same as on the 1967 map. South of the subject site, beyond Alessandro Boulevard, two smaller structures have been added north to north-northwest of a large industrial building.

The 2012 map does not generally show structural features. Based on the infrastructure shown, some expanded development has occurred in the region. The old 395 Highway is now shown as the 215 Freeway, which has been partially realigned and has improvements evident, associated with overpasses and on- and off-ramps.

The EDR Historical Topographic Map Report is provided in Appendix C.

Aerial Photograph Review

A search was previously conducted for available aerial photographs of the area on file at the County of Riverside Flood Control and Water Conservation District (CRFCWCD) by a geologist from this firm during our previous assessment in 2008. The search reviewed aerial photographs taken of the subject site and surrounding area in 1948, 1962, 1974, 1980, 1984, 1990, 1995, 2000, and 2005. Electronic copies of aerial photographs from the years 1938, 1949, 1953, 1959, 1967, 1978, 1985, 1989, 1994, 2006, 2009, and 2012 were provided by EDR for historical reference, and along with Google Earth Pro computer program (2018) recent (1994 to 2018) and online (Nationwide Environmental Title Research, LLC, 2018) historical aerial images, were used to enhance our review and/or provide supplementary review to those photographs reviewed at the CRFCWCD.

Copies of the electronic aerial photographs, provided by EDR, with the approximate subject site boundary and scale indicated, are provided in Appendix D.

The CRFCWCD aerial photographs reviewed generally consisted of vertical aerial stereographic photograph pairs of varying scales in black and white. These photographs were viewed using stereoscopes with magnifications of 2X and 4X for three-dimensional enhancement. Due to the relatively large photographic scales involved, the analysis and subsequent interpretation of detail from aerial photographs sometimes required a degree of subjective judgement. The degree of certainty on the interpretation of details depends upon such factors as the scale and the quality of the photograph. However, an analysis of aerial photographs will reveal the general site history as to the relative use of the land, possible ground disturbance, activities, etc.

A summary of the subject site and surrounding conditions during the various times, as reflected in the photographs is given below. For ease of discussion, the subject site APNs will be referred as Parcel 4 for APN 291-191-004, etc.

1. January 14, 1948, Photo Nos. 12 and 13, Scale 1"=1,600'

In these earliest aerial photographs, the subject site has residential structures with associated outbuildings in the south and southwest portions. These structures and outbuildings include single-family residences, detached garages, and sheds within Parcels 4, 28, 29, and the south portions of Parcels 8, 9, and 11. The north portion of the site consists of open, vacant land.

A cluster of single-family residences exist to the west of the site, with more widely spaced residences to the northwest and northeast. To the east, land has been recently cleared and/or graded, and a few residences with detached garages have been built. Natural, open land exists to the southwest and southeast beyond Alessandro Boulevard. March Air Force Base is well established approximately 1 mile to the southeast with evidence for expansion closer to the site, approximately 0.5 to 1 mile to the southeast.

2. January 28, 1962, Photo Nos. 1-101 and 1-102, Scale 1"=2,000'

Within Parcel 27 of the subject site, a large, approximate 150- by 200-foot fenced area has been constructed, and three small (approximately 5 by 10 feet) associated rectangular objects are located, evenly spaced, within and along the west side of the fenced area. On the east side of the fenced area is a square clearing (approximately 100 by 100 feet). The dirt driveway for Parcel 9 has been extended north to a broad, irregularly-shaped clearing near the center of the site. A residence has been built within parcel 12, and a large (approximately 50 by 200 feet) storage-type building is now located in the south portion of Parcel 13.

Alessandro Boulevard has been widened/paved and Sherman Avenue is now a graded dirt road. More development, mostly residential, exists in the area of the site, mainly to the north.

The 1959 EDR electronic aerial photograph shows the present day coin laundry building adjacent to the east of the south end of the subject site.

The online Nationwide Environmental Title Research, LLC aerial images from 1966 and 1967 and 1967 EDR electronic aerial photograph show the present day canopy and small building north of it, both east of the present day coin laundry, and associated with the gasoline station that operated from the 1960s until 1999.

3. May 24, 1974, Photo Nos. 232 and 233, Scale 1"=2,000'

The fenced area in Parcel 27 no longer appears to be in use, and the three rectangular objects that were present along its west side are gone. A dirt trail now extends from near the middle of Parcel 13 to the northwest beyond Sherman Avenue.

Trees planted around residences are now mature. A commercial/industrial warehouse facility with four large buildings has been built to the south-southeast of the subject site beyond Alessandro Boulevard.

4. February 1, 1980, Photo Nos. 242 and 243, Scale 1"=2,000'

The subject site and immediate surrounding region appear largely as shown in the previous photographs.

5. February 7, 1984, Photo Nos. 1483 and 1484, Scale 1"=1,600'

A tree or power pole now exists in the far northwest corner of the subject site, and the long building in the south portion of Parcel 13 has been removed. Fencing around some of the parcels, including Parcels 4, 11, 28, and 29 is now much more apparent and/or new.

Commercial and residential development of nearby vacant land continues. To the southwest of the subject site, a facility, possibly industrial, has expanded, and now has several large, north-south oriented rows of stored items too small to determine their nature.

6. January 23, 1990, Photo Nos. 5-25 and 5-26, Scale 1"=1,600'

The subject site and immediate surrounding region appear largely as shown in the previous photographs.

7. January 28, 1995, Photo Nos. 5-22 and 5-23, Scale 1"=1,600'

A dirt trail now extends northwest from the central portion of Parcel 9 to Sherman Avenue and back through Parcel 8 to the front of Parcel 9. Most of the stored rows of items within the possible industrial parcel southwest of the subject site are no longer present. Otherwise, the subject site and immediate surrounding region generally appear as shown in the previous photographs.

8. March 11, 2000, Photo Nos. 5-23 and 5-24, Scale 1"=1,600'

A dirt trail now extends north from the east side of Parcel 9 to Sherman Avenue. Otherwise, the subject site and immediate surrounding region generally appear as previously shown.

9. April 14, 2005, Photo Nos. 5-21 and 5-22, Scale 1"=1,600'

The narrow, north-south parcel (26) along the west side of Day Street at the corner with Alessandro Boulevard is now barren of vegetation, as is a small (approximately 50 by 100 feet) area along the south side of Sherman Avenue in the north portion of Parcel 8. Otherwise, the subject site and immediate surrounding region appear largely as shown in the previous photographs.

The post-2005 Google Earth Pro aerial images and 2006, 2009, and 2012 electronic aerial photographs indicate all onsite residential structures were removed around 2008 to 2009, and the site has remained vacant since. Concrete sidewalk and curb and gutter were constructed along Day Street in early 2011 and along Sherman Avenue in 2016. Two storm drain outlets were constructed in the central portion near the north side of the site, apparently during the sidewalk construction activities along Sherman Avenue.

County Assessor's Parcel and Ownership Information

The subject site is comprised of APNs 291-191-004, -007 through -013, and -025 through -029. These parcels comprise a total of approximately 8.5 acres. The following subject site parcels have associated addresses: APN 291-191-004 at 13956 Day Street; APN 291-191-007 at 22030 Alessandro Boulevard; APN 291-191-008 at 22042 Alessandro Boulevard; APN 291-191-009 at 22058 Alessandro Boulevard; APN 291-191-011 at 22088 Alessandro Boulevard; APN 291-191-012 at 22105 Sherman Avenue; APN 291-191-028 at 13920 Day Street; and APN 291-191-029 at 13942 Day Street (Parcel Quest Lite, 2018). These parcels are shown with vacant or single-family residential uses. All of the parcels, except for APN 291-191-004, are owned by the City of Moreno Valley. The owner(s) of APN 291-191-004 are private individuals.

County Building and Safety Department Records Review

The County of Riverside Building and Safety Department was previously contacted in 2008 for copies of historical building permits for all parcels and known associated addresses for the subject site. Online records were also recently researched (County of Riverside Transportation and Land Management Agency, 2018). The following table summarizes the permit records on file:

COUNTY OF RIVERSIDE BUILDING & SAFETY DEPARTMENT RECORDS			
DATE	**ADDRESS or APN**	**PERMIT ACTIVITY**	**OWNER or APPLICANT**
11/19/62	22050 Alessandro Blvd.	Re-Side Dwelling	E. Howard
11/19/62	22050 Alessandro Blvd.	Re-Roof Dwelling	E. Howard
05/27/64	22050 Alessandro Blvd.	Change Electrical Service (2-220 Circuits)	Irving Howard
08/04/64	22105 Sherman Avenue	Addition to Dwelling	R.C. Pyle
02/13/68	22018 Alessandro Blvd.	Remove Partition in Dwelling and Add Plywood to Garage	J.S. Lyon
02/21/68	22018 Alessandro Blvd.	New Commercial Electrical Service and Outlets	Jay Lyon
04/01/68	22018 Alessandro Blvd.	Onsite Sign	Jay S. Lyon
06/05/70	22088 Alessandro Blvd.	Demolish Dwelling	Keith A. Small
06/05/70	22088 Alessandro Blvd.	Dwelling	Keith A. Small
05/18/70	13942-44 Day Street	Duplex	E. Savedia
07/06/77	APN 291-191-013	Special Inspection of 8-Unit Apartment Building	Not Available
04/27/78	22050 Alessandro Blvd.	Gas (Natural) Line	D.L. Ortega
06/28/78	13956 Day Street	Special Inspection (Structure was Substandard)	Desmond C. Devereux
08/27/79	13956 Day Street	Demolish Dwelling	Salvador R. Duarte
08/06/85	13956 Day Street	Demolish Dwelling	Salvador R. Duarte
08/06/85	22018 Alessandro Blvd.	Electrical Safety Inspection to Dwelling	Salvador R. Duarte

Most of the building records are related to residential construction and/or demolition. Some of the permits for 22018 Alessandro Boulevard, APN 291-191-006, indicate some type of commercial activity. However, nothing in the County building permit records indicates any significant environmental issues.

City Building and Safety Division Records Review

The City of Moreno Valley Building and Safety Division was previously contacted in 2008 through the City Clerk for copies of historical building permits for all known addresses associated with the subject site on Alessandro Boulevard, Day Street, and Sherman Avenue. Online records were also recently researched (City of Moreno Valley, 2018). The following table summarizes the permit records on file:

CITY OF MORENO VALLEY BUILDING & SAFETY DIVISION RECORDS

DATE	ADDRESS	PERMIT ACTIVITY	OWNER/ APPLICANT
08/06/85	13956 Day Street	Demolish Dwelling	Salvador R. Duarte
Unreadable	22030 Alessandro Blvd.	Electrical (expired)	Unreadable
05/01/87	22030 Alessandro Blvd.	Upgrade Electrical Service	Unreadable
03/06/91	13946 Day Street	Re-Plumb House	Rose Pindle
09/25/91	22010 Alessandro Blvd.	Special Inspection C of O, Ernest Zabala Refr. Co.	Jesus C. Aguon
10/09/91	13942-44 Day Street	Re-Roof Composition over Composition	Rosa Savedra
11/10/92	13920 Day Street	Demolition of Abandoned Septic System	Tate Le Etta
03/22/93	13946 Day Street	Special Investigation for Edison Release (Electrical)	Manju Garg
12/12/95	22030 Alessandro Blvd.	Demolition of SFD (Single-Family Dwelling)	Margaret Cameron
12/15/98	22042 Alessandro Blvd.	New Electrical Service Panel	Betty J. Mosher Donald Ortego
07/15/03	22010 Alessandro Blvd.	Demolition of SFD (Single-Family Dwelling)	City of Moreno Valley
01/09/06	13920 Day Street	Replace Single Wall Heater	Armando Heredia, Emilia Sosa

CITY OF MORENO VALLEY BUILDING & SAFETY DIVISION RECORDS			
DATE	**ADDRESS**	**PERMIT ACTIVITY**	**OWNER/ APPLICANT**
10/31/2008	22018 Alessandro Blvd.	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
10/31/2008	22042 Alessandro Blvd.	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
10/31/2008	22058 Alessandro Blvd.	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
10/31/2008	13920 Dat Street	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
10/31/2008	13942 Day Street	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
10/31/2008	13946 Day Street	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
10/31/2008	22105 Sherman Avenue	Demolition of Single-Family Dwelling and Any Accessory Structures	Not Available
11/16/2010	13910 Day Street	Electrical - Time Warner Meter Box Relocation (Required for City Street Project)	Not Available

All of the building permits are related to residential construction and/or demolition, with a couple of exceptions, including a Certificate of Occupancy and utility meter box relocation associated with a City street project. Nothing in the City building permit records indicates any significant environmental issues.

City Directory Information

Historical EDR city directory information for listings along Alessandro Boulevard and Day

Street was reviewed, as these streets are known to have included commercial or industrial operations. The available listings were from 1975 to 2014. The listings for the subject site and surrounding properties are largely residential. The only non-residential listing for the subject site is Aguon Typewriter Service, likely a home-based business, at 22010 Alessandro Boulevard in 1992 and 1995.

Listings for adjacent or nearby properties with commercial or industrial operations include mini storage, Moose Lodge, coin laundry, gasoline station, a market, truck body manufacturing, trailer manufacturing, restaurants, auto washing/detailing, auto smog shop, liquor store, auto glass shop, muffler shop, heating and air conditioning service, recycler, steel company, tractor equipment company, and recreational vehicle manufacturer. Most of the commercial and industrial listings are along Alessandro Boulevard.

The EDR-City Directory Image Report is provided in Appendix E.

Interviews

On July 17, 2018, Mr. Marshall Eyerman with the City of Moreno was interviewed regarding the history and potential environmental concerns associated with the subject site. Mr. Eyerman indicated the subject site parcels, except for APN 291-191-004, were previously acquired by the City's former Redevelopment Agency, now defunct, before his employ with the City. The City previously demolished and cleared the features associated with the former onsite residences. Since the demolition and clearing activities, the City has kept the weeds controlled onsite and constructed sidewalks along Day Street and Sherman Avenue. To his knowledge, the site has been residential or vacant with no known environmental issues. Mr. Eyerman was unaware of the presence of the onsite groundwater monitoring well MW-13, which is associated with the assessment and monitoring of the offsite, former gasoline station at the northwest corner of Alessandro Boulevard and Pepper Street, addressed 22144 Alessandro Boulevard. He mentioned the local water purveyor is Box Springs Mutual Water Company.

The following interviews were conducted during our past Phase I ESA in 2008. During our site visit on March 3, 2008, we interviewed some of the property owners and tenants. Other interviews were conducted by telephone.

At APN 291-191-002 (current APN 291-191-028), we met with one of the owners, Ms. Emilia Sosa, and their real estate broker, Mr. Steven Ramirez. Mr. Ramirez was present to translate, as Ms. Sosa only spoke Spanish. The owners purchased the parcel approximately 3 years prior, and were unaware of any environmental issues. The shed and

1-car garage were used to store party rental supplies. No vehicle maintenance had been performed at the parcel by the owners.

Mr. Michael O'Malley, one of the owners of APN 291-191-003 (current APN 291-191-029), was interviewed. He owned the parcel along with his wife, Mrs. Diane O'Malley. They purchased the property approximately 12 years prior. Mr. O'Malley was unaware of any environmental issues. He indicated a former septic tank was removed from the single-family residence along Day Street, prior to being hooked up to the municipal sewer system. The three sheds present, which contained various personal items, were brought to the property by Mr. O'Malley. Mr. O'Malley indicated that the previous owner of APN 291-191-002 (current APN 291-191-028) had grown up there, and had owned the parcel since about 1975. Mr. O'Malley observed some minor auto body work being done at APN 291-191-002 a few years prior.

Two of the tenants at APN 291-191-008, Mr. Steven Wilson and Ms. Jennifer Rapata, were interviewed. Mr. Wilson had been at the property since November 2005 and Ms. Rapata for 8 or 9 years. Neither one was aware of any environmental issues, but indicated that illegal dumping of trash and stolen vehicles was common at APN 291-191-008 and nearby properties. Mr. Wilson stated that the filled-in concrete block structure in front (south) of the residence that he was renting was a former koi fish pond. They indicated that the shop building that was converted into a residence on APN 291-191-009 was apparently condemned by the city.

One of the tenants at APN 291-191-011, Mr. Israel Montoya, was interviewed. He indicated that they moved into the residence only 4 months prior. He said that they did not perform any vehicle maintenance, but the previous tenants changed oil on the parcel along the west side of the residence. The estimated 9 gallons of waste oil, near the small wooden shed that he brought to the property, was left behind by the previous tenants. Mr. Montoya stated that there had been a small fire involving a tire and some plastic items. To put out the fire, which occurred at night, someone inadvertently grabbed a bucket with some waste oil, thinking it was water, and dumped it on the fire, which extinguished the fire. The stained soil immediately near the wooden shed and adjacent concrete slab to the west were from this incident. Other stained soils in the vicinity were due to leakage from some of the containers of waste oil left by the previous tenants.

On March 5, 2008, Mr. John Strickler was interviewed by telephone regarding his knowledge of the history of APN 291-191-005 (current APN 291-191-028). Mr. Strickler was the Housing Program Coordinator with the City of Moreno Valley Economic Development Department. The City of Moreno Valley was the current owner of APN

291-191-005, which it purchased 3 or 4 years prior. The parcel had a single-family residence when purchased, which was subsequently demolished. The previous owner had rented out the residence for roughly 10 years prior to selling it to the city. He had lived in the residence previous to that. Since the demolition, the city had only kept the weeds down.

On March 10, 2008, Mr. Eugene Gabrych was interviewed by telephone regarding his knowledge of the history of APN 291-191-001 (current APN 291-191-027). Mr. Gabrych purchased the parcel in June 2005. The parcel was essentially the same as when it was purchased. As far he knew, the parcel had always been vacant. Mr. Gabrych was unaware of any environmental issues associated with the parcel.

On March 11, 2008, Ms. Carolyn Emord was interviewed by telephone regarding her knowledge of the history of the subject site and surrounding area, including APNs 291-191-010 and -012. Ms. Emord was most familiar with the subject site and surrounding area from the 1950s to 1996. Ms. Emord currently owned APN 291-191-010. Her parents had owned APNs 291-191-010 and -012 from 1955 to 1994, when her mother passed away. In 1996, APN 291-191-012 was sold, leaving Ms. Emord with the remaining parcel.

The single-family residence at APN 291-191-012 was made of adobe, though stucco was placed on it in 1996. Ms. Emord's father constructed an adobe addition to the east of the original residence, including a bedroom, bathroom, and hallway. The adobe residence never had a garage. Ms. Emord's mother had the chain-link fence put up around APN 291-191-010, which had always been vacant.

According to Ms. Emord, the subject site was largely the same as it was in 1955. When asked about the former rectangular building at APN 291-191-013, she recalled that a 3- to 5-unit apartment building was present. The apartment building was a single-story structure with apartments side by side. This apartment building sat in the south end of APN 291-191-013, opposite the laundromat on the adjacent property to the east. The laundromat had been present since the 1950s, and was never a drycleaners.

Ms. Emord mentioned that APN 291-191-001 (current APN 291-191-027) formerly had a fence around the whole parcel. However, this parcel had always been vacant.

When asked about the use(s) of the subject site, Ms. Emord stated that it had always been vacant land or residential use with no commercial uses that she knew. Also, she was unaware of any groundwater wells, fuel tanks (above- or underground), or environmental issues at the site.

Ms. Emord believed that the four apartment units, which are present to the north of APN 291-191-012 beyond Sherman Avenue, were added in the 1970s.

On March 11, 2008, Ms. Margaret Cameron was interviewed by telephone regarding her knowledge of the history of the subject site and surrounding area, including APN 291-191-007. Ms. Cameron purchased APN 291-191-007 in the 1950s or 1960s. She bought it in anticipation of selling the property to a potential gasoline station that could have been placed at the northeast corner of the intersection at Alessandro Boulevard and Day Street. The parcel formerly had a 2- or 3-bedroom single-family residence on it, which had since been demolished. The residence was formerly used as a rental. Ms. Cameron has lived in Hawaii since the 1970s, but to her knowledge, the subject site had been either vacant land or residential use. She was unaware of any environmental issues, including tanks, associated with the site.

On March 11, 2008, Mrs. Linda Tsai was interviewed by telephone regarding her knowledge of the history of APN 291-191-013. Mrs. Tsai, along with her husband, Mr. Lon Tsai, and Mr. Fred Chang, owned APN 291-191-013. The parcel was vacant land when purchased a long time prior. It was essentially the same as when purchased. Mrs. Tsai was unaware of any environmental issues associated with the parcel.

On March 11, 2008, Ms. Donna Small was interviewed by telephone regarding her knowledge of the history of the subject site, including APN 291-191-011. Ms. Small's grandmother purchased APN 291-191-011 in the early 1900s, and it had remained in the family ever since, passed down to her through her father. To her knowledge, the parcel had always been residential. In the early 1970s, her father demolished the old residence that was present, and had the (then current) single-family residence constructed. She visited the parcel as a child, but did not live there. When she was a child, there were chickens and ducks at the parcel, and she remembers there being a 1-story apartment building next door. She was unaware of any environmental issues, including tanks, associated with the site.

On March 12, 2008, Ms. Jean Ortego was interviewed by telephone regarding her knowledge of the history of the subject site, including APNs 291-191-008 and -009. Ms. Ortego and her husband (now deceased) purchased APNs 291-191-008 and -009 thirty-one (31) years prior. These parcels were essentially the same as when purchased, and she indicated that no new structures had been built in the neighborhood near their property since then. The shop building that was converted into a residence had not been used recently, and was apparently used as a blacksmith's shop about 75 years prior. The concrete structure in front of the southernmost residence was a planter for flowers, and existed when the parcels were purchased. She was unaware of any environmental issues, including tanks, associated with the site.

On March 13, 2008, Mr. Antonio Anaya was interviewed by telephone regarding his knowledge of the history of APN 291-191-012. Mr. Anaya and his wife, Maria, had lived at the house on APN 291-191-012 for 8 years, but his sister owned it for the first two. This parcel was essentially the same as when purchased. He was unaware of any environmental issues, including tanks, associated with the site.

SITE RECONNAISSANCE

Site reconnaissance was previously conducted on March 3, 2008, and more recently on July 9, 2018. To orient our site reconnaissance, a copy of the Assessor's Parcel Map and recent color aerial photograph were obtained for our use. Copies of the Assessor's Parcel Map and color aerial photograph with approximate site boundaries are present on Figures 3 and 4, respectively.

The subject site is approximately 8.5 acres of residential property, comprised of thirteen parcels of vacant land in a roughly rectangular shape. Former residences and associated structures and development are gone. The topography of the site is somewhat hilly, with a ridge line trending southwesterly from the northeast corner to near and just east of the southwest corner. Hilly slopes face all directions, but an overall drop in onsite elevation falls generally to the southwest. From the highest to lowest elevation is over 10 feet. The elevations of bordering Day Street and Sherman Avenue are higher than the northwest portion, creating a slight bowl effect; however, bermed soils have been placed along the edges of this bowl effect to prevent vehicle access. Bermed soil is also present along the east portion of the south side of the site, on the north side of Alessandro Boulevard. Vegetation is comprised of light grasses and weeds up to a foot high, disced in the relative recent past, with over a dozen landscaped and volunteer trees.

Onsite dirt roads include an apparent west-southwest trending dirt access road leading from a gate along the west side of an offsite property (APN 291-191-016), situated along the east side of the subject site. This dirt access road terminates at a looping dirt road in the central, northwest, and southwest portions of the site. Areas of bare ground are present at the northwest and southwest corners of the looping dirt road.

A groundwater monitoring well, MW-13, associated with the offsite former gasoline station within 100 feet east of the south end of the subject site, is present within 10 feet of the east site boundary in the southeast portion. This well is marked by an approximate 2-foot diameter concrete round pad, in which an approximate 12-inch steel manhole cover is situated.

Utilities at the periphery along Alessandro Boulevard, Day Street, and Sherman Avenue include utility poles (some with mounted electrical transformers) with power and telecommunication lines, traffic signal, street lighting, fire hydrants, pad-mounted electrical transformers, storm drain, water, and utility boxes, including telecommunications. No leakage was observed at the transformers. Storm drain inlet concrete head walls and associated rock are present onsite near the north side of the site in the central portion. Several apparent 1-inch water lines are sticking up along the east site boundary in the south end, coincident with the offsite coin laundry to the east. These water pipes have elbows that are plugged or have hose bibs. These water pipes appear to be decades old.

Some illegally dumped trash and debris are present, including asphalt, concrete, metal, brick, cardboard, plastic, wood, green waste, carpet, cloth, clothing, a chair, shopping cart, a microwave, glass, and a tire. Flat, thin, platy debris was observed in the northeast portion of the subject site, near the east boundary and just south of west-southwest trending dirt road leading from a gate along the west side of an offsite property (APN 291-191-016). This platy debris appears to be asbestos-containing cement. A 1-gallon paint can with hardened paint was is also present.

No oil-stained soils, including those previously observed at APNs 291-191-002 (current APN 291-191-028), -003 (current APN 291-191-029), -011, and -013, were noted at the subject site.

Adjoining Properties

The subject site is bordered to the north, west, and south by Sherman Avenue, Day Street, and Alessandro Boulevard, respectively, all asphalt-paved roads. To the north beyond Sherman Avenue and to the west beyond Day are single- and/or multi-family residential properties and vacant land. A mini-storage (Alessandro Self Storage) is located at the southwest corner of the intersection of Alessandro Boulevard and Day Street. To the south beyond Alessandro Boulevard are industrial properties that include a trailer manufacturer (CIMC Reefer Trailer, Inc.) and truck body manufacturer (Supreme Truck Bodies). Adjacent to the east are residential properties and a laundromat (Soap & Pepper Coin Laundry). One of these residential properties, adjacent to the northeast corner of APN 291-191-013, previously appeared to be in use for a construction-related business, possibly re-roofing, but does not appear to be at present. Adjacent to the east of the laundromat is the canopy and other remnants of a former gasoline station (Flite Chief and Gas 4 Less). The location of the former underground fueling facilities associated with this former gasoline station is within 100 feet to the east of the subject site. A groundwater monitoring well, MW-13, associated with this former gasoline station, is located at the subject site along the east boundary, approximately 180 feet north of the right-of-way for Alessandro Boulevard.

Color photographs of the subject site and adjoining properties are provided in Appendix F.

REGULATORY AGENCY RECORDS REVIEW

For records relating to environmental compliance and hazardous materials/waste within the County of Riverside, the CRDEH generally is the lead agency. The California Regional Water Quality Control Board, Santa Ana Region (CRWQCB-SAR) or CRDEH may be the lead agency for soil and/or groundwater investigations and remediation. These agencies were contacted, directly or online, for records they may have for the subject site and/or nearby properties.

County of Riverside Department of Environmental Health

A request to review records for the subject site was emailed to the CRDEH. In letters dated July 5, 2018, the CRDEH indicated that no records were found for the address ranges along Alessandro Boulevard, Day Street, and Sherman Avenue within which addresses associated with the subject site fall. Copies of the CRDEH records response letters are provided in Appendix G.

California Regional Water Quality Control Board - Santa Ana Region

The California State Water Resources Control Board maintains the online GeoTracker database, which includes CRWQCB-SAR records for: 1) cleanup sites, including leaking underground storage tank (LUST) sites, cleanup program sites, military cleanup sites, and California Department of Toxic Substances Control (DTSC) cleanup sites; 2) permitted facilities, including waste discharge requirements sites, permitted USTs, DTSC hazardous waste sites, land disposal sites, irrigated lands regulatory program sites, and oil/gas sites; and 3) other sites, including project sites, non-case information sites, sampling points - public, and field points. This database was searched for records that may pertain to the subject site, and none were found. The closest identified site to the subject site is Flite Chief, Inc. (Mobil) and Gas 4 Less, both former gasoline stations located at

22144 Alessandro Boulevard. Both of these former gasoline stations have associated LUST cases. The older of the two LUST cases, associated with Flite Chief, Inc. (Mobil), was opened in July 1991 and closed in February 1993 under the CRDEH as lead regulatory agency. This case involved gasoline compounds, including benzene, reported in soil samples in the turbine and fill boxes, with some soil removal. The more recent case associated with Gas 4 Less was opened in 1999 and is still open, but closure is pending under the CRWQCB-SAR. Releases from the tank and dispensing systems was discovered during tank removal. Information provided in the Draft Case Closure Summary indicates the gasoline station operated from the 1960s until 1999. Since 1999, assessment and remediation activities have been periodically conducted, including soil and groundwater assessment, groundwater monitoring, air sparging of groundwater, and soil vapor extraction. The remedial activities, including air sparging and soil vapor extraction, from 2008 to 2016 removed an estimated 4,977 gallons of hydrocarbon vapor. Soil concentrations of total petroleum hydrocarbons as gasoline, benzene, toluene, ethylbenzene, and total xylenes (BTEX), MtBE, and tBA decreased from 16,000 milligrams per kilogram (mg/kg) to 376 mg/kg, 400 mg/kg to 0.012 mg/kg, 2,000 mg/kg to 0.112 mg/kg, 700 mg/kg to 1.27 mg/kg, 3,500 mg/kg to 17.8 mg/kg, 282 mg/kg to 9.94 mg/kg, and 11 mg/kg to 8.47 mg/kg, respectively. The highest concentrations in groundwater when last measured in December 2016 for TPH-G, BTEX, MtBE, and tBA were 17,000 micrograms per liter (µg/L), 1,700 µg/L, 40 µg/L, 760 µg/L, 2,200 µg/L, 900 µg/L, and 24,000 µg/L, respectively. Groundwater flow direction was indicated to be variable, from west-northwest to southwest. Groundwater levels were reportedly around 56 to 58 feet bgs in November 2005, rising to around 26 to 30 feet bgs in December 2016. It was indicated the post-remedial groundwater plume was stable and concentrations met the criteria established in the State of California Low Threat Closure Policy; the existing land use is commercial with no known planned changes in land use; and therefore, no further action was recommended. A groundwater monitoring well associated with this LUST case, MW-13, is located along the east side of the subject site in the southeast portion, approximately 180 feet north of the right-of-way for Alessandro Boulevard. This well has had reported concentrations of TPH-G, MtBE, and tBA reported up to 210 µg/L, 88.6 µg/L, and 374 µg/L, respectively. From June 2011 to December 2016, groundwater levels in well MW-13 have been measured from approximately 27 to 36 feet bgs, with water levels rising over this time period.

ENVIRONMENTAL DATABASE REVIEW

EDR was contacted to provide an environmental database search for the subject site. The database search provides information regarding landfills, USTs, hazardous waste generators, etc., at the subject site and surrounding properties in accordance with ASTM Standards and AAI. Over a dozen mapped sites, not including the subject site, were found in EDR's search of available government records within the respective search radii. A copy of the EDR database report, which provides a complete list of the federal, state, tribal, and proprietary records searched, is provided in Appendix H.

NPL

Pursuant to the Comprehensive Environmental Resource Conservation and Liability Act of 1980 (CERCLA), the U.S. EPA has developed and maintained lists of contaminated properties under the Federal Superfund Program. March Air Force Base (MAFB)/March Air Reserve Base, located over 0.5 mile south-southeast of the subject site, is listed in the EPA National Priority List (NPL) database. The subject site is shown within an area shaded for Department of Defense (DOD) sites on the Overview Map within the EDR environmental database report ("The EDR Radius Map™ Report with GeoCheck®); however, the subject site was not part of the former MAFB. MAFB is listed in the Superfund Enterprise Management System (SEMS) database. The SEMS is the renamed Comprehensive Environmental Resource Conservation and Liability Information System (CERCLIS) list. MAFB is also listed in several other databases, including the, US ENG (engineering) CONTROLS, US INST (institutional) CONTROL, ENVIROSTOR, DOD, ROD (Record of Decision), and UXO (unexploded ordnance) databases. MAFB started out in 1918 as Alessandro Aviation Field, and has served as a training base and refueling operations base. Industrial operations (including aircraft maintenance and repair) involved use of solvents and disposal of solvent wastes. Various uses of the base have occurred over time, including pilot, bombing, and gunnery training. MAFB participated in the Installation Restoration Program (IRP), which was established in 1978. Under this program, the United States DOD sought to identify, investigate, and clean up contamination from hazardous materials. The initial investigation of MAFB was centered at the main base complex. As part of the IRP, the Air Force investigated potentially contaminated disposal areas. MAFB Well No. 1, on-base, was found to be contaminated with trichloroethene (TCE), tetrachloroethene (PCE), and cis-1,2-dichloroethene at levels that exceed State of California drinking water standards. The well was taken out of service. Soils at the base were contaminated with toluene and benzene. An estimated 11,600 people obtain drinking water from municipal wells within 3 miles of hazardous substances at MAFB. The Air Force has conducted remedial investigation and identified alternatives for remedial action. At least 38 areas (IRP sites) of soil and/or groundwater contamination have been identified at MAFB. Three operable units were designated.

Contamination has occurred at MAFB in association with various activities, including disposal of waste in waste pits, landfill placement, fuel storage, discharge into effluent ponds and a drainage channel, fire training, and maintenance. Contaminants identified at MAFB include PCBs, solvents (including TCE and PCE), petroleum hydrocarbons (including diesel, gasoline, oil, hydraulic fluids, and jet fuel), paint thinners, paint strippers, and battery acids. On-base and off-base TCE and PCE groundwater plumes have impacted several groundwater production wells, mostly east of the base.

MAFB has generated numerous hazardous wastes, including heavy metals (include cadmium, lead, mercury, and silver), volatile organic compounds (including solvents), and ignitable and corrosive wastes. General generator Notices of Violation were issued in 1984 and 1995. MAFB is listed with numerous engineering controls in place, including operation and maintenance of groundwater extraction and discharge with the use of liquid-phase carbon adsorption, soil vapor extraction (in-situ), bioremediation (ex-situ), groundwater monitoring, areas of contaminated soil that have been capped, soil disposal, soil recycling, soil excavation, impermeable barrier of some type for soil, low temperature thermal desorption of soil, and no action regarding areas of soil and/or groundwater. Institutional controls are in place as well, including covenants, deed notices, base use plan change, and subdivision, zoning, and building, demolition, or excavation regulations.

Based on the regulatory oversight provided by federal and state regulatory agencies, distance from the subject site, and no groundwater plume associated with MAFB at the subject site, MAFB is not anticipated to have a significant environmental impact to the subject site.

RCRA-SQG

Resource Conservation and Recovery Act (RCRA) Small Quantity Generators (LQG) include sites that generate between 100 and 1,000 kilograms (kg) of hazardous waste per month. Three sites are listed in this database, the closest of which is Supreme Truck Bodies, indicated to be approximately 0.1 mile southeast of the subject site. Supreme Truck Bodies generates ignitable hazardous wastes, and has no reported violations. The other two RCRA-SQG sites also have no reported violations. Based on the distance away and lack of reported violations, the listed RCRA-SQG sites should have no adverse environmental impact to the subject site.

ENVIROSTOR

The California DTSC Site Mitigation and Brownfields Reuse Program's ENVIROSTOR database identifies sites that have known contamination or sites for which there may be reasons to investigate further. There are five sites listed in this database, including Towngate Elementary School, MAFB USAR, March Field, Alper Cleaners, and Edgemont Elementary School. Two of the sites are associated with the former MAFB, previously discussed in the NPL subsection of this report. The remaining sites are indicated to be greater than 0.5 mile from the subject site. Based on distance from the subject site to these ENVIROSTOR listed sites, including to known sites at the former MAFB, no adverse environmental impact to the subject site is anticipated.

LUST

The State Water Resource Control Board (SWRCB) maintains a list of all leaking underground storage tanks (LUST) within the state. Three sites (two sites are listed thrice) are listed within 0.5 mile of the subject site. Two of these three sites are indicated to be located over 0.1 mile from the subject site. One of these two sites has a closed LUST case. The closest site is Gas 4 Less/Flite Chief, Inc. (Mobil), located within 100 feet to the east of the subject site. This site has had two LUST cases, one of which has been closed, and the other shown online at the SWRCB GeoTracker website as being eligible for case closure. The two LUST sites farther away are not anticipated to have an adverse environmental impact to the subject site based on their regulatory oversight, LUST case closure, and/or distance from the subject site. The closest LUST site is discussed under other sections of this report, including the **REGULATORY AGENCY RECORDS REVIEW** and **VAPOR ENCROACHMENT EVALUATION** sections.

SWRCY

This state database is a listing of recycling facilities in California. One site, Menlo Recycling Center at 22405 Golden Crest Drive, is listed over 0.4 mile southeast of the subject site. This site is listed as being non-rural, not a grandfathered facility, and with an operation start date on August 3, 2016. This recycling facility receives aluminum, glass, plastic, and bimetal. Based on the distance away and nature of the recycling operation, this site should present no adverse environmental impact to the subject site.

SWEEPS UST

The Statewide Environmental Evaluation and Planning System (SWEEPS) database is an UST listing that was updated and maintained by a company contracted by the SWRCB. Two sites are listed in this database within 0.25 mile of the subject site. The closest site, Flite Chief at 22144 Alessandro Boulevard, is located within 100 to the east of the subject site. The SWEEPS UST database lists this site with a 9,940-gallon leaded gasoline UST, 7,500-gallon unleaded gasoline UST, and 9,940-gallon unleaded gasoline UST. This site is also listed in the LUST database, eligible for LUST case closure, and is discussed under the **REGULATORY AGENCY RECORDS REVIEW** and **VAPOR ENCROACHMENT EVALUATION** sections of this report. The second site, My Tran E Shop, LLC at 21891 Alessandro Boulevard, is located over 0.1 mile west-southwest of the subject site, and should have no adverse environmental impact to the subject site.

HIST UST

The SWRCB maintains the Historical UST (HIST UST) list which contains active and inactive underground storage tank locations. One site, Charlebois Liquors at 21840 Alessandro Boulevard, is listed in this database over 0.1 mile from the subject site. This site has a closed LUST case. The listed HIST UST site should have no adverse environmental impact to the subject site due to regulatory LUST case closure and distance away.

CA FID UST

The California Facility Inventory Database (CA FID) contains a historical listing of active and inactive UST locations from the SWRCB. The same two sites listed in the SWEEPS UST are also listed in the CA FID UST database.

HIST CORTESE

The historical Cortese (HIST CORTESE) list is a historical listing from the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (CALSITES). Two of the three sites listed in the LUST database are also listed in the HIST CORTESE database, including Flight Chief, Inc. (Mobil) and Charlebois Liquors.

CA Notify 65

This database, no longer updated, includes listings of all Proposition 65 incidents reported to counties by the SWRCB and the RWQCB. Three sites over 0.7 mile from the subject site are listed in this database. Based on the distance from the subject site and regulatory oversight, these Notify 65 sites should have no adverse environmental impact to the subject site.

EDR Hist Auto

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. One site at 22144 Alessandro Boulevard, under Complete Auto Detail, is listed in this database. This site is located within 100 feet to the east of the subject site, and has listings for Texaco Flight Chief in 1992 and 1993, N S Enterprises in 2001 through 2004, and Complete Auto Detail in 2010 through 2014. The EDR Hist Auto site is discussed under other sections of this report, including the **REGULATORY AGENCY RECORDS REVIEW** and **VAPOR ENCROACHMENT EVALUATION** sections.

Orphan Summary

The Orphan Summary within the EDR database report, which is a list of all sites whose location is not readily identified (mapped), and may be near the subject site, was reviewed. The subject site and adjoining properties are not listed in the Orphan Summary.

Division of Oil, Gas, and Geothermal Resources

The California Division of Oil, Gas, and Geothermal Resources (DOGGR) maintains a list of all producing and abandoned oil and gas wells within the State of California. We reviewed the online DOGGR Well Finder, which indicates no abandoned or producing gas and/or oil wells have been located within one mile of the subject site (DOGGR, 2018).

VAPOR ENCROACHMENT EVALUATION

As part of this Phase I ESA, a VES was conducted to determine if a VEC exists, based on the information obtained during the Phase I ESA. A VEC is the presence or likely presence of chemicals of concern (COC) vapors in the subsurface of the target property caused by the release of vapors from contaminated soil or groundwater either on or near the target property (i.e., subject site).

Vapor Encroachment Screen

A Vapor Encroachment Screen (VES), comprised of Tier 1 and 2 (non-invasive) screening, was conducted by this firm for the subject site. The VES was conducted in general accordance with the Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions, ASTM E2600-15. Although not required to satisfy the requirements of the Phase I ESA under ASTM E1527-13, ASTM E2600-15 was chosen as a methodology to evaluate potential contaminant vapor concerns at or adjoining the subject site.

The subject site use has historically included vacant land and residential. The site is located in a mixed residential, commercial, and industrial area. The subject site and surrounding area are underlain by interbedded silty sands and sandy silts with lessor units of clayey sand, lean clay with sand, and well-graded sand. Based on the local geology and groundwater hydrology, groundwater beneath the subject site, anticipated to be as shallow as approximately 24 feet bgs and as deep as approximately 33 feet bgs, is considered a potential source of vapor into the subject site.

Based on the results of Tier 1 screening, utilizing The EDR Radius Map™ Report with GeoCheck® and research of the history of the subject site and adjoining properties, the Flite Chief, Inc. (Mobil)/Gas 4 Less at 22144 Alessandro Boulevard is the only site within 0.33 mile with current and/or former potential sources of soil vapor intrusion or encroachment, such as leaking (current or former) USTs, dry cleaners, etc., including sites involving only hydrocarbon chemicals of concern. Based on the results of the VES, Tier 1 screening, a VEC at the subject site cannot be ruled out.

Under VES, Tier 2 screening (non-invasive), using the critical distance determination, the Flite Chief, Inc. (Mobil)/Gas 4 Less former gasoline station site is located greater than the critical distance of 30 feet for dissolved petroleum hydrocarbon COC; however, groundwater contamination from this former gasoline station has been confirmed to be periodically present onsite, along the east boundary, based on groundwater sample analytical data associated with monitoring well MW-13. This well has had reported concentrations of TPH-G, MtBE, and tBA reported up to 210 µg/L, 88.6 µg/L, and 374 µg/L, respectively. From June 2011 to December 2016, groundwater levels in well MW-13 have been measured from approximately 27 to 36 feet bgs, with water levels rising over this time period. Based on the past presence of COC-contaminated groundwater, a VEC existed, and may still exist, at the subject site. Based on the results of the Tier 2 screening (non-invasive), a VEC cannot be ruled out.

DATA GAPS

Under AAI and ASTM E1527-13, data gaps that remain after the conduct of all required activities must be identified. The source of information consulted to address the data gaps should be identified, and the significance of the data gaps with respect to our ability to identify conditions indicative of releases or threatened release of hazardous substances on, at, in, or to the property should be addressed.

There are no significant data gaps remaining after our conduct of AAI and ASTM E1527-13.

CONCLUSIONS AND RECOMMENDATIONS

No drums, buckets, or other containers, which might pose an adverse environmental impact to the parcel, were observed. No soil staining, chemical odor, or distressed vegetation were noted.

There are over a dozen sites listed in environmental regulatory databases within 1 mile of the subject site, none of which are located at the subject site. Based on the results of our VES, Tier 1 and 2 (non-invasive) screening, a VEC at the subject site cannot be ruled out. Based on groundwater sample data from an onsite groundwater monitoring well, MW-13, associated with an offsite former gasoline station (Flite Chief, Inc./Gas 4 Less) within 100 feet to the east of the south end of the subject site, there have been reportable concentrations of TPH-G, MtBE, tBA, which means a VEC previously existed, and may still exist.

We have performed this Phase I ESA in conformance with ASTM E1527-13 and AAI set forth in 40 CFR Part 312 for APNs 291-191-004, -007 through -013, and -025 through -029, located in Moreno Valley, California. This Phase I ESA has revealed no evidence of RECs, HRECs, or CRECs indicative of releases or threatened releases of hazardous substances on, at, in, or to the subject site, except for the reported groundwater contaminants in onsite groundwater monitoring well MW-13, which may represent a REC. The VEC that previously existed onsite, and may still exist, may or may not include impacted soil vapor high enough to preclude the planned residential development, but a subsurface soil vapor investigation should be conducted to confirm the environmental condition of the site with respect to potential gasoline contaminants in soil vapor in the southeast portion of the subject site near the east boundary.

STATEMENT OF QUALIFICATIONS

We have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. We have developed and performed the all appropriate inquires in conformance with the standards and practices set forth in 40 CFR Part 312.

Mr. John Leuer is the President of LOR Geotechnical Group, Inc., founded in 1988. As a cofounder and President of the company, Mr. Leuer has managed LOR through hundreds of Phase I Environmental Site Assessments, as well as numerous Phase II Environmental Site Assessments and remediation projects, primarily remedial excavation. Mr. Leuer has over 36 years experience in the geotechnical and environmental fields. Mr. Leuer has substantial experience coordinating projects for many city, county and state agencies, as well as in the public sector, gaining a reputation for being responsive to clients needs while providing strong technical expertise. LOR Geotechnical Group, Inc. is one of three firms that previously provided report review for underground storage tank closure for the County of San Bernardino, Fire Department Hazardous Materials Division.

Mr. Leuer holds a B.S. in Civil Engineering from Cal State University at Northridge. He is a registered Geotechnical and Civil Engineer in the State of California. Mr. Leuer is a member of the American Society of Civil Engineers.

Mr. Mathew L. Hunt has over 19 years experience in the environmental field. Mr. Hunt works under LOR Geotechnical Group's environmental operations and has conducted over 300 Phase I Environmental Site Assessments for the private and public sectors. The properties have ranged from agricultural to residential to commercial/industrial. In addition to his experience with environmental assessments for property transfers, he has worked on projects that require mitigation prior to development. Mr. Hunt is well versed in hazardous waste sampling and characterization methodologies in soil and groundwater regimes for groundwater monitoring, site assessment, and site remediation. Projects have ranged from leaking USTs at gasoline stations to commercial and government (including Superfund/CERCLA sites) projects involving metals, perchlorate, and solvents.

Mr. Hunt has a B.S. in soil science from California Polytechnic State University, San Luis Obispo and a M.S. in soil and water science from the University of California, Riverside.

LIMITATIONS

This report was prepared solely for the use and benefit of LOR's client, City of Moreno Valley, and their designates and assigns. They may release this information to third parties, who may use and rely upon this information at their discretion. However, any use of or reliance upon this information by a party other than the City of Moreno Valley and their designates and assigns, shall be solely at the risk of such third party and without legal recourse against LOR Geotechnical Group, Inc.; its subsidiaries and affiliates; or their respective employees, officers, or directors; regardless of whether the action in which recovery of damages is sought is based upon contract, statute, or otherwise.

The content and conclusions provided by LOR in this assessment are based on information collected during our investigation, which may include, but is not limited to, visual site inspections, interviews with the site owner, regulatory agencies and other pertinent individuals, a review of available public documents, and our professional judgement based on said information at the time of preparation of this document. Any subsurface samples results and observations presented herein are considered to be representative of the area of investigation; however, soil conditions may vary between sample locations and may not necessarily apply to the general site as a whole. If future subsurface or other conditions are revealed which may vary from these findings, the newly-revealed conditions must be evaluated and may invalidate the conclusions of this report.

This report has been prepared in accordance with generally accepted practices using standards of care and diligence normally practiced by recognized consulting firms performing services of a similar nature. LOR Geotechnical Group, Inc. (LOR) is not responsible for the accuracy of information provided by other individuals or entities which is used in this report. This report presents our professional judgement based upon data and findings identified in this report, and the interpretation of such data based upon our experience and background, and no warranty, either expressed or implied, is made. The conclusions presented are based upon the current regulatory climate and may require revision if future regulatory changes occur.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc., verifying the suitability of the conclusions and recommendations. Based on ASTM E1527-13 and AAI, certain components of this report are no longer valid after 180 days of their being performed, including interviews, visual inspection of the subject property and adjoining properties, and review of federal, tribal, state, and local government records. Once this 180-day period has expired, this report should be updated or revised to meet the requirements for continued viability under the ASTM and AAI standards.

CLOSURE

We declare that, to the best of our professional knowledge and belief, we meet the definition of Environmental Professional as defined in § 312.10 of 40 CFR part 312.

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this office.

Respectfully submitted,
LOR Geotechnical Group, Inc.

Mathew L. Hunt
Environmental Scientist

John P. Leuer, CE 34996
President

REGISTERED PROFESSIONAL ENGINEER
JOHN P. LEUER
NO. 34996
CIVIL
STATE OF CALIFORNIA

MLH:JPL\ss

Distribution: Addressee (2) and a PDF via email: marshalle@moval.org

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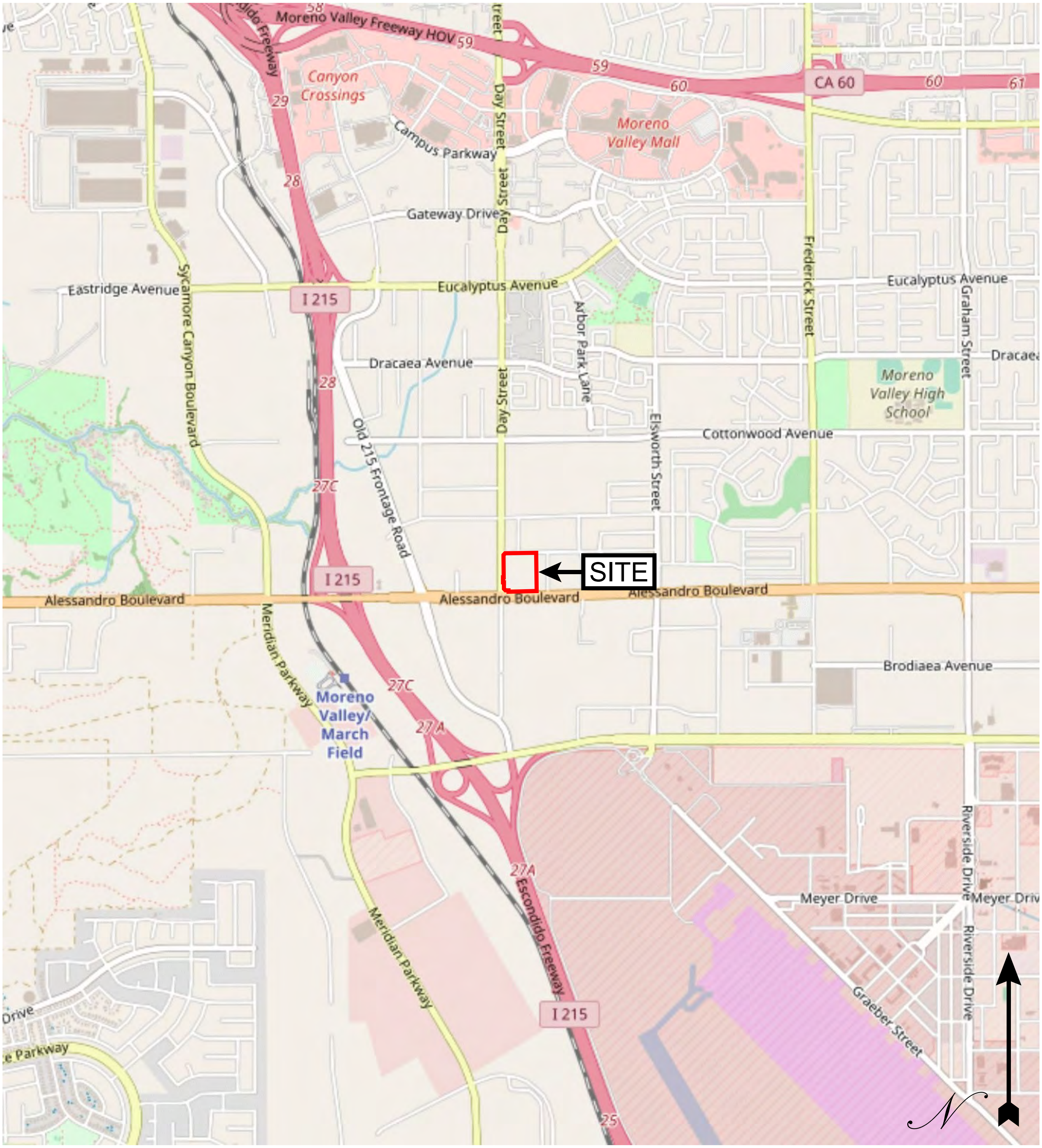
FIGURES

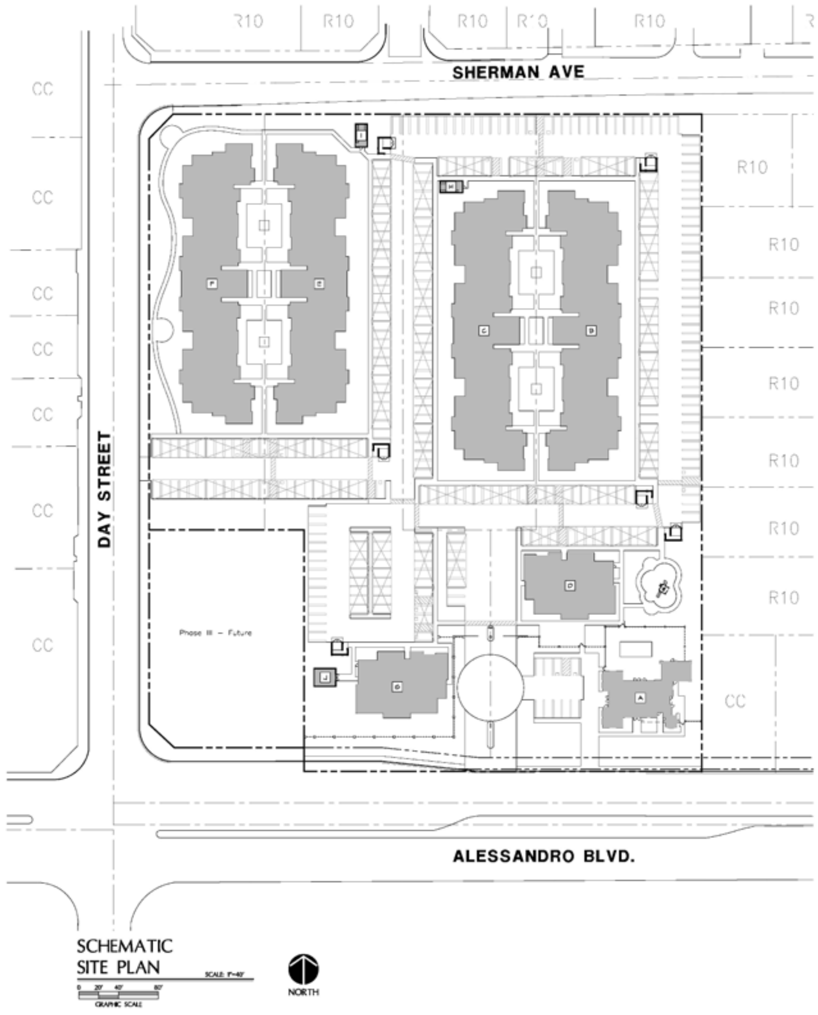


Basemap Source: Environmental Data Resources, Inc. Online Lightbox™

INDEX MAP

PROJECT:	**NEC ALESSANDRO BLVD. AND DAY ST., MORENO VALLEY, RIVERSIDE CO., CA**	**PROJECT NO.:**	**62522.21**
CLIENT:	**CITY OF MORENO VALLEY**	**FIGURE:**	**1**
		DATE:	**JULY 2018**
		SCALE:	**1" ~ 2,340'**

LOR Geotechnical Group, Inc.



Project Description

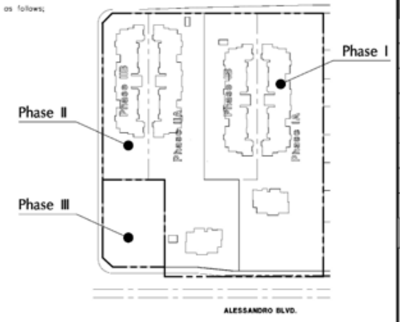
A 199 unit gated affordable apartment project on an 8.3 acre parcel including four family apartment buildings, two senior apartment buildings, one community building, one maintenance building, two laundry buildings, one pool and one tot lot. The unit mix includes 1, 2, and 3 bedroom apartments ranging in size from 627 square feet to 1002 square feet.

Project Phasing
The project will be constructed in 3 phases as follows;

Phase One (IA & IB)
84 family apartments
15 senior apartments
community building / managers unit
1 laundry building
pool
tot lot

Phase Two (IIA & IIB)
83 family apartments
15 senior apartments
1 managers unit
1 laundry building
1 maintenance building

Phase 3
approximately 0.90 acre
parcel for future development



Phasing Key NO SCALE

Legal Description

x

Project Data

Property Information
Address: Northeast Corner of Alessandro Blvd. and Day St.
Moreno Valley, CA. 92553

Site Data

Gross Parcel:	8.3 acres (zoned R-30)
Net Residential:	7.3 acres (zoned R-30)
Net Commercial:	0.9 acres (zoned CC)

Zoning Information
Current Zoning: R-30 (Residential 30 District)
Proposed Zoning: R-30 (Residential 30 District)
CC (Community Commercial District)

Lot Coverage (excludes commercial lot)

Building A – Community Building	3,582 SF
Building B – Family Apartment Building	15,400 SF
Building C – Family Apartment Building	15,400 SF
Building D – Senior Apartment Building	5,200 SF
Building E – Family Apartment Building	15,400 SF
Building F – Family Apartment Building	15,400 SF
Building G – Senior Apartment Building	5,200 SF
Building H – Laundry Building	276 SF
Building I – Laundry Building	276 SF
Building J – Maintenance Building	396 SF
Total Buildings	76,530 SF

76,530 SF / 317,988 SF = 0.24% Coverage

Rental Unit Mix
Phase I:

One Bedroom	48	(24%)
Two Bedroom	78	(40%)
Three Bedroom	71	(36%)

Parking Data (Based on 100% Affordable Housing)

Parking Per Unit:		
One Bedroom	1 Space x 48=	48 Spaces
Two Bedroom	1.5 Spaces x 78=	117 Spaces
Three Bedroom	2 Spaces x 73=	146 Spaces
Parking for Community Building		
1 per 250 Gross Square Feet		15 Spaces
Minimum Required Parking		326 Spaces
Parking Provided:		
Covered Standard Spaces		207 Spaces
Covered Accessible Spaces		20 Spaces
Open Standard Spaces		99 Spaces
Open Accessible Spaces		8 Spaces
Total Parking Spaces Provided		334 Spaces

Rental Unit Data

Building B: (Phase I)

Unit Type	Count	Bed/Bath	Livable Area
1	(6)	1/1	627 SF
2	(18)	2/1	800 SF
3	(18)	3/2	1002 SF

Building C: (Phase I)

Unit Type	Count	Bed/Bath	Livable Area
1	(6)	1/1	627 SF
2	(18)	2/1	800 SF
3	(18)	3/2	1002 SF

Building D: (Phase I)

Unit Type	Count	Bed/Bath	Livable Area
1	(12)	1/1	627 SF
2	(3)	2/1	800 SF

Building E: (Phase II)

Unit Type	Count	Bed/Bath	Livable Area
1	(6)	1/1	627 SF
2	(18)	2/1	800 SF
3	(18)	3/2	1002 SF

Building F: (Phase II)

Unit Type	Count	Bed/Bath	Livable Area
1	(6)	1/1	627 SF
2	(18)	2/1	800 SF
3	(17)	3/2	1002 SF
Manager	(1)	3/2	1002 SF

Building G: (Phase II)

Unit Type	Count	Bed/Bath	Livable Area
1	(12)	1/1	627 SF
2	(3)	2/1	800 SF

Building Data

Building	Const. Type	Stories	Occupancy	Area
A	VB Sprinkled	2	A3/B/R3	4,435 SF
B	VB Sprinkled	3	R2	44,870 SF
C	VB Sprinkled	3	R2	44,870 SF
D	VB Sprinkled	3	R2	14,744 SF
E	VB Sprinkled	3	R2	44,870 SF
F	VB Sprinkled	3	R2	44,870 SF
G	VB Sprinkled	3	R2	14,744 SF
H	VB NS	1	B	276 SF
I	VB NS	1	B	276 SF
J	VB NS	1	U	396 SF

derra
495 E. Rincon Street, Suite 204
Corona, CA 92879
Ph: 951.268.1650 Fax: 951.268.1651

A SCHEMATIC DESIGN

Revisions

A Proposed Affordable Community
Rancho Belago Developers, Inc.
Northeast Corner of Alessandro Blvd. & Day Street

Job No. –	Date 3/31/18
Drawn By	Checked By WGA

Sheet Title
Schematic Site Plan

A–1.0

Plan Source: Derra Design, Inc.

SCHEMATIC SITE PLAN

PROJECT: NEC ALESSANDRO BOULEVARD AND DAY STREET, MORENO VALLEY, RIVERSIDE COUNTY, CA

PROJECT NO.: 62522.21

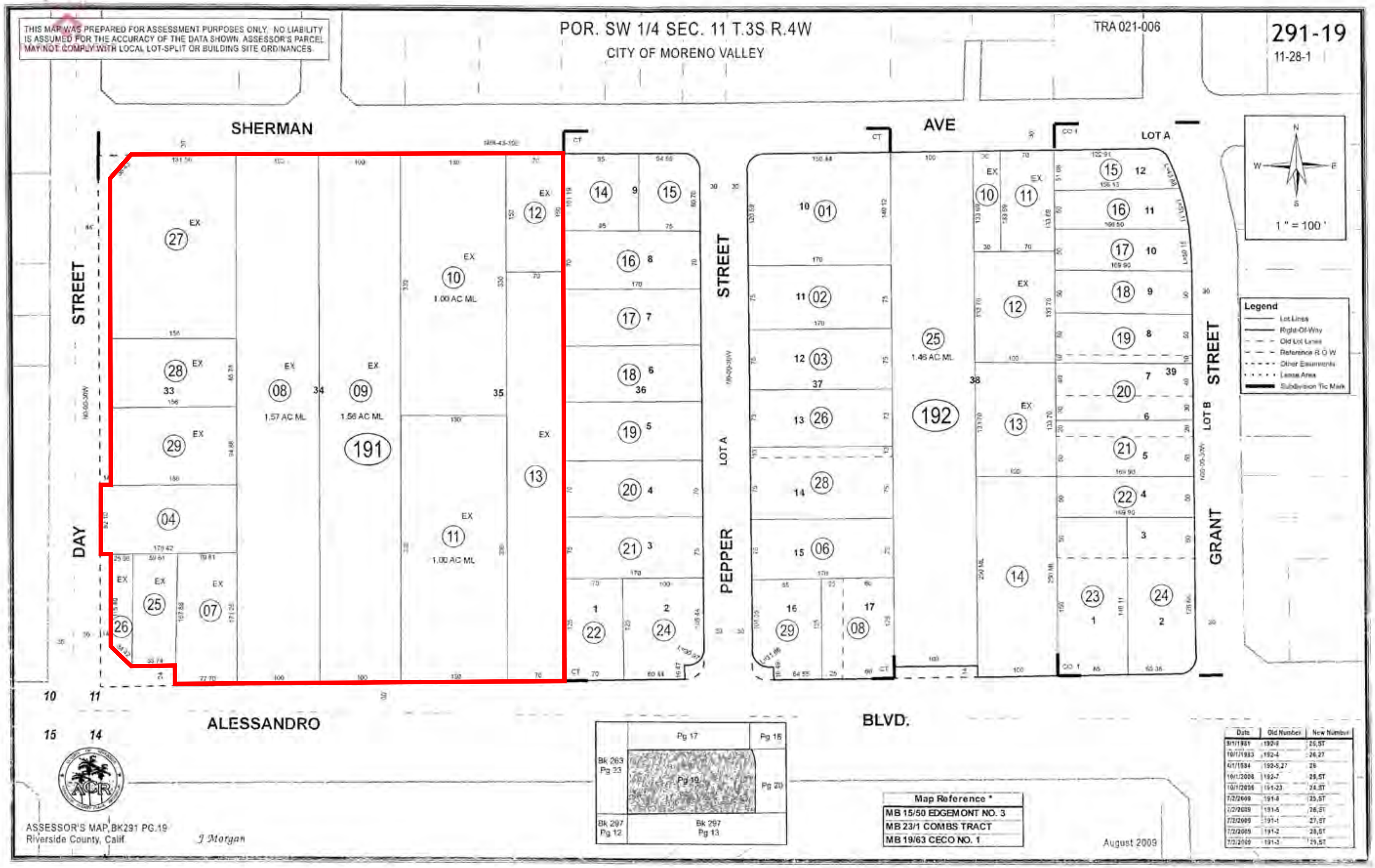
CLIENT: CITY OF MORENO VALLEY

FIGURE: 2

DATE: JULY 2018

APPROX. SCALE: 1" = 190'

LOR Geotechnical Group, Inc.



Basemap Source: ParcelQuest Lite Online (https://assr.parcelquest.com/Home)

Approximate Site Boundary

ASSESSOR'S PARCEL MAP

PROJECT: NEC ALESSANDRO BOULEVARD AND DAY STREET, MORENO VALLEY, RIVERSIDE COUNTY, CA

PROJECT NO.: 62522.21

CLIENT: CITY OF MORENO VALLEY

FIGURE: 3

DATE: JULY 2018

APPROX. SCALE: 1" = 180'

LOR Geotechnical Group, Inc.

Approximate Site Boundary

Aerial Image Source: Google Earth Pro Computer Program

RECENT COLOR AERIAL PHOTOGRAPH

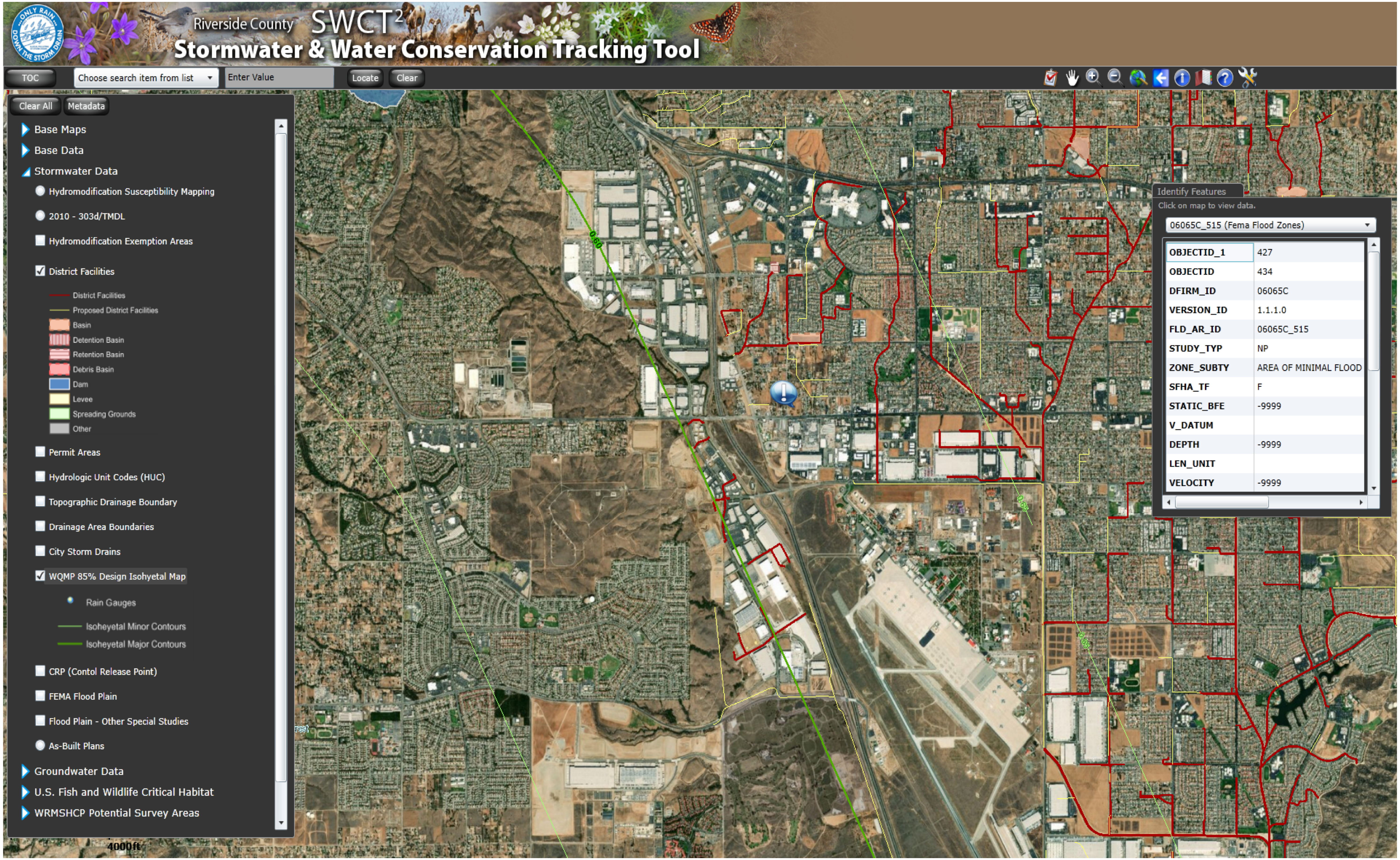
PROJECT:	**NEC ALESSANDRO BOULEVARD AND DAY STREET, MORENO VALLEY, RIVERSIDE COUNTY, CA**	**PROJECT NO.:**	**62522.21**
CLIENT:	**CITY OF MORENO VALLEY**	**FIGURE:**	**4**
LOR Geotechnical Group, Inc.		**DATE:**	**JULY 2018**
		APPROX. SCALE:	**1" = 240'**

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis (NOT APPLICABLE)

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation



- Base Maps
- Base Data
- Stormwater Data
  - ○ Hydromodification Susceptibility Mapping
  - ○ 2010 - 303d/TMDL
  - ☐ Hydromodification Exemption Areas
  - ☑ District Facilities
    - District Facilities
    - Proposed District Facilities
    - Basin
    - Detention Basin
    - Retention Basin
    - Debris Basin
    - Dam
    - Levee
    - Spreading Grounds
    - Other
  - ☐ Permit Areas
  - ☐ Hydrologic Unit Codes (HUC)
  - ☐ Topographic Drainage Boundary
  - ☐ Drainage Area Boundaries
  - ☐ City Storm Drains
  - ☑ WQMP 85% Design Isohyetal Map
    - ● Rain Gauges
    - Isoheyetal Minor Contours
    - Isoheyetal 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

Identify Features

Click on map to view data.

06065C_515 (Fema Flood Zones)

OBJECTID_1	427
OBJECTID	434
DFIRM_ID	06065C
VERSION_ID	1.1.1.0
FLD_AR_ID	06065C_515
STUDY_TYP	NP
ZONE_SUBTY	AREA OF MINIMAL FLOOD
SFHA_TF	F
STATIC_BFE	-9999
V_DATUM	
DEPTH	-9999
LEN_UNIT	
VELOCITY	-9999

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 Thienes Engineering, Inc.
Date 8/10/2020
Designed by Luis Prado
Case No
Company Project Number/Name 3846

BMP Identification

BMP NAME / ID STC "A" / DMA A

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}= 0.62 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)*
A1	*307098*	*Roofs*	*1*	*0.89*	*273931.4*			
A2	*15246*	*Ornamental Landscaping*	*0.1*	*0.11*	*1684*			
	322344	***Total***			**275615.4**	**0.62**	***14240.1***	***42085***

Notes:
Tributary Area = 7.40 acres
An additional 27,844 cu-ft is provided in the chambers to mitigate the HCOCs.

Infiltration Basin - Design Procedure

(Rev. 03-2012)

BMP ID: DMA A

Legend: Required Entries
Calculated Cells

Company Name: Thienes Engineering

Designed by:

Date: 5/20/2020

County/City Case No.:

Design Volume

a) Tributary area (BMP subarea) A_T = 7.4 acres

b) Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 14,241 ft^3

Maximum Depth

a) Infiltration rate I = 2.7 in/hr

b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook) FS = 3

c) Calculate D_1

$$D_1 = \frac{I\text{ (in/hr)} \times 72\text{ hrs}}{12\text{ (in/ft)} \times FS}$$

D_1 = 5.4 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) 35 ft

f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin) 35 ft

g) D_2 is the smaller of:

Depth to groundwater - (10 ft + freeboard) and
Depth to impermeable layer - (5 ft + freeboard)

D_2 = 24.0 ft

h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet D_{MAX} = 5.4 ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1) z = n/a :1

b) Proposed basin depth (excluding freeboard) d_B = 4.45 ft

c) Minimum bottom surface area of basin (A_S= V_{BMP}/d_B) A_S = 3200 ft^2

d) Proposed Design Surface Area A_D = 12368.0 ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP}) Volume = 71 ft^3

b) Forebay depth (height of berm/splashwall. 1 foot min.) Depth = n/a ft

c) Forebay surface area (minimum) Area = ####### ft^2

d) Full height notch-type weir Width (W) = n/a in

Notes: STC Ponding Depth = 4.45 feet = ((1' + 0.75') x 0.40) + 3.75' (MC-3500 STC)

StormTech

Detention • Retention • Recharge

Subsurface Stormwater Management℠

MC-3500 Site Calculator

Project Information:

Project Name: Alessandro Blvd. and Day St.
Location: Moreno Valley, CA
Date: 8/10/2020
Engineer: Thienes Engineering, Inc.
StormTech RPM:

System Requirements

Units		Imperial	
Required Storage Volume		41915	CF
Stone Porosity (Industry Standard = 40%)		40	%
Stone Above Chambers	(12 inch min.)	12	inches
Stone Foundation Depth	(9 inch min.)	9	inches
Average Cover over Chambers	(24 inch min.)	24	inches
Bed size controlled by WIDTH or LENGTH?		WIDTH	
Limiting WIDTH or LENGTH dimension		80	feet
Storage Volume per Chamber		178.9	CF
Storage Volume per End Cap		46.9	CF

System Sizing

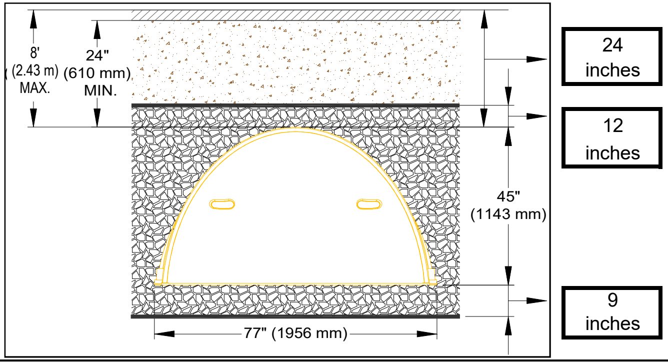
Number of Chambers Required	230	each
Number of End Caps Required	20	each
Bed Size (including perimeter stone)	12,368	square feet
Stone Required (including perimeter stone)	2190	tons
Volume of Excavation	2977	cubic yards
Non-woven Filter Fabric Required (20% Safety Factor)	3654	square yards
Length of Isolator Row	169.6	feet
Non-woven Isolator Row Fabric (20% Safety Factor)	294	square yards
Woven Isolator Row Fabric (20% Safety Factor)	373	square yards
Installed Storage Volume	42,085	cubic feet

Controlled by Width (Rows)

Maximum Width =	80	feet

10 rows of 23 chambers

Maximum Length =	169.61	feet
Maximum Width =	72.92	feet



*This represents the estimated material and site work costs (US dollars) for the project. Materials excluded from this estimate are conveyance pipe, pavement design, etc. It is always advisable to seek detailed construction costs from local installers. Please contact STORMTECH at 888-892-2694 for additional cost information.

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 Thienes Engineering, Inc.
Date 8/10/2020
Designed by Luis Prado
Case No
Company Project Number/Name 3846

BMP Identification

BMP NAME / ID Street BMP - Bioretention

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}= 0.62 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)*
B1	*20,473*	*Concrete or Asphalt*	*1*	*0.89*	*18262.1*			
B2	*2,178*	*Ornamental Landscaping*	*0.1*	*0.11*	*240.6*			
	22651.2	***Total***			**18502.7**	**0.62**	***956***	***1244***

Notes:

Street BMP - Bioretention Calculations (using section view)

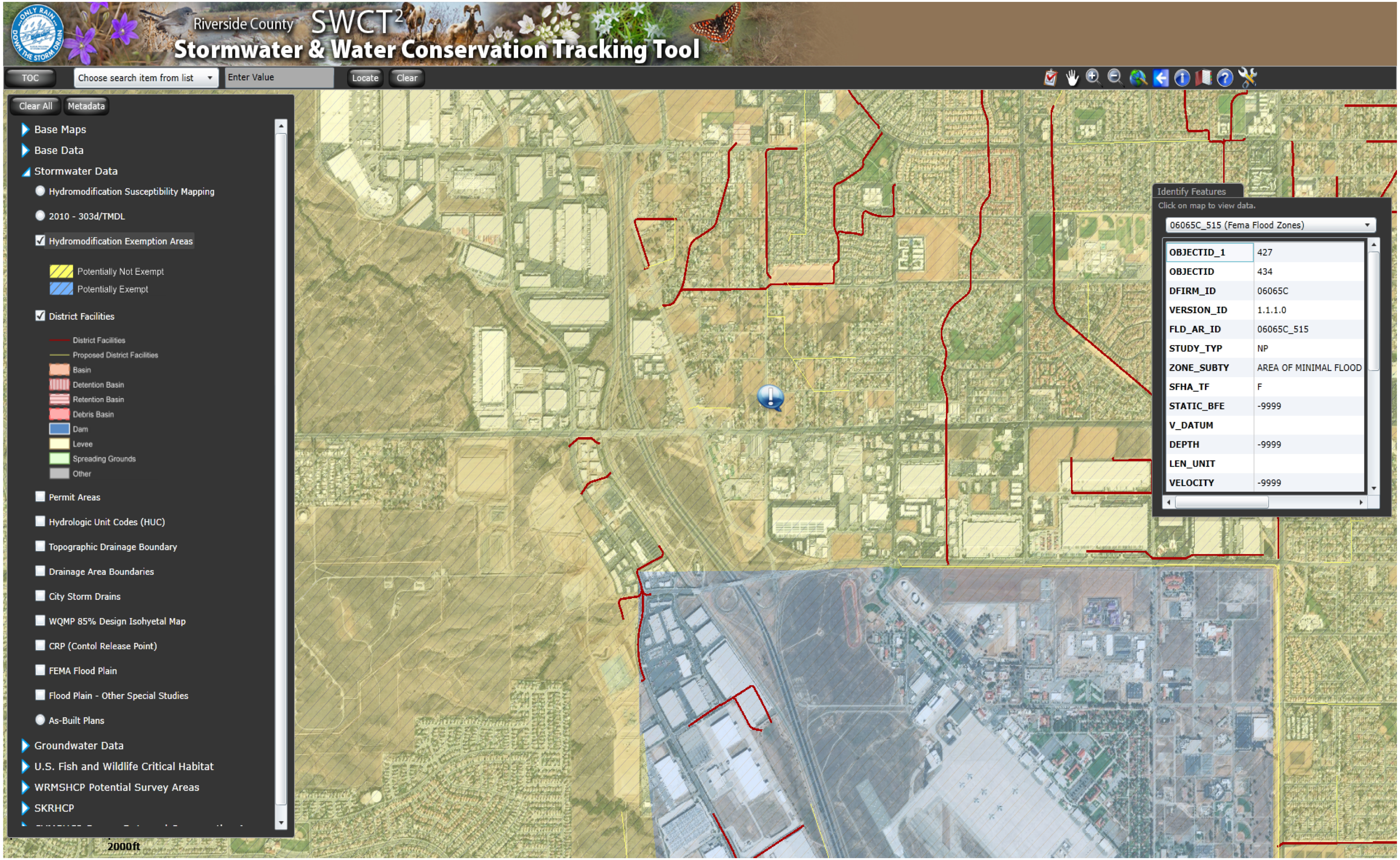
Triangular Ponding North of Bioretention FL =	1.0417	SF	2.5' total width x 10" ponding ÷ 2
Triangular Ponding South of Bioretention FL =	1.3875	SF	3.33' total width x 10" ponding ÷ 2
Average Ponding Depth =	**5.0000**	INCHES	For reference only to compare to 6" min. Not used in caculations. ∑ Ponding Surface Area ÷ Ponding Overall Width
Triangular Soil North of Bioretention FL =	1.250	SF	2.5' total width x 12" soil ÷ 2
Trapezoidal Soil South of Bioretention FL =	2.835	SF	4.25' total width
Soil Below FL =	6.125	SF	10.5" thick over 7.0' width
Soil Porosity =	0.30	unitless	
Average Soil Depth =	**18.15**	INCHES	For reference only to compare to 18" min. Not used in caculations. ∑ Soil Surface Area ÷ Bioretention Overall Width
Gravel Section =	7.00	SF	12" thick over 7.0' width
Gravel Porosity =	0.40	unitless	
Volume Required (Vbmp) =	956	CF	
Bioretention Section Effective Area =	**8.292**	SF	= (Ponding Area) + (Soil-Area x Soil-Porosity) + (Gravel-Area x Gravel-Porosity)
Min. Bioretention Length Required =	**115**	LF	= Vbmp ÷ Bioretention Section Effective Area
Bioretention Length Provided =	50	LF	
Bioreteniton Quantity =	3	EA	
Bioretention TOTAL Length Provided =	**150**	LF	= Bioretention Length Provided x Bioretention Quantity
Volume Provided =	**1,244**	cu-ft	= Bioretention TOTAL Length Provided x Bioretention Section Effective Area

* Minor modification of LID bioretention design approved through email correspondances between City staff (Rae Beimer) and Thienes Engineering on April 4, 2019. This modification is used soley for incorporating LID BMPs within the public right-of-way in an acceptable manner that does not present a hazard to pedestrian safety and complies with current design guidelines to the MEP.

Additional modifications to the street bioretention design was coordinated with the City on April 13, 2020. Revisions were due to a conflict between a MVU utility line and the previously approved bioretentions that were curb-adjacent. The bioretentions have been moved away from the curb and more towards the proposed building. Sidewalk is now curb-adjacent.

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern



- Base Maps
- Base Data
- Stormwater Data
  - ○ Hydromodification Susceptibility Mapping
  - ○ 2010 - 303d/TMDL
  - ☑ Hydromodification Exemption Areas
    - ▨ Potentially Not Exempt
    - ▨ Potentially Exempt
  - ☑ District Facilities
    - District Facilities
    - Proposed District Facilities
    - Basin
    - Detention Basin
    - Retention Basin
    - Debris Basin
    - Dam
    - Levee
    - Spreading Grounds
    - Other
  - ☐ Permit Areas
  - ☐ Hydrologic Unit Codes (HUC)
  - ☐ Topographic Drainage Boundary
  - ☐ Drainage Area Boundaries
  - ☐ City Storm Drains
  - ☐ WQMP 85% Design Isohyetal Map
  - ☐ 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

Identify Features

Click on map to view data.

06065C_515 (Fema Flood Zones)

OBJECTID_1	427
OBJECTID	434
DFIRM_ID	06065C
VERSION_ID	1.1.1.0
FLD_AR_ID	06065C_515
STUDY_TYP	NP
ZONE_SUBTY	AREA OF MINIMAL FLOOD
SFHA_TF	F
STATIC_BFE	-9999
V_DATUM	
DEPTH	-9999
LEN_UNIT	
VELOCITY	-9999

```
        U n i t   H y d r o g r a p h   A n a l y s i s

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0
                Study date  12/28/20 File: 3846ex2242.out


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978


Program License Serial Number 6400

---------------------------------------------------------------------
 English (in-lb) Input Units Used
 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



---------------------------------------------------------------------
3846
EXIST CONDITION
2YEAR

--------------------------------------------------------------------
Drainage Area =       8.05(Ac.)  =      0.013 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =      8.05(Ac.)  =      0.013 Sq. Mi.
Length along longest watercourse =     569.00(Ft.)
Length along longest watercourse measured to centroid =     285.00(Ft.)
Length along longest watercourse =      0.108 Mi.
Length along longest watercourse measured to centroid =      0.054 Mi.
Difference in elevation =      12.50(Ft.)
Slope along watercourse =    115.9930 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time =    0.041 Hr.
Lag time =     2.48 Min.
25% of lag time =     0.62 Min.
40% of lag time =     0.99 Min.
Unit time =     5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        8.05            1.90                   15.30

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        8.05            4.00                   32.20

STORM EVENT (YEAR) =    2.00
Area Averaged 2-Year Rainfall =    1.900(In)
Area Averaged 100-Year Rainfall =    4.000(In)

Point rain (area averaged) =    1.900(In)
Areal adjustment factor =  100.00 %
Adjusted average point rain =    1.900(In)

Sub-Area Data:
Area(Ac.)         Runoff Index   Impervious %
     8.050           84.00         0.000
 Total Area Entered =      8.05(Ac.)
```

```
       RI    RI   Infil. Rate Impervious   Adj. Infil. Rate  Area%     F
       AMC2 AMC-1     (In/Hr)    (Dec.%)     (In/Hr)      (Dec.)    (In/Hr)
       84.0  68.6      0.377     0.000        0.377       1.000      0.377
                                                         Sum (F) =   0.377
       Area averaged mean soil loss (F) (In/Hr) =  0.377
       Minimum soil loss rate ((In/Hr)) =  0.189
       (for 24 hour storm duration)
       Soil low loss rate (decimal) =   0.900
       --------------------------------------------------------------------

                       U n i t  H y d r o g r a p h
                               VALLEY S-Curve
       -------------------------------------------------------------------
                       Unit Hydrograph Data
       --------------------------------------------------------------------
       Unit time period   Time % of lag   Distribution   Unit Hydrograph
           (hrs)                           Graph %           (CFS)
       --------------------------------------------------------------------
           1   0.083        201.905         43.729             3.548
           2   0.167        403.809         43.235             3.508
           3   0.250        605.714          8.716             0.707
           4   0.333        807.619          4.320             0.350
                                      Sum = 100.000   Sum=       8.113
-----------------------------------------------------------------------


 The following loss rate calculations reflect use of the minimum calculated loss
 rate subtracted from the Storm Rain to produce the maximum Effective Rain value

  Unit Time   Pattern   Storm Rain     Loss rate(In./Hr)     Effective
       (Hr.)  Percent   (In/Hr)         Max   |   Low        (In/Hr)
   1   0.08     0.07      0.015       (  0.669)      0.014        0.002
   2   0.17     0.07      0.015       (  0.666)      0.014        0.002
   3   0.25     0.07      0.015       (  0.663)      0.014        0.002
   4   0.33     0.10      0.023       (  0.661)      0.021        0.002
   5   0.42     0.10      0.023       (  0.658)      0.021        0.002
   6   0.50     0.10      0.023       (  0.656)      0.021        0.002
   7   0.58     0.10      0.023       (  0.653)      0.021        0.002
   8   0.67     0.10      0.023       (  0.651)      0.021        0.002
   9   0.75     0.10      0.023       (  0.648)      0.021        0.002
  10   0.83     0.13      0.030       (  0.645)      0.027        0.003
  11   0.92     0.13      0.030       (  0.643)      0.027        0.003
  12   1.00     0.13      0.030       (  0.640)      0.027        0.003
  13   1.08     0.10      0.023       (  0.638)      0.021        0.002
  14   1.17     0.10      0.023       (  0.635)      0.021        0.002
  15   1.25     0.10      0.023       (  0.633)      0.021        0.002
  16   1.33     0.10      0.023       (  0.630)      0.021        0.002
  17   1.42     0.10      0.023       (  0.628)      0.021        0.002
  18   1.50     0.10      0.023       (  0.625)      0.021        0.002
  19   1.58     0.10      0.023       (  0.623)      0.021        0.002
  20   1.67     0.10      0.023       (  0.620)      0.021        0.002
  21   1.75     0.10      0.023       (  0.618)      0.021        0.002
  22   1.83     0.13      0.030       (  0.615)      0.027        0.003
  23   1.92     0.13      0.030       (  0.613)      0.027        0.003
  24   2.00     0.13      0.030       (  0.610)      0.027        0.003
  25   2.08     0.13      0.030       (  0.608)      0.027        0.003
  26   2.17     0.13      0.030       (  0.605)      0.027        0.003
  27   2.25     0.13      0.030       (  0.603)      0.027        0.003
  28   2.33     0.13      0.030       (  0.600)      0.027        0.003
  29   2.42     0.13      0.030       (  0.598)      0.027        0.003
  30   2.50     0.13      0.030       (  0.596)      0.027        0.003
  31   2.58     0.17      0.038       (  0.593)      0.034        0.004
  32   2.67     0.17      0.038       (  0.591)      0.034        0.004
  33   2.75     0.17      0.038       (  0.588)      0.034        0.004
  34   2.83     0.17      0.038       (  0.586)      0.034        0.004
  35   2.92     0.17      0.038       (  0.583)      0.034        0.004
  36   3.00     0.17      0.038       (  0.581)      0.034        0.004
  37   3.08     0.17      0.038       (  0.579)      0.034        0.004
  38   3.17     0.17      0.038       (  0.576)      0.034        0.004
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  39   3.25     0.17      0.038       (  0.574)       0.034         0.004
  40   3.33     0.17      0.038       (  0.571)       0.034         0.004
  41   3.42     0.17      0.038       (  0.569)       0.034         0.004
  42   3.50     0.17      0.038       (  0.567)       0.034         0.004
  43   3.58     0.17      0.038       (  0.564)       0.034         0.004
  44   3.67     0.17      0.038       (  0.562)       0.034         0.004
  45   3.75     0.17      0.038       (  0.560)       0.034         0.004
  46   3.83     0.20      0.046       (  0.557)       0.041         0.005
  47   3.92     0.20      0.046       (  0.555)       0.041         0.005
  48   4.00     0.20      0.046       (  0.553)       0.041         0.005
  49   4.08     0.20      0.046       (  0.550)       0.041         0.005
  50   4.17     0.20      0.046       (  0.548)       0.041         0.005
  51   4.25     0.20      0.046       (  0.546)       0.041         0.005
  52   4.33     0.23      0.053       (  0.543)       0.048         0.005
  53   4.42     0.23      0.053       (  0.541)       0.048         0.005
  54   4.50     0.23      0.053       (  0.539)       0.048         0.005
  55   4.58     0.23      0.053       (  0.536)       0.048         0.005
  56   4.67     0.23      0.053       (  0.534)       0.048         0.005
  57   4.75     0.23      0.053       (  0.532)       0.048         0.005
  58   4.83     0.27      0.061       (  0.529)       0.055         0.006
  59   4.92     0.27      0.061       (  0.527)       0.055         0.006
  60   5.00     0.27      0.061       (  0.525)       0.055         0.006
  61   5.08     0.20      0.046       (  0.522)       0.041         0.005
  62   5.17     0.20      0.046       (  0.520)       0.041         0.005
  63   5.25     0.20      0.046       (  0.518)       0.041         0.005
  64   5.33     0.23      0.053       (  0.516)       0.048         0.005
  65   5.42     0.23      0.053       (  0.513)       0.048         0.005
  66   5.50     0.23      0.053       (  0.511)       0.048         0.005
  67   5.58     0.27      0.061       (  0.509)       0.055         0.006
  68   5.67     0.27      0.061       (  0.507)       0.055         0.006
  69   5.75     0.27      0.061       (  0.504)       0.055         0.006
  70   5.83     0.27      0.061       (  0.502)       0.055         0.006
  71   5.92     0.27      0.061       (  0.500)       0.055         0.006
  72   6.00     0.27      0.061       (  0.498)       0.055         0.006
  73   6.08     0.30      0.068       (  0.496)       0.062         0.007
  74   6.17     0.30      0.068       (  0.493)       0.062         0.007
  75   6.25     0.30      0.068       (  0.491)       0.062         0.007
  76   6.33     0.30      0.068       (  0.489)       0.062         0.007
  77   6.42     0.30      0.068       (  0.487)       0.062         0.007
  78   6.50     0.30      0.068       (  0.485)       0.062         0.007
  79   6.58     0.33      0.076       (  0.482)       0.068         0.008
  80   6.67     0.33      0.076       (  0.480)       0.068         0.008
  81   6.75     0.33      0.076       (  0.478)       0.068         0.008
  82   6.83     0.33      0.076       (  0.476)       0.068         0.008
  83   6.92     0.33      0.076       (  0.474)       0.068         0.008
  84   7.00     0.33      0.076       (  0.472)       0.068         0.008
  85   7.08     0.33      0.076       (  0.469)       0.068         0.008
  86   7.17     0.33      0.076       (  0.467)       0.068         0.008
  87   7.25     0.33      0.076       (  0.465)       0.068         0.008
  88   7.33     0.37      0.084       (  0.463)       0.075         0.008
  89   7.42     0.37      0.084       (  0.461)       0.075         0.008
  90   7.50     0.37      0.084       (  0.459)       0.075         0.008
  91   7.58     0.40      0.091       (  0.457)       0.082         0.009
  92   7.67     0.40      0.091       (  0.455)       0.082         0.009
  93   7.75     0.40      0.091       (  0.453)       0.082         0.009
  94   7.83     0.43      0.099       (  0.450)       0.089         0.010
  95   7.92     0.43      0.099       (  0.448)       0.089         0.010
  96   8.00     0.43      0.099       (  0.446)       0.089         0.010
  97   8.08     0.50      0.114       (  0.444)       0.103         0.011
  98   8.17     0.50      0.114       (  0.442)       0.103         0.011
  99   8.25     0.50      0.114       (  0.440)       0.103         0.011
 100   8.33     0.50      0.114       (  0.438)       0.103         0.011
 101   8.42     0.50      0.114       (  0.436)       0.103         0.011
 102   8.50     0.50      0.114       (  0.434)       0.103         0.011
 103   8.58     0.53      0.122       (  0.432)       0.109         0.012
 104   8.67     0.53      0.122       (  0.430)       0.109         0.012
 105   8.75     0.53      0.122       (  0.428)       0.109         0.012
 106   8.83     0.57      0.129       (  0.426)       0.116         0.013
 107   8.92     0.57      0.129       (  0.424)       0.116         0.013
 108   9.00     0.57      0.129       (  0.422)       0.116         0.013
 109   9.08     0.63      0.144       (  0.420)       0.130         0.014
```

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110   9.17     0.63      0.144       (  0.418)       0.130        0.014
111   9.25     0.63      0.144       (  0.416)       0.130        0.014
112   9.33     0.67      0.152       (  0.414)       0.137        0.015
113   9.42     0.67      0.152       (  0.412)       0.137        0.015
114   9.50     0.67      0.152       (  0.410)       0.137        0.015
115   9.58     0.70      0.160       (  0.408)       0.144        0.016
116   9.67     0.70      0.160       (  0.406)       0.144        0.016
117   9.75     0.70      0.160       (  0.404)       0.144        0.016
118   9.83     0.73      0.167       (  0.402)       0.150        0.017
119   9.92     0.73      0.167       (  0.400)       0.150        0.017
120  10.00     0.73      0.167       (  0.398)       0.150        0.017
121  10.08     0.50      0.114       (  0.396)       0.103        0.011
122  10.17     0.50      0.114       (  0.394)       0.103        0.011
123  10.25     0.50      0.114       (  0.392)       0.103        0.011
124  10.33     0.50      0.114       (  0.391)       0.103        0.011
125  10.42     0.50      0.114       (  0.389)       0.103        0.011
126  10.50     0.50      0.114       (  0.387)       0.103        0.011
127  10.58     0.67      0.152       (  0.385)       0.137        0.015
128  10.67     0.67      0.152       (  0.383)       0.137        0.015
129  10.75     0.67      0.152       (  0.381)       0.137        0.015
130  10.83     0.67      0.152       (  0.379)       0.137        0.015
131  10.92     0.67      0.152       (  0.377)       0.137        0.015
132  11.00     0.67      0.152       (  0.376)       0.137        0.015
133  11.08     0.63      0.144       (  0.374)       0.130        0.014
134  11.17     0.63      0.144       (  0.372)       0.130        0.014
135  11.25     0.63      0.144       (  0.370)       0.130        0.014
136  11.33     0.63      0.144       (  0.368)       0.130        0.014
137  11.42     0.63      0.144       (  0.366)       0.130        0.014
138  11.50     0.63      0.144       (  0.365)       0.130        0.014
139  11.58     0.57      0.129       (  0.363)       0.116        0.013
140  11.67     0.57      0.129       (  0.361)       0.116        0.013
141  11.75     0.57      0.129       (  0.359)       0.116        0.013
142  11.83     0.60      0.137       (  0.357)       0.123        0.014
143  11.92     0.60      0.137       (  0.356)       0.123        0.014
144  12.00     0.60      0.137       (  0.354)       0.123        0.014
145  12.08     0.83      0.190       (  0.352)       0.171        0.019
146  12.17     0.83      0.190       (  0.350)       0.171        0.019
147  12.25     0.83      0.190       (  0.349)       0.171        0.019
148  12.33     0.87      0.198       (  0.347)       0.178        0.020
149  12.42     0.87      0.198       (  0.345)       0.178        0.020
150  12.50     0.87      0.198       (  0.343)       0.178        0.020
151  12.58     0.93      0.213       (  0.342)       0.192        0.021
152  12.67     0.93      0.213       (  0.340)       0.192        0.021
153  12.75     0.93      0.213       (  0.338)       0.192        0.021
154  12.83     0.97      0.220       (  0.336)       0.198        0.022
155  12.92     0.97      0.220       (  0.335)       0.198        0.022
156  13.00     0.97      0.220       (  0.333)       0.198        0.022
157  13.08     1.13      0.258       (  0.331)       0.233        0.026
158  13.17     1.13      0.258       (  0.330)       0.233        0.026
159  13.25     1.13      0.258       (  0.328)       0.233        0.026
160  13.33     1.13      0.258       (  0.326)       0.233        0.026
161  13.42     1.13      0.258       (  0.325)       0.233        0.026
162  13.50     1.13      0.258       (  0.323)       0.233        0.026
163  13.58     0.77      0.175       (  0.321)       0.157        0.017
164  13.67     0.77      0.175       (  0.320)       0.157        0.017
165  13.75     0.77      0.175       (  0.318)       0.157        0.017
166  13.83     0.77      0.175       (  0.316)       0.157        0.017
167  13.92     0.77      0.175       (  0.315)       0.157        0.017
168  14.00     0.77      0.175       (  0.313)       0.157        0.017
169  14.08     0.90      0.205       (  0.312)       0.185        0.021
170  14.17     0.90      0.205       (  0.310)       0.185        0.021
171  14.25     0.90      0.205       (  0.308)       0.185        0.021
172  14.33     0.87      0.198       (  0.307)       0.178        0.020
173  14.42     0.87      0.198       (  0.305)       0.178        0.020
174  14.50     0.87      0.198       (  0.304)       0.178        0.020
175  14.58     0.87      0.198       (  0.302)       0.178        0.020
176  14.67     0.87      0.198       (  0.301)       0.178        0.020
177  14.75     0.87      0.198       (  0.299)       0.178        0.020
178  14.83     0.83      0.190       (  0.298)       0.171        0.019
179  14.92     0.83      0.190       (  0.296)       0.171        0.019
180  15.00     0.83      0.190       (  0.295)       0.171        0.019
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181  15.08     0.80     0.182      (  0.293)      0.164       0.018
182  15.17     0.80     0.182      (  0.292)      0.164       0.018
183  15.25     0.80     0.182      (  0.290)      0.164       0.018
184  15.33     0.77     0.175      (  0.289)      0.157       0.017
185  15.42     0.77     0.175      (  0.287)      0.157       0.017
186  15.50     0.77     0.175      (  0.286)      0.157       0.017
187  15.58     0.63     0.144      (  0.284)      0.130       0.014
188  15.67     0.63     0.144      (  0.283)      0.130       0.014
189  15.75     0.63     0.144      (  0.281)      0.130       0.014
190  15.83     0.63     0.144      (  0.280)      0.130       0.014
191  15.92     0.63     0.144      (  0.278)      0.130       0.014
192  16.00     0.63     0.144      (  0.277)      0.130       0.014
193  16.08     0.13     0.030      (  0.276)      0.027       0.003
194  16.17     0.13     0.030      (  0.274)      0.027       0.003
195  16.25     0.13     0.030      (  0.273)      0.027       0.003
196  16.33     0.13     0.030      (  0.271)      0.027       0.003
197  16.42     0.13     0.030      (  0.270)      0.027       0.003
198  16.50     0.13     0.030      (  0.269)      0.027       0.003
199  16.58     0.10     0.023      (  0.267)      0.021       0.002
200  16.67     0.10     0.023      (  0.266)      0.021       0.002
201  16.75     0.10     0.023      (  0.264)      0.021       0.002
202  16.83     0.10     0.023      (  0.263)      0.021       0.002
203  16.92     0.10     0.023      (  0.262)      0.021       0.002
204  17.00     0.10     0.023      (  0.260)      0.021       0.002
205  17.08     0.17     0.038      (  0.259)      0.034       0.004
206  17.17     0.17     0.038      (  0.258)      0.034       0.004
207  17.25     0.17     0.038      (  0.257)      0.034       0.004
208  17.33     0.17     0.038      (  0.255)      0.034       0.004
209  17.42     0.17     0.038      (  0.254)      0.034       0.004
210  17.50     0.17     0.038      (  0.253)      0.034       0.004
211  17.58     0.17     0.038      (  0.251)      0.034       0.004
212  17.67     0.17     0.038      (  0.250)      0.034       0.004
213  17.75     0.17     0.038      (  0.249)      0.034       0.004
214  17.83     0.13     0.030      (  0.248)      0.027       0.003
215  17.92     0.13     0.030      (  0.247)      0.027       0.003
216  18.00     0.13     0.030      (  0.245)      0.027       0.003
217  18.08     0.13     0.030      (  0.244)      0.027       0.003
218  18.17     0.13     0.030      (  0.243)      0.027       0.003
219  18.25     0.13     0.030      (  0.242)      0.027       0.003
220  18.33     0.13     0.030      (  0.241)      0.027       0.003
221  18.42     0.13     0.030      (  0.239)      0.027       0.003
222  18.50     0.13     0.030      (  0.238)      0.027       0.003
223  18.58     0.10     0.023      (  0.237)      0.021       0.002
224  18.67     0.10     0.023      (  0.236)      0.021       0.002
225  18.75     0.10     0.023      (  0.235)      0.021       0.002
226  18.83     0.07     0.015      (  0.234)      0.014       0.002
227  18.92     0.07     0.015      (  0.233)      0.014       0.002
228  19.00     0.07     0.015      (  0.231)      0.014       0.002
229  19.08     0.10     0.023      (  0.230)      0.021       0.002
230  19.17     0.10     0.023      (  0.229)      0.021       0.002
231  19.25     0.10     0.023      (  0.228)      0.021       0.002
232  19.33     0.13     0.030      (  0.227)      0.027       0.003
233  19.42     0.13     0.030      (  0.226)      0.027       0.003
234  19.50     0.13     0.030      (  0.225)      0.027       0.003
235  19.58     0.10     0.023      (  0.224)      0.021       0.002
236  19.67     0.10     0.023      (  0.223)      0.021       0.002
237  19.75     0.10     0.023      (  0.222)      0.021       0.002
238  19.83     0.07     0.015      (  0.221)      0.014       0.002
239  19.92     0.07     0.015      (  0.220)      0.014       0.002
240  20.00     0.07     0.015      (  0.219)      0.014       0.002
241  20.08     0.10     0.023      (  0.218)      0.021       0.002
242  20.17     0.10     0.023      (  0.217)      0.021       0.002
243  20.25     0.10     0.023      (  0.216)      0.021       0.002
244  20.33     0.10     0.023      (  0.215)      0.021       0.002
245  20.42     0.10     0.023      (  0.214)      0.021       0.002
246  20.50     0.10     0.023      (  0.213)      0.021       0.002
247  20.58     0.10     0.023      (  0.212)      0.021       0.002
248  20.67     0.10     0.023      (  0.212)      0.021       0.002
249  20.75     0.10     0.023      (  0.211)      0.021       0.002
250  20.83     0.07     0.015      (  0.210)      0.014       0.002
251  20.92     0.07     0.015      (  0.209)      0.014       0.002
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252  21.00     0.07      0.015       (  0.208)       0.014        0.002
253  21.08     0.10      0.023       (  0.207)       0.021        0.002
254  21.17     0.10      0.023       (  0.207)       0.021        0.002
255  21.25     0.10      0.023       (  0.206)       0.021        0.002
256  21.33     0.07      0.015       (  0.205)       0.014        0.002
257  21.42     0.07      0.015       (  0.204)       0.014        0.002
258  21.50     0.07      0.015       (  0.203)       0.014        0.002
259  21.58     0.10      0.023       (  0.203)       0.021        0.002
260  21.67     0.10      0.023       (  0.202)       0.021        0.002
261  21.75     0.10      0.023       (  0.201)       0.021        0.002
262  21.83     0.07      0.015       (  0.200)       0.014        0.002
263  21.92     0.07      0.015       (  0.200)       0.014        0.002
264  22.00     0.07      0.015       (  0.199)       0.014        0.002
265  22.08     0.10      0.023       (  0.198)       0.021        0.002
266  22.17     0.10      0.023       (  0.198)       0.021        0.002
267  22.25     0.10      0.023       (  0.197)       0.021        0.002
268  22.33     0.07      0.015       (  0.197)       0.014        0.002
269  22.42     0.07      0.015       (  0.196)       0.014        0.002
270  22.50     0.07      0.015       (  0.195)       0.014        0.002
271  22.58     0.07      0.015       (  0.195)       0.014        0.002
272  22.67     0.07      0.015       (  0.194)       0.014        0.002
273  22.75     0.07      0.015       (  0.194)       0.014        0.002
274  22.83     0.07      0.015       (  0.193)       0.014        0.002
275  22.92     0.07      0.015       (  0.193)       0.014        0.002
276  23.00     0.07      0.015       (  0.192)       0.014        0.002
277  23.08     0.07      0.015       (  0.192)       0.014        0.002
278  23.17     0.07      0.015       (  0.191)       0.014        0.002
279  23.25     0.07      0.015       (  0.191)       0.014        0.002
280  23.33     0.07      0.015       (  0.191)       0.014        0.002
281  23.42     0.07      0.015       (  0.190)       0.014        0.002
282  23.50     0.07      0.015       (  0.190)       0.014        0.002
283  23.58     0.07      0.015       (  0.190)       0.014        0.002
284  23.67     0.07      0.015       (  0.189)       0.014        0.002
285  23.75     0.07      0.015       (  0.189)       0.014        0.002
286  23.83     0.07      0.015       (  0.189)       0.014        0.002
287  23.92     0.07      0.015       (  0.189)       0.014        0.002
288  24.00     0.07      0.015       (  0.189)       0.014        0.002
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =     2.3
       Flood volume = Effective rainfall      0.19(In)
        times area       8.1(Ac.)/[(In)/(Ft.)] =       0.1(Ac.Ft)
       Total soil loss =      1.71(In)
       Total soil loss =     1.147(Ac.Ft)
       Total rainfall =      1.90(In)
       Flood volume =        5552.0 Cubic Feet
       Total soil loss =       49968.0 Cubic Feet
       --------------------------------------------------------------------
        Peak flow rate of this hydrograph =      0.210(CFS)
       --------------------------------------------------------------------
       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           24 - H O U R   S T O R M
                      R u n o f f     H y d r o g r a p h
       --------------------------------------------------------------------
                   Hydrograph in   5   Minute intervals ((CFS))

       --------------------------------------------------------------------
 Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
 -----------------------------------------------------------------------
   0+ 5       0.0000      0.01  Q         |         |         |         |
   0+10       0.0001      0.01  Q         |         |         |         |
   0+15       0.0002      0.01  Q         |         |         |         |
   0+20       0.0003      0.02  Q         |         |         |         |
   0+25       0.0004      0.02  Q         |         |         |         |
   0+30       0.0005      0.02  Q         |         |         |         |
   0+35       0.0007      0.02  Q         |         |         |         |
   0+40       0.0008      0.02  Q         |         |         |         |
   0+45       0.0009      0.02  Q         |         |         |         |
   0+50       0.0011      0.02  Q         |         |         |         |
   0+55       0.0012      0.02  Q         |         |         |         |
   1+ 0       0.0014      0.02  Q         |         |         |         |
   1+ 5       0.0016      0.02  Q         |         |         |         |
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1+10       0.0017      0.02  Q         |         |         |         |
1+15       0.0018      0.02  Q         |         |         |         |
1+20       0.0019      0.02  Q         |         |         |         |
1+25       0.0021      0.02  Q         |         |         |         |
1+30       0.0022      0.02  Q         |         |         |         |
1+35       0.0023      0.02  Q         |         |         |         |
1+40       0.0025      0.02  Q         |         |         |         |
1+45       0.0026      0.02  Q         |         |         |         |
1+50       0.0027      0.02  Q         |         |         |         |
1+55       0.0029      0.02  Q         |         |         |         |
2+ 0       0.0031      0.02  Q         |         |         |         |
2+ 5       0.0032      0.02  QV        |         |         |         |
2+10       0.0034      0.02  QV        |         |         |         |
2+15       0.0036      0.02  QV        |         |         |         |
2+20       0.0037      0.02  QV        |         |         |         |
2+25       0.0039      0.02  QV        |         |         |         |
2+30       0.0041      0.02  QV        |         |         |         |
2+35       0.0043      0.03  QV        |         |         |         |
2+40       0.0045      0.03  QV        |         |         |         |
2+45       0.0047      0.03  QV        |         |         |         |
2+50       0.0049      0.03  QV        |         |         |         |
2+55       0.0051      0.03  QV        |         |         |         |
3+ 0       0.0053      0.03  QV        |         |         |         |
3+ 5       0.0055      0.03  QV        |         |         |         |
3+10       0.0057      0.03  QV        |         |         |         |
3+15       0.0060      0.03  QV        |         |         |         |
3+20       0.0062      0.03  QV        |         |         |         |
3+25       0.0064      0.03  Q V       |         |         |         |
3+30       0.0066      0.03  Q V       |         |         |         |
3+35       0.0068      0.03  Q V       |         |         |         |
3+40       0.0070      0.03  Q V       |         |         |         |
3+45       0.0072      0.03  Q V       |         |         |         |
3+50       0.0075      0.03  Q V       |         |         |         |
3+55       0.0077      0.04  Q V       |         |         |         |
4+ 0       0.0080      0.04  Q V       |         |         |         |
4+ 5       0.0082      0.04  Q V       |         |         |         |
4+10       0.0085      0.04  Q V       |         |         |         |
4+15       0.0087      0.04  Q V       |         |         |         |
4+20       0.0090      0.04  Q V       |         |         |         |
4+25       0.0093      0.04  Q V       |         |         |         |
4+30       0.0096      0.04  Q  V      |         |         |         |
4+35       0.0099      0.04  Q  V      |         |         |         |
4+40       0.0102      0.04  Q  V      |         |         |         |
4+45       0.0105      0.04  Q  V      |         |         |         |
4+50       0.0108      0.05  Q  V      |         |         |         |
4+55       0.0111      0.05  Q  V      |         |         |         |
5+ 0       0.0115      0.05  Q  V      |         |         |         |
5+ 5       0.0118      0.04  Q  V      |         |         |         |
5+10       0.0120      0.04  Q  V      |         |         |         |
5+15       0.0123      0.04  Q  V      |         |         |         |
5+20       0.0126      0.04  Q  V      |         |         |         |
5+25       0.0129      0.04  Q   V     |         |         |         |
5+30       0.0132      0.04  Q   V     |         |         |         |
5+35       0.0135      0.05  Q   V     |         |         |         |
5+40       0.0138      0.05  Q   V     |         |         |         |
5+45       0.0142      0.05  Q   V     |         |         |         |
5+50       0.0145      0.05  Q   V     |         |         |         |
5+55       0.0148      0.05  Q   V     |         |         |         |
6+ 0       0.0152      0.05  Q   V     |         |         |         |
6+ 5       0.0155      0.05  Q   V     |         |         |         |
6+10       0.0159      0.05  Q   V     |         |         |         |
6+15       0.0163      0.06  Q    V    |         |         |         |
6+20       0.0167      0.06  Q    V    |         |         |         |
6+25       0.0171      0.06  Q    V    |         |         |         |
6+30       0.0174      0.06  Q    V    |         |         |         |
6+35       0.0178      0.06  Q    V    |         |         |         |
6+40       0.0183      0.06  Q    V    |         |         |         |
6+45       0.0187      0.06  Q    V    |         |         |         |
6+50       0.0191      0.06  Q    V    |         |         |         |
6+55       0.0195      0.06  Q     V   |         |         |         |
7+ 0       0.0200      0.06  Q     V   |         |         |         |
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 7+ 5       0.0204      0.06  Q     V   |         |         |         |
 7+10       0.0208      0.06  Q     V   |         |         |         |
 7+15       0.0212      0.06  Q     V   |         |         |         |
 7+20       0.0217      0.06  Q     V   |         |         |         |
 7+25       0.0221      0.07  Q     V   |         |         |         |
 7+30       0.0226      0.07  Q      V  |         |         |         |
 7+35       0.0231      0.07  Q      V  |         |         |         |
 7+40       0.0236      0.07  Q      V  |         |         |         |
 7+45       0.0241      0.07  Q      V  |         |         |         |
 7+50       0.0246      0.08  Q      V  |         |         |         |
 7+55       0.0252      0.08  Q      V  |         |         |         |
 8+ 0       0.0257      0.08  Q       V |         |         |         |
 8+ 5       0.0263      0.09  Q       V |         |         |         |
 8+10       0.0269      0.09  Q       V |         |         |         |
 8+15       0.0276      0.09  Q       V |         |         |         |
 8+20       0.0282      0.09  Q       V |         |         |         |
 8+25       0.0288      0.09  Q        V|         |         |         |
 8+30       0.0295      0.09  Q        V|         |         |         |
 8+35       0.0301      0.10  Q        V|         |         |         |
 8+40       0.0308      0.10  Q        V|         |         |         |
 8+45       0.0315      0.10  Q        V|         |         |         |
 8+50       0.0322      0.10  Q         V         |         |         |
 8+55       0.0329      0.10  Q         V         |         |         |
 9+ 0       0.0336      0.10  Q         V         |         |         |
 9+ 5       0.0344      0.11  Q         V         |         |         |
 9+10       0.0352      0.12  Q         |V        |         |         |
 9+15       0.0360      0.12  Q         |V        |         |         |
 9+20       0.0368      0.12  Q         |V        |         |         |
 9+25       0.0377      0.12  Q         |V        |         |         |
 9+30       0.0385      0.12  Q         | V       |         |         |
 9+35       0.0394      0.13  Q         | V       |         |         |
 9+40       0.0403      0.13  Q         | V       |         |         |
 9+45       0.0411      0.13  Q         | V       |         |         |
 9+50       0.0421      0.13  Q         |  V      |         |         |
 9+55       0.0430      0.13  Q         |  V      |         |         |
10+ 0       0.0439      0.14  Q         |  V      |         |         |
10+ 5       0.0447      0.12  Q         |   V     |         |         |
10+10       0.0454      0.10  Q         |   V     |         |         |
10+15       0.0461      0.09  Q         |   V     |         |         |
10+20       0.0467      0.09  Q         |   V     |         |         |
10+25       0.0473      0.09  Q         |   V     |         |         |
10+30       0.0480      0.09  Q         |    V    |         |         |
10+35       0.0487      0.11  Q         |    V    |         |         |
10+40       0.0495      0.12  Q         |    V    |         |         |
10+45       0.0504      0.12  Q         |    V    |         |         |
10+50       0.0512      0.12  Q         |     V   |         |         |
10+55       0.0521      0.12  Q         |     V   |         |         |
11+ 0       0.0529      0.12  Q         |     V   |         |         |
11+ 5       0.0537      0.12  Q         |     V   |         |         |
11+10       0.0545      0.12  Q         |      V  |         |         |
11+15       0.0554      0.12  Q         |      V  |         |         |
11+20       0.0562      0.12  Q         |      V  |         |         |
11+25       0.0570      0.12  Q         |      V  |         |         |
11+30       0.0578      0.12  Q         |       V |         |         |
11+35       0.0586      0.11  Q         |       V |         |         |
11+40       0.0593      0.11  Q         |       V |         |         |
11+45       0.0600      0.11  Q         |       V |         |         |
11+50       0.0608      0.11  Q         |        V|         |         |
11+55       0.0615      0.11  Q         |        V|         |         |
12+ 0       0.0623      0.11  Q         |        V|         |         |
12+ 5       0.0632      0.13  Q         |        V|         |         |
12+10       0.0642      0.15  Q         |         V         |         |
12+15       0.0652      0.15  Q         |         V         |         |
12+20       0.0663      0.16  Q         |         V         |         |
12+25       0.0674      0.16  Q         |         |V        |         |
12+30       0.0685      0.16  Q         |         |V        |         |
12+35       0.0697      0.17  Q         |         |V        |         |
12+40       0.0708      0.17  Q         |         | V       |         |
12+45       0.0720      0.17  Q         |         | V       |         |
12+50       0.0732      0.18  Q         |         | V       |         |
12+55       0.0745      0.18  Q         |         |  V      |         |
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13+ 0       0.0757      0.18  Q         |         |  V      |         |
13+ 5       0.0770      0.19  Q         |         |   V     |         |
13+10       0.0784      0.21  Q         |         |   V     |         |
13+15       0.0799      0.21  Q         |         |    V    |         |
13+20       0.0813      0.21  Q         |         |    V    |         |
13+25       0.0828      0.21  Q         |         |    V    |         |
13+30       0.0842      0.21  Q         |         |     V   |         |
13+35       0.0854      0.18  Q         |         |     V   |         |
13+40       0.0865      0.15  Q         |         |      V  |         |
13+45       0.0875      0.14  Q         |         |      V  |         |
13+50       0.0885      0.14  Q         |         |      V  |         |
13+55       0.0894      0.14  Q         |         |       V |         |
14+ 0       0.0904      0.14  Q         |         |       V |         |
14+ 5       0.0915      0.15  Q         |         |       V |         |
14+10       0.0926      0.16  Q         |         |        V|         |
14+15       0.0937      0.17  Q         |         |        V|         |
14+20       0.0949      0.16  Q         |         |        V|         |
14+25       0.0960      0.16  Q         |         |         V         |
14+30       0.0971      0.16  Q         |         |         V         |
14+35       0.0982      0.16  Q         |         |         V         |
14+40       0.0993      0.16  Q         |         |         |V        |
14+45       0.1004      0.16  Q         |         |         |V        |
14+50       0.1015      0.16  Q         |         |         |V        |
14+55       0.1025      0.16  Q         |         |         | V       |
15+ 0       0.1036      0.15  Q         |         |         | V       |
15+ 5       0.1046      0.15  Q         |         |         | V       |
15+10       0.1057      0.15  Q         |         |         |  V      |
15+15       0.1067      0.15  Q         |         |         |  V      |
15+20       0.1077      0.15  Q         |         |         |  V      |
15+25       0.1087      0.14  Q         |         |         |   V     |
15+30       0.1097      0.14  Q         |         |         |   V     |
15+35       0.1106      0.13  Q         |         |         |   V     |
15+40       0.1114      0.12  Q         |         |         |   V     |
15+45       0.1122      0.12  Q         |         |         |    V    |
15+50       0.1130      0.12  Q         |         |         |    V    |
15+55       0.1138      0.12  Q         |         |         |    V    |
16+ 0       0.1146      0.12  Q         |         |         |    V    |
16+ 5       0.1152      0.08  Q         |         |         |     V   |
16+10       0.1154      0.04  Q         |         |         |     V   |
16+15       0.1156      0.03  Q         |         |         |     V   |
16+20       0.1158      0.02  Q         |         |         |     V   |
16+25       0.1159      0.02  Q         |         |         |     V   |
16+30       0.1161      0.02  Q         |         |         |     V   |
16+35       0.1163      0.02  Q         |         |         |     V   |
16+40       0.1164      0.02  Q         |         |         |     V   |
16+45       0.1165      0.02  Q         |         |         |     V   |
16+50       0.1167      0.02  Q         |         |         |     V   |
16+55       0.1168      0.02  Q         |         |         |     V   |
17+ 0       0.1169      0.02  Q         |         |         |     V   |
17+ 5       0.1171      0.02  Q         |         |         |     V   |
17+10       0.1173      0.03  Q         |         |         |     V   |
17+15       0.1175      0.03  Q         |         |         |     V   |
17+20       0.1177      0.03  Q         |         |         |     V   |
17+25       0.1179      0.03  Q         |         |         |      V  |
17+30       0.1181      0.03  Q         |         |         |      V  |
17+35       0.1183      0.03  Q         |         |         |      V  |
17+40       0.1185      0.03  Q         |         |         |      V  |
17+45       0.1188      0.03  Q         |         |         |      V  |
17+50       0.1190      0.03  Q         |         |         |      V  |
17+55       0.1191      0.03  Q         |         |         |      V  |
18+ 0       0.1193      0.02  Q         |         |         |      V  |
18+ 5       0.1195      0.02  Q         |         |         |      V  |
18+10       0.1196      0.02  Q         |         |         |      V  |
18+15       0.1198      0.02  Q         |         |         |      V  |
18+20       0.1200      0.02  Q         |         |         |      V  |
18+25       0.1202      0.02  Q         |         |         |      V  |
18+30       0.1203      0.02  Q         |         |         |      V  |
18+35       0.1205      0.02  Q         |         |         |      V  |
18+40       0.1206      0.02  Q         |         |         |      V  |
18+45       0.1207      0.02  Q         |         |         |      V  |
18+50       0.1208      0.02  Q         |         |         |      V  |
```

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   18+55       0.1209      0.01  Q          |         |         |      V  |
   19+ 0       0.1210      0.01  Q          |         |         |      V  |
   19+ 5       0.1211      0.02  Q          |         |         |       V |
   19+10       0.1212      0.02  Q          |         |         |       V |
   19+15       0.1214      0.02  Q          |         |         |       V |
   19+20       0.1215      0.02  Q          |         |         |       V |
   19+25       0.1217      0.02  Q          |         |         |       V |
   19+30       0.1219      0.02  Q          |         |         |       V |
   19+35       0.1220      0.02  Q          |         |         |       V |
   19+40       0.1221      0.02  Q          |         |         |       V |
   19+45       0.1223      0.02  Q          |         |         |       V |
   19+50       0.1224      0.02  Q          |         |         |       V |
   19+55       0.1225      0.01  Q          |         |         |       V |
   20+ 0       0.1226      0.01  Q          |         |         |       V |
   20+ 5       0.1227      0.02  Q          |         |         |       V |
   20+10       0.1228      0.02  Q          |         |         |       V |
   20+15       0.1229      0.02  Q          |         |         |       V |
   20+20       0.1230      0.02  Q          |         |         |       V |
   20+25       0.1232      0.02  Q          |         |         |       V |
   20+30       0.1233      0.02  Q          |         |         |       V |
   20+35       0.1234      0.02  Q          |         |         |       V |
   20+40       0.1235      0.02  Q          |         |         |       V |
   20+45       0.1237      0.02  Q          |         |         |       V |
   20+50       0.1238      0.02  Q          |         |         |       V |
   20+55       0.1239      0.01  Q          |         |         |       V |
   21+ 0       0.1240      0.01  Q          |         |         |       V |
   21+ 5       0.1241      0.02  Q          |         |         |       V |
   21+10       0.1242      0.02  Q          |         |         |       V |
   21+15       0.1243      0.02  Q          |         |         |        V|
   21+20       0.1244      0.02  Q          |         |         |        V|
   21+25       0.1245      0.01  Q          |         |         |        V|
   21+30       0.1246      0.01  Q          |         |         |        V|
   21+35       0.1247      0.02  Q          |         |         |        V|
   21+40       0.1248      0.02  Q          |         |         |        V|
   21+45       0.1249      0.02  Q          |         |         |        V|
   21+50       0.1250      0.02  Q          |         |         |        V|
   21+55       0.1251      0.01  Q          |         |         |        V|
   22+ 0       0.1252      0.01  Q          |         |         |        V|
   22+ 5       0.1253      0.02  Q          |         |         |        V|
   22+10       0.1255      0.02  Q          |         |         |        V|
   22+15       0.1256      0.02  Q          |         |         |        V|
   22+20       0.1257      0.02  Q          |         |         |        V|
   22+25       0.1258      0.01  Q          |         |         |        V|
   22+30       0.1259      0.01  Q          |         |         |        V|
   22+35       0.1259      0.01  Q          |         |         |        V|
   22+40       0.1260      0.01  Q          |         |         |        V|
   22+45       0.1261      0.01  Q          |         |         |        V|
   22+50       0.1262      0.01  Q          |         |         |        V|
   22+55       0.1263      0.01  Q          |         |         |        V|
   23+ 0       0.1264      0.01  Q          |         |         |        V|
   23+ 5       0.1265      0.01  Q          |         |         |        V|
   23+10       0.1265      0.01  Q          |         |         |        V|
   23+15       0.1266      0.01  Q          |         |         |        V|
   23+20       0.1267      0.01  Q          |         |         |        V|
   23+25       0.1268      0.01  Q          |         |         |        V|
   23+30       0.1269      0.01  Q          |         |         |        V|
   23+35       0.1270      0.01  Q          |         |         |        V|
   23+40       0.1271      0.01  Q          |         |         |        V|
   23+45       0.1271      0.01  Q          |         |         |        V|
   23+50       0.1272      0.01  Q          |         |         |        V|
   23+55       0.1273      0.01  Q          |         |         |        V|
   24+ 0       0.1274      0.01  Q          |         |         |        V|
   24+ 5       0.1274      0.01  Q          |         |         |        V|
   24+10       0.1275      0.00  Q          |         |         |        V|
   24+15       0.1275      0.00  Q          |         |         |         V
----------------------------------------------------------------------
```

```
        U n i t   H y d r o g r a p h   A n a l y s i s

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0
                Study date  06/26/20 File: 3846PR2242.out


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Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978


Program License Serial Number 6400

---------------------------------------------------------------------
 English (in-lb) Input Units Used
 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



---------------------------------------------------------------------
3846
PROPOSED CONDITION
ENTIRE SITE
2 YEAR
--------------------------------------------------------------------
Drainage Area =       8.05(Ac.)  =      0.013 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       8.05(Ac.)  =      0.013 Sq. Mi.
Length along longest watercourse =     522.00(Ft.)
Length along longest watercourse measured to centroid =     261.00(Ft.)
Length along longest watercourse =      0.099 Mi.
Length along longest watercourse measured to centroid =      0.049 Mi.
Difference in elevation =       4.25(Ft.)
Slope along watercourse =     42.9885 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.023 Hr.
Lag time =     1.40 Min.
25% of lag time =     0.35 Min.
40% of lag time =     0.56 Min.
Unit time =     5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        8.05            1.90                  15.30

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        8.05            4.00                  32.20

STORM EVENT (YEAR) =    2.00
Area Averaged 2-Year Rainfall =    1.900(In)
Area Averaged 100-Year Rainfall =    4.000(In)

Point rain (area averaged) =    1.900(In)
Areal adjustment factor =  100.00 %
Adjusted average point rain =    1.900(In)

Sub-Area Data:
Area(Ac.)         Runoff Index   Impervious %
     8.050           69.00         0.900
 Total Area Entered =      8.05(Ac.)


RI    RI   Infil. Rate Impervious   Adj. Infil. Rate  Area%     F
AMC2 AMC-1     (In/Hr)    (Dec.%)     (In/Hr)      (Dec.)    (In/Hr)
69.0  49.8      0.574     0.900        0.109       1.000      0.109
                                                  Sum (F) =   0.109
Area averaged mean soil loss (F) (In/Hr) =  0.109
Minimum soil loss rate ((In/Hr)) =  0.055
```

```
        (for 24 hour storm duration)
        Soil low loss rate (decimal) =   0.100
        ---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
                            VALLEY S-Curve
        --------------------------------------------------------------------
                        Unit Hydrograph Data
        ---------------------------------------------------------------------
        Unit time period   Time % of lag   Distribution   Unit Hydrograph
            (hrs)                            Graph %            (CFS)
        ---------------------------------------------------------------------
            1   0.083        357.287         61.896             5.022
            2   0.167        714.573         34.163             2.772
            3   0.250       1071.860          3.941             0.320
                                      Sum = 100.000   Sum=       8.113
-----------------------------------------------------------------------


 The following loss rate calculations reflect use of the minimum calculated loss
 rate subtracted from the Storm Rain to produce the maximum Effective Rain value

  Unit Time   Pattern   Storm Rain     Loss rate(In./Hr)     Effective
       (Hr.)  Percent   (In/Hr)         Max   |   Low        (In/Hr)
   1   0.08     0.07      0.015       (  0.193)      0.002        0.014
   2   0.17     0.07      0.015       (  0.193)      0.002        0.014
   3   0.25     0.07      0.015       (  0.192)      0.002        0.014
   4   0.33     0.10      0.023       (  0.191)      0.002        0.021
   5   0.42     0.10      0.023       (  0.190)      0.002        0.021
   6   0.50     0.10      0.023       (  0.190)      0.002        0.021
   7   0.58     0.10      0.023       (  0.189)      0.002        0.021
   8   0.67     0.10      0.023       (  0.188)      0.002        0.021
   9   0.75     0.10      0.023       (  0.187)      0.002        0.021
  10   0.83     0.13      0.030       (  0.187)      0.003        0.027
  11   0.92     0.13      0.030       (  0.186)      0.003        0.027
  12   1.00     0.13      0.030       (  0.185)      0.003        0.027
  13   1.08     0.10      0.023       (  0.184)      0.002        0.021
  14   1.17     0.10      0.023       (  0.184)      0.002        0.021
  15   1.25     0.10      0.023       (  0.183)      0.002        0.021
  16   1.33     0.10      0.023       (  0.182)      0.002        0.021
  17   1.42     0.10      0.023       (  0.182)      0.002        0.021
  18   1.50     0.10      0.023       (  0.181)      0.002        0.021
  19   1.58     0.10      0.023       (  0.180)      0.002        0.021
  20   1.67     0.10      0.023       (  0.179)      0.002        0.021
  21   1.75     0.10      0.023       (  0.179)      0.002        0.021
  22   1.83     0.13      0.030       (  0.178)      0.003        0.027
  23   1.92     0.13      0.030       (  0.177)      0.003        0.027
  24   2.00     0.13      0.030       (  0.176)      0.003        0.027
  25   2.08     0.13      0.030       (  0.176)      0.003        0.027
  26   2.17     0.13      0.030       (  0.175)      0.003        0.027
  27   2.25     0.13      0.030       (  0.174)      0.003        0.027
  28   2.33     0.13      0.030       (  0.174)      0.003        0.027
  29   2.42     0.13      0.030       (  0.173)      0.003        0.027
  30   2.50     0.13      0.030       (  0.172)      0.003        0.027
  31   2.58     0.17      0.038       (  0.172)      0.004        0.034
  32   2.67     0.17      0.038       (  0.171)      0.004        0.034
  33   2.75     0.17      0.038       (  0.170)      0.004        0.034
  34   2.83     0.17      0.038       (  0.169)      0.004        0.034
  35   2.92     0.17      0.038       (  0.169)      0.004        0.034
  36   3.00     0.17      0.038       (  0.168)      0.004        0.034
  37   3.08     0.17      0.038       (  0.167)      0.004        0.034
  38   3.17     0.17      0.038       (  0.167)      0.004        0.034
  39   3.25     0.17      0.038       (  0.166)      0.004        0.034
  40   3.33     0.17      0.038       (  0.165)      0.004        0.034
  41   3.42     0.17      0.038       (  0.165)      0.004        0.034
  42   3.50     0.17      0.038       (  0.164)      0.004        0.034
  43   3.58     0.17      0.038       (  0.163)      0.004        0.034
  44   3.67     0.17      0.038       (  0.162)      0.004        0.034
  45   3.75     0.17      0.038       (  0.162)      0.004        0.034
  46   3.83     0.20      0.046       (  0.161)      0.005        0.041
  47   3.92     0.20      0.046       (  0.160)      0.005        0.041
  48   4.00     0.20      0.046       (  0.160)      0.005        0.041
  49   4.08     0.20      0.046       (  0.159)      0.005        0.041
  50   4.17     0.20      0.046       (  0.158)      0.005        0.041
  51   4.25     0.20      0.046       (  0.158)      0.005        0.041
  52   4.33     0.23      0.053       (  0.157)      0.005        0.048
  53   4.42     0.23      0.053       (  0.156)      0.005        0.048
  54   4.50     0.23      0.053       (  0.156)      0.005        0.048
  55   4.58     0.23      0.053       (  0.155)      0.005        0.048
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 56   4.67     0.23      0.053       (  0.154)       0.005        0.048
 57   4.75     0.23      0.053       (  0.154)       0.005        0.048
 58   4.83     0.27      0.061       (  0.153)       0.006        0.055
 59   4.92     0.27      0.061       (  0.152)       0.006        0.055
 60   5.00     0.27      0.061       (  0.152)       0.006        0.055
 61   5.08     0.20      0.046       (  0.151)       0.005        0.041
 62   5.17     0.20      0.046       (  0.150)       0.005        0.041
 63   5.25     0.20      0.046       (  0.150)       0.005        0.041
 64   5.33     0.23      0.053       (  0.149)       0.005        0.048
 65   5.42     0.23      0.053       (  0.148)       0.005        0.048
 66   5.50     0.23      0.053       (  0.148)       0.005        0.048
 67   5.58     0.27      0.061       (  0.147)       0.006        0.055
 68   5.67     0.27      0.061       (  0.147)       0.006        0.055
 69   5.75     0.27      0.061       (  0.146)       0.006        0.055
 70   5.83     0.27      0.061       (  0.145)       0.006        0.055
 71   5.92     0.27      0.061       (  0.145)       0.006        0.055
 72   6.00     0.27      0.061       (  0.144)       0.006        0.055
 73   6.08     0.30      0.068       (  0.143)       0.007        0.062
 74   6.17     0.30      0.068       (  0.143)       0.007        0.062
 75   6.25     0.30      0.068       (  0.142)       0.007        0.062
 76   6.33     0.30      0.068       (  0.141)       0.007        0.062
 77   6.42     0.30      0.068       (  0.141)       0.007        0.062
 78   6.50     0.30      0.068       (  0.140)       0.007        0.062
 79   6.58     0.33      0.076       (  0.140)       0.008        0.068
 80   6.67     0.33      0.076       (  0.139)       0.008        0.068
 81   6.75     0.33      0.076       (  0.138)       0.008        0.068
 82   6.83     0.33      0.076       (  0.138)       0.008        0.068
 83   6.92     0.33      0.076       (  0.137)       0.008        0.068
 84   7.00     0.33      0.076       (  0.136)       0.008        0.068
 85   7.08     0.33      0.076       (  0.136)       0.008        0.068
 86   7.17     0.33      0.076       (  0.135)       0.008        0.068
 87   7.25     0.33      0.076       (  0.135)       0.008        0.068
 88   7.33     0.37      0.084       (  0.134)       0.008        0.075
 89   7.42     0.37      0.084       (  0.133)       0.008        0.075
 90   7.50     0.37      0.084       (  0.133)       0.008        0.075
 91   7.58     0.40      0.091       (  0.132)       0.009        0.082
 92   7.67     0.40      0.091       (  0.131)       0.009        0.082
 93   7.75     0.40      0.091       (  0.131)       0.009        0.082
 94   7.83     0.43      0.099       (  0.130)       0.010        0.089
 95   7.92     0.43      0.099       (  0.130)       0.010        0.089
 96   8.00     0.43      0.099       (  0.129)       0.010        0.089
 97   8.08     0.50      0.114       (  0.128)       0.011        0.103
 98   8.17     0.50      0.114       (  0.128)       0.011        0.103
 99   8.25     0.50      0.114       (  0.127)       0.011        0.103
100   8.33     0.50      0.114       (  0.127)       0.011        0.103
101   8.42     0.50      0.114       (  0.126)       0.011        0.103
102   8.50     0.50      0.114       (  0.125)       0.011        0.103
103   8.58     0.53      0.122       (  0.125)       0.012        0.109
104   8.67     0.53      0.122       (  0.124)       0.012        0.109
105   8.75     0.53      0.122       (  0.124)       0.012        0.109
106   8.83     0.57      0.129       (  0.123)       0.013        0.116
107   8.92     0.57      0.129       (  0.123)       0.013        0.116
108   9.00     0.57      0.129       (  0.122)       0.013        0.116
109   9.08     0.63      0.144       (  0.121)       0.014        0.130
110   9.17     0.63      0.144       (  0.121)       0.014        0.130
111   9.25     0.63      0.144       (  0.120)       0.014        0.130
112   9.33     0.67      0.152       (  0.120)       0.015        0.137
113   9.42     0.67      0.152       (  0.119)       0.015        0.137
114   9.50     0.67      0.152       (  0.119)       0.015        0.137
115   9.58     0.70      0.160       (  0.118)       0.016        0.144
116   9.67     0.70      0.160       (  0.117)       0.016        0.144
117   9.75     0.70      0.160       (  0.117)       0.016        0.144
118   9.83     0.73      0.167       (  0.116)       0.017        0.150
119   9.92     0.73      0.167       (  0.116)       0.017        0.150
120  10.00     0.73      0.167       (  0.115)       0.017        0.150
121  10.08     0.50      0.114       (  0.115)       0.011        0.103
122  10.17     0.50      0.114       (  0.114)       0.011        0.103
123  10.25     0.50      0.114       (  0.113)       0.011        0.103
124  10.33     0.50      0.114       (  0.113)       0.011        0.103
125  10.42     0.50      0.114       (  0.112)       0.011        0.103
126  10.50     0.50      0.114       (  0.112)       0.011        0.103
127  10.58     0.67      0.152       (  0.111)       0.015        0.137
128  10.67     0.67      0.152       (  0.111)       0.015        0.137
129  10.75     0.67      0.152       (  0.110)       0.015        0.137
130  10.83     0.67      0.152       (  0.110)       0.015        0.137
131  10.92     0.67      0.152       (  0.109)       0.015        0.137
132  11.00     0.67      0.152       (  0.109)       0.015        0.137
133  11.08     0.63      0.144       (  0.108)       0.014        0.130
134  11.17     0.63      0.144       (  0.108)       0.014        0.130
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135  11.25     0.63      0.144       (  0.107)       0.014        0.130
136  11.33     0.63      0.144       (  0.106)       0.014        0.130
137  11.42     0.63      0.144       (  0.106)       0.014        0.130
138  11.50     0.63      0.144       (  0.105)       0.014        0.130
139  11.58     0.57      0.129       (  0.105)       0.013        0.116
140  11.67     0.57      0.129       (  0.104)       0.013        0.116
141  11.75     0.57      0.129       (  0.104)       0.013        0.116
142  11.83     0.60      0.137       (  0.103)       0.014        0.123
143  11.92     0.60      0.137       (  0.103)       0.014        0.123
144  12.00     0.60      0.137       (  0.102)       0.014        0.123
145  12.08     0.83      0.190       (  0.102)       0.019        0.171
146  12.17     0.83      0.190       (  0.101)       0.019        0.171
147  12.25     0.83      0.190       (  0.101)       0.019        0.171
148  12.33     0.87      0.198       (  0.100)       0.020        0.178
149  12.42     0.87      0.198       (  0.100)       0.020        0.178
150  12.50     0.87      0.198       (  0.099)       0.020        0.178
151  12.58     0.93      0.213       (  0.099)       0.021        0.192
152  12.67     0.93      0.213       (  0.098)       0.021        0.192
153  12.75     0.93      0.213       (  0.098)       0.021        0.192
154  12.83     0.97      0.220       (  0.097)       0.022        0.198
155  12.92     0.97      0.220       (  0.097)       0.022        0.198
156  13.00     0.97      0.220       (  0.096)       0.022        0.198
157  13.08     1.13      0.258       (  0.096)       0.026        0.233
158  13.17     1.13      0.258       (  0.095)       0.026        0.233
159  13.25     1.13      0.258       (  0.095)       0.026        0.233
160  13.33     1.13      0.258       (  0.094)       0.026        0.233
161  13.42     1.13      0.258       (  0.094)       0.026        0.233
162  13.50     1.13      0.258       (  0.093)       0.026        0.233
163  13.58     0.77      0.175       (  0.093)       0.017        0.157
164  13.67     0.77      0.175       (  0.092)       0.017        0.157
165  13.75     0.77      0.175       (  0.092)       0.017        0.157
166  13.83     0.77      0.175       (  0.092)       0.017        0.157
167  13.92     0.77      0.175       (  0.091)       0.017        0.157
168  14.00     0.77      0.175       (  0.091)       0.017        0.157
169  14.08     0.90      0.205       (  0.090)       0.021        0.185
170  14.17     0.90      0.205       (  0.090)       0.021        0.185
171  14.25     0.90      0.205       (  0.089)       0.021        0.185
172  14.33     0.87      0.198       (  0.089)       0.020        0.178
173  14.42     0.87      0.198       (  0.088)       0.020        0.178
174  14.50     0.87      0.198       (  0.088)       0.020        0.178
175  14.58     0.87      0.198       (  0.087)       0.020        0.178
176  14.67     0.87      0.198       (  0.087)       0.020        0.178
177  14.75     0.87      0.198       (  0.086)       0.020        0.178
178  14.83     0.83      0.190       (  0.086)       0.019        0.171
179  14.92     0.83      0.190       (  0.086)       0.019        0.171
180  15.00     0.83      0.190       (  0.085)       0.019        0.171
181  15.08     0.80      0.182       (  0.085)       0.018        0.164
182  15.17     0.80      0.182       (  0.084)       0.018        0.164
183  15.25     0.80      0.182       (  0.084)       0.018        0.164
184  15.33     0.77      0.175       (  0.083)       0.017        0.157
185  15.42     0.77      0.175       (  0.083)       0.017        0.157
186  15.50     0.77      0.175       (  0.083)       0.017        0.157
187  15.58     0.63      0.144       (  0.082)       0.014        0.130
188  15.67     0.63      0.144       (  0.082)       0.014        0.130
189  15.75     0.63      0.144       (  0.081)       0.014        0.130
190  15.83     0.63      0.144       (  0.081)       0.014        0.130
191  15.92     0.63      0.144       (  0.080)       0.014        0.130
192  16.00     0.63      0.144       (  0.080)       0.014        0.130
193  16.08     0.13      0.030       (  0.080)       0.003        0.027
194  16.17     0.13      0.030       (  0.079)       0.003        0.027
195  16.25     0.13      0.030       (  0.079)       0.003        0.027
196  16.33     0.13      0.030       (  0.078)       0.003        0.027
197  16.42     0.13      0.030       (  0.078)       0.003        0.027
198  16.50     0.13      0.030       (  0.078)       0.003        0.027
199  16.58     0.10      0.023       (  0.077)       0.002        0.021
200  16.67     0.10      0.023       (  0.077)       0.002        0.021
201  16.75     0.10      0.023       (  0.076)       0.002        0.021
202  16.83     0.10      0.023       (  0.076)       0.002        0.021
203  16.92     0.10      0.023       (  0.076)       0.002        0.021
204  17.00     0.10      0.023       (  0.075)       0.002        0.021
205  17.08     0.17      0.038       (  0.075)       0.004        0.034
206  17.17     0.17      0.038       (  0.075)       0.004        0.034
207  17.25     0.17      0.038       (  0.074)       0.004        0.034
208  17.33     0.17      0.038       (  0.074)       0.004        0.034
209  17.42     0.17      0.038       (  0.073)       0.004        0.034
210  17.50     0.17      0.038       (  0.073)       0.004        0.034
211  17.58     0.17      0.038       (  0.073)       0.004        0.034
212  17.67     0.17      0.038       (  0.072)       0.004        0.034
213  17.75     0.17      0.038       (  0.072)       0.004        0.034
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214  17.83     0.13      0.030       (  0.072)      0.003        0.027
215  17.92     0.13      0.030       (  0.071)      0.003        0.027
216  18.00     0.13      0.030       (  0.071)      0.003        0.027
217  18.08     0.13      0.030       (  0.071)      0.003        0.027
218  18.17     0.13      0.030       (  0.070)      0.003        0.027
219  18.25     0.13      0.030       (  0.070)      0.003        0.027
220  18.33     0.13      0.030       (  0.070)      0.003        0.027
221  18.42     0.13      0.030       (  0.069)      0.003        0.027
222  18.50     0.13      0.030       (  0.069)      0.003        0.027
223  18.58     0.10      0.023       (  0.069)      0.002        0.021
224  18.67     0.10      0.023       (  0.068)      0.002        0.021
225  18.75     0.10      0.023       (  0.068)      0.002        0.021
226  18.83     0.07      0.015       (  0.068)      0.002        0.014
227  18.92     0.07      0.015       (  0.067)      0.002        0.014
228  19.00     0.07      0.015       (  0.067)      0.002        0.014
229  19.08     0.10      0.023       (  0.067)      0.002        0.021
230  19.17     0.10      0.023       (  0.066)      0.002        0.021
231  19.25     0.10      0.023       (  0.066)      0.002        0.021
232  19.33     0.13      0.030       (  0.066)      0.003        0.027
233  19.42     0.13      0.030       (  0.065)      0.003        0.027
234  19.50     0.13      0.030       (  0.065)      0.003        0.027
235  19.58     0.10      0.023       (  0.065)      0.002        0.021
236  19.67     0.10      0.023       (  0.064)      0.002        0.021
237  19.75     0.10      0.023       (  0.064)      0.002        0.021
238  19.83     0.07      0.015       (  0.064)      0.002        0.014
239  19.92     0.07      0.015       (  0.064)      0.002        0.014
240  20.00     0.07      0.015       (  0.063)      0.002        0.014
241  20.08     0.10      0.023       (  0.063)      0.002        0.021
242  20.17     0.10      0.023       (  0.063)      0.002        0.021
243  20.25     0.10      0.023       (  0.062)      0.002        0.021
244  20.33     0.10      0.023       (  0.062)      0.002        0.021
245  20.42     0.10      0.023       (  0.062)      0.002        0.021
246  20.50     0.10      0.023       (  0.062)      0.002        0.021
247  20.58     0.10      0.023       (  0.061)      0.002        0.021
248  20.67     0.10      0.023       (  0.061)      0.002        0.021
249  20.75     0.10      0.023       (  0.061)      0.002        0.021
250  20.83     0.07      0.015       (  0.061)      0.002        0.014
251  20.92     0.07      0.015       (  0.060)      0.002        0.014
252  21.00     0.07      0.015       (  0.060)      0.002        0.014
253  21.08     0.10      0.023       (  0.060)      0.002        0.021
254  21.17     0.10      0.023       (  0.060)      0.002        0.021
255  21.25     0.10      0.023       (  0.059)      0.002        0.021
256  21.33     0.07      0.015       (  0.059)      0.002        0.014
257  21.42     0.07      0.015       (  0.059)      0.002        0.014
258  21.50     0.07      0.015       (  0.059)      0.002        0.014
259  21.58     0.10      0.023       (  0.059)      0.002        0.021
260  21.67     0.10      0.023       (  0.058)      0.002        0.021
261  21.75     0.10      0.023       (  0.058)      0.002        0.021
262  21.83     0.07      0.015       (  0.058)      0.002        0.014
263  21.92     0.07      0.015       (  0.058)      0.002        0.014
264  22.00     0.07      0.015       (  0.058)      0.002        0.014
265  22.08     0.10      0.023       (  0.057)      0.002        0.021
266  22.17     0.10      0.023       (  0.057)      0.002        0.021
267  22.25     0.10      0.023       (  0.057)      0.002        0.021
268  22.33     0.07      0.015       (  0.057)      0.002        0.014
269  22.42     0.07      0.015       (  0.057)      0.002        0.014
270  22.50     0.07      0.015       (  0.057)      0.002        0.014
271  22.58     0.07      0.015       (  0.056)      0.002        0.014
272  22.67     0.07      0.015       (  0.056)      0.002        0.014
273  22.75     0.07      0.015       (  0.056)      0.002        0.014
274  22.83     0.07      0.015       (  0.056)      0.002        0.014
275  22.92     0.07      0.015       (  0.056)      0.002        0.014
276  23.00     0.07      0.015       (  0.056)      0.002        0.014
277  23.08     0.07      0.015       (  0.055)      0.002        0.014
278  23.17     0.07      0.015       (  0.055)      0.002        0.014
279  23.25     0.07      0.015       (  0.055)      0.002        0.014
280  23.33     0.07      0.015       (  0.055)      0.002        0.014
281  23.42     0.07      0.015       (  0.055)      0.002        0.014
282  23.50     0.07      0.015       (  0.055)      0.002        0.014
283  23.58     0.07      0.015       (  0.055)      0.002        0.014
284  23.67     0.07      0.015       (  0.055)      0.002        0.014
285  23.75     0.07      0.015       (  0.055)      0.002        0.014
286  23.83     0.07      0.015       (  0.055)      0.002        0.014
287  23.92     0.07      0.015       (  0.055)      0.002        0.014
288  24.00     0.07      0.015       (  0.055)      0.002        0.014
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =    20.5
       Flood volume = Effective rainfall      1.71(In)
        times area       8.1(Ac.)/[(In)/(Ft.)] =       1.1(Ac.Ft)
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```
      Total soil loss =      0.19(In)
      Total soil loss =     0.127(Ac.Ft)
      Total rainfall =      1.90(In)
      Flood volume =       49968.0 Cubic Feet
      Total soil loss =        5552.0 Cubic Feet
      --------------------------------------------------------------------
       Peak flow rate of this hydrograph =      1.888(CFS)
      --------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R    S T O R M
                     R u n o f f      H y d r o g r a p h
      --------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+ 5       0.0005      0.07  Q         |         |         |         |
  0+10       0.0012      0.11  Q         |         |         |         |
  0+15       0.0020      0.11  Q         |         |         |         |
  0+20       0.0030      0.15  Q         |         |         |         |
  0+25       0.0041      0.16  Q         |         |         |         |
  0+30       0.0053      0.17  Q         |         |         |         |
  0+35       0.0064      0.17  Q         |         |         |         |
  0+40       0.0075      0.17  Q         |         |         |         |
  0+45       0.0087      0.17  Q         |         |         |         |
  0+50       0.0101      0.20  Q         |         |         |         |
  0+55       0.0116      0.22  Q         |         |         |         |
  1+ 0       0.0131      0.22  Q         |         |         |         |
  1+ 5       0.0144      0.19  Q         |         |         |         |
  1+10       0.0156      0.17  Q         |         |         |         |
  1+15       0.0167      0.17  Q         |         |         |         |
  1+20       0.0179      0.17  Q         |         |         |         |
  1+25       0.0190      0.17  Q         |         |         |         |
  1+30       0.0202      0.17  Q         |         |         |         |
  1+35       0.0213      0.17  Q         |         |         |         |
  1+40       0.0225      0.17  Q         |         |         |         |
  1+45       0.0236      0.17  Q         |         |         |         |
  1+50       0.0250      0.20  Q         |         |         |         |
  1+55       0.0265      0.22  Q         |         |         |         |
  2+ 0       0.0280      0.22  Q         |         |         |         |
  2+ 5       0.0296      0.22  QV        |         |         |         |
  2+10       0.0311      0.22  QV        |         |         |         |
  2+15       0.0326      0.22  QV        |         |         |         |
  2+20       0.0342      0.22  QV        |         |         |         |
  2+25       0.0357      0.22  QV        |         |         |         |
  2+30       0.0372      0.22  QV        |         |         |         |
  2+35       0.0390      0.26  |Q        |         |         |         |
  2+40       0.0409      0.28  |Q        |         |         |         |
  2+45       0.0428      0.28  |Q        |         |         |         |
  2+50       0.0447      0.28  |Q        |         |         |         |
  2+55       0.0466      0.28  |Q        |         |         |         |
  3+ 0       0.0485      0.28  |Q        |         |         |         |
  3+ 5       0.0504      0.28  |Q        |         |         |         |
  3+10       0.0523      0.28  |Q        |         |         |         |
  3+15       0.0543      0.28  |Q        |         |         |         |
  3+20       0.0562      0.28  |Q        |         |         |         |
  3+25       0.0581      0.28  |QV       |         |         |         |
  3+30       0.0600      0.28  |QV       |         |         |         |
  3+35       0.0619      0.28  |QV       |         |         |         |
  3+40       0.0638      0.28  |QV       |         |         |         |
  3+45       0.0657      0.28  |QV       |         |         |         |
  3+50       0.0679      0.31  |QV       |         |         |         |
  3+55       0.0702      0.33  |QV       |         |         |         |
  4+ 0       0.0725      0.33  |QV       |         |         |         |
  4+ 5       0.0747      0.33  |QV       |         |         |         |
  4+10       0.0770      0.33  |QV       |         |         |         |
  4+15       0.0793      0.33  |QV       |         |         |         |
  4+20       0.0819      0.37  |QV       |         |         |         |
  4+25       0.0845      0.39  |QV       |         |         |         |
  4+30       0.0872      0.39  |Q V      |         |         |         |
  4+35       0.0899      0.39  |Q V      |         |         |         |
  4+40       0.0926      0.39  |Q V      |         |         |         |
  4+45       0.0952      0.39  |Q V      |         |         |         |
  4+50       0.0981      0.42  |Q V      |         |         |         |
  4+55       0.1012      0.44  |Q V      |         |         |         |
  5+ 0       0.1042      0.44  |Q V      |         |         |         |
  5+ 5       0.1068      0.38  |Q V      |         |         |         |
  5+10       0.1092      0.34  |Q V      |         |         |         |
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 5+15       0.1115      0.33  |Q V      |         |         |         |
 5+20       0.1140      0.37  |Q V      |         |         |         |
 5+25       0.1166      0.39  |Q  V     |         |         |         |
 5+30       0.1193      0.39  |Q  V     |         |         |         |
 5+35       0.1222      0.42  |Q  V     |         |         |         |
 5+40       0.1253      0.44  |Q  V     |         |         |         |
 5+45       0.1283      0.44  |Q  V     |         |         |         |
 5+50       0.1314      0.44  |Q  V     |         |         |         |
 5+55       0.1345      0.44  |Q  V     |         |         |         |
 6+ 0       0.1375      0.44  |Q  V     |         |         |         |
 6+ 5       0.1408      0.48  |Q  V     |         |         |         |
 6+10       0.1442      0.50  |Q   V    |         |         |         |
 6+15       0.1477      0.50  |Q   V    |         |         |         |
 6+20       0.1511      0.50  |Q   V    |         |         |         |
 6+25       0.1546      0.50  |Q   V    |         |         |         |
 6+30       0.1580      0.50  |Q   V    |         |         |         |
 6+35       0.1617      0.53  | Q  V    |         |         |         |
 6+40       0.1655      0.55  | Q  V    |         |         |         |
 6+45       0.1693      0.56  | Q  V    |         |         |         |
 6+50       0.1731      0.56  | Q   V   |         |         |         |
 6+55       0.1770      0.56  | Q   V   |         |         |         |
 7+ 0       0.1808      0.56  | Q   V   |         |         |         |
 7+ 5       0.1846      0.56  | Q   V   |         |         |         |
 7+10       0.1884      0.56  | Q   V   |         |         |         |
 7+15       0.1923      0.56  | Q   V   |         |         |         |
 7+20       0.1963      0.59  | Q   V   |         |         |         |
 7+25       0.2005      0.61  | Q   V   |         |         |         |
 7+30       0.2047      0.61  | Q    V  |         |         |         |
 7+35       0.2092      0.65  | Q    V  |         |         |         |
 7+40       0.2137      0.66  | Q    V  |         |         |         |
 7+45       0.2183      0.67  | Q    V  |         |         |         |
 7+50       0.2231      0.70  | Q    V  |         |         |         |
 7+55       0.2281      0.72  | Q    V  |         |         |         |
 8+ 0       0.2331      0.72  | Q     V |         |         |         |
 8+ 5       0.2385      0.79  |  Q    V |         |         |         |
 8+10       0.2442      0.83  |  Q    V |         |         |         |
 8+15       0.2500      0.83  |  Q    V |         |         |         |
 8+20       0.2557      0.83  |  Q    V |         |         |         |
 8+25       0.2614      0.83  |  Q     V|         |         |         |
 8+30       0.2672      0.83  |  Q     V|         |         |         |
 8+35       0.2731      0.87  |  Q     V|         |         |         |
 8+40       0.2792      0.89  |  Q     V|         |         |         |
 8+45       0.2854      0.89  |  Q     V|         |         |         |
 8+50       0.2917      0.92  |  Q      V         |         |         |
 8+55       0.2982      0.94  |  Q      V         |         |         |
 9+ 0       0.3047      0.94  |  Q      V         |         |         |
 9+ 5       0.3117      1.01  |   Q     V         |         |         |
 9+10       0.3189      1.05  |   Q     |V        |         |         |
 9+15       0.3262      1.05  |   Q     |V        |         |         |
 9+20       0.3337      1.09  |   Q     |V        |         |         |
 9+25       0.3413      1.11  |   Q     |V        |         |         |
 9+30       0.3489      1.11  |   Q     | V       |         |         |
 9+35       0.3568      1.14  |   Q     | V       |         |         |
 9+40       0.3648      1.16  |   Q     | V       |         |         |
 9+45       0.3729      1.17  |   Q     |  V      |         |         |
 9+50       0.3811      1.20  |   Q     |  V      |         |         |
 9+55       0.3895      1.22  |   Q     |  V      |         |         |
10+ 0       0.3980      1.22  |   Q     |  V      |         |         |
10+ 5       0.4047      0.98  |  Q      |   V     |         |         |
10+10       0.4105      0.85  |  Q      |   V     |         |         |
10+15       0.4163      0.83  |  Q      |   V     |         |         |
10+20       0.4220      0.83  |  Q      |   V     |         |         |
10+25       0.4278      0.83  |  Q      |   V     |         |         |
10+30       0.4335      0.83  |  Q      |    V    |         |         |
10+35       0.4404      1.00  |   Q     |    V    |         |         |
10+40       0.4480      1.10  |   Q     |    V    |         |         |
10+45       0.4556      1.11  |   Q     |    V    |         |         |
10+50       0.4633      1.11  |   Q     |     V   |         |         |
10+55       0.4709      1.11  |   Q     |     V   |         |         |
11+ 0       0.4786      1.11  |   Q     |     V   |         |         |
11+ 5       0.4860      1.08  |   Q     |     V   |         |         |
11+10       0.4933      1.06  |   Q     |      V  |         |         |
11+15       0.5005      1.05  |   Q     |      V  |         |         |
11+20       0.5078      1.05  |   Q     |      V  |         |         |
11+25       0.5151      1.05  |   Q     |      V  |         |         |
11+30       0.5223      1.05  |   Q     |       V |         |         |
11+35       0.5291      0.99  |  Q      |       V |         |         |
11+40       0.5356      0.95  |  Q      |       V |         |         |
11+45       0.5421      0.94  |  Q      |       V |         |         |
```

```
11+50       0.5489      0.98  |  Q      |        V|         |         |
11+55       0.5557      1.00  |  Q      |        V|         |         |
12+ 0       0.5626      1.00  |  Q      |        V|         |         |
12+ 5       0.5712      1.24  |   Q     |        V|         |         |
12+10       0.5806      1.37  |    Q    |         V         |         |
12+15       0.5902      1.39  |    Q    |         V         |         |
12+20       0.6000      1.42  |    Q    |         V         |         |
12+25       0.6099      1.44  |    Q    |         |V        |         |
12+30       0.6198      1.44  |    Q    |         |V        |         |
12+35       0.6303      1.51  |     Q   |         |V        |         |
12+40       0.6409      1.55  |     Q   |         | V       |         |
12+45       0.6516      1.55  |     Q   |         | V       |         |
12+50       0.6626      1.59  |     Q   |         |  V      |         |
12+55       0.6737      1.61  |     Q   |         |  V      |         |
13+ 0       0.6847      1.61  |     Q   |         |  V      |         |
13+ 5       0.6970      1.78  |      Q  |         |   V     |         |
13+10       0.7099      1.88  |      Q  |         |   V     |         |
13+15       0.7229      1.89  |      Q  |         |    V    |         |
13+20       0.7359      1.89  |      Q  |         |    V    |         |
13+25       0.7489      1.89  |      Q  |         |     V   |         |
13+30       0.7619      1.89  |      Q  |         |     V   |         |
13+35       0.7723      1.51  |     Q   |         |     V   |         |
13+40       0.7813      1.30  |    Q    |         |      V  |         |
13+45       0.7901      1.28  |    Q    |         |      V  |         |
13+50       0.7989      1.28  |    Q    |         |      V  |         |
13+55       0.8077      1.28  |    Q    |         |       V |         |
14+ 0       0.8165      1.28  |    Q    |         |       V |         |
14+ 5       0.8262      1.41  |    Q    |         |       V |         |
14+10       0.8365      1.49  |    Q    |         |        V|         |
14+15       0.8468      1.50  |    Q    |         |        V|         |
14+20       0.8569      1.46  |    Q    |         |        V|         |
14+25       0.8669      1.45  |    Q    |         |         V         |
14+30       0.8768      1.44  |    Q    |         |         V         |
14+35       0.8867      1.44  |    Q    |         |         V         |
14+40       0.8967      1.44  |    Q    |         |         |V        |
14+45       0.9066      1.44  |    Q    |         |         |V        |
14+50       0.9163      1.41  |    Q    |         |         |V        |
14+55       0.9259      1.39  |    Q    |         |         | V       |
15+ 0       0.9355      1.39  |    Q    |         |         | V       |
15+ 5       0.9448      1.35  |    Q    |         |         | V       |
15+10       0.9540      1.33  |    Q    |         |         |  V      |
15+15       0.9632      1.33  |    Q    |         |         |  V      |
15+20       0.9721      1.30  |    Q    |         |         |  V      |
15+25       0.9809      1.28  |    Q    |         |         |   V     |
15+30       0.9897      1.28  |    Q    |         |         |   V     |
15+35       0.9975      1.14  |   Q     |         |         |   V     |
15+40       1.0049      1.06  |   Q     |         |         |    V    |
15+45       1.0121      1.05  |   Q     |         |         |    V    |
15+50       1.0194      1.05  |   Q     |         |         |    V    |
15+55       1.0267      1.05  |   Q     |         |         |    V    |
16+ 0       1.0339      1.05  |   Q     |         |         |     V   |
16+ 5       1.0376      0.54  | Q       |         |         |     V   |
16+10       1.0394      0.25  |Q        |         |         |     V   |
16+15       1.0409      0.22  Q         |         |         |     V   |
16+20       1.0425      0.22  Q         |         |         |     V   |
16+25       1.0440      0.22  Q         |         |         |     V   |
16+30       1.0455      0.22  Q         |         |         |     V   |
16+35       1.0468      0.19  Q         |         |         |     V   |
16+40       1.0480      0.17  Q         |         |         |     V   |
16+45       1.0491      0.17  Q         |         |         |     V   |
16+50       1.0503      0.17  Q         |         |         |     V   |
16+55       1.0514      0.17  Q         |         |         |     V   |
17+ 0       1.0526      0.17  Q         |         |         |     V   |
17+ 5       1.0542      0.24  Q         |         |         |     V   |
17+10       1.0561      0.27  |Q        |         |         |     V   |
17+15       1.0580      0.28  |Q        |         |         |     V   |
17+20       1.0599      0.28  |Q        |         |         |     V   |
17+25       1.0618      0.28  |Q        |         |         |      V  |
17+30       1.0637      0.28  |Q        |         |         |      V  |
17+35       1.0656      0.28  |Q        |         |         |      V  |
17+40       1.0675      0.28  |Q        |         |         |      V  |
17+45       1.0694      0.28  |Q        |         |         |      V  |
17+50       1.0711      0.24  Q         |         |         |      V  |
17+55       1.0727      0.22  Q         |         |         |      V  |
18+ 0       1.0742      0.22  Q         |         |         |      V  |
18+ 5       1.0757      0.22  Q         |         |         |      V  |
18+10       1.0773      0.22  Q         |         |         |      V  |
18+15       1.0788      0.22  Q         |         |         |      V  |
18+20       1.0803      0.22  Q         |         |         |      V  |
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   18+25       1.0818      0.22  Q         |         |         |      V  |
   18+30       1.0834      0.22  Q         |         |         |      V  |
   18+35       1.0847      0.19  Q         |         |         |      V  |
   18+40       1.0858      0.17  Q         |         |         |      V  |
   18+45       1.0870      0.17  Q         |         |         |      V  |
   18+50       1.0879      0.13  Q         |         |         |      V  |
   18+55       1.0887      0.11  Q         |         |         |      V  |
   19+ 0       1.0894      0.11  Q         |         |         |      V  |
   19+ 5       1.0904      0.15  Q         |         |         |       V |
   19+10       1.0916      0.16  Q         |         |         |       V |
   19+15       1.0927      0.17  Q         |         |         |       V |
   19+20       1.0941      0.20  Q         |         |         |       V |
   19+25       1.0956      0.22  Q         |         |         |       V |
   19+30       1.0971      0.22  Q         |         |         |       V |
   19+35       1.0984      0.19  Q         |         |         |       V |
   19+40       1.0996      0.17  Q         |         |         |       V |
   19+45       1.1007      0.17  Q         |         |         |       V |
   19+50       1.1017      0.13  Q         |         |         |       V |
   19+55       1.1024      0.11  Q         |         |         |       V |
   20+ 0       1.1032      0.11  Q         |         |         |       V |
   20+ 5       1.1042      0.15  Q         |         |         |       V |
   20+10       1.1053      0.16  Q         |         |         |       V |
   20+15       1.1065      0.17  Q         |         |         |       V |
   20+20       1.1076      0.17  Q         |         |         |       V |
   20+25       1.1088      0.17  Q         |         |         |       V |
   20+30       1.1099      0.17  Q         |         |         |       V |
   20+35       1.1111      0.17  Q         |         |         |       V |
   20+40       1.1122      0.17  Q         |         |         |       V |
   20+45       1.1134      0.17  Q         |         |         |       V |
   20+50       1.1143      0.13  Q         |         |         |       V |
   20+55       1.1150      0.11  Q         |         |         |       V |
   21+ 0       1.1158      0.11  Q         |         |         |       V |
   21+ 5       1.1168      0.15  Q         |         |         |       V |
   21+10       1.1179      0.16  Q         |         |         |       V |
   21+15       1.1191      0.17  Q         |         |         |        V|
   21+20       1.1200      0.13  Q         |         |         |        V|
   21+25       1.1208      0.11  Q         |         |         |        V|
   21+30       1.1215      0.11  Q         |         |         |        V|
   21+35       1.1226      0.15  Q         |         |         |        V|
   21+40       1.1237      0.16  Q         |         |         |        V|
   21+45       1.1248      0.17  Q         |         |         |        V|
   21+50       1.1257      0.13  Q         |         |         |        V|
   21+55       1.1265      0.11  Q         |         |         |        V|
   22+ 0       1.1273      0.11  Q         |         |         |        V|
   22+ 5       1.1283      0.15  Q         |         |         |        V|
   22+10       1.1294      0.16  Q         |         |         |        V|
   22+15       1.1306      0.17  Q         |         |         |        V|
   22+20       1.1315      0.13  Q         |         |         |        V|
   22+25       1.1323      0.11  Q         |         |         |        V|
   22+30       1.1330      0.11  Q         |         |         |        V|
   22+35       1.1338      0.11  Q         |         |         |        V|
   22+40       1.1345      0.11  Q         |         |         |        V|
   22+45       1.1353      0.11  Q         |         |         |        V|
   22+50       1.1361      0.11  Q         |         |         |        V|
   22+55       1.1368      0.11  Q         |         |         |        V|
   23+ 0       1.1376      0.11  Q         |         |         |        V|
   23+ 5       1.1384      0.11  Q         |         |         |        V|
   23+10       1.1391      0.11  Q         |         |         |        V|
   23+15       1.1399      0.11  Q         |         |         |        V|
   23+20       1.1407      0.11  Q         |         |         |        V|
   23+25       1.1414      0.11  Q         |         |         |        V|
   23+30       1.1422      0.11  Q         |         |         |        V|
   23+35       1.1430      0.11  Q         |         |         |        V|
   23+40       1.1437      0.11  Q         |         |         |        V|
   23+45       1.1445      0.11  Q         |         |         |        V|
   23+50       1.1453      0.11  Q         |         |         |        V|
   23+55       1.1460      0.11  Q         |         |         |        V|
   24+ 0       1.1468      0.11  Q         |         |         |        V|
   24+ 5       1.1471      0.04  Q         |         |         |        V|
   24+10       1.1471      0.00  Q         |         |         |         V
-----------------------------------------------------------------------
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****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2016 Advanced Engineering Software (aes)
                      (Rational Tabling Version 23.0)
                   Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3846                                                          *
* EXISTING CONDITION                                                       *
* 2 YEAR STORM EVENT                                                       *
 **************************************************************************

  FILE NAME: W:\3846\100X2.DAT
  TIME/DATE OF STUDY: 11:29 12/16/2020
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.455
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.150
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    2.00   1-HOUR INTENSITY(INCH/HOUR) =   0.455
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH GOOD COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   570.00
  UPSTREAM ELEVATION(FEET) =   1569.90
  DOWNSTREAM ELEVATION(FEET) =   1557.40
  ELEVATION DIFFERENCE(FEET) =     12.50
  TC = 0.937*[(  570.00**3)/(    12.50)]**.2 =   25.472
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.698
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .4844
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      1.00
  TOTAL AREA(ACRES) =      2.95   TOTAL RUNOFF(CFS) =      1.00
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.0  TC(MIN.) =     25.47
  PEAK FLOW RATE(CFS)   =       1.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2016 Advanced Engineering Software (aes)
                      (Rational Tabling Version 23.0)
                   Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

                         THIENES ENGINEERING, INC.
                            14349 FIRESTONE BLVD
                            LA MIRADA, CA 90638
                                714-521-4811

 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3846                                                           *
* EXISTING CONDITION                                                        *
* 2 YEAR STORM EVENT                                                        *
 **************************************************************************

  FILE NAME: W:\3846\200X2.DAT
  TIME/DATE OF STUDY: 11:50 12/16/2020
-----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
-----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.455
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.150
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    2.00   1-HOUR INTENSITY(INCH/HOUR) =   0.455
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
-----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
=============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH FAIR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   763.00
  UPSTREAM ELEVATION(FEET) =   1570.60
  DOWNSTREAM ELEVATION(FEET) =   1547.10
  ELEVATION DIFFERENCE(FEET) =     23.50
  TC = 0.709*[(  763.00**3)/(    23.50)]**.2 =   20.239
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  0.783
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .5100
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      2.04
  TOTAL AREA(ACRES) =      5.10   TOTAL RUNOFF(CFS) =      2.04
=============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        5.1  TC(MIN.) =     20.24
  PEAK FLOW RATE(CFS)   =       2.04
=============================================================================
=============================================================================
  END OF RATIONAL METHOD ANALYSIS

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            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2016 Advanced Engineering Software (aes)
                      (Rational Tabling Version 23.0)
                   Release Date: 07/01/2016  License ID 1435

                           Analysis prepared by:

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 ************************** DESCRIPTION OF STUDY **************************
* TEI JOB NO 3846                                                          *
* PROPOSED CONDITION                                                       *
* 2 YEAR STORM EVENT                                                       *
 **************************************************************************

  FILE NAME: W:\3846\100P2.DAT
  TIME/DATE OF STUDY: 11:27 12/16/2020
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =    2.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.455
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.150
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =    2.00   1-HOUR INTENSITY(INCH/HOUR) =   0.455
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   474.00
  UPSTREAM ELEVATION(FEET) =   1560.69
  DOWNSTREAM ELEVATION(FEET) =   1555.64
  ELEVATION DIFFERENCE(FEET) =      5.05
  TC = 0.303*[(  474.00**3)/(     5.05)]**.2 =    8.839
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.185
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8698
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      2.53
  TOTAL AREA(ACRES) =      2.45   TOTAL RUNOFF(CFS) =      2.53

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    403.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1549.70  DOWNSTREAM(FEET) =  1547.63
  FLOW LENGTH(FEET) =   527.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.63
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.53
  PIPE TRAVEL TIME(MIN.) =   2.42    Tc(MIN.) =   11.26
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    403.00 =    1001.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   457.00
  UPSTREAM ELEVATION(FEET) =   1560.69
  DOWNSTREAM ELEVATION(FEET) =   1553.98
  ELEVATION DIFFERENCE(FEET) =      6.71
  TC = 0.303*[(  457.00**3)/(     6.71)]**.2 =    8.169
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.233
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8706
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      1.61
  TOTAL AREA(ACRES) =      1.50   TOTAL RUNOFF(CFS) =      1.61

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1550.54  DOWNSTREAM(FEET) =  1549.89
  FLOW LENGTH(FEET) =   135.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.50
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.61
  PIPE TRAVEL TIME(MIN.) =   0.64    Tc(MIN.) =    8.81
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     592.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.187
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8578
  SOIL CLASSIFICATION IS "B"
  SUBAREA AREA(ACRES) =    0.40   SUBAREA RUNOFF(CFS) =    0.41
  TOTAL AREA(ACRES) =        1.9   TOTAL RUNOFF(CFS) =       2.02
  TC(MIN.) =    8.81

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    302.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1549.89  DOWNSTREAM(FEET) =  1549.20
  FLOW LENGTH(FEET) =   131.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.81
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.02
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =    9.39
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    302.00 =     723.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.39
  RAINFALL INTENSITY(INCH/HR) =   1.15
  TOTAL STREAM AREA(ACRES) =     1.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.02

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
```

```
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   230.00
  UPSTREAM ELEVATION(FEET) =   1555.98
  DOWNSTREAM ELEVATION(FEET) =   1552.98
  ELEVATION DIFFERENCE(FEET) =      3.00
  TC = 0.303*[(  230.00**3)/(     3.00)]**.2 =    6.356
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.398
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8730
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      1.53
  TOTAL AREA(ACRES) =      1.25   TOTAL RUNOFF(CFS) =      1.53

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1550.05  DOWNSTREAM(FEET) =  1549.89
  FLOW LENGTH(FEET) =    64.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   2.67
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.53
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =    6.76
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     294.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.76
  RAINFALL INTENSITY(INCH/HR) =   1.36
  TOTAL STREAM AREA(ACRES) =     1.25
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.53

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        2.02     9.39        1.150         1.90
      2        1.53     6.76        1.356         1.25

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        2.98     6.76       1.356
      2        3.31     9.39       1.150

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       3.31   Tc(MIN.) =    9.39
  TOTAL AREA(ACRES) =        3.2
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    302.00 =     723.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    402.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1549.89  DOWNSTREAM(FEET) =  1548.20
  FLOW LENGTH(FEET) =   202.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.99
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.31
  PIPE TRAVEL TIME(MIN.) =   0.67    Tc(MIN.) =   10.06
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    402.00 =     925.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.06
  RAINFALL INTENSITY(INCH/HR) =   1.11
  TOTAL STREAM AREA(ACRES) =     3.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.31

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   232.00
  UPSTREAM ELEVATION(FEET) =   1555.98
  DOWNSTREAM ELEVATION(FEET) =   1552.98
  ELEVATION DIFFERENCE(FEET) =      3.00
  TC = 0.303*[(  232.00**3)/(     3.00)]**.2 =    6.389
     2 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.394
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8730
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      2.07
  TOTAL AREA(ACRES) =      1.70   TOTAL RUNOFF(CFS) =      2.07

****************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1548.98  DOWNSTREAM(FEET) =  1548.20
  FLOW LENGTH(FEET) =    75.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.98
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       2.07
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =    6.64
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =     307.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.64
  RAINFALL INTENSITY(INCH/HR) =   1.37
  TOTAL STREAM AREA(ACRES) =     1.70
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.07

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        3.31    10.06        1.111          3.15
      2        2.07     6.64        1.368          1.70

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        4.25     6.64       1.368
      2        4.99    10.06       1.111

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.99   Tc(MIN.) =   10.06
  TOTAL AREA(ACRES) =        4.9
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    402.00 =     925.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =  1548.20  DOWNSTREAM(FEET) =  1547.63
  FLOW LENGTH(FEET) =   108.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.80
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.99
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =   10.44
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    403.00 =    1033.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        4.99    10.44       1.091        4.85
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    403.00 =    1033.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
      1        2.53    11.26       1.050        2.45
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    403.00 =    1001.00 FEET.

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
      1       7.33      10.44        1.091
      2       7.33      11.26        1.050

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.33   Tc(MIN.) =   10.44
  TOTAL AREA(ACRES) =        7.3

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1547.63  DOWNSTREAM(FEET) =  1535.09
  FLOW LENGTH(FEET) =   167.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  14.25
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.33
  PIPE TRAVEL TIME(MIN.) =   0.20    Tc(MIN.) =   10.63
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    404.00 =    1200.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        7.3  TC(MIN.) =     10.63
  PEAK FLOW RATE(CFS)   =       7.33
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

↑
```

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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☒ M. **Loading Docks**	☒ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ☐ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ☐ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		☒ **Move loaded and unloaded items indoors as soon as possible.** ☒ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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☐ 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.**	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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☒ 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

Operation and Maintenance Plan

Project Title: LCD - Alessandro

Contact Information:

Prepared for:
LDC Industrial Realty, LLC
555 N. El Camino Real, #A456
San Clemente, CA 92672
(949) 226-4601
Contact: Larry D. Cochrun

Prepared by:
Thienes Engineering, Inc.
14349 Firestone Boulevard
La Mirada, CA 90638
(714) 521-4811
Contact: Luis Prado
(luisp@thieneseng.com)
Job No. 3846

Original Date Prepared: December 28, 2020

Revision Date(s): ____________________

Revision Date(s): ____________________

Revision Date(s): ____________________

Revision Date(s): ____________________

Table of Contents

List of Appendices

I. Inspection and Maintenance Log

Date	Observations/Actions	Inspector

Additional inspection and maintenance logs to be included in Appendix 1 of this O&M Plan.

II. Updates, Revisions, and Errata

Revision Number	Date	Brief Description of Update/Revision/Errata, include section and page number	Prepared and Approved By

Additional updates, revisions, and errata to be include in Appendix 2 of this O&M Plan.

III. Introduction

Proposed improvements to the site consist of the construction of one warehouse type building with an area of 161,660 square feet.

The overall project encompasses approximately 8.57 acres of improvements which includes 8.05 acres of onsite work and 0.52 acres of offsite work along Alessandro Boulevard. There will be a truck yard on the west side of the building and vehicle parking lot along the north and east sides of the building. A set of underground chambers, servicing the entire site, is located in the truck yard. The remainder of the site will be reserved for landscaping.

In addition, the disturbed area along Alessandro Boulevard will drain to three bioretention facilities located within the right-of-way. Treated flows will be conveyed via a proposed storm drain to the back of the proposed public catch basin in Alessandro Boulevard.

Existing Conditions

The entire project site (onsite) is currently an undeveloped dirt lot (8.05 acres) with no impervious areas. The site can be divided into two drainage zones. The northwestern portion of the site sheet flows onto Day Street. The remaining southeastern portion of the site sheet flows onto Alessandro Boulevard.

Proposed Conditions

Runoff from the easterly portion of the building and the easterly vehicle parking lot will drain to a catch basin in the vehicle parking lot. Runoff is then conveyed westerly via a proposed onsite storm drain (easterly storm drain). A proposed diversion manhole structure will direct the DCV to the underground chambers in the truck yard. Once the DCV is met, additional flows will continue to drain westerly.

Runoff from the westerly portion of the building, the northerly vehicle parking lot and the truck yard will drain to several catch basins in the northerly vehicle parking lot and truck yard. Runoff will then be conveyed southerly via another proposed onsite storm drain (westerly storm drain). Another proposed diversion manhole will direct the DCV to the same underground chambers in the truck yard. Once the DCV is met, additional flows will continue to drain southerly.

Runoff from both proposed onsite storm drains confluence near the southwest corner of the site before discharging offsite into the proposed public storm drain in Day Street.

Approximately 0.65 acres of landscaped areas (and driveway approaches) fronting Day Street and Alessandro Boulevard will sheet flow offsite. The landscaped areas are considered self-treating areas.

IV. Responsibility for Maintenance

IV.A General

Funding will be provided by the owner:

LDC Industrial Realty, LLC
555 N. El Camino Real, #A456
San Clemente, CA 92672
(949) 226-4601
Contact: Larry D. Cochrun

A copy of the Covenant Agreement will be attached in Appendix 3 of this O&M Plan.

IV.B Staff Training Program

Staff training records and descriptions will be inserted in Appendix 4 of this O&M Plan.

IV.C Records

Maintenance records are to be inserted chronologically in Appendix 1 of this O&M Plan.

IV.D Safety

All maintenance procedures shall comply with the latest OSHA standards.

V. Summary of Drainage Management Areas and Stormwater BMPs

V.A Drainage Areas

See Appendix 5 of this O&M Plan for WQMP site map.

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	Area (Acres)	DMA Type
A1	Roofs/Conc/Asphalt	307,098	7.05	Type D
A2	Ornamental Landscaping	15,246	0.35	Type D
B1	Concrete or Asphalt	20,473	0.47	Type D
B2	Ornamental Landscaping	2,178	0.05	Type D
C	Ornamental Landscaping	13,068	0.30	Type A
D	Ornamental Landscaping	15,246	0.35	Type A

DMA Name or ID	BMP Name or ID	Type of Stormwater BMP	Location of DMA	Pervious Areas (ac.)	Impervious Areas (ac.)	Geo-Location of BMPs	
						Latitude	
A1	STC "A"	Underground Chambers	DMA A1 consists of roof area, concrete and asphalt parking/drive aisles (which is the majority of the project site).	*0.00*	*7.05*	33.917710	-117.278446
A2			DMA A2 consists of landscaping located at the parking lot areas, along the building edges and along the project boundaries.	*0.35*	*0.00*		
B1	STREET BIO "B"	Bioretention	DMA B1 consists of asphalt pavement in the street, curb and gutter, and sidewalk. These areas are located within the northerly half of Alessandro Boulevard.	*0.47*	*0.00*	33.917072 33.917064 33.917062	-117.278077 -117.277698 -117.277226
B2			DMA D2 consists of landscaping along the parkway area in Alessandro Boulevard.	*0.00*	*0.05*		

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

V.B Structural Post-Construction BMPs

See Appendix 5 of this O&M Plan for WQMP site map.

Additional BMP details are available in Appendix 10 of the WQMP.

V.C Self-Retaining Areas or Other

DMA B is considered self-treating areas which will be maintained with normal landscape maintenance.

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
C	13,068	Drought Tolerant	Timed Sprinklers
D	15,246	Drought Tolerant	Timed Sprinklers

VI. Stormwater BMP Design Documentation

VI.A "As-Built" Drawings of each Stormwater BMP

See Appendix 6 of this O&M Plan for "as-built" drawings.

VI.B Manufacturer's Data, Manuals, and Maintenance Requirements

Not applicable, there are no manufactured stormwater BMPs.

VI.C Specific Operation and Maintenance Concerns and Troubleshooting

Not applicable.

VII. Maintenance Schedule or Matrix

VII.A Maintenance Schedule

Schedule (Underground Retention Facility)	**Inspection and Maintenance Activity (Underground Retention Facility)**
The isolator row shall be inspected semi-annually (by October 1st and February 1st) and cleaned by water-flush and vacuum when solids accumulate to 3" depth. Maintenance to be conducted through service contract with the vendor or equally qualified contractor.	The isolator row shall be inspected for debris and sediment accumulations and maintained by a qualified technician and he/she will properly dispose of all wastes and inspect for standing water. A manhole is installed in order to inspect and maintain the inlet row. All entry into the chamber system must be done per OSHA codes to ensure operator and inspector safety. Inspection ports should be checked 48 hours after storm events to see that the water is draining down, at least once each rainy season, following a major storm event. Records shall be maintained by owner to document inspections.
Schedule (Bioretention)	**Inspection and Maintenance Activity (Bioretention)**
Ongoing	• Keep adjacent landscape areas maintained. Remove clippings from landscape maintenance activities. • Remove trash and debris • Replace damaged grass and/or plants • Replace surface mulch layer as needed to maintain a 2-3 inch soil cover.
After storm events	• Inspect areas for ponding
Annually	• Inspect/clean inlets and outlets

Source Control BMPs

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	• Mark all inlets with the words “Only Rain Down the Storm Drain” or similar.	• Maintain and periodically repaint or replace inlet markings annually. • Provide stormwater pollution prevention information to new site owners, lessees, or operators upon occupancy and annually thereafter. • See CASQA fact sheet SC-44 for “Drainage System Maintenance,” included in Appendix of this document. • Include the following lease agreements: “Tenant shall not allow anyone to discharge anything to storm drain 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	• Interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.	• Inspect and maintain drains semi-annually to prevent blockages and overflow.

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
D2. Landscape / Outdoor Pesticide Use	• Landscape plans will minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. • Pest-resistant plans will be used adjacent to hardscape. • The landscape plans will consider plants appropriate to the site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	• Maintain landscaping only using minimum pesticides, when needed. • See Appendix 10 for "Landscape and Gardening" brochure by RCFlood. • Provide Integrated Pest Management (IPM) information to new owners, lessees and operators upon occupancy and annually thereafter. IPM is an effective and environmentally sensitive approach to pest management.
G. Refuse Areas	• Site refuse will be handled by contractor on a weekly basis. • Signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	• A minimum of two receptacles will be provided and locate dindoors. Receptacles are to be inspected daily and repairs or replacements to leaky receptacles will be completed immediately. Receptacles are to remain covered with not in use. Dumping of liquid or hazardous wastes is prohibited. A "no hazardous materials" sign will be posted. Spills will be cleaned immediately upon discovery. Spill control materials will be available onsite. See Appendix 10 for CASQA fact sheet SC-34 for "Waste Handling and Disposal."
H. Industrial processes	• All process activities to be performed indoors. No processes to drain to exterior or to storm drain system.	• See Appendix 10 for CASQA fact sheet SC-10 for "Non-Stormwater Discharges"
M. Loading Docks	• Spills will be cleaned up immediately and disposed of properly.	• Move loaded and unloaded items indoors as soon as possible. • See Appendix 10 for CASQA fact sheet SC-30 for "Outdoor Loading and Unloading"
P. Plazas, sidewalks, and parking lots		• Sweep plazas, sidewalks, and parking lots monthly 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.

VII.B Service Agreement Information

See Appendix 8 of this O&M Plan for service agreement information with any contractors regarding the O&M of BMPs at the site, if any.

Appendix 1: Inspection and Maintenance Logs

Insert Additional Inspection or Maintenance Logs Here

Date	Observations/Actions	Inspector

Appendix 2: Updates, Revisions, and Errata

Insert Additional Updates, Revisions, and Errata Logs Here

Revision Number	Date	Brief Description of Update/Revision/Errata, include section and page number	Prepared and Approved By

Appendix 3: Maintenance Mechanism

Copy of Covenant Agreement
Establishing Notification Process And Responsibility
For Water Quality Management Plan Implementation And Maintenance

MAINTENANCE AGREEMENTS AND O&M DOCUMENTS WILL BE PROVIDED WITH FWQMP SUBMITTAL

Notification Process and Responsibility

1. Name: ____________________
Title: ____________________
Phone: ____________________

<u>WQMP Responsibilities:</u>
(1) Routine inspections to evaluate BMP effectiveness.
(2) Identifying when BMPs require maintenance.
(3) Working with qualified contractors to maintain the BMP.
(4) Recordkeeping of inspections and maintenance activities.

2. Name: ____________________
Title: ____________________
Phone: ____________________

<u>WQMP Responsibilities:</u>
(1) Cleaning, repairing, servicing, and maintenance of BMP.

3. Name: ____________________
Title: ____________________
Phone: ____________________

<u>WQMP Responsibilities:</u>
(1) In event of failure, and with City Engineer’s authorization, modify or replace with an upgraded BMP to prevent future failure.
(2) Notify successors of BMPs and maintenance requirements.

RECORDING REQUESTED BY
AND WHEN RECORDED MAIL TO:

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

EXEMPT FROM FEE PER G.C. Section 6103

SPACE ABOVE THIS LINE FOR RECORDER'S USE

STORMWATER TREATMENT DEVICE AND CONTROL MEASURE ACCESS AND MAINTENANCE COVENANT

Assessor’s Parcel Number(s) **291-191-04, -07, -08, -09, -10, -11, -12, -13, -25, -26, -27, -28 and -29**

THIS INSTRUMENT is made and entered into this _______ day of _________________ 20**21**, by and between **LDC Industrial Realty, LLC** hereinafter referred to as "Owner," and the City of Moreno Valley, a municipal corporation, hereinafter referred to as "City."

RECITALS

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

WHEREAS, at the time of approval of the development project known as **PEN20-0162: LDC - Alessandro** (the "Project") for the Property, the City required the Project to employ on-site storm water and non-storm water control measures to mitigate the Project impacts to water quality and minimize pollutants in urban storm water runoff; and

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

WHEREAS, the Owner has chosen to install **one (1) underground infiltration facility and three (3) offsite bioretention facilities**, hereinafter referred to as the "Device" and other control measures all as described in the Final Water Quality Management Plan (WQMP) and depicted on Exhibit B to minimize pollutants in urban storm water and non-storm water runoff; and

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

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

WHEREAS, the Owner is aware that periodic and continuous maintenance including, but not necessarily limited to, filter material replacement and sediment removal is required to assure discharges from the Device, other control measures and the Project are in compliance with the City's Municipal Code for storm water and non-storm water discharges and that such maintenance activity will require compliance with all Federal, State and local laws and regulations, including those pertaining to confined space and waste disposal methods in effect at the time such maintenance occurs;

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

1. The Owner hereby provides the City and its designees with full right of access to the Device and other control measures and the immediate vicinity of the property at any time, upon reasonable notice; or in the event of emergency, as determined by City's Public Works Director/City Engineer or designees, no advance notice;

for the purpose of inspection, sampling and testing of the Device and other control measures, and in cases of emergency, where the public health, safety, or welfare is compromised, such emergency shall be declared a "nuisance" as defined in the Municipal Code. Such conditions that created the emergency shall be abated as provided for in the Municipal Code and at the Owner's expense as provided for in Section 3, below.

2. The Owner shall diligently maintain the Device and other control measures in a manner assuring all discharges from the Device, other control measures and the Project are in compliance with the Municipal Code for storm water and non-storm water discharges at all times. All reasonable precautions shall be exercised by the Owner and the Owner's representatives in the removal and extraction of materials from the Device and other control measures, and the ultimate disposal of the materials in a manner consistent with all applicable laws. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the materials removed, the quantity and the recycle of disposal destinations, as appropriate.

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

4. This Instrument shall be recorded in the Official Records of the County of Riverside at the expense of the Owner and shall constitute notice to all successors and assigns to the title to the Property of the obligations herein set forth. This Instrument shall also constitute the right for the City of Moreno Valley to file a lien against the Property in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

5. It is the intent of the Owner that the burdens and benefits herein undertaken shall constitute covenants that run with the Property and shall constitute the right for the City of Moreno Valley to file a lien against the Property.

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

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

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

9. Any notice to a party required or called for in this Instrument shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change notice address only by providing written notice thereof to the other party.

CITY:	OWNER:
Public Works Director/City Engineer	Name: TBD
City of Moreno Valley	Company: LDC Industrial Realty, LLC
PO Box 88005	Address: 555 N. El Camino Real
14177 Frederick Street	Suite #A456
Moreno Valley, CA 92552-0805	City/State/ZIP: San Clemente, CA 92672

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

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

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

OWNER:

____
TBD, [title]

LDC INDUSTRIAL REALTY, LLC

CITY:

CITY OF MORENO VALLEY

APPROVED AS TO FORM:

____
City Attorney

By: ________________________________ Date: ____________________
Mike Lee, City Manager

Attest:

By: ________________________________ Date: ____________________
Pat Jacquez-Nares, City Clerk

O:\2800-2899\2890\2890d\WQMP\2018-10-01 Maintenance Agreement (blank)\Appendix 3 - Maintenance Agreement.doc

Appendix 4: Training Records

Insert Training Records with Brief Discussion Here

Appendix 5: Site Plan and Details

WQMP Site Map and BMP Details

Appendix 6: “As-Built” Drawings

Insert “As-Builts” Here When Available

Appendix 7: Manufacturer Information

Brochures, Manuals, and Maintenance Requirements

Appendix 8: Service Agreement Information

Insert Contractor Information (if any)

Appendix 10: Educational Materials

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

3.1 INFILTRATION BASIN

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evapotranspiration (when vegetated), Evaporation, and Sedimentation
Maximum Treatment Area	50 acres
Other Names	Bioinfiltration Basin

Description

Figure 1 – Infiltration Basin

An Infiltration Basin is a flat earthen basin designed to capture the design capture volume, V_{BMP}. The stormwater infiltrates through the bottom of the basin into the underlying soil over a 72 hour drawdown period. Flows exceeding V_{BMP} must discharge to a downstream conveyance system. Trash and sediment accumulate within the forebay as stormwater passes into the basin. Infiltration basins are highly effective in removing all targeted pollutants from stormwater runoff.

See Appendix A, and Appendix C, Section 1 of *Basin Guidelines*, for additional requirements.

Siting Considerations

The use of infiltration basins may be restricted by concerns over ground water contamination, soil permeability, and clogging at the site. See the applicable WQMP for any specific feasibility considerations for using infiltration BMPs. Where this BMP is being used, the soil beneath the basin must be thoroughly evaluated in a geotechnical report since the underlying soils are critical to the basin’s long term performance. To protect the basin from erosion, the sides and bottom of the basin must be vegetated, preferably with native or low water use plant species.

In addition, these basins may not be appropriate for the following site conditions:

- Industrial sites or locations where spills of toxic materials may occur
- Sites with very low soil infiltration rates
- Sites with high groundwater tables or excessively high soil infiltration rates, where pollutants can affect ground water quality
- Sites with unstabilized soil or construction activity upstream
- On steeply sloping terrain
- Infiltration basins located in a fill condition should refer to Appendix A of this Handbook for details on special requirements/restrictions

Setbacks

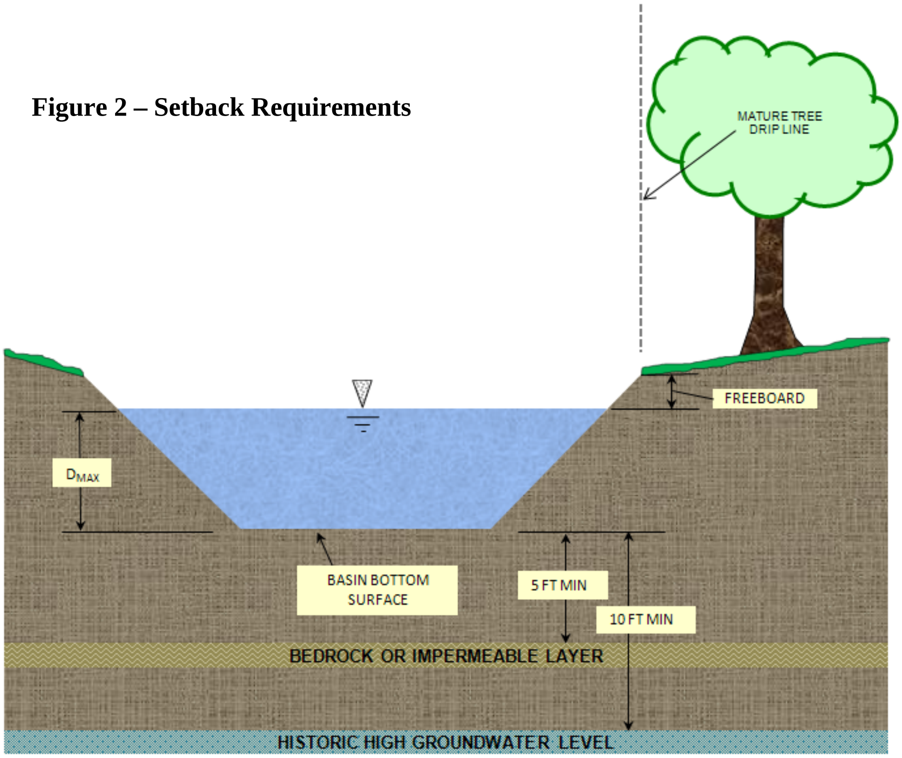
Always consult your geotechnical engineer for site specific recommendations regarding setbacks for infiltration trenches. Recommended setbacks are needed to protect buildings, existing trees, walls, onsite or nearby wells, streams, and tanks. Setbacks should be considered early in the design process since they can affect where infiltration facilities may be placed and how deep they are allowed to be. For instance, depth setbacks can dictate fairly shallow facilities that will have a larger footprint and, in some cases, may make an infiltration basin infeasible. In that instance, another BMP must be selected.

Infiltration basins typically must be set back:

- 10 feet from the historic high groundwater (measured vertically from the bottom of the basin, as shown in Figure 2)
- 5 feet from bedrock or impermeable surface layer (measured vertically from the bottom of the basin, as shown in Figure 2)
- From all existing mature tree drip lines as indicated in Figure 2 (to protect their root structure)
- 100 feet horizontally from wells, tanks or springs

Setbacks to walls and foundations must be included as part of the Geotechnical Report. All other setbacks shall be in accordance with applicable standards of the District's *Basin Guidelines* (Appendix C).

Figure 2 – Setback Requirements



Forebay

A concrete forebay shall be provided to reduce sediment clogging and to reduce erosion. The forebay shall have a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall / berm. Full height notch-type weir(s), offset from the line of flow from the basin inlet to prevent short circuiting, shall be used to outlet the forebay. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

Overflow

Flows exceeding V_{BMP} must discharge to an acceptable downstream conveyance system. Where an adequate outlet is present, an overflow structure may be used. Where an embankment is present, an emergency spillway may be used instead. Overflows must be placed just above the design water surface for V_{BMP} and be near the outlet of the system. The overflow structure shall be similar to the District's Standard Drawing CB 110. Additional details may be found in the District's *Basin Guidelines* (Appendix C).

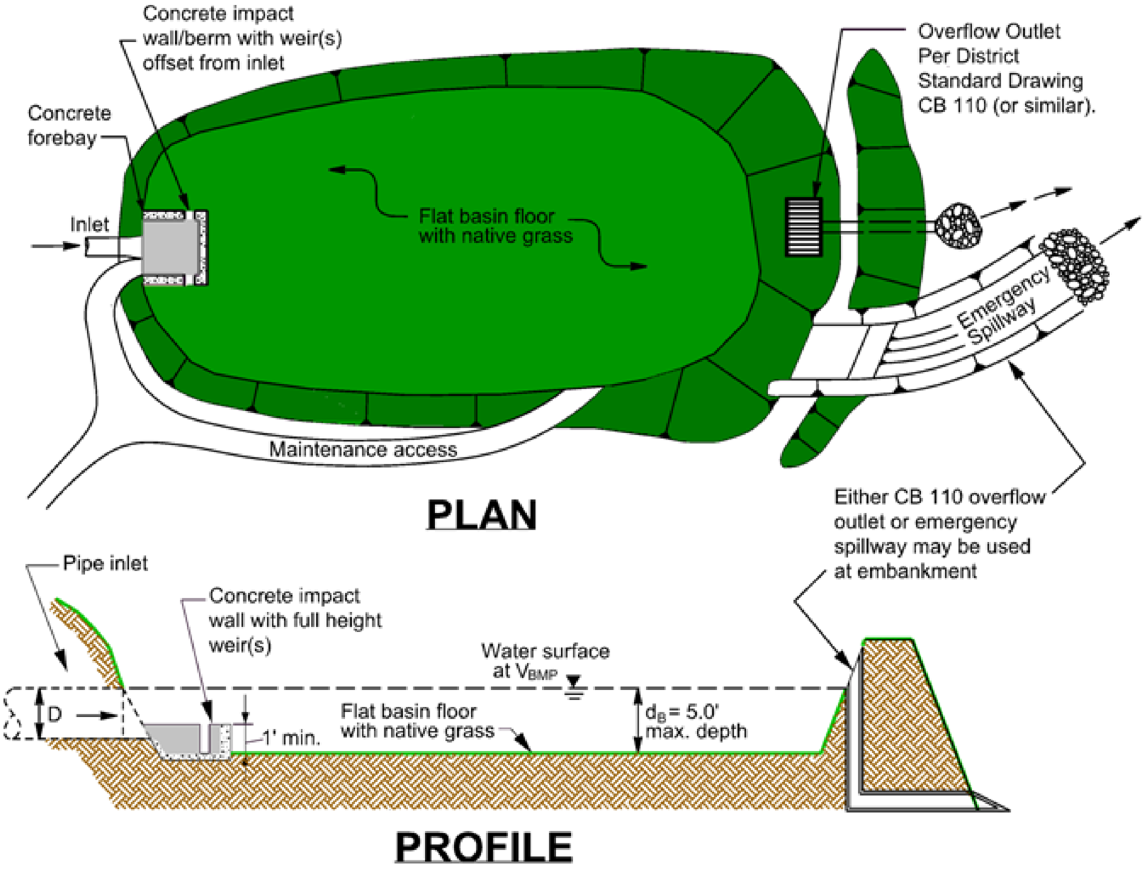


Figure 3 – Infiltration Basin

Landscaping Requirements

Basin vegetation provides erosion protection, improves sediment removal and assists in allowing infiltration to occur. The basin surface and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with County of Riverside Ordinance 859 and the District's *Basin Guidelines* (Appendix C), or other guidelines issued by the Engineering Authority.

Maintenance

Normal maintenance of an infiltration basin includes the maintenance of landscaping, debris and trash removal from the surface of the basin, and tending to problems associated with standing water (vectors, odors, etc.). Significant ponding, especially more than 72 hours after an event, may indicate that the basin surface is no longer providing sufficient infiltration and requires aeration. See the District's *Basin Guidelines* (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.).

Table 1 - Inspection and Maintenance

Schedule	Inspection and Maintenance Activity
Ongoing including just before annual storm seasons and following rainfall events.	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strenuously avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used, o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rain season. • Remove debris and litter from the entire basin to minimize clogging and improve aesthetics. • Check for obvious problems and repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. There should be no long-term ponding water. • Check for erosion and sediment laden areas in the basin. Repair as needed. Clean forebay if needed. • Revegetate side slopes where needed.
Annually. If possible, schedule these inspections within 72 hours after a significant rainfall.	• Inspection of hydraulic and structural facilities. Examine the inlet for blockage, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Check basin depth for sediment build up and reduced total capacity. Scrape bottom as needed and remove sediment. Restore to original cross-section and infiltration rate. Replant basin vegetation. • Verify the basin bottom is allowing acceptable infiltration. Use a disc or other method to aerate basin bottom only if there is actual significant loss of infiltrative capacity, rather than on a routine basis[1]. • No water should be present 72 hours after an event. No long term standing water should be present at all. No algae formation should be visible. Correct problem as needed.
1. CA Stormwater BMP Handbook for New Development and Significant Redevelopment	

Table 2 - Design and Sizing Criteria for Infiltration Basins

Design Parameter	Infiltration Basin
Design Volume	V_{BMP}
Forebay Volume	0.5% V_{BMP}
Drawdown time (maximum)	72 hours
Maximum tributary area	50 acres [2]
Minimum infiltration rate	Must be sufficient to drain the basin within the required Drawdown time over the life of the BMP. The WQMP may include specific requirements for minimum tested infiltration rates.
Maximum Depth	5 feet
Spillway erosion control	Energy dissipators to reduce velocities[1]
Basin Slope	0%
Freeboard (minimum)	1 foot [1]
Historic High Groundwater Setback (max)	10 feet
Bedrock/impermeable layer setback (max)	5 feet
Tree setbacks	Mature tree drip line must not overhang the basin
Set back from wells, tanks or springs	100 feet
Set back from foundations	As recommended in Geotechnical Report

1. Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures
2. CA Stormwater BMP Handbook for New Development and Significant Redevelopment

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the District's Basin Guidelines (Appendix C). In addition, information herein may be superseded by other guidelines issued by the co-permittee.

INFILTRATION BASIN SIZING PROCEDURE

1. Find the Design Volume, V_{BMP}.
    a) Enter the Tributary Area, A_T.
    b) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.
2. Determine the Maximum Depth.
    a) Enter the infiltration rate. The infiltration rate shall be established as described in Appendix A: "Infiltration Testing".
    b) Enter the design Factor of Safety from Table 1 in Appendix A: "Infiltration Testing".
    c) The spreadsheet will determine D_1, the maximum allowable depth of the basin based on the infiltration rate along with the maximum drawdown time (72 hours) and the Factor of Safety.

$$D_1 = [(t) \times (I)] / 12s$$

Where I = site infiltration rate (in/hr)
s = safety factor
t = drawdown time (maximum 72 hours)

d) Enter the depth of freeboard.

e) Enter the depth to the historic high groundwater level measured from the top of the basin.

f) Enter the depth to the top of bedrock or other impermeable layer measured from the finished grade.

g) The spreadsheet will determine D_2, the total basin depth (including freeboard, if used) of the basin, based on restrictions to the depth by groundwater and an impermeable layer.

$$D_2 = \text{Depth to groundwater} - (10 + \text{freeboard}) \text{ (ft)};$$

or

$$D_2 = \text{Depth to impermeable layer} - (5 + \text{freeboard}) \text{ (ft)}$$

Whichever is least.

h) The spreadsheet will determine the maximum allowable effective depth of basin, D_{MAX}, based on the smallest value between D_1 and D_2. D_{MAX} is the maximum depth of water only and does not include freeboard. D_{MAX} shall not exceed 5 feet.

3. Basin Geometry

a) Enter the basin side slopes, z (no steeper than 4:1).

b) Enter the proposed basin depth, d_B excluding freeboard.

c) The spreadsheet will determine the minimum required surface area of the basin:

$$A_s = V_{BMP} / d_B$$

Where A_s = minimum area required (ft^2)
V_{BMP} = volume of the infiltration basin (ft^3)
d_B= proposed depth not to exceed maximum allowable depth, D_{MAX} (ft)

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

4. Forebay

A concrete forebay with a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall shall be provided. Full-height rectangular weir(s) shall be used to outlet the forebay. The weir(s) must be offset from the line of flow from the basin inlet. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

a) The spreadsheet will determine the minimum required forebay volume based on 0.5% V_{BMP}.

b) Enter the proposed depth of the forebay berm/splashwall (1foot minimum).

c) The spreadsheet will determine the minimum required forebay surface area.

d) Enter the width of rectangular weir to be used (minimum 1.5 inches). Weir width should be established based on a 5 minute drawdown time.

StormTech®
Detention • Retention • Water Quality
An ADS company

Isolator® Row O&M Manual

THE MOST *ADVANCED* NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

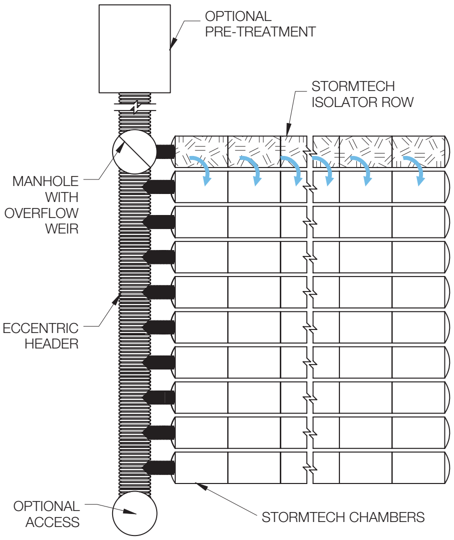
The Isolator Row is typically designed to capture the “first flush” and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

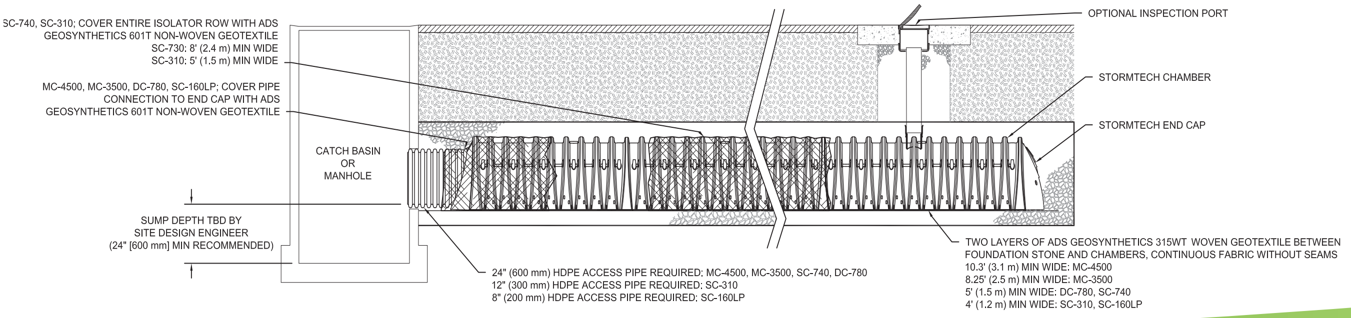
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row for sediment.

- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row using the JetVac process.

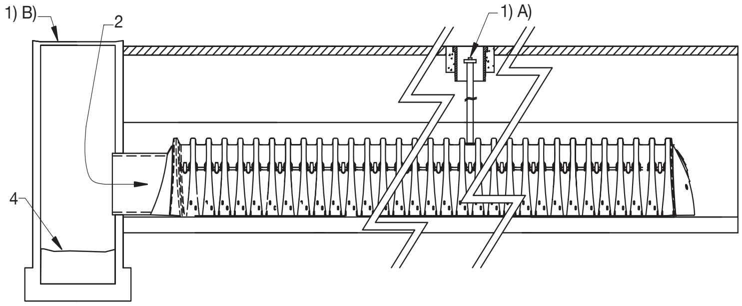
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

3.5 Bioretention Facility

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

Description

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

Siting Considerations

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

- ✓ Parking islands
- ✓ Medians
- ✓ Site entrances

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

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

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

Design and Sizing Criteria

The recommended cross section necessary for a Bioretention Facility includes:

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

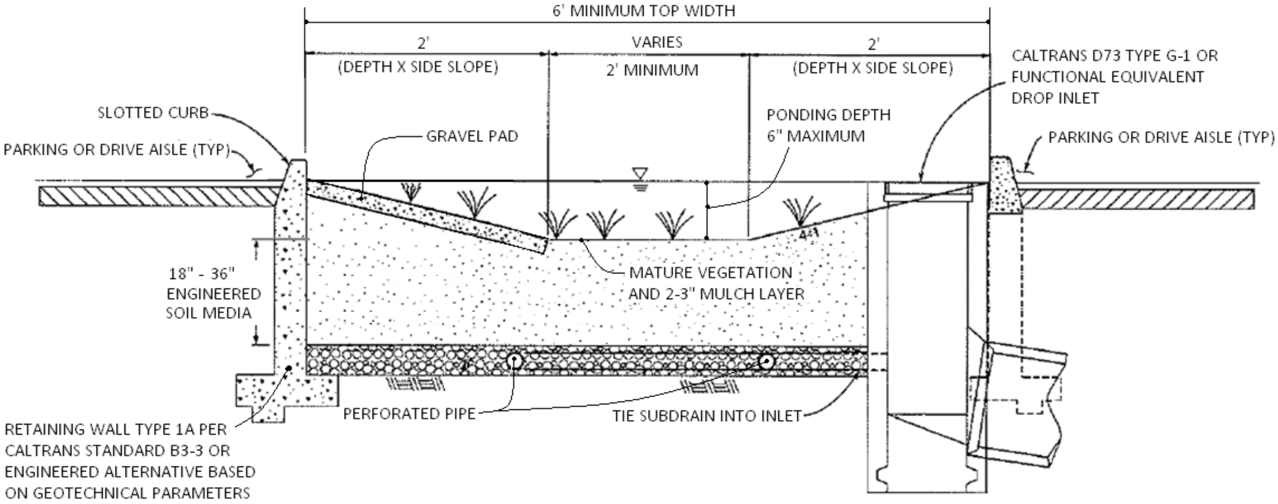

Figure 1: Standard Layout for a Bioretention Facility

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

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

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

Engineered Soil Media Requirements

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

Table 1: Mineral Component Range Requirements

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

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

Vegetation Requirements

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

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

Curb Cuts

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

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

Figure 2: Curb Cut located in a Bioretention Facility

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

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

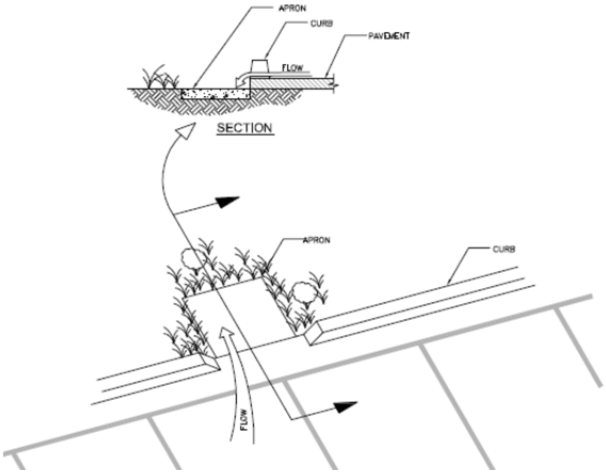


Figure 3: Apron located in a Bioretention Facility

Terracing the Landscaped Filter Basin

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

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

Table 2: Check Dam Spacing

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

Roof Runoff

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

Retaining Walls

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

Side Slope Requirements

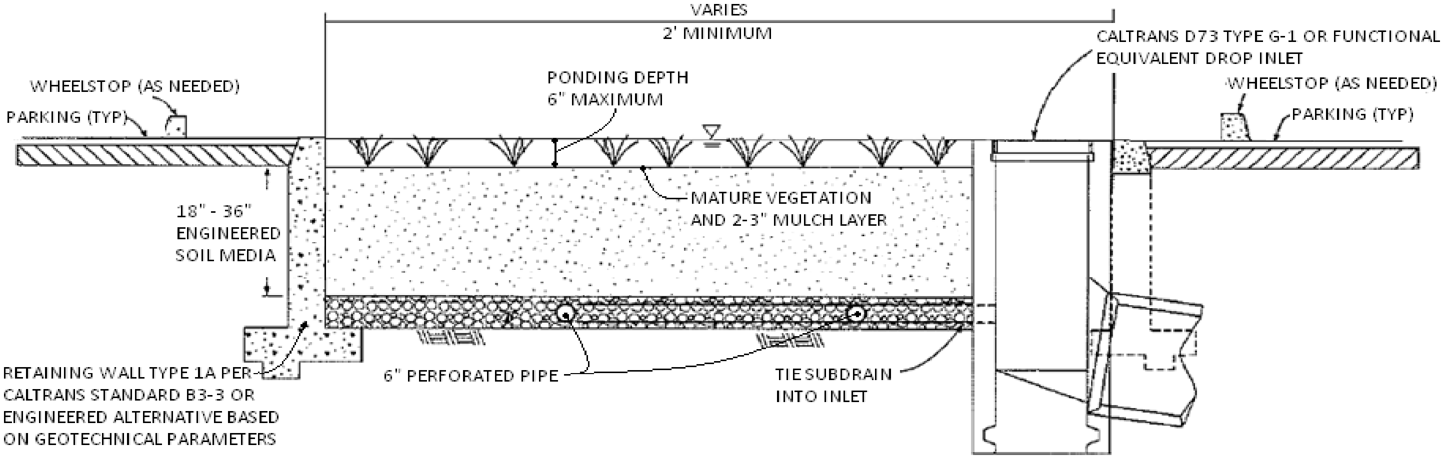
Bioretention Facilities Requiring Side Slopes

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

Bioretention Facilities Not Requiring Side Slopes

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

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



Planter Boxes

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

Figure 5: Planter Box

Source: LA Team Effort

Overflow

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

Underdrain Gravel and Pipes

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

Figure 6: Incorrect Placement of an Overflow Inlet.

Inspection and Maintenance Schedule

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

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

Bioretention Facility Design Procedure

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

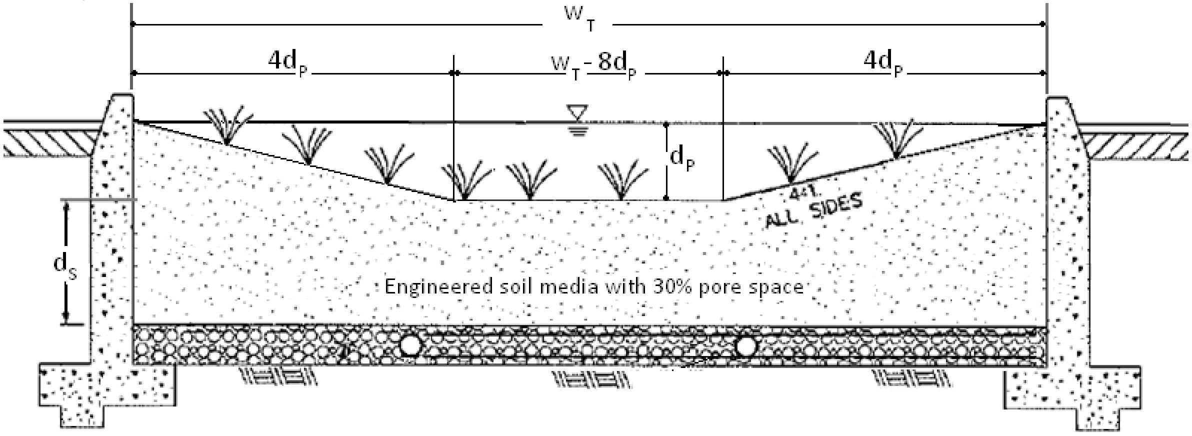
2) Enter the Design Volume, $V_{BMP,}$ determined from Section 2.1 of this Handbook.

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

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

5) Enter the top width of the Bioretention Facility.

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



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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13) Describe the vegetation used within the Bioretention Facility.

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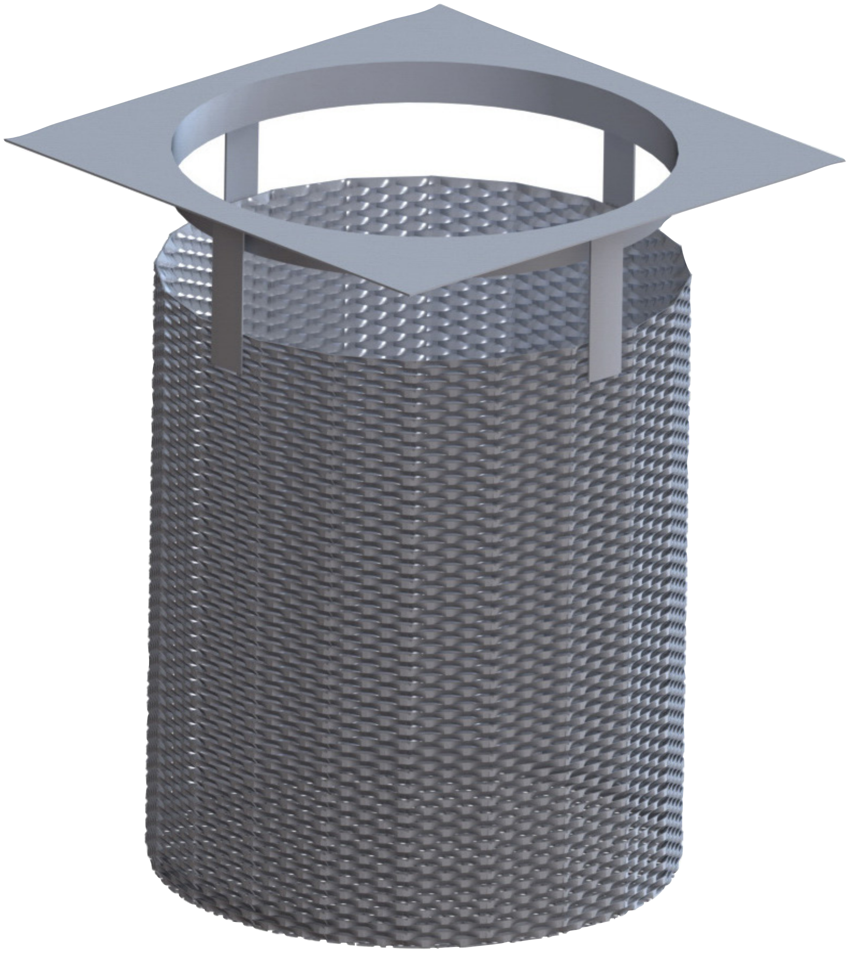
Grate Inlet Filter

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE



Bio Clean Environmental Services, Inc.
398 Via El Centro
Oceanside, CA 92058

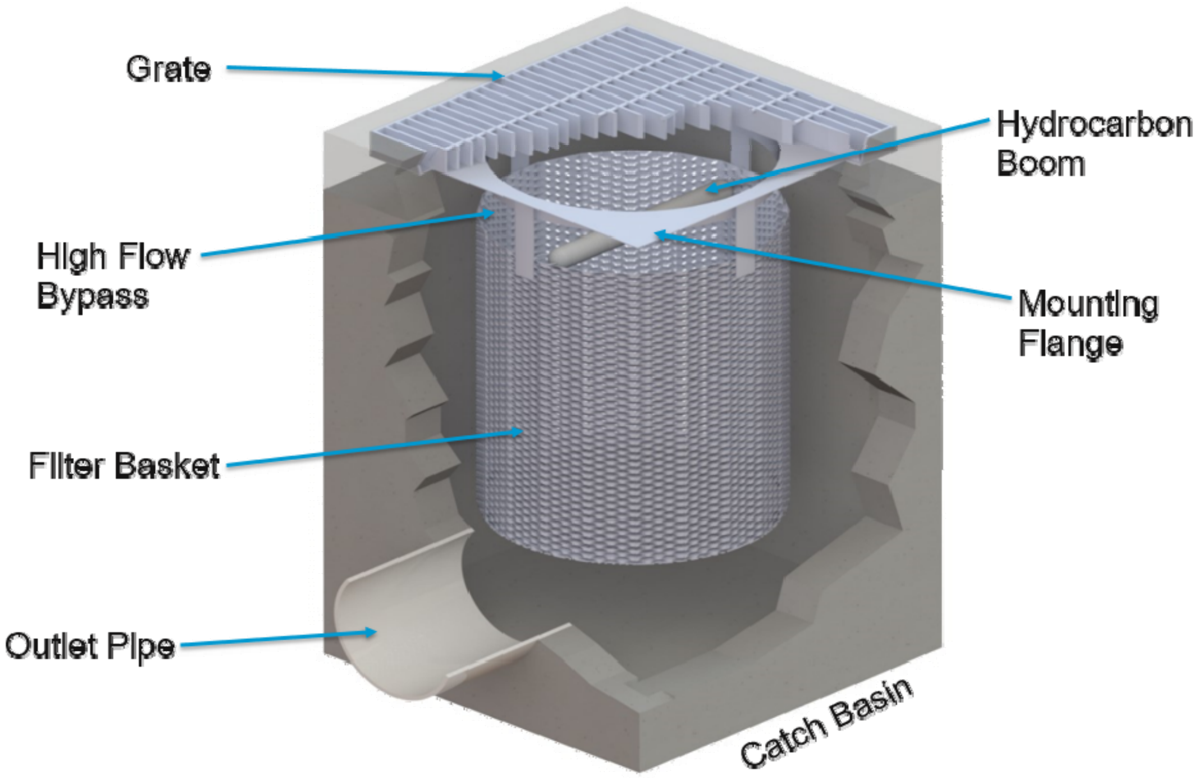
www.BioCleanEnvironmental.com
p: 760.433.7640
f: 760.433.3176

Bio Clean
A Forterra Company

OPERATION & MAINTENANCE

The Bio Clean Grate Inlet Filter is a stormwater device designed to remove high levels of trash, debris, sediments and hydrocarbons. The filter is available in several configurations including trash full capture, multi-level screening, Kraken membrane filter and media filter variations. This manual covers maintenance procedures of the trash full capture and multi-level screening configurations. A supplemental manual is available for the Kraken and media filter variations. This filter is made of 100% stainless steel and is available and various sizes and depths allowing it to fit in any grated catch basin inlet. The filters heavy duty construction allows for cleaning with any vacuum truck. The filet can also easily be cleaned by hand.

As with all stormwater BMPs, inspection and maintenance on the Grate Inlet Filter is necessary. Stormwater regulations require BMPs be inspected and maintained to ensure they are operating as designed to allow for effective pollutant removal and provide protection to receiving water bodies. It is recommended that inspections be performed multiple times during the first year to assess site-specific loading conditions. This is recommended because pollutant loading can vary greatly from site to site. Variables such as nearby soil erosion or construction sites, winter sanding of roads, amount of daily traffic and land use can increase pollutant loading on the system. The first year of inspections can be used to set inspection and maintenance intervals for subsequent years. Without appropriate maintenance a BMP can exceed its storage capacity which can negatively affect its continued performance in removing and retaining captured pollutants.



System Diagram:

Inspection Equipment

Following is a list of equipment to allow for simple and effective inspection of the Grate Inlet Filter:

- Bio Clean Environmental Inspection Form (contained within this manual).
- Manhole hook or appropriate tools to remove access hatches and covers.
- Appropriate traffic control signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine inspections or maintenance of the system.

Inspection Steps

The core to any successful stormwater BMP maintenance program is routine inspections. The inspection steps required on the Grate Inlet Filter are quick and easy. As mentioned above the first year should be seen as the maintenance interval establishment phase. During the first year more frequent inspections should occur in order to gather loading data and maintenance requirements for that specific site. This information can be used to establish a base for long-term inspection and maintenance interval requirements.

The Grate Inlet Filter can be inspected though visual observation. All necessary pre-inspection steps must be carried out before inspection occurs, such as safety measures to protect the inspector and nearby pedestrians from any dangers associated with an open grated inlet. Once the grate has been safely removed the inspection process can proceed:

- Prepare the inspection form by writing in the necessary information including project name, location, date & time, unit number and other info (see inspection form).
- Observe the filter with the grate removed.
- Look for any out of the ordinary obstructions on the grate or in the filter and its bypass. Write down any observations on the inspection form.
- Through observation and/or digital photographs estimate the amount of trash, foliage and sediment accumulated inside the filter basket. Record this information on the inspection form.
- Observe the condition and color of the hydrocarbon boom. Record this information on the inspection form.
- Finalize inspection report for analysis by the maintenance manager to determine if maintenance is required.

Maintenance Indicators

Based upon observations made during inspection, maintenance of the system may be required based on the following indicators:

- Missing or damaged internal components.
- Obstructions in the filter basket and its bypass.
- Excessive accumulation of trash, foliage and sediment in the filter basket. Maintenance is required when the basket is greater than half-full.
- The following chart shows the 50% and 100% storage capacity of each filter height:

Model	Filter Basket Diameter (in)	Filter Basket Height (in)	50% Storage Capacity (cu ft)	100% Storage Capacity (cu ft)
BC-GRATE-12-12-12	10.00	12.00	0.27	0.55
BC-GRATE-18-18-18	16.00	18.00	1.05	2.09
BC-GRATE-24-24-24	21.00	24.00	2.41	4.81
BC-GRATE-30-30-24	27.00	24.00	3.98	7.95
BC-GRATE-36-36-24	33.00	24.00	5.94	11.88
BC-GRATE-48-48-18	44.00	18.00	7.92	15.84

Maintenance Equipment

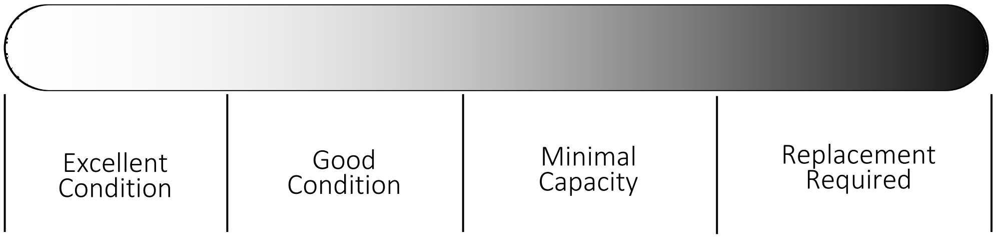
It is recommended that a vacuum truck be utilized to minimize the time required to maintain the Curb Inlet Filter, though it can easily cleaned by hand:

- Bio Clean Environmental Maintenance Form (contained in O&M Manual).
- Manhole hook or appropriate tools to remove the grate.
- Appropriate safety signage and procedures.
- Protective clothing and eye protection.
- Note: entering a confined space requires appropriate safety and certification. It is generally not required for routine maintenance of the system. Small or large vacuum truck (with pressure washer attachment preferred).

Maintenance Procedures

It is recommended that maintenance occurs at least two days after the most recent rain event to allow debris and sediments to dry out. Maintaining the system while flows are still entering it will increase the time and complexity required for maintenance. Cleaning of the Grate Inlet Filter can be performed utilizing a vacuum truck. Once all safety measures have been set up cleaning of the Grate Inlet Filter can proceed as followed:

- Remove grate (traffic control and safety measures to be completed prior).
- Using an extension on a vacuum truck position the hose over the opened catch basin. Insert the vacuum hose down into the filter basket and suck out trash, foliage and sediment. A pressure wash is recommended and will assist in spraying of any debris stuck on the side or bottom of the filter basket. Power wash off the filter basket sides and bottom.
- Next remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom. Booms can be ordered directly from the manufacturer.
- Follow is a replacement indication color chart for the hydrocarbon booms:

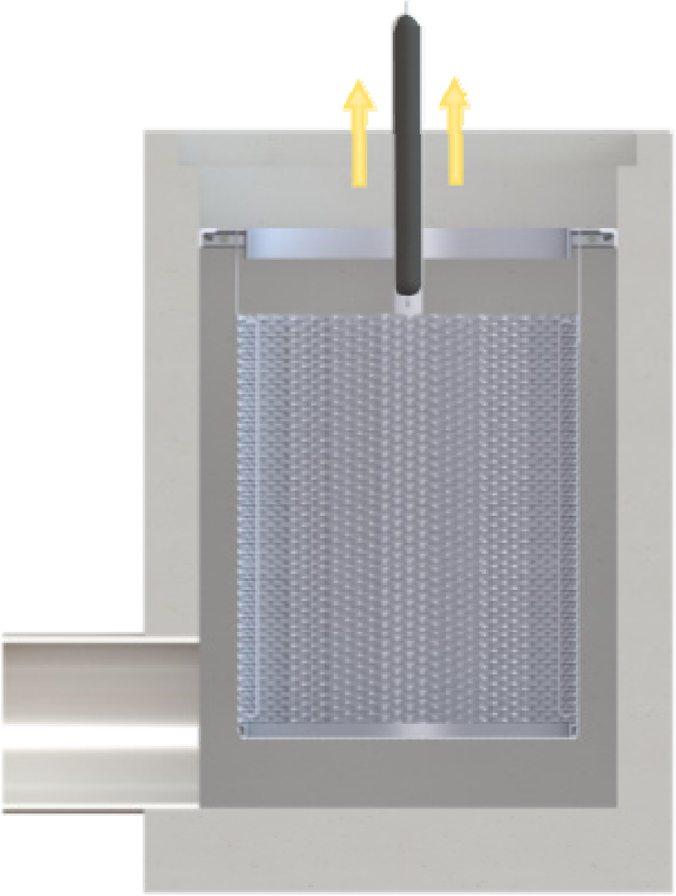


- The last step is to replace the grate and remove all traffic control.
- All removed debris and pollutants shall be disposed of following local and state requirements.
- Disposal requirements for recovered pollutants may vary depending on local guidelines. In most areas the sediment, once dewatered, can be disposed of in a sanitary landfill. It is not anticipated that the sediment would be classified as hazardous waste.
- In the case of damaged components, replacement parts can be ordered from the manufacturer. Hydrocarbon booms can also be ordered directly from the manufacturer as previously noted.

Maintenance Sequence

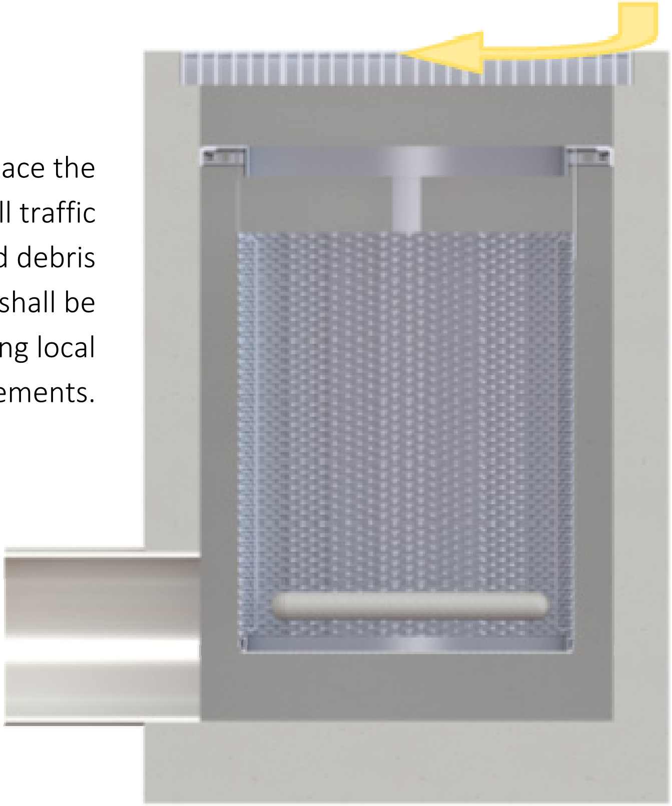
Remove grate and set up vacuum truck to clean the filter basket.

Insert the vacuum hose down into the filter basket and suck out debris. Use a pressure washer to assist in vacuum removal. Pressure wash off screens.



Remove the hydrocarbon boom that is attached to the inside of the filter basket. The hydrocarbon boom is fastened to rails on two opposite sides of the basket (vertical rails). Assess the color and condition of the boom using the following information in the next bullet point. If replacement is required install and fasten on a new hydrocarbon boom.

Close up and replace the grate and remove all traffic control. All removed debris and pollutants shall be disposed of following local and state requirements.



For Maintenance Services or Information Please Contact Us At:
760-433-7640
Or Email:
info@biocleanenvironmental.com

Bio Clean
A Forterra Company

Inspection and Maintenance Report
Catch Basin Only

Project Name ______________________________

Project Address ______________________________ (city) (Zip Code)

Owner / Management Company ______________________________

Contact ______________________________ Phone (   )   –

Inspector Name ______________________________ Date ____/____/______ Time __________ AM / PM

Type of Inspection ☐ Routine ☐ollow Up ☐omplaint ☐torm Storm Event in Last 72-hours? ☐o ☐es

Weather Condition ______________________________ Additional Notes

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

Site Map #	GPS Coordinates of Insert	Catch Basin Size	Evidence of Illicit Discharge?	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Signs of Structural Damage?	Functioning Properly or Maintenance Needed?
1	Lat: Long:							
2	Lat: Long:							
3	Lat: Long:							
4	Lat: Long:							
5	Lat: Long:							
6	Lat: Long:							
7	Lat: Long:							
8	Lat: Long:							
10	Lat: Long:							
11	Lat: Long:							
12	Lat: Long:							

Comments:

398 Via El Centro, Oceanside, CA 92058 P. 760.433.7640 F. 760.433.3176

Landscaping and garden maintenance activities can be major contributors to water pollution. Soils, yard wastes, over-watering and garden chemicals become part of the urban runoff mix that winds its way through streets, gutters and storm drains before entering lakes, rivers, streams, etc. Urban runoff pollution contaminates water and harms aquatic life!

In Riverside County, report illegal discharges
into the storm drain, call
1-800-506-2555
"Only Rain Down the Storm Drain"

Important Links:

Riverside County Household Hazardous
Waste Collection Information
1-800-304-2226 or www.rivcowm.org

Riverside County Backyard
Composting Program
1-800-366-SAVE

Integrated Pest Management (IPM) Solutions
www.ipm.ucdavis.edu

California Master Gardener Programs
www.mastergardeners.org
www.camastergardeners.ucdavis.edu

California Native Plant Society
www.cnps.org

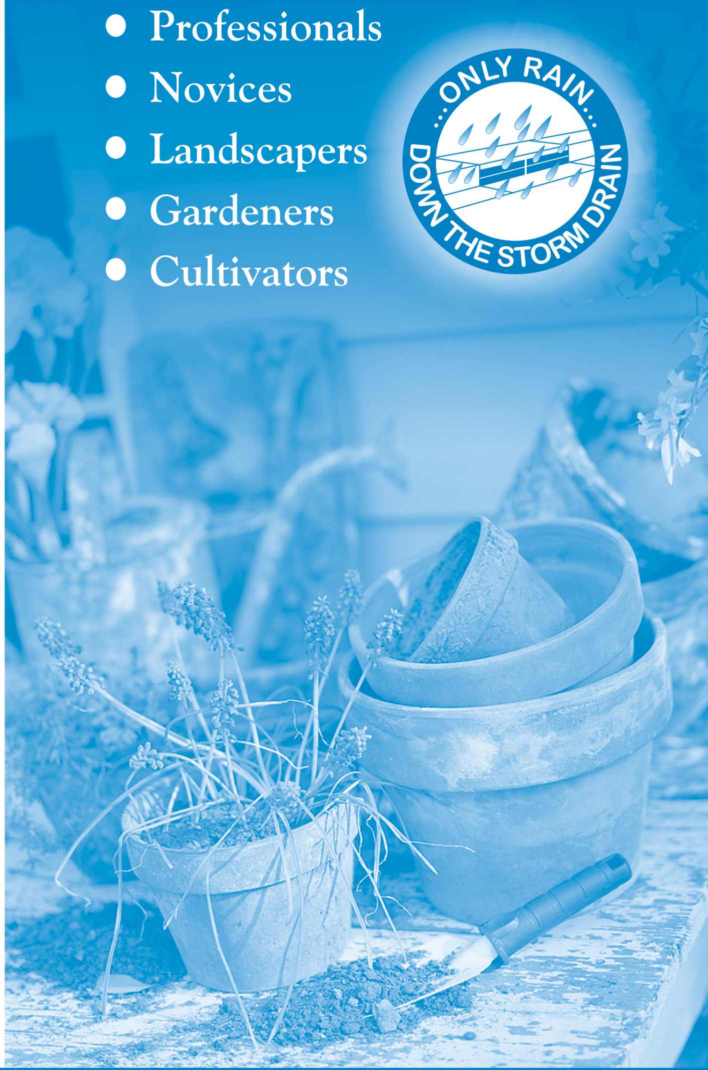
The Riverside County "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges Orange County's Storm Water Program for their contribution to this brochure.

...Only Rain Down
...the Storm Drain

What you should know for...
Landscape and Gardening

Best Management tips for:

- Professionals
- Novices
- Landscapers
- Gardeners
- Cultivators



Tips for Landscape & Gardening

This brochure will help you to get the most of your lawn and gardening efforts and keep our waterways clean. Clean waterways provide recreation, establish thriving fish habitats, secure safe sanctuaries for wildlife, and add beauty to our communities. NEVER allow gardening products or waste water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.

- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.
- Plant native vegetation to reduce the amount of water, fertilizers and pesticides applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers.

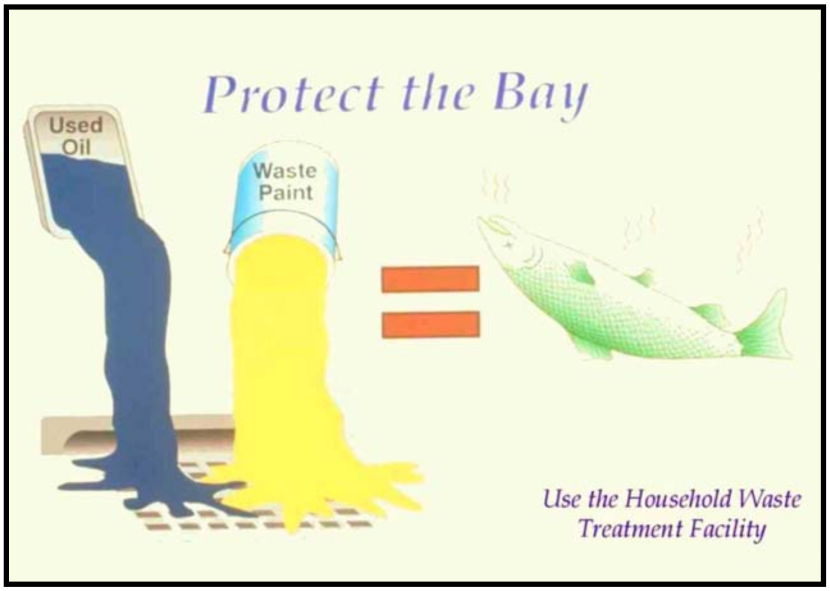
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.
- Consider recycling your green waste and adding "nature's own fertilizer" to your lawn or garden.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.
- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains or sewers. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting.
- Try natural long-term common sense solutions first. Integrated Pest Management (IPM) can provide landscaping guidance and solutions, such as:
  - **Physical Controls** - Try hand picking, barriers, traps or caulking holes to control weeds and pests.
  - **Biological Controls** - Use predatory insects to control harmful pests.
  - **Chemical Controls** - Check out www.ipm.ucdavis.edu before using chemicals. Remember, all chemicals should be used cautiously and in moderation.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Waste Collection Center to be recycled.
- *Dumping toxics into the street, gutter or storm drain is illegal!*

www.bewaterwise.com Great water conservation tips and drought tolerant garden designs.

www.ourwaterourworld.com Learn how to safely manage home and garden pests.

Additional information can also be found on the back of this brochure.

Non-Stormwater Discharges SC-10



Art Credit: Margie Winter

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

CASQA
California
Stormwater
Quality
Association

Pollution Prevention

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

Suggested Protocols

Recommended Complaint Investigation Equipment

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

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections

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

Visual Inspection and Inventory

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

Review Infield Piping

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

Smoke Testing

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

Dye Testing

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

TV Inspection of Drainage System

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

Illegal Dumping

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

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

Once a site has been cleaned:

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

Inspection

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

Reporting

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

Training

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

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

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

- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.

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

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

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

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.

- Cost for containment and disposal is borne by the discharger.

- Illicit connections can be difficult to locate especially if there is groundwater infiltration.

- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

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

Supplemental Information

Further Detail of the BMP

Illegal Dumping

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

- Establish a system for tracking incidents. The system should be designed to identify the following:

    - Illegal dumping hot spots

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

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

What constitutes a "non-stormwater" discharge?

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

Permit Requirements

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

Performance Evaluation

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

References and Resources

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

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

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

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

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

Spill Prevention, Control & Cleanup SC-11

Photo Credit: Geoff Brosseau

Objectives

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

Targeted Constituents

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

Description

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

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

Approach

Pollution Prevention

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

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

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  - Description of the facility, owner and address, activities and chemicals present
  - Facility map
  - Notification and evacuation procedures
  - Cleanup instructions
  - Identification of responsible departments
  - Identify key spill response personnel

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

Suggested Protocols (including equipment needs)

Spill Prevention

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

- If consistent illegal dumping is observed at the facility:
  - Post “No Dumping” signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - Landscaping and beautification efforts may also discourage illegal dumping.
  - Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

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

- If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

- Routine maintenance:
  - Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
  - Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site’s spill control plan and/or proper spill cleanup procedures.
  - Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

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

- Label all containers according to their contents (e.g., solvent, gasoline).

- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).

- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.

- Clean up leaks and spills immediately.

- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).

- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.

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

- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

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

Reporting

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

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

- Report spills to local agencies, such as the fire department; they can assist in cleanup.

- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Types and quantities (in some cases) of wastes

  - Patterns in time of occurrence (time of day/night, month, or year)

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

Training

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

Other Considerations (Limitations and Regulations)

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

Requirements

Costs (including capital and operation & maintenance)

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

Maintenance (including administrative and staffing)

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

Supplemental Information

Further Detail of the BMP

Reporting

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

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

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

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

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

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

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

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

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

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

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

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

Vehicle Leak and Spill Control

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

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

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don’t leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

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

Vehicle and Equipment Fueling

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

Industrial Spill Prevention Response

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

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

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

References and Resources

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

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

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

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

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

Outdoor Loading/Unloading SC-30

Photo Credit: Geoff Brosseau

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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Suggested Protocols

Loading and Unloading – General Guidelines

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations (Limitations and Regulations)

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

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

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

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

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

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

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

References and Resources

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

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

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

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

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

Outdoor Equipment Operations SC-32

Description

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

Approach

Pollution Prevention

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

Suggested Protocols

- Consider enclosing the activity in a building and connecting the floor drains to the sanitary sewer.
- Cover the work area with a permanent roof if possible.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention). If possible, connect process equipment area to public sewer or facility wastewater treatment system. Some municipalities require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
- Dry clean the work area regularly.

Training

- Train employees to perform the activity during dry periods only or substituting benign materials for more toxic ones.
- Train employee and contractors in proper techniques for spill containment and cleanup. Employees should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

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

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

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

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

Other Considerations

- Providing cover may be expensive.

- Space limitations may preclude enclosing some equipment.

- Storage sheds often must meet building and fire code requirements.

Requirements

Costs

Costs vary depending on the complexity of the operation and the amount of control necessary for stormwater pollution control.

Maintenance

- Conduct routine preventive maintenance, including checking process equipment for leaks.

- Clean the storm drain system regularly.

Supplemental Information

Further Detail of the BMP

Hydraulic/Treatment Modifications

If stormwater becomes polluted, it should be captured and treated. If you do not have your own process wastewater treatment system, consider discharging to the public sewer system. Use of the public sewer might be allowed under the following conditions:

- If the activity area is very small (less than a few hundred square feet), the local sewer authority may be willing to allow the area to remain uncovered with the drain connected to the public sewer.

- It may be possible under unusual circumstances to connect a much larger area to the public sewer, as long as the rate of stormwater discharges does not exceed the capacity of the wastewater treatment plant. The stormwater could be stored during the storm and then transferred to the public sewer when the normal flow is low, such as at night.

Industries that generate large volumes of process wastewater typically have their own treatment system and corresponding permit. These industries have the discretion to use their wastewater treatment system to treat stormwater within the constraints of their permit requirements for process treatment. It may also be possible for the industry to discharge the stormwater directly to an effluent outfall without treatment as long as the total loading of the discharged process water and stormwater does not exceed the loading had a stormwater treatment device been used. This could be achieved by reducing the loading from the process wastewater treatment system. Check with your Regional Water Quality Control Board or local sewering agency, as this option would be subject to permit constraints and potentially regular monitoring.

References and Resources

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

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

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

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

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

Waste Handling & Disposal SC-34

Photo Credit: Geoff Brosseau

Objectives

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

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

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Suggested Protocols

General

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.

- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.

- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.

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

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

- Transfer waste from damaged containers into safe containers.

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

Controlling Litter

- Post “No Littering” signs and enforce anti-litter laws.

- Provide a sufficient number of litter receptacles for the facility.

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

Waste Collection

- Keep waste collection areas clean.

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

- Secure solid waste containers; containers must be closed tightly when not in use.

- Do not fill waste containers with washout water or any other liquid.

- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

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

Good Housekeeping

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

Chemical/Hazardous Wastes

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

Run-on/Runoff Prevention

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

Inspection

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

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

Training

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

Spill Response and Prevention

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

Other Considerations (Limitations and Regulations)

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

Requirements

Costs

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

Maintenance

- None except for maintaining equipment for material tracking program.

Supplemental Information

Further Detail of the BMP

Land Treatment System

Minimize runoff of polluted stormwater from land application by:

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

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water

- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site

- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)

- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins

- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples

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

References and Resources

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

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

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

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

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

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

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

Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The “Precautionary Principle,” which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests by methods that pose a lower risk to employees, the public, and the environment.
- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies

Objectives

- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

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- Procedures
    - Standard operating procedures (SOPs)
    - Purchasing guidelines and procedures
    - Bid packages (services and supplies)
- Materials
    - Preferred or approved product and supplier lists
    - Product and supplier evaluation criteria
    - Training sessions and manuals
    - Fact sheets for employees

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC20 – SC22) and SC41, Building and Grounds Maintenance.

Training

- Employees who handle potentially harmful materials in the use of safer alternatives.
- Purchasing departments should be encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.

Regulations

This BMP has no regulatory requirements. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements,
- Storm water runoff sampling requirements,
- Training and licensing requirements, and
- Record keeping and reporting requirements.

Equipment

- There are no major equipment requirements to this BMP.

Limitations

- Alternative products may not be available, suitable, or effective in every case.

Requirements

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.

- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources listed below.

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Rerefined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps. All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.
- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control (www.dtsc.ca.gov)

California Integrated Waste Management Board (www.ciwmb.ca.gov)

City of Santa Monica (www.santa-monica.org/environment)

City of Palo Alto (www.city.palo-alto.ca.us/cleanbay)

City and County of San Francisco, Department of the Environment (www.ci.sf.ca.us/sfenvironment)

Earth 911 (www.earth911.org/master.asp)

Environmental Finance Center Region IX (www.greenstart.org/efc9)

Flex Your Power (www.flexyourpower.ca.gov)

GreenBiz.com (www.greenbiz.com)

Green Business Program (www.abag.org/bayarea/enviro/gbus/gb.html)

Pacific Industrial and Business Association (www.piba.org)

Sacramento Clean Water Business Partners (www.sacstormwater.org)

USEPA BMP fact sheet – Alternative products (http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll_2.cfm)

USEPA Region IX Pollution Prevention Program (www.epa.gov/region09/p2)

Western Regional Pollution Prevention Network (www.westp2net.org)

Metals (mercury, copper)

National Electrical Manufacturers Association - Environment, Health and Safety (www.nema.org)

Sustainable Conservation (www.suscon.org)

  Auto Recycling Project

  Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center (www.birc.org)

California Department of Pesticide Regulation (www.cdpr.ca.gov)

University of California Statewide IPM Program (www.ipm.ucdavis.edu/default.html)

Dioxins

Bay Area Dioxins Project (http://dioxin.abag.ca.gov/)

Building & Grounds Maintenance SC-41

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

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

Landscaping Activities

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

Building Repair, Remodeling, and Construction

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

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

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

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

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

Training

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

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

- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.

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

- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.

- Clean up spills immediately.

Other Considerations

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

Requirements

Costs

- Cost will vary depending on the type and size of facility.

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

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

References and Resources

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

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

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

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

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

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

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

Building Repair and Construction SC-42

Objectives

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

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

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

Suggested Protocols

Repair & Remodeling

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

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100% effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.

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

Training

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

Spill Response and Prevention

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

Limitations

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

Requirements

Costs

These BMPs are generally low to modest in cost.

Maintenance

N/A

Supplemental Information

Further Detail of the BMP

Soil/Erosion Control

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

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. See Treatment Control Fact Sheet TC-20 Wet Pond/Basin in Section 5 of the New Development and Redevelopment Handbook regarding design criteria. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

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

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

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

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

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

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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Suggested Protocols

General

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

Controlling Litter

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

Surface Cleaning

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

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

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

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

References and Resources

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

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

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

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

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

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

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

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

Suggested Protocols

Catch Basins/Inlet Structures

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

- 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

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

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

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

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

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

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

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

Drain Insert MP-52

General Description

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

Inspection/Maintenance Considerations

Washout problems increase with rain intensity. Susceptibility of accumulated sediments to be re-suspended at low flow rates, can be corrected with an energy dissipater between gate and treatment areas.

Inspection Activities	Suggested Frequency
■ Inspect for sediment buildup and proper functioning.	At the beginning of the wet season and after significant storms
■ Verify that stormwater enters the unit and does not leak around the perimeter.	After construction.

Maintenance Activities	Suggested Frequency
■ Remove sediment as needed.	At the beginning of the wet season and as necessary

Maintenance Concerns, Objectives, and Goals

- Sediment Removal

Targeted Constituents

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

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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Efficient Irrigation SD-12

Design Objectives

☑ Maximize Infiltration

☑ Provide Retention

☑ Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

☑ Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

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

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.

- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.

- Pave trash storage areas with an impervious surface to mitigate spills.

- Do not locate storm drains in immediate vicinity of the trash storage area.

- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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