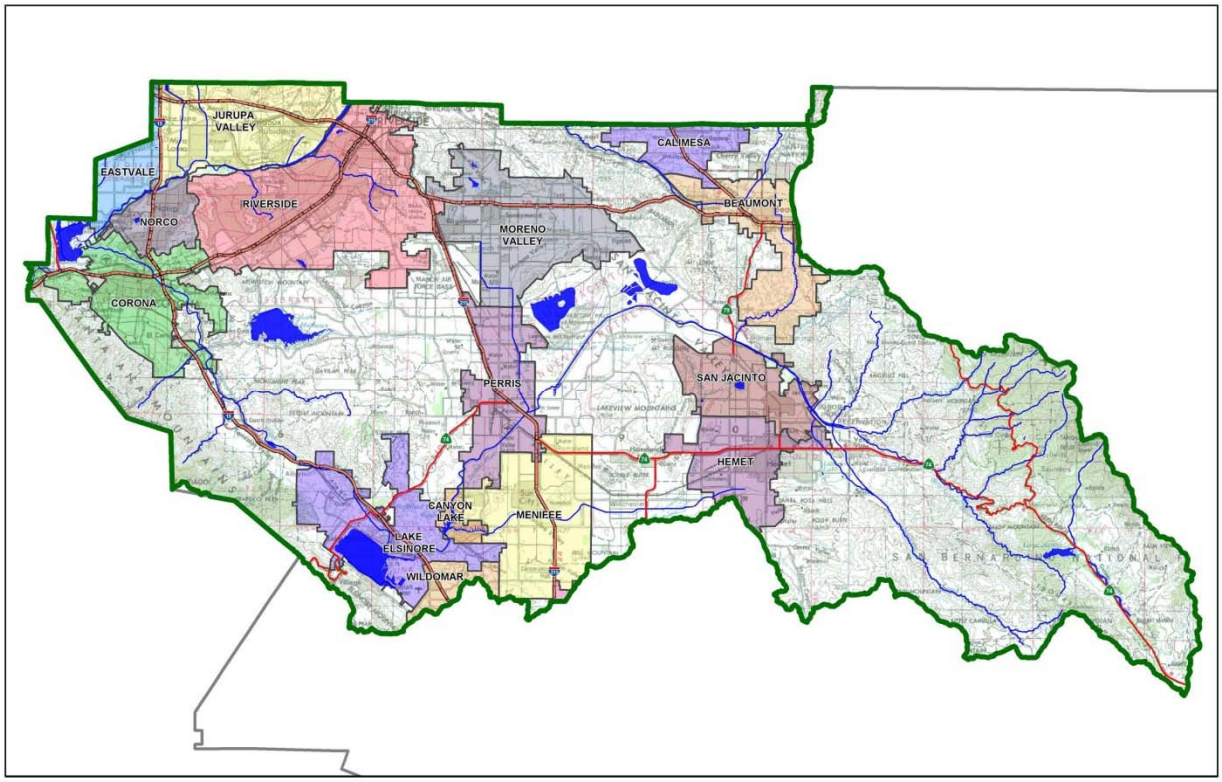
Project Specific Water Quality Management Plan

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

Project Title: Sattleback Industrial

Development No: TBD

Design Review/Case No: TBD



☒ **Preliminary**
☐ **Final**

Original Date Prepared: April 2, 2021
Revision Date(s): August 3, 2021, December 1, 2021

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

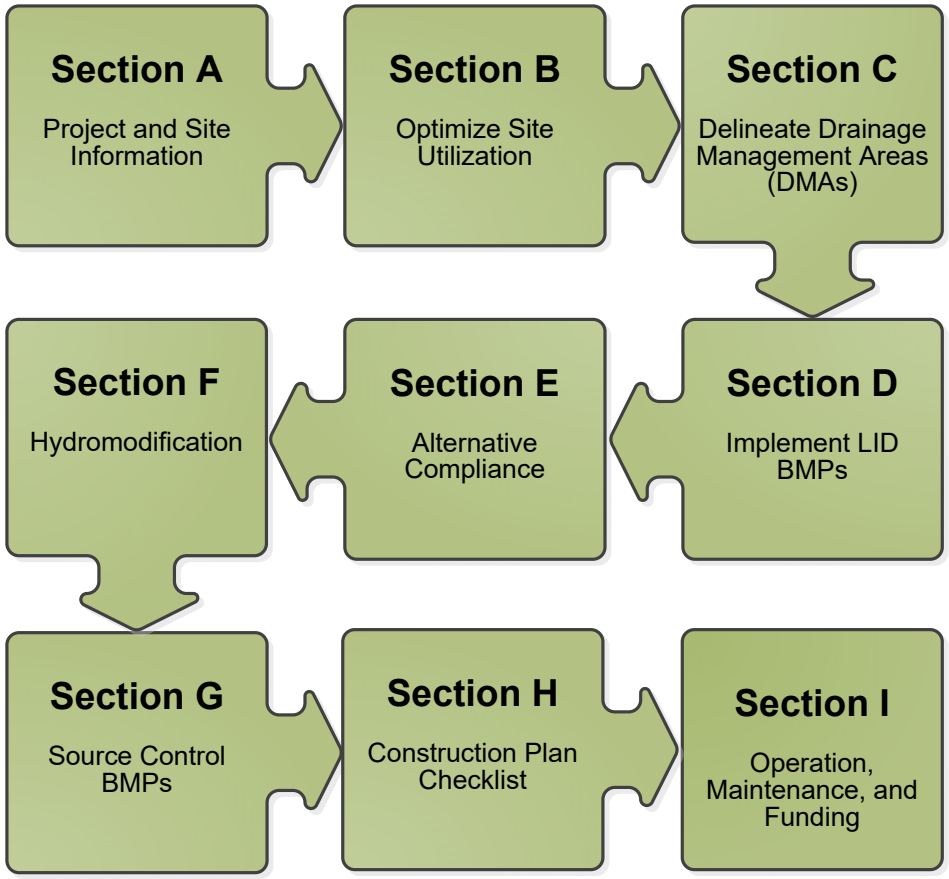
Contact Information:

Prepared for: Saddleback Associates
c/o Mark Severson
27405 Puerta Real, Suite 120
Mission Viejo, CA 92691
(949) 635-1970

Prepared by: Joseph L. Castaneda
41660 Ivy Street, Suite A
Murrieta, CA 92562
(951) 304-9552

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 SADDLEBACK ASSOCIATES by JLC Engineering and Consulting, Inc. for the Saddleback Industrial project.

This WQMP is intended to comply with the requirements of City of Lake Elsinore for the City of Lake Elsinore Stormwater/Urban Runoff Management and Discharge Controls Ordinance, which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under City of Lake Elsinore Water Quality Ordinance (Municipal Code Chapter 14.08).

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

Owner's Signature	Date
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

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

Preparer's Signature	Date
Joseph L. Castaneda	**Project Manager**
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

Table of Contents

List of Tables

List of Appendices

Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Industrial
Planning Area:	N/A
Community Name:	Lake Elsinore
Development Name:	Saddleback Industrial

PROJECT LOCATION

Latitude & Longitude (DMS): 33°41'50"N, 117°20'51"W

Project Watershed and Sub-Watershed: Santa Ana Watershed, Lake Matthews HSA

APN(s): 389-220-003, 389-220-004, 389-220-005, 389-220-006

Map Book and Page No.: TBD

PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Industrial
Proposed or Potential SIC Code(s)	TBD
Area of Impervious Project Footprint (SF)	315,810
Total Area of proposed Impervious Surfaces within the Project Limits (SF)/or Replacement	284,229
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N
EXISTING SITE CHARACTERISTICS	
Total area of existing Impervious Surfaces within the project limits (SF)	5,173
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
Are there any natural hydrologic features on the project site?	☐ Y ☒ N
Is a Geotechnical Report attached?	☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	B & C
What is the Water Quality Design Storm Depth for the project?	0.70

PROJECT DESCRIPTION:

The project site is a proposed industrial warehouse project that will construct buildings, parking lot areas, utility infrastructure, subsurface storm drain, modular wetlands systems, and subsurface detention systems. The buildings shall be used for warehouses or business offices, and will be determined during occupancy. Tributary offsite flows from the north and east will be collected via subsurface storm drain and conveyed downstream to the south side of Collier Avenue. Flows from the onsite area will not comingle with offsite flows prior to treatment for water quality purposes and addressing the hydrologic conditions of concern. The onsite flows will be treated for water quality purposes within one of three modular wetlands systems. Flows will then be conveyed to one of three subsurface systems to address the hydrological conditions of concern.

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
- Source Control BMPs
- Buildings, Roof Lines, Downspouts

- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- 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
Temescal Creek – Reach 6	N/A	GWR, REC1, REC2, WARM, WILD	Not a RARE-designated water body
Temescal Creek – Reach 5	N/A	AGR, GWR, REC1, REC2, WARM, WILD, RARE	1690 FEET FROM PROJECT SITE
Temescal Creek – Reach 4	N/A	AGR, GWR, REC1, REC2, WARM, WILD, RARE	1.68 MILES FROM PROJECT SITE
Temescal Creek – Reach 3 (LEE LAKE)	N/A	AGR, IND, GWR, REC1, REC2, COMM, WARM, WILD	Not a RARE-designated water body
Temescal Creek – Reach 2	N/A	AGR, IND, GWR, REC1, REC2, WARM, WILD, RARE	3.13 MILES FROM PROJECT SITE
Temescal Creek – Reach 1B	pH	REC2, WARM, WILD	Not a RARE-designated water body
Temescal Creek – Reach 1A	pH	REC2, WARM, WILD	Not a RARE-designated water body
Santa Ana River – Reach 3	Indicator Bacteria (Bacteria & Viruses); Copper, Lead (Metals)	AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN	25.20 MILES FROM THE PROJECT SITE
Prado Dam	Nutrients, Indicator Bacteria (Bacteria and Viruses)	REC1, REC2, COMM, WARM, WILD, RARE	25.20 MILES FROM THE PROJECT SITE
Santa Ana River – Reach 2	Indicator Bacteria (Bacteria & Viruses)	AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN	30.78 MILES FROM THE PROJECT SITE
Santa Ana River – Reach 1	N/A	REC1, REC2, WARM, WILD	Not a RARE-designated water body

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)*	☐ 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?

> *The project site currently drains from the north easterly to south westerly portion of the project site. Offsite flows currently sheet flow across the project site to an existing concrete channel and RCB structure (which are to be removed or abandoned). The flows in the post project condition mimic the existing condition in that all flows are tributary to the south side of Collier Avenue into Temescal Canyon Wash.*

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

> *A portion of the existing site was previously a building and some asphalt area. The project site is constructing commercial/industrial buildings and parking area, therefore any existing vegetation within the project site will not be preserved.*

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

> *Infiltration within the project site is not feasible due to the shallow historical groundwater being less than 10 feet. Per the geotechnical engineer's recommendation, infiltration was not utilized.*

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

> *The project site will incorporate landscaped areas throughout the project site to minimize impervious areas.*

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

Runoff from roofs will sheet flow into grate inlets and curb openings. Any roof runoff that can be discharged into adjacent landscaping shall be done, and roof drains will be located during final engineering.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1]	Area (Sq. Ft.)	DMA Type
DMA A	Roof, asphalt, landscape	94,525	Type D
DMA B1	Roof, asphalt, landscape	70,132	Type D
DMA B2	Asphalt, Concrete, Landscape	69,696	Type D
DMA C	Asphalt, Concrete, Landscape	81,457	Type D

[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)

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]

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

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	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

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

DMA Name or ID	BMP Name or ID
DMA A	Modular Wetlands "A"
DMA B1	Modular Wetlands "B1"
DMA B2	Modular Wetlands "B2"
DMA C	Modular Wetlands "C"

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?	X	
If Yes, list affected DMAs: A, B1, B2, C		
…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 identify other site-specific factors that would preclude effective and safe infiltration?		X
Describe here:		

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

Per the Geotechnical Report, ground water was encountered approximately 9 to 18 feet below the existing ground surface, which, per the report, correspond to elevations 1250 through 1254. The subsurface system bottoms are at elevations 1259.02, 1258.49, and 1258.93 for Basins A, B, and C, respectively. This is less than the minimum required 10 feet between historical ground water and the infiltrating surface, therefore infiltration is not feasible. Furthermore, since infiltration is not a viable treatment mechanism due to the location of ground water, infiltration testing was not performed, as even an infiltrating surface at the FS of the project (1260.00 adjacent to Collier Avenue) would not be feasible.

D.2 Harvest and Use Assessment

Please check what applies*:*

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

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

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: 0.73 ac

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

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: 6.52 ac

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: 1.32

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: 8.61

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)
8.61	0.73

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: 80

Project Type: Commercial/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: 6.52 ac

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

Enter your TUTIA factor: 198

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: 1290

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)
1290	80

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.

Based upon the Harvest and Use assessment, the project site does not have the required landscaped area or required toilet users to utilize harvest and use BMPs.

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

D.4 Feasibility Assessment Summaries

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

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DMA A	☐	☐	☐	☒	☐
DMA B1	☐	☐	☐	☒	☐
DMA B2	☐	☐	☐	☒	☐
DMA C	☐	☐	☐	☒	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

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.

The project site is a proposed commercial/industrial complex that will construct 5 buildings (with 12 individual units), parking area, landscaped area, subsurface storm drain, four modular wetlands, and three subsurface detention basins. The project site ultimately discharges into a proposed RCB storm drain that will be constructed through the project site.

The project site will keep the offsite flows separate from the onsite flows via the RCB storm drain traversing the site. Flows from the DMAs will be conveyed to one of four modular wetlands units for water quality treatment. Flows will then be conveyed to one of three subsurface detention systems, in which flows will be stored and metered out at levels equal to or less than pre-project levels in order to address the Hydrologic Conditions of Concern.

Water quality flow rates were calculated using the Santa Ana Watershed BMP Design Volume and Design Flow Rate Spreadsheet. These values were then compared to the modular wetlands fact sheets to determine the preliminary sizes required to treat the project site. The rainfall depth for the project site is 0.70 inches.

DMA A will drain to Modular Wetlands "A", which will be located subsurface with the exception of the planted area, which will be located in the landscaped median. Flows will be intercepted by a series of grate inlets located along the ditch in the center isle. Due to the vertical constraint of the site, a subsurface system had to be provided for DMA A, since the subsurface systems for DMA B or C could not provide enough volume for DMA A. Due to the location of Subsurface Basin A, the only feasible treatment mechanics is a subsurface modular wetlands, as a curb opening was not feasible along the center isle ribbon gutter. Flows ultimately discharge into Subsurface Basin A for HCOC mitigation.

DMAs B1 and B2 will drain to Modular Wetlands B1 and B2, respectively. DMA B1 will have two collection points, one within the ribbon gutter (similar to DMA A) and one at a low point in the parking stalls. A curb opening will be provided for the low point, and grate inlets will be provided within the ribbon gutter. The flows from the grate inlets will be conveyed to a side opening within the modular wetlands that will allow the flows to be treated in Modular Wetlands B1. DMA B2 will drain to a low point in the west corner of the project site and enter through a curb opening modular wetlands. Both DMAs B1 and B2 will discharge into Subsurface Basin B for HCOC mitigation.

DMA C drains to a low point in the parking area just south of the main entrance driveway. The flows will enter the Modular Wetlands via a curb opening. The entrance driveway slopes towards Collier Avenue, therefore a trench drain will be constructed at the right-of-way in order to intercept the flows and convey them to Modular Wetlands C. Flows are then conveyed to Subsurface Basin C for HCOC mitigation.

All onsite flows ultimately discharge into the proposed RCB Storm Drain Traversing the site.

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 QBMP Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperviousness Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Modular Wetlands "A"*		
	[A]		[B]	[C]	[A] x [C]			
DMA A-1	*85072.68*	*Concrete or Asphalt*	*1.0*	*0.89*	*75884.8*	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate, Q_{BMP} (cfs)*	*Proposed Flow Rate (cfs)*
DMA A-2	*9452.52*	*Ornamental Landscaping*	*0.1*	*0.11*	*1044.1*			
	94525.2				76928.9	0.20	0.40	0.577

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

Table D.4 QBMP Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperviousness Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Modular Wetlands "B1"*		
	[A]		[B]	[C]	[A] x [C]			
DMA B1-1	*63118.44*	*Concrete or Asphalt*	*1.0*	*0.89*	*56301.6*	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate, Q_{BMP} (cfs)*	*Proposed Flow Rate (cfs)*
DMA B1-2	*7013.16*	*Ornamental Landscaping*	*0.1*	*0.11*	*774.7*			
	70131.6				57076.3	0.20	0.30	0.346

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

Table D.5 QBMP 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	*Modular Wetlands "B2"*		
	[A]		[B]	[C]	[A] x [C]			
DMA B2-1	*62726.4*	*Concrete or Asphalt*	*1.0*	*0.89*	*55951.9*	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate, Q_{BMP} (cfs)*	*Proposed Flow Rate (cfs)*
DMA B2-2	*6969.6*	*Ornamental Landscaping*	*0.1*	*0.11*	*769.8*			
	69696				56721.7	0.20	0.30	0.346

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

Table D.6 QBMP 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	*Modular Wetlands "C"*		
	[A]		[B]	[C]	[A] x [C]			
DMA C-1	*73311.48*	*Concrete or Asphalt*	*1.0*	*0.89*	*65393.8*	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate, Q_{BMP} (cfs)*	*Proposed Flow Rate (cfs)*
DMA C-2	*8145.72*	*Ornamental Landscaping*	*0.1*	*0.11*	*899.8*			
	81457.2				66293.60	0.20	0.30	0.346

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

The modular wetlands were sized using the Santa Ana Watershed BMP Design Flow Rate Spreadsheet and the Modular Wetlands Brochure. The design flow rate is based upon a design rainfall intensity of 0.20 in/hr. The DMA's assume 90% impervious for commercial area. During final engineering, a detailed impervious fraction will be calculated using the pervious and impervious areas within the site. However, since this is a preliminary WQMP and the site will likely go through revisions during the entitlement process.

The design flow rate was then compared to the Bioclean Modular Wetlands brochure to determine the size of the modular wetlands needed to address water quality. Based upon the sizing table, the following are the minimum size requirements:

DMA	*Area (sq. ft.)*	*QBMP*	*MWS Treatment Flow Rate*	*MWS Model*
A	*94,525*	*0.40 cfs*	*0.577 cfs*	*MWS-L-8-20*
B1	*70,132*	*0.30 cfs*	*0.346 cfs*	*MWS-L-8-12*
B2	*69,696*	*0.30 cfs*	*0.346 cfs*	*MWS-L-8-12*
C	*81,457*	*0.30 cfs*	*0.346 cfs*	*MWS-L-8-12*

During final engineering, the exact model number and design will be determined through coordination with BioClean. The design will ensure that the QBMP treatment flow rate is met.

Section E: Alternative Compliance (LID Waiver Program)

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

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

- *Or* -

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

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

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

P = Potential

N = Not Potential

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

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

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

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
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 Impervious Fraction, I_f	DMA Runoff Factor	DMA Area x Runoff Factor				
	[A]		[B]	[C]	[A] x [C]				
						Design Storm Intensity (in/hr)	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*

[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]

[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			
Volume (Cubic Feet)			

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

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

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

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

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.

The project site will utilize two subsurface systems to meet the hydrologic conditions of concern for the onsite area. Since DMA E is not constructing impervious area, the DMA E will not create a hydrologic condition of concern.

Pre-project and post-project unit hydrograph calculations were performed for DMA's A, B and C to determine the required volume needed to address the hydrologic conditions of concern and mitigate for increased runoff. The flows will be detained in subsurface basins and metered out through a structure that will be designed during final engineering. During the preliminary stages, the existing condition flow rate was used to determine the required volume that must be stored in order to meeting the hydrologic conditions of concern criteria. The existing flow rate was found on the recess limb of the post-project condition unit hydrograph to determine the corresponding volume. This would ensure that if this volume in its totality is stored in the subsurface system, only the existing

condition flow rate will discharge from the subsurface systems. The following table summarizes the results:

	2-Year, 24-Hour Storm Duration						
DMA	Pre-Project Flow Rate	Pre-Project Volume (ac-ft)	Post-Project Flow Rate	Post-Project Volume (ac-ft)	Volume on Recess Limb of Hydrograph @ Pre-Project Flow Rate (ac-ft)	Volume on Recess Limb of Hydrograph @ Pre-Project Flow Rate (cu. ft.)	Subsurface System Storage Volume (cu. ft.)
DMA A	0.111 ft^3/s	0.0673	0.610 ft^3/s	0.3707	0.3359	14,632	15,485
DMA B	0.110 ft^3/s	0.0669	0.902 ft^3/s	0.5484	0.5246	22,852	23,105
DMA C	0.064 ft^3/s	0.0390	0.526 ft^3/s	0.3195	0.3056	13,312	13,365

It should be noted that DMA B includes two subsurface systems that will be connected with an equalization pipe, and will have the same invert elevation. This was required as the subsurface basins adjacent to Collier Avenue was not sufficient for HCOC mitigation of DMA B. Therefore the second Subsurface Basin is proposed and will equalize and function as one basin with the basin adjacent to Collier Avenue.

Based upon the preliminary sizing, the subsurface systems will adequate address the hydrologic conditions of concern. During final engineering, detailed basin routing will be performed for the subsurface basins and their corresponding outlet structures to demonstrate HCOC compliance.

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 "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 markers. • Provide stormwater pollution prevention information to new site owners, lessees, or operators. • Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to bioretention planter 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
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 operatorts.
D2. Landscape/Outdoor Pesticide Use	• 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, landuse, air movement, ecological consistency, and plant interactions.	• Maintain landscaping usin minimum or no pesticides. • See applicable operational BMPs in "What you should know for…… Landscape and Gardening" • Provide IPM information to new owners, lessees and operators.
G. Refuse Areas	• Trash receptacles will be covered or closed at all times. • Signs will be posted on dumpsters stating "Do not dump hazardous materials here" or similar.	• Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping or 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 Handbook at www.cabmphandbooks.com
H. Industrial Processes	• 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
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. Roofing, gutters and trim	• Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	
P. Sidewalks		• Sweep sidewalks regularly to prevent accumulation of litter and debris. Collect

		debris from pressure washing to prevent entry into storm drain system.

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)
A	Modular Wetlands "A"	TBD
A	Subsurface System "A"	TBD
B1	Modular Wetlands "B1"	TBD
B2	Modular Wetlands "B2"	TBD
B	Subsurface System "B"	
C	Modular Wetlands "C"	TBD
C	Subsurface System "C"	TBD

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: Property Owner

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

Figure 1 – Vicinity Map

SADDLEBACK INDUSTRIAL
VICINITY MAP

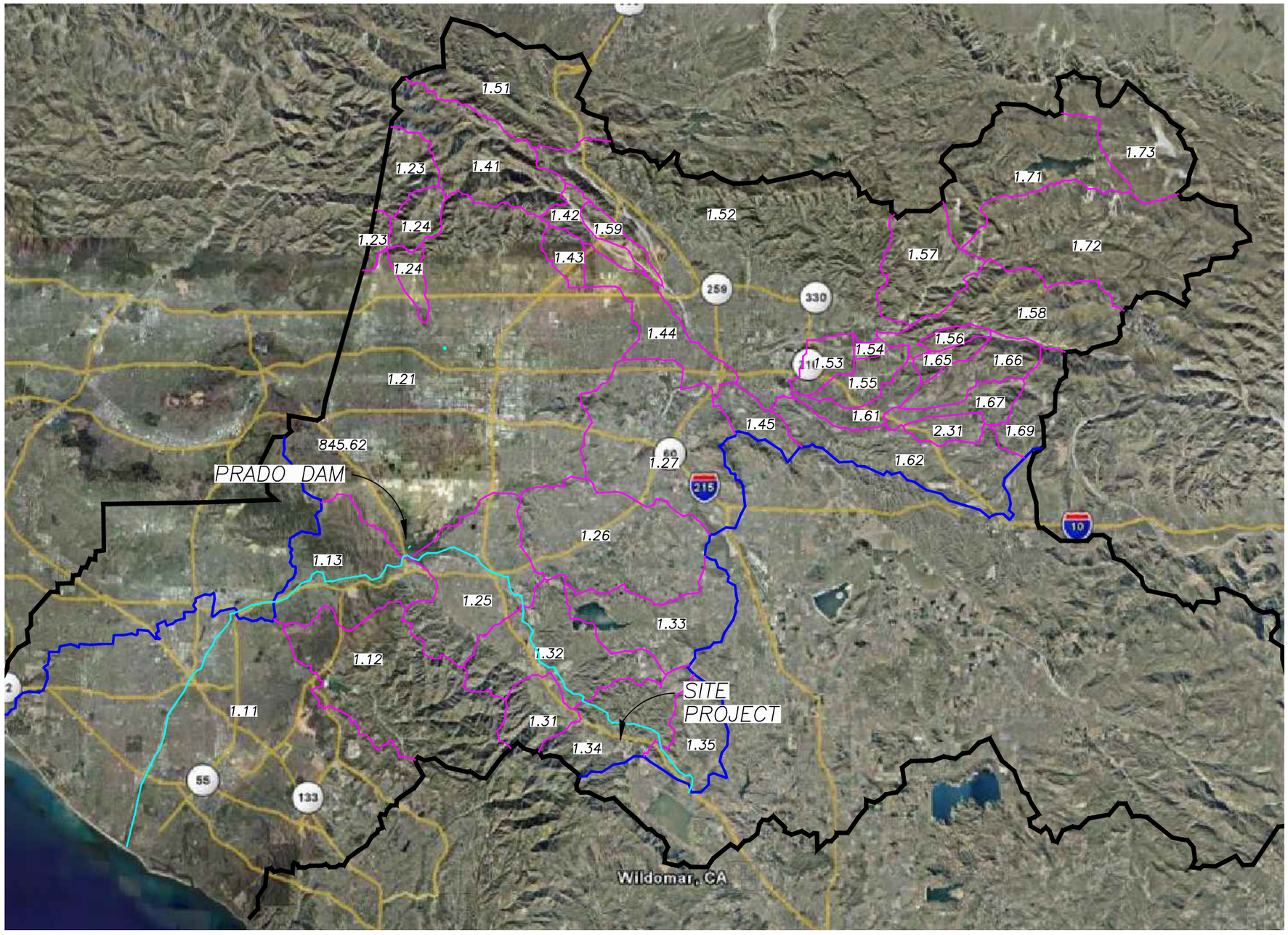
0 800 1600 Feet

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

FIGURE 1

Drawing Name: O:\292.01.20\Engineering\Hydrology_Plan\Exhibits\Figure 1 - Vicinity Map.dwg
Last Opened: Mar 31, 2021 - 9:53am by jcarver

Figure 2 – Receiving Waters Map



LEGEND

- Regional Boundary
- Hydrologic Unit Boundary (HU)
- Hydrologic Subarea Boundary (SA)
- FLOW PATH

SADDLEBACK INDUSTRIAL - RECEIVING WATERS MAP

N

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

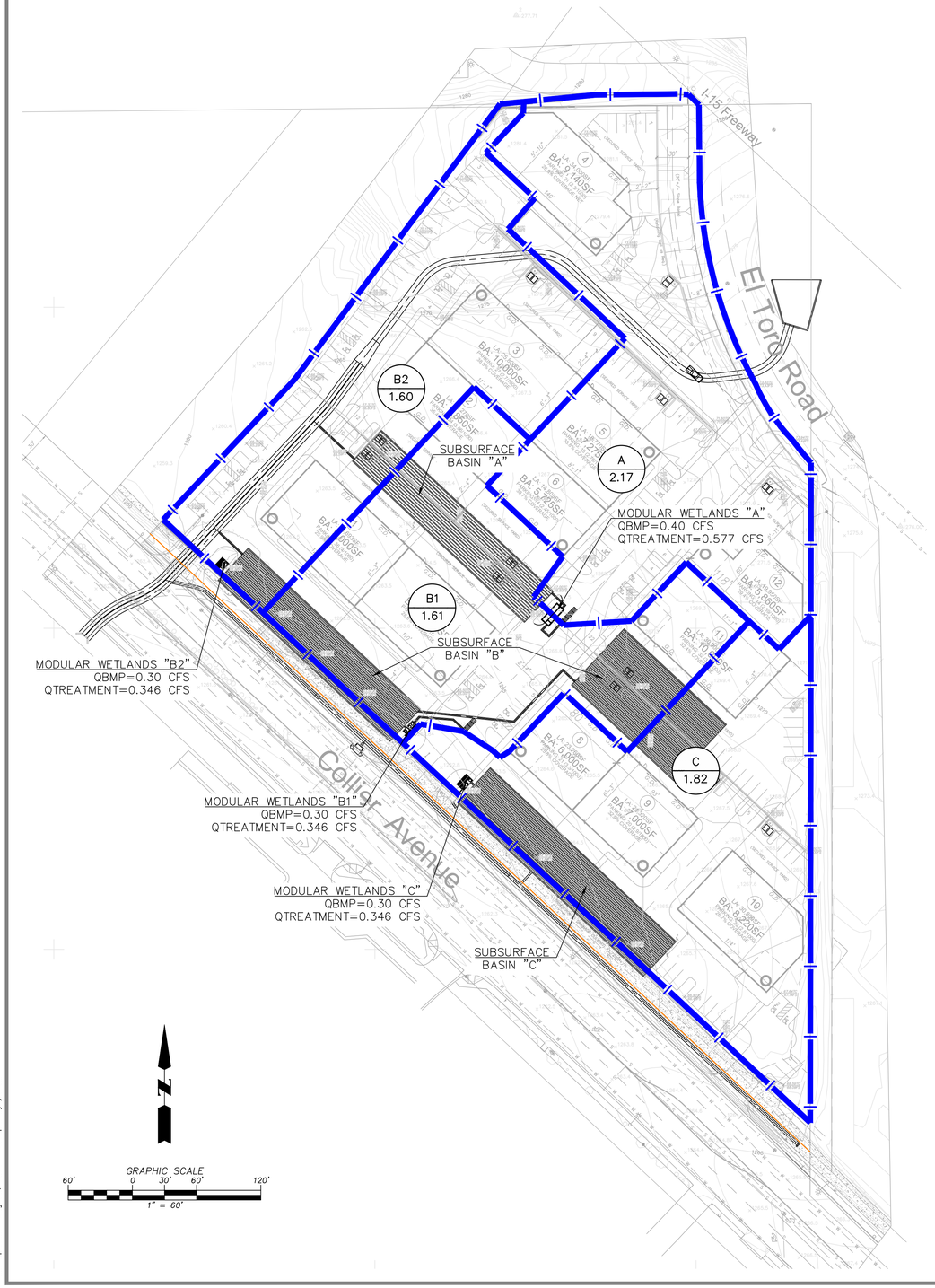
FIGURE 2

Figure 3 – WQMP Site Plan

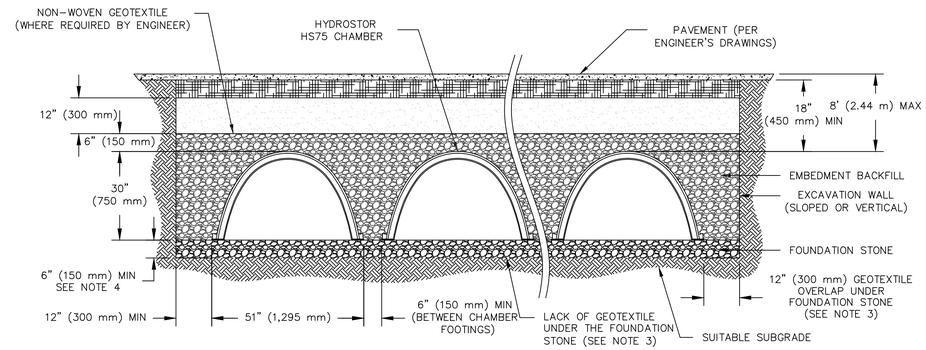
SADDLEBACK INDUSTRIAL

IN THE CITY OF LAKE ELSINORE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

WQMP SITE PLAN

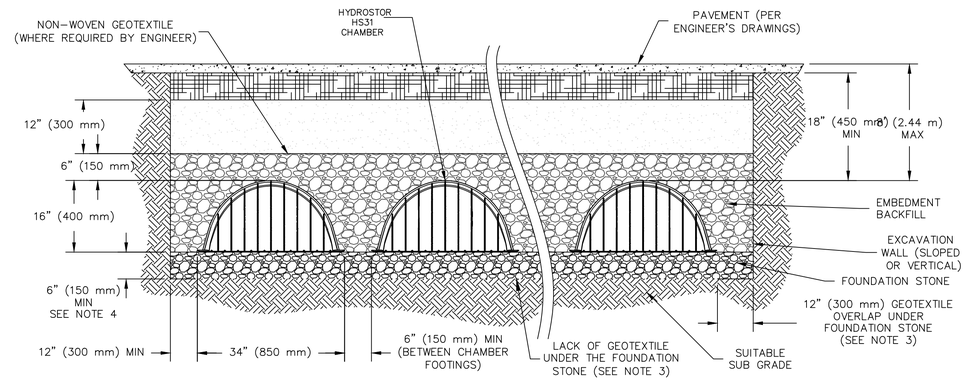


THE MODULAR WETLANDS SHALL INCLUDE AN INTERNAL OVERFLOW THAT WILL ALLOW FLOWS IN EXCESS OF THE WATER QUALITY FLOW RATE TO BYPASS INTO THE SUBSURFACE SYSTEM. OUTLET STRUCTURES WILL BE INCLUDED DOWNSTREAM OF THE SUBSURFACE SYSTEMS THAT WILL MITIGATE FLOWS TO PRE-PROJECT LEVELS. OVERFLOW WEIRS WILL BE INCLUDED IN THESE STRUCTURES IN CASE THE ORIFICE/RESTRICTION PLATES FAIL ON THE OUTLET STRUCTURE. SYSTEMS HAVE BEEN DESIGNED FOR THE PEAK 100-YEAR FLOW RATE TO ENSURE THAT OVERFLOW AND EMERGENCY FLOWS CAN BE CONVEYED DOWNSTREAM.



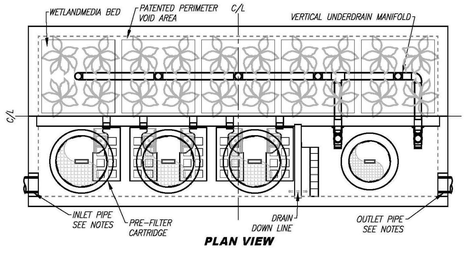
SUBSURACE SYSTEM "A" TYPICAL SECTION

SYSTEM SHALL BE LINED WITH IMPERMEABLE LINER

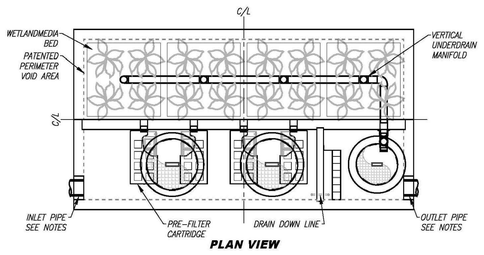


SUBSURACE SYSTEM "B" AND "C" TYPICAL SECTION

SYSTEM SHALL BE LINED WITH IMPERMEABLE LINER



TYPICAL MWS-L-8-20
DMA A



TYPICAL MWS-6-12
DMA B1, B2 AND B3

DMA	REQUIRED HCOC VOLUME (CU.FT.)	VOLUME PROVIDED (CU. FT.)
A	14,632	15,485
B	22,852	23,105
C	13,312	13,365

FIGURE "3"

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

SADDLEBACK INDUSTRIAL

WQMP SITE PLAN

Drawing Name: G:\332.01.20\Engineering\WQMP\Appendix 1 - Maps & Site Plan\WQMP Site Plan.dwg
Last Opened: Aug 03, 2021 - 4:18pm by jcarver

Appendix 2: Construction Plans

Grading and Drainage Plans

IN THE CITY OF LAKE ELSINORE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

PRELIMINARY GRADING PLAN

FOR THE

NORTH ELSINORE BUSINESS PARK

CUP# _____

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN IS SITUATED IN THE CITY OF LAKE ELSINORE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

PARCEL 1:
ALL THAT PORTION OF THE NORTHEAST QUARTER OF FRACTIONAL SECTION 36, TOWNSHIP 5 SOUTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN, AS SHOWN BY UNITED SATES GOVERNMENT SURVEY, DESCRIBED AS FOLLOWS:
COMMENCING AT THE INTERSECTION OF THE NORTH LINE OF SAID SECTION 36, AND THE NORTHEASTERLY LINE OF RANCHO LA LAGUNA; THENCE SOUTH 46°30' EAST, ALONG SAID NORTHEASTERLY LINE OF RANCHO LA LAGUNA, 603.46 FEET; THENCE NORTH 43°30' EAST, 227.22 FEET; THENCE NORTH 36°58'16" EAST, 317.71 FEET, MORE OR LESS, TO A POINT ON THE NORTH LINE OF SAID SECTION 36, SAID POINT BEING THE TRUE POINT OF BEGINNING; THENCE EASTERLY ALONG THE NORTH LINE OF SAID SECTION 36, A DISTANCE OF 293.31 FEET TO THE NORTHEAST CORNER OF SAID SECTION 36; THENCE SOUTH ALONG THE EASTERLY LINE OF SAID SECTION 36, A DISTANCE OF 195.18 FEET; THENCE NORTH 89°45'40" WEST, TO A POINT WHICH BEARS SOUTH 36°58'16" WEST FROM THE TRUE POINT OF BEGINNING; THENCE NORTH 36°58'16" EAST, A DISTANCE OF 243.54 FEET TO THE TRUE POINT OF BEGINNING.
EXCEPTING THAT PORTION CONVEYED TO THE STATE OF CALIFORNIA BY DEED RECORDED APRIL 15, 1955 IN BOOK 1723, PAGE 537 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.
ALSO EXCEPTING THAT PORTION CONVEYED TO THE COUNTY OF RIVERSIDE, BY DEED RECORDED DECEMBER 9, 1963 AS INSTRUMENT NO. 129506 IN BOOK 3552, PAGE 358 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

PARCEL 2:
ALL THAT PORTION OF THE NORTHEAST QUARTER OF FRACTIONAL SECTION 36, TOWNSHIP 5 SOUTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN, AS SHOWN BY MAP OF UNITED STATES GOVERNMENT SURVEY, DESCRIBED AS FOLLOWS:
COMMENCING AT THE INTERSECTION OF THE NORTH LINE OF SAID SECTION 36, AND THE NORTHEASTERLY LINE OF RANCHO LA LAGUNA;
THENCE SOUTH 46°30' EAST ALONG SAID NORTHEASTERLY LINE OF RANCHO LA LAGUNA 603.46 FEET;
THENCE NORTH 43°30' EAST 227.22 FEET;
THENCE SOUTH 46°30' EAST, 290 FEET TO THE TRUE POINT OF BEGINNING;
THENCE NORTH 43°30' EAST TO THE SOUTHWESTERLY LINE OF THE LAND CONVEYED TO THE COUNTY OF RIVERSIDE BY DEED RECORDED DECEMBER 9, 1963, AS INSTRUMENT NO. 129506 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA; THENCE SOUTHEASTERLY ALONG SAID SOUTHWESTERLY LINE TO THE EASTERLY LINE OF SAID SECTION 36' THENCE SOUTHERLY ALONG THE EASTERLY LINE OF SAID SECTION TO A LINE THAT BEARS SOUTH 46°30' EAST FROM THE TRUE POINT OF BEGINNING; THENCE NORTH 46°30' WEST IN A DIRECT LINE TO THE TRUE POINT OF BEGINNING.

PARCEL 3:
ALL THAT PORTION OF THE NORTHEAST QUARTER OF FRACTIONAL SECTION 36, TOWNSHIP 5 SOUTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN, AS SHOWN BY UNITED STATES GOVERNMENT SURVEY, DESCRIBED AS FOLLOWS:
COMMENCING AT THE INTERSECTION OF THE NORTH LINE OF SAID SECTION 36, AND THE NORTHEASTERLY LINE OF RANCHO LA LAGUNA;
THENCE SOUTH 46°30' EAST ALONG SAID NORTHEASTERLY LINE OF RANCHO LA LAGUNA 603.46 FEET;
THENCE NORTH 43°30' EAST, 227.22 FEET TO THE TRUE POINT OF BEGINNING;
THENCE SOUTH 46°30' EAST 290 FEET;
THENCE NORTH 43°30' EAST, TO A POINT ON THE SOUTHWESTERLY LINE OF THE PROPERTY CONVEYED TO THE COUNTY OF RIVERSIDE BY DEED RECORDED DECEMBER 9, 1963 AS INSTRUMENT NO. 129506 OF OFFICIAL RECORDS OF RIVERSIDE COUNTY, SAID POINT BEING ON A CURVE CONCAVE NORTHEASTERLY WITH A RADIUS OF 430 FEET, A CENTRAL ANGLE OF 42°50'45" AND AN ARC DISTANCE OF 321.55 FEET;
THENCE NORTHWESTERLY ALONG SAID SOUTHWESTERLY LINE OF THE CONVEYANCE TO THE COUNTY OF RIVERSIDE, A DISTANCE OF 60 FEET, TO A POINT OF INTERACTION WITH A LINE THAT IS NORTH 36°58'16" EAST, 74.17 FEET, AND SOUTH 89°45'40" EAST FROM THE TRUE POINT OF BEGINNING; THENCE NORTH 89°45'40" WEST TO A POINT THAT IS NORTH 36°58'16" EAST, 74.14 FEET FROM THE TRUE POINT OF BEGINNING; THENCE SOUTH 36°58'16" WEST, 74.14 FEET TO THE TRUE POINT OF BEGINNING.

PARCEL 4:
THAT PORTION OF THE NORTHEAST QUARTER OF FRACTIONAL SECTION 36, TOWNSHIP 5 SOUTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN, DESCRIBED AS FOLLOWS:
COMMENCING AT THE INTERSECTION OF THE NORTHERLY LINE OF SAID SECTION WITH THE NORTHEASTERLY LINE OF RANCHO LA LAGUNA;
THENCE 46°30' EAST, ON THE NORTHEASTERLY LINE OF RANCHO LA LAGUNA, 603.46 FEET TO THE TRUE POINT OF BEGINNING;
THENCE NORTH 43°30' EAST, 227.22 FEET TO THE MOST WESTERLY CORNER OF THAT CERTAIN PARCEL CONVEYED, TO CHARLES E. BICKER AND WIFE, BY DEED FILED FOR RECORD JANUARY 17, 1962 AS INSTRUMENT NO. 4864;
THENCE SOUTH 46°30' EAST ON THE SOUTHWESTERLY LINE OF SAID PARCEL, 660.69 FEET, MORE OR LESS TO THE EAST LINE OF SAID FRACTION SECTION 36;
THENCE SOUTH ON THE EAST LINE OF SAID SECTION 310.91 FEET, MORE OR LESS, TO THE MOST SOUTHERLY CORNER OF SAID FRACTIONAL SECTION 36;
THENCE NORTH 43°30' WEST ON THE NORTHEASTERLY LINE OF RANCHO LA LAGUNA, 872.49 FEET TO THE TRUE POINT OF BEGINNING.

APNS: 389-220-003/004/005/006

ADDRESS: 29033 EL TORO ROAD
COLLIER AVENUE, NUMBER NOT YET ASSIGNED.

AREA

PARCEL 1: 1.15 AC GROSS = 50,207 SQ FT
PARCEL 2: 1.43 AC GROSS = 62,082 SQ FT
PARCEL 3: 1.52 AC GROSS = 66,373 SQ FT
PARCEL 4: 3.41 AC GROSS = 148,480 SQ FT

BASIS OF BEARINGS

BEARINGS HEREON ARE BASED UPON THE RANCHO LA LAGUNA LINE AS SHOWN ON PM 219/1-7, OFFICIAL RECORDS RIVERSIDE COUNTY, CALIFORNIA, BEING N 46° 51' 59" W

EASEMENT NOTES

CHICAGO TITLE INSURANCE COMPANY, ORDER NO. 00128508-987-OC1-K27 DATED JUNE 1, 2020.
NUMBERS SHOWN HEREON REFER TO ITEMS LISTED AS EXCEPTIONS AND EXCLUSIONS IN SAID REPORT.

EASEMENTS SHOWN THUS △ ARE PLOTTED HEREON.

1.1 THE CENTERLINE OF A UNDISCLOSED WIDTH RIGHT OF WAY EASEMENT IN FAVOR OF CALIFORNIA ELECTRIC POWER COMPANY, A CORPORATION AND CALIFORNIA WATER & TELEPHONE COMPANY, A CORPORATION, THEIR RESPECTIVE SUCCESSORS AND ASSIGNS, FOR CONSTRUCTION, MAINTENANCE, OPERATION, INSPECTION, REPAIR, ALTERATION, REPLACEMENT AND REMOVAL OF ELECTRICAL LINES AND TELEPHONE LINES RECORDED OCTOBER 11, 1963 AS INSTRUMENT NO. 1963-107712.

1.2 THE CENTERLINE OF A UNDISCLOSED WIDTH RIGHT OF WAY EASEMENT IN FAVOR OF CALIFORNIA ELECTRIC POWER COMPANY, A CORPORATION AND CALIFORNIA WATER & TELEPHONE COMPANY, A CORPORATION, THEIR RESPECTIVE SUCCESSORS AND ASSIGNS, FOR CONSTRUCTION, MAINTENANCE, OPERATION, INSPECTION, REPAIR, ALTERATION, REPLACEMENT AND REMOVAL OF ELECTRICAL LINES AND TELEPHONE LINES RECORDED OCTOBER 11, 1963 AS INSTRUMENT NO. 1963-107713.

2. A 5' WIDE EASEMENT IN FAVOR OF ANNA LEE BIECHER, RESERVED FOR WATERLINE AND INCIDENTAL PURPOSES RECORDED SEPTEMBER 28, 1965 AS INSTRUMENT NUMBER 1965-110956, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA. RE-RECORDED MARCH 10, 1966 AS INSTRUMENT NUMBER 1966-25699, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

3. A 5' WIDE EASEMENT IN FAVOR OF JACK L. WILLIAMS AND DARLA R. WILLIAMS, RESERVED FOR WATERLINE AND INCIDENTAL PURPOSES RECORDED SEPTEMBER 21, 1976 AS INSTRUMENT NUMBER 1976-140719, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

4. A 40' EASEMENT IN FAVOR OF MICHAEL J. HILLSTROM AND JOYCE HILLSTROM FOR RIGHT OF WAY FOR, BUT NOT LIMITED TO, INGRESS, EGRESS, GAS, WATER, SEWER, ELECTRICITY, AND OTHER UTILITIES RECORDED NOVEMBER 16, 1988 AS INSTRUMENT NUMBER 1988-334581, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

5. AN EASEMENT IN FAVOR OF THE CITY OF LAKE ELSINORE, A MUNICIPAL CORPORATION, FOR DRAINAGE, PUBLIC UTILITIES, WIRES, CABLES, CONDUITS, STORM SEWERS, SANITARY SEWERS AND WATER PIPELINES, RECORDED NOVEMBER 23, 1999 AS INSTRUMENT NUMBER 1999-514924, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

6. AN EASEMENT IN FAVOR OF THE CITY OF LAKE ELSINORE, A MUNICIPAL CORPORATION, FOR SLOPES, RECORDED NOVEMBER 23, 1999 AS INSTRUMENT NUMBER 1999-514925, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

7. AN AGREEMENT BETWEEN PROPERTY OWNERS HILLSTROMS AND THE CITY OF LAKE ELSINORE, A MUNICIPAL CORPORATION CONTAINING AMONG OTHER THINGS AN EASEMENT FOR ENCROACHMENT OF PRIVATELY OWNED DRAINAGE FACILITIES INTO CITY-OWNED PROPERTY, RECORDED OCTOBER 12, 2012 AS INSTRUMENT NO. 2012-04999.35, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA. THE EXACT NATURE AND LOCATION OF THE EASEMENTS OR ENCROACHMENTS CANNOT BE DETERMINED AS THE RECORDED DOCUMENT IS INCOMPLETE, MISSING SEVERAL PAGES AND REFERENCED EXHIBITS.

4A. A 40' EASEMENT IN FAVOR OF MICHAEL J. HILLSTROM AND JOYCE HESS HILLSTROM, TRUSTEES OF THE HILSTROM FAMILY TRUST FOR RIGHT OF WAY FOR, BUT NOT LIMITED TO, INGRESS, EGRESS, GAS, WATER, SEWER, ELECTRICITY, AND OTHER UTILITIES RECORDED JULY 24, 1990 AS INSTRUMENT NUMBER 1990-271083, OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

TOPOGRAPHY SOURCE

CONTOURS SHOWN HEREON ARE BASED ON AN AERIAL SURVEY PERFORMED ON FEBRUARY 5, 2020. FIELD CONTROL SET BY IE SURVEY AND ENGINEERING, INC. ON FEBRUARY 3, 2020.

CONTOUR INTERVAL: 1'

BENCHMARK: ELEVATIONS ARE BASED ON A OPUS SOLUTION AND ARE IN NAVD 1988.
TEMPORARY BENCHMARK IS A PK NAIL IN ASPHALT NORTHERLY OF PROPERTY. ELEV 1277.71'. SHOWN HEREON AS ⊕

ZONING

M-1 (LIMITED MANUFACTURING)

SETBACKS-REFER TO CITY ZONING ORDINANCE FOR EXCEPTIONS
FRONT-AVERAGE 20 FEET BUT NOT LESS THAN 15'
SIDE, STREET-AVERAGE 20 FEET BUT NOT LESS THAN 15'
SIDE, INTERIOR-0'
REAR, INTERIOR-0'
PARKING: AS PROVIDED BY LEMC CHAPTER 17.148

BUILDING HEIGHT
40 FOOT MAXIMUM UNLESS OTHERWISE PROVIDED BY LEMC 17.136.030

GENERAL PLAN DESIGNATION

BUSINESS PROFESSIONAL

UTILITIES

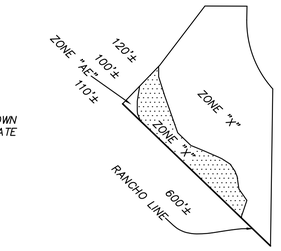
UTILITIES SHOWN HEREON ARE PLOTTED FROM OBSERVATION OF SURFACE MANIFESTATIONS OF UNDERGROUND UTILITIES AND FROM EXAMINATION OF AVAILABLE PUBLIC RECORD PLANS. THE PROPERTY IS SERVED BY WATER, SEWER, & OVERHEAD ELECTRICAL.

LEGEND

TREE
PALM
SHRUB
WM — WATER METER BOX
WV — WATER VALVE
W — WATER SERVICE
G — GAS METER BOX
SEWER CLEAN OUT
TD — TOP OF DIKE
AC — ASPHALT CONCRETE
NO ACCESS PER ITEM C
CF — CURB FACE
BO — WATER BLOW OFF
FIRE HYDRANT
MANHOLE
SD — STORMDRAIN
LIGHT STANDARD
TYP. — TYPICAL
OD — OUTSIDE DIAMETER
E — EDISON VAULT
W — WATER VAULT
T — TELEPHONE VAULT
IRRIGATION CONTROL VALVE
ER — ELECTRIC RISER
SIGN
TRAFFIC VAULT
TRAFFIC BOX
POWER POLE
A.V.A.R
ANCHOR
SEWER RISER
GV — GAS VALVE
DRAIN
ELECTRIC BOX
COMMUNICATION RISER
AC PAVEMENT
BLOCK WALL
WOOD FENCE
FF — FINISHED FLOOR ELEVATION
PAD — PAD ELEVATION
HP — HIGH POINT
GB — GRADE BREAK
FL — FLOW LINE
℄ — CENTERLINE
PL — PROPERTY LINE
2:1 SLOPE (UNLESS OTHERWISE NOTED)
1040 — EXISTING CONTOUR
1050 — PROPOSED CONTOUR
C / F — CUT/FILL LINE
DAYLIGHT
RIP RAP
SWALE
CONCRETE INTERCEPTOR
000.00 DES? — SPOT ELEVATION

FLOOD STATEMENT

THE PROPERTY LIES WITHIN FEMA FLOOD INSURANCE RATE MAP NO. 06065C PANEL 2028G, EFFECTIVE DATE AUGUST 28, 2008, AND IS IN ZONE X, AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD AND ZONE AE, SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD WITH BASE FLOOD ELEVATIONS DETERMINED.

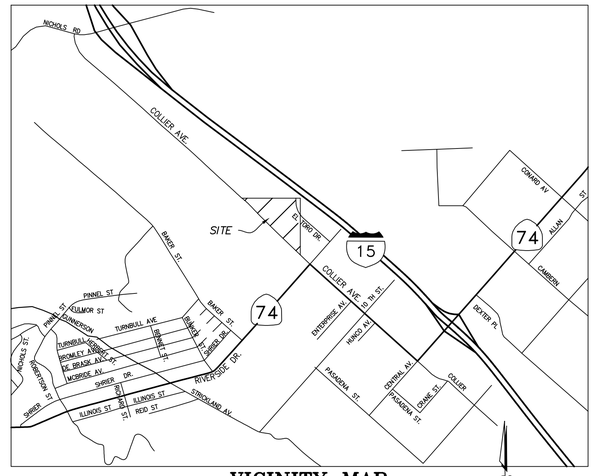


DISTANCES SHOWN ARE APPROXIMATE ONLY

ZONE X: AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN

SHADED ZONE X: AREAS OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD

ZONE AE: SPECIAL FLOOD HAZARD AREA SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD WITH BASE FLOOD ELEVATION DETERMINED TO BE AT ELEV. 1261.



VICINITY MAP

NO SCALE

SHEET INDEX

APPLICANT:

SADDLEBACK ASSOCIATES
c/o Mark Severson, President
27405 Puerta Real, Suite 120
Mission Viejo, CA 92691
Tel: (949) 635-1970
Email: mseverson@saddlebackassociates.com

GEOTECHNICAL ENGINEER:

EnGen Corporation
41625 Enterprise Circle S., Suite B-2, Temecula, CA 92590
(951) 296-3511
EnGen Project No. 4626GS

EARTHWORK QUANTITIES

CUT:	17,000 **Cu. Yds.**
FILL:	7,000 **Cu. Yds.**
BALANCE:	10,000 **Cu Yds** *(EXPORT)*

NOTE: EARTHWORK QUANTITIES BASED ON AN ASSUMED ONSITE TRAFFIC INDEX (TI) OF 6 & PER GEOTECH PAVING RECOMMENDATIONS.

IE SURVEY & ENGINEERING, INC.
41146 ELM STREET, SUITE G
MURRIETA, CA 92562
T: (951) 698.1830
E: INFO@IESURVEYANDENG.COM

Underground Service Alert 811 TWO WORKING DAYS BEFORE YOU DIG

MARK	REVISIONS	APPR.	DATE

THESE PLANS HAVE BEEN REVIEWED FOR COMPLIANCE WITH THE APPROPRIATE CONDITIONS OF DEVELOPMENT AND/OR CITY AND STATE LAWS AND HAVE BEEN FOUND ACCEPTABLE

REMON HABIB, PE RCE No. 83156 — DATE
CITY ENGINEER
CITY OF LAKE ELSINORE

PREPARED BY:

John B. Rogers, P.E., R.C.E. No. 22428 — DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER JOHN B. ROGERS No. 22428 CIVIL STATE OF CALIFORNIA

SOURCE OF TOPOGRAPHY
ON-SITE FIELD SURVEY BY INLAND EMPIRE SURVEY AND ENGINEERING, INC. ON 2-3-2020
AERIAL SURVEY PREFORMED BY TERRASCRIBE ON 2-5-2020

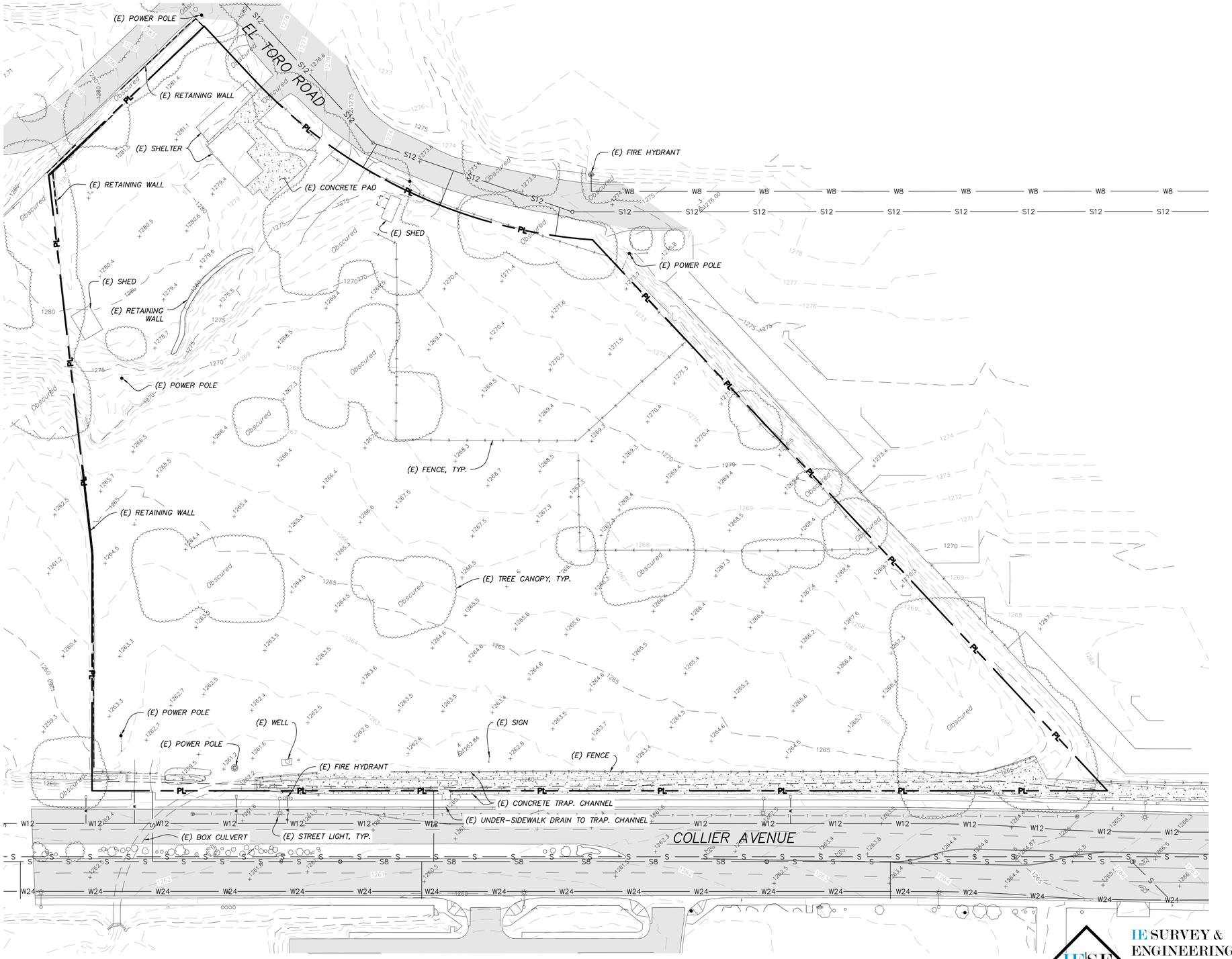
SCALE: 1"= 40'
DATE: 8-3-2021
BENCH MARK: ELEVATIONS SHOWN HEREON ARE BASED ON A OPUS SOLUTION AND ARE IN NAVD88.

CITY OF LAKE ELSINORE
TITLE SHEET
APN 389-220-003 THRU APN 389-220-004
NORTH ELSINORE BUSINESS PARK

SHEET 1 OF 5 SHEETS
FILE No.

DWG: 20038 CGP 20210803.dwg SHEET:TITLE DATE: Aug 03, 2021 - 12:13:02pm

IESE JOB NO: 20038



Underground Service Alert
811
TWO WORKING DAYS BEFORE YOU DIG

IE SURVEY & ENGINEERING, INC.
41146 ELM STREET, SUITE G
MURRIETA, CA 92562
T: (951) 698.1830
E: INFO@IESURVEYANDENG.COM

N

40 0 20 40 80 120

SCALE: 1"= 40'

MARK	REVISIONS	APPR.	DATE

THESE PLANS HAVE BEEN REVIEWED FOR COMPLIANCE WITH THE APPROPRIATE CONDITIONS OF DEVELOPMENT AND/OR CITY AND STATE LAWS AND HAVE BEEN FOUND ACCEPTABLE

REMON HABIB, PE RCE No. 83156
CITY ENGINEER
CITY OF LAKE ELSINORE
DATE

PREPARED BY:

John B. Rogers, P.E., R.C.E. No. 22428
DATE

SEAL
REGISTERED PROFESSIONAL ENGINEER
JOHN B. ROGERS
No. 22428
CIVIL
STATE OF CALIFORNIA

SOURCE OF TOPOGRAPHY

ON-SITE FIELD SURVEY BY INLAND EMPIRE SURVEY AND ENGINEERING, INC. ON 2-3-2020
AERIAL SURVEY PREFORMED BY TERRASCRIBE ON 2-5-2020

SCALE: 1"= 40'

DATE: 8-3-2021

BENCH MARK:

ELEVATIONS SHOWN HEREON ARE BASED ON A OPUS SOLUTION AND ARE IN NAVD88.

CITY OF LAKE ELSINORE

EXISTING CONDITIONS

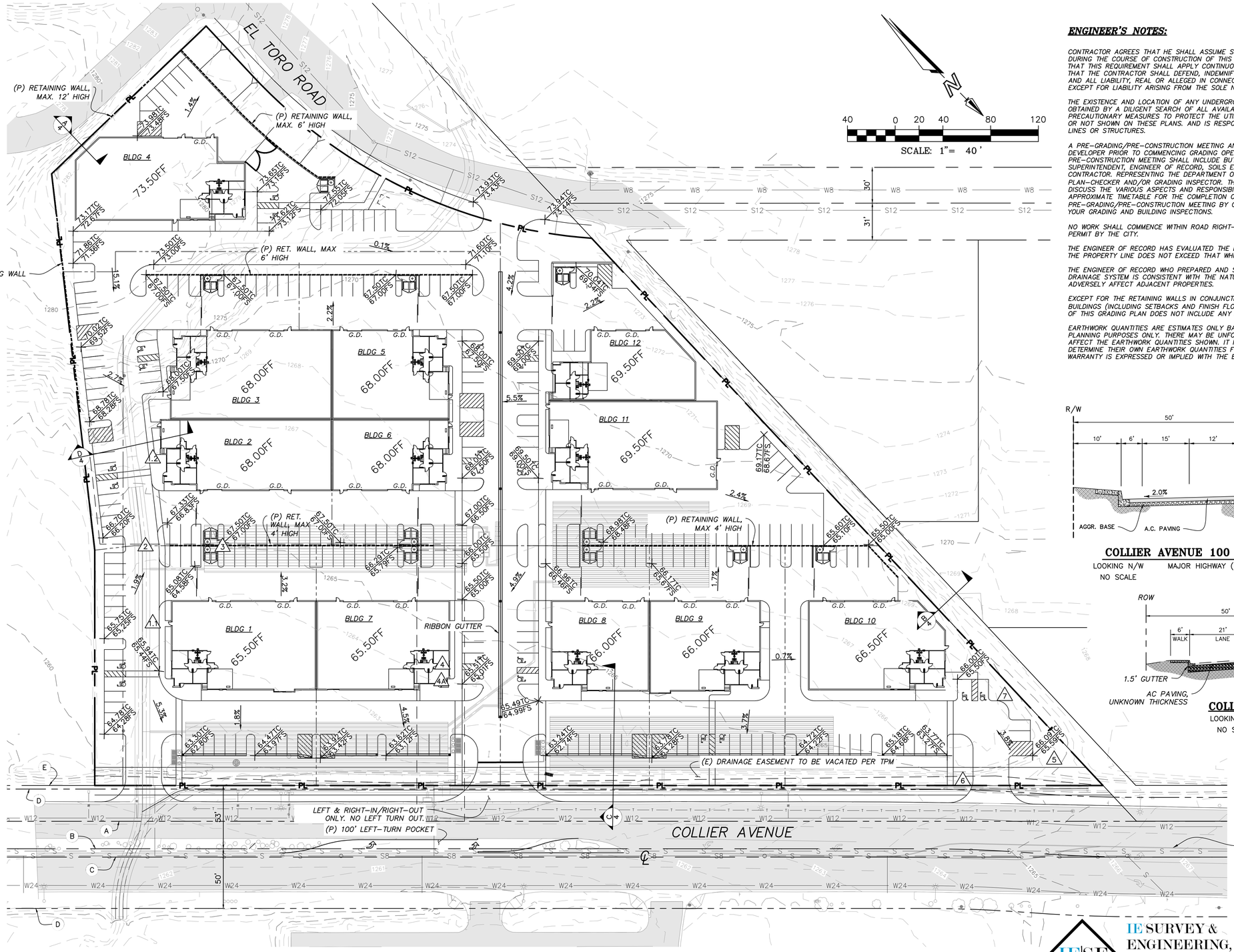
APN 389-220-003 THRU APN 389-220-004
NORTH ELSINORE BUSINESS PARK

SHEET 2 OF 5 SHEETS

FILE No.

IESE JOB NO: 20038

DWG: 20038 CGP 20210803.dwg SHEET:EXIST DATE: Aug 03, 2021 - 12:13:04pm



ENGINEER'S NOTES:

CONTRACTOR AGREES THAT HE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT. INCLUDING SAFETY OF ALL PERSONS AND PROPERTY; THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE OWNER AND ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPT FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITIES OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A DILIGENT SEARCH OF ALL AVAILABLE RECORDS. THE CONTRACTOR IS REQUIRED TO TAKE ALL PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN AND ANY OTHER LINES OR STRUCTURES SHOWN OR NOT SHOWN ON THESE PLANS. AND IS RESPONSIBLE FOR THE PROTECTION OF, AND ANY DAMAGE TO THESE LINES OR STRUCTURES.

A PRE-GRADING/PRE-CONSTRUCTION MEETING AND SITE INSPECTION SHALL BE ARRANGED FOR BY THE SITE DEVELOPER PRIOR TO COMMENCING GRADING OPERATIONS. THOSE PARTIES REQUIRED TO ATTEND THE PRE-CONSTRUCTION MEETING SHALL INCLUDE BUT ARE NOT LIMITED TO THE DEVELOPER, PROJECT SUPERINTENDENT, ENGINEER OF RECORD, SOILS ENGINEER, GRADING CONTRACTOR, AND UNDERGROUND UTILITIES CONTRACTOR. REPRESENTING THE DEPARTMENT OF BUILDING AND SAFETY SHALL BE THE GRADING PLAN-CHECKER AND/OR GRADING INSPECTOR. THE FOCUS OF THE PRE-CONSTRUCTION MEETING SHALL BE TO DISCUSS THE VARIOUS ASPECTS AND RESPONSIBILITIES OF THE GRADING PROJECT AND TO PROVIDE AN APPROXIMATE TIMETABLE FOR THE COMPLETION OF ROUGH GRADING. ARRANGE FOR A PRE-GRADING/PRE-CONSTRUCTION MEETING BY CALLING THE DISTRICT OFFICE RESPONSIBLE FOR PROVIDING YOUR GRADING AND BUILDING INSPECTIONS.

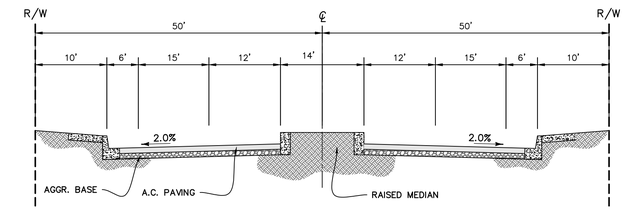
NO WORK SHALL COMMENCE WITHIN ROAD RIGHT-OF-WAY (R/W) PRIOR TO ISSUANCE OF AN ENCROACHMENT PERMIT BY THE CITY.

THE ENGINEER OF RECORD HAS EVALUATED THE DRAINAGE AND HAS DETERMINED THAT THE DRAINAGE ACROSS THE PROPERTY LINE DOES NOT EXCEED THAT WHICH EXISTED PRIOR TO GRADING.

THE ENGINEER OF RECORD WHO PREPARED AND SIGNED THE GRADING PLAN HAS VERIFIED THAT THE PROPOSED DRAINAGE SYSTEM IS CONSISTENT WITH THE NATURAL DRAINAGE PATTERN OF THE SITE AND WILL NOT ADVERSELY AFFECT ADJACENT PROPERTIES.

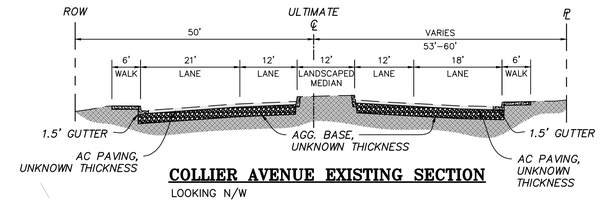
EXCEPT FOR THE RETAINING WALLS IN CONJUNCTION WITH THIS GRADING, ALL INFORMATION ASSOCIATED WITH BUILDINGS (INCLUDING SETBACKS AND FINISH FLOOR ELEVATIONS) IS FOR REFERENCE ONLY AND THE APPROVAL OF THIS GRADING PLAN DOES NOT INCLUDE ANY PROVISIONS ASSOCIATED WITH BUILDINGS.

EARTHWORK QUANTITIES ARE ESTIMATES ONLY BASED UPON THE TOPO AND SHALL ONLY BE USED FOR PLANNING PURPOSES ONLY. THERE MAY BE UNFORSEEN OR OTHERWISE UNQUANTIFIABLE VARIABLES THAT MAY AFFECT THE EARTHWORK QUANTITIES SHOWN. IT IS THE SOLE RESPONSIBILITY OF THE GRADING CONTRACTOR TO DETERMINE THEIR OWN EARTHWORK QUANTITIES FOR PURPOSES OF BIDDING AND PLANNING. NO GUARANTEE OR WARRANTY IS EXPRESSED OR IMPLIED WITH THE EARTHWORK QUANTITIES SHOWN ON THESE PLANS.



COLLIER AVENUE 100 R/W ULTIMATE TYPICAL SECTION

LOOKING N/W MAJOR HIGHWAY (4-LANE) PER CITY STANDARD 100C
NO SCALE



COLLIER AVENUE EXISTING SECTION

LOOKING N/W
NO SCALE

CENTERLINE, RIGHT-OF-WAY, PROPERTY LINE NOTES

A. RANCHO LINE PER PM 32991 PARCEL MB 219
B. ULTIMATE CENTERLINE
C. CENTERLINE PER RS 74/82
D. ULTIMATE RIGHT-OF-WAY
E. PL PER LEGAL DESCRIPTION

Underground Service Alert 811 TWO WORKING DAYS BEFORE YOU DIG

IE SURVEY & ENGINEERING, INC.
41146 ELM STREET, SUITE G
MURRIETA, CA 92562
T: (951) 698.1830
E: INFO@IESURVEYANDENG.COM

MARK	REVISIONS	APPR.	DATE

THESE PLANS HAVE BEEN REVIEWED FOR COMPLIANCE WITH THE APPROPRIATE CONDITIONS OF DEVELOPMENT AND/OR CITY AND STATE LAWS AND HAVE BEEN FOUND ACCEPTABLE

REMON HABIB, PE RCE No. 83156 — DATE
CITY ENGINEER
CITY OF LAKE ELSINORE

PREPARED BY:

John B. Rogers, P.E., R.C.E. No. 22428 — DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER JOHN B. ROGERS No. 22428 CIVIL STATE OF CALIFORNIA

SOURCE OF TOPOGRAPHY
ON-SITE FIELD SURVEY BY INLAND EMPIRE SURVEY AND ENGINEERING, INC. ON 2-3-2020
AERIAL SURVEY PREFORMED BY TERRASCRIBE ON 2-5-2020

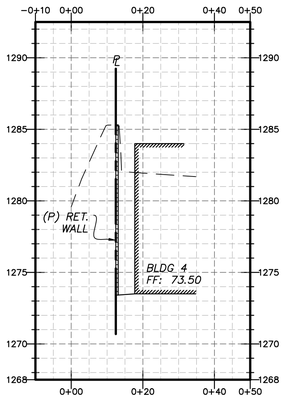
SCALE: 1"= 40'
DATE: 8-3-2021
BENCH MARK: ELEVATIONS SHOWN HEREON ARE BASED ON A OPUS SOLUTION AND ARE IN NAVD88.

CITY OF LAKE ELSINORE
PRELIMINARY GRADING PLAN
APN 389-220-003 THRU APN 389-220-004
NORTH ELSINORE BUSINESS PARK

SHEET 3 OF 5 SHEETS
FILE No.

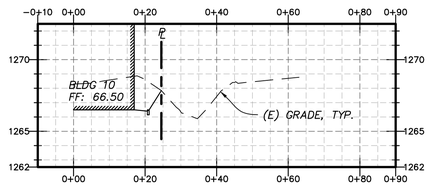
IESE JOB NO: 20038

DWG: 20038 CGP 20210803.dwg SHEET:CGP DATE: Aug 03, 2021 - 12:13:07pm



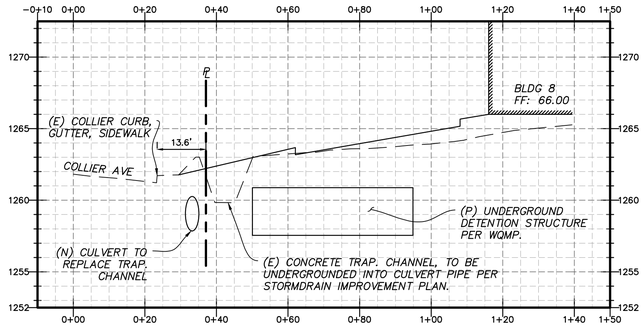
CROSS SECTION A–A

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=5'



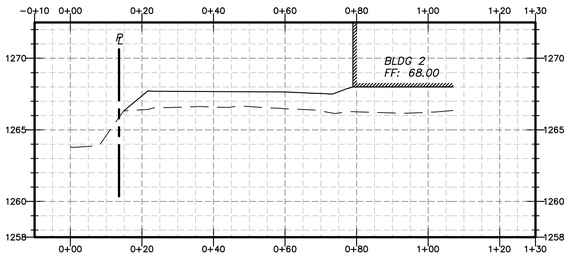
CROSS SECTION B–B

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=5'



CROSS SECTION C–C

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=5'



CROSS SECTION D–D

HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=5'

Underground Service Alert
811
TWO WORKING DAYS BEFORE YOU DIG

IE SURVEY & ENGINEERING, INC.
41146 ELM STREET, SUITE G
MURRIETA, CA 92562
T: (951) 698.1830
E: INFO@IESURVEYANDENG.COM

MARK	REVISIONS	APPR.	DATE

THESE PLANS HAVE BEEN REVIEWED FOR COMPLIANCE WITH THE APPROPRIATE CONDITIONS OF DEVELOPMENT AND/OR CITY AND STATE LAWS AND HAVE BEEN FOUND ACCEPTABLE

REMON HABIB, PE RCE No. 83156
CITY ENGINEER
CITY OF LAKE ELSINORE
DATE

PREPARED BY:

John B. Rogers, P.E., R.C.E. No. 22428
DATE

SEAL
REGISTERED PROFESSIONAL ENGINEER
JOHN B. ROGERS
No. 22428
CIVIL
STATE OF CALIFORNIA

SOURCE OF TOPOGRAPHY

ON-SITE FIELD SURVEY BY INLAND EMPIRE SURVEY AND ENGINEERING, INC. ON 2-3-2020
AERIAL SURVEY PREFORMED BY TERRASCRIBE ON 2-5-2020

SCALE: 1"= 40'
DATE: 8-3-2021

BENCH MARK:
ELEVATIONS SHOWN HEREON ARE BASED ON A OPUS SOLUTION AND ARE IN NAVD88.

CITY OF LAKE ELSINORE

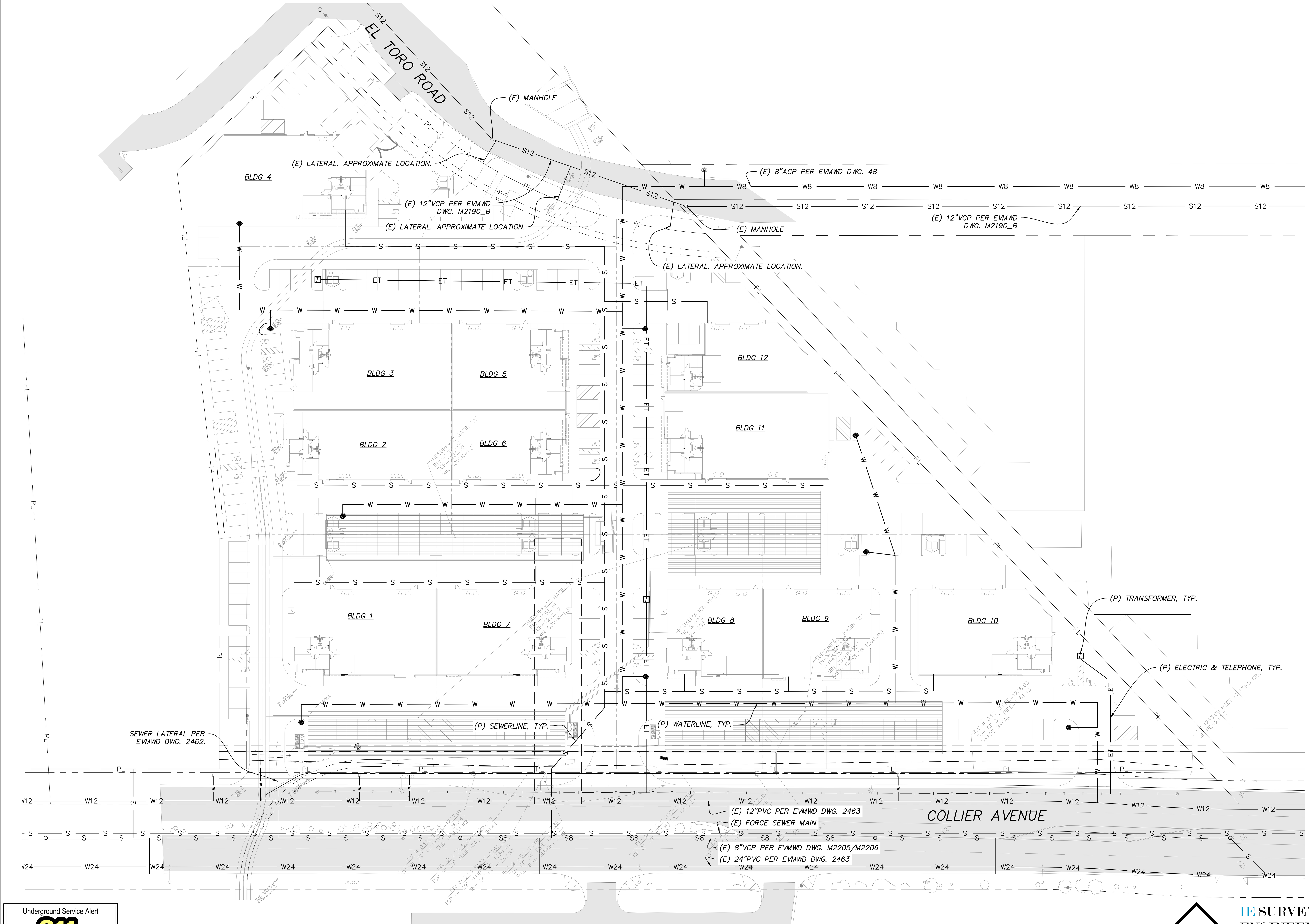
CROSS SECTIONS

APN 389-220-003 THRU APN 389-220-004
NORTH ELSINORE BUSINESS PARK

SHEET 4 OF 5 SHEETS
FILE No.

DWG: 20038 CGP 20210803.dwg SHEET:XSECTIONS DATE: Aug 03, 2021 - 12:13:10pm

IESE JOB NO: 20038



UTILITY NOTES

1. WATER LINES & HYDRANTS SHOWN SHALL BE WITHIN EVMWD-OWNED 20' WIDE EASEMENT, LOCATED 10' ON EITHER SIDE OF WATER LINE.
2. SEPARATE DCDA'S & FDC'S REQUIRED FOR EACH BUILDING.
3. BASIC POWER & TELEPHONE BACKBONE SHOWN. ADDITIONAL TRANSFORMERS & PULL BOXES WILL BE REQUIRED.

Underground Service Alert
811
TWO WORKING DAYS BEFORE YOU DIG

NOTE: ALL SEWER LATERALS TO BUILDINGS TO BE 6-INCH VCP. ALL WATER LINE SERVICE CONNECTIONS TO BUILDINGS TO BE 2-INCH WATER SERVICE, MINIMUM. ALL SERVICE CROSSINGS TO COMPLY WITH EVMWD SERVICE CROSSING STANDARDS.

IE SURVEY & ENGINEERING, INC.
41146 ELM STREET, SUITE G
MURRIETA, CA 92562
T: (951) 698.1830
E: INFO@IESURVEYANDENG.COM

40 0 20 40 80 120
SCALE: 1"= 40'

MARK	REVISIONS	APPR.	DATE

THESE PLANS HAVE BEEN REVIEWED FOR COMPLIANCE WITH THE APPROPRIATE CONDITIONS OF DEVELOPMENT AND/OR CITY AND STATE LAWS AND HAVE BEEN FOUND ACCEPTABLE

REMON HABIB, PE RCE No. 83156 DATE
CITY ENGINEER
CITY OF LAKE ELSINORE

PREPARED BY:

John B. Rogers, P.E., R.C.E. No. 22428 DATE

SEAL: REGISTERED PROFESSIONAL ENGINEER, JOHN B. ROGERS, No. 22428, CIVIL, STATE OF CALIFORNIA

SOURCE OF TOPOGRAPHY
ON-SITE FIELD SURVEY BY INLAND EMPIRE SURVEY AND ENGINEERING, INC. ON 2-3-2020
AERIAL SURVEY PREFORMED BY TERRASCRIBE ON 2-5-2020

SCALE: 1"= 40'
DATE: 8-3-2021

BENCH MARK:
ELEVATIONS SHOWN HEREON ARE BASED ON A OPUS SOLUTION AND ARE IN NAVD88.

CITY OF LAKE ELSINORE
UTILITY PLAN
APN 389-220-003 THRU APN 389-220-004
NORTH ELSINORE BUSINESS PARK

SHEET 5 OF 5 SHEETS
FILE No.

IESE JOB NO: 20038

DWG: 20038 CGP 20210803.dwg SHEET:UTILITY DATE: Aug 03, 2021 - 12:13:12pm

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

ENGEN CORPORATION
Geotechnical & Environmental Services

41625 Enterprise Circle S., B-2
Temecula, CA 92590

info@engencorp.com

engencorp.com

ph | 951.296.3511

fx | 951.240.3380

SDVOSB | DVBE

In Memory Of
Chris Stevens
Tyrone Woods
Ann Smedingoff
Glen Doherty
Sean Smith

Geotechnical Feasibility Study

Collier Avenue Project
(APN 389-220-003 through APN 389-220-006)

Project Number: 4626GS

February 1, 2021

Prepared for:

Saddleback Associates Inc.
27405 Puerta Real, #120
Mission Viejo, California 92691

TABLE OF CONTENTS

SECTION NUMBER AND TITLE **PAGE**

TABLE OF CONTENTS

SECTION NUMBER AND TITLE **PAGE**

ENGEN CORPORATION
Geotechnical & Environmental Services

41625 Enterprise Circle S., B-2
Temecula, CA 92590
info@engencorp.com
engencorp.com
ph | 951.296.3511
fx | 951.240.3380
SDVOSB | DVBE

February 1, 2021

Mr. Mark Severson
Saddleback and Associates, Inc.
27405 Puerta Real, Suite #120
Mission Viejo, California 92691

Subject: **Geotechnical Feasibility Study**
Collier Avenue Project, APN 389-220-003 through APN 389-220-006
Project Number: 4626GS

References: 1. **IE Surveying & Engineering**, Precise Grading Plan, APN 389-220-003 through APN 389-220-004, Saddleback Industrial, Lake Elsinore, CA, dated: December 8, 2020, scale: 1"=40'

Mr. Severson:

In accordance with your request and signed authorization, a representative of this firm has visited the subject site on November 13 and 16, 2020 to visually observe the surface conditions of the subject site, perform subsurface exploration and testing and collect samples of representative site earth materials. Laboratory testing was performed on these samples. Recommendations for grading operations and preliminary foundation design are provided in the subsequent sections of this report.

1.0 EXECUTIVE SUMMARY

1.1 Feasibility for development:

It is the opinion of this firm the proposed improvements are feasible from a geotechnical standpoint, provided that the recommendations presented in this report are incorporated in the design and construction of the project.

1.2 Demolition Operations:

All demolition operations should be conducted under the observation and documentation and testing of the project geotechnical engineer. **Failure to coordinate the demolition operations with the project geotechnical consultant of record may result in additional fieldwork beyond that represented herein**. It is the owner or the owner's authorized representative responsibility to ensure that the geotechnical consultant is informed of the demolition operations so that a qualified representative can be dispatched for observation and testing.

1.3 Unsuitable Soils:

The site is underlain by undocumented man-made fill, alluvium, Pauba Formation and Santiago Formation bedrock. A suspected trash pit that is considered undocumented fill was discovered near the center of the site. The undocumented fill, and upper portions of the alluvium are considered unsuitable for support and they should be removed to competent alluvium or competent bedrock in the areas of the proposed development.

1.4 Expansive and Corrosive Soils:

Based on the remediation recommendations for site grading operations, the expansive and corrosive properties of the soils that will be in contact with and supporting concrete foundations and slabs is not known. However, based on the laboratory test results conducted on representative samples of the on-site earth materials, we anticipate low expansive non-corrosive properties.

2.0 SITE AND PROJECT DESCRIPTION

2.1 General:

The site consists of an approximately 7.5-acres irregularly shaped lot located approximately 225 to 650 feet northwest of Riverside Drive, on the northeast side of Collier Avenue and the southwest side of

terminus of El Toro Road, in the City of Lake Elsinore, County of Riverside, California. Topographic relief across the site is approximately 20-feet. A prominent flat knob is located at the northern corner of the site while the remainder of the site is very gently sloping. Site drainage is generally through sheet flow to the southwest toward Collier Avenue. Vegetation consisted of a moderate cover of weeds and grasses, along with scattered bushes, and several mature trees. Two areas within the property were enclosed with chain link fences at the time of our investigation, both adjacent to the east side of the site. The southerly fenced area appeared in a mostly natural state. The central fenced area appears to have been utilized as a construction storage yard. At the time of our investigation the ground surface within the central fenced area was covered by crushed rock, and various construction materials were stored within the fenced area, including lumber, various diameter plastic pipes, traffic control devices, and assorted hardware.

2.2 Background:

Based on a review of historical aerial photos, it appears that the knob at the northern corner had been previously developed with a single-family residence, with associated out buildings, free standing shade structures, a driveway and low retaining walls as recently as 2018. At the time of our investigation the structures had been removed, however, the driveway, concrete slabs and retaining walls, along with some wooden posts and supports for the shade structures remained.

2.3 Existing Septic System and Water Well:

A vitrified clay pipe was encountered on the knob. This clay pipe likely is connected to a septic system on the property. What appears to be a pressure vessel for a water well was observed near western corner of the site.

2.4 Project Description:

Based on our review of the grading plan, it is our understanding that the proposed earthwork will include typical cut and fill type grading. All cut and fill slopes are planned to be constructed at a ratio of 2:1 (horizontal to vertical) or flatter. The proposed development will consist of 6 commercial/light industrial tilt-up or steel-framed structures constructed with a slab on grade foundations, along with associated hardscape and landscape improvements.

Foundation plans were not available prior to this writing and should be reviewed by this office once available so that supplemental recommendations can be given if necessary. For the purposes of this report foundations bearing load criteria will be based on the following criteria:

Maximum Structure Bearing Loads	
Description	**Maximum Loads**
Maximum Wall Loads	2 kips per linear foot
Maximum Column Loads	30 kips
Maximum Floor Slab Pressure	150 pounds per cubic foot
Parking and Traffic Structural Loads (Design Life of 20 Years)	
Description	**Maximum Loads**
Concrete and Asphalt Pavement Areas	Equivalent Single Axle Loads = 18 kips
Concrete and Asphalt Pavement Areas	Maximum Loads = 60,000

It is represented that the proposed development will include infrastructure such as street, storm drains and utility improvements.

2.5 Scope of Work:

The scope of this study was to provide a preliminary geotechnical assessment of the surface and subsurface conditions within the proposed development area, and to provide recommendations for the development of the site from a geotechnical point of view. The scope included: 1) site reconnaissance and geologic mapping, 2) subsurface exploration and field testing, 3) sampling and laboratory testing of on-site materials, 4) engineering analysis of field and laboratory data, and 5) preparation of this report.

2.6 Field Study:

Field Reconnaissance: Field reconnaissance, geologic mapping and subsurface exploration was conducted at the subject property on November 13 and 16, 2020. The purpose of the subsurface

exploration was to assess the underlying earth materials' existing condition and geotechnical properties as well as the presence of groundwater.

Borings: Four exploratory borings (B1 through B4) and seven exploratory test pits (TP1 through TP7) were excavated at the study site. The borings were advanced by Martini Drilling using a CME 75 truck-mounted drill rig equipped with 8-inch outside diameter hollow-stem augers. The maximum depth explored was approximately 48-feet below the existing ground surface at the boring locations. Bulk and relatively undisturbed samples of the earth materials encountered were obtained at various depths in the exploratory borings and transported to our soils laboratory for verification of field classifications and testing. Bulk samples were obtained from cutting developed during the excavation process and represent a mixture of the soils within the depth indicated on the logs. Relatively undisturbed samples of the earth materials encountered were obtained by driving a thin-walled steel sampler lined with 1.0-inch high, 2.42-inch inside diameter brass rings. Disturbed samples were obtained at various depths within the borings utilizing a Standard Penetration Test (SPT) sampler. The samplers were driven with successive drops of a 140-pound weight having a free fall of approximately 30-inches. The blow counts for each successive 6.0-inches of penetration, or fraction thereof, are shown in the Geotechnical Boring Logs presented in the Appendix. The ring samples were retained in close-fitting moisture-proof containers and transported to our laboratory for testing.

Test Pits: The test pits were excavated by Tiger Equipment Grading & Excavation utilizing a Caterpillar 420D wheel-mounted backhoe. The maximum test pit excavation depth was 14-feet below the existing ground surface. In-situ moisture and density were determined at various depths within the test pits utilizing a nuclear moisture-density gauge. Bulk soil samples were collected from the cuttings generated during the test pit excavation. The approximate locations of the exploratory borings and test pits are shown on the Geotechnical Site Plan (Plate 1).

2.7 Exploratory Test Pit Backfill Compaction:

The exploratory test pits were backfilled with loose soil cuttings after completion of logging, testing and sampling operations. No compaction efforts were applied during the backfill operations, and tests were not performed to determine the compaction of the backfilled material. The exploratory test pit backfill should be removed and re-compacted during grading and verified as meeting a minimum density of the surrounding earth materials within the body of the final grading report for the proposed project.

3.0 LABORATORY TESTING

3.1 General:

The results of laboratory tests performed on samples of earth material obtained during the site visit are presented in the attached Exhibits. Following is a listing and brief explanation of the laboratory tests performed. The samples obtained during the field study will be discarded 30 days after the date of this report. This office should be notified immediately if retention of samples will be needed beyond 30 days.

3.2 Classification:

The field classification of soil materials encountered during our site visit were verified in the laboratory in general accordance with the Unified Soils Classification System, ASTM D 2488, Standard Practice for Determination and Identification of Soils (Visual-Manual Procedures). The final classification is shown in the Moisture Density Test Report presented in the Appendix.

3.3 Maximum Dry Density/Optimum Moisture Content Relationship Test:

Maximum dry density/optimum moisture content relationship determinations were performed on samples of near-surface earth material in general accordance with ASTM 1557 procedures using a 4.0-inch diameter mold. Samples were prepared at various moisture contents and compacted in five (5) layers using a 10-pound weight dropping 18-inches and with 25 blows per layer. A plot of the compacted dry density versus the moisture content of the specimens is constructed and the maximum dry density and optimum moisture content determined from the plot. The plot is shown in the Moisture Density Test Report presented in the Appendix.

3.4 Expansion Test:

Laboratory expansion tests were performed on samples of near-surface earth material in general accordance with CBC 18-2. In this testing procedure, a remolded sample is compacted in two (2) layers in a 4.0-inch diameter mold to a total compacted thickness of approximately 1.0-inch by using a 5.5-pound weight dropping 12-inches and with 15 blows per layer. The sample should be compacted at a saturation between 49 and 51 percent. After remolding, the sample is confined under a pressure of 144 pounds per square foot (psf) and allowed to soak for 24 hours. The resulting volume change due to the increase in moisture content within the sample is recorded and the Expansion Index (EI) calculated.

3.5 Direct Shear Test:

Direct shear tests were performed on select samples of near-surface earth material in general accordance with ASTM D 3080 procedures. The shear machine is of the constant strain type. The shear machine is designed to receive a 1.0-inch high, 2.42-inch diameter ring sample. Specimens from the sample were sheared at various pressures normal to the face of the specimens. The specimens were tested in a submerged condition. The maximum shear stresses were plotted versus the normal confining stresses to determine the shear strength (cohesion and angle of internal friction).

3.6 Grain Size Distribution Test:

An evaluation was performed on selected representative soil samples in general accordance with ASTM D 422. This “grain-size” or “sieve analysis” test method determines the distribution of particle sizes in soils which allows for the proper classification according to the Unified Soils Classification System (USCS). In this test procedure, a weighed sample is processed through multiple sieves designated by their size generally ranging from a No. 4 (0.25-inch) to a No. 200 sieve by means of a lateral and vertical motion of the sieve on a mechanical shaker. The percentage of material passing each sieve is weighed and recorded with the results plotted in graph form.

3.7 Hydrometer Analysis:

An evaluation was performed on selected representative soil samples in general accordance with ASTM D 7928. This "particle size" or "gradation" test method determines the distribution of fine-grained particle sizes by means of the sedimentation hydrometer analysis which separates silts and clay fractions. In this procedure the particle size distribution of material that finer than No. 200 sieve are determined, and results are presented as the mass percent finer versus the log of particle diameter.

3.8 Consolidation Test:

Settlement predictions of the on-site soil and compacted fill behavior under load were made, based on consolidation tests that were performed in general accordance with ASTM D 2435 procedures. The consolidation apparatus is designed to receive a 1.0-inch high, 2.416-inch diameter ring sample. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore water and pore pressure. Loads normal to the face of the specimen are applied in several increments in a geometric progression under both field moisture and submerged conditions. The resulting changes in sample thickness are recorded at selected time intervals. Water was added to the test apparatus at various loads to create a submerged condition and to measure the collapse potential (hydroconsolidation) of the sample. The resulting change in sample thickness was recorded.

3.9 In-Situ Moisture Content and Density Test:

The in-situ moisture content and dry density were determined in general accordance with ASTM D 2216 and ASTM D 2937 procedures, respectively, for each selected undisturbed sample obtained. The dry density is determined in pounds per cubic foot and the moisture content is determined as a percentage of the oven dry weight of the soil.

3.10 In-Situ Moisture Content and Density Test (Nuclear Method):

Relative compaction testing was performed in general accordance with ASTM D 2922 and ASTM D 3017 procedures for determining in-place density and moisture content, respectively, using nuclear density gauge equipment.

3.11 R-Value:

An evaluation was performed on a selected representative soil sample in general accordance with California Test Method 301. The resistance (R-Value) test method is used to measure the potential strength of subgrade, subbase, and base course materials for use in road pavements.

3.12 Soluble Sulfate Test:

Samples of the near-surface earth materials were obtained for soluble sulfate testing for the site. The concentration of soluble sulfates was determined in the general conformance with California Test Method 417 procedures.

3.13 pH/Minimum Resistivity:

Samples Sample(s) of near surface soils were tested for pH and minimum resistivity in general accordance with CTM 643.

3.14 Chloride Content:

Sample(s) of near surface soils were tested for chloride content in general conformance with CTM 422.

4.0 FINDINGS

4.1 Site Review:

At the time of our recent field study, no permanent structures were located on the site. Most of the site is nearly flat with a low knob at the northern corner of the site. It appears that previous structures that had once been located at the northern corner of the site had been removed, leaving remnants such as slabs, a driveway, retaining walls, wooden posts, etc. A water well, and likely a septic system are also located on the site. Vegetation on the site consisted of grasses, and bushes, as well as mature trees.

4.2 Subsurface Soil Profile:

Undocumented fill and alluvial deposits are exposed across the site. Pauba Formation sandstone bedrock underlies the undocumented fill and alluvium beneath the knob at the northern corner of the site, while the sandstone member of the Santiago Formation underlies the undocumented fill and alluvium in the remaining flat portions of the site. Excavation in the undocumented fill and alluvium is expected to be relatively easy with conventional heavy grading equipment. Based on our experience on similar projects near the subject site, the Pauba Formation bedrock is expected to be moderate to difficult ripping within the upper 6 feet. Based on the expected depths of removal, Santiago Formation will not likely be encountered during grading. A more detailed description of the earth materials encountered at the site are presented in the **Earth Materials** section of this report. The exploratory boring and test pit logs of earth materials encountered during the subsurface exploration are included in the Appendix.

4.3 Transition Areas:

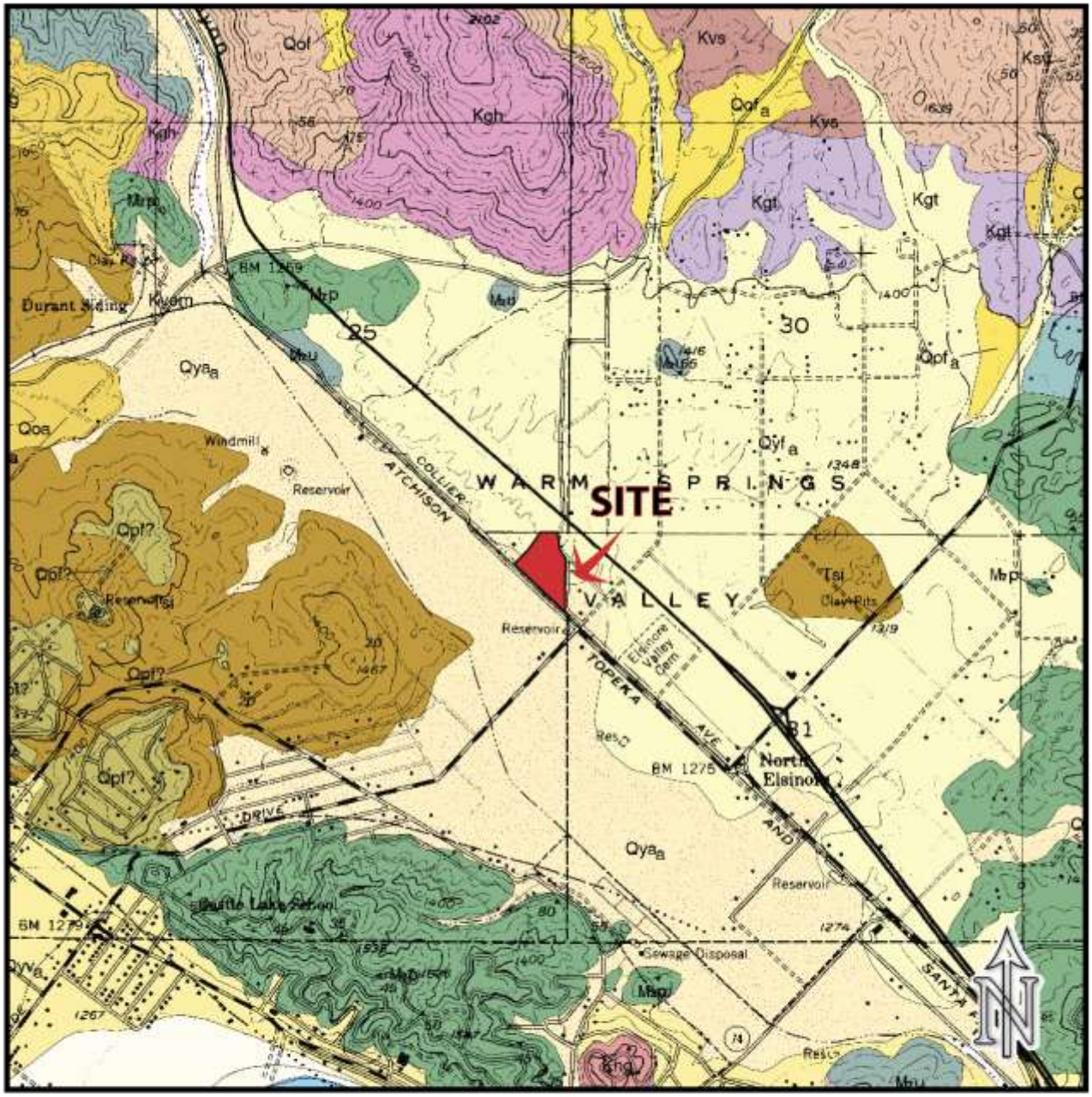
Transitions between cut and fill areas on the building pads are identified on the Referenced No. 1 grading plan. To guard against potential differential settlement, the footprint of the future structures should be over-excavated and recompacted to a minimum of 90 percent relative compaction (See § 7.1).

5.0 GEOLOGY AND SEISMICITY

5.1 Geologic Setting:

The site is located in the Northern Peninsular Range on the southern sector of the structural unit known as the Perris Block. The Perris Block is bounded on the northeast by the San Jacinto Fault Zone, on the southwest by the Elsinore Fault Zone, and on the north by the Cucamonga Fault Zone. The southern boundary of the Perris Block is believed to coincide with a complex group of faults trending southeast from the Murrieta, California area (Kennedy, 1977). The Peninsular Range is characterized by large Mesozoic age intrusive rock masses flanked by volcanic, metasedimentary, and sedimentary rocks. Various thicknesses of colluvial/alluvial sediments derived from the erosion of the elevated portions of the region fill the low-lying areas.

FIGURE 2 - REGIONAL GEOLOGIC MAP



Base Map: Preliminary Geologic Map of the the Elsinore 7.5' Quad., Riv Co, Open File Rpt. 03-281, Scale 1:24,000, DR Morton, 1978, 1998

LEGEND

- Qyw = **Young Alluvial-Wash deposits (Holocene & late Pleistocene)** Unconsolidated bouldery to sandy alluvium. Recently active washes
- Qya$_c$ = **Young Alluvial Channel deposits (Holocene & late Pleistocene)** - Fluvial deposits along valley floors. Consists of sand, silt, and clay -bearing alluvium
- Qof$_c$ = **Old Alluvial Channel deposits (middle to early Pleistocene)**- Fluvial sediments on broad canyon floors. Consists of moderately to well-indurated, gravel, sand, silt
- Kt = **Tonalite, undifferentiated (Cretaceous)** Gray, medium grained biotite hornblende tolanite, typicaly foliated. Western edge of large body exposed at eastern edge of quadrngle.
- Qpf = **Pauba Formation Sandstone (Pleistocene)** - Siltstone, sandstone and conglomerate. subdivided into two informal members; only sandstone member exposed in quadrangle
- Qvoa = **Very old alluvial channel deposits (middle to early Pleistocene)** - Fluvial sediments deposited on broad canyon floors. Moderate to well-indurated
- Tsi = **Silverado Formation (Paleocene)** - Nonmarine and marine sandstone, siltstone, and conglomerate. Thoroughly weathered. Claymont clay bed underlies conglomerate
- Khg = **Hypabyssal Tonalite (Cretaceous)** - Includes a wide variety of heterogeneous granitic rocks. Mostly of granodioritic and tonalitic composition.

5.2 Seismic Hazards:

Because the proposed development is located in tectonically active southern California, it will likely experience some effects from earthquakes. The type or severity of seismic hazards affecting the site is mainly dependent upon the distance to the causative fault, the intensity of the seismic event, and the soil characteristics. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction or dynamic settlement. The following is a site-specific discussion about ground motion parameters, earthquake induced settlement hazards, and liquefaction. The purpose of this analysis is to identify potential seismic hazards and propose mitigations, if necessary, to an acceptable level of risk.

5.3 Seismic Design Parameters:

The 2019 California Building Code (CBC) seismic design parameters for the subject site were obtained from the seismic design mapping web application by the Structural Engineers Association of California (SEAOC) using ASCE 7-16 seismic maps and by using 2019 CBC Tables 11.4-1 and 11.4-2. Site Class D was assumed. Obtaining site-specific shear wave velocities were not within the scope of work, however, they may be obtained on request. The project Structural Engineer should determine the actual footing widths and depths necessary to resist vertical, horizontal, and uplift forces using the following seismic criteria:

DESCRIPTION	DESIGN PARAMETERS
SITE LATITUDE:	33.697263° North
SITE LONGITUDE:	-117.348679° West
SITE CLASS:	D (default)
SPECTRAL RESPONSE – SHORT (0.2 SEC):	S_S = 2.209
SPECTRAL RESPONSE - ONE SECOND:	$S_{1 =}$ 0.789
SHORT PERIOD SITE COEFFICIENT:	Fa = 1.2
1-SECOND PERIOD SITE COEFFICIENT:	Fv = 1.7
ADJUSTED SPECTRAL RESPONSE – SHORT (0.2 SEC):	S_{MS} = 2.651
ADJUSTED SPECTRAL RESPONSE – ONE SECOND:	S_{M1} = 1.341
DESIGN SPECTRAL RESPONSE – SHORT (0.2 SEC):	S_{DS} = 1.768
DESIGN SPECTRAL RESPONSE – ONE SECOND:	S_{D1} = 0.894

5.4 Surface Fault Rupture:

The fault mapping application “Earthquake Zones of Required Investigation” by the California Geological Survey (CGS) was viewed at https://maps.conservation.ca.gov/cgs/EQZApp. The “Map My County”, version 10, page by the County of Riverside Geographic Information System was viewed at https://gis.countyofriverside.us. Based on those maps the site is not located within an Alquist-Priolo Earthquake Fault Zone or a County Fault Zone. The nearest zoned fault is the Elsinore Fault which trends northwest-southeast and is located approximately 1.25 miles southwest of the site. Based on the County maps an unnamed splay of the Elsinore Fault, which is not within a County Fault Zone, is located approximately 3,300 feet south of the site. The splay also trends generally northwest-southeast. The mapped faulting is oblique to the site and does not trend toward the site. Therefore, no known active faults exist on the subject site or trend toward the site. Accordingly, the potential for fault surface rupture on the site is considered unlikely.

5.5 Liquefaction Evaluation:

The "Map My County" page by the County of Riverside Geographic Information System was reviewed for the site's susceptibility to liquefaction. Based on information provided by the Riverside County website, the site's susceptibility to liquefaction is considered very high.

Liquefaction is a phenomenon where a sudden large decrease of shearing resistance takes place in fine-grained cohesionless and/or low plasticity cohesive soils due to the cyclic stresses produced by earthquakes causing a sudden, but temporary, increase of porewater pressure. The increased porewater pressure occurs below the water table, but can cause propagation of groundwater upward into overlying soil and possibly to the ground surface and cause sand boils as excess porewater escapes. Potential hazards due to liquefaction include significant total and/or differential settlements of the ground surface and structures as well as possible collapse of structures due to loss of support of foundations. It has been shown by laboratory testing and from the analysis of soil conditions at sites where liquefaction has occurred that the soil types most susceptible to liquefaction are saturated, fine sand to sandy silt with a mean grain size ranging from approximately 0.075mm to 0.5mm. These soils derive their shear strength from intergranular friction and do not drain quickly during earthquakes. Published studies and field and laboratory test data indicate that coarse sands and silty or clayey sands beyond the above-mentioned grain size range are considerably less vulnerable to liquefaction. To a large extent, the relative density of the soil also controls the susceptibility to liquefaction for a given number of cycles and acceleration levels during a seismic event. Other characteristics such as confining pressure and the stresses created within the soil during a seismic event also affect the liquefaction potential of a site. Liquefaction of soil does not generally occur at depths of 40 to 50-feet below ground surface due to the confining pressure at that depth. The potential for liquefaction of the site is considered to be high due to the following conditions:

1. The existence of nearby major active faults may cause exceptionally high ground accelerations at the site.
2. The fine-grained nature (fine- to medium-grained silty sands) of the earth materials encountered make them susceptible to liquefaction.
3. Low to medium relative densities of some of the in-situ soils above and below the groundwater table.
4. Relatively shallow (up to 9-feet below ground surface) groundwater was encountered.

Settlement: The total potential settlement in the event of liquefaction has been calculated at 10.8-inches, assuming a groundwater maximum elevation of 9-feet below ground surface, and no mitigation measures are undertaken. The proposed 10-foot minimum blanket of engineered fill in the alluvial areas with the addition of geogrid reinforcement is expected to aid in mitigating the potential effects of liquefaction to within tolerable limits from a life safety standpoint in accordance with CDMG SP 117.

5.6 Seismically Induced Landsliding and Rockfalls:

Due to the relatively low topographic relief and lack of large boulders at the site, the probability of seismically induced landsliding and rockfalls is considered very low.

5.7 Seismically Induced Flooding, Seiches, and Tsunamis:

The site is located approximately 1.25 miles north of the lake in the City of Lake Elsinore and is approximately 20 feet higher in elevation than the lake. Portions of the Elsinore Fault pass beneath the lake. The Elsinore Fault is a major right-lateral strike-slip fault. In order to cause seismically induced flooding that could affect the site, a sizeable vertical offset of the lake floor would need to occur, as may be expected from a dip-slip fault. Strike-slip faults do not cause large vertical offsets in a single seismic event that would cause a displacement of the water above the fault, leading to seismically induced flooding. The site is higher in elevation than lake in the City of Lake Elsinore. Due to the type of faulting that passes beneath the lake, the distance from the lake, and the elevation above the lake, the possibility of seismically induced flooding or seiches is considered low. Due to the large distance of the project site to the Pacific Ocean, the possibility for seismically induced tsunamis is considered nil.

6.0 EARTH MATERIALS

6.1 Undocumented Fill (Afu):

Undocumented fill is associated with the previous residential building pad near the northern corner of the site, and other undocumented fills appear to spread over much of the flat areas in the central, western and southern portions of the site. Relatively minor fills are associated with the driveway and building pad areas, and low retaining walls, on the order of 1 to 4 feet thick are thought to exist near the northern corner of the site, with the thicker fills near the southwestern end of the existing pad area. A 4-inch diameter vitrified clay pipe that was buried with clean crushed rock was encountered in TP1 near the northern corner of the site. This pipe likely connected the former residence to a buried septic system on the site, however, the septic system was not located during our investigation. The central, western, and southern portions of the site generally appear to have relatively minor fills on the order of 1 to 3 feet thick. One notable exception to the minor undocumented fill depths is in the central portion of the site, in the vicinity of B3 and TP3, where a trash pit was discovered to extend to depths of at least 7 to 8 feet below the existing ground surface. Man-made materials, including lumber, plastic and metal were found buried in the trash pit at this location. The lateral extent of trash pit was not determined, nor can we confirm the maximum depth of the trash pit, since the deepest part may not have been located during our investigation. Delineating the maximum depth and maximum lateral extent of the suspected trash pit is beyond the scope of this report. In general, the undocumented fill was found to consist of silty fine to medium grained sand that is dry to slightly moist, and loose in place.

6.2 Alluvium (Qal):

Alluvium underlies the undocumented fill, and it is exposed at the ground surface generally along the eastern side of the site, and on portions of the previous house pad area at the northern corner of the

site. The alluvium was found to be on the order of 9 to 10 feet thick in the vicinity of the previous house pad near the northern corner of the site, and it was found to extend to depths of approximately 32 to 36 feet below the existing ground surface at the locations of B1 and B2 in the low-lying, generally flat areas of the site. The alluvium was found to consist of very loose to medium dense silty fine to medium grained sands and silty fine to medium grained sands that were dry to wet in-place. Pinhole pores were commonly observed within the alluvium to depths of up to approximately 10 feet below the existing ground surface.

6.3 Pauba Formation Sandstone (Qps):

Sandstone of the Pauba Formation was found to underlie the undocumented fill and alluvium at the knob that supported the previous house pad area at the northern corner of the site at depths of approximately 9 to 10 feet below the existing ground surface. The Pauba Formation was found to consist of medium grained sands and silty fine-grained sands that are moist and dense in place.

6.4 Santiago Formation (Tsi):

The sandstone member of the Santiago Formation underlies the entire site. It was encountered at depths of approximately 32 to 36 feet below the existing ground surface in the deeper borings, B1 and B2, that were advanced in the low-lying, relatively flat portions of the site. The Santiago Formation was recovered as medium to coarse grained sands and gravel that are wet and dense to very dense in place. Refusal to advance the drill was encountered at approximately 9 to 16 feet into the Santiago Formation, at depths of approximately 45 to 48 feet below the existing ground surface.

6.5 Groundwater:

Groundwater was encountered at depths of approximately 9 to 18 feet below the existing ground surface at the time of our investigation in November 2020. Seasonal fluctuations of the groundwater should be anticipated. The areas where the groundwater was encountered at shallower depths was generally in the flat, lower-lying alluvial areas on the southwestern side if the site, in the vicinity of Collier Avenue. No sounding was made at the existing water well near Collier Avenue. These depths below the ground surface correspond to elevations of approximately 1250 to 1254 above mean sea level, based on the referenced No. 1 plan. Groundwater may be encountered during grading and excavation.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Earthwork Recommendations:

1. Demolition Operations: All demolition operations should be conducted under the observation and documentation and testing of the project geotechnical engineer. **Failure to coordinate the demolition operations with the project geotechnical consultant of record may result in additional fieldwork beyond that represented herein**. It is the owner or the owner's authorized representative responsibility to ensure that the geotechnical consultant id informed of the demolition operations so that a qualified representative can be dispatched for observation and testing.

2. **Vegetation:** All vegetation should be removed from areas to be graded and not used in fills, including tree roots.

3. **Man-made Debris:** All man-made material should be removed from the site and not used in fills.

4. **Water Well Removal**: Prior to grading the site, the existing water well should be destroyed and abandoned per Riverside County Department of Environmental Health standards.

5. **Unsuitable Soil Removal:** Undocumented fill and loose, compressible, and/or porous alluvial soils are considered unsuitable for support of structural fill. All existing undocumented fill should be removed. The undocumented fill in the area of the previous residence at the northern end of the site is anticipated to be on the order of approximately 1 to 4 feet thick. The undocumented fill in the central, western, and southern portions of the site are anticipated to be on the order of 1 to 3 feet thick. An on-site sewage disposal (septic) system is likely located on the site and should be removed. Undocumented fill comprising a suspected trash pit was encountered in the central portion of the site in the vicinity of B3 and TP3. The undocumented fill of the trash pit is at least 7 to 8 feet deep, but the maximum depth and maximum lateral extent of the suspected trash pit were not determined as a part of this study. All loose, compressible, and/or porous alluvium should be removed to competent alluvium, or competent bedrock.
6. **Alluvial Removals in Structure Areas:** In order to address both static settlement of loose, compressible, and/or porous alluvium, and dynamic settlement due to the effects of liquefaction, alluvial removals beneath the proposed structures should be made to a minimum depth of 10 feet below the existing ground surface in proposed fill areas and 10 feet below pad grade in proposed cut areas so that a minimum of 10 feet of engineered fill exists beneath the structure, unless competent bedrock is reached at a shallower depth. The removal bottoms should extend laterally beyond the structure perimeter a distance equal to the removal depth, with a minimum of 10 feet, so that a 1:1 plane may be projected from the structure perimeter to the bottom outside edge of the removal. Deeper removals may be necessary based upon exposed conditions during grading. Groundwater may be reached during the recommended alluvial removals. The soils that have been removed should be cleared of vegetation and man-made debris and may then be stockpiled for re-use as engineered fill. For reference, a representative cross section, X-X', showing proposed alluvial removals in structure areas is included as Plate 2. Note that there is vertical exaggeration in the cross section in order to show the removals in more detail.
7. **Alluvial Removals in Parking, Driveway and Other Hardscape Areas:** Where native alluvium is exposed at the ground surface removals for parking, driveway and other hardscape areas should be a minimum of 3 feet below the ground surface in proposed fill areas and 3 feet below finished grade in proposed cut areas so that a minimum of 3 feet of engineered fill underlies these areas. Where undocumented fill is exposed at the ground surface the undocumented fill should be removed. After all undocumented fills have been removed, a minimum of the upper 3 feet of

alluvium beneath the undocumented fills should be removed. Therefore, in areas where approximately 1 to 4 feet of undocumented fills exist, removals are anticipated to be approximately 4 to 7 feet below the existing ground surface (3 feet below the 1 to 4 feet of undocumented fill).

8. **Overexcavation:** Structures on shallow footings must not straddle a cut/fill transition. The cut and shallow fill portions of the building pad should be overexcavated so that building does not straddle a cut/fill transition. Overexcavation in the cut and shallow fill portions of the building pad should be performed to half the depth of the maximum fill thickness below proposed grade, with a minimum of 5 feet. The horizontal extent of the overexcavation should extend laterally outside of the perimeter footings a distance equal to the overexcavation depth, with a minimum of 5 feet. It is anticipated that cut to shallow fill transitions may exist primarily in the proposed structures located near the northern corner of the site which is likely the only area where bedrock of the Pauba Formation Sandstone may be reached at depths less than 10 feet below the ground surface. Overexcavation estimates are conditionally based upon the estimated removal depth, however, deeper overexcavation may be necessary based on conditions exposed during grading.
9. **Removal Bottoms:** All exposed removal bottoms should be inspected and probed by the Geotechnical Engineer or Engineering Geologist, or their representative prior to placement of any fill. Natural, undisturbed bottoms should expose competent Pauba Formation bedrock or competent alluvium. Competent alluvium should be defined as alluvium that has in-place density that is at least 85% of the maximum density. The approved exposed bottoms should be scarified 12-inches, brought to near optimum moisture content, and compacted to a minimum of 90 percent relative compaction before placement of fill.

7.2 Groundwater and Removal Bottom Stabilization:

Where removal bottoms expose bedrock no groundwater and no stabilization of the removal bottom is anticipated. Where alluvial bottoms are exposed, groundwater is anticipated at or near the elevation of the removal bottoms in the relatively flat areas of the site, especially the low-lying southwestern side of the site, near Collier Avenue. Saturated removal bottoms may exhibit excessive “pumping” and rutting of the bottoms, especially when wheel-mounted vehicles are used. Therefore, special techniques may be needed in order to achieve the recommended removal depth, and the removal bottom may have to be stabilized prior to the placement of geogrid reinforcement and engineered fill. Placement of clean crushed rock or other methods may be utilized to stabilize the bottom prior to placement of geogrid reinforcement and engineered fill. The grading contractor should select the methods and equipment that will be used in order to achieve the recommended removal depths.

7.3 Geogrid Reinforcement:

In order to mitigate for the effects of settlement due to liquefaction, two layers of geogrid reinforcement should be placed where the removal bottoms expose alluvium. Once the removal bottom is achieved, a layer of bi-directional geogrid reinforcement such as Tensar BX 1200 or equivalent should be placed across the entire bottom. Geogrid rolls should overlap per the manufacturer’s recommendations, with

a minimum of 2 feet. Engineered fill should be placed to a height of 2 feet above the lower layer of geogrid reinforcement, and then a second layer of bi-directional geogrid should be placed across the entire bottom. After the second layer of geogrid has been placed, engineered fill may be placed in order to achieve the proposed grades without additional geogrid layers. Care must be taken so that the geogrid layers are not disturbed or damaged by grading equipment following their placement.

7.4 Engineered Fill:

Engineered fill should be compacted to a minimum of 90 percent relative compaction. Maximum dry density and optimum moisture content for compacted materials should be determined according to ASTM D 1557 procedures.

7.5 Oversize Material:

We anticipate that no oversize material, defined as rocks or boulders that cannot be reduced to less than 12-inches in diameter, will be encountered during the grading for the proposed development. Should oversize material be encountered, please contact our office for further recommendations.

7.6 Structural Fill:

All fill material, whether on-site material or import, should be accepted by the Project Geotechnical Engineer and/or his representative before placement. All fill should be free from vegetation, organic material, and other debris. Import fill should be no more expansive than the existing on-site material, unless approved by the Project Geotechnical Engineer. Approved fill material should be placed in horizontal lifts not exceeding 6.0 to 8.0-inches in thickness, and watered or aerated to obtain near-optimum moisture content (within 2.0 percent of optimum). Each lift should be spread evenly and should be thoroughly mixed to ensure uniformity of soil moisture. Structural fill should meet a minimum relative compaction of 90 percent of maximum dry density based upon ASTM D 1557 procedures. Moisture content of fill materials should not vary more than 2.0 percent of optimum, unless approved by the Project Geotechnical Engineer.

7.7 Soil Expansion Potential:

Preliminary Expansion Index testing was performed, yielding an EI of 0. This is classified as a **very low expansion** potential. Import soils or soils used near finish grade may have a different EI. Final foundation design parameters should be based on EI testing of near-surface soils and be performed at the conclusion of rough grading. Those results should be forwarded and incorporated into the final design by the Project Structural Engineer.

7.8 Soil Corrosive Potential:

The following table lists the corrosive tests performed and their results:

Soil Corrosion Parameter Test Results (California Test Methods 643, 417, and 422)					
Sample Number	**Location and Depth**	**pH**	**Minimum Resistivity (ohm-cm)**	**Chloride (ppm)**	**Sulfate (ppm)**
TP2@0'-9'	TP2@0'-9'	8.4	3195	250	60

CALTRANS considers soils that will be in contact with foundation elements to have corrosive properties if one or more of the following conditions exist:

(1) The pH is equal to or less than 5.5

(2) The resistivity is equal to or less than 1,000 ohm-cm

(3) Chloride concentration is equal to or greater than 500 parts per million (ppm)

(4) Sulfate concentration is equal to or greater than 2,000 ppm.

(5) Based on the test results from the samples obtained that will may be in contact with proposed footings, the soils are not considered corrosive to concrete foundations, thus, type II concrete may be used.

8.0 SLOPE RECOMMENDATIONS

8.1 Fill Slopes:

It is our opinion that 2:1 (horizontal to vertical) or flatter fill slopes possess gross and surficial stability in excess of generally accepted minimum engineering criteria (Factor of Safety at least 1.5) and therefore 2:1 or flatter fill slopes are anticipated to be suitable for their intended purpose provided that proper slope maintenance procedures are maintained. These procedures include but are not limited to installation and maintenance of drainage devices and planting of slope faces to protect from erosion in accordance with City and County standards. Any fill slopes should be constructed at slope ratios no steeper than 2:1 (horizontal to vertical). A keyway excavated into competent native earth materials should be constructed at the toe of all fill slopes that are proposed on natural grades of 5:1 (horizontal to vertical) or steeper. Keyways should be a minimum of 15 feet wide (equipment width) and tilted a minimum of two percent into the hillside. A series of level benches should be constructed into competent bedrock or native soil on natural grades of 5:1 or steeper prior to placing fill.

8.2 Cut Slopes:

It is our opinion that 2:1 (horizontal to vertical) or flatter cut slopes possess gross and surficial stability in excess of generally accepted minimum engineering criteria (Factor of Safety at least 1.5) and therefore 2:1 or flatter cut slopes are anticipated to be suitable for their intended purpose provided that proper slope maintenance procedures are maintained. These procedures include but are not limited to installation and maintenance of drainage devices and planting of slope faces to protect from erosion in accordance with City and County standards. All cut slopes should be inspected by the Project Engineering Geologist to verify stability. Cut slopes exposing significant amounts of alluvium or weathered bedrock may be unstable. Unstable cut slopes may require flattening or buttressing.

8.3 Slope Protection and Maintenance:

The following recommendations are presented for slope protection and maintenance.

8.3.1 Surface Drainage:

Surface water should not be allowed to flow over the slopes other than incidental rainfall. No alteration of pad gradients should be allowed that will prevent pad and roof run-off from being expediently directed to approved disposal areas away from the tops of slopes.

8.3.2 **Off-Site Drainage:**

Concentrated surface waters entering the property from off-site sources should be collected and directed to a permanent drainage system away from the tops of slopes.

8.3.3 **Maintenance Responsibility:**

The property owner is responsible for the maintenance and cleaning of all interceptor ditches, drainage terraces, downdrains and any other drainage devices that have been installed to promote slope stability.

8.3.4 **Slope Protection:**

It is recommended that slopes be planted with ground cover, shrubs, and trees that possess deep, dense root structures that require a minimum of irrigation. It should be the responsibility of the landscape architect to provide such plants initially and of the resident to maintain such planting. Alteration of the planting scheme is at the property owner's risk.

8.3.5 **Excessive Irrigation:**

If automatic sprinkler systems are installed on the slopes, their use should be adjusted to account for natural rainfall.

8.3.6 **Burrowing Animals:**

The resident and/or owner should maintain a program for the elimination of burrowing animals. This should be an on-going program to protect slope stability.

9.0 FOUNDATION DESIGN RECOMMENDATIONS:

9.1 General:

Foundations for the proposed structures may consist of conventional column footings and continuous wall footings founded on compacted fill. The recommendations presented in the subsequent paragraphs for foundation design and construction are based on geotechnical characteristics and upon a very low expansion potential for the supporting soils and should not preclude more restrictive structural requirements. The Structural Engineer for the project should determine the actual footing width and depth in accordance with the latest edition of the California Building Code to resist design vertical, horizontal, and uplift forces and should either verify or amend the design based on final expansion testing at the completion of grading.

9.2 Foundation Size:

Continuous footings should have a minimum width of 12-inches. Continuous footings should be continuously reinforced with a minimum of one (1) No. 4 steel reinforcing bar located near the top and near the bottom of the footings to minimize the effects of slight differential movements which may occur due to minor variations in the engineering characteristics or seasonal moisture change in the supporting soils. Column footings should have a minimum width of 18-inches by 18-inches and be suitably reinforced, based on structural requirements. A grade beam, founded at the same depths and reinforced the same as the adjacent footings, should be provided across doorway and garage entrances.

9.3 Depth of Embedment:

Exterior and interior footings founded in engineered fill material should extend to a minimum depth of 18-inches below lowest adjacent finish grade.

9.4 Bearing Capacity:

Provided the recommendations for site earthwork, minimum footing width, and minimum depth of embedment for footings are incorporated into the project design and construction, the allowable bearing value for design of continuous and column footings, for the residential structure for the total dead plus frequently-applied live loads is 1,500 psf for footings in competent engineered fill. The allowable bearing value has a Factor of Safety of at least 3.0 and may be increased by 33.3 percent for short durations of live and/or dynamic loading such as wind or seismic forces.

9.5 Settlement:

Based on the recommended mitigation measures for site earthwork in consideration of the life-safety standard guidelines of CDMG SP 117, the footings designed to the recommended bearing value limits described under § 2.1 of this report settlement is not expected to exceed a maximum of 0.75-inch or a differential settlement of 0.50-inch over a distance of 40-feet in compacted fill material under static load conditions.

9.6 Lateral Capacity:

Additional foundation design parameters for the residence based on compacted fill for resistance to static lateral forces, are as follows:

Allowable Lateral Pressure (Equivalent Fluid Pressure), Passive Case:
Engineered Fill – 200 pcf
Allowable Coefficient of Friction:
Engineered Fill - 0.35

Lateral load resistance may be developed by a combination of friction acting on the base of foundations and slabs and passive earth pressure developed on the sides of the footings and stem walls below grade when in contact with engineered fill material. The above values are allowable design values and may be used in combination without reduction in evaluating the resistance to lateral loads. The allowable values may be increased by 33.3 percent for short durations of live and/or dynamic loading, such as wind or seismic forces. For the calculation of passive earth resistance, the upper 1.0-foot of material should be neglected unless confined by a concrete slab or pavement. The maximum recommended allowable passive pressure is 5.0 times the recommended design value.

9.7 Slab-on-Grade Recommendations:

The recommendations for concrete slabs, both interior and exterior, excluding PCC pavement, are based upon the anticipated building usage and upon a very low expansion potential for the supporting material as determined by Chapter 18 of the California Building Code. Concrete slabs should be designed to minimize cracking as a result of shrinkage. Joints (isolation, contraction, and construction) should be placed in accordance with the American Concrete Institute (ACI) guidelines. Special precautions should be taken during placement and curing of all concrete slabs. Excessive slump (high

water/cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could result in excessive shrinkage, cracking, or curling in the slabs. It is recommended that all concrete proportioning, placement, and curing be performed in accordance with ACI recommendations and procedures.

Slab-on-grade reinforcement and thickness should be provided by the structural engineer based on structural considerations, but as a minimum, it is recommended that concrete floor slabs subjected to crane loads for tilt-up buildings be at least 5-inches in actual thickness and reinforced with at least No. 3 reinforcing bars placed 18-inches on center, both ways, placed at mid-height of the slab cross-section.

9.8 Exterior Slabs:

All exterior concrete slabs cast on finish subgrade (patios, sidewalks, etc., with the exception of PCC pavement) should be a minimum of 4-inches nominal in thickness. Reinforcing in the slabs and the use of a compacted sand or gravel base beneath the slabs should be according to the current local standards. Subgrade soils should be moisture conditioned to at least optimum moisture content to a depth of 12-inches immediately before placing the concrete.

10.0 RETAINING WALL RECOMMENDATIONS

10.1 Earth Pressures:

Retaining walls should be backfilled with non-expansive granular soil (EI=0) or very low expansive potential materials (Expansion Index of 20 or less) within a zone extending upward and away from the heel of the footing at a slope of 0.5:1 (horizontal to vertical) or flatter can be designed to resist the following static lateral soil pressures:

Condition	Level Backfill	2:1 Slope	Seismic*
Active	35 pcf	50 pcf	K_u=0.2
At Rest	65 pcf	--	--

**For use on walls exceeding 6' in height. To be used with Mononobe-Okabe method.*

Further expansion testing of potential backfill material should be performed at the time of retaining wall construction to determine suitability. Walls that are free to deflect 0.01 radian at the top may be designed for the above-recommended active condition. Walls that need to be restricted from this amount of movement should be assumed rigid and designed for the at-rest condition. The above values assume well-drained backfill and no buildup of hydrostatic pressure. Surcharge loads, dead and/or live, acting on the backfill behind the wall should also be considered in the design.

10.2 Retaining Wall Design:

Retaining wall footings should be founded to the same depths into firm, competent, undisturbed, engineered fill as standard foundations and may be designed for an allowable bearing value of 1,500 psf (as long as the resultant force is located in the middle one-third of the footing), and with an allowable static lateral bearing pressure of 200 psf/ft and allowable sliding resistance coefficient of friction of 0.35. When using the allowable lateral pressure and allowable sliding resistance, a Factor of Safety of 1.5 should be achieved.

10.3 Subdrain:

A subdrain system should be constructed behind and at the base of retaining walls equal to or in excess of 4-feet in height to allow drainage and to prevent the buildup of excessive hydrostatic pressures. Gravel galleries and/or filter rock, if not properly designed and graded for the on-site and/or import materials, should be enclosed in a geotextile fabric such as Mirafi 140N, Supac 4NP, or a suitable substitute in order to prevent infiltration of fines and clogging of the system. The perforated pipes should be at least 4.0-inches in diameter. Pipe perforations should be placed downward. Gravel filters should have volume of at least 1.0 cubic foot per lineal foot of pipe. For retaining walls with an overall height of less than 4-feet, subdrains may include weep holes with a continuous gravel gallery, perforated pipe surrounded by filter rock, or some other approved system. Subdrains should maintain a positive flow gradient and have outlets that drain in a non-erosive manner.

10.4 Backfill:

Backfill directly behind retaining walls (if backfill width is less than 3 feet) may consist of 0.5 to 0.75-inch diameter, rounded to subrounded gravel enclosed in a geotextile fabric such as Mirafi 140N, Supac 4NP, or a suitable substitute or a clean sand (Sand Equivalent Value greater than 50) water jetted into place to obtain proper compaction. If water jetting is used, the subdrain system should be in place. Even if water jetting is used, the sand should be densified to a minimum of 90 percent relative compaction. If the specified density is not obtained by water jetting, mechanical methods will be required. If other types of soil or gravel are used for backfill, mechanical compaction methods will be required to obtain a relative compaction of at least 90 percent of maximum dry density. Backfill directly behind retaining walls should not be compacted by wheel, track or other rolling by heavy construction equipment unless the wall is designed for the surcharge loading. If gravel, clean sand or other imported backfill is used behind retaining walls, the upper 18-inches of backfill in unpaved areas should consist of typical on-site material compacted to a minimum of 90 percent relative compaction in order to prevent the influx of surface runoff into the granular backfill and into the subdrain system. Maximum dry density and optimum moisture content for backfill materials should be determined in accordance with ASTM D 1557 procedures.

10.5 Pavement Design

The following structural pavement section is for proposed street improvements for the subject development and are presented for preliminary design purposes only. *The final design should be based on R-Values testing performed at subgrade upon completion of grading***.** The preliminary pavement sections as presented below are based on the County of Riverside Standards and Specifications and an R-Value of 10. The sections listed are provided for reference purposes and are calculated as a minimum based on varying Traffic Indexes:

Traffic Index	Calculated Section
5.0	3-inches AC over 7.5-inches AB, placed on properly prepared subgrade.
6.0	3-inches AC over 12.0-inches AB, placed on properly prepared subgrade.
6.5	3-inches AC over 13.6-inches AB, placed on properly prepared subgrade.
7.0	3-inches AC over 15.2-inches AB, placed on properly prepared subgrade.

10.6 CalTrans Standard Specification:

Asphalt concrete pavement materials should be as specified in Sections 39-2.01 and 39-2.02 of the current **Caltrans** Standard Specifications or a suitable equivalent. Aggregate base should conform to 3/4-inch Class II material as specified in Section 26-01.02B of the current **Caltrans** Standard Specifications or a suitable equivalent. To properly prepare the subgrade, the soil should be recompacted to a minimum 90 percent relative compaction in asphalt pavement areas and 95 percent relative compaction in Portland cement concrete areas, to a minimum depth of 12-inches below finish subgrade elevation. The aggregate base material should be compacted to at least 95 percent relative compaction. Maximum dry density and optimum moisture content for subgrade and aggregate base materials should be determined according to ASTM D 1557 procedures. If pavement subgrade soils are prepared and aggregate base material is not placed immediately, or the aggregate base material is placed and the area is not paved immediately, additional observations and testing will be required prior to placing aggregate base material or asphaltic concrete to locate areas that may have been damaged by construction traffic, construction activities, and/or seasonal wetting and drying.

11.0 MISCELLANEOUS RECOMMENDATIONS

11.1 Utility Trench Recommendations:

Utility trenches within the zone of influence of foundations or under building floor slabs, hardscape, and/or pavement areas should be backfilled with properly compacted soil. It is recommended that all utility trenches excavated to depths of 5.0-feet or deeper be cut back to an inclination not steeper than 1:1 (horizontal to vertical) or be adequately shored during construction. Where interior or exterior utility trenches are proposed parallel and/or perpendicular to any building footing, the bottom of the trench should not be located below a 1:1 plane projected downward from the outside bottom edge of the adjacent footing unless the utility lines are designed for the footing surcharge loads. Backfill material should be placed in a lift thickness appropriate for the type of backfill material and compaction equipment used. Backfill material should be compacted to a minimum of 90 percent relative compaction by mechanical means. Jetting of the backfill material will not be considered a satisfactory method for compaction. Maximum dry density and optimum moisture content for backfill material should be determined according to ASTM D 1557 procedures.

11.2 Finish Lot Drainage Recommendations:

Finish lot surface gradients in unpaved areas should be provided next to tops of slopes and buildings to direct surface water away from foundations and slabs and from flowing over the tops of slopes. The surface water should be directed toward suitable drainage facilities. Ponding of surface water should not be allowed next to structures or on pavements. In unpaved areas, a minimum positive gradient of 2.0 percent away from the structures and tops of slopes for a minimum distance of 10.0-feet and a minimum of 1.0 percent pad drainage off the property in a non-erosive manner should be provided.

11.3 Bio-Retention Basin:

Based on the referenced grading plan, no bio-retention basins are proposed.

11.4 Planter Recommendations:

Planters around the perimeter of the structure should be designed with proper surface slope or a sufficient number of area drains should be installed within the planters to ensure that adequate drainage is maintained, and minimal irrigation water is allowed to percolate into the soils underlying the building. Planters in parking areas should be avoided or should at least be very well-drained because percolation into the parking subgrade may significantly reduce the lifespan of the pavement adjacent to the planters.

11.5 Supplemental Construction Observations and Testing:

Any subsequent grading for development of the subject property should be performed under engineering observation and testing performed by EnGEN Corporation. Subsequent grading includes, but is not limited to, any additional overexcavation of cut and/or cut/fill transitions, fill placement, and excavation of temporary and permanent cut and fill slopes. In addition, EnGEN Corporation should observe all foundation excavations. Observations should be made prior to installation of concrete forms and/or reinforcing steel to verify and/or modify, if necessary, the conclusions and recommendations in this report. Observations of overexcavation cuts, fill placement, finish grading, utility or other trench backfill, pavement subgrade and base course, retaining wall backfill, slab pre-saturation, or other earthwork completed for the development of subject property should be performed by EnGEN Corporation. If any of the observations and testing to verify site geotechnical conditions are not performed by EnGEN Corporation, liability for the safety and performance of the development is limited to the actual portions of the project observed and/or tested by EnGEN Corporation.

12.0 PLAN REVIEW

Subsequent to formulation of final plans and specifications for the project but before bids for construction are requested, grading and foundation plans for the proposed development should be reviewed by EnGEN Corporation to verify compatibility with site geotechnical conditions and conformance with the recommendations contained in this report. If EnGEN Corporation is not accorded the opportunity to make the recommended review, we will assume no responsibility for misinterpretation of the recommendations presented in this report.

13.0 CONFERENCES

13.1 Pre-Bid Conference:

It is recommended that a pre-bid conference be held with the owner or an authorized representative, the Project Architect, the Project Civil Engineer, the Project Geotechnical Engineer and the proposed contractors present. This conference will provide continuity in the bidding process and clarify questions relative to the supplemental grading and construction requirements of the project.

13.2 Pre-Grading Conference:

Before the start of any grading, a conference should be held with the owner or an authorized representative, the contractor, the Project Architect, the Project Civil Engineer, and the Project Geotechnical Engineer present. The purpose of this meeting should be to clarify questions relating to the intent of the supplemental grading recommendations and to verify that the project specifications comply with the recommendations of this geotechnical engineering report. Any special grading procedures and/or difficulties proposed by the contractor can also be discussed at that time.

14.0 CLOSURE

This report has been prepared for use by the parties or project named or described in this document. It may or may not contain sufficient information for other parties or purposes. In the event that changes in the assumed nature, design, or location of the proposed structure and/or project as described in this report, are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions and recommendations of this report are modified or verified in writing. This study was conducted in general accordance with the applicable standards of our profession and the accepted soil and foundation engineering principles and practices at the time this report was prepared. No other warranty, implied or expressed beyond the representations of this report, is made. Although every effort has been made to obtain information regarding the geotechnical and subsurface conditions of the site, limitations exist with respect to the knowledge of unknown regional or localized off-site conditions that may have an impact at the site. The recommendations presented in this report are valid as of the date of the report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or to the works of man on this and/or adjacent properties. If conditions are observed or information becomes available during the design and construction process that are not reflected in this report, EnGEN Corporation should be notified so that supplemental evaluations can be performed and the conclusions and recommendations presented in this report can be modified or verified in writing. Changes in applicable or appropriate standards of care or practice occur, whether they result from legislation or the broadening of knowledge and experience. Accordingly, the conclusions and recommendations presented in this report may be invalidated, wholly or in part, by changes outside of the control of EnGEN Corporation which occur in the future.

Thank you for the opportunity to provide our services. Often, because of design and construction details which occur on a project, questions arise concerning the geotechnical conditions on the site. If we can be of further service or should you have questions regarding this report, please do not hesitate to contact this office at your convenience. Because of our involvement in the project to date, we would be pleased to discuss engineering testing and observation services that may be applicable on the project.

Respectfully submitted,
EnGEN Corporation

Wayne Baimbridge, Principal
General Manager, REPA 467279

Osbjorn Bratene, Principal
GE 162

Colby Matthews, Project Engineering Geologist
CEG 2460

WB/CM/OB:ch

Distribution: (2) Addressee

APPENDIX 1 - GENERAL TECHNICAL REFERENCES

1. **California Building Code (CBC)**, 2019, State of California, California Code of Regulations, Title 24, California Building Code.

2. **California Division of Mines and Geology (CDMG)**, 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

3. **California Geological Survey (CGS)**, 2002, California Geomorphic Provinces: CDMG, Note 36.

4. **California Geological Survey (CGS)**, 2014, Guidelines for Evaluating and Mitigating Seismic Hazards in California, 2008, Special Publication 117A.

5. **California Geological Survey (CGS),** 2021, Earthquake Zones of Required Investigation web application viewed at https://maps.conservation.ca.gov/cgs/EQZApp.

6. **Hart, Earl W., and Bryant, William A**., Revised 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zone Maps: State of California, Department of Conservation, Division of Mines and Geology, Special Publication 42.

7. **Kennedy, M.P**., 1977, Recency and Character of Faulting Along the Elsinore Fault Zone in Southern Riverside County, California: California Division of Mines and Geology, Special Report 131, 12 p., 1 Plate, Scale 1:24,000.

8. **Mann, J.F., Jr**., October 1955, Geology of a Portion of the Elsinore Fault Zone, California: State of California, Department of Natural Resources, Division of Mines, Special Report 43.

9. **Morton, D.M. and Weber, F.H. Jr.,** 2003, Geologic Map of the Elsinore 7.5 Quadrangle, California, Version 1.0, Scale 1:24,000, Digital Database by Rachel Alvarez and Diane Burns, USGS Open File Report 03-281.

10. **Riverside County Transportation and Land Management Agency**, 2000, Technical Guidelines for Review of Geotechnical and Geologic Reports.

11. **Riverside County Planning Department**, January 1983, Riverside County Comprehensive General Plan - County Seismic Hazards Map, Scale 1 Inch = 2 Miles.

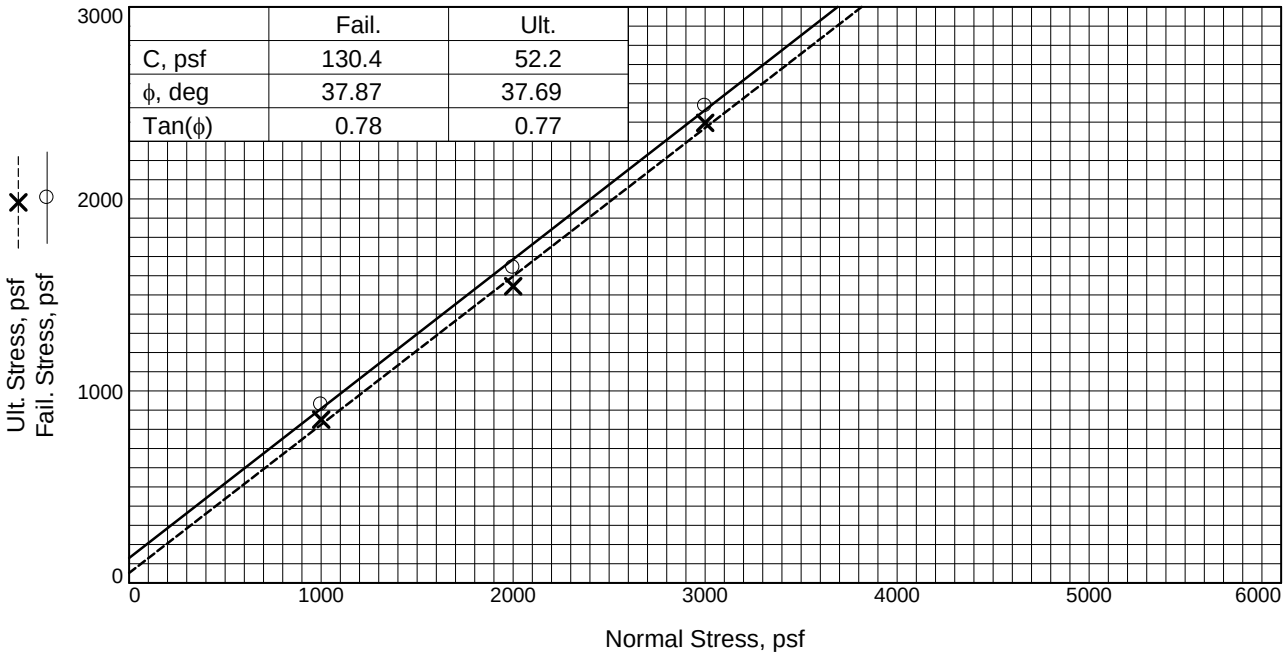
12. **Riverside County Land Information System**: HTTP://WWW3.TLMA.CO.RIVERSIDE.CA.US/PA/RCLIS/

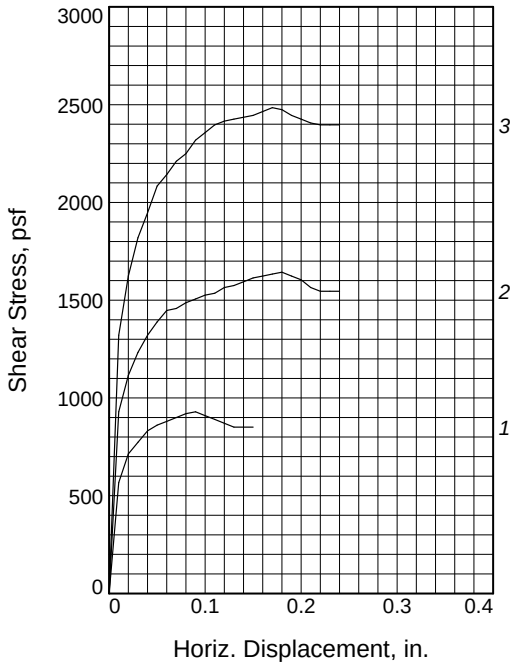
13. **Riverside County Geographic Information System,** 2021, Map My County web application, version 10, viewed at https://gis.countyofriverside.us.

14. **Southern California Earthquake Data Center (SCEDC),** 2021, Southern California Earthquake Data Center Website, HTTP://WWW.SCECDC.SCEC.ORG.

15. **Structural Engineers Association of California (SEAOC),** 2021, Seismic Design Mapping Tool, web application viewed at: WWW.SEAOC.ORG/PAGE/SEISMICDESIGNMAPTOOL

APPENDIX 2 - LABORATORY TEST RESULTS





Sample No.		1	2	3
Initial	Water Content, %	8.5	8.5	8.5
	Dry Density, pcf	118.9	118.9	118.9
	Saturation, %	52.9	52.9	52.9
	Void Ratio	0.4438	0.4438	0.4438
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	14.5	13.9	13.4
	Dry Density, pcf	118.9	118.9	118.9
	Saturation, %	90.0	86.4	83.0
	Void Ratio	0.4438	0.4438	0.4438
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.000	1.000	1.000
Normal Stress, psf		1000.0	2000.0	3000.0
Fail. Stress, psf		929.2	1643.3	2484.5
Displacement, in.		0.090	0.180	0.170
Ult. Stress, psf		851.0	1545.4	2396.4
Displacement, in.		0.130	0.220	0.220
Strain rate, in./min.		0.100	0.100	0.100

Sample Type: BULK
Description: Silty fine sand, light brown (5YR 6/4)

Specific Gravity= 2.75
Remarks:

Figure _____

Client: Saddleback & Assc.

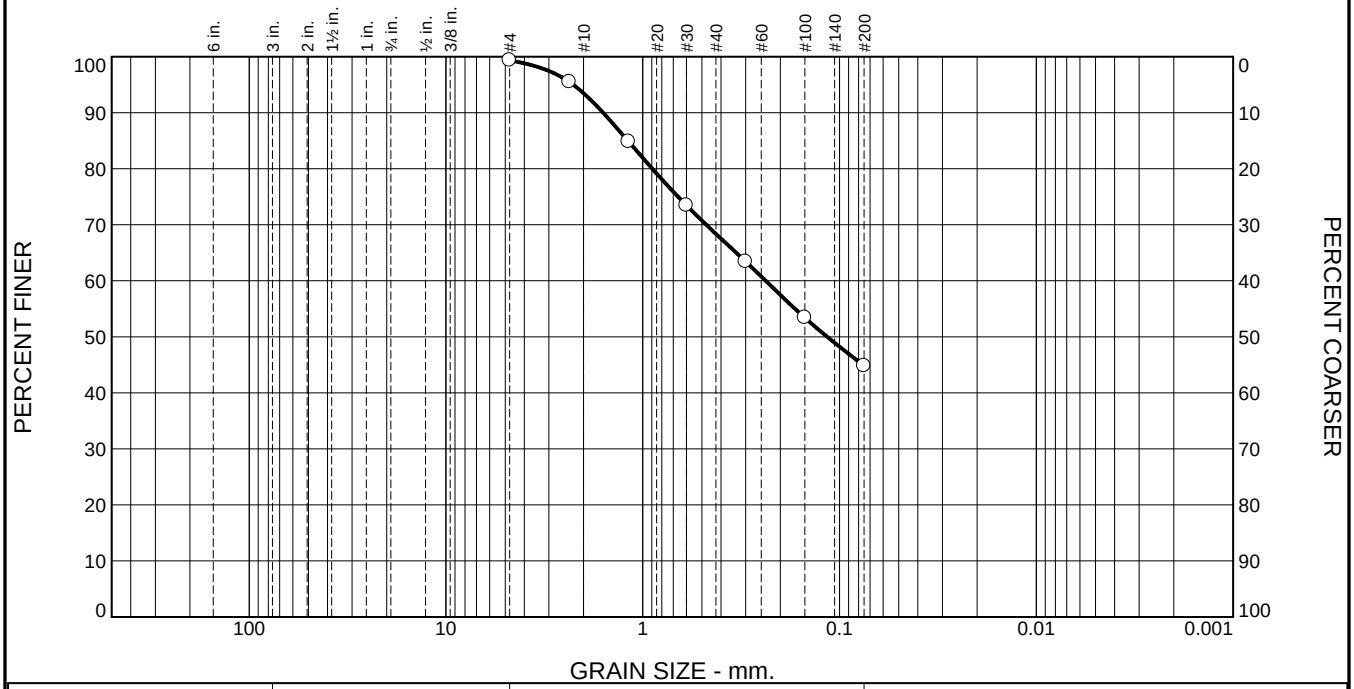
Project: Saddleback LAKE ELSINORE

Source of Sample: Shears **Depth:** 0'-5'
Sample Number: B1@0'-5'
Proj. No.: 4626 GFS **Date Sampled:** 11/13/20

DIRECT SHEAR TEST REPORT

EnGEN Corporation

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			5.9	25.1	23.6	44.8	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	99.4		
#8	95.5		
#16	84.8		
#30	73.5		
#50	63.4		
#100	53.4		
#200	44.8		

* (no specification provided)

Material Description

Silty fine sand, light brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 1.5901 D_{85}= 1.1909 D_{60}= 0.2374
D_{50}= 0.1154 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

F.M.=1.30

Date Received: **Date Tested:** 1/21/21

Tested By: GK

Checked By: GK

Title:

Source of Sample: B2 (Gradation) **Depth:** 2.5' **Date Sampled:** 11/13/20

Sample Number: B2@2.5

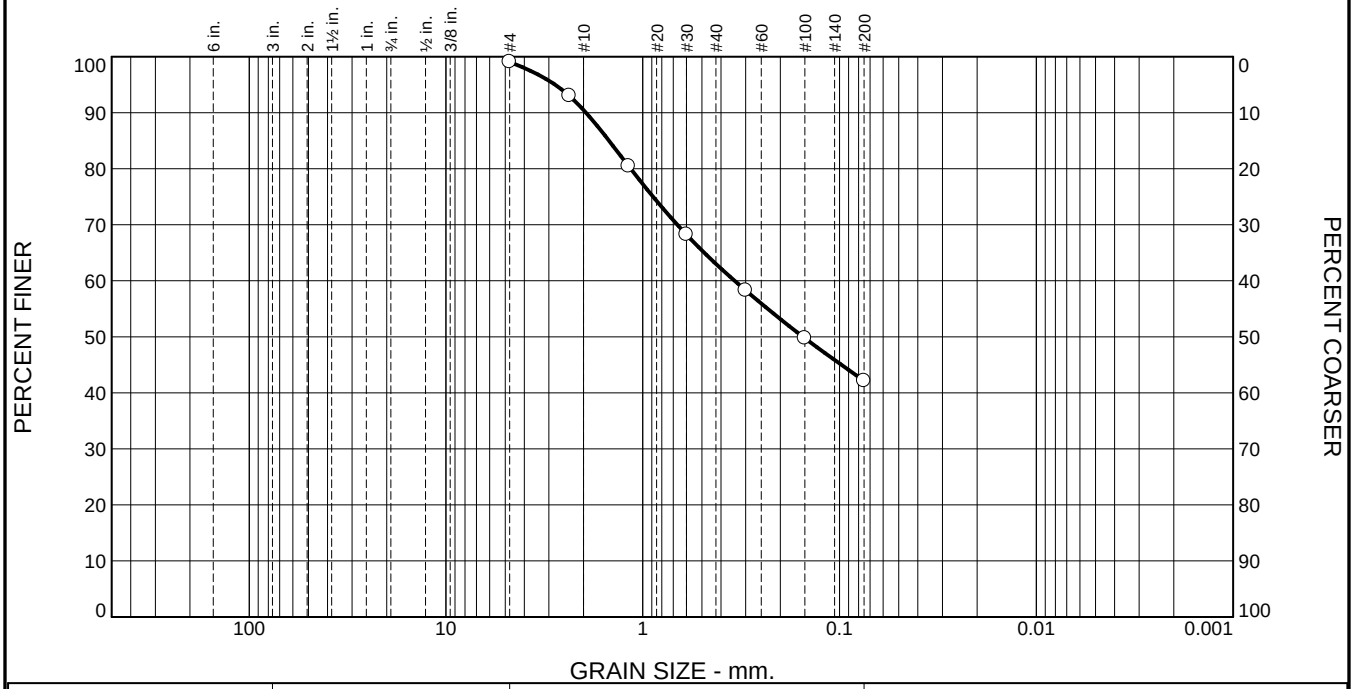
EnGEN Corporation

Client: Saddleback & Assc.

Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			8.6	27.5	20.9	42.1	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	99.1		
#8	93.0		
#16	80.5		
#30	68.2		
#50	58.3		
#100	49.8		
#200	42.1		

* (no specification provided)

Material Description

Silty sand, light brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 1.9434 D_{85}= 1.4841 D_{60}= 0.3413
D_{50}= 0.1532 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

F.M.=1.51

Date Received: **Date Tested:** 1/21/21

Tested By: GK

Checked By: GK

Title:

Source of Sample: B2 (Gradation) **Depth:** 5' **Date Sampled:** 11/13/20

Sample Number: B2@5

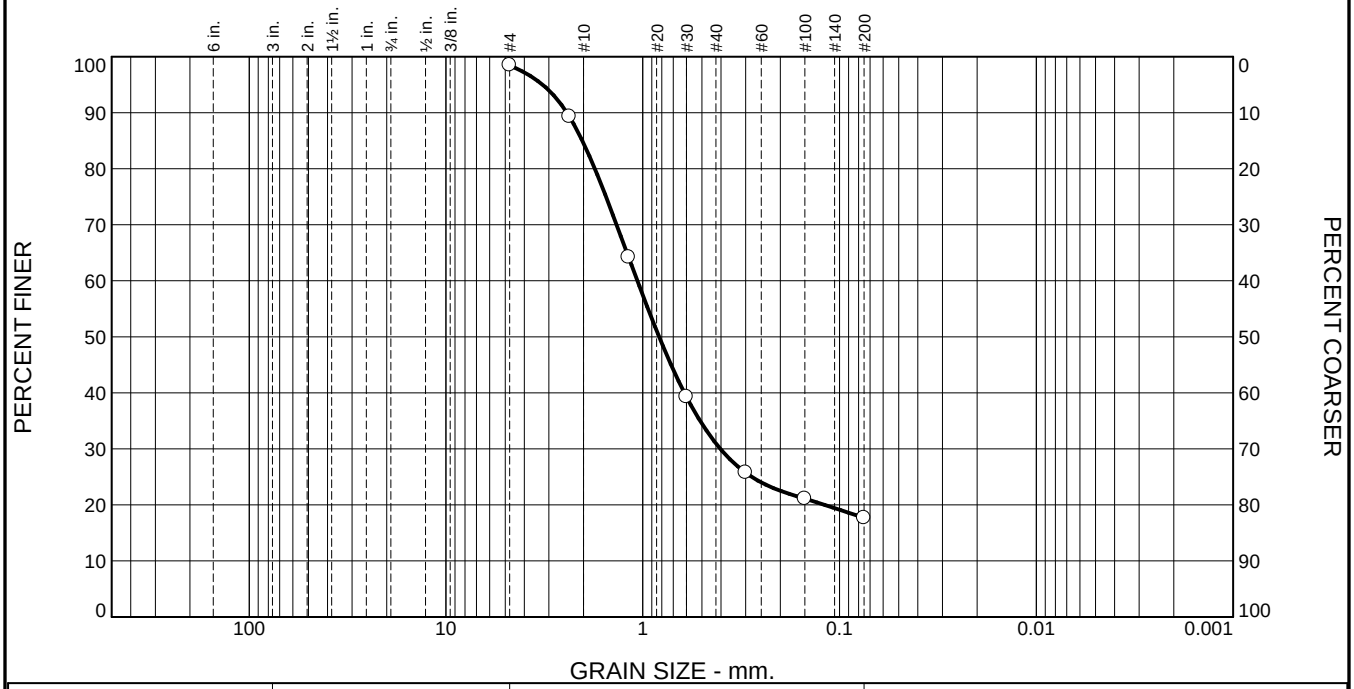
EnGEN Corporation

Client: Saddleback & Assc.

Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			14.0	53.5	13.3	17.7	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	98.5		
#8	89.3		
#16	64.2		
#30	39.3		
#50	25.7		
#100	21.1		
#200	17.7		

* (no specification provided)

Material Description

Medium sand, medium yellowish brown (10YR 5/4)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.4280 D_{85}= 2.0284 D_{60}= 1.0652
D_{50}= 0.8254 D_{30}= 0.4031 D_{15}=
D_{10}= C_u= C_c=

Remarks

F.M.=2.62

Date Received: **Date Tested:** 1/19/21

Tested By: GK

Checked By: GK

Title:

Source of Sample: B2 (Gradation) **Depth:** 25' **Date Sampled:** 11/13/20

Sample Number: B2@25

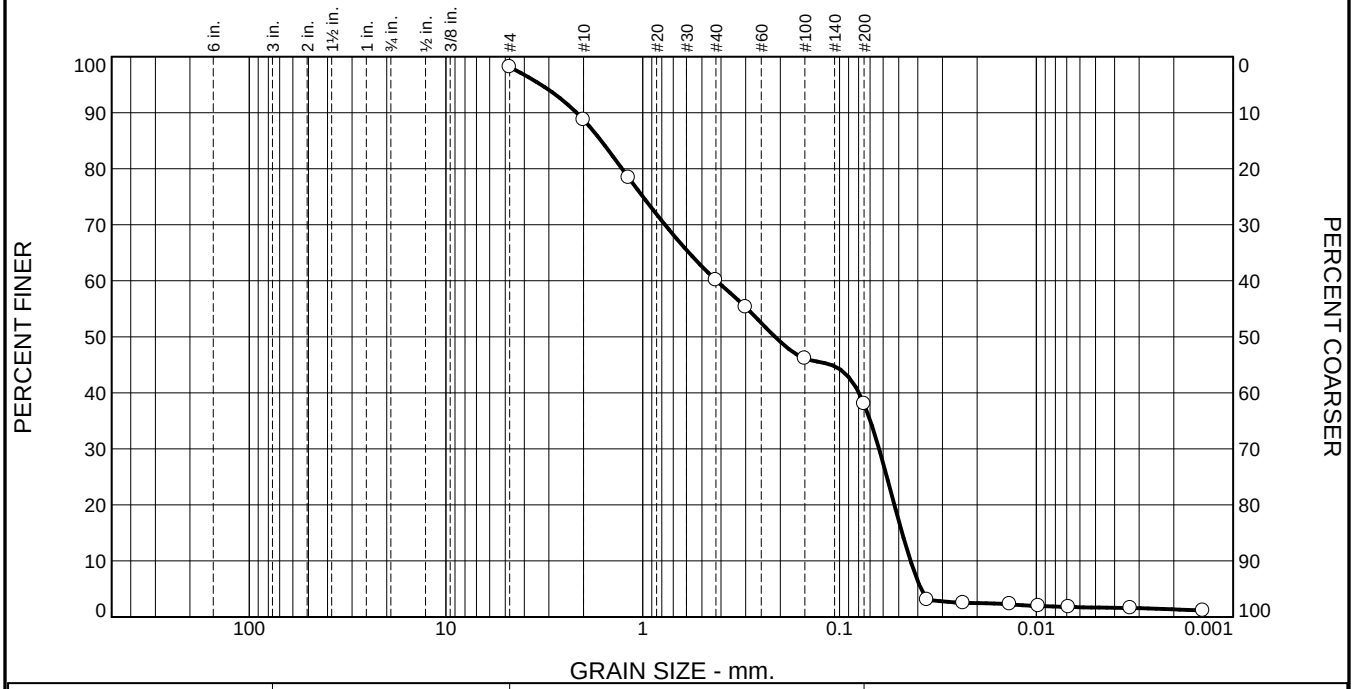
EnGEN Corporation

Client: Saddleback & Assc.

Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			9.5	28.6	22.1	36.3	1.7

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	98.2		
#10	88.7		
#16	78.4		
#40	60.1		
#50	55.3		
#100	46.1		
#200	38.0		
0.0359 mm.	3.1		
0.0235 mm.	2.5		
0.0136 mm.	2.3		
0.0098 mm.	2.0		
0.0069 mm.	1.8		
0.0033 mm.	1.6		
0.0014 mm.	1.1		

* (no specification provided)

Material Description

Silty fine to medium sand, light brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.1688 D_{85}= 1.6287 D_{60}= 0.4215
D_{50}= 0.2129 D_{30}= 0.0629 D_{15}= 0.0481
D_{10}= 0.0436 C_u= 9.67 C_c= 0.22

Remarks

F.M.=1.65

Date Received: **Date Tested:** 1/11/21

Tested By: GK

Checked By: GK

Title:

Location: B2@10'
Sample Number: B2@10 **Depth:** 10'

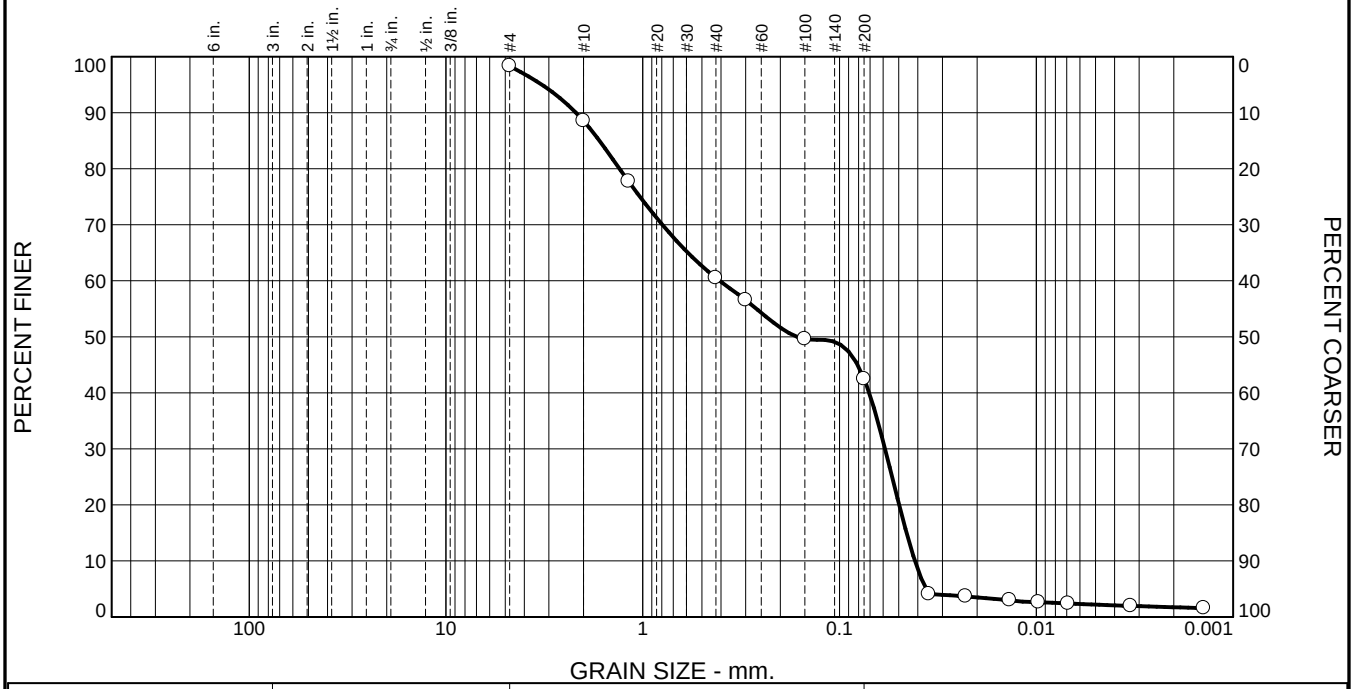
Date Sampled: 11/13/20

EnGEN Corporation

Client: Saddleback & Assc.
Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			9.8	28.0	18.0	40.3	2.2

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	98.3		
#10	88.5		
#16	77.7		
#40	60.5		
#50	56.6		
#100	49.6		
#200	42.5		
0.0351 mm.	4.1		
0.0228 mm.	3.7		
0.0137 mm.	3.0		
0.0098 mm.	2.6		
0.0069 mm.	2.4		
0.0033 mm.	2.0		
0.0014 mm.	1.6		

* (no specification provided)

Material Description

Silty fine sand, medium yellowish brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.1851 D_{85}= 1.6609 D_{60}= 0.4066
D_{50}= 0.1642 D_{30}= 0.0587 D_{15}= 0.0456
D_{10}= 0.0414 C_u= 9.82 C_c= 0.20

Remarks

F.M.=1.61

Date Received: _____ **Date Tested:** 1/11/21

Tested By: GK

Checked By: GK

Title: _____

Location: B2@15'
Sample Number: B2@15 **Depth:** 15'

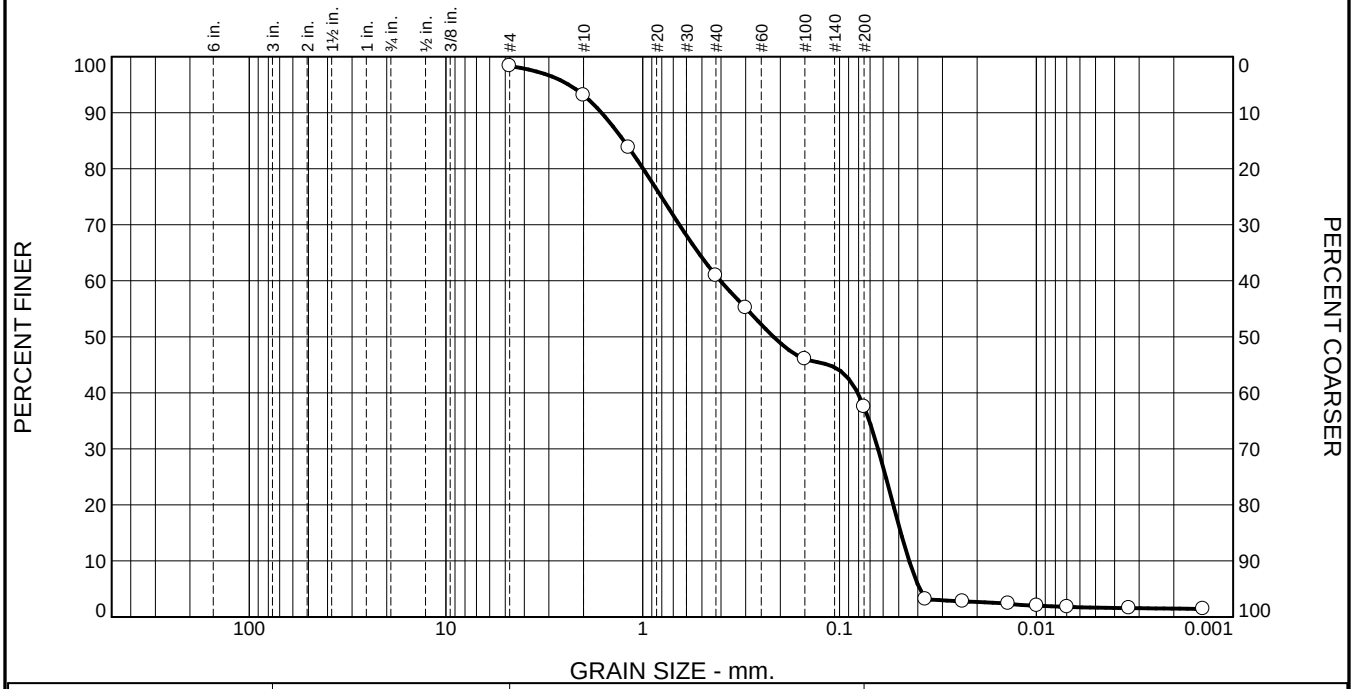
Date Sampled: 11/13/20

EnGEN Corporation

Client: Saddleback & Assc.
Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			5.2	32.2	23.4	35.8	1.7

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	98.3		
#10	93.1		
#16	83.8		
#40	60.9		
#50	55.2		
#100	46.1		
#200	37.5		
0.0366 mm.	3.2		
0.0237 mm.	2.8		
0.0139 mm.	2.4		
0.0099 mm.	2.0		
0.0070 mm.	1.8		
0.0034 mm.	1.6		
0.0014 mm.	1.4		

* (no specification provided)

Material Description

Silty to clayey fine to medium sand, light brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 1.6215 D_{85}= 1.2482 D_{60}= 0.4032
D_{50}= 0.2165 D_{30}= 0.0638 D_{15}= 0.0488
D_{10}= 0.0442 C_u= 9.11 C_c= 0.23

Remarks

F.M.=1.54

Date Received: _____ **Date Tested:** 1/11/21

Tested By: GK

Checked By: GK

Title: _____

Location: B2@20'
Sample Number: B2@20 **Depth:** 20'

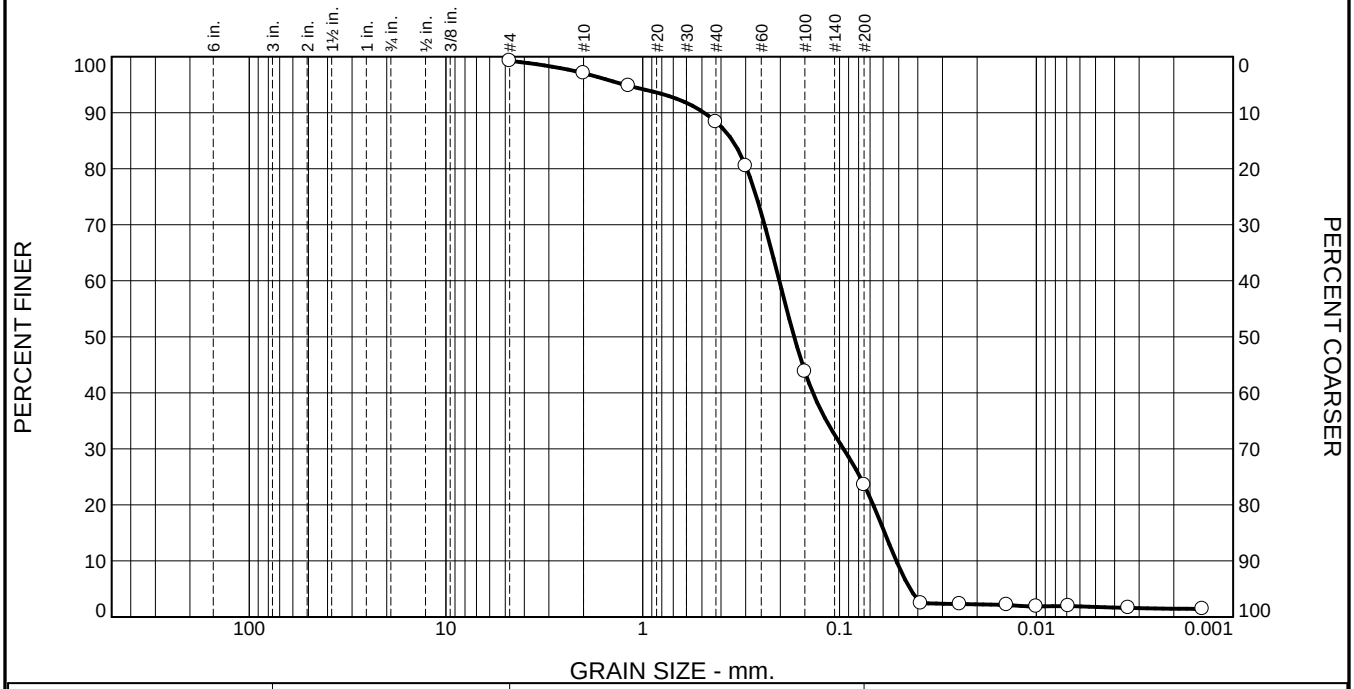
Date Sampled: 11/13/20

EnGEN Corporation

Client: Saddleback & Assc.
Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			2.2	8.7	64.8	21.8	1.8

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	99.3		
#10	97.1		
#16	94.8		
#40	88.4		
#50	80.5		
#100	43.8		
#200	23.6		
0.0386 mm.	2.5		
0.0245 mm.	2.3		
0.0141 mm.	2.2		
0.0100 mm.	1.9		
0.0069 mm.	1.9		
0.0034 mm.	1.6		
0.0014 mm.	1.5		

* (no specification provided)

Material Description

Medium yellowish brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 0.4880 D_{85}= 0.3492 D_{60}= 0.2024
D_{50}= 0.1700 D_{30}= 0.0955 D_{15}= 0.0589
D_{10}= 0.0514 C_u= 3.94 C_c= 0.88

Remarks

F.M.=0.92

Date Received: **Date Tested:** 1/11/21

Tested By: GK

Checked By: GK

Title:

Location: B2@30'
Sample Number: B2@30 **Depth:** 30'

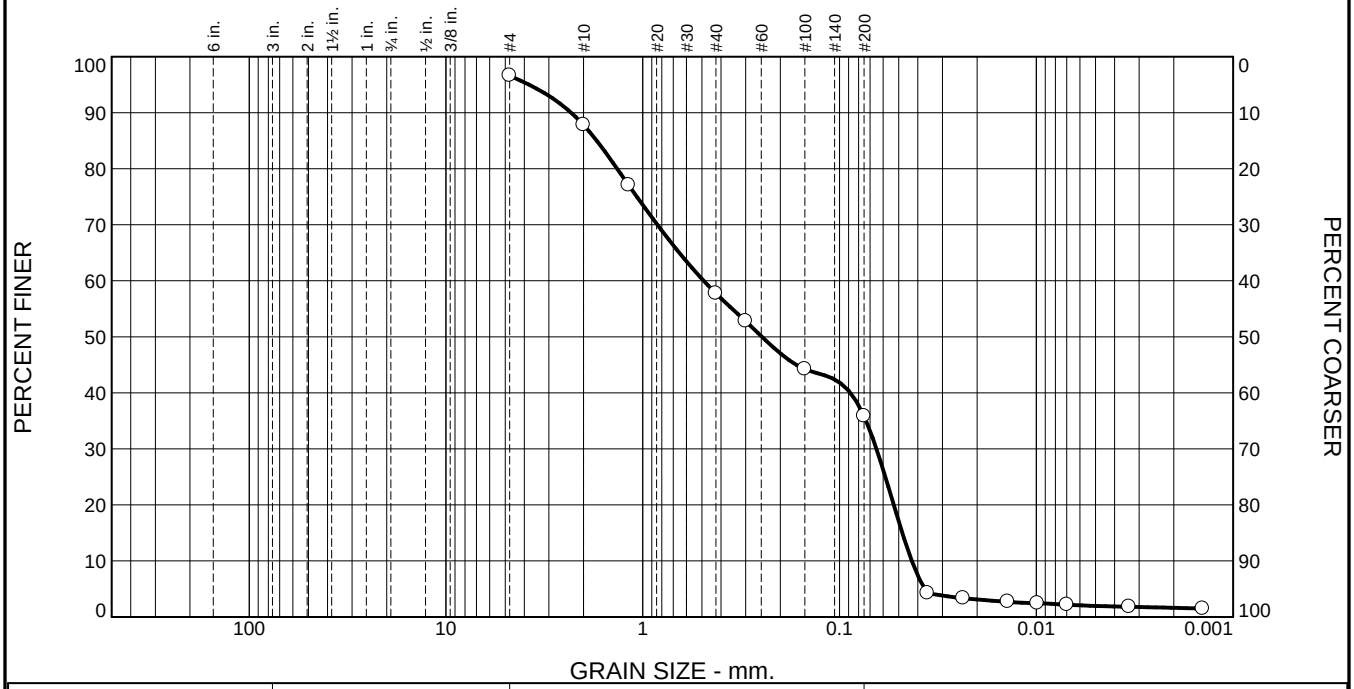
Date Sampled: 11/13/20

EnGEN Corporation

Client: Saddleback & Assc.
Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			8.8	30.1	21.9	33.8	2.0

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#4	96.6		
#10	87.8		
#16	77.1		
#40	57.7		
#50	52.8		
#100	44.2		
#200	35.8		
0.0357 mm.	4.2		
0.0235 mm.	3.3		
0.0140 mm.	2.7		
0.0099 mm.	2.5		
0.0070 mm.	2.2		
0.0034 mm.	1.8		
0.0014 mm.	1.5		

* (no specification provided)

Material Description

Silty fine sand, light brown (5YR 5/6)

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.3106 D_{85}= 1.7137 D_{60}= 0.4905
D_{50}= 0.2480 D_{30}= 0.0649 D_{15}= 0.0479
D_{10}= 0.0429 C_u= 11.44 C_c= 0.20

Remarks

F.M.=1.76

Date Received: **Date Tested:** 1/11/21

Tested By: GK

Checked By: GK

Title:

Location: B2@7.5' **Date Sampled:** 11/13/20

Sample Number: B2@7.5 **Depth:** 7.5'

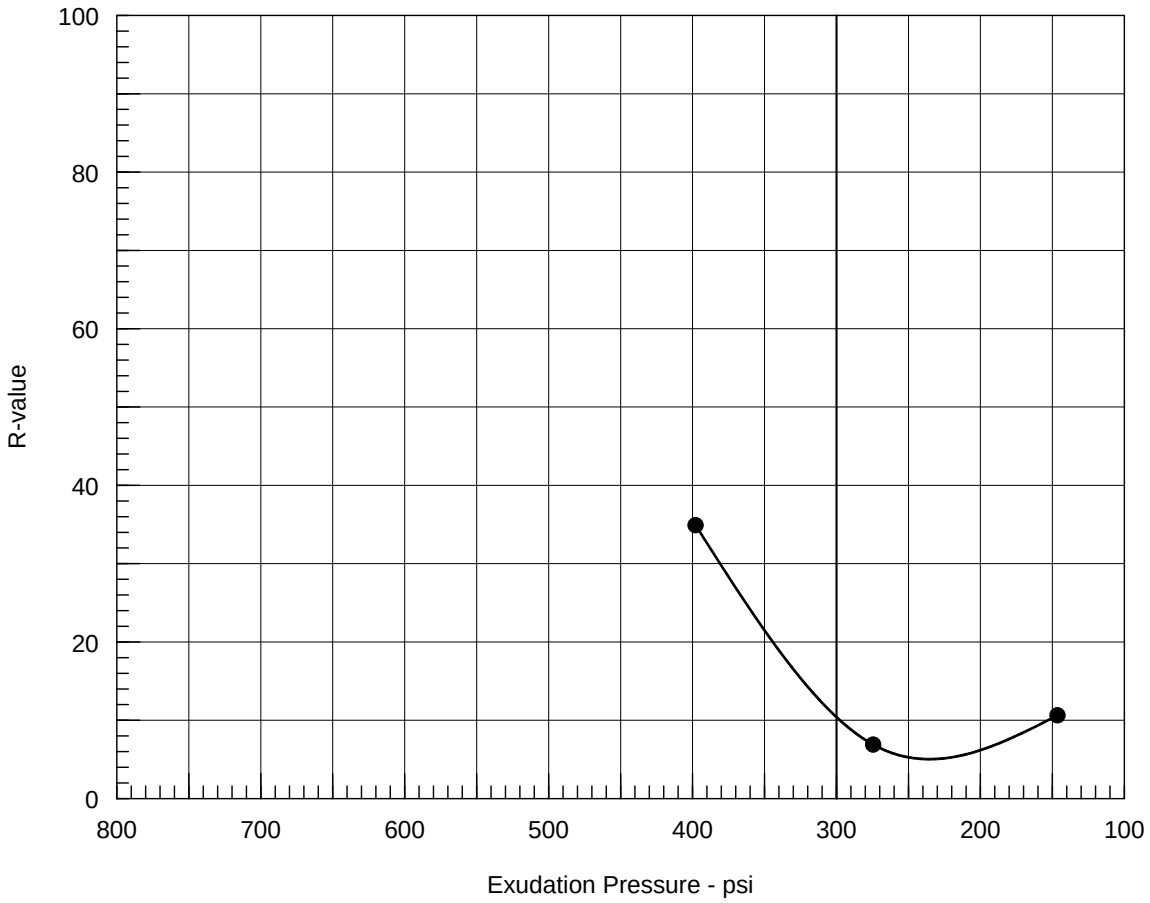
EnGEN Corporation

Client: Saddleback & Assc.

Project: Saddleback LAKE ELSINORE

Project No: 4626 GFS **Figure**

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - Cal Test 301

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psi	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	50	127.3	12.6	0.00	117	2.58	146	10.1	10.6
2	200	128.9	10.9	0.00	132	2.50	275	6.9	6.9
3	350	126.1	9.8	0.00	74	2.58	398	33.1	34.9

Test Results	Material Description
R-value at 300 psi exudation pressure = 10.4	Silty fine sand

Project No.: 4626GFS
Project: SADDLEBACK LAKE ELSINORE
Source of Sample: R-VALUES **Depth:** 0'-9'
Sample Number: TP2@0-9 FEET
Date: 2/4/2021

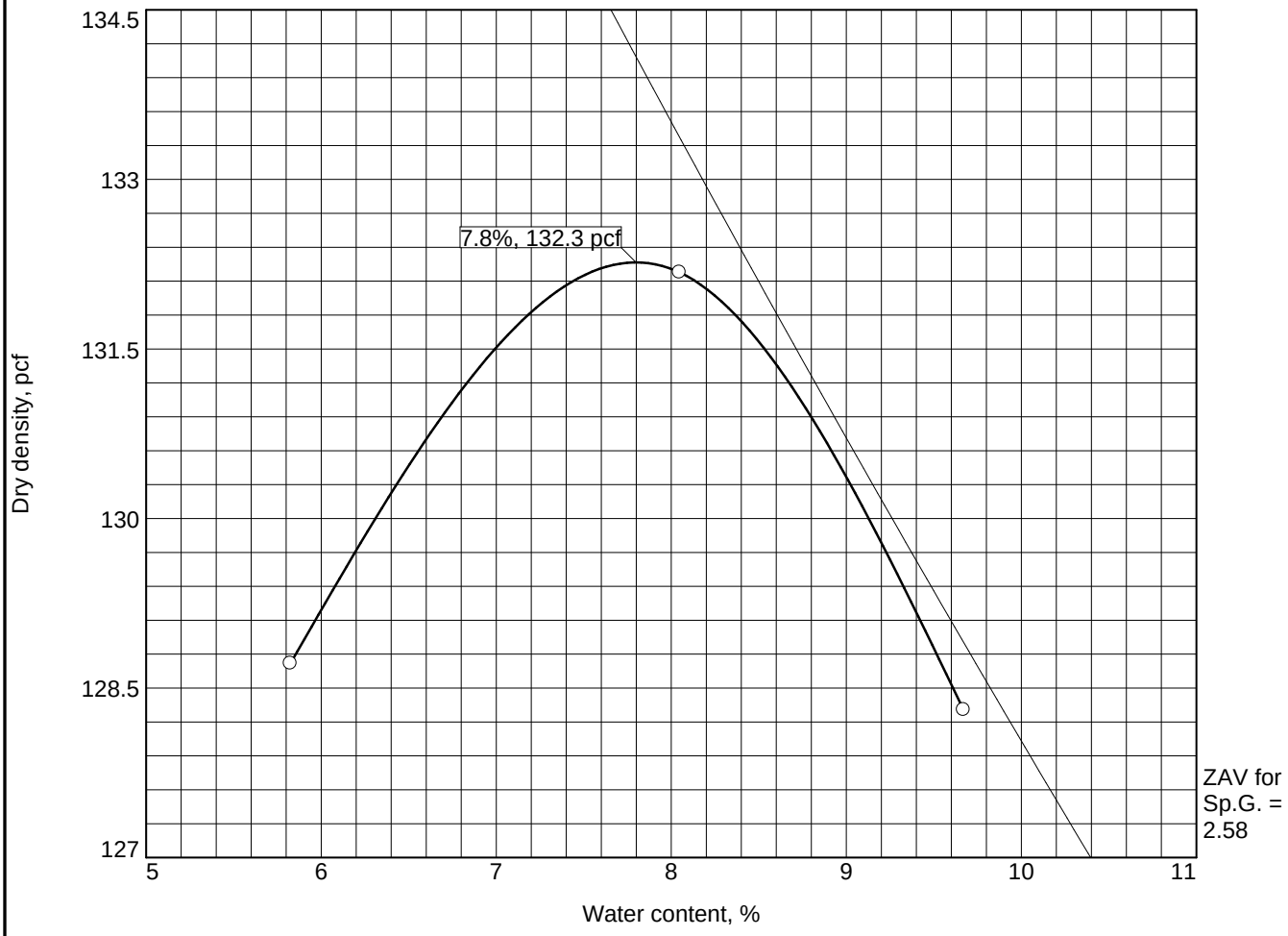
Tested by: JP
Checked by: HWB
Remarks:

R-VALUE TEST REPORT

EnGEN Corporation

Figure _____

MAXIMUM DENSITY - OPTIMUM MOISTURE REPORT



Test specification: ASTM D 1557-00 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0-5'								

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 132.3 pcf Optimum moisture = 7.8 %	Silty Sand

Project No. 4626GFS **Client:** Saddleback
Project: Saddleback, Lake Elsinore

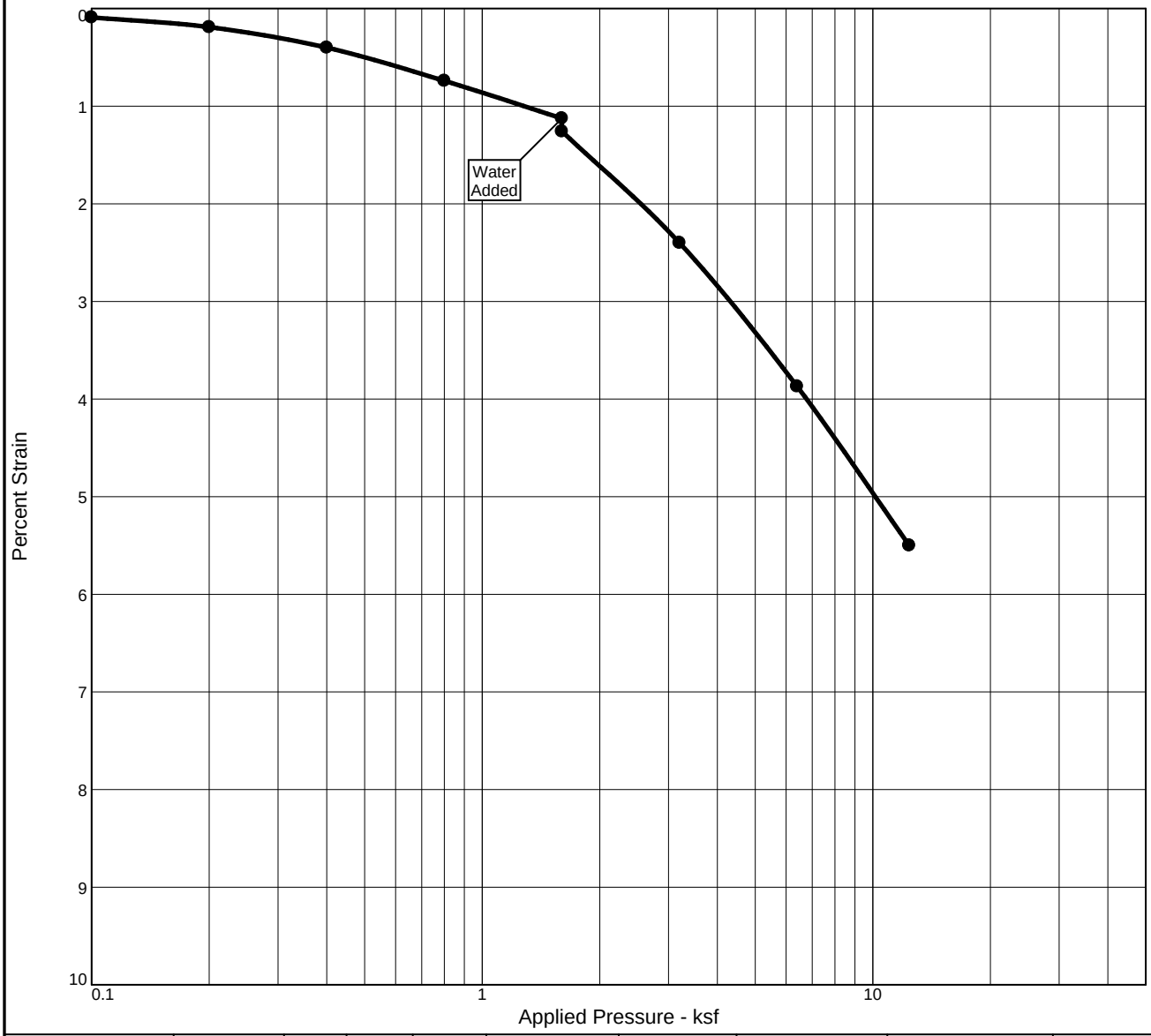
○**Location:** BH1 **Sample Number:** B1

Remarks:

EnGEN Corporation

Figure

CONSOLIDATION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
24.2 %	4.8 %	108.1			2.65		0.530		0.1	

MATERIAL DESCRIPTION	USCS	AASHTO
Silty fine sand, medium yellowish brown (5/YR 5/4)	SM	

Project No. 4626GFS **Client:** Saddleback & Assc.

Project: SADDLEBACK LAKE ELSINORE

Source of Sample: CONSOLS **Depth:** 20-FEET **Sample Number:** B1@20'

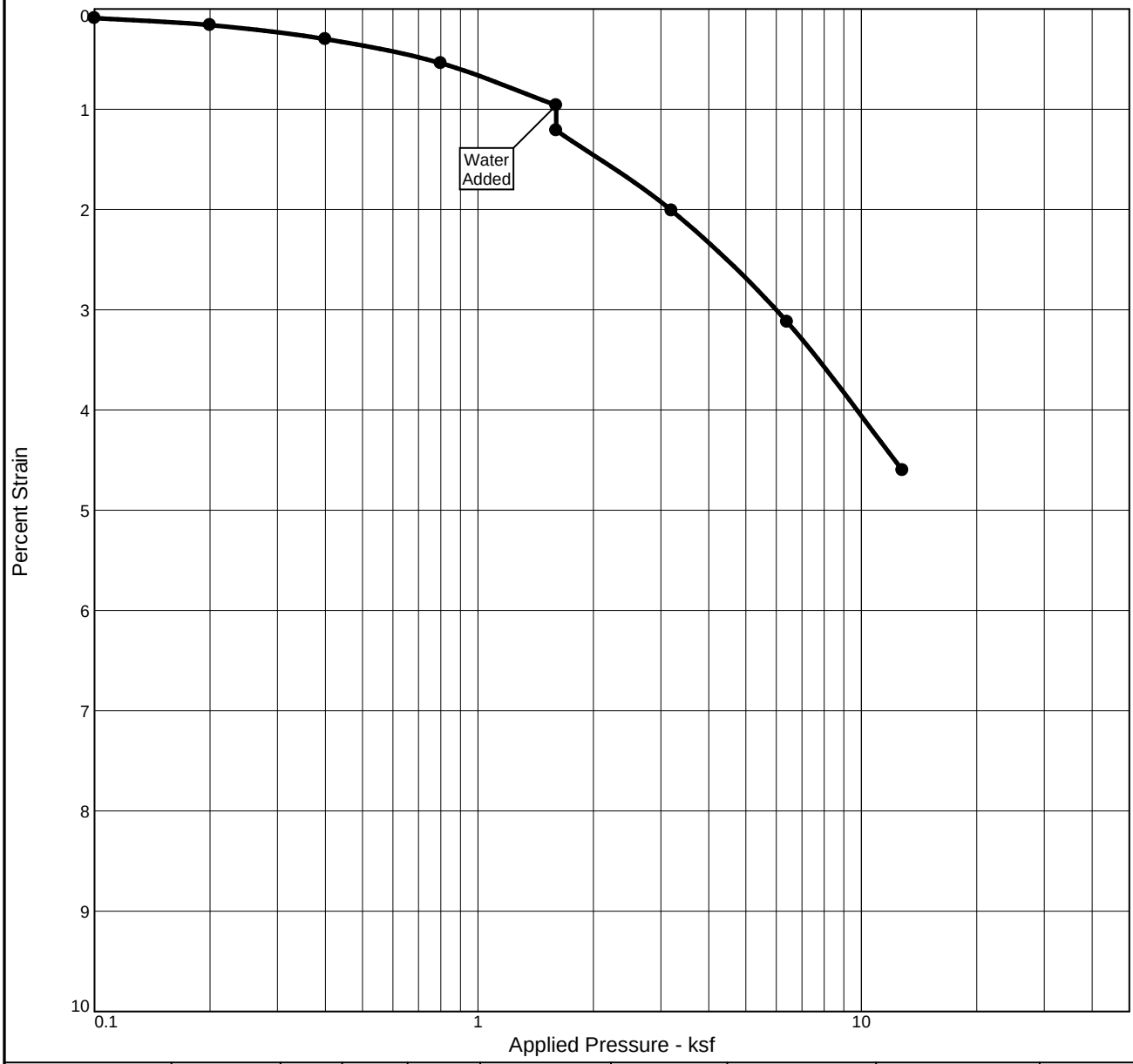
Remarks:
SAMPLE B1 @ 20'
COLLECTED BY CM
COLLECTED ON 11-13-2020

EnGEN Corporation

Figure

Tested By: GK **Checked By:** HWB

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
Sat.	Moist.									
26.6 %	5.8 %	104.7			2.65		0.580		0.2	

MATERIAL DESCRIPTION	USCS	AASHTO
Silty to clayey fine to medium sand, light brown (5YR 5/6)	SM-SP	

Project No. 4626GFS **Client:** Saddleback & Assc.

Project: SADDLEBACK LAKE ELSINORE

Source of Sample: CONSOLS **Depth:** 25-FEET **Sample Number:** B1@25'

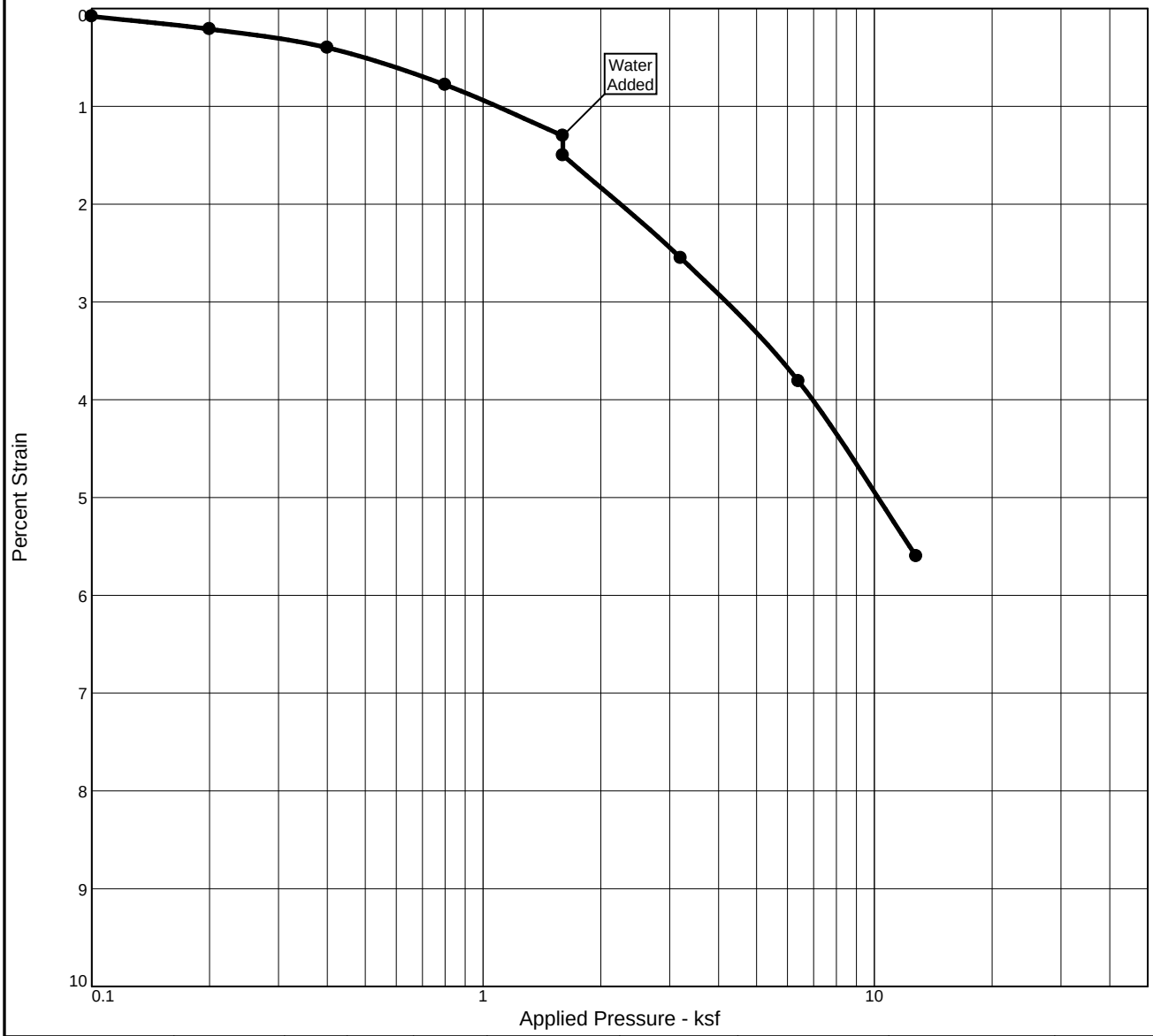
Remarks:

SAMPLE B1 @ 25'
COLLECTED BY CM
COLLECTED ON 11-13-2020

EnGEN Corporation

Figure

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
Sat.	Moist.									
111.3 %	18.0 %	115.7			2.65		0.429		0.2	

MATERIAL DESCRIPTION	USCS	AASHTO
Silty to clayey fine sand, light brown (5YR 5/6)	SM	

Project No. 4626GFS **Client:** Saddleback & Assc.

Project: SADDLEBACK LAKE ELSINORE

Source of Sample: CONSOLS **Depth:** 30-FEET **Sample Number:** B1@30'

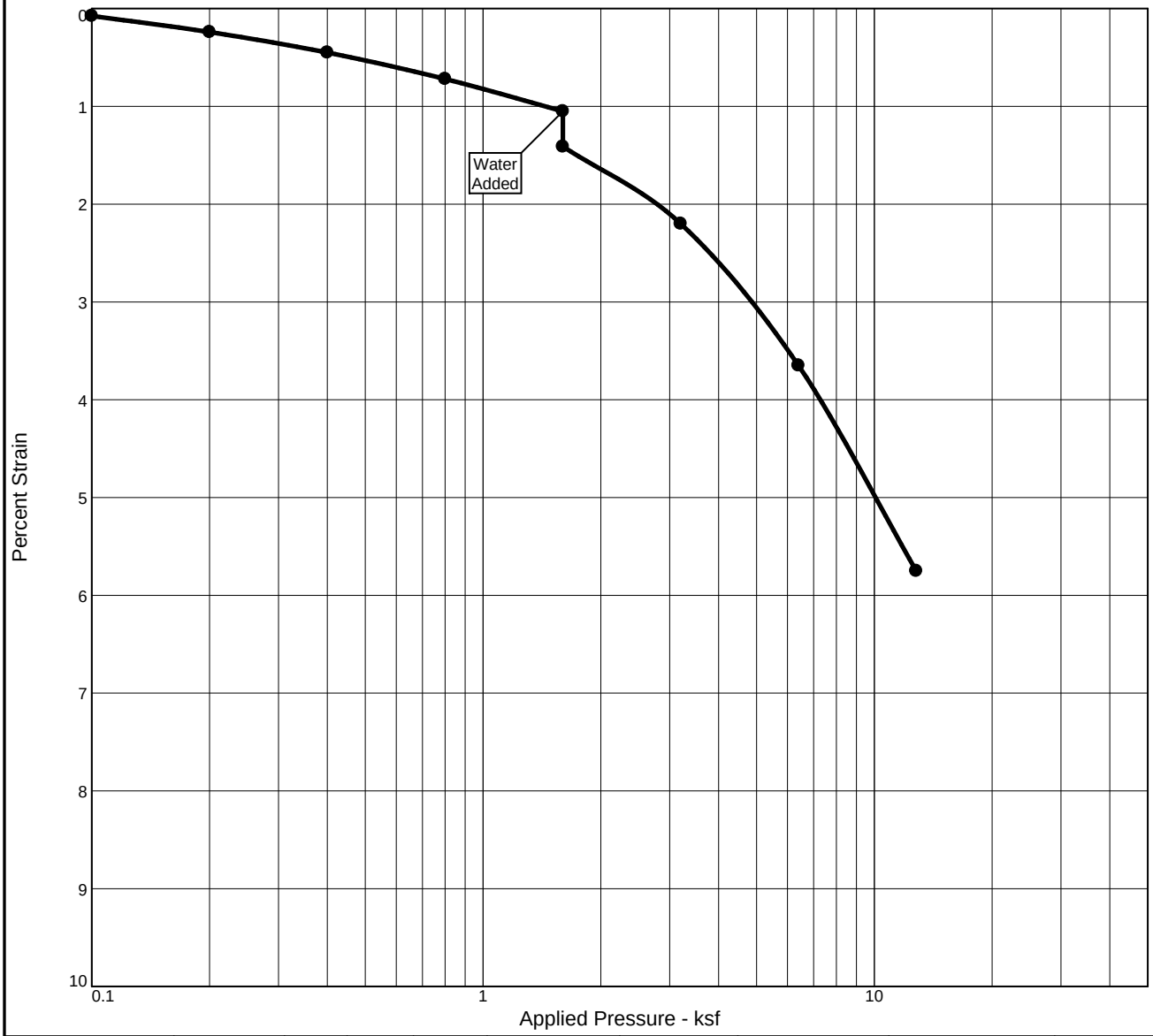
Remarks:
SAMPLE B1
B1 @ 30'
COLLECTED BY CM
COLLECTED ON 11-13-2020

EnGEN Corporation

Figure

Tested By: GK **Checked By:** HWB

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
Sat.	Moist.									
85.7 %	15.5 %	111.8			2.65		0.480		0.4	

MATERIAL DESCRIPTION	USCS	AASHTO
Silty fine sand, light brown (5YR 5/6)	SM-SP	

Project No. 4626GFS **Client:** Saddleback & Assc.

Project: SADDLEBACK LAKE ELSINORE

Source of Sample: CONSOLS **Depth:** 15-feet **Sample Number:** B4@15'

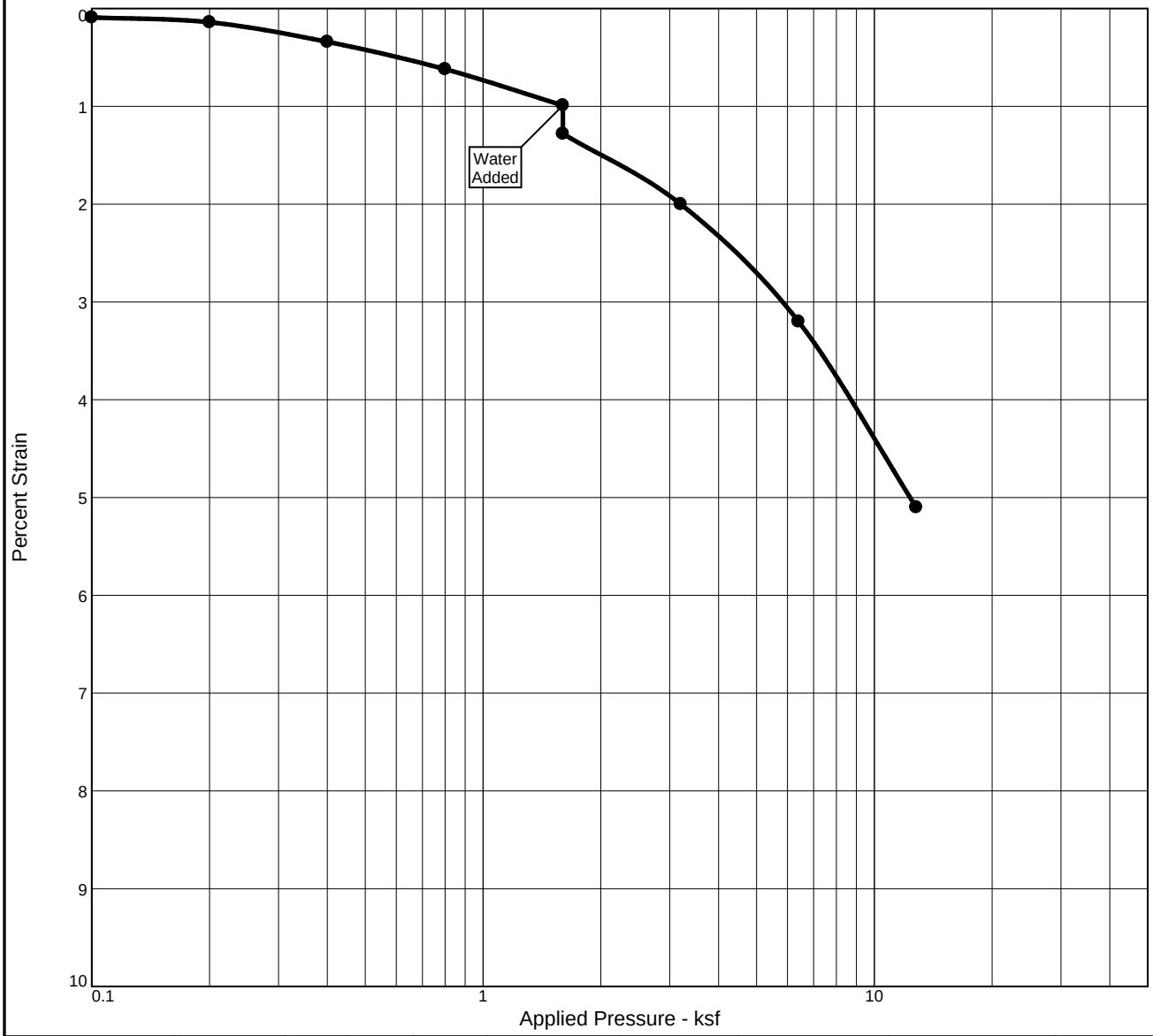
Remarks:
SAMPLE B4 @ 15'
COLLECTED BY CM
COLLECTED ON 11-13-2020

EnGEN Corporation

Figure

Tested By: GK **Checked By:** HWB

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
Sat.	Moist.									
90.9 %	14.3 %	116.6			2.65		0.418		0.3	

MATERIAL DESCRIPTION	USCS	AASHTO
Silty fine to medium sand, with trace clay, medium yellowish brown (5YR 5/4)	SM	

Project No. 4626GFS **Client:** Saddleback & Assc.

Project: SADDLEBACK LAKE ELSINORE

Source of Sample: CONSOLS **Depth:** 20-FEET **Sample Number:** B4@20'

Remarks:

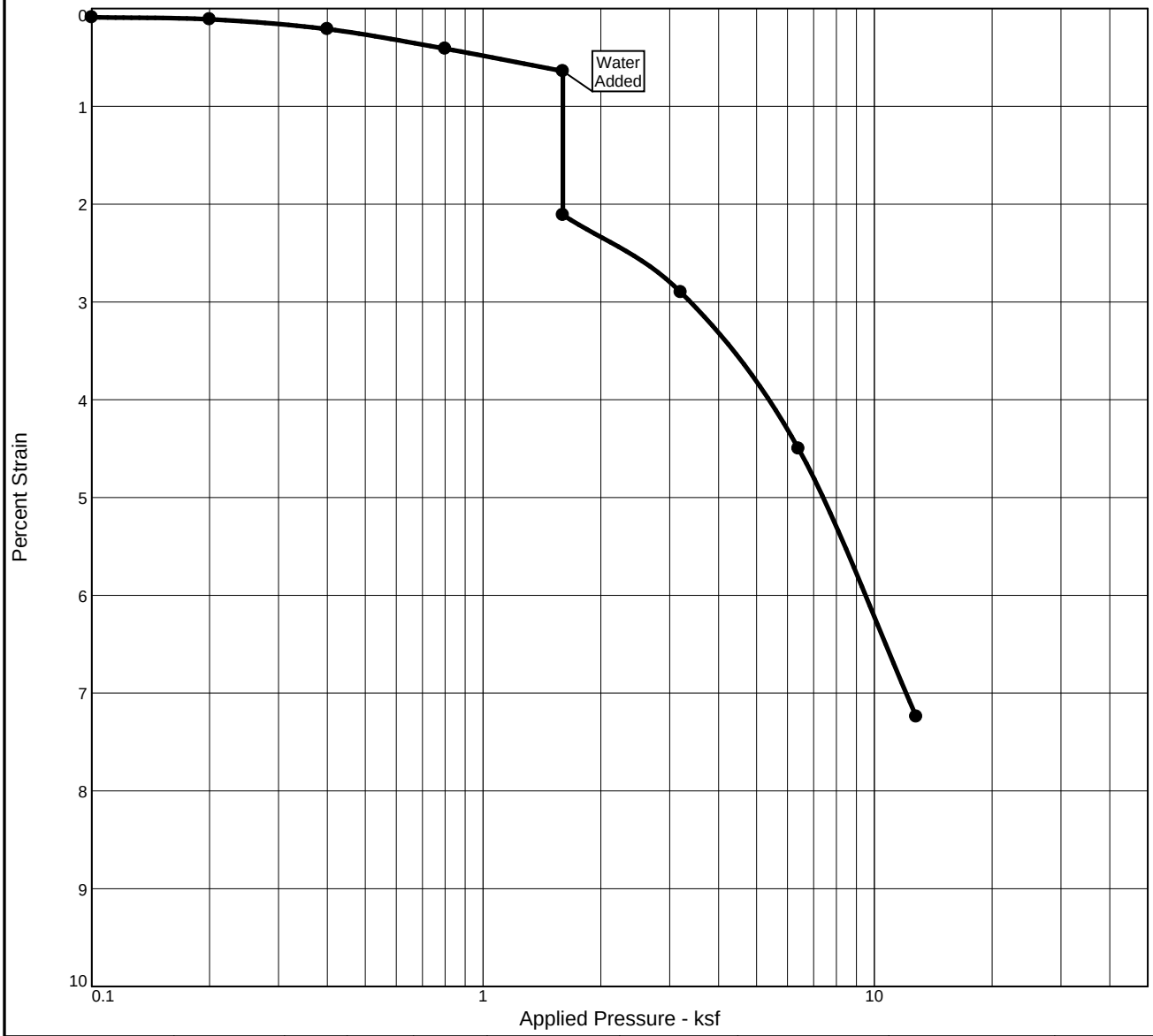
SAMPLE B4 @ 20'
COLLECTED BY CM
COLLECTED ON 11-13-2020

EnGEN Corporation

Figure

Tested By: GK **Checked By:** HWB

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
Sat.	Moist.									
69.2 %	13.1 %	110.3			2.65		0.500		1.5	

MATERIAL DESCRIPTION	USCS	AASHTO
Silty fine to medium sand, light brown (5YR 5/6)	SM	

Project No. 4626GFS **Client:** Saddleback & Assc.

Project: SADDLEBACK LAKE ELSINORE

Source of Sample: CONSOLS **Depth:** 25-FEET **Sample Number:** B4@25'

Remarks:
SAMPLE B4 @ 25'
COLLECTED BY CM
COLLECTED ON 11-13-2020

EnGEN Corporation

Figure

Tested By: GK **Checked By:** HWB

APPENDIX 3 - SUBSURFACE EXPLORATORY LOGS

GEOTECHNICAL BORING LOG

Project Number: 4626GS
Project: Saddleback Business Park
Boring Number: B-1
Surface Elevation: 1265
Date: 11/13/20
Logged By: CM

Elevation	Soil Graphic	Description	Sampler	Sample Depth	USCS	Blow Count	Dry Density	In-Situ Moisture Content	% Collapse	% Passing #200
1265		Undocumented Fill(Afu), silty fine sand, light brown (5YR 6/4) dry, loose		0	SM					
		Alluvium(Qal), silty fine sand, light brown (5YR 5/6), dry, medium dense, slightly moist, loose, pinhole pores, root hairs			SM	20-18-22				
1260		Silty fine sand, light brown (5YR 5/6), moist, loose		5	SM	5-3-3	107.4	5.5		
		Silty fine sand, light brown (5YR 5/6), moist, loose			SM	7-5-6	107.4	9.5		
1255		Silty fine to medium sand, light brown (5YR 5/6), very moist, loose		10	SM	2-2-2	107.2	11.8		
1250		Silty fine sand, medium yellowish brown (5YR 5/4), wet, loose		15	SM	2-1-5	108.2	17.5		
1245		Silty to fine to medium sand, light brown (5YR 5/6), wet, loose, heaving, partially disturbed sample		20	SM	6-5-4	107.1	5.2	0.1	
1240		Silty to fine to medium sand, light brown (5YR 5/6), wet, loose		25	SM	2-2-3	103.7	19.6	0.2	
1235		Medium yellowish brown (5YR 5/4), wet, very loose		30	SM	4-2-2	101.4	25.3	.02	
1230		Silty fine sand, medium yellowish brown (10 YR 5/4), overlying medium sand, light olive gray		35	SP-SM	3-9-18	102.2	17.4		

Notes:

EnGEN Corporation

GEOTECHNICAL BORING LOG SUMMARY

Boring Number: B-1
Project: Saddleback Business Park
Date: 11/13/20

Project Number: 4626GS
Surface Elevation: 1265
Logged By: CM

Elevation	Soil Graphic	Description	Sampler	Sample Depth	USCS	Blow Count	Dry Density	In-Situ Moisture Content	% Collapse	% Passing #200
		(5YR 4/1), wet, medium dense			GP-SP					
		Santiago Formation(Tsi)								
1225		Gravelly sand to sandy gravel light olive gray (5YR 4/1), wet, very dense, gravel up to 2" in diameter		40	GP/SP	15-25-50 for 5"	n/a			
1220		Silty medium sand, light olive gray (5YR 4/1), moist, very dense		45	SM	50 for 5"	n/a			
		REFUSAL @ 45.5 FEET GROUNDWATER @ 12 FEET								
1215				50						
1210				55						
1205				60						
1200				65						
1195				70						

Notes:

EnGEN Corporation

GEOTECHNICAL BORING LOG

Project Number: 4626GS
Project: Saddleback Business Park
Boring Number: B-2
Surface Elevation: 1263
Date: 11/13/20
Logged By: CM

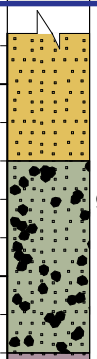
Elevation	Soil Graphic	Description	Sampler	Sample Depth	USCS	Blow Count	Dry Density	In-Situ Moisture Content	% Collapse	% Passing #200
		Undocumented Fill(Afu), silty fine sand, light brown (5YR 5/6), dry, medium dense, dry, loose		0	SM					
1260		Alluvium(Qal), silty fine sand, light brown (5YR 5/6), dry, medium dense, slightly moist, loose			SM	6-9-8				44.8
		Slightly moist, loose		5	SM	3-3-2				42.1
1255		Moist, very loose			SM	1-1-push				35.8
		Silty to clayey, fine to medium sand, light brown (5YR 5/6), wet, very loose		10	SM	1-push				38.0
1250										
		Silty fine to medium sand, light brown (5YR 5/6), wet, very loose		15	SM	1-1-1				42.5
1245										
		Silty fine to medium sand, light brown (5YR 5/6), wet, very loose		20	SM	2-1-1				37.5
1240										
		Medium sand, medium yelloish brown (10YR 5/4), wet, very loose		25	SP	1-1-3				17.7
1235										
		Silty fine sand, dark grayish brown (10YR 4/2), wet, loose		30	SM	1-3-5				23.6
		Santiago Formation (Tsi)			SP					
1230										
		Recovered as medium to coarse sand, light olive gray (5YR 6/1), wet, dense		35	SP	3-10-27				

Notes:

GEOTECHNICAL BORING LOG SUMMARY

Boring Number: B-2
Project: Saddleback Business Park
Date: 11/13/20

Project Number: 4626GS
Surface Elevation: 1263
Logged By: CM

Elevation	Soil Graphic	Description	Sampler	Sample Depth	USCS	Blow Count	Dry Density	In-Situ Moisture Content	% Collapse	% Passing #200
1225		Medium to course sand to fine gravel, light olive gray (5YR 6/1), wet, very dense		40	GP/SP	7-22-31				
1220				45	SP	7-17-36				
1215		Medium to coarse sand, light olive gray (5YR 6/1), wet, very dense REFUSAL @ 48 FEET GROUNDWATER @ 9 FEET		50						
1210				55						
1205				60						
1200				65						
1195				70						
1190										

Notes:

EnGEN Corporation

GEOTECHNICAL BORING LOG

Project Number: 4626GS
Project: Saddleback Business Park
Boring Number: B-3
Surface Elevation: 1267
Date: 11/13/20
Logged By: CM

Elevation	Soil Graphic	Description	Sampler	Sample Depth	USCS	Blow Count	Dry Density	In-Situ Moisture Content	% Collapse	% Passing #200
		Undocumented Fill(Afu), silty fine sand, medium yellowish brown(10YR 5/4), dry, medium dense		0	SM					
1265					SM	7-14-20				
		1.5" Rock in sampler		5	SM	10-10-16				
1260		Alluvium(Qal), silty fine to medium sand, light brown (5YR 5/6), moist, loose, pinhole pores			SM	5-5-7				
		Silty fine to medium sand, light brown (5YR 5/6), moist, loose, pinhole pores		10	SC-SM	3-3-5				
1255										
		Silty to clayey fine sand, light brown (5YR 5/6), moist, loose		15	SP-SM	3-6-7				
1250										
		Silty to clayey fine sand, light brown (5YR 5/6), wet, very loose		20	SC-SM	2-2-2				
1245										
		Silty to clayey fine sand, light brown (5YR 5/6), wet, very loose		25	SM	5-6-7				
1240										
		Silty fine sand, light brown (5YR 5/6), wet, medium dense		30	SM	7-12-19				
1235		TOTAL DEPTH 31.5 FEET GROUNDWATER @ 17 FEET		35						

Notes:

EnGEN Corporation

GEOTECHNICAL BORING LOG

Project Number: 4626GS
Project: Saddleback Business Park
Boring Number: B-4
Surface Elevation: 1271
Date: 11-30-20
Logged By: CM

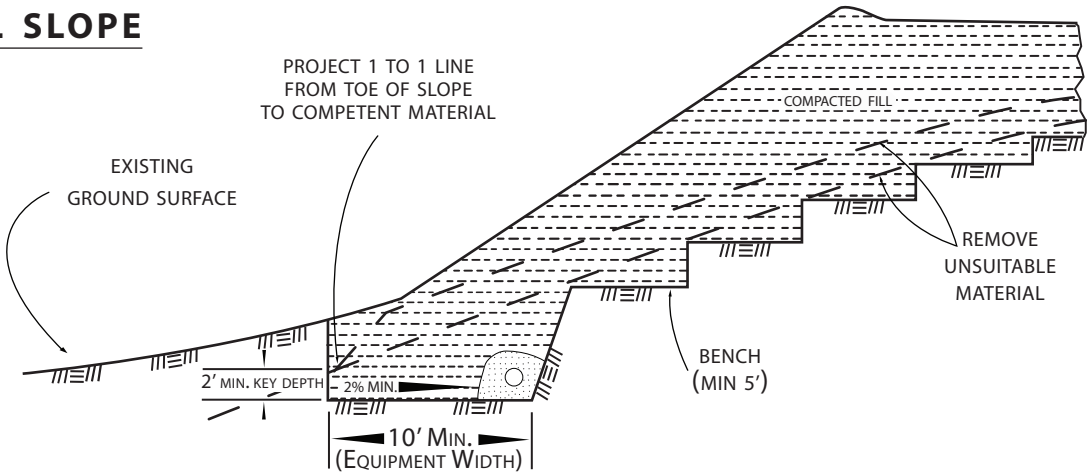
Elevation	Soil Graphic	Description	Sampler	Sample Depth	USCS	Blow Count	Dry Density	In-Situ Moisture Content	% Collapse	% Passing #200
1270		Alluvium(Qal), silty fine to medium sand, light brown (5YR 5/6), slightly moist, loose		0	SM					
					SM	3-4-6				
1265		Highly porous, pores are pinholes to 1/8" diameter		5	SM	4-5-5				
		Highly porous, pinhole pores			SM	3-4-5				
1260		Medium dense, highly porous, pinhole pores		10	SM	6-9-11				
1255		Silty to fine sand, light brown (5YR 5 6), moist, loose		15	SM	4-5-5			0.4	
1250		Silty fine to medium sand, light brown (5YR 5/6), wet, loose		20	SM	3-5-5			0.3	
1245		Very loose		25	SM	2-2-2			1.5	
1240		Silty fine sand overlying medium sand, light brown (5YR 5/6), wet, medium dense		30	SP-SM	2-4-6				
		TOTAL DEPTH 31.5 FEET GROUNDWATER @ 18 FEET								
1235				35						

Notes:

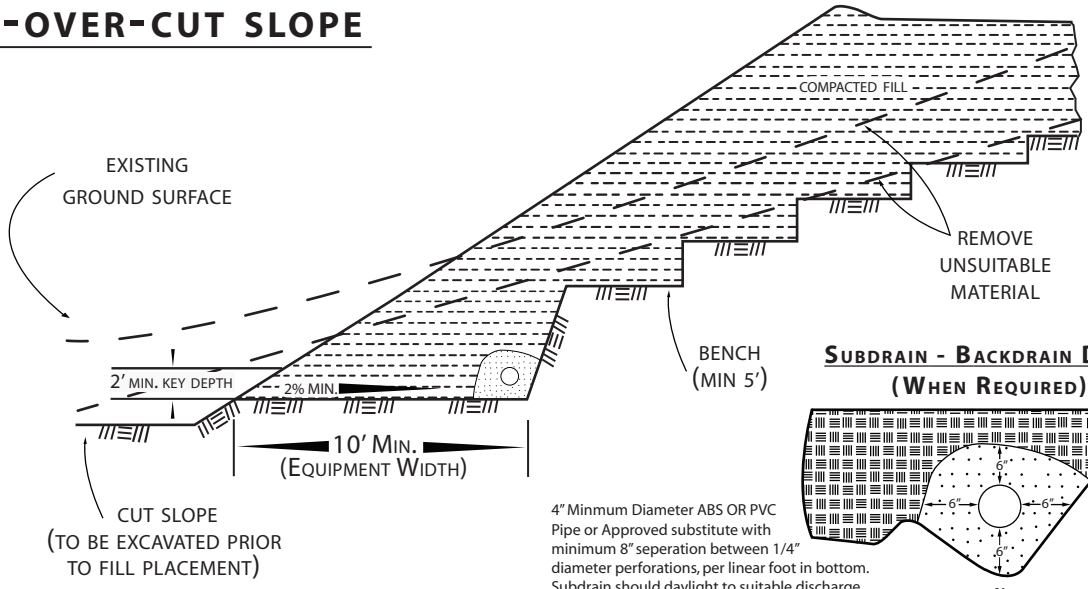
APPENDIX 4 - TYPICAL GRADING DETAILS

KEY AND BENCHING DETAIL

FILL SLOPE



FILL-OVER-CUT SLOPE

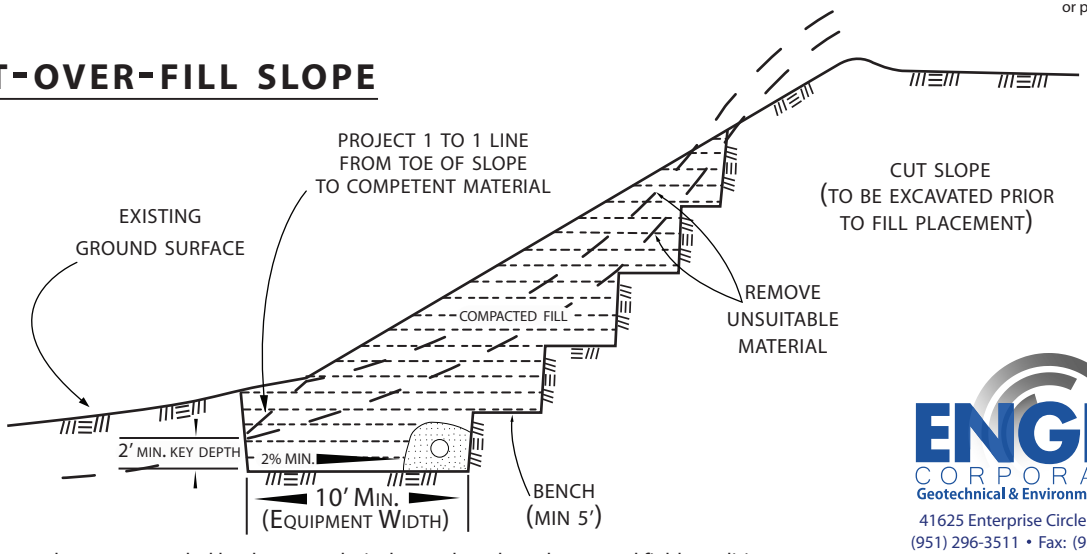


SUBDRAIN - BACKDRAIN DETAIL (WHEN REQUIRED)

4" Minmum Diameter ABS OR PVC Pipe or Approved substitute with minimum 8" seperation between 1/4" diameter perforations, per linear foot in bottom. Subdrain should daylight to suitable discharge facility per geotechnical engineer's approval.

Note: An approved filter fabric (Burrieto) may be wrapped around 3/4" crushed rock or pea gravel.

CUT-OVER-FILL SLOPE

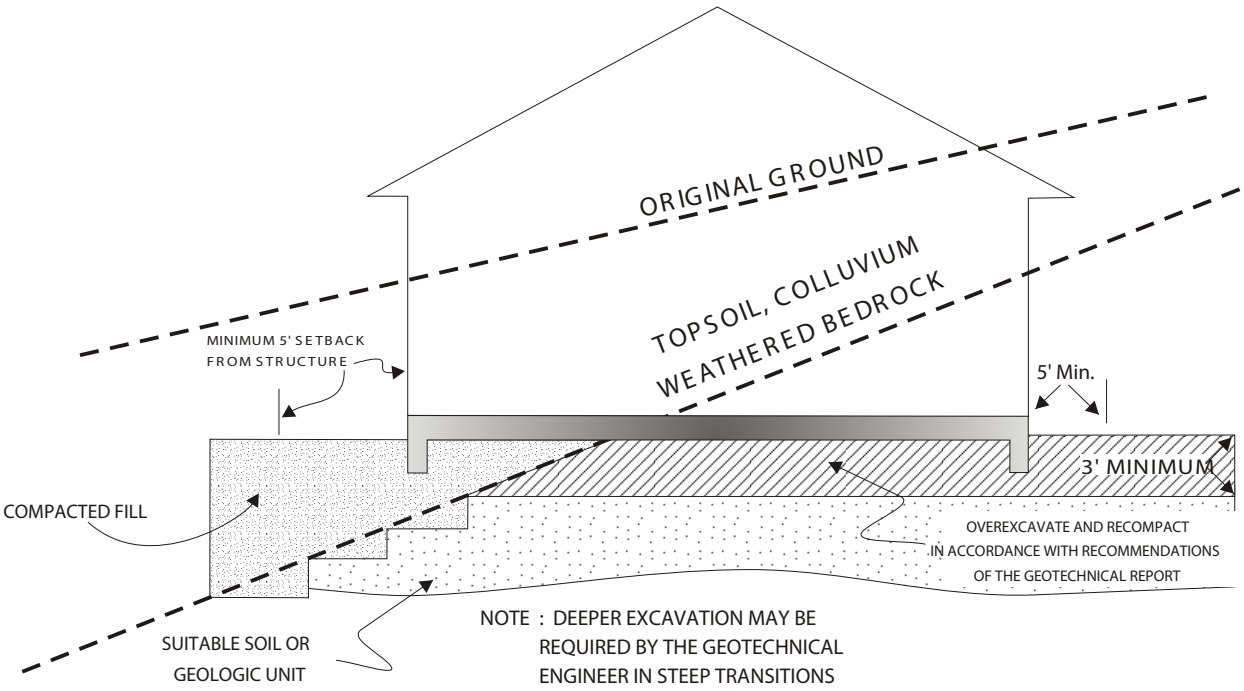


Note: Back drain may be recommended by the geotechnical consultant based on actual field conditions encountered. Bench dimension recommendations may also be altered on field conditions encountered.

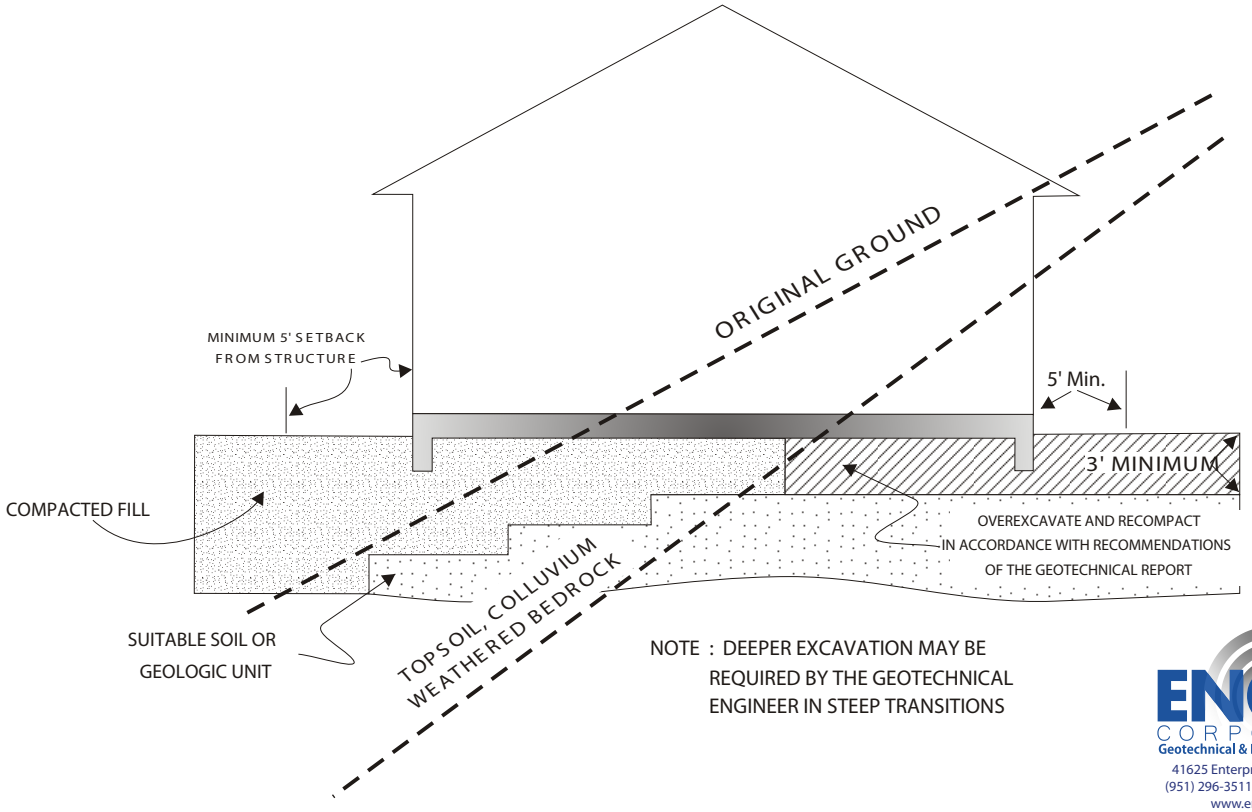
ENGEN CORPORATION
Geotechnical & Environmental Services
41625 Enterprise Circle South,"B-2"
(951) 296-3511 • Fax: (951) 296-3711
www.engencorp.com

GENERAL GRADING RECOMMENDATIONS

CUT LOT

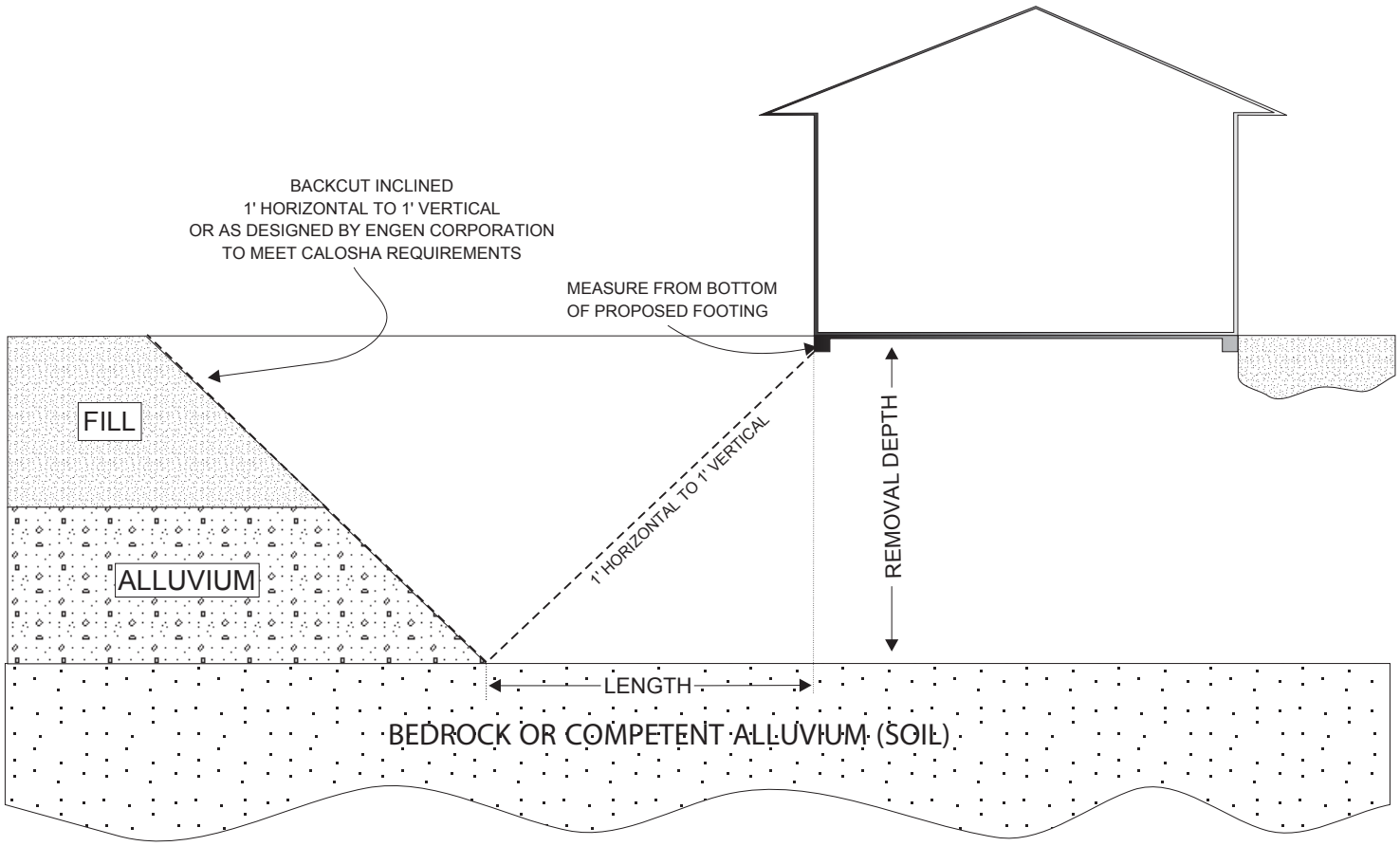


CUT-FILL LOT (TRANSITION)



ENGEN
CORPORATION
Geotechnical & Environmental Services
41625 Enterprise Circle South,"B-2"
(951) 296-3511 • Fax: (951) 296-3711
www.engencorp.com

Minimum Horizontal Removal Limits



REMOVALS TO EXTEND TO THE HORIZONTAL DISTANCE OUTSIDE OF THE BUILDING LINES EQUAL TO DEPTH OF REMOVAL (LENGTH = HEIGHT)

ENGEN CORPORATION
Geotechnical & Environmental Services

41625 Enterprise Circle South,"B-2"
(951) 296-3511 • Fax: (951) 296-3711
www.engencorp.com

APPENDIX 5 – LIQUEFACTION ANALYSIS

LIQUEFACTION CALCULATIONS SUMMARY

Layer Depth Range (ft)	Field N	Soil Classification (USCS)	Estimated Fines %	Factor of Safety	Settlement (inches)	
0 to 9	17	SM	44.8	NA (groundwater)	0.00	
Groundwater at 9 ft						
9 to 13	1	SM	38.0	0.18	2.17	
13 to 18	2	SM	42.5	0.18	2.44	
18 to 23	2	SM	37.5	0.16	2.48	
23 to 28	4	SM	17.7	0.17	2.32	
28 to 32	8	SM	23.6	0.23	1.38	
					10.8	**Total**

Calculations based on:
"Soil Liqufaction During Earthquakes", EERI Monogram MNO-12, by I.M. Idriss and R.W. Boulanger, 2008.

Note:

Peak Ground Acceleration	0.945
Earthquake Magnitude	6.8
Water table depth	9 ft

APPENDIX 6 - PLATE 1 - GEOTECHNICAL FEASIBILITY STUDY PLAN

Geotchnical Study Report Site Plan

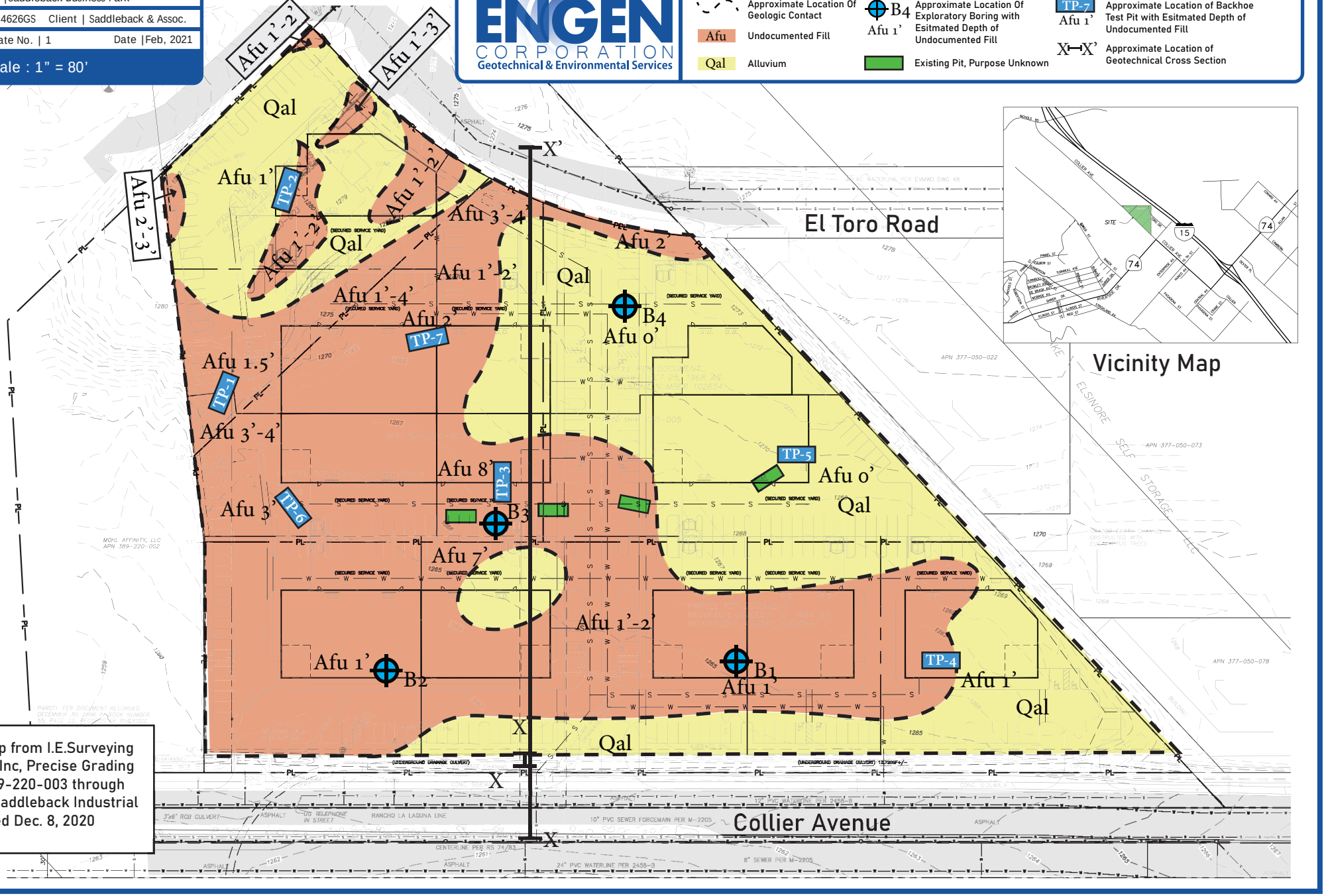
Project Name |	Saddleback Business Park
Project No. |	4626GS Client | Saddleback & Assoc.
Site Plan | Plate No. |	1 Date | Feb, 2021

Scale : 1" = 80'

ENGEN CORPORATION
Geotechnical & Environmental Services

Legend

- Approximate Location Of Geologic Contact
- Afu — Undocumented Fill
- Qal — Alluvium
- B4 / Afu 1' — Approximate Location Of Exploratory Boring with Esitmated Depth of Undocumented Fill
- Existing Pit, Purpose Unknown
- TP-7 / Afu 1' — Approximate Location of Backhoe Test Pit with Esitmated Depth of Undocumented Fill
- X—X' — Approximate Location of Geotechnical Cross Section

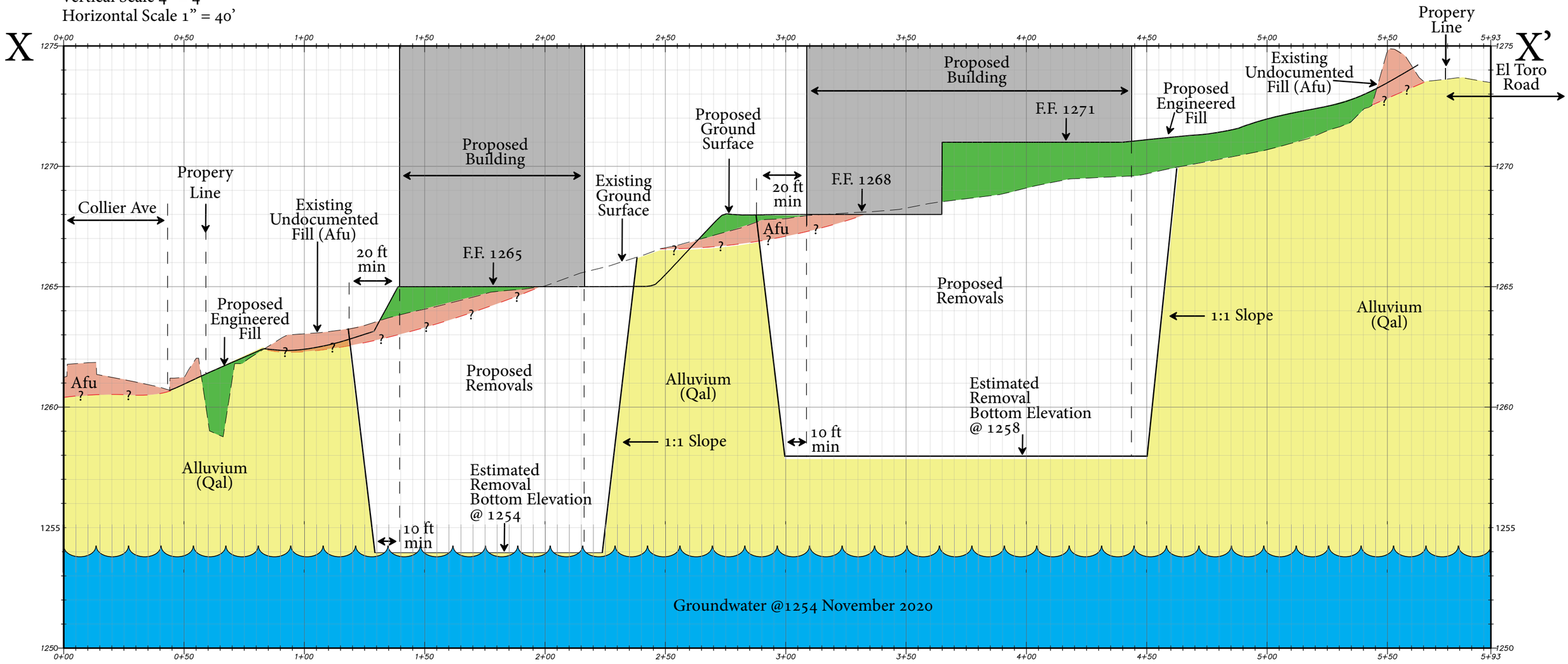


Note: Base map from I.E.Surveying & Engineering Inc, Precise Grading Plan, APN 389-220-003 through 389-220-004, Saddleback Industrial plan dated Dec. 8, 2020

APPENDIX 7 - PLATE 2 - GEOTECHNICAL CROSS SECTION X-X'

N43°E

Vertical Exageration 10:1
Vertical Scale 4” = 4’
Horizontal Scale 1” = 40’



Note: Base map from I.E.Surveying & Engineering Inc, Precise Grading Plan, APN 389-220-003 through 389-220-004, Saddleback Industrial plan dated Dec. 8, 2020

ENGEN CORPORATION
Geotechnical & Environmental Services

Legend

- Approximate Location Of Geologic Contact
- Afu — Undocumented Fill
- Qal — Alluvium
- Proposed Engineered Fill
- Groundwater
- X⊢X’ — Approximate Location of Geotechnical Cross Section

Geotchnical Cross Section X - X’

Project Name | Saddleback Business Park
Project No. | 4626GS Client | Saddleback & Assoc.
Site Plan | Plate No. | 2 Date | Feb, 2021

Appendix 4: Historical Site Conditions

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

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Isohyetal Map for the 85th Percentile 24-hour Storm Event

R 07 W | R 06 W | R 05 W | R 04 W | R 03 W | R 02 W | R 01 W | R 01 E | R 02 E | R 03 E | R 04 E | R 05 E

T 01 S
T 02 S
T 03 S
T 04 S
T 05 S
T 06 S
T 07 S
T 08 S

0.85 MiraLoma
0.61 RiversideNorth
0.68 PigeonPass
0.54 RiversideSouth
0.66 MorenoEast
0.85 Beaumont
0.88 PradoDam
0.51 Woodcrest
0.50 LakeMathews
0.68 PerrisReservoir
0.87 VistaGrandeGS
0.70 SanJacintoNWS
1.18 Idyllwild
0.58 SunCity
0.68 Winchester
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.90 HurkeyCreek
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley

Santa Ana River Watershed
Santa Margarita Watershed

EASTVALE | JURUPA VALLEY | CORONA | NORCO | RIVERSIDE | MORENO VALLEY | CALIMESA | BEAUMONT | SAN JACINTO | PERRIS | CANYON LAKE | LAKE ELSINORE | WILDOMAR | MENIFEE | MURRIETA | HEMET | TEMECULA

06	05	04	03	02	01
07	08	09	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: JLC Engineering and Consulting, Inc. — Date: 3/29/2021

Designed by: Jilleen Ferris — Case No:

Company Project Number/Name: Saddleback Industrial - 292.01.20

BMP Identification

BMP NAME / ID: Modular Wetlands A

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
A-1	*85072.68*	*Concrete or Asphalt*	*1*	*0.89*	*75884.8*			
A-2	*9452.52*	*Ornamental Landscaping*	*0.1*	*0.11046*	*1044.1*			
	94525.2	***Total***			**76928.9**	**0.20**	***0.4***	***0.577***

DMAs

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: JLC Engineering and Consulting, Inc.
Date: 3/29/2021
Designed by: Jilleen Ferris
Case No:
Company Project Number/Name: Saddleback Industrial - 292.01.20

BMP Identification

BMP NAME / ID: Modular Wetlands B1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

Drainage Management Area Tabulation

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

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*B1-1*	*63118.44*	*Concrete or Asphalt*	*1*	*0.89*	*56301.6*			
	B1-2	*7013.16*	*Ornamental Landscaping*	*0.1*	*0.11046*	*774.7*			
		70131.6	***Total***			**57076.3**	**0.20**	***0.3***	***0.346***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: JLC Engineering and Consulting, Inc. — Date: 3/29/2021

Designed by: Jilleen Ferris — Case No:

Company Project Number/Name: Saddleback Industrial - 292.01.20

BMP Identification

BMP NAME / ID: Modular Wetlands B2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity — I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imprevious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
B2-1	*62726.4*	*Concrete or Asphalt*	*1*	*0.89*	*55951.9*			
B2-2	*6969.6*	*Ornamental Landscaping*	*0.1*	*0.11046*	*769.8*			
	69696	**Total**			**56721.7**	**0.20**	**0.3**	**0.346**

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

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

Company Name: JLC Engineering and Consulting, Inc. | Date: 3/29/2021

Designed by: Jilleen Ferris | Case No:

Company Project Number/Name: Saddleback Industrial - 292.01.20

BMP Identification

BMP NAME / ID: Modular Wetlands C

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
C-1	*73311.48*	*Concrete or Asphalt*	*1*	*0.89*	*65393.8*			
C-2	*8145.72*	*Ornamental Landscaping*	*0.1*	*0.11046*	*899.8*			
	81457.2	***Total***			**66293.6**	**0.20**	***0.3***	***0.346***

DMAs

Notes:

Bio Clean

A Forterra Company

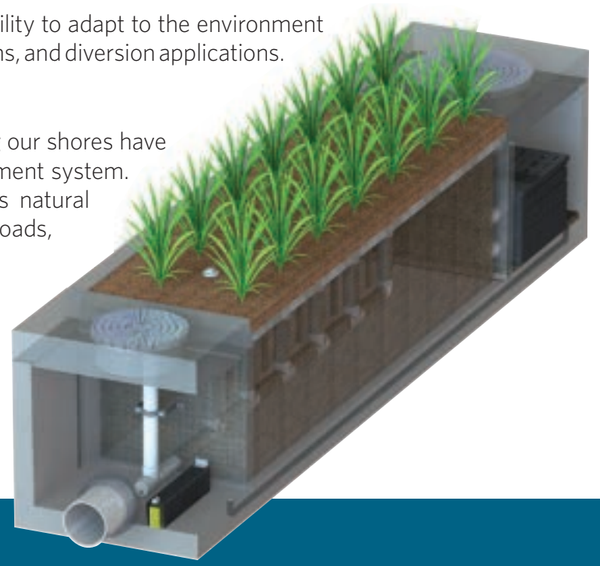
Modular Wetlands® System Linear

A Stormwater Biofiltration Solution

OVERVIEW

The Bio Clean Modular Wetlands® System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint, higher treatment capacity, and a wide range of versatility. While most biofilters use little or no pretreatment, the Modular Wetlands® incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, reducing maintenance costs and improving performance.

Horizontal flow also gives the system the unique ability to adapt to the environment through a variety of configurations, bypass orientations, and diversion applications.



The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as cities grow and develop, our environment's natural filtration systems are blanketed with impervious roads, rooftops, and parking lots.

Bio Clean understands this loss and has spent years re-establishing nature's presence in urban areas, and rejuvenating waterways with the Modular Wetlands® System Linear.

PERFORMANCE

The Modular Wetlands® continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the Modular Wetlands® has been field tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. In fact, the Modular Wetlands® harnesses some of the same biological processes found in natural wetlands in order to collect, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The Modular Wetlands® System Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world. Here is a list of some of the most high-profile approvals, certifications, and verifications from around the country.

Washington State Department of Ecology TAPE Approved
The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft² loading rate. The highest performing BMP on the market for all main pollutant categories.

California Water Resources Control Board, Full Capture Certification
The Modular Wetlands® System is the first biofiltration system to receive certification as a full capture trash treatment control device.

Virginia Department of Environmental Quality, Assignment
The Virginia Department of Environmental Quality assigned the MWS Linear the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) regulation technical criteria.

Maryland Department of the Environment, Approved ESD
Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP Evaluation
The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

Rhode Island Department of Environmental Management, Approved BMP
Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

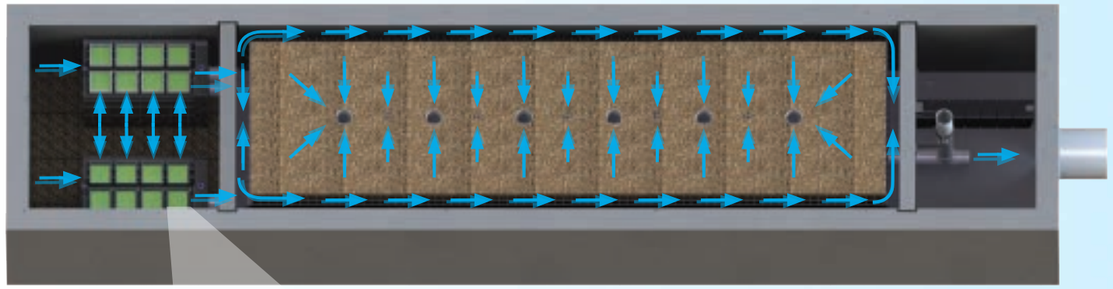
- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The Modular Wetlands® System Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which:

- Improves performance
- Reduces footprint
- Minimizes maintenance

Figure 1 & Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.



2x to 3x more surface area than traditional downward flow bioretention systems.

Figure 2, Top View

1 PRETREATMENT

SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN™ filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber

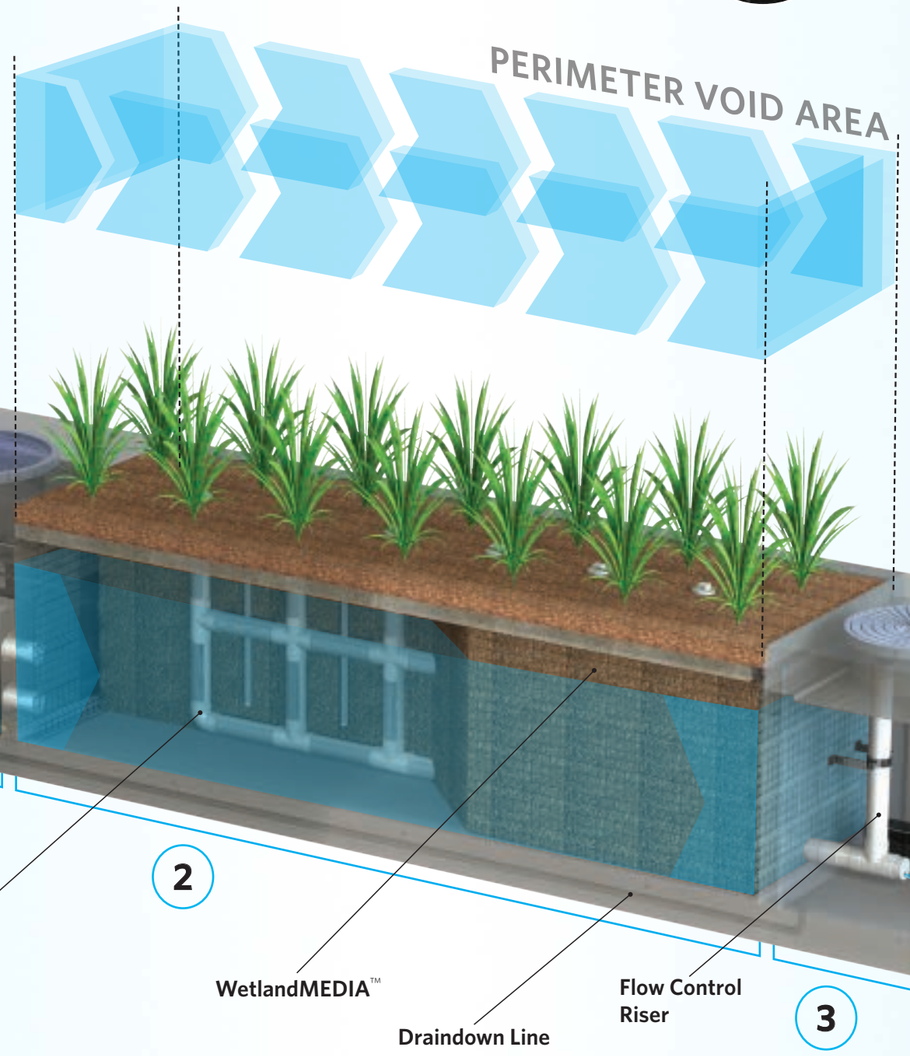


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA™ on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

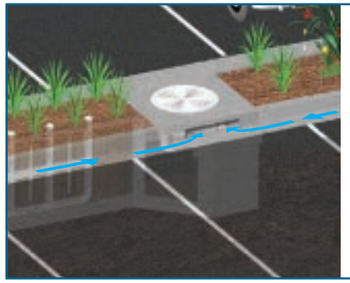
- Orifice plate controls flow of water through WetlandMEDIA™ to a level lower than the media's capacity
- Extends the life of the media and improves performance

DRAINDOWN FILTER

- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated

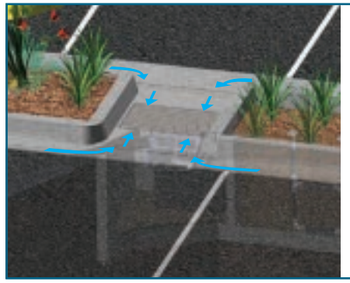
CONFIGURATIONS

The Modular Wetlands® System Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.



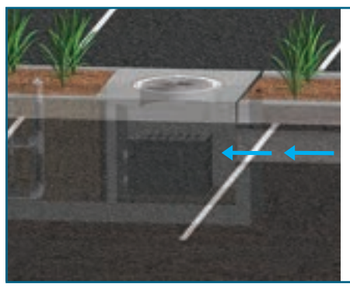
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

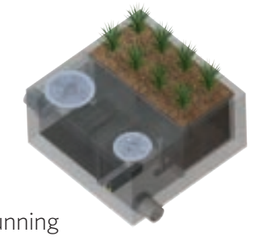
The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the Modular Wetlands® can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

DOWNSPOUT TYPE

The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

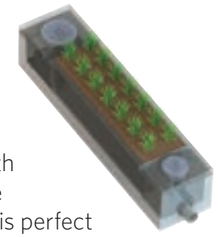
ORIENTATIONS

SIDE-BY-SIDE



The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

EXTERNAL DIVERSION WEIR STRUCTURE

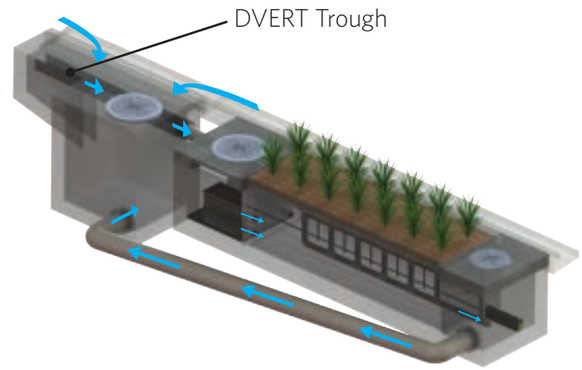
This traditional offline diversion method can be used with the Modular Wetlands® in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the Modular Wetlands® for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the Modular Wetlands® and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION

This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the Modular Wetlands® via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over



to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the Modular Wetlands® to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED DESIGNS

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements. Since the Modular Wetlands® is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

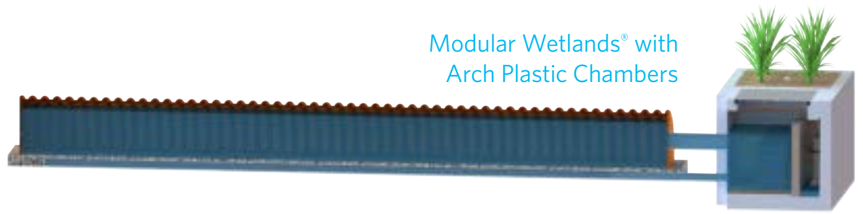
MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq. ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4′ x 4′	23	0.052
MWS-L-4-6	4′ x 6′	32	0.073
MWS-L-4-8	4′ x 8′	50	0.115
MWS-L-4-13	4′ x 13′	63	0.144
MWS-L-4-15	4′ x 15′	76	0.175
MWS-L-4-17	4′ x 17′	90	0.206
MWS-L-4-19	4′ x 19′	103	0.237
MWS-L-4-21	4′ x 21′	117	0.268
MWS-L-6-8	7′ x 9′	64	0.147
MWS-L-8-8	8′ x 8′	100	0.230
MWS-L-8-12	8′ x 12′	151	0.346
MWS-L-8-16	8′ x 16′	201	0.462
MWS-L-8-20	9′ x 21′	252	0.577
MWS-L-8-24	9′ x 25′	302	0.693
MWS-L-10-20	10' x 20'	302	0.693

VOLUME-BASED DESIGNS

HORIZONTAL FLOW BIOFILTRATION ADVANTAGE

Modular Wetlands® with
Box Culvert Prestorage

The Modular Wetlands® System Linear offers a unique advantage in the world of biofiltration due to its exclusive horizontal flow design: Volume-Based Design. No other biofilter has the ability to be placed downstream of detention ponds, extended dry detention basins, underground storage systems and permeable paver reservoirs. The systems horizontal flow configuration and built-in orifice control allows it to be installed with just 6" of fall between inlet and outlet pipe for a simple connection to projects with shallow downstream tie-in points. In the example above, the Modular Wetlands® is installed downstream of underground box culvert storage. Designed for the water quality volume, the Modular Wetlands® will treat and discharge the required volume within local draindown time requirements.



Modular Wetlands® with
Arch Plastic Chambers

DESIGN SUPPORT

Bio Clean engineers are trained to provide you with superior support for all volume sizing configurations throughout the country. Our vast knowledge of state and local regulations allow us to quickly and efficiently size a system to maximize feasibility. Volume control and hydromodification regulations are expanding the need to decrease the cost and size of your biofiltration system. Bio Clean will help you realize these cost savings with the Modular Wetlands®, the only biofilter than can be used downstream of storage BMPs.

ADVANTAGES

- LOWER COST THAN FLOW-BASED DESIGN
- MEETS LID REQUIREMENTS
- BUILT-IN ORIFICE CONTROL STRUCTURE
- WORKS WITH DEEP INSTALLATIONS

APPLICATIONS

The Modular Wetlands® System Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The Modular Wetlands® has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.

RESIDENTIAL

Low to high density developments can benefit from the versatile design of the Modular Wetlands®. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

STREETS

Street applications can be challenging due to limited space. The Modular Wetlands® is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

PARKING LOTS

Parking lots are designed to maximize space and the Modular Wetlands'® 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

COMMERCIAL

Compared to bioretention systems, the Modular Wetlands® can treat far more area in less space, meeting treatment and volume control requirements.

MIXED USE

The Modular Wetlands® can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the Modular Wetlands® System Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the Modular Wetlands®, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the Modular Wetlands'® micro/macro flora and fauna.

A wide range of plants are suitable for use in the Modular Wetlands®, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION

The Modular Wetlands® is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians is available to supervise installations and provide technical support.

MAINTENANCE

Reduce your maintenance costs, man hours, and materials with the Modular Wetlands®. Unlike other biofiltration systems that provide no pretreatment, the Modular Wetlands® is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

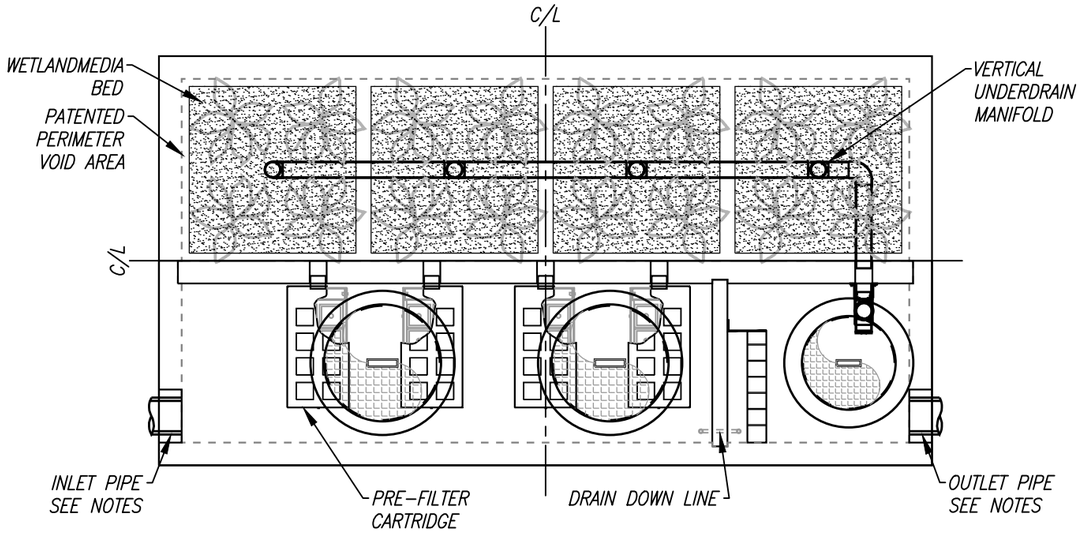
Bio Clean
A Forterra Company

5796 Armada Drive Suite 250
Carlsbad, CA 92008
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

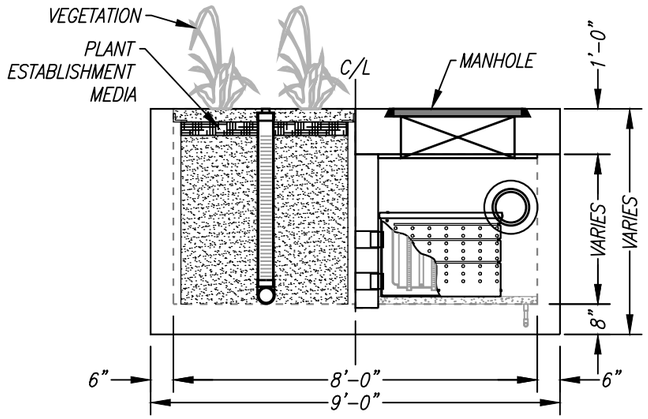
010419R1A

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.577	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	2EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



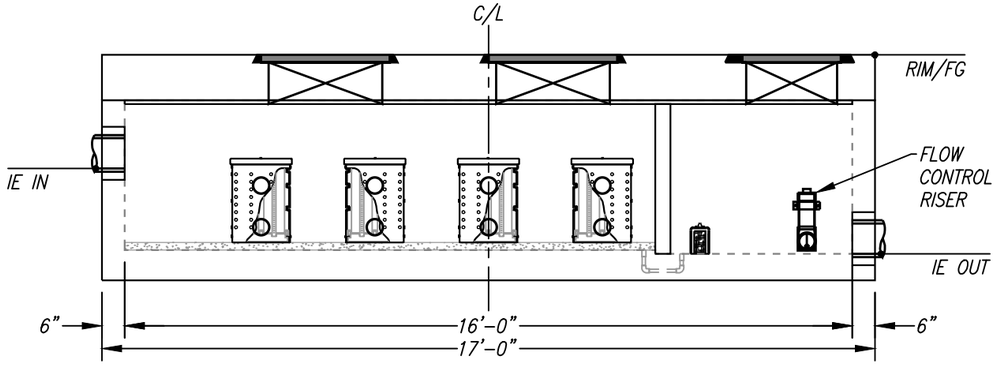
LEFT END VIEW

INSTALLATION NOTES

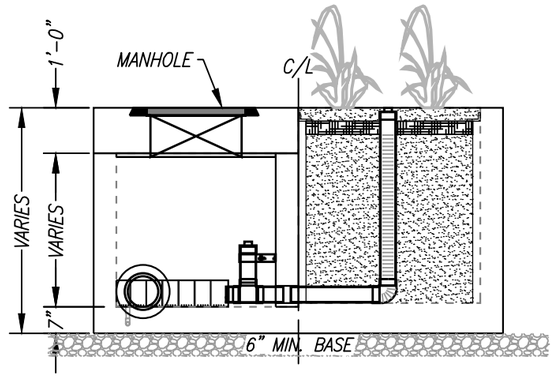
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

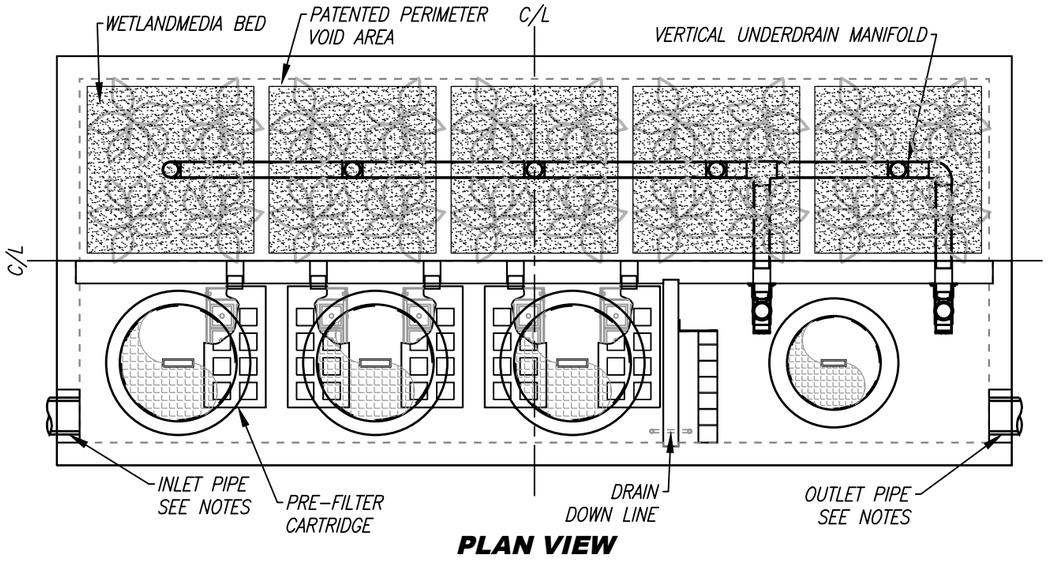
TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-16-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

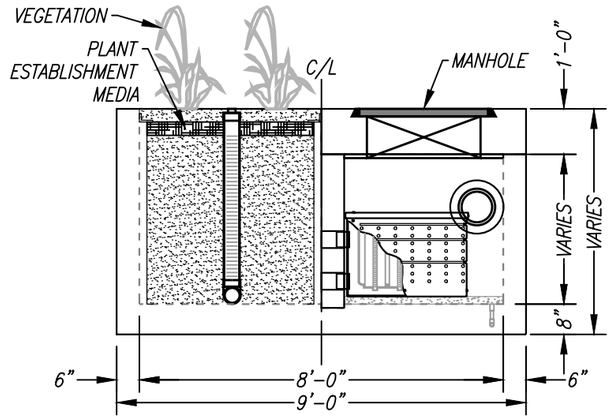
5/23/19 10:LEF

SITE SPECIFIC DATA			
PROJECT NUMBER			
PROJECT NAME			
PROJECT LOCATION			
STRUCTURE ID			
TREATMENT REQUIRED			
VOLUME BASED (CF)		FLOW BASED (CFS)	
N/A		0.577	
PEAK BYPASS REQUIRED (CFS) – IF APPLICABLE			OFFLINE
PIPE DATA	I.E.	MATERIAL	DIAMETER
INLET PIPE 1			
INLET PIPE 2	N/A	N/A	N/A
OUTLET PIPE			
	PRETREATMENT	BIOFILTRATION	DISCHARGE
RIM ELEVATION			
SURFACE LOAD	PEDESTRIAN		
FRAME & COVER	3EA ø30"	OPEN PLANTER	ø24"
NOTES:			

* PRELIMINARY NOT FOR CONSTRUCTION



PLAN VIEW



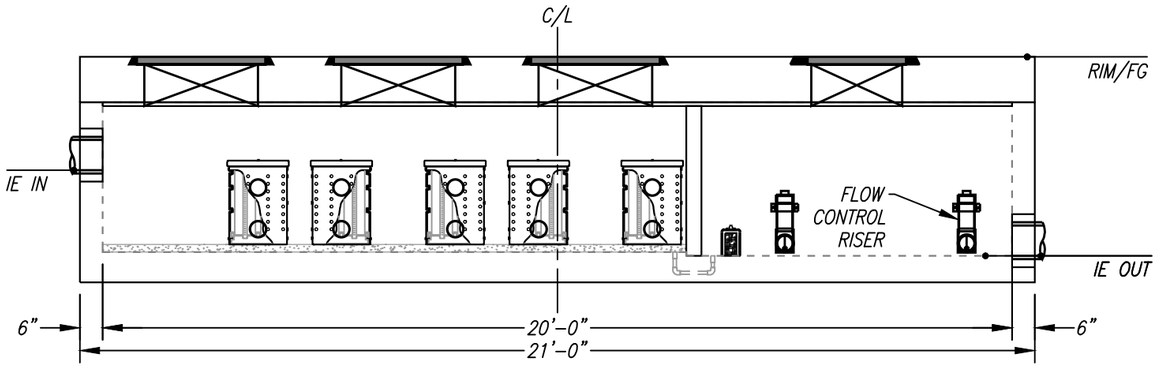
LEFT END VIEW

INSTALLATION NOTES

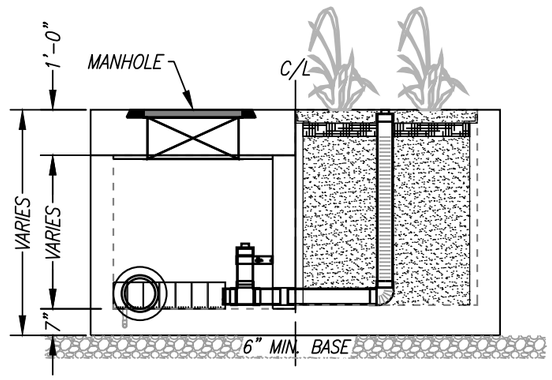
1. CONTRACTOR TO PROVIDE ALL LABOR, EQUIPMENT, MATERIALS AND INCIDENTALS REQUIRED TO OFFLOAD AND INSTALL THE SYSTEM AND APPURTENANCES IN ACCORDANCE WITH THIS DRAWING AND THE MANUFACTURERS SPECIFICATIONS, UNLESS OTHERWISE STATED IN MANUFACTURERS CONTRACT.
2. UNIT MUST BE INSTALLED ON LEVEL BASE. MANUFACTURER RECOMMENDS A MINIMUM 6" LEVEL ROCK BASE UNLESS SPECIFIED BY THE PROJECT ENGINEER. CONTRACTOR IS RESPONSIBLE TO VERIFY PROJECT ENGINEERS RECOMMENDED BASE SPECIFICATIONS.
4. CONTRACTOR TO SUPPLY AND INSTALL ALL EXTERNAL CONNECTING PIPES. ALL PIPES MUST BE FLUSH WITH INSIDE SURFACE OF CONCRETE. (PIPES CANNOT INTRUDE BEYOND FLUSH). INVERT OF OUTFLOW PIPE MUST BE FLUSH WITH DISCHARGE CHAMBER FLOOR. ALL PIPES SHALL BE SEALED WATER TIGHT PER MANUFACTURERS STANDARD CONNECTION DETAIL.
5. CONTRACTOR RESPONSIBLE FOR INSTALLATION OF ALL RISERS, MANHOLES, AND HATCHES. CONTRACTOR TO GROUT ALL MANHOLES AND HATCHES TO MATCH FINISHED SURFACE UNLESS SPECIFIED OTHERWISE.
6. VEGETATION SUPPLIED AND INSTALLED BY OTHERS. ALL UNITS WITH VEGETATION MUST HAVE DRIP OR SPRAY IRRIGATION SUPPLIED AND INSTALLED BY OTHERS.
7. CONTRACTOR RESPONSIBLE FOR CONTACTING BIO CLEAN FOR ACTIVATION OF UNIT. MANUFACTURERS WARRANTY IS VOID WITH OUT PROPER ACTIVATION BY A BIO CLEAN REPRESENTATIVE.

GENERAL NOTES

1. MANUFACTURER TO PROVIDE ALL MATERIALS UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS, ELEVATIONS, SPECIFICATIONS AND CAPACITIES ARE SUBJECT TO CHANGE. FOR PROJECT SPECIFIC DRAWINGS DETAILING EXACT DIMENSIONS, WEIGHTS AND ACCESSORIES PLEASE CONTACT BIO CLEAN.



ELEVATION VIEW



RIGHT END VIEW

TREATMENT FLOW (CFS)	0.577
OPERATING HEAD (FT)	3.4
PRETREATMENT LOADING RATE (GPM/SF)	2.0
WETLAND MEDIA LOADING RATE (GPM/SF)	1.0

MWS-L-8-20-V
STORMWATER BIOFILTRATION SYSTEM STANDARD DETAIL

5/23/19 10:LEE

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Pre-Project Unit Hydrograph Calculations
Area “A” – 2-year, 24-hour Storm Duration

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

Study date 03/26/21 File: ARAEX242.out

++

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

Program License Serial Number 6279

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

English Units used in output format

SADDLEBACK INDUSTRIAL PRE-PROJECT CONDITION HYDROLOGY
UNIT HYDROGRAPH ANALYSIS, 2-YEAR STORM EVENT
FILENAME: ARAEX

Drainage Area = 2.17(Ac.) = 0.003 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 2.17(Ac.) = 0.003 Sq. Mi.
Length along longest watercourse = 574.00(Ft.)
Length along longest watercourse measured to centroid = 326.00(Ft.)
Length along longest watercourse = 0.109 Mi.
Length along longest watercourse measured to centroid = 0.062 Mi.
Difference in elevation = 13.00(Ft.)
Slope along watercourse = 119.5819 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time = 0.043 Hr.
Lag time = 2.60 Min.
25% of lag time = 0.65 Min.
40% of lag time = 1.04 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]
2.17	2.50	5.42

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
2.17	6.50	14.11

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.500(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
2.170	78.76	0.000

Total Area Entered = 2.17(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
78.8	61.5	0.454	0.000	0.454	1.000	0.454
					Sum (F) =	0.454

Area averaged mean soil loss (F) (In/Hr) = 0.454
Minimum soil loss rate ((In/Hr)) = 0.227
(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 (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	192.325	42.043	0.919
2	0.167	384.650	43.907	0.960
3	0.250	576.974	9.114	0.199
4	0.333	769.299	3.606	0.079
5	0.417	961.624	1.330	0.029
			Sum = 100.000	Sum= 2.187

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 (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.804)	0.018	0.002
2	0.17	0.07	0.020	(0.801)	0.018	0.002
3	0.25	0.07	0.020	(0.798)	0.018	0.002
4	0.33	0.10	0.030	(0.795)	0.027	0.003
5	0.42	0.10	0.030	(0.792)	0.027	0.003
6	0.50	0.10	0.030	(0.789)	0.027	0.003
7	0.58	0.10	0.030	(0.786)	0.027	0.003
8	0.67	0.10	0.030	(0.783)	0.027	0.003
9	0.75	0.10	0.030	(0.780)	0.027	0.003
10	0.83	0.13	0.040	(0.776)	0.036	0.004
11	0.92	0.13	0.040	(0.773)	0.036	0.004
12	1.00	0.13	0.040	(0.770)	0.036	0.004
13	1.08	0.10	0.030	(0.767)	0.027	0.003
14	1.17	0.10	0.030	(0.764)	0.027	0.003
15	1.25	0.10	0.030	(0.761)	0.027	0.003
16	1.33	0.10	0.030	(0.758)	0.027	0.003
17	1.42	0.10	0.030	(0.755)	0.027	0.003
18	1.50	0.10	0.030	(0.752)	0.027	0.003
19	1.58	0.10	0.030	(0.749)	0.027	0.003
20	1.67	0.10	0.030	(0.746)	0.027	0.003
21	1.75	0.10	0.030	(0.743)	0.027	0.003
22	1.83	0.13	0.040	(0.740)	0.036	0.004
23	1.92	0.13	0.040	(0.737)	0.036	0.004
24	2.00	0.13	0.040	(0.734)	0.036	0.004
25	2.08	0.13	0.040	(0.731)	0.036	0.004
26	2.17	0.13	0.040	(0.728)	0.036	0.004
27	2.25	0.13	0.040	(0.725)	0.036	0.004
28	2.33	0.13	0.040	(0.722)	0.036	0.004
29	2.42	0.13	0.040	(0.719)	0.036	0.004
30	2.50	0.13	0.040	(0.717)	0.036	0.004
31	2.58	0.17	0.050	(0.714)	0.045	0.005
32	2.67	0.17	0.050	(0.711)	0.045	0.005
33	2.75	0.17	0.050	(0.708)	0.045	0.005
34	2.83	0.17	0.050	(0.705)	0.045	0.005
35	2.92	0.17	0.050	(0.702)	0.045	0.005
36	3.00	0.17	0.050	(0.699)	0.045	0.005
37	3.08	0.17	0.050	(0.696)	0.045	0.005

38	3.17	0.17	0.050	(0.693)	0.045	0.005
39	3.25	0.17	0.050	(0.690)	0.045	0.005
40	3.33	0.17	0.050	(0.687)	0.045	0.005
41	3.42	0.17	0.050	(0.685)	0.045	0.005
42	3.50	0.17	0.050	(0.682)	0.045	0.005
43	3.58	0.17	0.050	(0.679)	0.045	0.005
44	3.67	0.17	0.050	(0.676)	0.045	0.005
45	3.75	0.17	0.050	(0.673)	0.045	0.005
46	3.83	0.20	0.060	(0.670)	0.054	0.006
47	3.92	0.20	0.060	(0.667)	0.054	0.006
48	4.00	0.20	0.060	(0.665)	0.054	0.006
49	4.08	0.20	0.060	(0.662)	0.054	0.006
50	4.17	0.20	0.060	(0.659)	0.054	0.006
51	4.25	0.20	0.060	(0.656)	0.054	0.006
52	4.33	0.23	0.070	(0.653)	0.063	0.007
53	4.42	0.23	0.070	(0.651)	0.063	0.007
54	4.50	0.23	0.070	(0.648)	0.063	0.007
55	4.58	0.23	0.070	(0.645)	0.063	0.007
56	4.67	0.23	0.070	(0.642)	0.063	0.007
57	4.75	0.23	0.070	(0.640)	0.063	0.007
58	4.83	0.27	0.080	(0.637)	0.072	0.008
59	4.92	0.27	0.080	(0.634)	0.072	0.008
60	5.00	0.27	0.080	(0.631)	0.072	0.008
61	5.08	0.20	0.060	(0.629)	0.054	0.006
62	5.17	0.20	0.060	(0.626)	0.054	0.006
63	5.25	0.20	0.060	(0.623)	0.054	0.006
64	5.33	0.23	0.070	(0.620)	0.063	0.007
65	5.42	0.23	0.070	(0.618)	0.063	0.007
66	5.50	0.23	0.070	(0.615)	0.063	0.007
67	5.58	0.27	0.080	(0.612)	0.072	0.008
68	5.67	0.27	0.080	(0.610)	0.072	0.008
69	5.75	0.27	0.080	(0.607)	0.072	0.008
70	5.83	0.27	0.080	(0.604)	0.072	0.008
71	5.92	0.27	0.080	(0.602)	0.072	0.008
72	6.00	0.27	0.080	(0.599)	0.072	0.008
73	6.08	0.30	0.090	(0.596)	0.081	0.009
74	6.17	0.30	0.090	(0.594)	0.081	0.009
75	6.25	0.30	0.090	(0.591)	0.081	0.009
76	6.33	0.30	0.090	(0.588)	0.081	0.009
77	6.42	0.30	0.090	(0.586)	0.081	0.009
78	6.50	0.30	0.090	(0.583)	0.081	0.009
79	6.58	0.33	0.100	(0.580)	0.090	0.010
80	6.67	0.33	0.100	(0.578)	0.090	0.010
81	6.75	0.33	0.100	(0.575)	0.090	0.010
82	6.83	0.33	0.100	(0.573)	0.090	0.010
83	6.92	0.33	0.100	(0.570)	0.090	0.010
84	7.00	0.33	0.100	(0.567)	0.090	0.010
85	7.08	0.33	0.100	(0.565)	0.090	0.010
86	7.17	0.33	0.100	(0.562)	0.090	0.010
87	7.25	0.33	0.100	(0.560)	0.090	0.010
88	7.33	0.37	0.110	(0.557)	0.099	0.011
89	7.42	0.37	0.110	(0.555)	0.099	0.011
90	7.50	0.37	0.110	(0.552)	0.099	0.011
91	7.58	0.40	0.120	(0.549)	0.108	0.012
92	7.67	0.40	0.120	(0.547)	0.108	0.012
93	7.75	0.40	0.120	(0.544)	0.108	0.012
94	7.83	0.43	0.130	(0.542)	0.117	0.013
95	7.92	0.43	0.130	(0.539)	0.117	0.013
96	8.00	0.43	0.130	(0.537)	0.117	0.013
97	8.08	0.50	0.150	(0.534)	0.135	0.015
98	8.17	0.50	0.150	(0.532)	0.135	0.015
99	8.25	0.50	0.150	(0.529)	0.135	0.015
100	8.33	0.50	0.150	(0.527)	0.135	0.015
101	8.42	0.50	0.150	(0.525)	0.135	0.015
102	8.50	0.50	0.150	(0.522)	0.135	0.015
103	8.58	0.53	0.160	(0.520)	0.144	0.016
104	8.67	0.53	0.160	(0.517)	0.144	0.016
105	8.75	0.53	0.160	(0.515)	0.144	0.016
106	8.83	0.57	0.170	(0.512)	0.153	0.017
107	8.92	0.57	0.170	(0.510)	0.153	0.017
108	9.00	0.57	0.170	(0.507)	0.153	0.017

109	9.08	0.63	0.190	(0.505)	0.171	0.019
110	9.17	0.63	0.190	(0.503)	0.171	0.019
111	9.25	0.63	0.190	(0.500)	0.171	0.019
112	9.33	0.67	0.200	(0.498)	0.180	0.020
113	9.42	0.67	0.200	(0.496)	0.180	0.020
114	9.50	0.67	0.200	(0.493)	0.180	0.020
115	9.58	0.70	0.210	(0.491)	0.189	0.021
116	9.67	0.70	0.210	(0.488)	0.189	0.021
117	9.75	0.70	0.210	(0.486)	0.189	0.021
118	9.83	0.73	0.220	(0.484)	0.198	0.022
119	9.92	0.73	0.220	(0.481)	0.198	0.022
120	10.00	0.73	0.220	(0.479)	0.198	0.022
121	10.08	0.50	0.150	(0.477)	0.135	0.015
122	10.17	0.50	0.150	(0.474)	0.135	0.015
123	10.25	0.50	0.150	(0.472)	0.135	0.015
124	10.33	0.50	0.150	(0.470)	0.135	0.015
125	10.42	0.50	0.150	(0.468)	0.135	0.015
126	10.50	0.50	0.150	(0.465)	0.135	0.015
127	10.58	0.67	0.200	(0.463)	0.180	0.020
128	10.67	0.67	0.200	(0.461)	0.180	0.020
129	10.75	0.67	0.200	(0.459)	0.180	0.020
130	10.83	0.67	0.200	(0.456)	0.180	0.020
131	10.92	0.67	0.200	(0.454)	0.180	0.020
132	11.00	0.67	0.200	(0.452)	0.180	0.020
133	11.08	0.63	0.190	(0.450)	0.171	0.019
134	11.17	0.63	0.190	(0.447)	0.171	0.019
135	11.25	0.63	0.190	(0.445)	0.171	0.019
136	11.33	0.63	0.190	(0.443)	0.171	0.019
137	11.42	0.63	0.190	(0.441)	0.171	0.019
138	11.50	0.63	0.190	(0.439)	0.171	0.019
139	11.58	0.57	0.170	(0.436)	0.153	0.017
140	11.67	0.57	0.170	(0.434)	0.153	0.017
141	11.75	0.57	0.170	(0.432)	0.153	0.017
142	11.83	0.60	0.180	(0.430)	0.162	0.018
143	11.92	0.60	0.180	(0.428)	0.162	0.018
144	12.00	0.60	0.180	(0.426)	0.162	0.018
145	12.08	0.83	0.250	(0.423)	0.225	0.025
146	12.17	0.83	0.250	(0.421)	0.225	0.025
147	12.25	0.83	0.250	(0.419)	0.225	0.025
148	12.33	0.87	0.260	(0.417)	0.234	0.026
149	12.42	0.87	0.260	(0.415)	0.234	0.026
150	12.50	0.87	0.260	(0.413)	0.234	0.026
151	12.58	0.93	0.280	(0.411)	0.252	0.028
152	12.67	0.93	0.280	(0.409)	0.252	0.028
153	12.75	0.93	0.280	(0.407)	0.252	0.028
154	12.83	0.97	0.290	(0.405)	0.261	0.029
155	12.92	0.97	0.290	(0.403)	0.261	0.029
156	13.00	0.97	0.290	(0.401)	0.261	0.029
157	13.08	1.13	0.340	(0.399)	0.306	0.034
158	13.17	1.13	0.340	(0.397)	0.306	0.034
159	13.25	1.13	0.340	(0.395)	0.306	0.034
160	13.33	1.13	0.340	(0.393)	0.306	0.034
161	13.42	1.13	0.340	(0.391)	0.306	0.034
162	13.50	1.13	0.340	(0.389)	0.306	0.034
163	13.58	0.77	0.230	(0.387)	0.207	0.023
164	13.67	0.77	0.230	(0.385)	0.207	0.023
165	13.75	0.77	0.230	(0.383)	0.207	0.023
166	13.83	0.77	0.230	(0.381)	0.207	0.023
167	13.92	0.77	0.230	(0.379)	0.207	0.023
168	14.00	0.77	0.230	(0.377)	0.207	0.023
169	14.08	0.90	0.270	(0.375)	0.243	0.027
170	14.17	0.90	0.270	(0.373)	0.243	0.027
171	14.25	0.90	0.270	(0.371)	0.243	0.027
172	14.33	0.87	0.260	(0.369)	0.234	0.026
173	14.42	0.87	0.260	(0.367)	0.234	0.026
174	14.50	0.87	0.260	(0.365)	0.234	0.026
175	14.58	0.87	0.260	(0.364)	0.234	0.026
176	14.67	0.87	0.260	(0.362)	0.234	0.026
177	14.75	0.87	0.260	(0.360)	0.234	0.026
178	14.83	0.83	0.250	(0.358)	0.225	0.025
179	14.92	0.83	0.250	(0.356)	0.225	0.025

180	15.00	0.83	0.250	(0.354)	0.225	0.025
181	15.08	0.80	0.240	(0.353)	0.216	0.024
182	15.17	0.80	0.240	(0.351)	0.216	0.024
183	15.25	0.80	0.240	(0.349)	0.216	0.024
184	15.33	0.77	0.230	(0.347)	0.207	0.023
185	15.42	0.77	0.230	(0.345)	0.207	0.023
186	15.50	0.77	0.230	(0.344)	0.207	0.023
187	15.58	0.63	0.190	(0.342)	0.171	0.019
188	15.67	0.63	0.190	(0.340)	0.171	0.019
189	15.75	0.63	0.190	(0.338)	0.171	0.019
190	15.83	0.63	0.190	(0.337)	0.171	0.019
191	15.92	0.63	0.190	(0.335)	0.171	0.019
192	16.00	0.63	0.190	(0.333)	0.171	0.019
193	16.08	0.13	0.040	(0.331)	0.036	0.004
194	16.17	0.13	0.040	(0.330)	0.036	0.004
195	16.25	0.13	0.040	(0.328)	0.036	0.004
196	16.33	0.13	0.040	(0.326)	0.036	0.004
197	16.42	0.13	0.040	(0.325)	0.036	0.004
198	16.50	0.13	0.040	(0.323)	0.036	0.004
199	16.58	0.10	0.030	(0.321)	0.027	0.003
200	16.67	0.10	0.030	(0.320)	0.027	0.003
201	16.75	0.10	0.030	(0.318)	0.027	0.003
202	16.83	0.10	0.030	(0.317)	0.027	0.003
203	16.92	0.10	0.030	(0.315)	0.027	0.003
204	17.00	0.10	0.030	(0.313)	0.027	0.003
205	17.08	0.17	0.050	(0.312)	0.045	0.005
206	17.17	0.17	0.050	(0.310)	0.045	0.005
207	17.25	0.17	0.050	(0.309)	0.045	0.005
208	17.33	0.17	0.050	(0.307)	0.045	0.005
209	17.42	0.17	0.050	(0.306)	0.045	0.005
210	17.50	0.17	0.050	(0.304)	0.045	0.005
211	17.58	0.17	0.050	(0.303)	0.045	0.005
212	17.67	0.17	0.050	(0.301)	0.045	0.005
213	17.75	0.17	0.050	(0.300)	0.045	0.005
214	17.83	0.13	0.040	(0.298)	0.036	0.004
215	17.92	0.13	0.040	(0.297)	0.036	0.004
216	18.00	0.13	0.040	(0.295)	0.036	0.004
217	18.08	0.13	0.040	(0.294)	0.036	0.004
218	18.17	0.13	0.040	(0.292)	0.036	0.004
219	18.25	0.13	0.040	(0.291)	0.036	0.004
220	18.33	0.13	0.040	(0.289)	0.036	0.004
221	18.42	0.13	0.040	(0.288)	0.036	0.004
222	18.50	0.13	0.040	(0.287)	0.036	0.004
223	18.58	0.10	0.030	(0.285)	0.027	0.003
224	18.67	0.10	0.030	(0.284)	0.027	0.003
225	18.75	0.10	0.030	(0.282)	0.027	0.003
226	18.83	0.07	0.020	(0.281)	0.018	0.002
227	18.92	0.07	0.020	(0.280)	0.018	0.002
228	19.00	0.07	0.020	(0.278)	0.018	0.002
229	19.08	0.10	0.030	(0.277)	0.027	0.003
230	19.17	0.10	0.030	(0.276)	0.027	0.003
231	19.25	0.10	0.030	(0.274)	0.027	0.003
232	19.33	0.13	0.040	(0.273)	0.036	0.004
233	19.42	0.13	0.040	(0.272)	0.036	0.004
234	19.50	0.13	0.040	(0.271)	0.036	0.004
235	19.58	0.10	0.030	(0.269)	0.027	0.003
236	19.67	0.10	0.030	(0.268)	0.027	0.003
237	19.75	0.10	0.030	(0.267)	0.027	0.003
238	19.83	0.07	0.020	(0.266)	0.018	0.002
239	19.92	0.07	0.020	(0.265)	0.018	0.002
240	20.00	0.07	0.020	(0.263)	0.018	0.002
241	20.08	0.10	0.030	(0.262)	0.027	0.003
242	20.17	0.10	0.030	(0.261)	0.027	0.003
243	20.25	0.10	0.030	(0.260)	0.027	0.003
244	20.33	0.10	0.030	(0.259)	0.027	0.003
245	20.42	0.10	0.030	(0.258)	0.027	0.003
246	20.50	0.10	0.030	(0.257)	0.027	0.003
247	20.58	0.10	0.030	(0.256)	0.027	0.003
248	20.67	0.10	0.030	(0.255)	0.027	0.003
249	20.75	0.10	0.030	(0.253)	0.027	0.003
250	20.83	0.07	0.020	(0.252)	0.018	0.002

```
251  20.92     0.07      0.020       (  0.251)       0.018        0.002
252  21.00     0.07      0.020       (  0.250)       0.018        0.002
253  21.08     0.10      0.030       (  0.249)       0.027        0.003
254  21.17     0.10      0.030       (  0.248)       0.027        0.003
255  21.25     0.10      0.030       (  0.247)       0.027        0.003
256  21.33     0.07      0.020       (  0.247)       0.018        0.002
257  21.42     0.07      0.020       (  0.246)       0.018        0.002
258  21.50     0.07      0.020       (  0.245)       0.018        0.002
259  21.58     0.10      0.030       (  0.244)       0.027        0.003
260  21.67     0.10      0.030       (  0.243)       0.027        0.003
261  21.75     0.10      0.030       (  0.242)       0.027        0.003
262  21.83     0.07      0.020       (  0.241)       0.018        0.002
263  21.92     0.07      0.020       (  0.240)       0.018        0.002
264  22.00     0.07      0.020       (  0.240)       0.018        0.002
265  22.08     0.10      0.030       (  0.239)       0.027        0.003
266  22.17     0.10      0.030       (  0.238)       0.027        0.003
267  22.25     0.10      0.030       (  0.237)       0.027        0.003
268  22.33     0.07      0.020       (  0.236)       0.018        0.002
269  22.42     0.07      0.020       (  0.236)       0.018        0.002
270  22.50     0.07      0.020       (  0.235)       0.018        0.002
271  22.58     0.07      0.020       (  0.234)       0.018        0.002
272  22.67     0.07      0.020       (  0.234)       0.018        0.002
273  22.75     0.07      0.020       (  0.233)       0.018        0.002
274  22.83     0.07      0.020       (  0.232)       0.018        0.002
275  22.92     0.07      0.020       (  0.232)       0.018        0.002
276  23.00     0.07      0.020       (  0.231)       0.018        0.002
277  23.08     0.07      0.020       (  0.231)       0.018        0.002
278  23.17     0.07      0.020       (  0.230)       0.018        0.002
279  23.25     0.07      0.020       (  0.230)       0.018        0.002
280  23.33     0.07      0.020       (  0.229)       0.018        0.002
281  23.42     0.07      0.020       (  0.229)       0.018        0.002
282  23.50     0.07      0.020       (  0.228)       0.018        0.002
283  23.58     0.07      0.020       (  0.228)       0.018        0.002
284  23.67     0.07      0.020       (  0.228)       0.018        0.002
285  23.75     0.07      0.020       (  0.227)       0.018        0.002
286  23.83     0.07      0.020       (  0.227)       0.018        0.002
287  23.92     0.07      0.020       (  0.227)       0.018        0.002
288  24.00     0.07      0.020       (  0.227)       0.018        0.002
              (Loss Rate Not Used)
    Sum =     100.0                                  Sum =     3.0
      Flood volume = Effective rainfall      0.25(In)
       times area       2.2(Ac.)/[(In)/(Ft.)] =       0.0(Ac.Ft)
      Total soil loss =      2.25(In)
      Total soil loss =     0.407(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =        1969.3 Cubic Feet
      Total soil loss =       17723.4 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.074(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      0.00  Q         |         |         |         |
   0+10       0.0000      0.00  Q         |         |         |         |
   0+15       0.0001      0.00  Q         |         |         |         |
   0+20       0.0001      0.01  Q         |         |         |         |
   0+25       0.0001      0.01  Q         |         |         |         |
   0+30       0.0002      0.01  Q         |         |         |         |
   0+35       0.0002      0.01  Q         |         |         |         |
   0+40       0.0003      0.01  Q         |         |         |         |
   0+45       0.0003      0.01  Q         |         |         |         |
   0+50       0.0004      0.01  Q         |         |         |         |
   0+55       0.0004      0.01  Q         |         |         |         |
   1+ 0       0.0005      0.01  Q         |         |         |         |
```

1+ 5	0.0005	0.01	Q	|	|	|	|
1+10	0.0006	0.01	Q	|	|	|	|
1+15	0.0006	0.01	Q	|	|	|	|
1+20	0.0007	0.01	Q	|	|	|	|
1+25	0.0007	0.01	Q	|	|	|	|
1+30	0.0008	0.01	Q	|	|	|	|
1+35	0.0008	0.01	Q	|	|	|	|
1+40	0.0009	0.01	Q	|	|	|	|
1+45	0.0009	0.01	Q	|	|	|	|
1+50	0.0010	0.01	Q	|	|	|	|
1+55	0.0010	0.01	Q	|	|	|	|
2+ 0	0.0011	0.01	Q	|	|	|	|
2+ 5	0.0011	0.01	QV	|	|	|	|
2+10	0.0012	0.01	QV	|	|	|	|
2+15	0.0013	0.01	QV	|	|	|	|
2+20	0.0013	0.01	QV	|	|	|	|
2+25	0.0014	0.01	QV	|	|	|	|
2+30	0.0014	0.01	QV	|	|	|	|
2+35	0.0015	0.01	QV	|	|	|	|
2+40	0.0016	0.01	QV	|	|	|	|
2+45	0.0017	0.01	QV	|	|	|	|
2+50	0.0017	0.01	QV	|	|	|	|
2+55	0.0018	0.01	QV	|	|	|	|
3+ 0	0.0019	0.01	QV	|	|	|	|
3+ 5	0.0020	0.01	QV	|	|	|	|
3+10	0.0020	0.01	QV	|	|	|	|
3+15	0.0021	0.01	QV	|	|	|	|
3+20	0.0022	0.01	QV	|	|	|	|
3+25	0.0023	0.01	Q V	|	|	|	|
3+30	0.0023	0.01	Q V	|	|	|	|
3+35	0.0024	0.01	Q V	|	|	|	|
3+40	0.0025	0.01	Q V	|	|	|	|
3+45	0.0026	0.01	Q V	|	|	|	|
3+50	0.0026	0.01	Q V	|	|	|	|
3+55	0.0027	0.01	Q V	|	|	|	|
4+ 0	0.0028	0.01	Q V	|	|	|	|
4+ 5	0.0029	0.01	Q V	|	|	|	|
4+10	0.0030	0.01	Q V	|	|	|	|
4+15	0.0031	0.01	Q V	|	|	|	|
4+20	0.0032	0.01	Q V	|	|	|	|
4+25	0.0033	0.02	Q V	|	|	|	|
4+30	0.0034	0.02	Q V	|	|	|	|
4+35	0.0035	0.02	Q V	|	|	|	|
4+40	0.0036	0.02	Q V	|	|	|	|
4+45	0.0037	0.02	Q V	|	|	|	|
4+50	0.0038	0.02	Q V	|	|	|	|
4+55	0.0039	0.02	Q V	|	|	|	|
5+ 0	0.0041	0.02	Q V	|	|	|	|
5+ 5	0.0042	0.02	Q V	|	|	|	|
5+10	0.0043	0.01	Q V	|	|	|	|
5+15	0.0044	0.01	Q V	|	|	|	|
5+20	0.0045	0.01	Q V	|	|	|	|
5+25	0.0046	0.02	Q V	|	|	|	|
5+30	0.0047	0.02	Q V	|	|	|	|
5+35	0.0048	0.02	Q V	|	|	|	|
5+40	0.0049	0.02	Q V	|	|	|	|
5+45	0.0050	0.02	Q V	|	|	|	|
5+50	0.0051	0.02	Q V	|	|	|	|
5+55	0.0053	0.02	Q V	|	|	|	|
6+ 0	0.0054	0.02	Q V	|	|	|	|
6+ 5	0.0055	0.02	Q V	|	|	|	|
6+10	0.0056	0.02	Q V	|	|	|	|
6+15	0.0058	0.02	Q V	|	|	|	|
6+20	0.0059	0.02	Q V	|	|	|	|
6+25	0.0060	0.02	Q V	|	|	|	|
6+30	0.0062	0.02	Q V	|	|	|	|
6+35	0.0063	0.02	Q V	|	|	|	|
6+40	0.0065	0.02	Q V	|	|	|	|
6+45	0.0066	0.02	Q V	|	|	|	|
6+50	0.0068	0.02	Q V	|	|	|	|
6+55	0.0069	0.02	Q V	|	|	|	|

7+ 0	0.0071	0.02	Q	V	|	|	|	|
7+ 5	0.0072	0.02	Q	V	|	|	|	|
7+10	0.0074	0.02	Q	V	|	|	|	|
7+15	0.0075	0.02	Q	V	|	|	|	|
7+20	0.0077	0.02	Q	V	|	|	|	|
7+25	0.0078	0.02	Q	V	|	|	|	|
7+30	0.0080	0.02	Q	V	|	|	|	|
7+35	0.0082	0.02	Q	V	|	|	|	|
7+40	0.0084	0.03	Q	V	|	|	|	|
7+45	0.0085	0.03	Q	V	|	|	|	|
7+50	0.0087	0.03	Q	V	|	|	|	|
7+55	0.0089	0.03	Q	V	|	|	|	|
8+ 0	0.0091	0.03	Q	V	|	|	|	|
8+ 5	0.0093	0.03	Q	V	|	|	|	|
8+10	0.0095	0.03	Q	V	|	|	|	|
8+15	0.0098	0.03	Q	V	|	|	|	|
8+20	0.0100	0.03	Q	V	|	|	|	|
8+25	0.0102	0.03	Q	V	|	|	|	|
8+30	0.0104	0.03	Q	V	|	|	|	|
8+35	0.0107	0.03	Q	V	|	|	|	|
8+40	0.0109	0.03	Q	V	|	|	|	|
8+45	0.0112	0.03	Q	V	|	|	|	|
8+50	0.0114	0.04	Q	V	|	|	|	|
8+55	0.0117	0.04	Q	V	|	|	|	|
9+ 0	0.0119	0.04	Q	V	|	|	|	|
9+ 5	0.0122	0.04	Q	V	|	|	|	|
9+10	0.0125	0.04	Q	V	|	|	|	|
9+15	0.0128	0.04	Q	V	|	|	|	|
9+20	0.0130	0.04	Q	V	|	|	|	|
9+25	0.0133	0.04	Q	V	|	|	|	|
9+30	0.0136	0.04	Q	V	|	|	|	|
9+35	0.0140	0.04	Q	V	|	|	|	|
9+40	0.0143	0.05	Q	V	|	|	|	|
9+45	0.0146	0.05	Q	V	|	|	|	|
9+50	0.0149	0.05	Q	V	|	|	|	|
9+55	0.0152	0.05	Q	V	|	|	|	|
10+ 0	0.0156	0.05	Q	V	|	|	|	|
10+ 5	0.0159	0.04	Q	V	|	|	|	|
10+10	0.0161	0.03	Q	V	|	|	|	|
10+15	0.0163	0.03	Q	V	|	|	|	|
10+20	0.0166	0.03	Q	V	|	|	|	|
10+25	0.0168	0.03	Q	V	|	|	|	|
10+30	0.0170	0.03	Q	V	|	|	|	|
10+35	0.0173	0.04	Q	V	|	|	|	|
10+40	0.0176	0.04	Q	V	|	|	|	|
10+45	0.0178	0.04	Q	V	|	|	|	|
10+50	0.0181	0.04	Q	V	|	|	|	|
10+55	0.0185	0.04	Q	V	|	|	|	|
11+ 0	0.0188	0.04	Q	V	|	|	|	|
11+ 5	0.0190	0.04	Q	V	|	|	|	|
11+10	0.0193	0.04	Q	V	|	|	|	|
11+15	0.0196	0.04	Q	V	|	|	|	|
11+20	0.0199	0.04	Q	V	|	|	|	|
11+25	0.0202	0.04	Q	V	|	|	|	|
11+30	0.0205	0.04	Q	V	|	|	|	|
11+35	0.0208	0.04	Q	V	|	|	|	|
11+40	0.0210	0.04	Q	V	|	|	|	|
11+45	0.0213	0.04	Q	V	|	|	|	|
11+50	0.0215	0.04	Q	V	|	|	|	|
11+55	0.0218	0.04	Q	V	|	|	|	|
12+ 0	0.0221	0.04	Q	V	|	|	|	|
12+ 5	0.0224	0.05	Q	V	|	|	|	|
12+10	0.0228	0.05	Q	V	|	|	|	|
12+15	0.0231	0.05	Q	V	|	|	|	|
12+20	0.0235	0.06	Q	V	|	|	|	|
12+25	0.0239	0.06	Q	V	|	|	|	|
12+30	0.0243	0.06	Q	V	|	|	|	|
12+35	0.0247	0.06	Q	V	|	|	|	|
12+40	0.0251	0.06	Q	V	|	|	|	|
12+45	0.0255	0.06	Q	V	|	|	|	|
12+50	0.0260	0.06	Q	V	|	|	|	|

12+55	0.0264	0.06	Q			V		
13+ 0	0.0268	0.06	Q			V		
13+ 5	0.0273	0.07	Q			V		
13+10	0.0278	0.07	Q			V		
13+15	0.0283	0.07	Q			V		
13+20	0.0288	0.07	Q			V		
13+25	0.0293	0.07	Q			V		
13+30	0.0298	0.07	Q			V		
13+35	0.0303	0.06	Q			V		
13+40	0.0307	0.05	Q			V		
13+45	0.0310	0.05	Q			V		
13+50	0.0314	0.05	Q			V		
13+55	0.0317	0.05	Q			V		
14+ 0	0.0321	0.05	Q			V		
14+ 5	0.0324	0.05	Q			V		
14+10	0.0328	0.06	Q			V		
14+15	0.0332	0.06	Q			V		
14+20	0.0336	0.06	Q			V		
14+25	0.0340	0.06	Q			V		
14+30	0.0344	0.06	Q			V		
14+35	0.0348	0.06	Q			V		
14+40	0.0352	0.06	Q			V		
14+45	0.0356	0.06	Q			V		
14+50	0.0360	0.06	Q			V		
14+55	0.0364	0.06	Q			V		
15+ 0	0.0367	0.05	Q			V		
15+ 5	0.0371	0.05	Q			V		
15+10	0.0375	0.05	Q			V		
15+15	0.0378	0.05	Q			V		
15+20	0.0382	0.05	Q			V		
15+25	0.0385	0.05	Q			V		
15+30	0.0389	0.05	Q			V		
15+35	0.0392	0.05	Q			V		
15+40	0.0395	0.04	Q			V		
15+45	0.0398	0.04	Q			V		
15+50	0.0401	0.04	Q			V		
15+55	0.0404	0.04	Q			V		
16+ 0	0.0406	0.04	Q			V		
16+ 5	0.0408	0.03	Q			V		
16+10	0.0409	0.01	Q			V		
16+15	0.0410	0.01	Q			V		
16+20	0.0411	0.01	Q			V		
16+25	0.0411	0.01	Q			V		
16+30	0.0412	0.01	Q			V		
16+35	0.0412	0.01	Q			V		
16+40	0.0413	0.01	Q			V		
16+45	0.0413	0.01	Q			V		
16+50	0.0414	0.01	Q			V		
16+55	0.0414	0.01	Q			V		
17+ 0	0.0415	0.01	Q			V		
17+ 5	0.0415	0.01	Q			V		
17+10	0.0416	0.01	Q			V		
17+15	0.0417	0.01	Q			V		
17+20	0.0417	0.01	Q			V		
17+25	0.0418	0.01	Q			V		
17+30	0.0419	0.01	Q			V		
17+35	0.0420	0.01	Q			V		
17+40	0.0420	0.01	Q			V		
17+45	0.0421	0.01	Q			V		
17+50	0.0422	0.01	Q			V		
17+55	0.0423	0.01	Q			V		
18+ 0	0.0423	0.01	Q			V		
18+ 5	0.0424	0.01	Q			V		
18+10	0.0424	0.01	Q			V		
18+15	0.0425	0.01	Q			V		
18+20	0.0426	0.01	Q			V		
18+25	0.0426	0.01	Q			V		
18+30	0.0427	0.01	Q			V		
18+35	0.0427	0.01	Q			V		
18+40	0.0428	0.01	Q			V		
18+45	0.0428	0.01	Q			V		

```
   18+50       0.0429      0.01  Q          |          |          |       V  |
   18+55       0.0429      0.00  Q          |          |          |       V  |
   19+ 0       0.0429      0.00  Q          |          |          |       V  |
   19+ 5       0.0430      0.01  Q          |          |          |        V |
   19+10       0.0430      0.01  Q          |          |          |        V |
   19+15       0.0430      0.01  Q          |          |          |        V |
   19+20       0.0431      0.01  Q          |          |          |        V |
   19+25       0.0432      0.01  Q          |          |          |        V |
   19+30       0.0432      0.01  Q          |          |          |        V |
   19+35       0.0433      0.01  Q          |          |          |        V |
   19+40       0.0433      0.01  Q          |          |          |        V |
   19+45       0.0434      0.01  Q          |          |          |        V |
   19+50       0.0434      0.01  Q          |          |          |        V |
   19+55       0.0434      0.00  Q          |          |          |        V |
   20+ 0       0.0435      0.00  Q          |          |          |        V |
   20+ 5       0.0435      0.01  Q          |          |          |        V |
   20+10       0.0435      0.01  Q          |          |          |        V |
   20+15       0.0436      0.01  Q          |          |          |        V |
   20+20       0.0436      0.01  Q          |          |          |        V |
   20+25       0.0437      0.01  Q          |          |          |        V |
   20+30       0.0437      0.01  Q          |          |          |        V |
   20+35       0.0438      0.01  Q          |          |          |        V |
   20+40       0.0438      0.01  Q          |          |          |        V |
   20+45       0.0439      0.01  Q          |          |          |        V |
   20+50       0.0439      0.01  Q          |          |          |        V |
   20+55       0.0439      0.00  Q          |          |          |        V |
   21+ 0       0.0440      0.00  Q          |          |          |        V |
   21+ 5       0.0440      0.01  Q          |          |          |        V |
   21+10       0.0440      0.01  Q          |          |          |        V |
   21+15       0.0441      0.01  Q          |          |          |         V|
   21+20       0.0441      0.01  Q          |          |          |         V|
   21+25       0.0442      0.00  Q          |          |          |         V|
   21+30       0.0442      0.00  Q          |          |          |         V|
   21+35       0.0442      0.01  Q          |          |          |         V|
   21+40       0.0443      0.01  Q          |          |          |         V|
   21+45       0.0443      0.01  Q          |          |          |         V|
   21+50       0.0444      0.01  Q          |          |          |         V|
   21+55       0.0444      0.00  Q          |          |          |         V|
   22+ 0       0.0444      0.00  Q          |          |          |         V|
   22+ 5       0.0445      0.01  Q          |          |          |         V|
   22+10       0.0445      0.01  Q          |          |          |         V|
   22+15       0.0445      0.01  Q          |          |          |         V|
   22+20       0.0446      0.01  Q          |          |          |         V|
   22+25       0.0446      0.00  Q          |          |          |         V|
   22+30       0.0446      0.00  Q          |          |          |         V|
   22+35       0.0447      0.00  Q          |          |          |         V|
   22+40       0.0447      0.00  Q          |          |          |         V|
   22+45       0.0447      0.00  Q          |          |          |         V|
   22+50       0.0448      0.00  Q          |          |          |         V|
   22+55       0.0448      0.00  Q          |          |          |         V|
   23+ 0       0.0448      0.00  Q          |          |          |         V|
   23+ 5       0.0449      0.00  Q          |          |          |         V|
   23+10       0.0449      0.00  Q          |          |          |         V|
   23+15       0.0449      0.00  Q          |          |          |         V|
   23+20       0.0449      0.00  Q          |          |          |         V|
   23+25       0.0450      0.00  Q          |          |          |         V|
   23+30       0.0450      0.00  Q          |          |          |         V|
   23+35       0.0450      0.00  Q          |          |          |         V|
   23+40       0.0451      0.00  Q          |          |          |         V|
   23+45       0.0451      0.00  Q          |          |          |         V|
   23+50       0.0451      0.00  Q          |          |          |         V|
   23+55       0.0452      0.00  Q          |          |          |         V|
   24+ 0       0.0452      0.00  Q          |          |          |         V|
   24+ 5       0.0452      0.00  Q          |          |          |         V|
   24+10       0.0452      0.00  Q          |          |          |         V|
   24+15       0.0452      0.00  Q          |          |          |         V|
   24+20       0.0452      0.00  Q          |          |          |         V|
-------------------------------------------------------------------------
```

Pre-Project Unit Hydrograph Calculations
Area “B” – 2-year, 24-hour Storm Duration

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

Study date 03/26/21 File: ARBEX242.out

++

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

Program License Serial Number 6279

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

English Units used in output format

SADDLEBACK INDUSTRIAL PRE-PROJECT CONDITION HYDROLOGY
UNIT HYDROGRAPH ANALYSIS, 2-YEAR STORM EVENT
FILENAME: ARBEX

Drainage Area = 3.21(Ac.) = 0.005 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 3.21(Ac.) = 0.005 Sq. Mi.
Length along longest watercourse = 468.00(Ft.)
Length along longest watercourse measured to centroid = 197.00(Ft.)
Length along longest watercourse = 0.089 Mi.
Length along longest watercourse measured to centroid = 0.037 Mi.
Difference in elevation = 11.20(Ft.)
Slope along watercourse = 126.3590 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time = 0.033 Hr.
Lag time = 1.97 Min.
25% of lag time = 0.49 Min.
40% of lag time = 0.79 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]
3.21	2.50	8.03

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
3.21	6.50	20.86

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.500(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
3.210	76.53	0.000

Total Area Entered = 3.21(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
76.5	58.8	0.482	0.000	0.482	1.000	0.482
					Sum (F) =	0.482

Area averaged mean soil loss (F) (In/Hr) = 0.482
Minimum soil loss rate ((In/Hr)) = 0.241
(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 (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	254.333	51.455	1.665
2	0.167	508.666	39.787	1.287
3	0.250	762.999	6.880	0.223
4	0.333	1017.332	1.878	0.061
			Sum = 100.000 Sum=	3.235

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 (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.854)	0.018	0.002
2	0.17	0.07	0.020	(0.851)	0.018	0.002
3	0.25	0.07	0.020	(0.848)	0.018	0.002
4	0.33	0.10	0.030	(0.844)	0.027	0.003
5	0.42	0.10	0.030	(0.841)	0.027	0.003
6	0.50	0.10	0.030	(0.838)	0.027	0.003
7	0.58	0.10	0.030	(0.835)	0.027	0.003
8	0.67	0.10	0.030	(0.831)	0.027	0.003
9	0.75	0.10	0.030	(0.828)	0.027	0.003
10	0.83	0.13	0.040	(0.825)	0.036	0.004
11	0.92	0.13	0.040	(0.821)	0.036	0.004
12	1.00	0.13	0.040	(0.818)	0.036	0.004
13	1.08	0.10	0.030	(0.815)	0.027	0.003
14	1.17	0.10	0.030	(0.812)	0.027	0.003
15	1.25	0.10	0.030	(0.809)	0.027	0.003
16	1.33	0.10	0.030	(0.805)	0.027	0.003
17	1.42	0.10	0.030	(0.802)	0.027	0.003
18	1.50	0.10	0.030	(0.799)	0.027	0.003
19	1.58	0.10	0.030	(0.796)	0.027	0.003
20	1.67	0.10	0.030	(0.793)	0.027	0.003
21	1.75	0.10	0.030	(0.789)	0.027	0.003
22	1.83	0.13	0.040	(0.786)	0.036	0.004
23	1.92	0.13	0.040	(0.783)	0.036	0.004
24	2.00	0.13	0.040	(0.780)	0.036	0.004
25	2.08	0.13	0.040	(0.777)	0.036	0.004
26	2.17	0.13	0.040	(0.774)	0.036	0.004
27	2.25	0.13	0.040	(0.770)	0.036	0.004
28	2.33	0.13	0.040	(0.767)	0.036	0.004
29	2.42	0.13	0.040	(0.764)	0.036	0.004
30	2.50	0.13	0.040	(0.761)	0.036	0.004
31	2.58	0.17	0.050	(0.758)	0.045	0.005
32	2.67	0.17	0.050	(0.755)	0.045	0.005
33	2.75	0.17	0.050	(0.752)	0.045	0.005
34	2.83	0.17	0.050	(0.749)	0.045	0.005
35	2.92	0.17	0.050	(0.746)	0.045	0.005
36	3.00	0.17	0.050	(0.742)	0.045	0.005
37	3.08	0.17	0.050	(0.739)	0.045	0.005
38	3.17	0.17	0.050	(0.736)	0.045	0.005

39	3.25	0.17	0.050	(0.733)	0.045	0.005
40	3.33	0.17	0.050	(0.730)	0.045	0.005
41	3.42	0.17	0.050	(0.727)	0.045	0.005
42	3.50	0.17	0.050	(0.724)	0.045	0.005
43	3.58	0.17	0.050	(0.721)	0.045	0.005
44	3.67	0.17	0.050	(0.718)	0.045	0.005
45	3.75	0.17	0.050	(0.715)	0.045	0.005
46	3.83	0.20	0.060	(0.712)	0.054	0.006
47	3.92	0.20	0.060	(0.709)	0.054	0.006
48	4.00	0.20	0.060	(0.706)	0.054	0.006
49	4.08	0.20	0.060	(0.703)	0.054	0.006
50	4.17	0.20	0.060	(0.700)	0.054	0.006
51	4.25	0.20	0.060	(0.697)	0.054	0.006
52	4.33	0.23	0.070	(0.694)	0.063	0.007
53	4.42	0.23	0.070	(0.691)	0.063	0.007
54	4.50	0.23	0.070	(0.688)	0.063	0.007
55	4.58	0.23	0.070	(0.685)	0.063	0.007
56	4.67	0.23	0.070	(0.682)	0.063	0.007
57	4.75	0.23	0.070	(0.679)	0.063	0.007
58	4.83	0.27	0.080	(0.676)	0.072	0.008
59	4.92	0.27	0.080	(0.673)	0.072	0.008
60	5.00	0.27	0.080	(0.671)	0.072	0.008
61	5.08	0.20	0.060	(0.668)	0.054	0.006
62	5.17	0.20	0.060	(0.665)	0.054	0.006
63	5.25	0.20	0.060	(0.662)	0.054	0.006
64	5.33	0.23	0.070	(0.659)	0.063	0.007
65	5.42	0.23	0.070	(0.656)	0.063	0.007
66	5.50	0.23	0.070	(0.653)	0.063	0.007
67	5.58	0.27	0.080	(0.650)	0.072	0.008
68	5.67	0.27	0.080	(0.647)	0.072	0.008
69	5.75	0.27	0.080	(0.645)	0.072	0.008
70	5.83	0.27	0.080	(0.642)	0.072	0.008
71	5.92	0.27	0.080	(0.639)	0.072	0.008
72	6.00	0.27	0.080	(0.636)	0.072	0.008
73	6.08	0.30	0.090	(0.633)	0.081	0.009
74	6.17	0.30	0.090	(0.630)	0.081	0.009
75	6.25	0.30	0.090	(0.628)	0.081	0.009
76	6.33	0.30	0.090	(0.625)	0.081	0.009
77	6.42	0.30	0.090	(0.622)	0.081	0.009
78	6.50	0.30	0.090	(0.619)	0.081	0.009
79	6.58	0.33	0.100	(0.616)	0.090	0.010
80	6.67	0.33	0.100	(0.614)	0.090	0.010
81	6.75	0.33	0.100	(0.611)	0.090	0.010
82	6.83	0.33	0.100	(0.608)	0.090	0.010
83	6.92	0.33	0.100	(0.605)	0.090	0.010
84	7.00	0.33	0.100	(0.603)	0.090	0.010
85	7.08	0.33	0.100	(0.600)	0.090	0.010
86	7.17	0.33	0.100	(0.597)	0.090	0.010
87	7.25	0.33	0.100	(0.594)	0.090	0.010
88	7.33	0.37	0.110	(0.592)	0.099	0.011
89	7.42	0.37	0.110	(0.589)	0.099	0.011
90	7.50	0.37	0.110	(0.586)	0.099	0.011
91	7.58	0.40	0.120	(0.584)	0.108	0.012
92	7.67	0.40	0.120	(0.581)	0.108	0.012
93	7.75	0.40	0.120	(0.578)	0.108	0.012
94	7.83	0.43	0.130	(0.576)	0.117	0.013
95	7.92	0.43	0.130	(0.573)	0.117	0.013
96	8.00	0.43	0.130	(0.570)	0.117	0.013
97	8.08	0.50	0.150	(0.568)	0.135	0.015
98	8.17	0.50	0.150	(0.565)	0.135	0.015
99	8.25	0.50	0.150	(0.562)	0.135	0.015
100	8.33	0.50	0.150	(0.560)	0.135	0.015
101	8.42	0.50	0.150	(0.557)	0.135	0.015
102	8.50	0.50	0.150	(0.555)	0.135	0.015
103	8.58	0.53	0.160	(0.552)	0.144	0.016
104	8.67	0.53	0.160	(0.549)	0.144	0.016
105	8.75	0.53	0.160	(0.547)	0.144	0.016
106	8.83	0.57	0.170	(0.544)	0.153	0.017
107	8.92	0.57	0.170	(0.542)	0.153	0.017
108	9.00	0.57	0.170	(0.539)	0.153	0.017
109	9.08	0.63	0.190	(0.536)	0.171	0.019

110	9.17	0.63	0.190	(0.534)	0.171	0.019
111	9.25	0.63	0.190	(0.531)	0.171	0.019
112	9.33	0.67	0.200	(0.529)	0.180	0.020
113	9.42	0.67	0.200	(0.526)	0.180	0.020
114	9.50	0.67	0.200	(0.524)	0.180	0.020
115	9.58	0.70	0.210	(0.521)	0.189	0.021
116	9.67	0.70	0.210	(0.519)	0.189	0.021
117	9.75	0.70	0.210	(0.516)	0.189	0.021
118	9.83	0.73	0.220	(0.514)	0.198	0.022
119	9.92	0.73	0.220	(0.511)	0.198	0.022
120	10.00	0.73	0.220	(0.509)	0.198	0.022
121	10.08	0.50	0.150	(0.506)	0.135	0.015
122	10.17	0.50	0.150	(0.504)	0.135	0.015
123	10.25	0.50	0.150	(0.502)	0.135	0.015
124	10.33	0.50	0.150	(0.499)	0.135	0.015
125	10.42	0.50	0.150	(0.497)	0.135	0.015
126	10.50	0.50	0.150	(0.494)	0.135	0.015
127	10.58	0.67	0.200	(0.492)	0.180	0.020
128	10.67	0.67	0.200	(0.489)	0.180	0.020
129	10.75	0.67	0.200	(0.487)	0.180	0.020
130	10.83	0.67	0.200	(0.485)	0.180	0.020
131	10.92	0.67	0.200	(0.482)	0.180	0.020
132	11.00	0.67	0.200	(0.480)	0.180	0.020
133	11.08	0.63	0.190	(0.478)	0.171	0.019
134	11.17	0.63	0.190	(0.475)	0.171	0.019
135	11.25	0.63	0.190	(0.473)	0.171	0.019
136	11.33	0.63	0.190	(0.470)	0.171	0.019
137	11.42	0.63	0.190	(0.468)	0.171	0.019
138	11.50	0.63	0.190	(0.466)	0.171	0.019
139	11.58	0.57	0.170	(0.464)	0.153	0.017
140	11.67	0.57	0.170	(0.461)	0.153	0.017
141	11.75	0.57	0.170	(0.459)	0.153	0.017
142	11.83	0.60	0.180	(0.457)	0.162	0.018
143	11.92	0.60	0.180	(0.454)	0.162	0.018
144	12.00	0.60	0.180	(0.452)	0.162	0.018
145	12.08	0.83	0.250	(0.450)	0.225	0.025
146	12.17	0.83	0.250	(0.448)	0.225	0.025
147	12.25	0.83	0.250	(0.445)	0.225	0.025
148	12.33	0.87	0.260	(0.443)	0.234	0.026
149	12.42	0.87	0.260	(0.441)	0.234	0.026
150	12.50	0.87	0.260	(0.439)	0.234	0.026
151	12.58	0.93	0.280	(0.436)	0.252	0.028
152	12.67	0.93	0.280	(0.434)	0.252	0.028
153	12.75	0.93	0.280	(0.432)	0.252	0.028
154	12.83	0.97	0.290	(0.430)	0.261	0.029
155	12.92	0.97	0.290	(0.428)	0.261	0.029
156	13.00	0.97	0.290	(0.426)	0.261	0.029
157	13.08	1.13	0.340	(0.423)	0.306	0.034
158	13.17	1.13	0.340	(0.421)	0.306	0.034
159	13.25	1.13	0.340	(0.419)	0.306	0.034
160	13.33	1.13	0.340	(0.417)	0.306	0.034
161	13.42	1.13	0.340	(0.415)	0.306	0.034
162	13.50	1.13	0.340	(0.413)	0.306	0.034
163	13.58	0.77	0.230	(0.411)	0.207	0.023
164	13.67	0.77	0.230	(0.409)	0.207	0.023
165	13.75	0.77	0.230	(0.406)	0.207	0.023
166	13.83	0.77	0.230	(0.404)	0.207	0.023
167	13.92	0.77	0.230	(0.402)	0.207	0.023
168	14.00	0.77	0.230	(0.400)	0.207	0.023
169	14.08	0.90	0.270	(0.398)	0.243	0.027
170	14.17	0.90	0.270	(0.396)	0.243	0.027
171	14.25	0.90	0.270	(0.394)	0.243	0.027
172	14.33	0.87	0.260	(0.392)	0.234	0.026
173	14.42	0.87	0.260	(0.390)	0.234	0.026
174	14.50	0.87	0.260	(0.388)	0.234	0.026
175	14.58	0.87	0.260	(0.386)	0.234	0.026
176	14.67	0.87	0.260	(0.384)	0.234	0.026
177	14.75	0.87	0.260	(0.382)	0.234	0.026
178	14.83	0.83	0.250	(0.380)	0.225	0.025
179	14.92	0.83	0.250	(0.378)	0.225	0.025
180	15.00	0.83	0.250	(0.376)	0.225	0.025

181	15.08	0.80	0.240	(0.374)	0.216	0.024
182	15.17	0.80	0.240	(0.373)	0.216	0.024
183	15.25	0.80	0.240	(0.371)	0.216	0.024
184	15.33	0.77	0.230	(0.369)	0.207	0.023
185	15.42	0.77	0.230	(0.367)	0.207	0.023
186	15.50	0.77	0.230	(0.365)	0.207	0.023
187	15.58	0.63	0.190	(0.363)	0.171	0.019
188	15.67	0.63	0.190	(0.361)	0.171	0.019
189	15.75	0.63	0.190	(0.359)	0.171	0.019
190	15.83	0.63	0.190	(0.358)	0.171	0.019
191	15.92	0.63	0.190	(0.356)	0.171	0.019
192	16.00	0.63	0.190	(0.354)	0.171	0.019
193	16.08	0.13	0.040	(0.352)	0.036	0.004
194	16.17	0.13	0.040	(0.350)	0.036	0.004
195	16.25	0.13	0.040	(0.348)	0.036	0.004
196	16.33	0.13	0.040	(0.347)	0.036	0.004
197	16.42	0.13	0.040	(0.345)	0.036	0.004
198	16.50	0.13	0.040	(0.343)	0.036	0.004
199	16.58	0.10	0.030	(0.341)	0.027	0.003
200	16.67	0.10	0.030	(0.340)	0.027	0.003
201	16.75	0.10	0.030	(0.338)	0.027	0.003
202	16.83	0.10	0.030	(0.336)	0.027	0.003
203	16.92	0.10	0.030	(0.335)	0.027	0.003
204	17.00	0.10	0.030	(0.333)	0.027	0.003
205	17.08	0.17	0.050	(0.331)	0.045	0.005
206	17.17	0.17	0.050	(0.330)	0.045	0.005
207	17.25	0.17	0.050	(0.328)	0.045	0.005
208	17.33	0.17	0.050	(0.326)	0.045	0.005
209	17.42	0.17	0.050	(0.325)	0.045	0.005
210	17.50	0.17	0.050	(0.323)	0.045	0.005
211	17.58	0.17	0.050	(0.321)	0.045	0.005
212	17.67	0.17	0.050	(0.320)	0.045	0.005
213	17.75	0.17	0.050	(0.318)	0.045	0.005
214	17.83	0.13	0.040	(0.317)	0.036	0.004
215	17.92	0.13	0.040	(0.315)	0.036	0.004
216	18.00	0.13	0.040	(0.313)	0.036	0.004
217	18.08	0.13	0.040	(0.312)	0.036	0.004
218	18.17	0.13	0.040	(0.310)	0.036	0.004
219	18.25	0.13	0.040	(0.309)	0.036	0.004
220	18.33	0.13	0.040	(0.307)	0.036	0.004
221	18.42	0.13	0.040	(0.306)	0.036	0.004
222	18.50	0.13	0.040	(0.304)	0.036	0.004
223	18.58	0.10	0.030	(0.303)	0.027	0.003
224	18.67	0.10	0.030	(0.301)	0.027	0.003
225	18.75	0.10	0.030	(0.300)	0.027	0.003
226	18.83	0.07	0.020	(0.299)	0.018	0.002
227	18.92	0.07	0.020	(0.297)	0.018	0.002
228	19.00	0.07	0.020	(0.296)	0.018	0.002
229	19.08	0.10	0.030	(0.294)	0.027	0.003
230	19.17	0.10	0.030	(0.293)	0.027	0.003
231	19.25	0.10	0.030	(0.292)	0.027	0.003
232	19.33	0.13	0.040	(0.290)	0.036	0.004
233	19.42	0.13	0.040	(0.289)	0.036	0.004
234	19.50	0.13	0.040	(0.288)	0.036	0.004
235	19.58	0.10	0.030	(0.286)	0.027	0.003
236	19.67	0.10	0.030	(0.285)	0.027	0.003
237	19.75	0.10	0.030	(0.284)	0.027	0.003
238	19.83	0.07	0.020	(0.282)	0.018	0.002
239	19.92	0.07	0.020	(0.281)	0.018	0.002
240	20.00	0.07	0.020	(0.280)	0.018	0.002
241	20.08	0.10	0.030	(0.279)	0.027	0.003
242	20.17	0.10	0.030	(0.277)	0.027	0.003
243	20.25	0.10	0.030	(0.276)	0.027	0.003
244	20.33	0.10	0.030	(0.275)	0.027	0.003
245	20.42	0.10	0.030	(0.274)	0.027	0.003
246	20.50	0.10	0.030	(0.273)	0.027	0.003
247	20.58	0.10	0.030	(0.271)	0.027	0.003
248	20.67	0.10	0.030	(0.270)	0.027	0.003
249	20.75	0.10	0.030	(0.269)	0.027	0.003
250	20.83	0.07	0.020	(0.268)	0.018	0.002
251	20.92	0.07	0.020	(0.267)	0.018	0.002

```
252  21.00     0.07      0.020       (  0.266)       0.018        0.002
253  21.08     0.10      0.030       (  0.265)       0.027        0.003
254  21.17     0.10      0.030       (  0.264)       0.027        0.003
255  21.25     0.10      0.030       (  0.263)       0.027        0.003
256  21.33     0.07      0.020       (  0.262)       0.018        0.002
257  21.42     0.07      0.020       (  0.261)       0.018        0.002
258  21.50     0.07      0.020       (  0.260)       0.018        0.002
259  21.58     0.10      0.030       (  0.259)       0.027        0.003
260  21.67     0.10      0.030       (  0.258)       0.027        0.003
261  21.75     0.10      0.030       (  0.257)       0.027        0.003
262  21.83     0.07      0.020       (  0.256)       0.018        0.002
263  21.92     0.07      0.020       (  0.255)       0.018        0.002
264  22.00     0.07      0.020       (  0.254)       0.018        0.002
265  22.08     0.10      0.030       (  0.254)       0.027        0.003
266  22.17     0.10      0.030       (  0.253)       0.027        0.003
267  22.25     0.10      0.030       (  0.252)       0.027        0.003
268  22.33     0.07      0.020       (  0.251)       0.018        0.002
269  22.42     0.07      0.020       (  0.250)       0.018        0.002
270  22.50     0.07      0.020       (  0.250)       0.018        0.002
271  22.58     0.07      0.020       (  0.249)       0.018        0.002
272  22.67     0.07      0.020       (  0.248)       0.018        0.002
273  22.75     0.07      0.020       (  0.248)       0.018        0.002
274  22.83     0.07      0.020       (  0.247)       0.018        0.002
275  22.92     0.07      0.020       (  0.246)       0.018        0.002
276  23.00     0.07      0.020       (  0.246)       0.018        0.002
277  23.08     0.07      0.020       (  0.245)       0.018        0.002
278  23.17     0.07      0.020       (  0.245)       0.018        0.002
279  23.25     0.07      0.020       (  0.244)       0.018        0.002
280  23.33     0.07      0.020       (  0.244)       0.018        0.002
281  23.42     0.07      0.020       (  0.243)       0.018        0.002
282  23.50     0.07      0.020       (  0.243)       0.018        0.002
283  23.58     0.07      0.020       (  0.242)       0.018        0.002
284  23.67     0.07      0.020       (  0.242)       0.018        0.002
285  23.75     0.07      0.020       (  0.242)       0.018        0.002
286  23.83     0.07      0.020       (  0.241)       0.018        0.002
287  23.92     0.07      0.020       (  0.241)       0.018        0.002
288  24.00     0.07      0.020       (  0.241)       0.018        0.002
               (Loss Rate Not Used)
    Sum =     100.0                                    Sum =     3.0
      Flood volume = Effective rainfall      0.25(In)
       times area       3.2(Ac.)/[(In)/(Ft.)] =       0.1(Ac.Ft)
      Total soil loss =      2.25(In)
      Total soil loss =     0.602(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =        2913.1 Cubic Feet
      Total soil loss =       26217.5 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.110(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      0.00  Q         |         |         |         |
   0+10       0.0001      0.01  Q         |         |         |         |
   0+15       0.0001      0.01  Q         |         |         |         |
   0+20       0.0002      0.01  Q         |         |         |         |
   0+25       0.0002      0.01  Q         |         |         |         |
   0+30       0.0003      0.01  Q         |         |         |         |
   0+35       0.0004      0.01  Q         |         |         |         |
   0+40       0.0004      0.01  Q         |         |         |         |
   0+45       0.0005      0.01  Q         |         |         |         |
   0+50       0.0006      0.01  Q         |         |         |         |
   0+55       0.0007      0.01  Q         |         |         |         |
   1+ 0       0.0007      0.01  Q         |         |         |         |
   1+ 5       0.0008      0.01  Q         |         |         |         |
```

1+10	0.0009	0.01	Q	|	|	|	|
1+15	0.0010	0.01	Q	|	|	|	|
1+20	0.0010	0.01	Q	|	|	|	|
1+25	0.0011	0.01	Q	|	|	|	|
1+30	0.0012	0.01	Q	|	|	|	|
1+35	0.0012	0.01	Q	|	|	|	|
1+40	0.0013	0.01	Q	|	|	|	|
1+45	0.0014	0.01	Q	|	|	|	|
1+50	0.0014	0.01	Q	|	|	|	|
1+55	0.0015	0.01	Q	|	|	|	|
2+ 0	0.0016	0.01	Q	|	|	|	|
2+ 5	0.0017	0.01	QV	|	|	|	|
2+10	0.0018	0.01	QV	|	|	|	|
2+15	0.0019	0.01	QV	|	|	|	|
2+20	0.0020	0.01	QV	|	|	|	|
2+25	0.0021	0.01	QV	|	|	|	|
2+30	0.0022	0.01	QV	|	|	|	|
2+35	0.0023	0.01	QV	|	|	|	|
2+40	0.0024	0.02	QV	|	|	|	|
2+45	0.0025	0.02	QV	|	|	|	|
2+50	0.0026	0.02	QV	|	|	|	|
2+55	0.0027	0.02	QV	|	|	|	|
3+ 0	0.0028	0.02	QV	|	|	|	|
3+ 5	0.0029	0.02	QV	|	|	|	|
3+10	0.0030	0.02	QV	|	|	|	|
3+15	0.0031	0.02	QV	|	|	|	|
3+20	0.0033	0.02	QV	|	|	|	|
3+25	0.0034	0.02	Q V	|	|	|	|
3+30	0.0035	0.02	Q V	|	|	|	|
3+35	0.0036	0.02	Q V	|	|	|	|
3+40	0.0037	0.02	Q V	|	|	|	|
3+45	0.0038	0.02	Q V	|	|	|	|
3+50	0.0039	0.02	Q V	|	|	|	|
3+55	0.0041	0.02	Q V	|	|	|	|
4+ 0	0.0042	0.02	Q V	|	|	|	|
4+ 5	0.0043	0.02	Q V	|	|	|	|
4+10	0.0045	0.02	Q V	|	|	|	|
4+15	0.0046	0.02	Q V	|	|	|	|
4+20	0.0047	0.02	Q V	|	|	|	|
4+25	0.0049	0.02	Q V	|	|	|	|
4+30	0.0051	0.02	Q V	|	|	|	|
4+35	0.0052	0.02	Q V	|	|	|	|
4+40	0.0054	0.02	Q V	|	|	|	|
4+45	0.0055	0.02	Q V	|	|	|	|
4+50	0.0057	0.02	Q V	|	|	|	|
4+55	0.0059	0.03	Q V	|	|	|	|
5+ 0	0.0060	0.03	Q V	|	|	|	|
5+ 5	0.0062	0.02	Q V	|	|	|	|
5+10	0.0063	0.02	Q V	|	|	|	|
5+15	0.0065	0.02	Q V	|	|	|	|
5+20	0.0066	0.02	Q V	|	|	|	|
5+25	0.0068	0.02	Q V	|	|	|	|
5+30	0.0069	0.02	Q V	|	|	|	|
5+35	0.0071	0.02	Q V	|	|	|	|
5+40	0.0073	0.03	Q V	|	|	|	|
5+45	0.0075	0.03	Q V	|	|	|	|
5+50	0.0076	0.03	Q V	|	|	|	|
5+55	0.0078	0.03	Q V	|	|	|	|
6+ 0	0.0080	0.03	Q V	|	|	|	|
6+ 5	0.0082	0.03	Q V	|	|	|	|
6+10	0.0084	0.03	Q V	|	|	|	|
6+15	0.0086	0.03	Q V	|	|	|	|
6+20	0.0088	0.03	Q V	|	|	|	|
6+25	0.0090	0.03	Q V	|	|	|	|
6+30	0.0092	0.03	Q V	|	|	|	|
6+35	0.0094	0.03	Q V	|	|	|	|
6+40	0.0096	0.03	Q V	|	|	|	|
6+45	0.0098	0.03	Q V	|	|	|	|
6+50	0.0101	0.03	Q V	|	|	|	|
6+55	0.0103	0.03	Q V	|	|	|	|
7+ 0	0.0105	0.03	Q V	|	|	|	|

7+ 5	0.0107	0.03	Q	V	|	|	|	|
7+10	0.0109	0.03	Q	V	|	|	|	|
7+15	0.0112	0.03	Q	V	|	|	|	|
7+20	0.0114	0.03	Q	V	|	|	|	|
7+25	0.0116	0.04	Q	V	|	|	|	|
7+30	0.0119	0.04	Q	V	|	|	|	|
7+35	0.0121	0.04	Q	V	|	|	|	|
7+40	0.0124	0.04	Q	V	|	|	|	|
7+45	0.0127	0.04	Q	V	|	|	|	|
7+50	0.0130	0.04	Q	V	|	|	|	|
7+55	0.0132	0.04	Q	V	|	|	|	|
8+ 0	0.0135	0.04	Q	V	|	|	|	|
8+ 5	0.0139	0.05	Q	V	|	|	|	|
8+10	0.0142	0.05	Q	V	|	|	|	|
8+15	0.0145	0.05	Q	V	|	|	|	|
8+20	0.0148	0.05	Q	V	|	|	|	|
8+25	0.0152	0.05	Q	V	|	|	|	|
8+30	0.0155	0.05	Q	V	|	|	|	|
8+35	0.0159	0.05	Q	V	|	|	|	|
8+40	0.0162	0.05	Q	V	|	|	|	|
8+45	0.0166	0.05	Q	V	|	|	|	|
8+50	0.0169	0.05	Q	V	|	|	|	|
8+55	0.0173	0.05	Q	V	|	|	|	|
9+ 0	0.0177	0.05	Q	V	|	|	|	|
9+ 5	0.0181	0.06	Q	V	|	|	|	|
9+10	0.0185	0.06	Q	V	|	|	|	|
9+15	0.0189	0.06	Q	V	|	|	|	|
9+20	0.0194	0.06	Q	V	|	|	|	|
9+25	0.0198	0.06	Q	V	|	|	|	|
9+30	0.0203	0.06	Q	V	|	|	|	|
9+35	0.0207	0.07	Q	V	|	|	|	|
9+40	0.0212	0.07	Q	V	|	|	|	|
9+45	0.0217	0.07	Q	V	|	|	|	|
9+50	0.0221	0.07	Q	V	|	|	|	|
9+55	0.0226	0.07	Q	V	|	|	|	|
10+ 0	0.0231	0.07	Q	V	|	|	|	|
10+ 5	0.0235	0.06	Q	V	|	|	|	|
10+10	0.0239	0.05	Q	V	|	|	|	|
10+15	0.0242	0.05	Q	V	|	|	|	|
10+20	0.0245	0.05	Q	V	|	|	|	|
10+25	0.0249	0.05	Q	V	|	|	|	|
10+30	0.0252	0.05	Q	V	|	|	|	|
10+35	0.0256	0.06	Q	V	|	|	|	|
10+40	0.0260	0.06	Q	V	|	|	|	|
10+45	0.0265	0.06	Q	V	|	|	|	|
10+50	0.0269	0.06	Q	V	|	|	|	|
10+55	0.0274	0.06	Q	V	|	|	|	|
11+ 0	0.0278	0.06	Q	V	|	|	|	|
11+ 5	0.0283	0.06	Q	V	|	|	|	|
11+10	0.0287	0.06	Q	V	|	|	|	|
11+15	0.0291	0.06	Q	V	|	|	|	|
11+20	0.0295	0.06	Q	V	|	|	|	|
11+25	0.0300	0.06	Q	V	|	|	|	|
11+30	0.0304	0.06	Q	V	|	|	|	|
11+35	0.0308	0.06	Q	V	|	|	|	|
11+40	0.0312	0.06	Q	V	|	|	|	|
11+45	0.0315	0.06	Q	V	|	|	|	|
11+50	0.0319	0.06	Q	V	|	|	|	|
11+55	0.0323	0.06	Q	V	|	|	|	|
12+ 0	0.0327	0.06	Q	V	|	|	|	|
12+ 5	0.0332	0.07	Q	V	|	|	|	|
12+10	0.0338	0.08	Q	V	|	|	|	|
12+15	0.0343	0.08	Q	V	|	|	|	|
12+20	0.0349	0.08	Q	V	|	|	|	|
12+25	0.0355	0.08	Q	V	|	|	|	|
12+30	0.0360	0.08	Q	V	|	|	|	|
12+35	0.0366	0.09	Q	V	|	|	|	|
12+40	0.0373	0.09	Q	V	|	|	|	|
12+45	0.0379	0.09	Q	V	|	|	|	|
12+50	0.0385	0.09	Q	V	|	|	|	|
12+55	0.0392	0.09	Q	V	|	|	|	|

13+ 0	0.0398	0.09	Q	|	|	V |	|	|
13+ 5	0.0405	0.10	Q	|	|	V |	|	|
13+10	0.0413	0.11	Q	|	|	V |	|	|
13+15	0.0420	0.11	Q	|	|	V |	|	|
13+20	0.0428	0.11	Q	|	|	V |	|	|
13+25	0.0435	0.11	Q	|	|	V |	|	|
13+30	0.0443	0.11	Q	|	|	V |	|	|
13+35	0.0449	0.09	Q	|	|	V |	|	|
13+40	0.0455	0.08	Q	|	|	V |	|	|
13+45	0.0460	0.08	Q	|	|	V |	|	|
13+50	0.0465	0.07	Q	|	|	V |	|	|
13+55	0.0470	0.07	Q	|	|	V |	|	|
14+ 0	0.0475	0.07	Q	|	|	V |	|	|
14+ 5	0.0481	0.08	Q	|	|	V |	|	|
14+10	0.0487	0.09	Q	|	|	V |	|	|
14+15	0.0493	0.09	Q	|	|	V |	|	|
14+20	0.0499	0.09	Q	|	|	V |	|	|
14+25	0.0504	0.08	Q	|	|	V |	|	|
14+30	0.0510	0.08	Q	|	|	V |	|	|
14+35	0.0516	0.08	Q	|	|	V |	|	|
14+40	0.0522	0.08	Q	|	|	|V |	|	|
14+45	0.0528	0.08	Q	|	|	|V |	|	|
14+50	0.0533	0.08	Q	|	|	|V |	|	|
14+55	0.0539	0.08	Q	|	|	| V |	|	|
15+ 0	0.0544	0.08	Q	|	|	| V |	|	|
15+ 5	0.0550	0.08	Q	|	|	| V |	|	|
15+10	0.0555	0.08	Q	|	|	| V |	|	|
15+15	0.0561	0.08	Q	|	|	| V |	|	|
15+20	0.0566	0.08	Q	|	|	| V |	|	|
15+25	0.0571	0.07	Q	|	|	| V |	|	|
15+30	0.0576	0.07	Q	|	|	| V |	|	|
15+35	0.0581	0.07	Q	|	|	| V |	|	|
15+40	0.0585	0.06	Q	|	|	| V |	|	|
15+45	0.0589	0.06	Q	|	|	| V |	|	|
15+50	0.0594	0.06	Q	|	|	| V |	|	|
15+55	0.0598	0.06	Q	|	|	| V |	|	|
16+ 0	0.0602	0.06	Q	|	|	| V |	|	|
16+ 5	0.0605	0.04	Q	|	|	| V |	|	|
16+10	0.0606	0.02	Q	|	|	| V |	|	|
16+15	0.0607	0.01	Q	|	|	| V |	|	|
16+20	0.0608	0.01	Q	|	|	| V |	|	|
16+25	0.0608	0.01	Q	|	|	| V |	|	|
16+30	0.0609	0.01	Q	|	|	| V |	|	|
16+35	0.0610	0.01	Q	|	|	| V |	|	|
16+40	0.0611	0.01	Q	|	|	| V |	|	|
16+45	0.0612	0.01	Q	|	|	| V |	|	|
16+50	0.0612	0.01	Q	|	|	| V |	|	|
16+55	0.0613	0.01	Q	|	|	| V |	|	|
17+ 0	0.0614	0.01	Q	|	|	| V |	|	|
17+ 5	0.0614	0.01	Q	|	|	| V |	|	|
17+10	0.0615	0.02	Q	|	|	| V |	|	|
17+15	0.0617	0.02	Q	|	|	| V |	|	|
17+20	0.0618	0.02	Q	|	|	| V |	|	|
17+25	0.0619	0.02	Q	|	|	| V |	|	|
17+30	0.0620	0.02	Q	|	|	| V |	|	|
17+35	0.0621	0.02	Q	|	|	| V |	|	|
17+40	0.0622	0.02	Q	|	|	| V |	|	|
17+45	0.0623	0.02	Q	|	|	| V |	|	|
17+50	0.0624	0.01	Q	|	|	| V |	|	|
17+55	0.0625	0.01	Q	|	|	| V |	|	|
18+ 0	0.0626	0.01	Q	|	|	| V |	|	|
18+ 5	0.0627	0.01	Q	|	|	| V |	|	|
18+10	0.0628	0.01	Q	|	|	| V |	|	|
18+15	0.0629	0.01	Q	|	|	| V |	|	|
18+20	0.0630	0.01	Q	|	|	| V |	|	|
18+25	0.0631	0.01	Q	|	|	| V |	|	|
18+30	0.0631	0.01	Q	|	|	| V |	|	|
18+35	0.0632	0.01	Q	|	|	| V |	|	|
18+40	0.0633	0.01	Q	|	|	| V |	|	|
18+45	0.0634	0.01	Q	|	|	| V |	|	|
18+50	0.0634	0.01	Q	|	|	| V |	|	|

```
  18+55       0.0635      0.01  Q          |          |          |      V  |
  19+ 0       0.0635      0.01  Q          |          |          |      V  |
  19+ 5       0.0636      0.01  Q          |          |          |       V |
  19+10       0.0636      0.01  Q          |          |          |       V |
  19+15       0.0637      0.01  Q          |          |          |       V |
  19+20       0.0638      0.01  Q          |          |          |       V |
  19+25       0.0639      0.01  Q          |          |          |       V |
  19+30       0.0639      0.01  Q          |          |          |       V |
  19+35       0.0640      0.01  Q          |          |          |       V |
  19+40       0.0641      0.01  Q          |          |          |       V |
  19+45       0.0642      0.01  Q          |          |          |       V |
  19+50       0.0642      0.01  Q          |          |          |       V |
  19+55       0.0643      0.01  Q          |          |          |       V |
  20+ 0       0.0643      0.01  Q          |          |          |       V |
  20+ 5       0.0644      0.01  Q          |          |          |       V |
  20+10       0.0644      0.01  Q          |          |          |       V |
  20+15       0.0645      0.01  Q          |          |          |       V |
  20+20       0.0646      0.01  Q          |          |          |       V |
  20+25       0.0646      0.01  Q          |          |          |       V |
  20+30       0.0647      0.01  Q          |          |          |       V |
  20+35       0.0648      0.01  Q          |          |          |       V |
  20+40       0.0648      0.01  Q          |          |          |       V |
  20+45       0.0649      0.01  Q          |          |          |       V |
  20+50       0.0650      0.01  Q          |          |          |       V |
  20+55       0.0650      0.01  Q          |          |          |       V |
  21+ 0       0.0650      0.01  Q          |          |          |       V |
  21+ 5       0.0651      0.01  Q          |          |          |       V |
  21+10       0.0652      0.01  Q          |          |          |       V |
  21+15       0.0652      0.01  Q          |          |          |        V|
  21+20       0.0653      0.01  Q          |          |          |        V|
  21+25       0.0653      0.01  Q          |          |          |        V|
  21+30       0.0654      0.01  Q          |          |          |        V|
  21+35       0.0654      0.01  Q          |          |          |        V|
  21+40       0.0655      0.01  Q          |          |          |        V|
  21+45       0.0656      0.01  Q          |          |          |        V|
  21+50       0.0656      0.01  Q          |          |          |        V|
  21+55       0.0657      0.01  Q          |          |          |        V|
  22+ 0       0.0657      0.01  Q          |          |          |        V|
  22+ 5       0.0658      0.01  Q          |          |          |        V|
  22+10       0.0658      0.01  Q          |          |          |        V|
  22+15       0.0659      0.01  Q          |          |          |        V|
  22+20       0.0660      0.01  Q          |          |          |        V|
  22+25       0.0660      0.01  Q          |          |          |        V|
  22+30       0.0660      0.01  Q          |          |          |        V|
  22+35       0.0661      0.01  Q          |          |          |        V|
  22+40       0.0661      0.01  Q          |          |          |        V|
  22+45       0.0662      0.01  Q          |          |          |        V|
  22+50       0.0662      0.01  Q          |          |          |        V|
  22+55       0.0663      0.01  Q          |          |          |        V|
  23+ 0       0.0663      0.01  Q          |          |          |        V|
  23+ 5       0.0664      0.01  Q          |          |          |        V|
  23+10       0.0664      0.01  Q          |          |          |        V|
  23+15       0.0664      0.01  Q          |          |          |        V|
  23+20       0.0665      0.01  Q          |          |          |        V|
  23+25       0.0665      0.01  Q          |          |          |        V|
  23+30       0.0666      0.01  Q          |          |          |        V|
  23+35       0.0666      0.01  Q          |          |          |        V|
  23+40       0.0667      0.01  Q          |          |          |        V|
  23+45       0.0667      0.01  Q          |          |          |        V|
  23+50       0.0668      0.01  Q          |          |          |        V|
  23+55       0.0668      0.01  Q          |          |          |        V|
  24+ 0       0.0668      0.01  Q          |          |          |        V|
  24+ 5       0.0669      0.00  Q          |          |          |        V|
  24+10       0.0669      0.00  Q          |          |          |        V|
  24+15       0.0669      0.00  Q          |          |          |         V
-------------------------------------------------------------------------
```

Pre-Project Unit Hydrograph Calculations
Area “C” – 2-year, 24-hour Storm Duration

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

Study date 03/26/21 File: ARCEX242.out

++

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

Program License Serial Number 6279

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

English Units used in output format

SADDLEBACK INDUSTRIAL PRE-PROJECT CONDITION HYDROLOGY
UNIT HYDROGRAPH ANALYSIS, 2-YEAR STORM EVENT
FILENAME: ARCEX

Drainage Area = 1.87(Ac.) = 0.003 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 1.87(Ac.) = 0.003 Sq. Mi.
Length along longest watercourse = 478.00(Ft.)
Length along longest watercourse measured to centroid = 257.00(Ft.)
Length along longest watercourse = 0.091 Mi.
Length along longest watercourse measured to centroid = 0.049 Mi.
Difference in elevation = 6.76(Ft.)
Slope along watercourse = 74.6711 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time = 0.040 Hr.
Lag time = 2.42 Min.
25% of lag time = 0.61 Min.
40% of lag time = 0.97 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]
1.87	2.50	4.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
1.87	6.50	12.16

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.500(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
1.870	76.00	0.000

Total Area Entered = 1.87(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
76.0	58.2	0.488	0.000	0.488	1.000	0.488
					Sum (F) =	0.488

Area averaged mean soil loss (F) (In/Hr) = 0.488
Minimum soil loss rate ((In/Hr)) = 0.244
(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 (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	206.362	44.480	0.838
2	0.167	412.724	42.926	0.809
3	0.250	619.086	8.540	0.161
4	0.333	825.448	4.054	0.076
			Sum = 100.000 Sum=	1.885

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 (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.866)	0.018	0.002
2	0.17	0.07	0.020	(0.862)	0.018	0.002
3	0.25	0.07	0.020	(0.859)	0.018	0.002
4	0.33	0.10	0.030	(0.856)	0.027	0.003
5	0.42	0.10	0.030	(0.852)	0.027	0.003
6	0.50	0.10	0.030	(0.849)	0.027	0.003
7	0.58	0.10	0.030	(0.846)	0.027	0.003
8	0.67	0.10	0.030	(0.842)	0.027	0.003
9	0.75	0.10	0.030	(0.839)	0.027	0.003
10	0.83	0.13	0.040	(0.836)	0.036	0.004
11	0.92	0.13	0.040	(0.833)	0.036	0.004
12	1.00	0.13	0.040	(0.829)	0.036	0.004
13	1.08	0.10	0.030	(0.826)	0.027	0.003
14	1.17	0.10	0.030	(0.823)	0.027	0.003
15	1.25	0.10	0.030	(0.819)	0.027	0.003
16	1.33	0.10	0.030	(0.816)	0.027	0.003
17	1.42	0.10	0.030	(0.813)	0.027	0.003
18	1.50	0.10	0.030	(0.810)	0.027	0.003
19	1.58	0.10	0.030	(0.806)	0.027	0.003
20	1.67	0.10	0.030	(0.803)	0.027	0.003
21	1.75	0.10	0.030	(0.800)	0.027	0.003
22	1.83	0.13	0.040	(0.797)	0.036	0.004
23	1.92	0.13	0.040	(0.794)	0.036	0.004
24	2.00	0.13	0.040	(0.790)	0.036	0.004
25	2.08	0.13	0.040	(0.787)	0.036	0.004
26	2.17	0.13	0.040	(0.784)	0.036	0.004
27	2.25	0.13	0.040	(0.781)	0.036	0.004
28	2.33	0.13	0.040	(0.778)	0.036	0.004
29	2.42	0.13	0.040	(0.774)	0.036	0.004
30	2.50	0.13	0.040	(0.771)	0.036	0.004
31	2.58	0.17	0.050	(0.768)	0.045	0.005
32	2.67	0.17	0.050	(0.765)	0.045	0.005
33	2.75	0.17	0.050	(0.762)	0.045	0.005
34	2.83	0.17	0.050	(0.759)	0.045	0.005
35	2.92	0.17	0.050	(0.756)	0.045	0.005
36	3.00	0.17	0.050	(0.752)	0.045	0.005
37	3.08	0.17	0.050	(0.749)	0.045	0.005
38	3.17	0.17	0.050	(0.746)	0.045	0.005

39	3.25	0.17	0.050	(0.743)	0.045	0.005
40	3.33	0.17	0.050	(0.740)	0.045	0.005
41	3.42	0.17	0.050	(0.737)	0.045	0.005
42	3.50	0.17	0.050	(0.734)	0.045	0.005
43	3.58	0.17	0.050	(0.731)	0.045	0.005
44	3.67	0.17	0.050	(0.728)	0.045	0.005
45	3.75	0.17	0.050	(0.725)	0.045	0.005
46	3.83	0.20	0.060	(0.722)	0.054	0.006
47	3.92	0.20	0.060	(0.719)	0.054	0.006
48	4.00	0.20	0.060	(0.715)	0.054	0.006
49	4.08	0.20	0.060	(0.712)	0.054	0.006
50	4.17	0.20	0.060	(0.709)	0.054	0.006
51	4.25	0.20	0.060	(0.706)	0.054	0.006
52	4.33	0.23	0.070	(0.703)	0.063	0.007
53	4.42	0.23	0.070	(0.700)	0.063	0.007
54	4.50	0.23	0.070	(0.697)	0.063	0.007
55	4.58	0.23	0.070	(0.694)	0.063	0.007
56	4.67	0.23	0.070	(0.691)	0.063	0.007
57	4.75	0.23	0.070	(0.688)	0.063	0.007
58	4.83	0.27	0.080	(0.685)	0.072	0.008
59	4.92	0.27	0.080	(0.683)	0.072	0.008
60	5.00	0.27	0.080	(0.680)	0.072	0.008
61	5.08	0.20	0.060	(0.677)	0.054	0.006
62	5.17	0.20	0.060	(0.674)	0.054	0.006
63	5.25	0.20	0.060	(0.671)	0.054	0.006
64	5.33	0.23	0.070	(0.668)	0.063	0.007
65	5.42	0.23	0.070	(0.665)	0.063	0.007
66	5.50	0.23	0.070	(0.662)	0.063	0.007
67	5.58	0.27	0.080	(0.659)	0.072	0.008
68	5.67	0.27	0.080	(0.656)	0.072	0.008
69	5.75	0.27	0.080	(0.653)	0.072	0.008
70	5.83	0.27	0.080	(0.650)	0.072	0.008
71	5.92	0.27	0.080	(0.647)	0.072	0.008
72	6.00	0.27	0.080	(0.645)	0.072	0.008
73	6.08	0.30	0.090	(0.642)	0.081	0.009
74	6.17	0.30	0.090	(0.639)	0.081	0.009
75	6.25	0.30	0.090	(0.636)	0.081	0.009
76	6.33	0.30	0.090	(0.633)	0.081	0.009
77	6.42	0.30	0.090	(0.630)	0.081	0.009
78	6.50	0.30	0.090	(0.628)	0.081	0.009
79	6.58	0.33	0.100	(0.625)	0.090	0.010
80	6.67	0.33	0.100	(0.622)	0.090	0.010
81	6.75	0.33	0.100	(0.619)	0.090	0.010
82	6.83	0.33	0.100	(0.616)	0.090	0.010
83	6.92	0.33	0.100	(0.614)	0.090	0.010
84	7.00	0.33	0.100	(0.611)	0.090	0.010
85	7.08	0.33	0.100	(0.608)	0.090	0.010
86	7.17	0.33	0.100	(0.605)	0.090	0.010
87	7.25	0.33	0.100	(0.602)	0.090	0.010
88	7.33	0.37	0.110	(0.600)	0.099	0.011
89	7.42	0.37	0.110	(0.597)	0.099	0.011
90	7.50	0.37	0.110	(0.594)	0.099	0.011
91	7.58	0.40	0.120	(0.591)	0.108	0.012
92	7.67	0.40	0.120	(0.589)	0.108	0.012
93	7.75	0.40	0.120	(0.586)	0.108	0.012
94	7.83	0.43	0.130	(0.583)	0.117	0.013
95	7.92	0.43	0.130	(0.581)	0.117	0.013
96	8.00	0.43	0.130	(0.578)	0.117	0.013
97	8.08	0.50	0.150	(0.575)	0.135	0.015
98	8.17	0.50	0.150	(0.573)	0.135	0.015
99	8.25	0.50	0.150	(0.570)	0.135	0.015
100	8.33	0.50	0.150	(0.567)	0.135	0.015
101	8.42	0.50	0.150	(0.565)	0.135	0.015
102	8.50	0.50	0.150	(0.562)	0.135	0.015
103	8.58	0.53	0.160	(0.559)	0.144	0.016
104	8.67	0.53	0.160	(0.557)	0.144	0.016
105	8.75	0.53	0.160	(0.554)	0.144	0.016
106	8.83	0.57	0.170	(0.551)	0.153	0.017
107	8.92	0.57	0.170	(0.549)	0.153	0.017
108	9.00	0.57	0.170	(0.546)	0.153	0.017
109	9.08	0.63	0.190	(0.544)	0.171	0.019

110	9.17	0.63	0.190	(0.541)	0.171	0.019
111	9.25	0.63	0.190	(0.539)	0.171	0.019
112	9.33	0.67	0.200	(0.536)	0.180	0.020
113	9.42	0.67	0.200	(0.533)	0.180	0.020
114	9.50	0.67	0.200	(0.531)	0.180	0.020
115	9.58	0.70	0.210	(0.528)	0.189	0.021
116	9.67	0.70	0.210	(0.526)	0.189	0.021
117	9.75	0.70	0.210	(0.523)	0.189	0.021
118	9.83	0.73	0.220	(0.521)	0.198	0.022
119	9.92	0.73	0.220	(0.518)	0.198	0.022
120	10.00	0.73	0.220	(0.516)	0.198	0.022
121	10.08	0.50	0.150	(0.513)	0.135	0.015
122	10.17	0.50	0.150	(0.511)	0.135	0.015
123	10.25	0.50	0.150	(0.508)	0.135	0.015
124	10.33	0.50	0.150	(0.506)	0.135	0.015
125	10.42	0.50	0.150	(0.503)	0.135	0.015
126	10.50	0.50	0.150	(0.501)	0.135	0.015
127	10.58	0.67	0.200	(0.498)	0.180	0.020
128	10.67	0.67	0.200	(0.496)	0.180	0.020
129	10.75	0.67	0.200	(0.494)	0.180	0.020
130	10.83	0.67	0.200	(0.491)	0.180	0.020
131	10.92	0.67	0.200	(0.489)	0.180	0.020
132	11.00	0.67	0.200	(0.486)	0.180	0.020
133	11.08	0.63	0.190	(0.484)	0.171	0.019
134	11.17	0.63	0.190	(0.482)	0.171	0.019
135	11.25	0.63	0.190	(0.479)	0.171	0.019
136	11.33	0.63	0.190	(0.477)	0.171	0.019
137	11.42	0.63	0.190	(0.474)	0.171	0.019
138	11.50	0.63	0.190	(0.472)	0.171	0.019
139	11.58	0.57	0.170	(0.470)	0.153	0.017
140	11.67	0.57	0.170	(0.467)	0.153	0.017
141	11.75	0.57	0.170	(0.465)	0.153	0.017
142	11.83	0.60	0.180	(0.463)	0.162	0.018
143	11.92	0.60	0.180	(0.460)	0.162	0.018
144	12.00	0.60	0.180	(0.458)	0.162	0.018
145	12.08	0.83	0.250	(0.456)	0.225	0.025
146	12.17	0.83	0.250	(0.454)	0.225	0.025
147	12.25	0.83	0.250	(0.451)	0.225	0.025
148	12.33	0.87	0.260	(0.449)	0.234	0.026
149	12.42	0.87	0.260	(0.447)	0.234	0.026
150	12.50	0.87	0.260	(0.445)	0.234	0.026
151	12.58	0.93	0.280	(0.442)	0.252	0.028
152	12.67	0.93	0.280	(0.440)	0.252	0.028
153	12.75	0.93	0.280	(0.438)	0.252	0.028
154	12.83	0.97	0.290	(0.436)	0.261	0.029
155	12.92	0.97	0.290	(0.433)	0.261	0.029
156	13.00	0.97	0.290	(0.431)	0.261	0.029
157	13.08	1.13	0.340	(0.429)	0.306	0.034
158	13.17	1.13	0.340	(0.427)	0.306	0.034
159	13.25	1.13	0.340	(0.425)	0.306	0.034
160	13.33	1.13	0.340	(0.423)	0.306	0.034
161	13.42	1.13	0.340	(0.420)	0.306	0.034
162	13.50	1.13	0.340	(0.418)	0.306	0.034
163	13.58	0.77	0.230	(0.416)	0.207	0.023
164	13.67	0.77	0.230	(0.414)	0.207	0.023
165	13.75	0.77	0.230	(0.412)	0.207	0.023
166	13.83	0.77	0.230	(0.410)	0.207	0.023
167	13.92	0.77	0.230	(0.408)	0.207	0.023
168	14.00	0.77	0.230	(0.406)	0.207	0.023
169	14.08	0.90	0.270	(0.404)	0.243	0.027
170	14.17	0.90	0.270	(0.402)	0.243	0.027
171	14.25	0.90	0.270	(0.399)	0.243	0.027
172	14.33	0.87	0.260	(0.397)	0.234	0.026
173	14.42	0.87	0.260	(0.395)	0.234	0.026
174	14.50	0.87	0.260	(0.393)	0.234	0.026
175	14.58	0.87	0.260	(0.391)	0.234	0.026
176	14.67	0.87	0.260	(0.389)	0.234	0.026
177	14.75	0.87	0.260	(0.387)	0.234	0.026
178	14.83	0.83	0.250	(0.385)	0.225	0.025
179	14.92	0.83	0.250	(0.383)	0.225	0.025
180	15.00	0.83	0.250	(0.381)	0.225	0.025

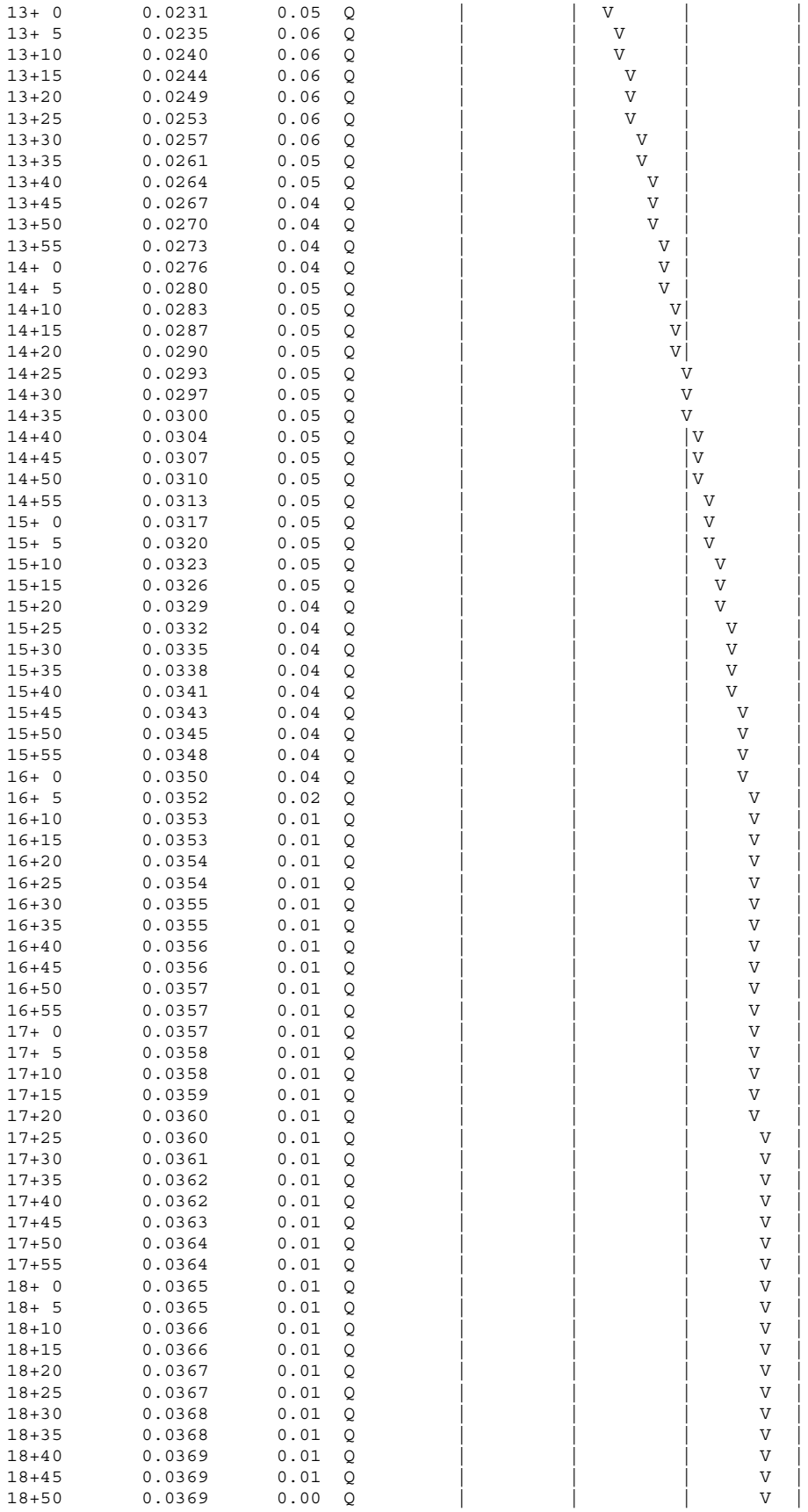
181	15.08	0.80	0.240	(0.379)	0.216	0.024
182	15.17	0.80	0.240	(0.378)	0.216	0.024
183	15.25	0.80	0.240	(0.376)	0.216	0.024
184	15.33	0.77	0.230	(0.374)	0.207	0.023
185	15.42	0.77	0.230	(0.372)	0.207	0.023
186	15.50	0.77	0.230	(0.370)	0.207	0.023
187	15.58	0.63	0.190	(0.368)	0.171	0.019
188	15.67	0.63	0.190	(0.366)	0.171	0.019
189	15.75	0.63	0.190	(0.364)	0.171	0.019
190	15.83	0.63	0.190	(0.362)	0.171	0.019
191	15.92	0.63	0.190	(0.360)	0.171	0.019
192	16.00	0.63	0.190	(0.359)	0.171	0.019
193	16.08	0.13	0.040	(0.357)	0.036	0.004
194	16.17	0.13	0.040	(0.355)	0.036	0.004
195	16.25	0.13	0.040	(0.353)	0.036	0.004
196	16.33	0.13	0.040	(0.351)	0.036	0.004
197	16.42	0.13	0.040	(0.350)	0.036	0.004
198	16.50	0.13	0.040	(0.348)	0.036	0.004
199	16.58	0.10	0.030	(0.346)	0.027	0.003
200	16.67	0.10	0.030	(0.344)	0.027	0.003
201	16.75	0.10	0.030	(0.343)	0.027	0.003
202	16.83	0.10	0.030	(0.341)	0.027	0.003
203	16.92	0.10	0.030	(0.339)	0.027	0.003
204	17.00	0.10	0.030	(0.337)	0.027	0.003
205	17.08	0.17	0.050	(0.336)	0.045	0.005
206	17.17	0.17	0.050	(0.334)	0.045	0.005
207	17.25	0.17	0.050	(0.332)	0.045	0.005
208	17.33	0.17	0.050	(0.331)	0.045	0.005
209	17.42	0.17	0.050	(0.329)	0.045	0.005
210	17.50	0.17	0.050	(0.327)	0.045	0.005
211	17.58	0.17	0.050	(0.326)	0.045	0.005
212	17.67	0.17	0.050	(0.324)	0.045	0.005
213	17.75	0.17	0.050	(0.322)	0.045	0.005
214	17.83	0.13	0.040	(0.321)	0.036	0.004
215	17.92	0.13	0.040	(0.319)	0.036	0.004
216	18.00	0.13	0.040	(0.318)	0.036	0.004
217	18.08	0.13	0.040	(0.316)	0.036	0.004
218	18.17	0.13	0.040	(0.315)	0.036	0.004
219	18.25	0.13	0.040	(0.313)	0.036	0.004
220	18.33	0.13	0.040	(0.311)	0.036	0.004
221	18.42	0.13	0.040	(0.310)	0.036	0.004
222	18.50	0.13	0.040	(0.308)	0.036	0.004
223	18.58	0.10	0.030	(0.307)	0.027	0.003
224	18.67	0.10	0.030	(0.305)	0.027	0.003
225	18.75	0.10	0.030	(0.304)	0.027	0.003
226	18.83	0.07	0.020	(0.303)	0.018	0.002
227	18.92	0.07	0.020	(0.301)	0.018	0.002
228	19.00	0.07	0.020	(0.300)	0.018	0.002
229	19.08	0.10	0.030	(0.298)	0.027	0.003
230	19.17	0.10	0.030	(0.297)	0.027	0.003
231	19.25	0.10	0.030	(0.295)	0.027	0.003
232	19.33	0.13	0.040	(0.294)	0.036	0.004
233	19.42	0.13	0.040	(0.293)	0.036	0.004
234	19.50	0.13	0.040	(0.291)	0.036	0.004
235	19.58	0.10	0.030	(0.290)	0.027	0.003
236	19.67	0.10	0.030	(0.289)	0.027	0.003
237	19.75	0.10	0.030	(0.287)	0.027	0.003
238	19.83	0.07	0.020	(0.286)	0.018	0.002
239	19.92	0.07	0.020	(0.285)	0.018	0.002
240	20.00	0.07	0.020	(0.284)	0.018	0.002
241	20.08	0.10	0.030	(0.282)	0.027	0.003
242	20.17	0.10	0.030	(0.281)	0.027	0.003
243	20.25	0.10	0.030	(0.280)	0.027	0.003
244	20.33	0.10	0.030	(0.279)	0.027	0.003
245	20.42	0.10	0.030	(0.277)	0.027	0.003
246	20.50	0.10	0.030	(0.276)	0.027	0.003
247	20.58	0.10	0.030	(0.275)	0.027	0.003
248	20.67	0.10	0.030	(0.274)	0.027	0.003
249	20.75	0.10	0.030	(0.273)	0.027	0.003
250	20.83	0.07	0.020	(0.272)	0.018	0.002
251	20.92	0.07	0.020	(0.271)	0.018	0.002

```
252  21.00     0.07      0.020       (  0.270)       0.018        0.002
253  21.08     0.10      0.030       (  0.268)       0.027        0.003
254  21.17     0.10      0.030       (  0.267)       0.027        0.003
255  21.25     0.10      0.030       (  0.266)       0.027        0.003
256  21.33     0.07      0.020       (  0.265)       0.018        0.002
257  21.42     0.07      0.020       (  0.264)       0.018        0.002
258  21.50     0.07      0.020       (  0.263)       0.018        0.002
259  21.58     0.10      0.030       (  0.262)       0.027        0.003
260  21.67     0.10      0.030       (  0.261)       0.027        0.003
261  21.75     0.10      0.030       (  0.261)       0.027        0.003
262  21.83     0.07      0.020       (  0.260)       0.018        0.002
263  21.92     0.07      0.020       (  0.259)       0.018        0.002
264  22.00     0.07      0.020       (  0.258)       0.018        0.002
265  22.08     0.10      0.030       (  0.257)       0.027        0.003
266  22.17     0.10      0.030       (  0.256)       0.027        0.003
267  22.25     0.10      0.030       (  0.255)       0.027        0.003
268  22.33     0.07      0.020       (  0.255)       0.018        0.002
269  22.42     0.07      0.020       (  0.254)       0.018        0.002
270  22.50     0.07      0.020       (  0.253)       0.018        0.002
271  22.58     0.07      0.020       (  0.252)       0.018        0.002
272  22.67     0.07      0.020       (  0.252)       0.018        0.002
273  22.75     0.07      0.020       (  0.251)       0.018        0.002
274  22.83     0.07      0.020       (  0.250)       0.018        0.002
275  22.92     0.07      0.020       (  0.250)       0.018        0.002
276  23.00     0.07      0.020       (  0.249)       0.018        0.002
277  23.08     0.07      0.020       (  0.248)       0.018        0.002
278  23.17     0.07      0.020       (  0.248)       0.018        0.002
279  23.25     0.07      0.020       (  0.247)       0.018        0.002
280  23.33     0.07      0.020       (  0.247)       0.018        0.002
281  23.42     0.07      0.020       (  0.246)       0.018        0.002
282  23.50     0.07      0.020       (  0.246)       0.018        0.002
283  23.58     0.07      0.020       (  0.246)       0.018        0.002
284  23.67     0.07      0.020       (  0.245)       0.018        0.002
285  23.75     0.07      0.020       (  0.245)       0.018        0.002
286  23.83     0.07      0.020       (  0.245)       0.018        0.002
287  23.92     0.07      0.020       (  0.244)       0.018        0.002
288  24.00     0.07      0.020       (  0.244)       0.018        0.002
               (Loss Rate Not Used)
    Sum =     100.0                                  Sum =     3.0
      Flood volume = Effective rainfall      0.25(In)
       times area       1.9(Ac.)/[(In)/(Ft.)] =       0.0(Ac.Ft)
      Total soil loss =      2.25(In)
      Total soil loss =     0.351(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =        1697.0 Cubic Feet
      Total soil loss =       15273.2 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.064(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      0.00  Q         |         |         |         |
   0+10       0.0000      0.00  Q         |         |         |         |
   0+15       0.0001      0.00  Q         |         |         |         |
   0+20       0.0001      0.00  Q         |         |         |         |
   0+25       0.0001      0.01  Q         |         |         |         |
   0+30       0.0002      0.01  Q         |         |         |         |
   0+35       0.0002      0.01  Q         |         |         |         |
   0+40       0.0002      0.01  Q         |         |         |         |
   0+45       0.0003      0.01  Q         |         |         |         |
   0+50       0.0003      0.01  Q         |         |         |         |
   0+55       0.0004      0.01  Q         |         |         |         |
   1+ 0       0.0004      0.01  Q         |         |         |         |
   1+ 5       0.0005      0.01  Q         |         |         |         |
```

1+10	0.0005	0.01	Q				
1+15	0.0006	0.01	Q				
1+20	0.0006	0.01	Q				
1+25	0.0006	0.01	Q				
1+30	0.0007	0.01	Q				
1+35	0.0007	0.01	Q				
1+40	0.0008	0.01	Q				
1+45	0.0008	0.01	Q				
1+50	0.0008	0.01	Q				
1+55	0.0009	0.01	Q				
2+ 0	0.0009	0.01	Q				
2+ 5	0.0010	0.01	QV				
2+10	0.0010	0.01	QV				
2+15	0.0011	0.01	QV				
2+20	0.0011	0.01	QV				
2+25	0.0012	0.01	QV				
2+30	0.0012	0.01	QV				
2+35	0.0013	0.01	QV				
2+40	0.0014	0.01	QV				
2+45	0.0014	0.01	QV				
2+50	0.0015	0.01	QV				
2+55	0.0016	0.01	QV				
3+ 0	0.0016	0.01	QV				
3+ 5	0.0017	0.01	QV				
3+10	0.0018	0.01	QV				
3+15	0.0018	0.01	QV				
3+20	0.0019	0.01	QV				
3+25	0.0020	0.01	Q V				
3+30	0.0020	0.01	Q V				
3+35	0.0021	0.01	Q V				
3+40	0.0021	0.01	Q V				
3+45	0.0022	0.01	Q V				
3+50	0.0023	0.01	Q V				
3+55	0.0024	0.01	Q V				
4+ 0	0.0024	0.01	Q V				
4+ 5	0.0025	0.01	Q V				
4+10	0.0026	0.01	Q V				
4+15	0.0027	0.01	Q V				
4+20	0.0028	0.01	Q V				
4+25	0.0028	0.01	Q V				
4+30	0.0029	0.01	Q V				
4+35	0.0030	0.01	Q V				
4+40	0.0031	0.01	Q V				
4+45	0.0032	0.01	Q V				
4+50	0.0033	0.01	Q V				
4+55	0.0034	0.01	Q V				
5+ 0	0.0035	0.02	Q V				
5+ 5	0.0036	0.01	Q V				
5+10	0.0037	0.01	Q V				
5+15	0.0038	0.01	Q V				
5+20	0.0038	0.01	Q V				
5+25	0.0039	0.01	Q V				
5+30	0.0040	0.01	Q V				
5+35	0.0041	0.01	Q V				
5+40	0.0042	0.01	Q V				
5+45	0.0043	0.02	Q V				
5+50	0.0044	0.02	Q V				
5+55	0.0045	0.02	Q V				
6+ 0	0.0046	0.02	Q V				
6+ 5	0.0047	0.02	Q V				
6+10	0.0049	0.02	Q V				
6+15	0.0050	0.02	Q V				
6+20	0.0051	0.02	Q V				
6+25	0.0052	0.02	Q V				
6+30	0.0053	0.02	Q V				
6+35	0.0055	0.02	Q V				
6+40	0.0056	0.02	Q V				
6+45	0.0057	0.02	Q V				
6+50	0.0058	0.02	Q V				
6+55	0.0060	0.02	Q V				
7+ 0	0.0061	0.02	Q V				

7+ 5	0.0062	0.02	Q	V	|	|	|	|
7+10	0.0064	0.02	Q	V	|	|	|	|
7+15	0.0065	0.02	Q	V	|	|	|	|
7+20	0.0066	0.02	Q	V	|	|	|	|
7+25	0.0068	0.02	Q	V	|	|	|	|
7+30	0.0069	0.02	Q	V	|	|	|	|
7+35	0.0071	0.02	Q	V	|	|	|	|
7+40	0.0072	0.02	Q	V	|	|	|	|
7+45	0.0074	0.02	Q	V	|	|	|	|
7+50	0.0075	0.02	Q	V	|	|	|	|
7+55	0.0077	0.02	Q	V	|	|	|	|
8+ 0	0.0079	0.02	Q	V	|	|	|	|
8+ 5	0.0080	0.03	Q	V	|	|	|	|
8+10	0.0082	0.03	Q	V	|	|	|	|
8+15	0.0084	0.03	Q	V	|	|	|	|
8+20	0.0086	0.03	Q	V	|	|	|	|
8+25	0.0088	0.03	Q	V	|	|	|	|
8+30	0.0090	0.03	Q	V	|	|	|	|
8+35	0.0092	0.03	Q	V	|	|	|	|
8+40	0.0094	0.03	Q	V	|	|	|	|
8+45	0.0096	0.03	Q	V	|	|	|	|
8+50	0.0098	0.03	Q	V	|	|	|	|
8+55	0.0101	0.03	Q	V	|	|	|	|
9+ 0	0.0103	0.03	Q	V	|	|	|	|
9+ 5	0.0105	0.03	Q	V	|	|	|	|
9+10	0.0108	0.04	Q	V	|	|	|	|
9+15	0.0110	0.04	Q	V	|	|	|	|
9+20	0.0113	0.04	Q	V	|	|	|	|
9+25	0.0115	0.04	Q	V	|	|	|	|
9+30	0.0118	0.04	Q	V	|	|	|	|
9+35	0.0120	0.04	Q	V	|	|	|	|
9+40	0.0123	0.04	Q	V	|	|	|	|
9+45	0.0126	0.04	Q	V	|	|	|	|
9+50	0.0129	0.04	Q	V	|	|	|	|
9+55	0.0131	0.04	Q	V	|	|	|	|
10+ 0	0.0134	0.04	Q	V	|	|	|	|
10+ 5	0.0137	0.04	Q	V	|	|	|	|
10+10	0.0139	0.03	Q	V	|	|	|	|
10+15	0.0141	0.03	Q	V	|	|	|	|
10+20	0.0143	0.03	Q	V	|	|	|	|
10+25	0.0145	0.03	Q	V	|	|	|	|
10+30	0.0147	0.03	Q	V	|	|	|	|
10+35	0.0149	0.03	Q	V	|	|	|	|
10+40	0.0151	0.04	Q	V	|	|	|	|
10+45	0.0154	0.04	Q	V	|	|	|	|
10+50	0.0157	0.04	Q	V	|	|	|	|
10+55	0.0159	0.04	Q	V	|	|	|	|
11+ 0	0.0162	0.04	Q	V	|	|	|	|
11+ 5	0.0164	0.04	Q	V	|	|	|	|
11+10	0.0167	0.04	Q	V	|	|	|	|
11+15	0.0169	0.04	Q	V	|	|	|	|
11+20	0.0172	0.04	Q	V	|	|	|	|
11+25	0.0174	0.04	Q	V	|	|	|	|
11+30	0.0177	0.04	Q	V	|	|	|	|
11+35	0.0179	0.03	Q	V	|	|	|	|
11+40	0.0181	0.03	Q	V	|	|	|	|
11+45	0.0183	0.03	Q	V	|	|	|	|
11+50	0.0186	0.03	Q	V	|	|	|	|
11+55	0.0188	0.03	Q	V	|	|	|	|
12+ 0	0.0190	0.03	Q	V	|	|	|	|
12+ 5	0.0193	0.04	Q	V	|	|	|	|
12+10	0.0196	0.05	Q	V	|	|	|	|
12+15	0.0199	0.05	Q	V	|	|	|	|
12+20	0.0203	0.05	Q	V	|	|	|	|
12+25	0.0206	0.05	Q	V	|	|	|	|
12+30	0.0209	0.05	Q	V	|	|	|	|
12+35	0.0213	0.05	Q	V	|	|	|	|
12+40	0.0217	0.05	Q	V	|	|	|	|
12+45	0.0220	0.05	Q	V	|	|	|	|
12+50	0.0224	0.05	Q	V	|	|	|	|
12+55	0.0228	0.05	Q	V	|	|	|	|


13+ 0 0.0231 0.05 Q
13+ 5 0.0235 0.06 Q
13+10 0.0240 0.06 Q
13+15 0.0244 0.06 Q
13+20 0.0249 0.06 Q
13+25 0.0253 0.06 Q
13+30 0.0257 0.06 Q
13+35 0.0261 0.05 Q
13+40 0.0264 0.05 Q
13+45 0.0267 0.04 Q
13+50 0.0270 0.04 Q
13+55 0.0273 0.04 Q
14+ 0 0.0276 0.04 Q
14+ 5 0.0280 0.05 Q
14+10 0.0283 0.05 Q
14+15 0.0287 0.05 Q
14+20 0.0290 0.05 Q
14+25 0.0293 0.05 Q
14+30 0.0297 0.05 Q
14+35 0.0300 0.05 Q
14+40 0.0304 0.05 Q
14+45 0.0307 0.05 Q
14+50 0.0310 0.05 Q
14+55 0.0313 0.05 Q
15+ 0 0.0317 0.05 Q
15+ 5 0.0320 0.05 Q
15+10 0.0323 0.05 Q
15+15 0.0326 0.05 Q
15+20 0.0329 0.04 Q
15+25 0.0332 0.04 Q
15+30 0.0335 0.04 Q
15+35 0.0338 0.04 Q
15+40 0.0341 0.04 Q
15+45 0.0343 0.04 Q
15+50 0.0345 0.04 Q
15+55 0.0348 0.04 Q
16+ 0 0.0350 0.04 Q
16+ 5 0.0352 0.02 Q
16+10 0.0353 0.01 Q
16+15 0.0353 0.01 Q
16+20 0.0354 0.01 Q
16+25 0.0354 0.01 Q
16+30 0.0355 0.01 Q
16+35 0.0355 0.01 Q
16+40 0.0356 0.01 Q
16+45 0.0356 0.01 Q
16+50 0.0357 0.01 Q
16+55 0.0357 0.01 Q
17+ 0 0.0357 0.01 Q
17+ 5 0.0358 0.01 Q
17+10 0.0358 0.01 Q
17+15 0.0359 0.01 Q
17+20 0.0360 0.01 Q
17+25 0.0360 0.01 Q
17+30 0.0361 0.01 Q
17+35 0.0362 0.01 Q
17+40 0.0362 0.01 Q
17+45 0.0363 0.01 Q
17+50 0.0364 0.01 Q
17+55 0.0364 0.01 Q
18+ 0 0.0365 0.01 Q
18+ 5 0.0365 0.01 Q
18+10 0.0366 0.01 Q
18+15 0.0366 0.01 Q
18+20 0.0367 0.01 Q
18+25 0.0367 0.01 Q
18+30 0.0368 0.01 Q
18+35 0.0368 0.01 Q
18+40 0.0369 0.01 Q
18+45 0.0369 0.01 Q
18+50 0.0369 0.00 Q

18+55	0.0370	0.00	Q				V
19+ 0	0.0370	0.00	Q				V
19+ 5	0.0370	0.00	Q				V
19+10	0.0371	0.01	Q				V
19+15	0.0371	0.01	Q				V
19+20	0.0371	0.01	Q				V
19+25	0.0372	0.01	Q				V
19+30	0.0372	0.01	Q				V
19+35	0.0373	0.01	Q				V
19+40	0.0373	0.01	Q				V
19+45	0.0374	0.01	Q				V
19+50	0.0374	0.00	Q				V
19+55	0.0374	0.00	Q				V
20+ 0	0.0375	0.00	Q				V
20+ 5	0.0375	0.00	Q				V
20+10	0.0375	0.01	Q				V
20+15	0.0376	0.01	Q				V
20+20	0.0376	0.01	Q				V
20+25	0.0376	0.01	Q				V
20+30	0.0377	0.01	Q				V
20+35	0.0377	0.01	Q				V
20+40	0.0378	0.01	Q				V
20+45	0.0378	0.01	Q				V
20+50	0.0378	0.00	Q				V
20+55	0.0379	0.00	Q				V
21+ 0	0.0379	0.00	Q				V
21+ 5	0.0379	0.00	Q				V
21+10	0.0380	0.01	Q				V
21+15	0.0380	0.01	Q				V
21+20	0.0380	0.00	Q				V
21+25	0.0381	0.00	Q				V
21+30	0.0381	0.00	Q				V
21+35	0.0381	0.00	Q				V
21+40	0.0382	0.01	Q				V
21+45	0.0382	0.01	Q				V
21+50	0.0382	0.00	Q				V
21+55	0.0383	0.00	Q				V
22+ 0	0.0383	0.00	Q				V
22+ 5	0.0383	0.00	Q				V
22+10	0.0383	0.01	Q				V
22+15	0.0384	0.01	Q				V
22+20	0.0384	0.00	Q				V
22+25	0.0384	0.00	Q				V
22+30	0.0385	0.00	Q				V
22+35	0.0385	0.00	Q				V
22+40	0.0385	0.00	Q				V
22+45	0.0385	0.00	Q				V
22+50	0.0386	0.00	Q				V
22+55	0.0386	0.00	Q				V
23+ 0	0.0386	0.00	Q				V
23+ 5	0.0387	0.00	Q				V
23+10	0.0387	0.00	Q				V
23+15	0.0387	0.00	Q				V
23+20	0.0387	0.00	Q				V
23+25	0.0388	0.00	Q				V
23+30	0.0388	0.00	Q				V
23+35	0.0388	0.00	Q				V
23+40	0.0388	0.00	Q				V
23+45	0.0389	0.00	Q				V
23+50	0.0389	0.00	Q				V
23+55	0.0389	0.00	Q				V
24+ 0	0.0389	0.00	Q				V
24+ 5	0.0390	0.00	Q				V
24+10	0.0390	0.00	Q				V
24+15	0.0390	0.00	Q				V

Post-Project Unit Hydrograph Calculations
Area “A” – 2-year, 24-hour Storm Duration

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

Study date 03/26/21 File: ARAP242.out

++

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

Program License Serial Number 6279

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

English Units used in output format

SADDLEBACK INDUSTRIAL POST-PROJECT CONDITION HYDROLOGY
UNIT HYDROGRAPH ANALYSIS, 2-YEAR STORM EVENT
FILENAME: ARAP

Drainage Area = 2.17(Ac.) = 0.003 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 2.17(Ac.) = 0.003 Sq. Mi.
Length along longest watercourse = 574.00(Ft.)
Length along longest watercourse measured to centroid = 326.00(Ft.)
Length along longest watercourse = 0.109 Mi.
Length along longest watercourse measured to centroid = 0.062 Mi.
Difference in elevation = 13.00(Ft.)
Slope along watercourse = 119.5819 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.022 Hr.
Lag time = 1.30 Min.
25% of lag time = 0.32 Min.
40% of lag time = 0.52 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]
2.17	2.50	5.42

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
2.17	6.50	14.11

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.500(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
2.170	60.48	0.900

Total Area Entered = 2.17(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
60.5	40.5	0.665	0.900	0.126	1.000	0.126
					Sum (F) =	0.126

Area averaged mean soil loss (F) (In/Hr) = 0.126
Minimum soil loss rate ((In/Hr)) = 0.063
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	384.650	63.996	1.400
2	0.167	769.299	32.871	0.719
3	0.250	1153.949	3.133	0.069
			Sum = 100.000 Sum=	2.187

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 (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.224)	0.004	0.016
2	0.17	0.07	0.020	(0.223)	0.004	0.016
3	0.25	0.07	0.020	(0.222)	0.004	0.016
4	0.33	0.10	0.030	(0.221)	0.005	0.025
5	0.42	0.10	0.030	(0.221)	0.005	0.025
6	0.50	0.10	0.030	(0.220)	0.005	0.025
7	0.58	0.10	0.030	(0.219)	0.005	0.025
8	0.67	0.10	0.030	(0.218)	0.005	0.025
9	0.75	0.10	0.030	(0.217)	0.005	0.025
10	0.83	0.13	0.040	(0.216)	0.007	0.033
11	0.92	0.13	0.040	(0.215)	0.007	0.033
12	1.00	0.13	0.040	(0.215)	0.007	0.033
13	1.08	0.10	0.030	(0.214)	0.005	0.025
14	1.17	0.10	0.030	(0.213)	0.005	0.025
15	1.25	0.10	0.030	(0.212)	0.005	0.025
16	1.33	0.10	0.030	(0.211)	0.005	0.025
17	1.42	0.10	0.030	(0.210)	0.005	0.025
18	1.50	0.10	0.030	(0.210)	0.005	0.025
19	1.58	0.10	0.030	(0.209)	0.005	0.025
20	1.67	0.10	0.030	(0.208)	0.005	0.025
21	1.75	0.10	0.030	(0.207)	0.005	0.025
22	1.83	0.13	0.040	(0.206)	0.007	0.033
23	1.92	0.13	0.040	(0.205)	0.007	0.033
24	2.00	0.13	0.040	(0.205)	0.007	0.033
25	2.08	0.13	0.040	(0.204)	0.007	0.033
26	2.17	0.13	0.040	(0.203)	0.007	0.033
27	2.25	0.13	0.040	(0.202)	0.007	0.033
28	2.33	0.13	0.040	(0.201)	0.007	0.033
29	2.42	0.13	0.040	(0.200)	0.007	0.033
30	2.50	0.13	0.040	(0.200)	0.007	0.033
31	2.58	0.17	0.050	(0.199)	0.009	0.041
32	2.67	0.17	0.050	(0.198)	0.009	0.041
33	2.75	0.17	0.050	(0.197)	0.009	0.041
34	2.83	0.17	0.050	(0.196)	0.009	0.041
35	2.92	0.17	0.050	(0.196)	0.009	0.041
36	3.00	0.17	0.050	(0.195)	0.009	0.041
37	3.08	0.17	0.050	(0.194)	0.009	0.041
38	3.17	0.17	0.050	(0.193)	0.009	0.041
39	3.25	0.17	0.050	(0.192)	0.009	0.041

40	3.33	0.17	0.050	(0.192)	0.009	0.041
41	3.42	0.17	0.050	(0.191)	0.009	0.041
42	3.50	0.17	0.050	(0.190)	0.009	0.041
43	3.58	0.17	0.050	(0.189)	0.009	0.041
44	3.67	0.17	0.050	(0.188)	0.009	0.041
45	3.75	0.17	0.050	(0.188)	0.009	0.041
46	3.83	0.20	0.060	(0.187)	0.011	0.049
47	3.92	0.20	0.060	(0.186)	0.011	0.049
48	4.00	0.20	0.060	(0.185)	0.011	0.049
49	4.08	0.20	0.060	(0.184)	0.011	0.049
50	4.17	0.20	0.060	(0.184)	0.011	0.049
51	4.25	0.20	0.060	(0.183)	0.011	0.049
52	4.33	0.23	0.070	(0.182)	0.013	0.057
53	4.42	0.23	0.070	(0.181)	0.013	0.057
54	4.50	0.23	0.070	(0.181)	0.013	0.057
55	4.58	0.23	0.070	(0.180)	0.013	0.057
56	4.67	0.23	0.070	(0.179)	0.013	0.057
57	4.75	0.23	0.070	(0.178)	0.013	0.057
58	4.83	0.27	0.080	(0.177)	0.014	0.066
59	4.92	0.27	0.080	(0.177)	0.014	0.066
60	5.00	0.27	0.080	(0.176)	0.014	0.066
61	5.08	0.20	0.060	(0.175)	0.011	0.049
62	5.17	0.20	0.060	(0.174)	0.011	0.049
63	5.25	0.20	0.060	(0.174)	0.011	0.049
64	5.33	0.23	0.070	(0.173)	0.013	0.057
65	5.42	0.23	0.070	(0.172)	0.013	0.057
66	5.50	0.23	0.070	(0.171)	0.013	0.057
67	5.58	0.27	0.080	(0.171)	0.014	0.066
68	5.67	0.27	0.080	(0.170)	0.014	0.066
69	5.75	0.27	0.080	(0.169)	0.014	0.066
70	5.83	0.27	0.080	(0.168)	0.014	0.066
71	5.92	0.27	0.080	(0.168)	0.014	0.066
72	6.00	0.27	0.080	(0.167)	0.014	0.066
73	6.08	0.30	0.090	(0.166)	0.016	0.074
74	6.17	0.30	0.090	(0.165)	0.016	0.074
75	6.25	0.30	0.090	(0.165)	0.016	0.074
76	6.33	0.30	0.090	(0.164)	0.016	0.074
77	6.42	0.30	0.090	(0.163)	0.016	0.074
78	6.50	0.30	0.090	(0.162)	0.016	0.074
79	6.58	0.33	0.100	(0.162)	0.018	0.082
80	6.67	0.33	0.100	(0.161)	0.018	0.082
81	6.75	0.33	0.100	(0.160)	0.018	0.082
82	6.83	0.33	0.100	(0.160)	0.018	0.082
83	6.92	0.33	0.100	(0.159)	0.018	0.082
84	7.00	0.33	0.100	(0.158)	0.018	0.082
85	7.08	0.33	0.100	(0.157)	0.018	0.082
86	7.17	0.33	0.100	(0.157)	0.018	0.082
87	7.25	0.33	0.100	(0.156)	0.018	0.082
88	7.33	0.37	0.110	(0.155)	0.020	0.090
89	7.42	0.37	0.110	(0.155)	0.020	0.090
90	7.50	0.37	0.110	(0.154)	0.020	0.090
91	7.58	0.40	0.120	(0.153)	0.022	0.098
92	7.67	0.40	0.120	(0.152)	0.022	0.098
93	7.75	0.40	0.120	(0.152)	0.022	0.098
94	7.83	0.43	0.130	(0.151)	0.023	0.107
95	7.92	0.43	0.130	(0.150)	0.023	0.107
96	8.00	0.43	0.130	(0.150)	0.023	0.107
97	8.08	0.50	0.150	(0.149)	0.027	0.123
98	8.17	0.50	0.150	(0.148)	0.027	0.123
99	8.25	0.50	0.150	(0.148)	0.027	0.123
100	8.33	0.50	0.150	(0.147)	0.027	0.123
101	8.42	0.50	0.150	(0.146)	0.027	0.123
102	8.50	0.50	0.150	(0.145)	0.027	0.123
103	8.58	0.53	0.160	(0.145)	0.029	0.131
104	8.67	0.53	0.160	(0.144)	0.029	0.131
105	8.75	0.53	0.160	(0.143)	0.029	0.131
106	8.83	0.57	0.170	(0.143)	0.031	0.139
107	8.92	0.57	0.170	(0.142)	0.031	0.139
108	9.00	0.57	0.170	(0.141)	0.031	0.139
109	9.08	0.63	0.190	(0.141)	0.034	0.156
110	9.17	0.63	0.190	(0.140)	0.034	0.156

111	9.25	0.63	0.190	(0.139)	0.034	0.156
112	9.33	0.67	0.200	(0.139)	0.036	0.164
113	9.42	0.67	0.200	(0.138)	0.036	0.164
114	9.50	0.67	0.200	(0.137)	0.036	0.164
115	9.58	0.70	0.210	(0.137)	0.038	0.172
116	9.67	0.70	0.210	(0.136)	0.038	0.172
117	9.75	0.70	0.210	(0.135)	0.038	0.172
118	9.83	0.73	0.220	(0.135)	0.040	0.180
119	9.92	0.73	0.220	(0.134)	0.040	0.180
120	10.00	0.73	0.220	(0.133)	0.040	0.180
121	10.08	0.50	0.150	(0.133)	0.027	0.123
122	10.17	0.50	0.150	(0.132)	0.027	0.123
123	10.25	0.50	0.150	(0.132)	0.027	0.123
124	10.33	0.50	0.150	(0.131)	0.027	0.123
125	10.42	0.50	0.150	(0.130)	0.027	0.123
126	10.50	0.50	0.150	(0.130)	0.027	0.123
127	10.58	0.67	0.200	(0.129)	0.036	0.164
128	10.67	0.67	0.200	(0.128)	0.036	0.164
129	10.75	0.67	0.200	(0.128)	0.036	0.164
130	10.83	0.67	0.200	(0.127)	0.036	0.164
131	10.92	0.67	0.200	(0.127)	0.036	0.164
132	11.00	0.67	0.200	(0.126)	0.036	0.164
133	11.08	0.63	0.190	(0.125)	0.034	0.156
134	11.17	0.63	0.190	(0.125)	0.034	0.156
135	11.25	0.63	0.190	(0.124)	0.034	0.156
136	11.33	0.63	0.190	(0.123)	0.034	0.156
137	11.42	0.63	0.190	(0.123)	0.034	0.156
138	11.50	0.63	0.190	(0.122)	0.034	0.156
139	11.58	0.57	0.170	(0.122)	0.031	0.139
140	11.67	0.57	0.170	(0.121)	0.031	0.139
141	11.75	0.57	0.170	(0.120)	0.031	0.139
142	11.83	0.60	0.180	(0.120)	0.032	0.148
143	11.92	0.60	0.180	(0.119)	0.032	0.148
144	12.00	0.60	0.180	(0.119)	0.032	0.148
145	12.08	0.83	0.250	(0.118)	0.045	0.205
146	12.17	0.83	0.250	(0.117)	0.045	0.205
147	12.25	0.83	0.250	(0.117)	0.045	0.205
148	12.33	0.87	0.260	(0.116)	0.047	0.213
149	12.42	0.87	0.260	(0.116)	0.047	0.213
150	12.50	0.87	0.260	(0.115)	0.047	0.213
151	12.58	0.93	0.280	(0.114)	0.050	0.230
152	12.67	0.93	0.280	(0.114)	0.050	0.230
153	12.75	0.93	0.280	(0.113)	0.050	0.230
154	12.83	0.97	0.290	(0.113)	0.052	0.238
155	12.92	0.97	0.290	(0.112)	0.052	0.238
156	13.00	0.97	0.290	(0.112)	0.052	0.238
157	13.08	1.13	0.340	(0.111)	0.061	0.279
158	13.17	1.13	0.340	(0.110)	0.061	0.279
159	13.25	1.13	0.340	(0.110)	0.061	0.279
160	13.33	1.13	0.340	(0.109)	0.061	0.279
161	13.42	1.13	0.340	(0.109)	0.061	0.279
162	13.50	1.13	0.340	(0.108)	0.061	0.279
163	13.58	0.77	0.230	(0.108)	0.041	0.189
164	13.67	0.77	0.230	(0.107)	0.041	0.189
165	13.75	0.77	0.230	(0.107)	0.041	0.189
166	13.83	0.77	0.230	(0.106)	0.041	0.189
167	13.92	0.77	0.230	(0.106)	0.041	0.189
168	14.00	0.77	0.230	(0.105)	0.041	0.189
169	14.08	0.90	0.270	(0.104)	0.049	0.221
170	14.17	0.90	0.270	(0.104)	0.049	0.221
171	14.25	0.90	0.270	(0.103)	0.049	0.221
172	14.33	0.87	0.260	(0.103)	0.047	0.213
173	14.42	0.87	0.260	(0.102)	0.047	0.213
174	14.50	0.87	0.260	(0.102)	0.047	0.213
175	14.58	0.87	0.260	(0.101)	0.047	0.213
176	14.67	0.87	0.260	(0.101)	0.047	0.213
177	14.75	0.87	0.260	(0.100)	0.047	0.213
178	14.83	0.83	0.250	(0.100)	0.045	0.205
179	14.92	0.83	0.250	(0.099)	0.045	0.205
180	15.00	0.83	0.250	(0.099)	0.045	0.205
181	15.08	0.80	0.240	(0.098)	0.043	0.197

182	15.17	0.80	0.240	(0.098)	0.043	0.197
183	15.25	0.80	0.240	(0.097)	0.043	0.197
184	15.33	0.77	0.230	(0.097)	0.041	0.189
185	15.42	0.77	0.230	(0.096)	0.041	0.189
186	15.50	0.77	0.230	(0.096)	0.041	0.189
187	15.58	0.63	0.190	(0.095)	0.034	0.156
188	15.67	0.63	0.190	(0.095)	0.034	0.156
189	15.75	0.63	0.190	(0.094)	0.034	0.156
190	15.83	0.63	0.190	(0.094)	0.034	0.156
191	15.92	0.63	0.190	(0.093)	0.034	0.156
192	16.00	0.63	0.190	(0.093)	0.034	0.156
193	16.08	0.13	0.040	(0.092)	0.007	0.033
194	16.17	0.13	0.040	(0.092)	0.007	0.033
195	16.25	0.13	0.040	(0.091)	0.007	0.033
196	16.33	0.13	0.040	(0.091)	0.007	0.033
197	16.42	0.13	0.040	(0.090)	0.007	0.033
198	16.50	0.13	0.040	(0.090)	0.007	0.033
199	16.58	0.10	0.030	(0.090)	0.005	0.025
200	16.67	0.10	0.030	(0.089)	0.005	0.025
201	16.75	0.10	0.030	(0.089)	0.005	0.025
202	16.83	0.10	0.030	(0.088)	0.005	0.025
203	16.92	0.10	0.030	(0.088)	0.005	0.025
204	17.00	0.10	0.030	(0.087)	0.005	0.025
205	17.08	0.17	0.050	(0.087)	0.009	0.041
206	17.17	0.17	0.050	(0.086)	0.009	0.041
207	17.25	0.17	0.050	(0.086)	0.009	0.041
208	17.33	0.17	0.050	(0.086)	0.009	0.041
209	17.42	0.17	0.050	(0.085)	0.009	0.041
210	17.50	0.17	0.050	(0.085)	0.009	0.041
211	17.58	0.17	0.050	(0.084)	0.009	0.041
212	17.67	0.17	0.050	(0.084)	0.009	0.041
213	17.75	0.17	0.050	(0.083)	0.009	0.041
214	17.83	0.13	0.040	(0.083)	0.007	0.033
215	17.92	0.13	0.040	(0.083)	0.007	0.033
216	18.00	0.13	0.040	(0.082)	0.007	0.033
217	18.08	0.13	0.040	(0.082)	0.007	0.033
218	18.17	0.13	0.040	(0.081)	0.007	0.033
219	18.25	0.13	0.040	(0.081)	0.007	0.033
220	18.33	0.13	0.040	(0.081)	0.007	0.033
221	18.42	0.13	0.040	(0.080)	0.007	0.033
222	18.50	0.13	0.040	(0.080)	0.007	0.033
223	18.58	0.10	0.030	(0.079)	0.005	0.025
224	18.67	0.10	0.030	(0.079)	0.005	0.025
225	18.75	0.10	0.030	(0.079)	0.005	0.025
226	18.83	0.07	0.020	(0.078)	0.004	0.016
227	18.92	0.07	0.020	(0.078)	0.004	0.016
228	19.00	0.07	0.020	(0.078)	0.004	0.016
229	19.08	0.10	0.030	(0.077)	0.005	0.025
230	19.17	0.10	0.030	(0.077)	0.005	0.025
231	19.25	0.10	0.030	(0.076)	0.005	0.025
232	19.33	0.13	0.040	(0.076)	0.007	0.033
233	19.42	0.13	0.040	(0.076)	0.007	0.033
234	19.50	0.13	0.040	(0.075)	0.007	0.033
235	19.58	0.10	0.030	(0.075)	0.005	0.025
236	19.67	0.10	0.030	(0.075)	0.005	0.025
237	19.75	0.10	0.030	(0.074)	0.005	0.025
238	19.83	0.07	0.020	(0.074)	0.004	0.016
239	19.92	0.07	0.020	(0.074)	0.004	0.016
240	20.00	0.07	0.020	(0.073)	0.004	0.016
241	20.08	0.10	0.030	(0.073)	0.005	0.025
242	20.17	0.10	0.030	(0.073)	0.005	0.025
243	20.25	0.10	0.030	(0.072)	0.005	0.025
244	20.33	0.10	0.030	(0.072)	0.005	0.025
245	20.42	0.10	0.030	(0.072)	0.005	0.025
246	20.50	0.10	0.030	(0.072)	0.005	0.025
247	20.58	0.10	0.030	(0.071)	0.005	0.025
248	20.67	0.10	0.030	(0.071)	0.005	0.025
249	20.75	0.10	0.030	(0.071)	0.005	0.025
250	20.83	0.07	0.020	(0.070)	0.004	0.016
251	20.92	0.07	0.020	(0.070)	0.004	0.016
252	21.00	0.07	0.020	(0.070)	0.004	0.016

```
253  21.08     0.10      0.030       (  0.069)       0.005        0.025
254  21.17     0.10      0.030       (  0.069)       0.005        0.025
255  21.25     0.10      0.030       (  0.069)       0.005        0.025
256  21.33     0.07      0.020       (  0.069)       0.004        0.016
257  21.42     0.07      0.020       (  0.068)       0.004        0.016
258  21.50     0.07      0.020       (  0.068)       0.004        0.016
259  21.58     0.10      0.030       (  0.068)       0.005        0.025
260  21.67     0.10      0.030       (  0.068)       0.005        0.025
261  21.75     0.10      0.030       (  0.067)       0.005        0.025
262  21.83     0.07      0.020       (  0.067)       0.004        0.016
263  21.92     0.07      0.020       (  0.067)       0.004        0.016
264  22.00     0.07      0.020       (  0.067)       0.004        0.016
265  22.08     0.10      0.030       (  0.067)       0.005        0.025
266  22.17     0.10      0.030       (  0.066)       0.005        0.025
267  22.25     0.10      0.030       (  0.066)       0.005        0.025
268  22.33     0.07      0.020       (  0.066)       0.004        0.016
269  22.42     0.07      0.020       (  0.066)       0.004        0.016
270  22.50     0.07      0.020       (  0.065)       0.004        0.016
271  22.58     0.07      0.020       (  0.065)       0.004        0.016
272  22.67     0.07      0.020       (  0.065)       0.004        0.016
273  22.75     0.07      0.020       (  0.065)       0.004        0.016
274  22.83     0.07      0.020       (  0.065)       0.004        0.016
275  22.92     0.07      0.020       (  0.065)       0.004        0.016
276  23.00     0.07      0.020       (  0.064)       0.004        0.016
277  23.08     0.07      0.020       (  0.064)       0.004        0.016
278  23.17     0.07      0.020       (  0.064)       0.004        0.016
279  23.25     0.07      0.020       (  0.064)       0.004        0.016
280  23.33     0.07      0.020       (  0.064)       0.004        0.016
281  23.42     0.07      0.020       (  0.064)       0.004        0.016
282  23.50     0.07      0.020       (  0.064)       0.004        0.016
283  23.58     0.07      0.020       (  0.064)       0.004        0.016
284  23.67     0.07      0.020       (  0.063)       0.004        0.016
285  23.75     0.07      0.020       (  0.063)       0.004        0.016
286  23.83     0.07      0.020       (  0.063)       0.004        0.016
287  23.92     0.07      0.020       (  0.063)       0.004        0.016
288  24.00     0.07      0.020       (  0.063)       0.004        0.016
               (Loss Rate Not Used)
    Sum =     100.0                                    Sum =    24.6
      Flood volume = Effective rainfall      2.05(In)
       times area       2.2(Ac.)/[(In)/(Ft.)] =       0.4(Ac.Ft)
      Total soil loss =      0.45(In)
      Total soil loss =     0.081(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =       16148.0 Cubic Feet
      Total soil loss =        3544.7 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.610(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       0.0002      0.02  Q         |         |         |         |
   0+10       0.0004      0.03  Q         |         |         |         |
   0+15       0.0006      0.04  Q         |         |         |         |
   0+20       0.0010      0.05  Q         |         |         |         |
   0+25       0.0013      0.05  Q         |         |         |         |
   0+30       0.0017      0.05  Q         |         |         |         |
   0+35       0.0021      0.05  Q         |         |         |         |
   0+40       0.0024      0.05  Q         |         |         |         |
   0+45       0.0028      0.05  Q         |         |         |         |
   0+50       0.0033      0.07  Q         |         |         |         |
   0+55       0.0038      0.07  Q         |         |         |         |
   1+ 0       0.0043      0.07  Q         |         |         |         |
   1+ 5       0.0047      0.06  Q         |         |         |         |
   1+10       0.0050      0.05  Q         |         |         |         |
```

1+15	0.0054	0.05	Q	|	|	|	|
1+20	0.0058	0.05	Q	|	|	|	|
1+25	0.0062	0.05	Q	|	|	|	|
1+30	0.0065	0.05	Q	|	|	|	|
1+35	0.0069	0.05	Q	|	|	|	|
1+40	0.0073	0.05	Q	|	|	|	|
1+45	0.0076	0.05	Q	|	|	|	|
1+50	0.0081	0.07	Q	|	|	|	|
1+55	0.0086	0.07	Q	|	|	|	|
2+ 0	0.0091	0.07	Q	|	|	|	|
2+ 5	0.0096	0.07	QV	|	|	|	|
2+10	0.0101	0.07	QV	|	|	|	|
2+15	0.0106	0.07	QV	|	|	|	|
2+20	0.0111	0.07	QV	|	|	|	|
2+25	0.0115	0.07	QV	|	|	|	|
2+30	0.0120	0.07	QV	|	|	|	|
2+35	0.0126	0.08	QV	|	|	|	|
2+40	0.0132	0.09	QV	|	|	|	|
2+45	0.0138	0.09	QV	|	|	|	|
2+50	0.0145	0.09	QV	|	|	|	|
2+55	0.0151	0.09	QV	|	|	|	|
3+ 0	0.0157	0.09	QV	|	|	|	|
3+ 5	0.0163	0.09	QV	|	|	|	|
3+10	0.0169	0.09	QV	|	|	|	|
3+15	0.0176	0.09	QV	|	|	|	|
3+20	0.0182	0.09	QV	|	|	|	|
3+25	0.0188	0.09	Q V	|	|	|	|
3+30	0.0194	0.09	Q V	|	|	|	|
3+35	0.0200	0.09	Q V	|	|	|	|
3+40	0.0206	0.09	Q V	|	|	|	|
3+45	0.0213	0.09	Q V	|	|	|	|
3+50	0.0220	0.10	Q V	|	|	|	|
3+55	0.0227	0.11	Q V	|	|	|	|
4+ 0	0.0234	0.11	Q V	|	|	|	|
4+ 5	0.0242	0.11	Q V	|	|	|	|
4+10	0.0249	0.11	Q V	|	|	|	|
4+15	0.0257	0.11	Q V	|	|	|	|
4+20	0.0265	0.12	Q V	|	|	|	|
4+25	0.0273	0.13	Q V	|	|	|	|
4+30	0.0282	0.13	Q V	|	|	|	|
4+35	0.0291	0.13	Q V	|	|	|	|
4+40	0.0299	0.13	Q V	|	|	|	|
4+45	0.0308	0.13	Q V	|	|	|	|
4+50	0.0317	0.14	Q V	|	|	|	|
4+55	0.0327	0.14	Q V	|	|	|	|
5+ 0	0.0337	0.14	Q V	|	|	|	|
5+ 5	0.0345	0.12	Q V	|	|	|	|
5+10	0.0353	0.11	Q V	|	|	|	|
5+15	0.0360	0.11	Q V	|	|	|	|
5+20	0.0369	0.12	Q V	|	|	|	|
5+25	0.0377	0.13	Q V	|	|	|	|
5+30	0.0386	0.13	Q V	|	|	|	|
5+35	0.0395	0.14	Q V	|	|	|	|
5+40	0.0405	0.14	Q V	|	|	|	|
5+45	0.0415	0.14	Q V	|	|	|	|
5+50	0.0425	0.14	Q V	|	|	|	|
5+55	0.0435	0.14	Q V	|	|	|	|
6+ 0	0.0445	0.14	Q V	|	|	|	|
6+ 5	0.0455	0.16	Q V	|	|	|	|
6+10	0.0466	0.16	Q V	|	|	|	|
6+15	0.0478	0.16	Q V	|	|	|	|
6+20	0.0489	0.16	Q V	|	|	|	|
6+25	0.0500	0.16	Q V	|	|	|	|
6+30	0.0511	0.16	Q V	|	|	|	|
6+35	0.0523	0.17	Q V	|	|	|	|
6+40	0.0535	0.18	Q V	|	|	|	|
6+45	0.0548	0.18	Q V	|	|	|	|
6+50	0.0560	0.18	Q V	|	|	|	|
6+55	0.0572	0.18	Q V	|	|	|	|
7+ 0	0.0585	0.18	Q V	|	|	|	|
7+ 5	0.0597	0.18	Q V	|	|	|	|

7+10	0.0609	0.18	Q	V			
7+15	0.0622	0.18	Q	V			
7+20	0.0635	0.19	Q	V			
7+25	0.0648	0.20	Q	V			
7+30	0.0662	0.20	Q	V			
7+35	0.0676	0.21	Q	V			
7+40	0.0691	0.21	Q	V			
7+45	0.0706	0.22	Q	V			
7+50	0.0722	0.23	Q	V			
7+55	0.0738	0.23	Q	V			
8+ 0	0.0754	0.23	Q	V			
8+ 5	0.0771	0.26	Q	V			
8+10	0.0790	0.27	Q	V			
8+15	0.0808	0.27	Q	V			
8+20	0.0827	0.27	Q	V			
8+25	0.0845	0.27	Q	V			
8+30	0.0864	0.27	Q	V			
8+35	0.0883	0.28	Q	V			
8+40	0.0903	0.29	Q	V			
8+45	0.0923	0.29	Q	V			
8+50	0.0943	0.30	Q	V			
8+55	0.0964	0.30	Q	V			
9+ 0	0.0985	0.31	Q	V			
9+ 5	0.1008	0.33	Q	V			
9+10	0.1031	0.34	Q	V			
9+15	0.1055	0.34	Q	V			
9+20	0.1079	0.35	Q	V			
9+25	0.1104	0.36	Q	V			
9+30	0.1128	0.36	Q	V			
9+35	0.1154	0.37	Q	V			
9+40	0.1180	0.38	Q	V			
9+45	0.1206	0.38	Q	V			
9+50	0.1233	0.39	Q	V			
9+55	0.1260	0.39	Q	V			
10+ 0	0.1287	0.39	Q	V			
10+ 5	0.1308	0.31	Q	V			
10+10	0.1327	0.27	Q	V			
10+15	0.1346	0.27	Q	V			
10+20	0.1364	0.27	Q	V			
10+25	0.1383	0.27	Q	V			
10+30	0.1401	0.27	Q	V			
10+35	0.1424	0.33	Q	V			
10+40	0.1448	0.36	Q	V			
10+45	0.1473	0.36	Q	V			
10+50	0.1498	0.36	Q	V			
10+55	0.1523	0.36	Q	V			
11+ 0	0.1547	0.36	Q	V			
11+ 5	0.1571	0.35	Q	V			
11+10	0.1595	0.34	Q	V			
11+15	0.1618	0.34	Q	V			
11+20	0.1642	0.34	Q	V			
11+25	0.1665	0.34	Q	V			
11+30	0.1689	0.34	Q	V			
11+35	0.1711	0.32	Q	V			
11+40	0.1732	0.31	Q	V			
11+45	0.1753	0.31	Q	V			
11+50	0.1774	0.32	Q	V			
11+55	0.1797	0.32	Q	V			
12+ 0	0.1819	0.32	Q	V			
12+ 5	0.1847	0.40	Q	V			
12+10	0.1877	0.44	Q	V			
12+15	0.1908	0.45	Q	V			
12+20	0.1940	0.46	Q	V			
12+25	0.1972	0.47	Q	V			
12+30	0.2004	0.47	Q	V			
12+35	0.2038	0.49	Q	V			
12+40	0.2072	0.50	Q	V			
12+45	0.2107	0.50	Q	V			
12+50	0.2142	0.51	Q	V			
12+55	0.2178	0.52	Q	V			
13+ 0	0.2214	0.52	Q	V			

13+ 5	0.2254	0.58	Q			V		
13+10	0.2296	0.61	Q			V		
13+15	0.2338	0.61	Q			V		
13+20	0.2380	0.61	Q			V		
13+25	0.2422	0.61	Q			V		
13+30	0.2464	0.61	Q			V		
13+35	0.2497	0.48	Q			V		
13+40	0.2526	0.42	Q			V		
13+45	0.2554	0.41	Q			V		
13+50	0.2583	0.41	Q			V		
13+55	0.2611	0.41	Q			V		
14+ 0	0.2639	0.41	Q			V		
14+ 5	0.2671	0.46	Q			V		
14+10	0.2704	0.48	Q			V		
14+15	0.2738	0.48	Q			V		
14+20	0.2770	0.47	Q			V		
14+25	0.2802	0.47	Q			V		
14+30	0.2834	0.47	Q			V		
14+35	0.2867	0.47	Q			V		
14+40	0.2899	0.47	Q			V		
14+45	0.2931	0.47	Q			V		
14+50	0.2962	0.46	Q			V		
14+55	0.2993	0.45	Q			V		
15+ 0	0.3024	0.45	Q			V		
15+ 5	0.3054	0.44	Q			V		
15+10	0.3084	0.43	Q			V		
15+15	0.3113	0.43	Q			V		
15+20	0.3142	0.42	Q			V		
15+25	0.3171	0.41	Q			V		
15+30	0.3199	0.41	Q			V		
15+35	0.3224	0.37	Q			V		
15+40	0.3248	0.34	Q			V		
15+45	0.3272	0.34	Q			V		
15+50	0.3295	0.34	Q			V		
15+55	0.3319	0.34	Q			V		
16+ 0	0.3342	0.34	Q			V		
16+ 5	0.3354	0.17	Q			V		
16+10	0.3359	0.08	Q			V		
16+15	0.3364	0.07	Q			V		
16+20	0.3369	0.07	Q			V		
16+25	0.3374	0.07	Q			V		
16+30	0.3379	0.07	Q			V		
16+35	0.3383	0.06	Q			V		
16+40	0.3387	0.05	Q			V		
16+45	0.3391	0.05	Q			V		
16+50	0.3394	0.05	Q			V		
16+55	0.3398	0.05	Q			V		
17+ 0	0.3402	0.05	Q			V		
17+ 5	0.3407	0.08	Q			V		
17+10	0.3413	0.09	Q			V		
17+15	0.3419	0.09	Q			V		
17+20	0.3425	0.09	Q			V		
17+25	0.3432	0.09	Q			V		
17+30	0.3438	0.09	Q			V		
17+35	0.3444	0.09	Q			V		
17+40	0.3450	0.09	Q			V		
17+45	0.3456	0.09	Q			V		
17+50	0.3462	0.08	Q			V		
17+55	0.3467	0.07	Q			V		
18+ 0	0.3472	0.07	Q			V		
18+ 5	0.3477	0.07	Q			V		
18+10	0.3481	0.07	Q			V		
18+15	0.3486	0.07	Q			V		
18+20	0.3491	0.07	Q			V		
18+25	0.3496	0.07	Q			V		
18+30	0.3501	0.07	Q			V		
18+35	0.3505	0.06	Q			V		
18+40	0.3509	0.05	Q			V		
18+45	0.3513	0.05	Q			V		
18+50	0.3516	0.04	Q			V		
18+55	0.3518	0.04	Q			V		

19+ 0	0.3521	0.04	Q				V
19+ 5	0.3524	0.05	Q				V
19+10	0.3528	0.05	Q				V
19+15	0.3531	0.05	Q				V
19+20	0.3536	0.07	Q				V
19+25	0.3541	0.07	Q				V
19+30	0.3546	0.07	Q				V
19+35	0.3550	0.06	Q				V
19+40	0.3554	0.05	Q				V
19+45	0.3557	0.05	Q				V
19+50	0.3560	0.04	Q				V
19+55	0.3563	0.04	Q				V
20+ 0	0.3565	0.04	Q				V
20+ 5	0.3568	0.05	Q				V
20+10	0.3572	0.05	Q				V
20+15	0.3576	0.05	Q				V
20+20	0.3580	0.05	Q				V
20+25	0.3583	0.05	Q				V
20+30	0.3587	0.05	Q				V
20+35	0.3591	0.05	Q				V
20+40	0.3594	0.05	Q				V
20+45	0.3598	0.05	Q				V
20+50	0.3601	0.04	Q				V
20+55	0.3604	0.04	Q				V
21+ 0	0.3606	0.04	Q				V
21+ 5	0.3609	0.05	Q				V
21+10	0.3613	0.05	Q				V
21+15	0.3617	0.05	Q				V
21+20	0.3620	0.04	Q				V
21+25	0.3622	0.04	Q				V
21+30	0.3625	0.04	Q				V
21+35	0.3628	0.05	Q				V
21+40	0.3631	0.05	Q				V
21+45	0.3635	0.05	Q				V
21+50	0.3638	0.04	Q				V
21+55	0.3641	0.04	Q				V
22+ 0	0.3643	0.04	Q				V
22+ 5	0.3646	0.05	Q				V
22+10	0.3650	0.05	Q				V
22+15	0.3654	0.05	Q				V
22+20	0.3657	0.04	Q				V
22+25	0.3659	0.04	Q				V
22+30	0.3662	0.04	Q				V
22+35	0.3664	0.04	Q				V
22+40	0.3667	0.04	Q				V
22+45	0.3669	0.04	Q				V
22+50	0.3672	0.04	Q				V
22+55	0.3674	0.04	Q				V
23+ 0	0.3676	0.04	Q				V
23+ 5	0.3679	0.04	Q				V
23+10	0.3681	0.04	Q				V
23+15	0.3684	0.04	Q				V
23+20	0.3686	0.04	Q				V
23+25	0.3689	0.04	Q				V
23+30	0.3691	0.04	Q				V
23+35	0.3694	0.04	Q				V
23+40	0.3696	0.04	Q				V
23+45	0.3699	0.04	Q				V
23+50	0.3701	0.04	Q				V
23+55	0.3704	0.04	Q				V
24+ 0	0.3706	0.04	Q				V
24+ 5	0.3707	0.01	Q				V
24+10	0.3707	0.00	Q				V

Post-Project Unit Hydrograph Calculations
Area “B” – 2-year, 24-hour Storm Duration

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

Study date 03/26/21 File: ARBP242.out

++

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

Program License Serial Number 6279

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

English Units used in output format

SADDLEBACK INDUSTRIAL POST-PROJECT CONDITION HYDROLOGY
UNIT HYDROGRAPH ANALYSIS, 2-YEAR STORM EVENT
FILENAME: ARBP

Drainage Area = 3.21(Ac.) = 0.005 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 3.21(Ac.) = 0.005 Sq. Mi.
Length along longest watercourse = 468.00(Ft.)
Length along longest watercourse measured to centroid = 197.00(Ft.)
Length along longest watercourse = 0.089 Mi.
Length along longest watercourse measured to centroid = 0.037 Mi.
Difference in elevation = 11.20(Ft.)
Slope along watercourse = 126.3590 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.016 Hr.
Lag time = 0.98 Min.
25% of lag time = 0.25 Min.
40% of lag time = 0.39 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]
3.21	2.50	8.03

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
3.21	6.50	20.86

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.500(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
3.210	56.86	0.900

Total Area Entered = 3.21(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
56.9	36.9	0.698	0.900	0.133	1.000	0.133
					Sum (F) =	0.133

Area averaged mean soil loss (F) (In/Hr) = 0.133
Minimum soil loss rate ((In/Hr)) = 0.066
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	508.666	71.348	2.308
2	0.167	1017.332	28.652	0.927
			Sum = 100.000 Sum=	3.235

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 (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.235)	0.004	0.016
2	0.17	0.07	0.020	(0.234)	0.004	0.016
3	0.25	0.07	0.020	(0.233)	0.004	0.016
4	0.33	0.10	0.030	(0.232)	0.005	0.025
5	0.42	0.10	0.030	(0.232)	0.005	0.025
6	0.50	0.10	0.030	(0.231)	0.005	0.025
7	0.58	0.10	0.030	(0.230)	0.005	0.025
8	0.67	0.10	0.030	(0.229)	0.005	0.025
9	0.75	0.10	0.030	(0.228)	0.005	0.025
10	0.83	0.13	0.040	(0.227)	0.007	0.033
11	0.92	0.13	0.040	(0.226)	0.007	0.033
12	1.00	0.13	0.040	(0.225)	0.007	0.033
13	1.08	0.10	0.030	(0.224)	0.005	0.025
14	1.17	0.10	0.030	(0.224)	0.005	0.025
15	1.25	0.10	0.030	(0.223)	0.005	0.025
16	1.33	0.10	0.030	(0.222)	0.005	0.025
17	1.42	0.10	0.030	(0.221)	0.005	0.025
18	1.50	0.10	0.030	(0.220)	0.005	0.025
19	1.58	0.10	0.030	(0.219)	0.005	0.025
20	1.67	0.10	0.030	(0.218)	0.005	0.025
21	1.75	0.10	0.030	(0.217)	0.005	0.025
22	1.83	0.13	0.040	(0.216)	0.007	0.033
23	1.92	0.13	0.040	(0.216)	0.007	0.033
24	2.00	0.13	0.040	(0.215)	0.007	0.033
25	2.08	0.13	0.040	(0.214)	0.007	0.033
26	2.17	0.13	0.040	(0.213)	0.007	0.033
27	2.25	0.13	0.040	(0.212)	0.007	0.033
28	2.33	0.13	0.040	(0.211)	0.007	0.033
29	2.42	0.13	0.040	(0.210)	0.007	0.033
30	2.50	0.13	0.040	(0.210)	0.007	0.033
31	2.58	0.17	0.050	(0.209)	0.009	0.041
32	2.67	0.17	0.050	(0.208)	0.009	0.041
33	2.75	0.17	0.050	(0.207)	0.009	0.041
34	2.83	0.17	0.050	(0.206)	0.009	0.041
35	2.92	0.17	0.050	(0.205)	0.009	0.041
36	3.00	0.17	0.050	(0.204)	0.009	0.041
37	3.08	0.17	0.050	(0.204)	0.009	0.041
38	3.17	0.17	0.050	(0.203)	0.009	0.041
39	3.25	0.17	0.050	(0.202)	0.009	0.041
40	3.33	0.17	0.050	(0.201)	0.009	0.041

41	3.42	0.17	0.050	(0.200)	0.009	0.041
42	3.50	0.17	0.050	(0.199)	0.009	0.041
43	3.58	0.17	0.050	(0.199)	0.009	0.041
44	3.67	0.17	0.050	(0.198)	0.009	0.041
45	3.75	0.17	0.050	(0.197)	0.009	0.041
46	3.83	0.20	0.060	(0.196)	0.011	0.049
47	3.92	0.20	0.060	(0.195)	0.011	0.049
48	4.00	0.20	0.060	(0.194)	0.011	0.049
49	4.08	0.20	0.060	(0.194)	0.011	0.049
50	4.17	0.20	0.060	(0.193)	0.011	0.049
51	4.25	0.20	0.060	(0.192)	0.011	0.049
52	4.33	0.23	0.070	(0.191)	0.013	0.057
53	4.42	0.23	0.070	(0.190)	0.013	0.057
54	4.50	0.23	0.070	(0.189)	0.013	0.057
55	4.58	0.23	0.070	(0.189)	0.013	0.057
56	4.67	0.23	0.070	(0.188)	0.013	0.057
57	4.75	0.23	0.070	(0.187)	0.013	0.057
58	4.83	0.27	0.080	(0.186)	0.014	0.066
59	4.92	0.27	0.080	(0.185)	0.014	0.066
60	5.00	0.27	0.080	(0.185)	0.014	0.066
61	5.08	0.20	0.060	(0.184)	0.011	0.049
62	5.17	0.20	0.060	(0.183)	0.011	0.049
63	5.25	0.20	0.060	(0.182)	0.011	0.049
64	5.33	0.23	0.070	(0.181)	0.013	0.057
65	5.42	0.23	0.070	(0.181)	0.013	0.057
66	5.50	0.23	0.070	(0.180)	0.013	0.057
67	5.58	0.27	0.080	(0.179)	0.014	0.066
68	5.67	0.27	0.080	(0.178)	0.014	0.066
69	5.75	0.27	0.080	(0.177)	0.014	0.066
70	5.83	0.27	0.080	(0.177)	0.014	0.066
71	5.92	0.27	0.080	(0.176)	0.014	0.066
72	6.00	0.27	0.080	(0.175)	0.014	0.066
73	6.08	0.30	0.090	(0.174)	0.016	0.074
74	6.17	0.30	0.090	(0.174)	0.016	0.074
75	6.25	0.30	0.090	(0.173)	0.016	0.074
76	6.33	0.30	0.090	(0.172)	0.016	0.074
77	6.42	0.30	0.090	(0.171)	0.016	0.074
78	6.50	0.30	0.090	(0.170)	0.016	0.074
79	6.58	0.33	0.100	(0.170)	0.018	0.082
80	6.67	0.33	0.100	(0.169)	0.018	0.082
81	6.75	0.33	0.100	(0.168)	0.018	0.082
82	6.83	0.33	0.100	(0.167)	0.018	0.082
83	6.92	0.33	0.100	(0.167)	0.018	0.082
84	7.00	0.33	0.100	(0.166)	0.018	0.082
85	7.08	0.33	0.100	(0.165)	0.018	0.082
86	7.17	0.33	0.100	(0.164)	0.018	0.082
87	7.25	0.33	0.100	(0.164)	0.018	0.082
88	7.33	0.37	0.110	(0.163)	0.020	0.090
89	7.42	0.37	0.110	(0.162)	0.020	0.090
90	7.50	0.37	0.110	(0.161)	0.020	0.090
91	7.58	0.40	0.120	(0.161)	0.022	0.098
92	7.67	0.40	0.120	(0.160)	0.022	0.098
93	7.75	0.40	0.120	(0.159)	0.022	0.098
94	7.83	0.43	0.130	(0.158)	0.023	0.107
95	7.92	0.43	0.130	(0.158)	0.023	0.107
96	8.00	0.43	0.130	(0.157)	0.023	0.107
97	8.08	0.50	0.150	(0.156)	0.027	0.123
98	8.17	0.50	0.150	(0.156)	0.027	0.123
99	8.25	0.50	0.150	(0.155)	0.027	0.123
100	8.33	0.50	0.150	(0.154)	0.027	0.123
101	8.42	0.50	0.150	(0.153)	0.027	0.123
102	8.50	0.50	0.150	(0.153)	0.027	0.123
103	8.58	0.53	0.160	(0.152)	0.029	0.131
104	8.67	0.53	0.160	(0.151)	0.029	0.131
105	8.75	0.53	0.160	(0.151)	0.029	0.131
106	8.83	0.57	0.170	(0.150)	0.031	0.139
107	8.92	0.57	0.170	(0.149)	0.031	0.139
108	9.00	0.57	0.170	(0.148)	0.031	0.139
109	9.08	0.63	0.190	(0.148)	0.034	0.156
110	9.17	0.63	0.190	(0.147)	0.034	0.156
111	9.25	0.63	0.190	(0.146)	0.034	0.156

112	9.33	0.67	0.200	(0.146)	0.036	0.164
113	9.42	0.67	0.200	(0.145)	0.036	0.164
114	9.50	0.67	0.200	(0.144)	0.036	0.164
115	9.58	0.70	0.210	(0.144)	0.038	0.172
116	9.67	0.70	0.210	(0.143)	0.038	0.172
117	9.75	0.70	0.210	(0.142)	0.038	0.172
118	9.83	0.73	0.220	(0.141)	0.040	0.180
119	9.92	0.73	0.220	(0.141)	0.040	0.180
120	10.00	0.73	0.220	(0.140)	0.040	0.180
121	10.08	0.50	0.150	(0.139)	0.027	0.123
122	10.17	0.50	0.150	(0.139)	0.027	0.123
123	10.25	0.50	0.150	(0.138)	0.027	0.123
124	10.33	0.50	0.150	(0.137)	0.027	0.123
125	10.42	0.50	0.150	(0.137)	0.027	0.123
126	10.50	0.50	0.150	(0.136)	0.027	0.123
127	10.58	0.67	0.200	(0.135)	0.036	0.164
128	10.67	0.67	0.200	(0.135)	0.036	0.164
129	10.75	0.67	0.200	(0.134)	0.036	0.164
130	10.83	0.67	0.200	(0.133)	0.036	0.164
131	10.92	0.67	0.200	(0.133)	0.036	0.164
132	11.00	0.67	0.200	(0.132)	0.036	0.164
133	11.08	0.63	0.190	(0.131)	0.034	0.156
134	11.17	0.63	0.190	(0.131)	0.034	0.156
135	11.25	0.63	0.190	(0.130)	0.034	0.156
136	11.33	0.63	0.190	(0.130)	0.034	0.156
137	11.42	0.63	0.190	(0.129)	0.034	0.156
138	11.50	0.63	0.190	(0.128)	0.034	0.156
139	11.58	0.57	0.170	(0.128)	0.031	0.139
140	11.67	0.57	0.170	(0.127)	0.031	0.139
141	11.75	0.57	0.170	(0.126)	0.031	0.139
142	11.83	0.60	0.180	(0.126)	0.032	0.148
143	11.92	0.60	0.180	(0.125)	0.032	0.148
144	12.00	0.60	0.180	(0.124)	0.032	0.148
145	12.08	0.83	0.250	(0.124)	0.045	0.205
146	12.17	0.83	0.250	(0.123)	0.045	0.205
147	12.25	0.83	0.250	(0.123)	0.045	0.205
148	12.33	0.87	0.260	(0.122)	0.047	0.213
149	12.42	0.87	0.260	(0.121)	0.047	0.213
150	12.50	0.87	0.260	(0.121)	0.047	0.213
151	12.58	0.93	0.280	(0.120)	0.050	0.230
152	12.67	0.93	0.280	(0.120)	0.050	0.230
153	12.75	0.93	0.280	(0.119)	0.050	0.230
154	12.83	0.97	0.290	(0.118)	0.052	0.238
155	12.92	0.97	0.290	(0.118)	0.052	0.238
156	13.00	0.97	0.290	(0.117)	0.052	0.238
157	13.08	1.13	0.340	(0.117)	0.061	0.279
158	13.17	1.13	0.340	(0.116)	0.061	0.279
159	13.25	1.13	0.340	(0.115)	0.061	0.279
160	13.33	1.13	0.340	(0.115)	0.061	0.279
161	13.42	1.13	0.340	(0.114)	0.061	0.279
162	13.50	1.13	0.340	(0.114)	0.061	0.279
163	13.58	0.77	0.230	(0.113)	0.041	0.189
164	13.67	0.77	0.230	(0.112)	0.041	0.189
165	13.75	0.77	0.230	(0.112)	0.041	0.189
166	13.83	0.77	0.230	(0.111)	0.041	0.189
167	13.92	0.77	0.230	(0.111)	0.041	0.189
168	14.00	0.77	0.230	(0.110)	0.041	0.189
169	14.08	0.90	0.270	(0.110)	0.049	0.221
170	14.17	0.90	0.270	(0.109)	0.049	0.221
171	14.25	0.90	0.270	(0.109)	0.049	0.221
172	14.33	0.87	0.260	(0.108)	0.047	0.213
173	14.42	0.87	0.260	(0.107)	0.047	0.213
174	14.50	0.87	0.260	(0.107)	0.047	0.213
175	14.58	0.87	0.260	(0.106)	0.047	0.213
176	14.67	0.87	0.260	(0.106)	0.047	0.213
177	14.75	0.87	0.260	(0.105)	0.047	0.213
178	14.83	0.83	0.250	(0.105)	0.045	0.205
179	14.92	0.83	0.250	(0.104)	0.045	0.205
180	15.00	0.83	0.250	(0.104)	0.045	0.205
181	15.08	0.80	0.240	(0.103)	0.043	0.197
182	15.17	0.80	0.240	(0.103)	0.043	0.197

183	15.25	0.80	0.240	(0.102)	0.043	0.197
184	15.33	0.77	0.230	(0.102)	0.041	0.189
185	15.42	0.77	0.230	(0.101)	0.041	0.189
186	15.50	0.77	0.230	(0.100)	0.041	0.189
187	15.58	0.63	0.190	(0.100)	0.034	0.156
188	15.67	0.63	0.190	(0.099)	0.034	0.156
189	15.75	0.63	0.190	(0.099)	0.034	0.156
190	15.83	0.63	0.190	(0.098)	0.034	0.156
191	15.92	0.63	0.190	(0.098)	0.034	0.156
192	16.00	0.63	0.190	(0.097)	0.034	0.156
193	16.08	0.13	0.040	(0.097)	0.007	0.033
194	16.17	0.13	0.040	(0.096)	0.007	0.033
195	16.25	0.13	0.040	(0.096)	0.007	0.033
196	16.33	0.13	0.040	(0.095)	0.007	0.033
197	16.42	0.13	0.040	(0.095)	0.007	0.033
198	16.50	0.13	0.040	(0.094)	0.007	0.033
199	16.58	0.10	0.030	(0.094)	0.005	0.025
200	16.67	0.10	0.030	(0.094)	0.005	0.025
201	16.75	0.10	0.030	(0.093)	0.005	0.025
202	16.83	0.10	0.030	(0.093)	0.005	0.025
203	16.92	0.10	0.030	(0.092)	0.005	0.025
204	17.00	0.10	0.030	(0.092)	0.005	0.025
205	17.08	0.17	0.050	(0.091)	0.009	0.041
206	17.17	0.17	0.050	(0.091)	0.009	0.041
207	17.25	0.17	0.050	(0.090)	0.009	0.041
208	17.33	0.17	0.050	(0.090)	0.009	0.041
209	17.42	0.17	0.050	(0.089)	0.009	0.041
210	17.50	0.17	0.050	(0.089)	0.009	0.041
211	17.58	0.17	0.050	(0.088)	0.009	0.041
212	17.67	0.17	0.050	(0.088)	0.009	0.041
213	17.75	0.17	0.050	(0.088)	0.009	0.041
214	17.83	0.13	0.040	(0.087)	0.007	0.033
215	17.92	0.13	0.040	(0.087)	0.007	0.033
216	18.00	0.13	0.040	(0.086)	0.007	0.033
217	18.08	0.13	0.040	(0.086)	0.007	0.033
218	18.17	0.13	0.040	(0.085)	0.007	0.033
219	18.25	0.13	0.040	(0.085)	0.007	0.033
220	18.33	0.13	0.040	(0.085)	0.007	0.033
221	18.42	0.13	0.040	(0.084)	0.007	0.033
222	18.50	0.13	0.040	(0.084)	0.007	0.033
223	18.58	0.10	0.030	(0.083)	0.005	0.025
224	18.67	0.10	0.030	(0.083)	0.005	0.025
225	18.75	0.10	0.030	(0.083)	0.005	0.025
226	18.83	0.07	0.020	(0.082)	0.004	0.016
227	18.92	0.07	0.020	(0.082)	0.004	0.016
228	19.00	0.07	0.020	(0.081)	0.004	0.016
229	19.08	0.10	0.030	(0.081)	0.005	0.025
230	19.17	0.10	0.030	(0.081)	0.005	0.025
231	19.25	0.10	0.030	(0.080)	0.005	0.025
232	19.33	0.13	0.040	(0.080)	0.007	0.033
233	19.42	0.13	0.040	(0.080)	0.007	0.033
234	19.50	0.13	0.040	(0.079)	0.007	0.033
235	19.58	0.10	0.030	(0.079)	0.005	0.025
236	19.67	0.10	0.030	(0.078)	0.005	0.025
237	19.75	0.10	0.030	(0.078)	0.005	0.025
238	19.83	0.07	0.020	(0.078)	0.004	0.016
239	19.92	0.07	0.020	(0.077)	0.004	0.016
240	20.00	0.07	0.020	(0.077)	0.004	0.016
241	20.08	0.10	0.030	(0.077)	0.005	0.025
242	20.17	0.10	0.030	(0.076)	0.005	0.025
243	20.25	0.10	0.030	(0.076)	0.005	0.025
244	20.33	0.10	0.030	(0.076)	0.005	0.025
245	20.42	0.10	0.030	(0.075)	0.005	0.025
246	20.50	0.10	0.030	(0.075)	0.005	0.025
247	20.58	0.10	0.030	(0.075)	0.005	0.025
248	20.67	0.10	0.030	(0.074)	0.005	0.025
249	20.75	0.10	0.030	(0.074)	0.005	0.025
250	20.83	0.07	0.020	(0.074)	0.004	0.016
251	20.92	0.07	0.020	(0.074)	0.004	0.016
252	21.00	0.07	0.020	(0.073)	0.004	0.016
253	21.08	0.10	0.030	(0.073)	0.005	0.025

```
254  21.17     0.10      0.030       (  0.073)       0.005        0.025
255  21.25     0.10      0.030       (  0.072)       0.005        0.025
256  21.33     0.07      0.020       (  0.072)       0.004        0.016
257  21.42     0.07      0.020       (  0.072)       0.004        0.016
258  21.50     0.07      0.020       (  0.072)       0.004        0.016
259  21.58     0.10      0.030       (  0.071)       0.005        0.025
260  21.67     0.10      0.030       (  0.071)       0.005        0.025
261  21.75     0.10      0.030       (  0.071)       0.005        0.025
262  21.83     0.07      0.020       (  0.071)       0.004        0.016
263  21.92     0.07      0.020       (  0.070)       0.004        0.016
264  22.00     0.07      0.020       (  0.070)       0.004        0.016
265  22.08     0.10      0.030       (  0.070)       0.005        0.025
266  22.17     0.10      0.030       (  0.070)       0.005        0.025
267  22.25     0.10      0.030       (  0.069)       0.005        0.025
268  22.33     0.07      0.020       (  0.069)       0.004        0.016
269  22.42     0.07      0.020       (  0.069)       0.004        0.016
270  22.50     0.07      0.020       (  0.069)       0.004        0.016
271  22.58     0.07      0.020       (  0.069)       0.004        0.016
272  22.67     0.07      0.020       (  0.068)       0.004        0.016
273  22.75     0.07      0.020       (  0.068)       0.004        0.016
274  22.83     0.07      0.020       (  0.068)       0.004        0.016
275  22.92     0.07      0.020       (  0.068)       0.004        0.016
276  23.00     0.07      0.020       (  0.068)       0.004        0.016
277  23.08     0.07      0.020       (  0.067)       0.004        0.016
278  23.17     0.07      0.020       (  0.067)       0.004        0.016
279  23.25     0.07      0.020       (  0.067)       0.004        0.016
280  23.33     0.07      0.020       (  0.067)       0.004        0.016
281  23.42     0.07      0.020       (  0.067)       0.004        0.016
282  23.50     0.07      0.020       (  0.067)       0.004        0.016
283  23.58     0.07      0.020       (  0.067)       0.004        0.016
284  23.67     0.07      0.020       (  0.067)       0.004        0.016
285  23.75     0.07      0.020       (  0.067)       0.004        0.016
286  23.83     0.07      0.020       (  0.066)       0.004        0.016
287  23.92     0.07      0.020       (  0.066)       0.004        0.016
288  24.00     0.07      0.020       (  0.066)       0.004        0.016
               (Loss Rate Not Used)
    Sum =     100.0                                    Sum =    24.6
      Flood volume = Effective rainfall      2.05(In)
       times area       3.2(Ac.)/[(In)/(Ft.)] =       0.5(Ac.Ft)
      Total soil loss =      0.45(In)
      Total soil loss =     0.120(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =       23887.1 Cubic Feet
      Total soil loss =        5243.5 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.902(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       0.0003      0.04  Q         |         |         |         |
   0+10       0.0006      0.05  Q         |         |         |         |
   0+15       0.0010      0.05  Q         |         |         |         |
   0+20       0.0015      0.07  Q         |         |         |         |
   0+25       0.0020      0.08  Q         |         |         |         |
   0+30       0.0026      0.08  Q         |         |         |         |
   0+35       0.0031      0.08  Q         |         |         |         |
   0+40       0.0037      0.08  Q         |         |         |         |
   0+45       0.0042      0.08  Q         |         |         |         |
   0+50       0.0049      0.10  Q         |         |         |         |
   0+55       0.0056      0.11  Q         |         |         |         |
   1+ 0       0.0064      0.11  Q         |         |         |         |
   1+ 5       0.0070      0.09  Q         |         |         |         |
   1+10       0.0075      0.08  Q         |         |         |         |
   1+15       0.0081      0.08  Q         |         |         |         |
```

1+20	0.0086	0.08	Q	|	|	|	|
1+25	0.0092	0.08	Q	|	|	|	|
1+30	0.0097	0.08	Q	|	|	|	|
1+35	0.0103	0.08	Q	|	|	|	|
1+40	0.0108	0.08	Q	|	|	|	|
1+45	0.0114	0.08	Q	|	|	|	|
1+50	0.0120	0.10	Q	|	|	|	|
1+55	0.0128	0.11	Q	|	|	|	|
2+ 0	0.0135	0.11	Q	|	|	|	|
2+ 5	0.0142	0.11	QV	|	|	|	|
2+10	0.0150	0.11	QV	|	|	|	|
2+15	0.0157	0.11	QV	|	|	|	|
2+20	0.0164	0.11	QV	|	|	|	|
2+25	0.0172	0.11	QV	|	|	|	|
2+30	0.0179	0.11	QV	|	|	|	|
2+35	0.0187	0.13	QV	|	|	|	|
2+40	0.0197	0.13	QV	|	|	|	|
2+45	0.0206	0.13	QV	|	|	|	|
2+50	0.0215	0.13	QV	|	|	|	|
2+55	0.0224	0.13	QV	|	|	|	|
3+ 0	0.0233	0.13	QV	|	|	|	|
3+ 5	0.0242	0.13	QV	|	|	|	|
3+10	0.0251	0.13	QV	|	|	|	|
3+15	0.0261	0.13	QV	|	|	|	|
3+20	0.0270	0.13	QV	|	|	|	|
3+25	0.0279	0.13	Q V	|	|	|	|
3+30	0.0288	0.13	Q V	|	|	|	|
3+35	0.0297	0.13	Q V	|	|	|	|
3+40	0.0306	0.13	Q V	|	|	|	|
3+45	0.0315	0.13	Q V	|	|	|	|
3+50	0.0326	0.15	Q V	|	|	|	|
3+55	0.0337	0.16	Q V	|	|	|	|
4+ 0	0.0348	0.16	Q V	|	|	|	|
4+ 5	0.0359	0.16	Q V	|	|	|	|
4+10	0.0370	0.16	Q V	|	|	|	|
4+15	0.0381	0.16	Q V	|	|	|	|
4+20	0.0393	0.18	Q V	|	|	|	|
4+25	0.0406	0.19	Q V	|	|	|	|
4+30	0.0419	0.19	Q V	|	|	|	|
4+35	0.0431	0.19	Q V	|	|	|	|
4+40	0.0444	0.19	Q V	|	|	|	|
4+45	0.0457	0.19	Q V	|	|	|	|
4+50	0.0471	0.20	Q V	|	|	|	|
4+55	0.0486	0.21	Q V	|	|	|	|
5+ 0	0.0500	0.21	Q V	|	|	|	|
5+ 5	0.0512	0.17	Q V	|	|	|	|
5+10	0.0523	0.16	Q V	|	|	|	|
5+15	0.0534	0.16	Q V	|	|	|	|
5+20	0.0547	0.18	Q V	|	|	|	|
5+25	0.0559	0.19	Q V	|	|	|	|
5+30	0.0572	0.19	Q V	|	|	|	|
5+35	0.0586	0.20	Q V	|	|	|	|
5+40	0.0601	0.21	Q V	|	|	|	|
5+45	0.0615	0.21	Q V	|	|	|	|
5+50	0.0630	0.21	Q V	|	|	|	|
5+55	0.0645	0.21	Q V	|	|	|	|
6+ 0	0.0659	0.21	Q V	|	|	|	|
6+ 5	0.0675	0.23	Q V	|	|	|	|
6+10	0.0692	0.24	Q V	|	|	|	|
6+15	0.0708	0.24	Q V	|	|	|	|
6+20	0.0725	0.24	Q V	|	|	|	|
6+25	0.0741	0.24	Q V	|	|	|	|
6+30	0.0758	0.24	Q V	|	|	|	|
6+35	0.0775	0.26	|Q V	|	|	|	|
6+40	0.0794	0.27	|Q V	|	|	|	|
6+45	0.0812	0.27	|Q V	|	|	|	|
6+50	0.0830	0.27	|Q V	|	|	|	|
6+55	0.0848	0.27	|Q V	|	|	|	|
7+ 0	0.0867	0.27	|Q V	|	|	|	|
7+ 5	0.0885	0.27	|Q V	|	|	|	|
7+10	0.0903	0.27	|Q V	|	|	|	|

7+15	0.0922	0.27	Q V				
7+20	0.0941	0.28	Q V				
7+25	0.0961	0.29	Q V				
7+30	0.0981	0.29	Q V				
7+35	0.1003	0.31	Q V				
7+40	0.1025	0.32	Q V				
7+45	0.1047	0.32	Q V				
7+50	0.1070	0.34	Q V				
7+55	0.1094	0.35	Q V				
8+ 0	0.1117	0.35	Q V				
8+ 5	0.1144	0.38	Q V				
8+10	0.1171	0.40	Q V				
8+15	0.1199	0.40	Q V				
8+20	0.1226	0.40	Q V				
8+25	0.1253	0.40	Q V				
8+30	0.1281	0.40	Q V				
8+35	0.1310	0.42	Q V				
8+40	0.1339	0.42	Q V				
8+45	0.1368	0.42	Q V				
8+50	0.1399	0.44	Q V				
8+55	0.1430	0.45	Q V				
9+ 0	0.1461	0.45	Q V				
9+ 5	0.1494	0.49	Q V				
9+10	0.1529	0.50	Q V				
9+15	0.1564	0.50	Q V				
9+20	0.1600	0.52	Q V				
9+25	0.1636	0.53	Q V				
9+30	0.1673	0.53	Q V				
9+35	0.1711	0.55	Q V				
9+40	0.1749	0.56	Q V				
9+45	0.1788	0.56	Q V				
9+50	0.1827	0.58	Q V				
9+55	0.1868	0.58	Q V				
10+ 0	0.1908	0.58	Q V				
10+ 5	0.1939	0.45	Q V				
10+10	0.1966	0.40	Q V				
10+15	0.1994	0.40	Q V				
10+20	0.2021	0.40	Q V				
10+25	0.2049	0.40	Q V				
10+30	0.2076	0.40	Q V				
10+35	0.2110	0.49	Q V				
10+40	0.2146	0.53	Q V				
10+45	0.2183	0.53	Q V				
10+50	0.2220	0.53	Q V				
10+55	0.2256	0.53	Q V				
11+ 0	0.2293	0.53	Q V				
11+ 5	0.2328	0.51	Q V				
11+10	0.2363	0.50	Q V				
11+15	0.2397	0.50	Q V				
11+20	0.2432	0.50	Q V				
11+25	0.2467	0.50	Q V				
11+30	0.2502	0.50	Q V				
11+35	0.2534	0.47	Q V				
11+40	0.2565	0.45	Q V				
11+45	0.2596	0.45	Q V				
11+50	0.2628	0.47	Q V				
11+55	0.2661	0.48	Q V				
12+ 0	0.2694	0.48	Q V				
12+ 5	0.2736	0.61	Q V				
12+10	0.2782	0.66	Q V				
12+15	0.2827	0.66	Q V				
12+20	0.2874	0.68	Q V				
12+25	0.2922	0.69	Q V				
12+30	0.2970	0.69	Q V				
12+35	0.3020	0.73	Q V				
12+40	0.3071	0.74	Q V				
12+45	0.3122	0.74	Q V				
12+50	0.3175	0.76	Q V				
12+55	0.3228	0.77	Q V				
13+ 0	0.3281	0.77	Q V				
13+ 5	0.3340	0.86	Q V				

13+10	0.3402	0.90	Q		V		
13+15	0.3464	0.90	Q		V		
13+20	0.3527	0.90	Q		V		
13+25	0.3589	0.90	Q		V		
13+30	0.3651	0.90	Q		V		
13+35	0.3699	0.69	Q		V		
13+40	0.3741	0.61	Q		V		
13+45	0.3783	0.61	Q		V		
13+50	0.3825	0.61	Q		V		
13+55	0.3867	0.61	Q		V		
14+ 0	0.3909	0.61	Q		V		
14+ 5	0.3956	0.69	Q		V		
14+10	0.4005	0.72	Q		V		
14+15	0.4055	0.72	Q		V		
14+20	0.4103	0.70	Q		V		
14+25	0.4150	0.69	Q		V		
14+30	0.4198	0.69	Q		V		
14+35	0.4245	0.69	Q		V		
14+40	0.4293	0.69	Q		V		
14+45	0.4340	0.69	Q		V		
14+50	0.4387	0.67	Q		V		
14+55	0.4432	0.66	Q		V		
15+ 0	0.4478	0.66	Q		V		
15+ 5	0.4522	0.64	Q		V		
15+10	0.4566	0.64	Q		V		
15+15	0.4610	0.64	Q		V		
15+20	0.4653	0.62	Q		V		
15+25	0.4695	0.61	Q		V		
15+30	0.4737	0.61	Q		V		
15+35	0.4774	0.53	Q		V		
15+40	0.4808	0.50	Q		V		
15+45	0.4843	0.50	Q		V		
15+50	0.4878	0.50	Q		V		
15+55	0.4913	0.50	Q		V		
16+ 0	0.4947	0.50	Q		V		
16+ 5	0.4962	0.22	Q		V		
16+10	0.4970	0.11	Q		V		
16+15	0.4977	0.11	Q		V		
16+20	0.4984	0.11	Q		V		
16+25	0.4992	0.11	Q		V		
16+30	0.4999	0.11	Q		V		
16+35	0.5005	0.09	Q		V		
16+40	0.5011	0.08	Q		V		
16+45	0.5016	0.08	Q		V		
16+50	0.5022	0.08	Q		V		
16+55	0.5027	0.08	Q		V		
17+ 0	0.5032	0.08	Q		V		
17+ 5	0.5041	0.12	Q		V		
17+10	0.5050	0.13	Q		V		
17+15	0.5059	0.13	Q		V		
17+20	0.5068	0.13	Q		V		
17+25	0.5077	0.13	Q		V		
17+30	0.5086	0.13	Q		V		
17+35	0.5095	0.13	Q		V		
17+40	0.5105	0.13	Q		V		
17+45	0.5114	0.13	Q		V		
17+50	0.5122	0.11	Q		V		
17+55	0.5129	0.11	Q		V		
18+ 0	0.5136	0.11	Q		V		
18+ 5	0.5143	0.11	Q		V		
18+10	0.5151	0.11	Q		V		
18+15	0.5158	0.11	Q		V		
18+20	0.5165	0.11	Q		V		
18+25	0.5173	0.11	Q		V		
18+30	0.5180	0.11	Q		V		
18+35	0.5186	0.09	Q		V		
18+40	0.5192	0.08	Q		V		
18+45	0.5197	0.08	Q		V		
18+50	0.5201	0.06	Q		V		
18+55	0.5205	0.05	Q		V		
19+ 0	0.5208	0.05	Q		V		

19+ 5	0.5213	0.07	Q	|	|	|	V |
19+10	0.5219	0.08	Q	|	|	|	V |
19+15	0.5224	0.08	Q	|	|	|	V |
19+20	0.5231	0.10	Q	|	|	|	V |
19+25	0.5239	0.11	Q	|	|	|	V |
19+30	0.5246	0.11	Q	|	|	|	V |
19+35	0.5252	0.09	Q	|	|	|	V |
19+40	0.5257	0.08	Q	|	|	|	V |
19+45	0.5263	0.08	Q	|	|	|	V |
19+50	0.5267	0.06	Q	|	|	|	V |
19+55	0.5271	0.05	Q	|	|	|	V |
20+ 0	0.5274	0.05	Q	|	|	|	V |
20+ 5	0.5279	0.07	Q	|	|	|	V |
20+10	0.5285	0.08	Q	|	|	|	V |
20+15	0.5290	0.08	Q	|	|	|	V |
20+20	0.5296	0.08	Q	|	|	|	V |
20+25	0.5301	0.08	Q	|	|	|	V |
20+30	0.5307	0.08	Q	|	|	|	V |
20+35	0.5312	0.08	Q	|	|	|	V |
20+40	0.5318	0.08	Q	|	|	|	V |
20+45	0.5323	0.08	Q	|	|	|	V |
20+50	0.5327	0.06	Q	|	|	|	V |
20+55	0.5331	0.05	Q	|	|	|	V |
21+ 0	0.5335	0.05	Q	|	|	|	V |
21+ 5	0.5340	0.07	Q	|	|	|	V |
21+10	0.5345	0.08	Q	|	|	|	V |
21+15	0.5351	0.08	Q	|	|	|	V|
21+20	0.5355	0.06	Q	|	|	|	V|
21+25	0.5358	0.05	Q	|	|	|	V|
21+30	0.5362	0.05	Q	|	|	|	V|
21+35	0.5367	0.07	Q	|	|	|	V|
21+40	0.5372	0.08	Q	|	|	|	V|
21+45	0.5378	0.08	Q	|	|	|	V|
21+50	0.5382	0.06	Q	|	|	|	V|
21+55	0.5386	0.05	Q	|	|	|	V|
22+ 0	0.5389	0.05	Q	|	|	|	V|
22+ 5	0.5394	0.07	Q	|	|	|	V|
22+10	0.5400	0.08	Q	|	|	|	V|
22+15	0.5405	0.08	Q	|	|	|	V|
22+20	0.5410	0.06	Q	|	|	|	V|
22+25	0.5413	0.05	Q	|	|	|	V|
22+30	0.5417	0.05	Q	|	|	|	V|
22+35	0.5421	0.05	Q	|	|	|	V|
22+40	0.5424	0.05	Q	|	|	|	V|
22+45	0.5428	0.05	Q	|	|	|	V|
22+50	0.5431	0.05	Q	|	|	|	V|
22+55	0.5435	0.05	Q	|	|	|	V|
23+ 0	0.5439	0.05	Q	|	|	|	V|
23+ 5	0.5442	0.05	Q	|	|	|	V|
23+10	0.5446	0.05	Q	|	|	|	V|
23+15	0.5450	0.05	Q	|	|	|	V|
23+20	0.5453	0.05	Q	|	|	|	V|
23+25	0.5457	0.05	Q	|	|	|	V|
23+30	0.5461	0.05	Q	|	|	|	V|
23+35	0.5464	0.05	Q	|	|	|	V|
23+40	0.5468	0.05	Q	|	|	|	V|
23+45	0.5472	0.05	Q	|	|	|	V|
23+50	0.5475	0.05	Q	|	|	|	V|
23+55	0.5479	0.05	Q	|	|	|	V|
24+ 0	0.5483	0.05	Q	|	|	|	V|
24+ 5	0.5484	0.02	Q	|	|	|	V|

Post-Project Unit Hydrograph Calculations
Area “C” – 2-year, 24-hour Storm Duration

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

Study date 03/26/21 File: ARCP242.out

++

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

Program License Serial Number 6279

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

English Units used in output format

SADDLEBACK INDUSTRIAL POST-PROJECT CONDITION HYDROLOGY
UNIT HYDROGRAPH ANALYSIS, 2-YEAR STORM EVENT
FILENAME: ARCP

Drainage Area = 1.87(Ac.) = 0.003 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 1.87(Ac.) = 0.003 Sq. Mi.
Length along longest watercourse = 478.00(Ft.)
Length along longest watercourse measured to centroid = 257.00(Ft.)
Length along longest watercourse = 0.091 Mi.
Length along longest watercourse measured to centroid = 0.049 Mi.
Difference in elevation = 6.76(Ft.)
Slope along watercourse = 74.6711 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.020 Hr.
Lag time = 1.21 Min.
25% of lag time = 0.30 Min.
40% of lag time = 0.48 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]
1.87	2.50	4.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
1.87	6.50	12.16

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 2.500(In)
Area Averaged 100-Year Rainfall = 6.500(In)

Point rain (area averaged) = 2.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 2.500(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
1.870	56.00	0.900

Total Area Entered = 1.87(Ac.)

RI AMC2	RI AMC-1	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
56.0	36.0	0.706	0.900	0.134	1.000	0.134
					Sum (F) =	0.134

Area averaged mean soil loss (F) (In/Hr) = 0.134
Minimum soil loss rate ((In/Hr)) = 0.067
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)		Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	412.724	65.943	1.243
2	0.167	825.448	34.057	0.642
			Sum = 100.000 Sum=	1.885

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 (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	0.07	0.020	(0.238)	0.004	0.016
2	0.17	0.07	0.020	(0.237)	0.004	0.016
3	0.25	0.07	0.020	(0.236)	0.004	0.016
4	0.33	0.10	0.030	(0.235)	0.005	0.025
5	0.42	0.10	0.030	(0.234)	0.005	0.025
6	0.50	0.10	0.030	(0.233)	0.005	0.025
7	0.58	0.10	0.030	(0.232)	0.005	0.025
8	0.67	0.10	0.030	(0.231)	0.005	0.025
9	0.75	0.10	0.030	(0.230)	0.005	0.025
10	0.83	0.13	0.040	(0.230)	0.007	0.033
11	0.92	0.13	0.040	(0.229)	0.007	0.033
12	1.00	0.13	0.040	(0.228)	0.007	0.033
13	1.08	0.10	0.030	(0.227)	0.005	0.025
14	1.17	0.10	0.030	(0.226)	0.005	0.025
15	1.25	0.10	0.030	(0.225)	0.005	0.025
16	1.33	0.10	0.030	(0.224)	0.005	0.025
17	1.42	0.10	0.030	(0.223)	0.005	0.025
18	1.50	0.10	0.030	(0.222)	0.005	0.025
19	1.58	0.10	0.030	(0.222)	0.005	0.025
20	1.67	0.10	0.030	(0.221)	0.005	0.025
21	1.75	0.10	0.030	(0.220)	0.005	0.025
22	1.83	0.13	0.040	(0.219)	0.007	0.033
23	1.92	0.13	0.040	(0.218)	0.007	0.033
24	2.00	0.13	0.040	(0.217)	0.007	0.033
25	2.08	0.13	0.040	(0.216)	0.007	0.033
26	2.17	0.13	0.040	(0.215)	0.007	0.033
27	2.25	0.13	0.040	(0.214)	0.007	0.033
28	2.33	0.13	0.040	(0.214)	0.007	0.033
29	2.42	0.13	0.040	(0.213)	0.007	0.033
30	2.50	0.13	0.040	(0.212)	0.007	0.033
31	2.58	0.17	0.050	(0.211)	0.009	0.041
32	2.67	0.17	0.050	(0.210)	0.009	0.041
33	2.75	0.17	0.050	(0.209)	0.009	0.041
34	2.83	0.17	0.050	(0.208)	0.009	0.041
35	2.92	0.17	0.050	(0.208)	0.009	0.041
36	3.00	0.17	0.050	(0.207)	0.009	0.041
37	3.08	0.17	0.050	(0.206)	0.009	0.041
38	3.17	0.17	0.050	(0.205)	0.009	0.041
39	3.25	0.17	0.050	(0.204)	0.009	0.041
40	3.33	0.17	0.050	(0.203)	0.009	0.041

41	3.42	0.17	0.050	(0.202)	0.009	0.041
42	3.50	0.17	0.050	(0.202)	0.009	0.041
43	3.58	0.17	0.050	(0.201)	0.009	0.041
44	3.67	0.17	0.050	(0.200)	0.009	0.041
45	3.75	0.17	0.050	(0.199)	0.009	0.041
46	3.83	0.20	0.060	(0.198)	0.011	0.049
47	3.92	0.20	0.060	(0.197)	0.011	0.049
48	4.00	0.20	0.060	(0.197)	0.011	0.049
49	4.08	0.20	0.060	(0.196)	0.011	0.049
50	4.17	0.20	0.060	(0.195)	0.011	0.049
51	4.25	0.20	0.060	(0.194)	0.011	0.049
52	4.33	0.23	0.070	(0.193)	0.013	0.057
53	4.42	0.23	0.070	(0.192)	0.013	0.057
54	4.50	0.23	0.070	(0.192)	0.013	0.057
55	4.58	0.23	0.070	(0.191)	0.013	0.057
56	4.67	0.23	0.070	(0.190)	0.013	0.057
57	4.75	0.23	0.070	(0.189)	0.013	0.057
58	4.83	0.27	0.080	(0.188)	0.014	0.066
59	4.92	0.27	0.080	(0.187)	0.014	0.066
60	5.00	0.27	0.080	(0.187)	0.014	0.066
61	5.08	0.20	0.060	(0.186)	0.011	0.049
62	5.17	0.20	0.060	(0.185)	0.011	0.049
63	5.25	0.20	0.060	(0.184)	0.011	0.049
64	5.33	0.23	0.070	(0.183)	0.013	0.057
65	5.42	0.23	0.070	(0.183)	0.013	0.057
66	5.50	0.23	0.070	(0.182)	0.013	0.057
67	5.58	0.27	0.080	(0.181)	0.014	0.066
68	5.67	0.27	0.080	(0.180)	0.014	0.066
69	5.75	0.27	0.080	(0.179)	0.014	0.066
70	5.83	0.27	0.080	(0.179)	0.014	0.066
71	5.92	0.27	0.080	(0.178)	0.014	0.066
72	6.00	0.27	0.080	(0.177)	0.014	0.066
73	6.08	0.30	0.090	(0.176)	0.016	0.074
74	6.17	0.30	0.090	(0.175)	0.016	0.074
75	6.25	0.30	0.090	(0.175)	0.016	0.074
76	6.33	0.30	0.090	(0.174)	0.016	0.074
77	6.42	0.30	0.090	(0.173)	0.016	0.074
78	6.50	0.30	0.090	(0.172)	0.016	0.074
79	6.58	0.33	0.100	(0.172)	0.018	0.082
80	6.67	0.33	0.100	(0.171)	0.018	0.082
81	6.75	0.33	0.100	(0.170)	0.018	0.082
82	6.83	0.33	0.100	(0.169)	0.018	0.082
83	6.92	0.33	0.100	(0.169)	0.018	0.082
84	7.00	0.33	0.100	(0.168)	0.018	0.082
85	7.08	0.33	0.100	(0.167)	0.018	0.082
86	7.17	0.33	0.100	(0.166)	0.018	0.082
87	7.25	0.33	0.100	(0.165)	0.018	0.082
88	7.33	0.37	0.110	(0.165)	0.020	0.090
89	7.42	0.37	0.110	(0.164)	0.020	0.090
90	7.50	0.37	0.110	(0.163)	0.020	0.090
91	7.58	0.40	0.120	(0.162)	0.022	0.098
92	7.67	0.40	0.120	(0.162)	0.022	0.098
93	7.75	0.40	0.120	(0.161)	0.022	0.098
94	7.83	0.43	0.130	(0.160)	0.023	0.107
95	7.92	0.43	0.130	(0.159)	0.023	0.107
96	8.00	0.43	0.130	(0.159)	0.023	0.107
97	8.08	0.50	0.150	(0.158)	0.027	0.123
98	8.17	0.50	0.150	(0.157)	0.027	0.123
99	8.25	0.50	0.150	(0.157)	0.027	0.123
100	8.33	0.50	0.150	(0.156)	0.027	0.123
101	8.42	0.50	0.150	(0.155)	0.027	0.123
102	8.50	0.50	0.150	(0.154)	0.027	0.123
103	8.58	0.53	0.160	(0.154)	0.029	0.131
104	8.67	0.53	0.160	(0.153)	0.029	0.131
105	8.75	0.53	0.160	(0.152)	0.029	0.131
106	8.83	0.57	0.170	(0.151)	0.031	0.139
107	8.92	0.57	0.170	(0.151)	0.031	0.139
108	9.00	0.57	0.170	(0.150)	0.031	0.139
109	9.08	0.63	0.190	(0.149)	0.034	0.156
110	9.17	0.63	0.190	(0.149)	0.034	0.156
111	9.25	0.63	0.190	(0.148)	0.034	0.156

112	9.33	0.67	0.200	(0.147)	0.036	0.164
113	9.42	0.67	0.200	(0.147)	0.036	0.164
114	9.50	0.67	0.200	(0.146)	0.036	0.164
115	9.58	0.70	0.210	(0.145)	0.038	0.172
116	9.67	0.70	0.210	(0.144)	0.038	0.172
117	9.75	0.70	0.210	(0.144)	0.038	0.172
118	9.83	0.73	0.220	(0.143)	0.040	0.180
119	9.92	0.73	0.220	(0.142)	0.040	0.180
120	10.00	0.73	0.220	(0.142)	0.040	0.180
121	10.08	0.50	0.150	(0.141)	0.027	0.123
122	10.17	0.50	0.150	(0.140)	0.027	0.123
123	10.25	0.50	0.150	(0.140)	0.027	0.123
124	10.33	0.50	0.150	(0.139)	0.027	0.123
125	10.42	0.50	0.150	(0.138)	0.027	0.123
126	10.50	0.50	0.150	(0.138)	0.027	0.123
127	10.58	0.67	0.200	(0.137)	0.036	0.164
128	10.67	0.67	0.200	(0.136)	0.036	0.164
129	10.75	0.67	0.200	(0.136)	0.036	0.164
130	10.83	0.67	0.200	(0.135)	0.036	0.164
131	10.92	0.67	0.200	(0.134)	0.036	0.164
132	11.00	0.67	0.200	(0.134)	0.036	0.164
133	11.08	0.63	0.190	(0.133)	0.034	0.156
134	11.17	0.63	0.190	(0.132)	0.034	0.156
135	11.25	0.63	0.190	(0.132)	0.034	0.156
136	11.33	0.63	0.190	(0.131)	0.034	0.156
137	11.42	0.63	0.190	(0.130)	0.034	0.156
138	11.50	0.63	0.190	(0.130)	0.034	0.156
139	11.58	0.57	0.170	(0.129)	0.031	0.139
140	11.67	0.57	0.170	(0.128)	0.031	0.139
141	11.75	0.57	0.170	(0.128)	0.031	0.139
142	11.83	0.60	0.180	(0.127)	0.032	0.148
143	11.92	0.60	0.180	(0.126)	0.032	0.148
144	12.00	0.60	0.180	(0.126)	0.032	0.148
145	12.08	0.83	0.250	(0.125)	0.045	0.205
146	12.17	0.83	0.250	(0.125)	0.045	0.205
147	12.25	0.83	0.250	(0.124)	0.045	0.205
148	12.33	0.87	0.260	(0.123)	0.047	0.213
149	12.42	0.87	0.260	(0.123)	0.047	0.213
150	12.50	0.87	0.260	(0.122)	0.047	0.213
151	12.58	0.93	0.280	(0.121)	0.050	0.230
152	12.67	0.93	0.280	(0.121)	0.050	0.230
153	12.75	0.93	0.280	(0.120)	0.050	0.230
154	12.83	0.97	0.290	(0.120)	0.052	0.238
155	12.92	0.97	0.290	(0.119)	0.052	0.238
156	13.00	0.97	0.290	(0.118)	0.052	0.238
157	13.08	1.13	0.340	(0.118)	0.061	0.279
158	13.17	1.13	0.340	(0.117)	0.061	0.279
159	13.25	1.13	0.340	(0.117)	0.061	0.279
160	13.33	1.13	0.340	(0.116)	0.061	0.279
161	13.42	1.13	0.340	(0.115)	0.061	0.279
162	13.50	1.13	0.340	(0.115)	0.061	0.279
163	13.58	0.77	0.230	(0.114)	0.041	0.189
164	13.67	0.77	0.230	(0.114)	0.041	0.189
165	13.75	0.77	0.230	(0.113)	0.041	0.189
166	13.83	0.77	0.230	(0.113)	0.041	0.189
167	13.92	0.77	0.230	(0.112)	0.041	0.189
168	14.00	0.77	0.230	(0.111)	0.041	0.189
169	14.08	0.90	0.270	(0.111)	0.049	0.221
170	14.17	0.90	0.270	(0.110)	0.049	0.221
171	14.25	0.90	0.270	(0.110)	0.049	0.221
172	14.33	0.87	0.260	(0.109)	0.047	0.213
173	14.42	0.87	0.260	(0.109)	0.047	0.213
174	14.50	0.87	0.260	(0.108)	0.047	0.213
175	14.58	0.87	0.260	(0.107)	0.047	0.213
176	14.67	0.87	0.260	(0.107)	0.047	0.213
177	14.75	0.87	0.260	(0.106)	0.047	0.213
178	14.83	0.83	0.250	(0.106)	0.045	0.205
179	14.92	0.83	0.250	(0.105)	0.045	0.205
180	15.00	0.83	0.250	(0.105)	0.045	0.205
181	15.08	0.80	0.240	(0.104)	0.043	0.197
182	15.17	0.80	0.240	(0.104)	0.043	0.197

183	15.25	0.80	0.240	(0.103)	0.043	0.197
184	15.33	0.77	0.230	(0.103)	0.041	0.189
185	15.42	0.77	0.230	(0.102)	0.041	0.189
186	15.50	0.77	0.230	(0.102)	0.041	0.189
187	15.58	0.63	0.190	(0.101)	0.034	0.156
188	15.67	0.63	0.190	(0.101)	0.034	0.156
189	15.75	0.63	0.190	(0.100)	0.034	0.156
190	15.83	0.63	0.190	(0.100)	0.034	0.156
191	15.92	0.63	0.190	(0.099)	0.034	0.156
192	16.00	0.63	0.190	(0.099)	0.034	0.156
193	16.08	0.13	0.040	(0.098)	0.007	0.033
194	16.17	0.13	0.040	(0.098)	0.007	0.033
195	16.25	0.13	0.040	(0.097)	0.007	0.033
196	16.33	0.13	0.040	(0.097)	0.007	0.033
197	16.42	0.13	0.040	(0.096)	0.007	0.033
198	16.50	0.13	0.040	(0.096)	0.007	0.033
199	16.58	0.10	0.030	(0.095)	0.005	0.025
200	16.67	0.10	0.030	(0.095)	0.005	0.025
201	16.75	0.10	0.030	(0.094)	0.005	0.025
202	16.83	0.10	0.030	(0.094)	0.005	0.025
203	16.92	0.10	0.030	(0.093)	0.005	0.025
204	17.00	0.10	0.030	(0.093)	0.005	0.025
205	17.08	0.17	0.050	(0.092)	0.009	0.041
206	17.17	0.17	0.050	(0.092)	0.009	0.041
207	17.25	0.17	0.050	(0.091)	0.009	0.041
208	17.33	0.17	0.050	(0.091)	0.009	0.041
209	17.42	0.17	0.050	(0.090)	0.009	0.041
210	17.50	0.17	0.050	(0.090)	0.009	0.041
211	17.58	0.17	0.050	(0.089)	0.009	0.041
212	17.67	0.17	0.050	(0.089)	0.009	0.041
213	17.75	0.17	0.050	(0.089)	0.009	0.041
214	17.83	0.13	0.040	(0.088)	0.007	0.033
215	17.92	0.13	0.040	(0.088)	0.007	0.033
216	18.00	0.13	0.040	(0.087)	0.007	0.033
217	18.08	0.13	0.040	(0.087)	0.007	0.033
218	18.17	0.13	0.040	(0.086)	0.007	0.033
219	18.25	0.13	0.040	(0.086)	0.007	0.033
220	18.33	0.13	0.040	(0.086)	0.007	0.033
221	18.42	0.13	0.040	(0.085)	0.007	0.033
222	18.50	0.13	0.040	(0.085)	0.007	0.033
223	18.58	0.10	0.030	(0.084)	0.005	0.025
224	18.67	0.10	0.030	(0.084)	0.005	0.025
225	18.75	0.10	0.030	(0.084)	0.005	0.025
226	18.83	0.07	0.020	(0.083)	0.004	0.016
227	18.92	0.07	0.020	(0.083)	0.004	0.016
228	19.00	0.07	0.020	(0.082)	0.004	0.016
229	19.08	0.10	0.030	(0.082)	0.005	0.025
230	19.17	0.10	0.030	(0.082)	0.005	0.025
231	19.25	0.10	0.030	(0.081)	0.005	0.025
232	19.33	0.13	0.040	(0.081)	0.007	0.033
233	19.42	0.13	0.040	(0.080)	0.007	0.033
234	19.50	0.13	0.040	(0.080)	0.007	0.033
235	19.58	0.10	0.030	(0.080)	0.005	0.025
236	19.67	0.10	0.030	(0.079)	0.005	0.025
237	19.75	0.10	0.030	(0.079)	0.005	0.025
238	19.83	0.07	0.020	(0.079)	0.004	0.016
239	19.92	0.07	0.020	(0.078)	0.004	0.016
240	20.00	0.07	0.020	(0.078)	0.004	0.016
241	20.08	0.10	0.030	(0.078)	0.005	0.025
242	20.17	0.10	0.030	(0.077)	0.005	0.025
243	20.25	0.10	0.030	(0.077)	0.005	0.025
244	20.33	0.10	0.030	(0.077)	0.005	0.025
245	20.42	0.10	0.030	(0.076)	0.005	0.025
246	20.50	0.10	0.030	(0.076)	0.005	0.025
247	20.58	0.10	0.030	(0.076)	0.005	0.025
248	20.67	0.10	0.030	(0.075)	0.005	0.025
249	20.75	0.10	0.030	(0.075)	0.005	0.025
250	20.83	0.07	0.020	(0.075)	0.004	0.016
251	20.92	0.07	0.020	(0.074)	0.004	0.016
252	21.00	0.07	0.020	(0.074)	0.004	0.016
253	21.08	0.10	0.030	(0.074)	0.005	0.025

```
254  21.17     0.10      0.030       (  0.073)       0.005        0.025
255  21.25     0.10      0.030       (  0.073)       0.005        0.025
256  21.33     0.07      0.020       (  0.073)       0.004        0.016
257  21.42     0.07      0.020       (  0.073)       0.004        0.016
258  21.50     0.07      0.020       (  0.072)       0.004        0.016
259  21.58     0.10      0.030       (  0.072)       0.005        0.025
260  21.67     0.10      0.030       (  0.072)       0.005        0.025
261  21.75     0.10      0.030       (  0.072)       0.005        0.025
262  21.83     0.07      0.020       (  0.071)       0.004        0.016
263  21.92     0.07      0.020       (  0.071)       0.004        0.016
264  22.00     0.07      0.020       (  0.071)       0.004        0.016
265  22.08     0.10      0.030       (  0.071)       0.005        0.025
266  22.17     0.10      0.030       (  0.070)       0.005        0.025
267  22.25     0.10      0.030       (  0.070)       0.005        0.025
268  22.33     0.07      0.020       (  0.070)       0.004        0.016
269  22.42     0.07      0.020       (  0.070)       0.004        0.016
270  22.50     0.07      0.020       (  0.069)       0.004        0.016
271  22.58     0.07      0.020       (  0.069)       0.004        0.016
272  22.67     0.07      0.020       (  0.069)       0.004        0.016
273  22.75     0.07      0.020       (  0.069)       0.004        0.016
274  22.83     0.07      0.020       (  0.069)       0.004        0.016
275  22.92     0.07      0.020       (  0.069)       0.004        0.016
276  23.00     0.07      0.020       (  0.068)       0.004        0.016
277  23.08     0.07      0.020       (  0.068)       0.004        0.016
278  23.17     0.07      0.020       (  0.068)       0.004        0.016
279  23.25     0.07      0.020       (  0.068)       0.004        0.016
280  23.33     0.07      0.020       (  0.068)       0.004        0.016
281  23.42     0.07      0.020       (  0.068)       0.004        0.016
282  23.50     0.07      0.020       (  0.068)       0.004        0.016
283  23.58     0.07      0.020       (  0.067)       0.004        0.016
284  23.67     0.07      0.020       (  0.067)       0.004        0.016
285  23.75     0.07      0.020       (  0.067)       0.004        0.016
286  23.83     0.07      0.020       (  0.067)       0.004        0.016
287  23.92     0.07      0.020       (  0.067)       0.004        0.016
288  24.00     0.07      0.020       (  0.067)       0.004        0.016
               (Loss Rate Not Used)
    Sum =     100.0                                    Sum =    24.6
      Flood volume = Effective rainfall      2.05(In)
       times area       1.9(Ac.)/[(In)/(Ft.)] =       0.3(Ac.Ft)
      Total soil loss =      0.45(In)
      Total soil loss =     0.070(Ac.Ft)
      Total rainfall =      2.50(In)
      Flood volume =       13915.6 Cubic Feet
      Total soil loss =        3054.6 Cubic Feet
      ---------------------------------------------------------------------
       Peak flow rate of this hydrograph =      0.526(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       0.0001      0.02  Q         |         |         |         |
   0+10       0.0004      0.03  Q         |         |         |         |
   0+15       0.0006      0.03  Q         |         |         |         |
   0+20       0.0008      0.04  Q         |         |         |         |
   0+25       0.0012      0.05  Q         |         |         |         |
   0+30       0.0015      0.05  Q         |         |         |         |
   0+35       0.0018      0.05  Q         |         |         |         |
   0+40       0.0021      0.05  Q         |         |         |         |
   0+45       0.0024      0.05  Q         |         |         |         |
   0+50       0.0028      0.06  Q         |         |         |         |
   0+55       0.0033      0.06  Q         |         |         |         |
   1+ 0       0.0037      0.06  Q         |         |         |         |
   1+ 5       0.0040      0.05  Q         |         |         |         |
   1+10       0.0044      0.05  Q         |         |         |         |
   1+15       0.0047      0.05  Q         |         |         |         |
```

1+20	0.0050	0.05	Q	|	|	|	|
1+25	0.0053	0.05	Q	|	|	|	|
1+30	0.0056	0.05	Q	|	|	|	|
1+35	0.0060	0.05	Q	|	|	|	|
1+40	0.0063	0.05	Q	|	|	|	|
1+45	0.0066	0.05	Q	|	|	|	|
1+50	0.0070	0.06	Q	|	|	|	|
1+55	0.0074	0.06	Q	|	|	|	|
2+ 0	0.0078	0.06	Q	|	|	|	|
2+ 5	0.0083	0.06	QV	|	|	|	|
2+10	0.0087	0.06	QV	|	|	|	|
2+15	0.0091	0.06	QV	|	|	|	|
2+20	0.0095	0.06	QV	|	|	|	|
2+25	0.0100	0.06	QV	|	|	|	|
2+30	0.0104	0.06	QV	|	|	|	|
2+35	0.0109	0.07	QV	|	|	|	|
2+40	0.0114	0.08	QV	|	|	|	|
2+45	0.0120	0.08	QV	|	|	|	|
2+50	0.0125	0.08	QV	|	|	|	|
2+55	0.0130	0.08	QV	|	|	|	|
3+ 0	0.0136	0.08	QV	|	|	|	|
3+ 5	0.0141	0.08	QV	|	|	|	|
3+10	0.0146	0.08	QV	|	|	|	|
3+15	0.0152	0.08	QV	|	|	|	|
3+20	0.0157	0.08	QV	|	|	|	|
3+25	0.0162	0.08	Q V	|	|	|	|
3+30	0.0167	0.08	Q V	|	|	|	|
3+35	0.0173	0.08	Q V	|	|	|	|
3+40	0.0178	0.08	Q V	|	|	|	|
3+45	0.0183	0.08	Q V	|	|	|	|
3+50	0.0189	0.09	Q V	|	|	|	|
3+55	0.0196	0.09	Q V	|	|	|	|
4+ 0	0.0202	0.09	Q V	|	|	|	|
4+ 5	0.0209	0.09	Q V	|	|	|	|
4+10	0.0215	0.09	Q V	|	|	|	|
4+15	0.0221	0.09	Q V	|	|	|	|
4+20	0.0229	0.10	Q V	|	|	|	|
4+25	0.0236	0.11	Q V	|	|	|	|
4+30	0.0243	0.11	Q V	|	|	|	|
4+35	0.0251	0.11	Q V	|	|	|	|
4+40	0.0258	0.11	Q V	|	|	|	|
4+45	0.0266	0.11	Q V	|	|	|	|
4+50	0.0274	0.12	Q V	|	|	|	|
4+55	0.0282	0.12	Q V	|	|	|	|
5+ 0	0.0291	0.12	Q V	|	|	|	|
5+ 5	0.0298	0.10	Q V	|	|	|	|
5+10	0.0305	0.09	Q V	|	|	|	|
5+15	0.0311	0.09	Q V	|	|	|	|
5+20	0.0318	0.10	Q V	|	|	|	|
5+25	0.0325	0.11	Q V	|	|	|	|
5+30	0.0333	0.11	Q V	|	|	|	|
5+35	0.0341	0.12	Q V	|	|	|	|
5+40	0.0350	0.12	Q V	|	|	|	|
5+45	0.0358	0.12	Q V	|	|	|	|
5+50	0.0367	0.12	Q V	|	|	|	|
5+55	0.0375	0.12	Q V	|	|	|	|
6+ 0	0.0384	0.12	Q V	|	|	|	|
6+ 5	0.0393	0.13	Q V	|	|	|	|
6+10	0.0402	0.14	Q V	|	|	|	|
6+15	0.0412	0.14	Q V	|	|	|	|
6+20	0.0422	0.14	Q V	|	|	|	|
6+25	0.0431	0.14	Q V	|	|	|	|
6+30	0.0441	0.14	Q V	|	|	|	|
6+35	0.0451	0.15	Q V	|	|	|	|
6+40	0.0462	0.15	Q V	|	|	|	|
6+45	0.0472	0.15	Q V	|	|	|	|
6+50	0.0483	0.15	Q V	|	|	|	|
6+55	0.0494	0.15	Q V	|	|	|	|
7+ 0	0.0504	0.15	Q V	|	|	|	|
7+ 5	0.0515	0.15	Q V	|	|	|	|
7+10	0.0526	0.15	Q V	|	|	|	|

7+15	0.0536	0.15	Q	V	|	|	|	|
7+20	0.0548	0.16	Q	V	|	|	|	|
7+25	0.0559	0.17	Q	V	|	|	|	|
7+30	0.0571	0.17	Q	V	|	|	|	|
7+35	0.0583	0.18	Q	V	|	|	|	|
7+40	0.0596	0.19	Q	V	|	|	|	|
7+45	0.0609	0.19	Q	V	|	|	|	|
7+50	0.0622	0.20	Q	V	|	|	|	|
7+55	0.0636	0.20	Q	V	|	|	|	|
8+ 0	0.0650	0.20	Q	V	|	|	|	|
8+ 5	0.0665	0.22	Q	V	|	|	|	|
8+10	0.0681	0.23	Q	V	|	|	|	|
8+15	0.0697	0.23	Q	V	|	|	|	|
8+20	0.0713	0.23	Q	V	|	|	|	|
8+25	0.0729	0.23	Q	V	|	|	|	|
8+30	0.0745	0.23	Q	V	|	|	|	|
8+35	0.0762	0.24	Q	V	|	|	|	|
8+40	0.0779	0.25	Q	V	|	|	|	|
8+45	0.0796	0.25	Q	V	|	|	|	|
8+50	0.0814	0.26	|Q	V	|	|	|	|
8+55	0.0832	0.26	|Q	V	|	|	|	|
9+ 0	0.0850	0.26	|Q	V	|	|	|	|
9+ 5	0.0869	0.28	|Q	V	|	|	|	|
9+10	0.0890	0.29	|Q	|V	|	|	|	|
9+15	0.0910	0.29	|Q	|V	|	|	|	|
9+20	0.0931	0.30	|Q	|V	|	|	|	|
9+25	0.0952	0.31	|Q	|V	|	|	|	|
9+30	0.0973	0.31	|Q	| V	|	|	|	|
9+35	0.0995	0.32	|Q	| V	|	|	|	|
9+40	0.1018	0.32	|Q	| V	|	|	|	|
9+45	0.1040	0.32	|Q	| V	|	|	|	|
9+50	0.1063	0.33	|Q	| V	|	|	|	|
9+55	0.1087	0.34	|Q	| V	|	|	|	|
10+ 0	0.1110	0.34	|Q	| V	|	|	|	|
10+ 5	0.1129	0.27	|Q	| V	|	|	|	|
10+10	0.1145	0.23	Q	| V	|	|	|	|
10+15	0.1161	0.23	Q	| V	|	|	|	|
10+20	0.1177	0.23	Q	| V	|	|	|	|
10+25	0.1193	0.23	Q	| V	|	|	|	|
10+30	0.1208	0.23	Q	| V	|	|	|	|
10+35	0.1228	0.28	|Q	| V	|	|	|	|
10+40	0.1249	0.31	|Q	| V	|	|	|	|
10+45	0.1271	0.31	|Q	| V	|	|	|	|
10+50	0.1292	0.31	|Q	| V	|	|	|	|
10+55	0.1313	0.31	|Q	| V	|	|	|	|
11+ 0	0.1334	0.31	|Q	| V	|	|	|	|
11+ 5	0.1355	0.30	|Q	| V	|	|	|	|
11+10	0.1375	0.29	|Q	| V	|	|	|	|
11+15	0.1396	0.29	|Q	| V	|	|	|	|
11+20	0.1416	0.29	|Q	| V	|	|	|	|
11+25	0.1436	0.29	|Q	| V	|	|	|	|
11+30	0.1456	0.29	|Q	| V	|	|	|	|
11+35	0.1475	0.27	|Q	| V	|	|	|	|
11+40	0.1493	0.26	|Q	| V	|	|	|	|
11+45	0.1511	0.26	|Q	| V	|	|	|	|
11+50	0.1530	0.27	|Q	| V	|	|	|	|
11+55	0.1549	0.28	|Q	| V	|	|	|	|
12+ 0	0.1568	0.28	|Q	| V	|	|	|	|
12+ 5	0.1592	0.35	|Q	| V	|	|	|	|
12+10	0.1619	0.39	|Q	| V	|	|	|	|
12+15	0.1646	0.39	|Q	| V	|	|	|	|
12+20	0.1673	0.40	|Q	| V	|	|	|	|
12+25	0.1701	0.40	|Q	| V	|	|	|	|
12+30	0.1728	0.40	|Q	| V	|	|	|	|
12+35	0.1758	0.42	|Q	| V	|	|	|	|
12+40	0.1787	0.43	|Q	| V	|	|	|	|
12+45	0.1817	0.43	|Q	| V	|	|	|	|
12+50	0.1848	0.44	|Q	| V	|	|	|	|
12+55	0.1879	0.45	|Q	| V	|	|	|	|
13+ 0	0.1909	0.45	|Q	| V	|	|	|	|
13+ 5	0.1944	0.50	|Q	| V	|	|	|	|

13+10	0.1980	0.53	Q		V		
13+15	0.2016	0.53	Q		V		
13+20	0.2052	0.53	Q		V		
13+25	0.2089	0.53	Q		V		
13+30	0.2125	0.53	Q		V		
13+35	0.2153	0.41	Q		V		
13+40	0.2178	0.36	Q		V		
13+45	0.2202	0.36	Q		V		
13+50	0.2227	0.36	Q		V		
13+55	0.2251	0.36	Q		V		
14+ 0	0.2276	0.36	Q		V		
14+ 5	0.2303	0.40	Q		V		
14+10	0.2332	0.42	Q		V		
14+15	0.2361	0.42	Q		V		
14+20	0.2389	0.41	Q		V		
14+25	0.2416	0.40	Q		V		
14+30	0.2444	0.40	Q		V		
14+35	0.2472	0.40	Q		V		
14+40	0.2499	0.40	Q		V		
14+45	0.2527	0.40	Q		V		
14+50	0.2554	0.39	Q		V		
14+55	0.2581	0.39	Q		V		
15+ 0	0.2607	0.39	Q		V		
15+ 5	0.2633	0.38	Q		V		
15+10	0.2659	0.37	Q		V		
15+15	0.2684	0.37	Q		V		
15+20	0.2709	0.36	Q		V		
15+25	0.2734	0.36	Q		V		
15+30	0.2758	0.36	Q		V		
15+35	0.2780	0.31	Q		V		
15+40	0.2800	0.29	Q		V		
15+45	0.2820	0.29	Q		V		
15+50	0.2841	0.29	Q		V		
15+55	0.2861	0.29	Q		V		
16+ 0	0.2881	0.29	Q		V		
16+ 5	0.2891	0.14	Q		V		
16+10	0.2895	0.06	Q		V		
16+15	0.2899	0.06	Q		V		
16+20	0.2903	0.06	Q		V		
16+25	0.2908	0.06	Q		V		
16+30	0.2912	0.06	Q		V		
16+35	0.2916	0.05	Q		V		
16+40	0.2919	0.05	Q		V		
16+45	0.2922	0.05	Q		V		
16+50	0.2925	0.05	Q		V		
16+55	0.2928	0.05	Q		V		
17+ 0	0.2932	0.05	Q		V		
17+ 5	0.2936	0.07	Q		V		
17+10	0.2941	0.08	Q		V		
17+15	0.2947	0.08	Q		V		
17+20	0.2952	0.08	Q		V		
17+25	0.2957	0.08	Q		V		
17+30	0.2963	0.08	Q		V		
17+35	0.2968	0.08	Q		V		
17+40	0.2973	0.08	Q		V		
17+45	0.2979	0.08	Q		V		
17+50	0.2983	0.07	Q		V		
17+55	0.2988	0.06	Q		V		
18+ 0	0.2992	0.06	Q		V		
18+ 5	0.2996	0.06	Q		V		
18+10	0.3000	0.06	Q		V		
18+15	0.3005	0.06	Q		V		
18+20	0.3009	0.06	Q		V		
18+25	0.3013	0.06	Q		V		
18+30	0.3017	0.06	Q		V		
18+35	0.3021	0.05	Q		V		
18+40	0.3024	0.05	Q		V		
18+45	0.3027	0.05	Q		V		
18+50	0.3030	0.04	Q		V		
18+55	0.3032	0.03	Q		V		
19+ 0	0.3034	0.03	Q		V		

19+ 5	0.3037	0.04	Q	|	|	|	V |
19+10	0.3040	0.05	Q	|	|	|	V |
19+15	0.3043	0.05	Q	|	|	|	V |
19+20	0.3047	0.06	Q	|	|	|	V |
19+25	0.3051	0.06	Q	|	|	|	V |
19+30	0.3056	0.06	Q	|	|	|	V |
19+35	0.3059	0.05	Q	|	|	|	V |
19+40	0.3063	0.05	Q	|	|	|	V |
19+45	0.3066	0.05	Q	|	|	|	V |
19+50	0.3068	0.04	Q	|	|	|	V |
19+55	0.3070	0.03	Q	|	|	|	V |
20+ 0	0.3072	0.03	Q	|	|	|	V |
20+ 5	0.3075	0.04	Q	|	|	|	V |
20+10	0.3078	0.05	Q	|	|	|	V |
20+15	0.3082	0.05	Q	|	|	|	V |
20+20	0.3085	0.05	Q	|	|	|	V |
20+25	0.3088	0.05	Q	|	|	|	V |
20+30	0.3091	0.05	Q	|	|	|	V |
20+35	0.3094	0.05	Q	|	|	|	V |
20+40	0.3098	0.05	Q	|	|	|	V |
20+45	0.3101	0.05	Q	|	|	|	V |
20+50	0.3103	0.04	Q	|	|	|	V |
20+55	0.3105	0.03	Q	|	|	|	V |
21+ 0	0.3108	0.03	Q	|	|	|	V |
21+ 5	0.3110	0.04	Q	|	|	|	V |
21+10	0.3114	0.05	Q	|	|	|	V |
21+15	0.3117	0.05	Q	|	|	|	V|
21+20	0.3119	0.04	Q	|	|	|	V|
21+25	0.3121	0.03	Q	|	|	|	V|
21+30	0.3124	0.03	Q	|	|	|	V|
21+35	0.3126	0.04	Q	|	|	|	V|
21+40	0.3130	0.05	Q	|	|	|	V|
21+45	0.3133	0.05	Q	|	|	|	V|
21+50	0.3135	0.04	Q	|	|	|	V|
21+55	0.3137	0.03	Q	|	|	|	V|
22+ 0	0.3140	0.03	Q	|	|	|	V|
22+ 5	0.3142	0.04	Q	|	|	|	V|
22+10	0.3146	0.05	Q	|	|	|	V|
22+15	0.3149	0.05	Q	|	|	|	V|
22+20	0.3151	0.04	Q	|	|	|	V|
22+25	0.3153	0.03	Q	|	|	|	V|
22+30	0.3156	0.03	Q	|	|	|	V|
22+35	0.3158	0.03	Q	|	|	|	V|
22+40	0.3160	0.03	Q	|	|	|	V|
22+45	0.3162	0.03	Q	|	|	|	V|
22+50	0.3164	0.03	Q	|	|	|	V|
22+55	0.3166	0.03	Q	|	|	|	V|
23+ 0	0.3168	0.03	Q	|	|	|	V|
23+ 5	0.3170	0.03	Q	|	|	|	V|
23+10	0.3173	0.03	Q	|	|	|	V|
23+15	0.3175	0.03	Q	|	|	|	V|
23+20	0.3177	0.03	Q	|	|	|	V|
23+25	0.3179	0.03	Q	|	|	|	V|
23+30	0.3181	0.03	Q	|	|	|	V|
23+35	0.3183	0.03	Q	|	|	|	V|
23+40	0.3185	0.03	Q	|	|	|	V|
23+45	0.3187	0.03	Q	|	|	|	V|
23+50	0.3190	0.03	Q	|	|	|	V|
23+55	0.3192	0.03	Q	|	|	|	V|
24+ 0	0.3194	0.03	Q	|	|	|	V|
24+ 5	0.3195	0.01	Q	|	|	|	V|

Unit Hydrograph Watershed Map

SADDLEBACK INDUSTRIAL

IN THE CITY OF LAKE ELSINORE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

UNIT HYDROGRAPH WATERSHED MAP

LEGEND:

- X.X / X.X — NODE/CONCENTRATION POINT, FLOWLINE ELEVATION
- XXX / X.X — SUB AREA, ACRES
- FLOW PATH
- WATERSHED BOUNDARY

N

GRAPHIC SCALE
60' 0 30' 60' 120'
1" = 60'

FIGURE 4

SADDLEBACK INDUSTRIAL

UNIT HYDROGRAPH WATERSHED MAP

JLC Engineering & Consulting, Inc.
41660 IVY STREET, SUITE A
MURRIETA, CA 92562
PH. 951.304.9552 FAX 951.304.3568

Drawing Name: G:\202.01.09\Engineering\Hydrology_Plan\Exhibits\Unit Hydrograph Watershed Map.dwg
Last Opened: Mon Jan 03, 2022 - 3:13pm by jforster

Subsurface System Volume Calculations

Chamber Model	HS75		
Number of Chambers	25		
Number of Endcaps	10		
Stone Voids (porosity)	40%		
Base of Stone Elevation	0	ft	
Recommended Stone Below Chambers*	9	in.	**Include perimeter stone?** Yes
Recommended Stone Above Chambers*	12	in.	

Area of System** 8690 sq.ft

***Area must be greater than:* **986 sq.ft**

*The minimum stone below and above the chambers to be determinded by the design engineer.

System Height (in)	Incremental Single Chamber Storage (cu.ft)	Incremental Single End Cap Storage (cu.ft)	Incremental Total Chamber Storage (cu.ft)	Incremental Total End Cap Storage (cu.ft)	Incremental Stone Storage (cu.ft)	Incremental Chamber, End Cap, & Stone (cu.ft)	Cumulative System Storage (cu.ft)	Elevation (ft)
51	0.000	0.000	0.000	0.000	289.67	289.67	15484.87	4.25
50	0.000	0.000	0.000	0.000	289.67	289.67	15195.20	4.17
49	0.000	0.000	0.000	0.000	289.67	289.67	14905.54	4.08
48	0.000	0.000	0.000	0.000	289.67	289.67	14615.87	4.00
47	0.000	0.000	0.000	0.000	289.67	289.67	14326.20	3.92
46	0.000	0.000	0.000	0.000	289.67	289.67	14036.54	3.83
45	0.000	0.000	0.000	0.000	289.67	289.67	13746.87	3.75
44	0.000	0.000	0.000	0.000	289.67	289.67	13457.20	3.67
43	0.000	0.000	0.000	0.000	289.67	289.67	13167.54	3.58
42	0.000	0.000	0.000	0.000	289.67	289.67	12877.87	3.50
41	0.000	0.000	0.000	0.000	289.67	289.67	12588.20	3.42
40	0.000	0.000	0.000	0.000	289.67	289.67	12298.54	3.33
39	0.125	0.000	3.124	0.000	288.42	291.54	12008.87	3.25
38	0.301	0.010	7.517	0.100	286.62	294.24	11717.33	3.17
37	0.616	0.020	15.409	0.200	283.42	299.03	11423.09	3.08
36	0.852	0.030	21.291	0.300	281.03	302.62	11124.06	3.00
35	1.012	0.040	25.289	0.400	279.39	305.08	10821.44	2.92
34	1.138	0.050	28.459	0.500	278.08	307.04	10516.36	2.83
33	1.244	0.060	31.092	0.600	276.99	308.68	10209.32	2.75
32	1.333	0.060	33.326	0.600	276.10	310.02	9900.63	2.67
31	1.411	0.070	35.269	0.700	275.28	311.25	9590.61	2.58
30	1.481	0.080	37.030	0.800	274.53	312.36	9279.36	2.50
29	1.547	0.080	38.672	0.800	273.88	313.35	8967.00	2.42
28	1.608	0.090	40.204	0.900	273.23	314.33	8653.65	2.33
27	1.665	0.100	41.633	1.000	272.61	315.25	8339.32	2.25
26	1.719	0.100	42.964	1.000	272.08	316.05	8024.07	2.17
25	1.768	0.110	44.204	1.100	271.55	316.85	7708.03	2.08
24	1.814	0.110	45.356	1.100	271.08	317.54	7391.18	2.00
23	1.855	0.120	46.366	1.200	270.64	318.21	7073.64	1.92
22	1.897	0.120	47.428	1.200	270.22	318.84	6755.43	1.83
21	1.935	0.120	48.372	1.200	269.84	319.41	6436.59	1.75
20	1.970	0.130	49.259	1.300	269.44	320.00	6117.18	1.67
19	2.004	0.130	50.088	1.300	269.11	320.50	5797.18	1.58
18	2.034	0.130	50.862	1.300	268.80	320.96	5476.68	1.50
17	2.064	0.140	51.599	1.400	268.47	321.47	5155.71	1.42
16	2.093	0.140	52.314	1.400	268.18	321.90	4834.25	1.33
15	2.121	0.140	53.029	1.400	267.90	322.32	4512.35	1.25
14	2.149	0.140	53.725	1.400	267.62	322.74	4190.03	1.17
13	2.175	0.140	54.386	1.400	267.35	323.14	3867.29	1.08
12	2.201	0.140	55.028	1.400	267.10	323.52	3544.15	1.00
11	2.226	0.150	55.654	1.500	266.81	323.96	3220.63	0.92
10	0.000	0.000	0.000	0.000	289.67	289.67	2896.67	0.83
9	0.000	0.000	0.000	0.000	289.67	289.67	2607.00	0.75
8	0.000	0.000	0.000	0.000	289.67	289.67	2317.33	0.67
7	0.000	0.000	0.000	0.000	289.67	289.67	2027.67	0.58
6	0.000	0.000	0.000	0.000	289.67	289.67	1738.00	0.50
5	0.000	0.000	0.000	0.000	289.67	289.67	1448.33	0.42
4	0.000	0.000	0.000	0.000	289.67	289.67	1158.67	0.33
3	0.000	0.000	0.000	0.000	289.67	289.67	869.00	0.25
2	0.000	0.000	0.000	0.000	289.67	289.67	579.33	0.17
1	0.000	0.000	0.000	0.000	289.67	289.67	289.67	0.08
0	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00

Chamber Model	HS31		
Number of Chambers	25		
Number of Endcaps	10		
Stone Voids (porosity)	40%		
Base of Stone Elevation	0	ft	
Recommended Stone Below Chambers*	9	in.	**Include perimeter stone?** Yes
Recommended Stone Above Chambers*	12	in.	

Area of System** 18549 sq.ft

***Area must be greater than:* **700 sq.ft**

*The minimum stone below and above the chambers to be determinded by the design engineer.

System Height (in)	Incremental Single Chamber Storage (cu.ft)	Incremental Single End Cap Storage (cu.ft)	Incremental Total Chamber Storage (cu.ft)	Incremental Total End Cap Storage (cu.ft)	Incremental Stone Storage (cu.ft)	Incremental Chamber, End Cap, & Stone (cu.ft)	Cumulative System Storage (cu.ft)	Elevation (ft)
37	0.000	0.000	0.000	0.000	618.30	618.30	23104.51	3.08
36	0.000	0.000	0.000	0.000	618.30	618.30	22486.21	3.00
35	0.000	0.000	0.000	0.000	618.30	618.30	21867.91	2.92
34	0.000	0.000	0.000	0.000	618.30	618.30	21249.61	2.83
33	0.000	0.000	0.000	0.000	618.30	618.30	20631.31	2.75
32	0.000	0.000	0.000	0.000	618.30	618.30	20013.01	2.67
31	0.000	0.000	0.000	0.000	618.30	618.30	19394.71	2.58
30	0.000	0.000	0.000	0.000	618.30	618.30	18776.41	2.50
29	0.000	0.000	0.000	0.000	618.30	618.30	18158.11	2.42
28	0.000	0.000	0.000	0.000	618.30	618.30	17539.81	2.33
27	0.000	0.000	0.000	0.000	618.30	618.30	16921.51	2.25
26	0.000	0.000	0.000	0.000	618.30	618.30	16303.21	2.17
25	0.057	0.002	1.435	0.017	617.72	619.17	15684.91	2.08
24	0.207	0.006	5.170	0.060	616.21	621.44	15065.74	2.00
23	0.372	0.012	9.290	0.124	614.53	623.95	14444.30	1.92
22	0.622	0.017	15.560	0.173	612.01	627.74	13820.35	1.83
21	0.773	0.022	19.330	0.215	610.48	630.03	13192.61	1.75
20	0.887	0.025	22.178	0.251	609.33	631.76	12562.58	1.67
19	0.978	0.028	24.440	0.284	608.41	633.13	11930.83	1.58
18	1.053	0.031	26.333	0.313	607.64	634.29	11297.69	1.50
17	1.115	0.034	27.878	0.340	607.01	635.23	10663.40	1.42
16	1.164	0.036	29.095	0.364	606.52	635.98	10028.17	1.33
15	1.205	0.039	30.128	0.386	606.09	636.61	9392.20	1.25
14	1.241	0.041	31.018	0.407	605.73	637.15	8755.59	1.17
13	1.276	0.043	31.893	0.426	605.37	637.69	8118.44	1.08
12	1.309	0.044	32.728	0.444	605.03	638.20	7480.74	1.00
11	1.342	0.046	33.555	0.463	604.69	638.71	6842.54	0.92
10	1.372	0.042	34.295	0.423	604.41	639.13	6203.83	0.83
9	0.000	0.000	0.000	0.000	618.30	618.30	5564.70	0.75
8	0.000	0.000	0.000	0.000	618.30	618.30	4946.40	0.67
7	0.000	0.000	0.000	0.000	618.30	618.30	4328.10	0.58
6	0.000	0.000	0.000	0.000	618.30	618.30	3709.80	0.50
5	0.000	0.000	0.000	0.000	618.30	618.30	3091.50	0.42
4	0.000	0.000	0.000	0.000	618.30	618.30	2473.20	0.33
3	0.000	0.000	0.000	0.000	618.30	618.30	1854.90	0.25
2	0.000	0.000	0.000	0.000	618.30	618.30	1236.60	0.17
1	0.000	0.000	0.000	0.000	618.30	618.30	618.30	0.08
0	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00

Chamber Model	HS31		
Number of Chambers	25		
Number of Endcaps	10		
Stone Voids (porosity)	40%		
Base of Stone Elevation	0	ft	
Recommended Stone Below Chambers*	9	in.	**Include perimeter stone?** Yes
Recommended Stone Above Chambers*	12	in.	

Area of System** **10652** sq.ft

***Area must be greater than:* **700 sq.ft**

*The minimum stone below and above the chambers to be determinded by the design engineer.

System Height (in)	Incremental Single Chamber Storage (cu.ft)	Incremental Single End Cap Storage (cu.ft)	Incremental Total Chamber Storage (cu.ft)	Incremental Total End Cap Storage (cu.ft)	Incremental Stone Storage (cu.ft)	Incremental Chamber, End Cap, & Stone (cu.ft)	Cumulative System Storage (cu.ft)	Elevation (ft)
37	0.000	0.000	0.000	0.000	355.07	355.07	13364.87	3.08
36	0.000	0.000	0.000	0.000	355.07	355.07	13009.81	3.00
35	0.000	0.000	0.000	0.000	355.07	355.07	12654.74	2.92
34	0.000	0.000	0.000	0.000	355.07	355.07	12299.67	2.83
33	0.000	0.000	0.000	0.000	355.07	355.07	11944.61	2.75
32	0.000	0.000	0.000	0.000	355.07	355.07	11589.54	2.67
31	0.000	0.000	0.000	0.000	355.07	355.07	11234.47	2.58
30	0.000	0.000	0.000	0.000	355.07	355.07	10879.41	2.50
29	0.000	0.000	0.000	0.000	355.07	355.07	10524.34	2.42
28	0.000	0.000	0.000	0.000	355.07	355.07	10169.27	2.33
27	0.000	0.000	0.000	0.000	355.07	355.07	9814.21	2.25
26	0.000	0.000	0.000	0.000	355.07	355.07	9459.14	2.17
25	0.057	0.002	1.435	0.017	354.49	355.94	9104.07	2.08
24	0.207	0.006	5.170	0.060	352.97	358.20	8748.14	2.00
23	0.372	0.012	9.290	0.124	351.30	360.72	8389.93	1.92
22	0.622	0.017	15.560	0.173	348.77	364.51	8029.22	1.83
21	0.773	0.022	19.330	0.215	347.25	366.79	7664.71	1.75
20	0.887	0.025	22.178	0.251	346.10	368.52	7297.92	1.67
19	0.978	0.028	24.440	0.284	345.18	369.90	6929.39	1.58
18	1.053	0.031	26.333	0.313	344.41	371.05	6559.49	1.50
17	1.115	0.034	27.878	0.340	343.78	372.00	6188.44	1.42
16	1.164	0.036	29.095	0.364	343.28	372.74	5816.44	1.33
15	1.205	0.039	30.128	0.386	342.86	373.37	5443.70	1.25
14	1.241	0.041	31.018	0.407	342.50	373.92	5070.32	1.17
13	1.276	0.043	31.893	0.426	342.14	374.46	4696.40	1.08
12	1.309	0.044	32.728	0.444	341.80	374.97	4321.94	1.00
11	1.342	0.046	33.555	0.463	341.46	375.48	3946.97	0.92
10	1.372	0.042	34.295	0.423	341.18	375.90	3571.50	0.83
9	0.000	0.000	0.000	0.000	355.07	355.07	3195.60	0.75
8	0.000	0.000	0.000	0.000	355.07	355.07	2840.53	0.67
7	0.000	0.000	0.000	0.000	355.07	355.07	2485.47	0.58
6	0.000	0.000	0.000	0.000	355.07	355.07	2130.40	0.50
5	0.000	0.000	0.000	0.000	355.07	355.07	1775.33	0.42
4	0.000	0.000	0.000	0.000	355.07	355.07	1420.27	0.33
3	0.000	0.000	0.000	0.000	355.07	355.07	1065.20	0.25
2	0.000	0.000	0.000	0.000	355.07	355.07	710.13	0.17
1	0.000	0.000	0.000	0.000	355.07	355.07	355.07	0.08
0	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

How to use this worksheet (also see instructions in Section 3.7 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.1, Section G of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

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

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ D1. **Need for future indoor & structural pest control**		☒ **Note building design features that discourage entry of pests.**	☒ **Provide Integrated Pest Management information to owners, lessees, and operators.**
☒ D2. **Landscape/ Outdoor Pesticide Use**	❑ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ❑ **Show self-retaining landscape areas, if any.** ☒ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** ❑ **Preserve existing native trees and shrubs, and ground covert 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, landuse, air movement, ecological consistency, and plant interactions.** ☒ **Irrigation runoff is prohibited.**	❑ **Maintain landscaping using minimum or no pesticides.** ❑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at http://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ❑ **Provide IPM information to new owners, lessees and operators.**

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

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

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

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

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

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

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

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

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

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

Appendix 9: O&M

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

WILL BE PROVIDED DURING FINAL ENGINEERING

Appendix 10: Educational Materials

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

Bio Clean

A Forterra Company

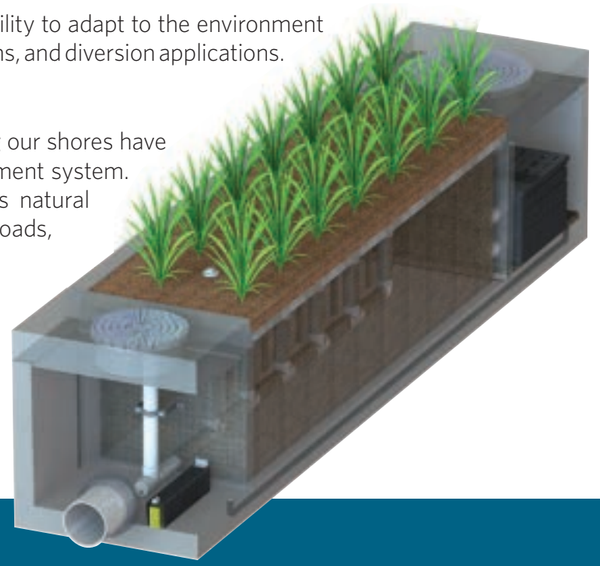
Modular Wetlands® System Linear

A Stormwater Biofiltration Solution

OVERVIEW

The Bio Clean Modular Wetlands® System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint, higher treatment capacity, and a wide range of versatility. While most biofilters use little or no pretreatment, the Modular Wetlands® incorporates an advanced pretreatment chamber that includes separation and pre-filter cartridges. In this chamber, sediment and hydrocarbons are removed from runoff before entering the biofiltration chamber, reducing maintenance costs and improving performance.

Horizontal flow also gives the system the unique ability to adapt to the environment through a variety of configurations, bypass orientations, and diversion applications.



The Urban Impact

For hundreds of years, natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as cities grow and develop, our environment's natural filtration systems are blanketed with impervious roads, rooftops, and parking lots.

Bio Clean understands this loss and has spent years re-establishing nature's presence in urban areas, and rejuvenating waterways with the Modular Wetlands® System Linear.

PERFORMANCE

The Modular Wetlands® continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons, and bacteria. Since 2007 the Modular Wetlands® has been field tested on numerous sites across the country and is proven to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. In fact, the Modular Wetlands® harnesses some of the same biological processes found in natural wetlands in order to collect, transform, and remove even the most harmful pollutants.

66% REMOVAL OF DISSOLVED ZINC	**69%** REMOVAL OF TOTAL ZINC	**38%** REMOVAL OF DISSOLVED COPPER	**64%** REMOVAL OF TOTAL PHOSPHORUS	
45% REMOVAL OF NITROGEN	**50%** REMOVAL OF TOTAL COPPER	**95%** REMOVAL OF MOTOR OIL	**67%** REMOVAL OF ORTHO PHOSPHORUS	**85%** REMOVAL OF TSS

APPROVALS

The Modular Wetlands® System Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation and perhaps the world. Here is a list of some of the most high-profile approvals, certifications, and verifications from around the country.

Washington State Department of Ecology TAPE Approved
The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft² loading rate. The highest performing BMP on the market for all main pollutant categories.

California Water Resources Control Board, Full Capture Certification
The Modular Wetlands® System is the first biofiltration system to receive certification as a full capture trash treatment control device.

Virginia Department of Environmental Quality, Assignment
The Virginia Department of Environmental Quality assigned the MWS Linear the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) regulation technical criteria.

Maryland Department of the Environment, Approved ESD
Granted Environmental Site Design (ESD) status for new construction, redevelopment, and retrofitting when designed in accordance with the design manual.

MASTEP Evaluation
The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% total phosphorus, 68.5% total zinc, and more.

Rhode Island Department of Environmental Management, Approved BMP
Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% pathogens, 30% total phosphorus, and 30% total nitrogen.

ADVANTAGES

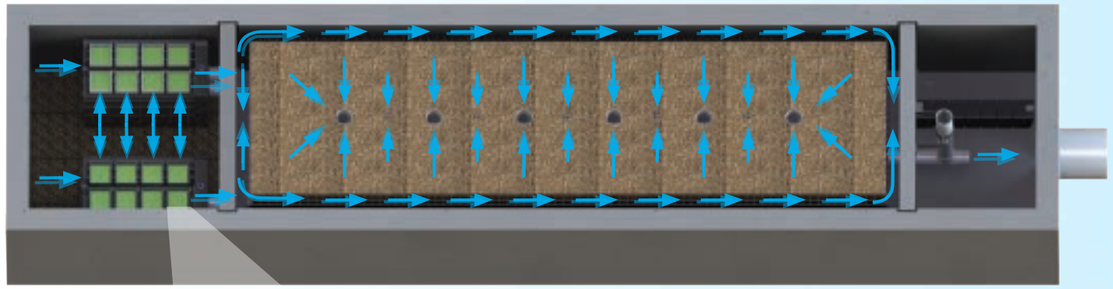
- HORIZONTAL FLOW BIOFILTRATION
- GREATER FILTER SURFACE AREA
- PRETREATMENT CHAMBER
- PATENTED PERIMETER VOID AREA
- FLOW CONTROL
- NO DEPRESSED PLANTER AREA
- AUTO DRAINDOWN MEANS NO MOSQUITO VECTOR

OPERATION

The Modular Wetlands® System Linear is the most efficient and versatile biofiltration system on the market, and it is the only system with horizontal flow which:

- Improves performance
- Reduces footprint
- Minimizes maintenance

Figure 1 & Figure 2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.



2x to 3x more surface area than traditional downward flow bioretention systems.

Figure 2, Top View

1 PRETREATMENT

SEPARATION

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

PRE-FILTER CARTRIDGES

- Over 25 sq. ft. of surface area per cartridge
- Utilizes BioMediaGREEN™ filter material
- Removes over 80% of TSS and 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber

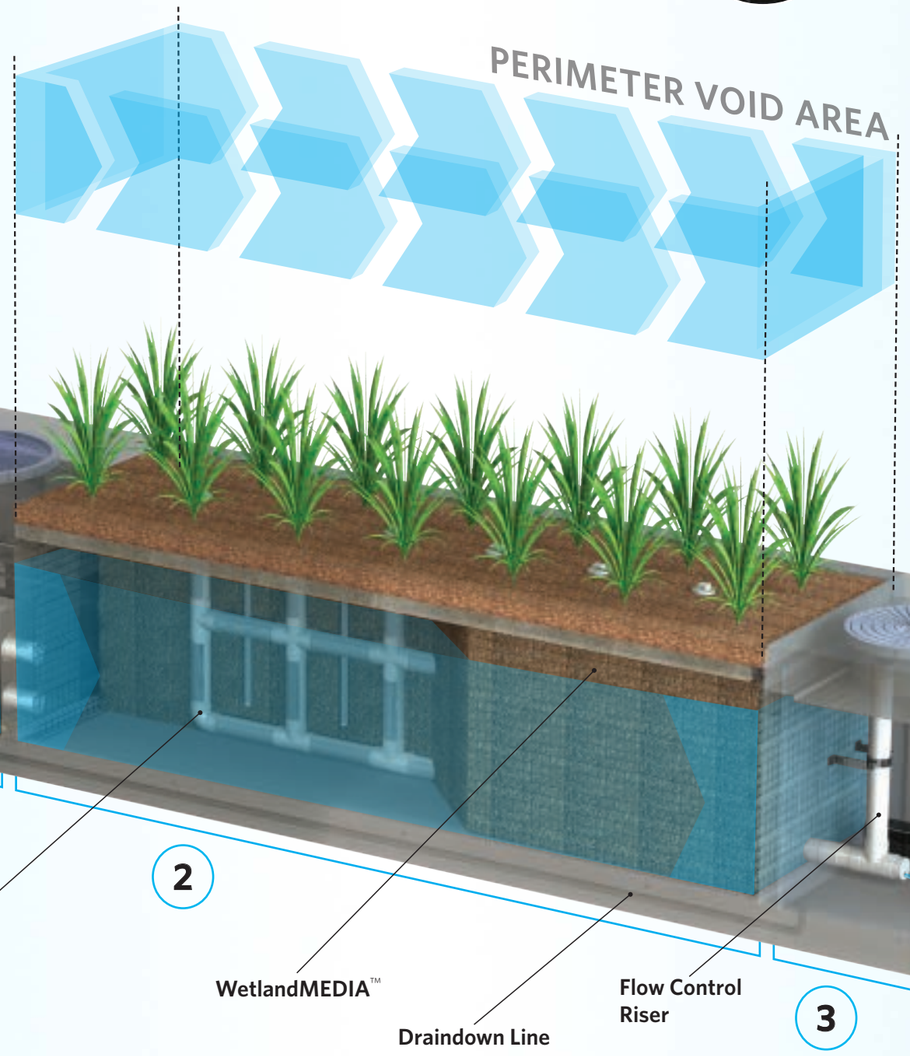


Figure 1

2 BIOFILTRATION

HORIZONTAL FLOW

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

PATENTED PERIMETER VOID AREA

- Vertically extends void area between the walls and the WetlandMEDIA™ on all four sides
- Maximizes surface area of the media for higher treatment capacity

WETLANDMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and lightweight

3 DISCHARGE

FLOW CONTROL

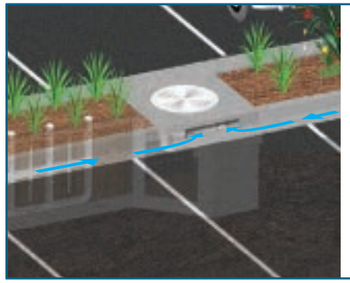
- Orifice plate controls flow of water through WetlandMEDIA™ to a level lower than the media's capacity
- Extends the life of the media and improves performance

DRAINDOWN FILTER

- The draindown is an optional feature that completely drains the pretreatment chamber
- Water that drains from the pretreatment chamber between storm events will be treated

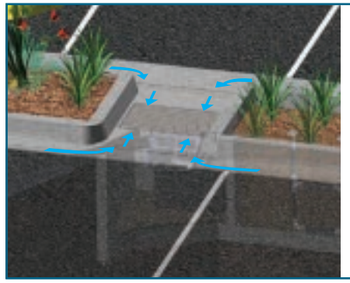
CONFIGURATIONS

The Modular Wetlands® System Linear is the preferred biofiltration system of civil engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your storm drain design.



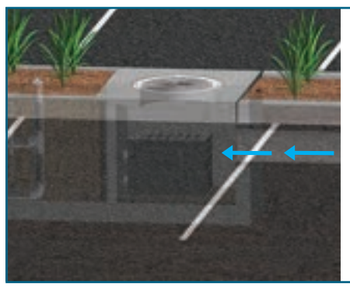
CURB TYPE

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along roadways and parking lots. It can be used in sump or flow-by conditions. Length of curb opening varies based on model and size.



GRATE TYPE

The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the systems pretreatment chamber. It has the added benefit of allowing pedestrian access over the inlet. ADA-compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



VAULT TYPE

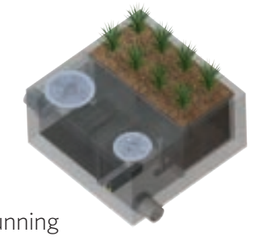
The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pretreatment chamber, meaning the Modular Wetlands® can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/ bioretention systems. Another benefit of the "pipe-in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

DOWNSPOUT TYPE

The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from rooftop and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

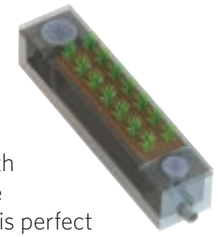
ORIENTATIONS

SIDE-BY-SIDE



The Side-By-Side orientation places the pretreatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

END-TO-END



The End-To-End orientation places the pretreatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft. (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is that bypass must be external.

BYPASS

INTERNAL BYPASS WEIR (SIDE-BY-SIDE ONLY)

The Side-By-Side orientation places the pretreatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pretreatment chamber directly to the discharge chamber.

EXTERNAL DIVERSION WEIR STRUCTURE

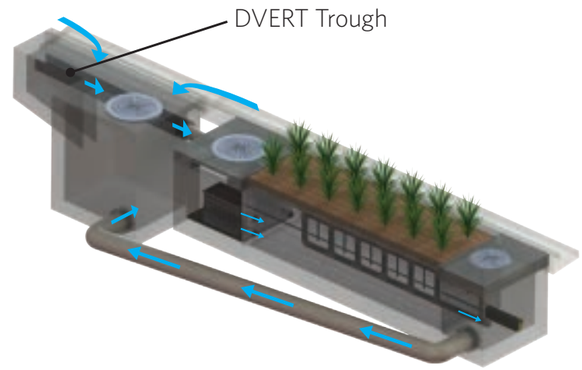
This traditional offline diversion method can be used with the Modular Wetlands® in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the Modular Wetlands® for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

FLOW-BY-DESIGN

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the Modular Wetlands® and into the standard inlet downstream.

DVERT LOW FLOW DIVERSION

This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the Modular Wetlands® via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over



to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allow the Modular Wetlands® to be installed anywhere space is available.

SPECIFICATIONS

FLOW-BASED DESIGNS

The Modular Wetlands® System Linear can be used in stand-alone applications to meet treatment flow requirements. Since the Modular Wetlands® is the only biofiltration system that can accept inflow pipes several feet below the surface, it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

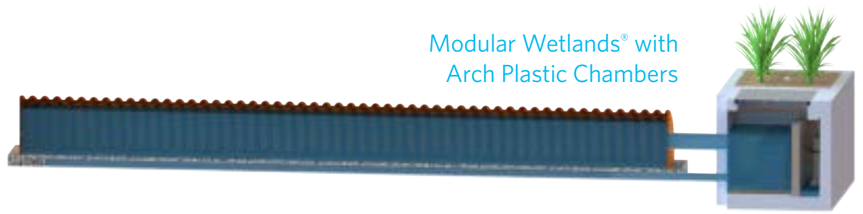
MODEL #	DIMENSIONS	WETLANDMEDIA SURFACE AREA (sq. ft.)	TREATMENT FLOW RATE (cfs)
MWS-L-4-4	4′ x 4′	23	0.052
MWS-L-4-6	4′ x 6′	32	0.073
MWS-L-4-8	4′ x 8′	50	0.115
MWS-L-4-13	4′ x 13′	63	0.144
MWS-L-4-15	4′ x 15′	76	0.175
MWS-L-4-17	4′ x 17′	90	0.206
MWS-L-4-19	4′ x 19′	103	0.237
MWS-L-4-21	4′ x 21′	117	0.268
MWS-L-6-8	7′ x 9′	64	0.147
MWS-L-8-8	8′ x 8′	100	0.230
MWS-L-8-12	8′ x 12′	151	0.346
MWS-L-8-16	8′ x 16′	201	0.462
MWS-L-8-20	9′ x 21′	252	0.577
MWS-L-8-24	9′ x 25′	302	0.693
MWS-L-10-20	10' x 20'	302	0.693

VOLUME-BASED DESIGNS

HORIZONTAL FLOW BIOFILTRATION ADVANTAGE

Modular Wetlands® with
Box Culvert Prestorage

The Modular Wetlands® System Linear offers a unique advantage in the world of biofiltration due to its exclusive horizontal flow design: Volume-Based Design. No other biofilter has the ability to be placed downstream of detention ponds, extended dry detention basins, underground storage systems and permeable paver reservoirs. The systems horizontal flow configuration and built-in orifice control allows it to be installed with just 6" of fall between inlet and outlet pipe for a simple connection to projects with shallow downstream tie-in points. In the example above, the Modular Wetlands® is installed downstream of underground box culvert storage. Designed for the water quality volume, the Modular Wetlands® will treat and discharge the required volume within local draindown time requirements.



Modular Wetlands® with
Arch Plastic Chambers

DESIGN SUPPORT

Bio Clean engineers are trained to provide you with superior support for all volume sizing configurations throughout the country. Our vast knowledge of state and local regulations allow us to quickly and efficiently size a system to maximize feasibility. Volume control and hydromodification regulations are expanding the need to decrease the cost and size of your biofiltration system. Bio Clean will help you realize these cost savings with the Modular Wetlands®, the only biofilter than can be used downstream of storage BMPs.

ADVANTAGES

- LOWER COST THAN FLOW-BASED DESIGN
- MEETS LID REQUIREMENTS
- BUILT-IN ORIFICE CONTROL STRUCTURE
- WORKS WITH DEEP INSTALLATIONS

APPLICATIONS

The Modular Wetlands® System Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

INDUSTRIAL

Many states enforce strict regulations for discharges from industrial sites. The Modular Wetlands® has helped various sites meet difficult EPA-mandated effluent limits for dissolved metals and other pollutants.

RESIDENTIAL

Low to high density developments can benefit from the versatile design of the Modular Wetlands®. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

STREETS

Street applications can be challenging due to limited space. The Modular Wetlands® is very adaptable, and it offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

PARKING LOTS

Parking lots are designed to maximize space and the Modular Wetlands'® 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

COMMERCIAL

Compared to bioretention systems, the Modular Wetlands® can treat far more area in less space, meeting treatment and volume control requirements.

MIXED USE

The Modular Wetlands® can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications include:

• Agriculture • Reuse • Low Impact Development • Waste Water

PLANT SELECTION

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the Modular Wetlands® System Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade, the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the Modular Wetlands®, giving the plants more contact time so that pollutants are more successfully decomposed, volatilized, and incorporated into the biomass of the Modular Wetlands'® micro/macro flora and fauna.

A wide range of plants are suitable for use in the Modular Wetlands®, but selections vary by location and climate. View suitable plants by visiting biocleanenvironmental.com/plants.

INSTALLATION

The Modular Wetlands® is simple, easy to install, and has a space-efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles precast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians is available to supervise installations and provide technical support.

MAINTENANCE

Reduce your maintenance costs, man hours, and materials with the Modular Wetlands®. Unlike other biofiltration systems that provide no pretreatment, the Modular Wetlands® is a self-contained treatment train which incorporates simple and effective pretreatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pretreatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pretreatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long-term operation, and there is absolutely no need to replace expensive biofiltration media.

Bio Clean
A Forterra Company

5796 Armada Drive Suite 250
Carlsbad, CA 92008
855.566.3938
stormwater@forterrabp.com
biocleanenvironmental.com

010419R1A

Stormwater and the Construction Industry

Protect Natural Features

Bad

Good

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

Construction Phasing

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

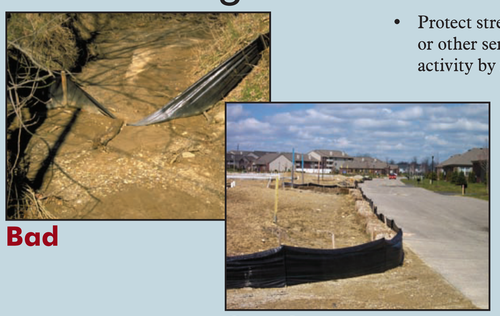
Vegetative Buffers

Bad

Good

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

Silt Fencing



Bad

Good

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

Maintain your BMPs!

IN RIVERSIDE COUNTY....Call 1-800-506-2555

TO REPORT ILLEGAL STORMDRAIN DISPOSAL

E-mail: Flood.fcnpdes@co.riverside.ca.us

Visit our website: www.floodcontrol.co.riverside.ca.us

Brought to you by the Storm Water/Clean Water Pollution Protection Program.....

REMEMBER, ONLY RAIN IN THE STORMDRAIN!

Site Stabilization

Bad

Good

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

Construction Entrances

Bad

Good

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

Slopes

Bad

Good

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

Dirt Stockpiles

Bad

Good

- Cover or seed all dirt stockpiles.

Storm Drain Inlet Protection

Bad

Good

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

www.epa.gov/npdes/menuofbmps

Stormwater and the Construction Industry

Planning and Implementing Erosion and Sediment Control Practices

The construction industry is a critical participant in the nation's efforts to protect streams, rivers, lakes, wetlands, and oceans. Through the use of best management practices (BMPs), construction site operators are the key defense against erosion and sedimentation.

As stormwater flows over a construction site, it picks up pollutants like sediment, debris, and chemicals. High volumes of stormwater can also cause stream bank erosion, and destroy downstream aquatic habitat. Preventing soil erosion and sedimentation is an important responsibility at all construction sites.

In addition to the environmental impact, uncontrolled erosion can have a significant financial impact on a construction project. It costs money and time to repair gullies, replace vegetation, clean sediment-clogged storm drains, replace poorly installed BMPs, and mitigate damage to other people's property or to natural resources.

Best Management Practice (BMP)
A BMP is a method used to prevent or control stormwater runoff and the discharge of pollutants, including sediment, into local waterbodies. Silt fences, inlet protection, and site-stabilization techniques are typical BMPs on a construction site.

Operator
An operator is someone who has control over and the ability to modify construction plans and specifications (e.g. owner, general contractor)

or

Someone who has control over the day-to-day operations at a site (e.g., owner, general contractor) that are necessary to ensure compliance with the permit requirements. It is the responsibility of a construction site owner or operator to contain stormwater runoff and prevent erosion during **all** stages of a project.

There may be more than one person at a site who meets these definitions and must apply for permit coverage. (States may have different definitions of the term "operator.")

So what's being done about polluted runoff?

The Clean Water Act includes the National Pollutant Discharge Elimination System (NPDES) permitting program. As of January 2003, 44 states and territories are authorized to issue NPDES stormwater permits. If your state isn't authorized to operate the NPDES stormwater permit program, EPA issues the permits. Permits vary from state to state, so contact your state or EPA for specific information. Your permitting authority has specific information on your state's NPDES stormwater permit program. In general, construction permits require construction operators to do all of the following:

- Develop and implement a stormwater pollution prevention plan
- Submit a permit application or notice of intent (NOI)
- Comply with the permit, including maintaining BMPs and inspecting the site

Under the NPDES program, construction activities that disturb 1 or more acres are required to obtain stormwater permit coverage. States have different names for the plans that construction operators must develop, such as

- Stormwater pollution prevention plan
- Erosion and sediment control plan
- Erosion control and stormwater management plan
- Stormwater management plan
- Water pollution control plan
- Pollution prevention plan

This document uses the term "*Plan*."

I think I need a permit... Where do I start?

All land-disturbing activities, including clearing, grading, and excavation, that disturb **1 or more acres** are required to be covered under a state or EPA-issued NPDES construction stormwater permit **prior to land disturbance**. Permit requirements vary by state. Begin by researching the specific requirements in your state. You might already be subject to local erosion and sediment control requirements, but that doesn't release you from the requirements of the NPDES program at the state or EPA level. Although you must comply with both sets of requirements, in most cases they have been designed to be complementary. Contact your permitting authority to find out exactly what you need to do. A good place to start your search is the Construction Industry Compliance Assistance web site at http://www.envcap.org/cica.

The NPDES permit requirements include small construction activities that are part of a larger common plan of development or sale, such as a single lot within a larger subdivision. For developments with multiple operators, all operators must have permit coverage for their individual parts of the larger development, no matter how large or small each operation happens to be. When there are multiple operators at one site, they're encouraged to develop and share one comprehensive Plan and obtain permit coverage as co-permitees.

The **owner or operator** of the construction site is responsible for complying with the requirements of the permit. Responsibilities include developing a Plan, obtaining permit coverage, implementing BMPs, and stabilizing the site at the end of the construction activity.

Construction sites that discharge unpermitted stormwater are in violation of the Clean Water Act and may be subject to fines of up to $27,500 a day per violation.

Determine your eligibility

All construction activity that disturbs 1 or more acres of land, as well as activity that disturbs less than 1 acre but is part of a larger common plan of development, must obtain permit coverage.

Read and understand your stormwater permit requirements

Get a copy of the permit for construction activities and a permit application (or notice of intent form) from your state or EPA permitting authority.

Develop a Plan

Most states do not require you to submit your Plan. However, you do need to keep the Plan on site. If that's impractical, you may post a notice that tells where the Plan is kept so it can be accessed by the permitting authority and other interested parties.

You'll need to post a copy of your completed application on site. Put it in a place where the public can see it so they'll know your site is covered by an NPDES permit!

Apply for permit coverage

Once you understand your permit requirements and have developed a Plan, you can submit a stormwater permit application (or notice of intent) to your permitting authority. This must be done before beginning any land disturbance on the site. Some states require a few days of lead time, so check with your permitting authority. Once you've submitted the application, you must satisfy the conditions of the permit.

Implement the Plan

Be prepared to implement the BMPs in your Plan before construction begins. Ensure that BMPs are properly maintained, and upgrade and repair them as necessary.

Developing and Implementing a Plan

You must have a Plan that includes erosion and sediment control and pollution prevention BMPs. These Plans require

- Advance planning and training to ensure proper implementation of the BMPs
- Erosion and sediment control BMPs in place until the area is permanently stabilized
- Pollution prevention BMPs to keep the construction site "clean"
- Regular inspection of the construction site to ensure proper installation and maintenance of BMPs

Fortunately, the practices and measures that must be included in your Plan are already part of the standard operating procedures at many construction sites.

Six steps are associated with developing and implementing a stormwater Plan. There's a wealth of information available on developing pollution prevention plans. Please contact your permitting authority for help in finding additional guidance materials, or visit www.epa.gov/npdes/stormwater. A sample construction plan is available at www.epa.gov/npdes/pubs/sample_swppp.pdf.

1. *Site Evaluation and Design Development*

- **Collect site information**
- **Develop site plan design**
- **Prepare pollution prevention site map**

The first step in preparing a Plan is to define the characteristics of the site and the type of construction that will occur. This involves collecting site information, identifying natural features that should be protected, developing a site plan design, describing the nature of the construction activity, and preparing a pollution prevention site map.

2. *Assessment*

- **Measure the site area**
- **Determine the drainage areas**
- **Calculate the runoff coefficient**

The next step is assessing the impact the project will have on stormwater runoff. Determine the drainage areas and estimate the runoff amounts and velocities. For more information on calculatng the runoff coefficient, go to www.epa.gov/npdes/pubs/chap02_conguide.pdf, page 11.

3. *Control Selection and Plan Design*

- **Review and incorporate state or local requirements**
- **Select erosion and sediment controls**
- **Select other controls**
- **Select stormwater management controls**
- **Indicate the location of controls on the site map**
- **Prepare an inspection and maintenance plan**
- **Coordinate controls with construction activity**
- **Prepare sequence of major activities**

In the third step you'll actually document your procedures to prevent and control polluted stormwater runoff. You must delineate areas that will not be disturbed, including critical natural areas like streamside areas, floodplains, and trees. You must also identify the measures (or BMPs) you'll use to protect these areas.

Phasing your project to minimize the amount of exposed soil at any given time is a highly effective way to prevent erosion. Erosion control measures designed to prevent soil from being mobilized include diversions to route stormwater away from exposed soils and stabilization with vegetation, mulch, and geotextiles. Sedimentation control measures designed to remove sediment from stormwater or prevent it from leaving the site include silt fences, sediment traps, and diversions.

You'll need to select erosion and sediment controls—including stabilization measures for protecting disturbed areas and structural controls for diverting run-off and removing sediment—that are appropriate for your particular site. The appropriateness of the control measures will depend on several factors, but will be influenced most directly by the site characteristics. Some stabilization measures you might consider are temporary seeding, permanent seeding, and mulching. Structural control measures include earth dikes, silt fences, and sediment traps. No single BMP will meet all of the erosion and sedimentation control needs of a construction site. A combination of BMPs is necessary. For more information on the types of BMPs appropriate for your construction site, see the BMP fact sheet series available at www.epa.gov/npdes/menuofbmps.

Soil erosion control tips...

- Design the site to infiltrate stormwater into the ground and to keep it out of storm drains. Eliminate or minimize the use of stormwater collection and conveyance systems while maximizing the use of stormwater infiltration and bioretention techniques.
- Minimize the amount of exposed soil on site.
  - To the extent possible, plan the project in stages to minimize the amount of area that is bare and subject to erosion. The less soil exposed, the easier and cheaper it will be to control erosion.
  - Vegetate disturbed areas with permanent or temporary seeding immediately upon reaching final grade.
  - Vegetate or cover stockpiles that will not be used immediately.
- Reduce the velocity of stormwater both onto and away from the project area.
  - Interceptors, diversions, vegetated buffers, and check dams are a few of the BMPs that can be used to slow down stormwater as it travels across and away from the project site.
  - Diversion measures can also be used to direct flow away from exposed areas toward stable portions of the site.
  - Silt fences and other types of perimeter filters should never be used to reduce the velocity of runoff.
- Protect defined channels immediately with measures adequate to handle the storm flows expected.
  - Sod, geotextile, natural fiber, riprap, or other stabilization measures should be used to allow the channels to carry water without causing erosion. Use softer measures like geotextile or vegetation where possible to prevent downstream impacts.
- Keep sediment on site.
  - Place aggregate or stone at construction site vehicle exits to accommodate at least two tire revolutions of large construction vehicles. Much of the dirt on the tires will fall off before the vehicle gets to the street.
  - Regular street sweeping at the construction entrance will prevent dirt from entering storm drains. Do not hose paved areas.
  - Sediment traps and basins are temporary structures and should be used in conjunction with other measures to reduce the amount of erosion.
- Maintaining all BMPs is critical to ensure their effectiveness during the life of the project.
  - Regularly remove collected sediment from silt fences, berms, traps, and other BMPs.
  - Ensure that geotextiles and mulch remain in place until vegetation is well established.
  - Maintain fences that protect sensitive areas, silt fences, diversion structures, and other BMPs.

Other BMPs and Activities to Control Polluted Runoff

You'll need to select other controls to address potential pollutant sources on your site. Construction materials, debris, trash, fuel, paint, and stockpiles become pollution sources when it rains. Basic pollution prevention practices can significantly reduce the amount of pollution leaving construction sites. The following are some simple practices that should be included in the Plan and implemented on site:

- Keep potential sources of pollution out of the rain as practicable (e.g., inside a building, covered with plastic or tarps, or sealed tightly in a leak-proof container).
- Clearly identify a protected, lined area for concrete truck washouts. This area should be located away from streams, storm drain inlets, or ditches and should be cleaned out periodically.
- Park, refuel, and maintain vehicles and equipment in one area of the site to minimize the area exposed to possible spills and fuel storage. This area should be well away from streams, storm drain inlets, or ditches. Keep spill kits close by and clean up any spills or leaks immediately, including spills on pavement or earthen surfaces.
- Practice good housekeeping. Keep the construction site free of litter, construction debris, and leaking containers. Keep all waste in one area to minimize cleaning.
- Never hose down paved surfaces to clean dust, debris, or trash. This water could wash directly into storm drains or streams. Sweep up materials and dispose of them in the trash. Never bury trash or debris!
- Dispose of hazardous materials properly.

4. *Certification and Notification*

- **Certify the Plan**
- **Submit permit application or notice of intent**

Once the Plan has been developed, an authorized representative must sign it. Now is the time to submit the permit application or notice of intent. Your permit might require that the Plan be kept on site, so be sure to keep it available for the staff implementing the Plan.

Erosion and sedimentation control practices are only as good as their installation and maintenance.

5. *Implementing and Maintaining a Plan*

- **Implement controls**
- **Inspect and maintain controls**
- **Update/change the Plan**
- **Report releases of hazardous materials**

A Plan describes the practices and activities you'll use to prevent stormwater contamination and meet the NPDES permit requirements. Make sure that the Plan is implemented and that the Plan is updated as necessary to reflect changes on the site.

Erosion and sedimentation control practices are only as good as their installation and maintenance. Train the contractors that will install the BMPs and inspect immediately to ensure that the BMPs have been installed correctly.

Regularly inspect the BMPs (especially before and after rain events) and perform any necessary repairs or maintenance immediately. Many BMPs are designed to handle a limited amount of sediment. If not maintained, they'll become ineffective and a source of sediment pollution.

It's also important to keep records of BMP installation, implementation, and maintenance. Keep track of major grading activities that occur on the site, when construction activities cease (temporarily or permanently), and when a site is temporarily or permanently stabilized.

If construction plans change at any time, or if more appropriate BMPs are chosen for the site, update the Plan accordingly.

6. *Completing the Project: Final Stabilization and Termination of the Permit*

- **Final stabilization**
- **Notice of Termination**
- **Record retention**

Many states and EPA require a Notice of Termination (NOT) or other notification signifying that the construction activity is completed. An NOT is required when

- Final stabilization has been achieved on all portions of the site for which the permittee is responsible.
- Another operator has assumed control over all areas of the site that have not been finally stabilized. That operator would need to submit a new permit application to the permitting authority.
- For residential construction only, temporary stabilization of a lot has been completed prior to transference of ownership to the homeowner, with the homeowner being made aware of the need to perform final stabilization.

Permittees must keep a copy of their permit application and their Plan for at least 3 years following final stabilization. This period may be longer depending on state and local requirements.

Preconstruction Checklist

- A site description, including
  - Nature of the activity
  - Intended sequence of major construction activities
  - Total area of the site
  - Existing soil type and rainfall runoff data
  - A site map with:
    - Drainage patterns
    - Approximate slopes after major grading
    - Area of soil disturbance
    - Outline of areas which will not be disturbed
    - Location of major structural and nonstructural soil erosion controls
    - Areas where stabilization practices are expected to occur
    - Surface waters
    - Stormwater discharge locations
  - Name of the receiving water(s)
- A description of controls:
  - Erosion and sediment controls, including
    - Stabilization practices for all areas disturbed by construction
    - Structural practices for all drainage/discharge locations
  - Stormwater management controls, including
    - Measures used to control pollutants occurring in stormwater discharges after construction activities are complete
    - Velocity dissipation devices to provide nonerosive flow conditions from the discharge point along the length of any outfall channel
  - Other controls, including
    - Waste disposal practices that prevent discharge of solid materials
    - Measures to minimize offset tracking of sediments by construction vehicles
    - Measures to ensure compliance with state or local waste disposal, sanitary sewer, or septic system regulations
  - Description of the timing during the construction when measures will be implemented
- State or local requirements incorporated into the Plan
- Inspection and maintenance procedures for control measures identified in the Plan
- Contractor certification and Plan certification

Implementation Checklist

- Maintain records of construction activities, including
  - Dates when major grading activities occur
  - Dates when construction activities temporarily cease on the site or a portion of the site
  - Dates when construction activities permanently cease on the site or a portion of the site
  - Dates when stabilization measures are completed on the site
- Prepare inspection reports summarizing
  - Name of person conducting BMP inspections
  - Qualifications of person conducting BMP inspections
  - BMPs/areas inspected
  - Observed conditions
  - Necessary changes to the Plan
- Report releases of reportable quantities of oil or hazardous materials
  - Notify the National Response Center at 800-424-8802 immediately
  - Report releases to your permitting authority immediately, or as specified in your permit. You must also provide a written report within 14 days.
  - Modify the Plan to include
    - The date of release
    - Circumstances leading to the release
    - Steps taken to prevent reoccurrence of the release
- Modify Plan as necessary
  - Incorporate requests of the permitting authority to bring the Plan into compliance
  - Address changes in design, construction operation, or maintenance that affect the potential for discharge of pollutants

An ounce of prevention is worth a pound of cure! It's far more efficient and cost-effective to prevent pollution than it is to try to correct problems later. Installing and maintaining simple BMPs and pollution prevention techniques on site can greatly reduce the potential for stormwater pollution and can also save you money!

Visit www.epa.gov/npdes/stormwater for more information.

StormWater CleanWater PROTECTION PROGRAM

Resources

State Water Resources Control Board
Division of Water Quality
1001 I Street
Sacramento CA 95814
(916) 341-5455
www.swrcb.ca.gov/stormwtr/

Colorado River Basin Regional Water
Quality Control Board - Region 7
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491
www.swrcb.ca.gov/~rwqcb7/

Santa Ana Regional Water
Quality Control Board - Region 8
3737 Main Street, Suite 500
Riverside, CA 92501-3348
(909) 782-4130
www.swrcb.ca.gov/~rwqcb8/

San Diego Regional Water
Quality Control Board - Region 9
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124
(858) 467-2952
www.swrcb.ca.gov/~rwqcb9/

To report a hazardous materials spill, call:

Riverside County Hazardous Materials
Emergency Response Team
(909) 358-5055 8:00 a.m. – 5:00 p.m.
(909) 358-5245 after 5:00 p.m.

In an emergency call: **911**

For recycling and hazardous waste disposal, call:

(909) 358-5055

To report an illegal dumping or a clogged storm drain, call:

1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, please call (909) 955-1200 or visit the StormWater/CleanWater Protection Program website at:
www.co.riverside.ca.us/depts/flood/waterquality npdes.asp

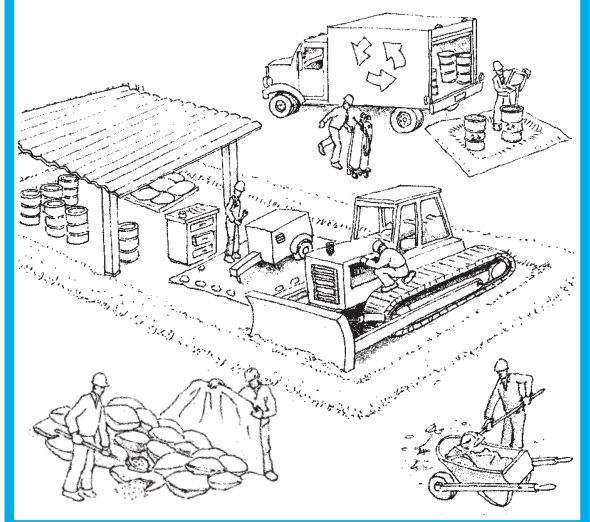
StormWater CleanWater
PROTECTION PROGRAM

The StormWater/CleanWater Protection Program gratefully acknowledges the Santa Clara Valley Nonpoint Pollution Control Program, Alameda Countywide CleanWater Program and the City of Los Angeles Stormwater Management Division for information provided in this brochure.

StormWater Pollution

What you should know for...

GENERAL CONSTRUCTION & SITE SUPERVISION



Best Management Practices (BMPs) for:

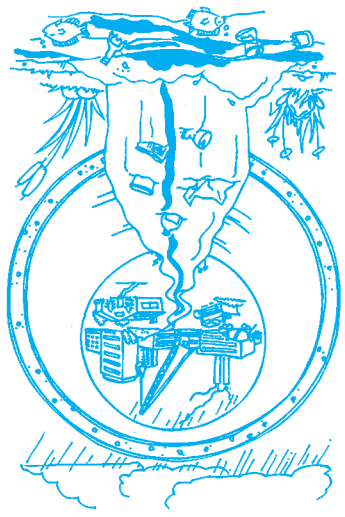
- Developers
- General Contractors
- Home Builders
- Construction Inspectors
- Anyone in the construction business

StormWater Pollution . . . What You Should Know

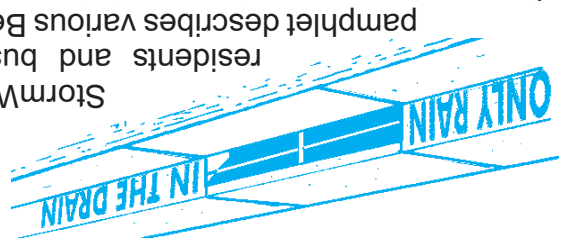
Riverside County has two drainage systems - sewers and storm drains. The storm drain system was designed to reduce flooding by carrying excess rainwater away from streets and developed areas. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our local waterways.

Unlike sanitary sewers, storm drains are not connected to a wastewater treatment plant – they flow directly to our local streams, rivers and lakes.

Stormwater runoff is a part of the natural hydrologic process. However, land development and construction activities can significantly alter natural drainage processes and introduce pollutants into stormwater runoff. Polluted stormwater runoff from construction sites has been identified as a major source of water pollution in California. It jeopardizes the quality of our local waterways and can pose a serious threat to the health of our aquatic ecosystems.



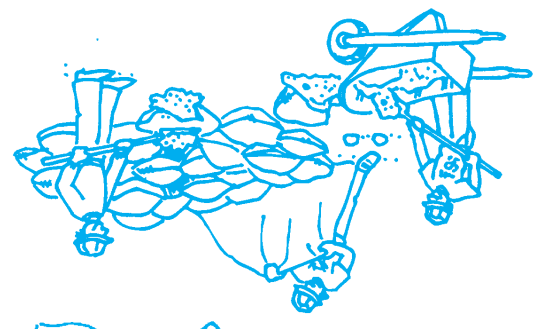
The Cities and County of Riverside StormWater/CleanWater Protection Program

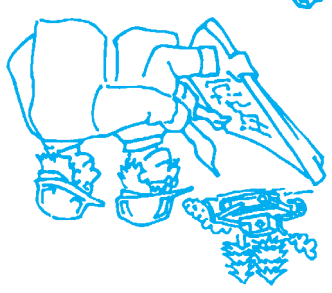


Because preventing pollution is much easier and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses on pollution prevention activities. This pamphlet describes various Best Management Practices (BMPs) that construction site operators can use to prevent stormwater pollution.

In accordance with applicable federal and state law, the Cities and County of Riverside have adopted ordinances for stormwater management and discharge control that **prohibit** the discharge of pollutants into the storm drain system or local surface water. This includes discharges from construction sites containing sediment, concrete, mortar, paint, solvents, lubricants, vehicle fluids, fuel, pesticides, and construction debris.

PLEASE NOTE: The Federal, State and local regulations strictly prohibit the discharge of sediment and pollutants into the streets, the storm drain system or waterways. As an owner, operator or supervisor of a construction site, you may be held financially responsible for any environmental damage caused by your subcontractors or employees.





STORMWATER POLLUTION FROM CONSTRUCTION ACTIVITIES

The two most common sources of stormwater pollution problems associated with construction activities are ***erosion*** and ***sedimentation***. Failure to maintain adequate erosion and sediment controls at construction sites often results in sediment discharges into the storm drain system, creating multiple problems once it enters local waterways.

Construction vehicles and heavy equipment can also track significant amounts of mud and sediment onto adjacent streets. Additionally, wind may transport construction materials and wastes into streets storm drains, or directly into our local waterways.

What Should You Do?

Advance Planning to Prevent Pollution

- ❑ Remove existing vegetation only as needed.
- ❑ Schedule excavation, grading, and paving operations for dry weather periods, if possible.
- ❑ Designate a specific area of the construction site, well away from storm drain inlets or watercourses, for material storage and equipment maintenance.
- ❑ Develop and implement an effective combination of erosion and sediment controls for the construction site.
- ❑ Practice source reduction by ordering only the amount of materials that are needed to finish the project.
- ❑ Educate your employees and subcontractors about stormwater management requirements and their pollution prevention responsibilities.
- ❑ Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site. ***Note:*** *Consult local drainage policies for more information.*

Best Management Practices

The following Best Management Practices (BMPs) can significantly reduce pollutant discharges from your construction site. Compliance with stormwater regulations can be as simple as minimizing stormwater contact with potential pollutants by providing covers and secondary containment for construction materials, designating areas away from storm drain systems for storing equipment and materials and implementing good housekeeping practices at the construction site.

- ❑ Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- ❑ Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- ❑ Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- ❑ Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- ❑ Phase grading operations to limit disturbed areas and duration of exposure.
- ❑ Perform major maintenance and repairs of vehicles and equipment offsite.
- ❑ Wash out concrete mixers only in designated washout areas at the construction site.
- ❑ Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- ❑ Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- ❑ Clean-up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas. .
- ❑ Prevent erosion by implementing any or a combination of soil stabilization practices such as mulching, surface roughening, permanent or temporary seeding.
- ❑ Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- ❑ Practice proper waste disposal. Many construction materials and wastes, including solvents, water-based paint, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation can be recycled. Materials that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste.
- ❑ Cover open dumpsters with secured tarps or plastic sheeting. Never clean out a dumpster by washing it down on the construction site.
- ❑ Arrange for an adequate debris disposal schedule to insure that dumpsters do not overflow.

General Construction Activities Stormwater Permit

(Construction Activities General Permit)

The State Water Resources Control Board (SWRCB) adopted a new Construction Activities General Permit (WQ Order No. 99-08DWQ) on August 19, 1999, superseding the now expired SWRCB statewide General Permit (WQ Order No. 92-08DWQ). This permit is administered and enforced by the SWRCB and the local Regional Water Quality Control Boards (RWQCB). The updated Construction Activities General Permit establishes a number of new stormwater management requirements for construction site operator.

NOTE: *Some construction activies stormwater permits are issued on a regional basis. Consult your local RWQCB to find out if your project requires coverage under any of these permits.*

Frequently Asked Questions:

Does my construction site require coverage under the Construction Activities General Permit?

Yes, if construction activity results in the disturbance of five or more acres of total land area or is part of a common plan of development that results in the disturbance of five or more acres.

How do I obtain coverage under the Construction Activities General Permit?

Obtain the permit package and submit the completed Notice of Intent (NOI) form to the SWRCB prior to grading or disturbing soil at the construction site. For ongoing construction activity involving a change of ownership, the new owner must submit a new NOI within 30 days of the date of change of ownership. The completed NOI along with the required fee should be mailed to the SWRCB.

What must I do to comply with the requirements of the Construction Activities General Permit?

- ● Implement BMPs for non-stormwater discharges year-round.
- ● Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities.
- ● Keep a copy of the SWPPP at the construction site for the entire duration of the project.
- ● Calculate the anticipated stormwater run-off.
- ● Implement an effective combination of erosion and sediment control on all soil disturbed areas.
- ● Conduct site inspections prior to anticipated storm events, every 24-hours during extended storm events, and after actual storm event.
- ● Perform repair and maintenance of BMPs as soon as possible after storm events depending upon worker safety.
- ● Update the SWPPP as needed, to manage pollutants or reflect changes in site conditions.
- ● Include description of post construction BMPs at the construction site, including parties responsible for long-term maintenance.

NOTE: *Please refer to the Construction Activities General Permit for detailed information. You may contact the SWRCB, your local RWQCB, or visit the SWRCB website at www.swrcb.ca.gov/stormwtr/ to obtain a State Construction Activities Stormwater General Permit packet.*

How long is this Construction Activities General Permit in effect?

The Permit coverage stays in effect untilyou submit a Notice of Termination (NOT) to the SWRCB. For the purpose of submitting a NOT, all soil disturbing activities have to be completed and one of the three following criteria has to be met:

1. Change of ownership;
2. A uniform vegetative cover with 70 percent coverage has been established; or,
3. Equivalent stabilization measures such as the use of reinforced channel liners, soil cement, fiber matrices, geotextiles, etc., have been employed.

Stormwater Pollution

What you should know for...

Industrial & Commercial Facilities

Best Management Practices (BMPS) for:

- Industrial Facilities
- Commercial Facilities

Riverside County Stormwater Program Members

City of Banning
(951) 922-3105

City of Beaumont
(951) 769-8520

City of Calimesa
(909) 795-9801

City of Canyon Lake
(951) 244-2955

City of Cathedral City
(760) 770-0340

City of Coachella
(760) 398-3502

City of Corona
(951) 736-2447

City of Desert Hot Springs
(760) 329-6411

City of Eastvale
(951) 361-0900

City of Hemet
(951) 765-2300

City of Indian Wells
(760) 346-2489

City of Indio
(760) 391-4000

City of Jurupa Valley
(951) 332-6464

City of Lake Elsinore
(951) 674-3124

City of La Quinta
(760) 777-7000

City of Menifee
(951) 672-6777

City of Moreno Valley
(951) 413-3000

City of Murrieta
(951) 304-2489

City of Norco
(951) 270-5607

City of Palm Desert
(760) 346-0611

City of Palm Springs
(760) 323-8299

City of Perris
(951) 943-6100

City of Rancho Mirage
(760) 324-4511

City of Riverside
(951) 826-5311

City of San Jacinto
(951) 487-7330

City of Temecula
(951) 694-6444

City of Wildomar
(951) 677-7751

Coachella Valley Water District
(760) 398-2651

County of Riverside
(951) 955-1000

Riverside County Flood Control District
(951) 955-1200

YOU can prevent Stormwater Pollution following these practices...

Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.
- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an emergency, call the Fire Department's Haz Mat Team at 911.

Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at www.cabmphandbooks.com.

Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: www.waterboards.ca.gov, select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: fcnpdes@rcflood.org.

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.

Living on the Edge

Your community preserves habitat for important native plants and animals. By habitat, we mean homes; food, water, and places with space to live. The habitat is managed as part of a ***biological conservation easement*****,** a legal agreement that permanently limits its use.

Many conservation easements include a waterway or wetland because plants and animals need clean, fresh water, the most limited resource in our dry Southern California climate. A waterway (also called watercourse, arroyo, wash) conveys a flowing creek, stream, or river, which provides drinking water for local and migrating wildlife.

Not all of our waterways have visible flowing water year-round. Some creeks and streams continue to flow underground, while others flow for a short time after a storm (ephemeral). The small, and often dry washes are important to wildlife because they provide habitat and their periodic flows drain into larger waterways. It's essential that people do not degrade the quality of any water that reaches local waterways.

Water supports an abundance of vegetation and a variety of life, or *biodiversity.* Streamside vegetation, along dry or flowing waterways, is referred to as *riparian.* **Native** riparian plants provide **native** animals with suitable food, shelter, nesting sites and escape-cover from predators.

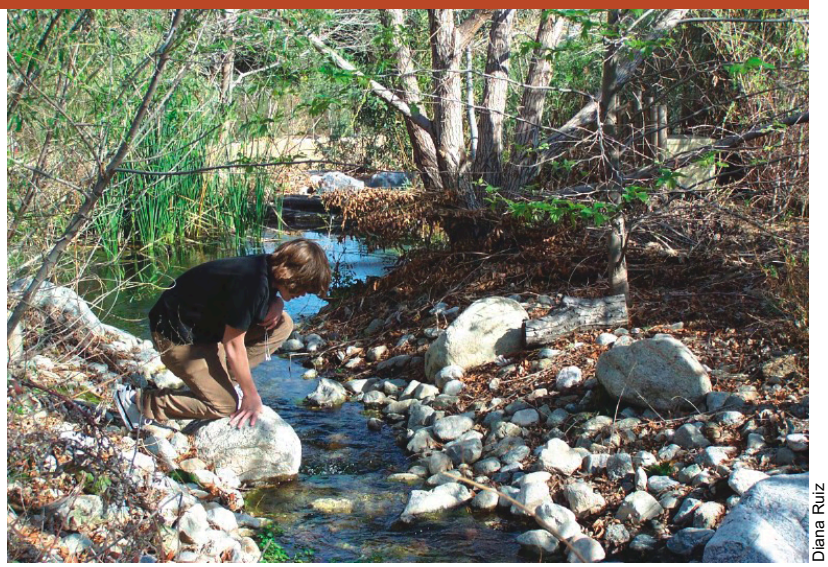
Help Your Wild Next-Door Neighbors

The purpose of this publication is to help homeowners become *habitat-friendly* neighbors for nearby habitat lands. The *Resources Directory*, inserted inside this booklet, provides helpful websites and contact information for agencies, organizations, gardens, and native plant nurseries.

Gerald & Buff Crosi, California Academy of Sciences

Unfortunately, our modern-day lifestyles have negative impacts on the environment around us. Human activity in, or near waterways can damage the capacity of the habitat to support some kinds of plant and animal life, especially species that do not adapt to urban/suburban conditions. Here are some ways to prevent and reduce negative impacts and help restore habitat to healthy conditions.

Reduce Impacts on Native Wildlife



Diana Ruiz

Prevent light, noise, and activity in, and adjacent to wetlands.

- If you wish to observe wildlife, please watch from afar, especially during the breeding and nesting season, from March to September. Most wild animals are naturally fearful of human contact. Human activity near a nest or den may frighten adult animals away from young and jeopardize their survival.
- When visiting natural areas, disturb as little as possible. Avoid walking or riding in a stream course or on channel banks. Heavy foot traffic, horses, and off-road vehicles may cause channel banks to collapse, accelerating erosion and increasing water-born sediment and turbidity.
- Help control entry into habitat areas. Close unessential roadways to prevent access for illegal dumping, trespass, and off-road vehicle use.
- Leave nothing behind.
- Focus necessary lighting downward and inward toward your home, yard, and buildings.
- To report poaching or polluting call CalTIP, Californians Turn In Poachers and Polluters, a confidential secret witness program. The toll free telephone number operates 24 hours a day, 7 days a week. (See the *Resources Directory* insert for contact information.)

USDA Natural Resources Conservation Service

Do not allow pets to roam in habitat land where they will disturb and hunt native wildlife. Keep pets on a leash and droppings out of waterways. Cats and dogs stress or kill wildlife and prevent natural ecosystems from supporting their own predators, such as hawks, coyotes, foxes, and bobcats. Conversely, domesticated animals face hazards in wild areas. Pets may be attacked by predators, such as coyotes and rattlesnakes, or may contract disease, fleas, and ticks.

Do not release unwanted animals into the wild. Abandoned cats, dogs, birds, reptiles and fish can have significant impacts on populations of native species, either through disease, predation or competition for food and space.

Lee Karney/ U.S. Fish and Wildlife Service

Brown-headed Cowbird

- Exotic invaders crowd out native species both on land and in water. Do not place fish, frogs, crayfish, turtles, or aquatic plants into creeks, streams or lakes. Some non-native species are not only able to survive, but also reproduce explosively due to a lack of natural predators. For example, the brown-headed cowbird is overwhelming riparian habitats. The cowbird lays its eggs in another bird's nest to the detriment of the host's young.

Mark A. Chappell

The endangered Least Bell's Vireo is threatened by the Brown-headed Cowbird.

- Pets are usually unable to survive in wildlands. They starve to death or are eaten. If you cannot find a home for a pet, contact animal control, your local animal shelter, or the Humane Society.

Respect and protect wild animals by keeping them wild. In some instances, being a good neighbor means protecting your living area by excluding certain kinds of wildlife, mainly mammals. The *human habitat* includes home sites, buildings, yards, gardens, and regularly used outdoor areas. Install fencing around the human habitat portion of your property and secure enclosures to protect children, pets, and farm animals.

- Do not take small animals, such as tortoises, tadpoles, frogs, snakes, birds, lizards or eggs from the wild. Never attempt to "adopt" or domesticate a wild animal.

- Discourage dangerous predators from penetrating human habitat areas. Install fencing that will exclude predators. Place sensors that trigger sprinklers and lights to deter predators and mammals from entering areas of human activity.

- Prevent mammals from living in and near your home by closing entries, filling holes, and removing brush, junk, and woodpiles near buildings.

- Don't feed human food to wildlife. Do not leave pet food outside. Prevent garbage from becoming a food source for wild mammals by sealing trash can lids. If you compost, use closed-containers or turn piles regularly. Compost plant material only; meat scraps should not be mixed in a compost pile.

R. H. Barrett/ U. S. Fish and Wildlife Service

For more information, contact the California Department of Fish and Game.
(See the *Resources Directory* insert for contact information.)

Reduce Impacts on Native Plants

Remove invasive, non-native plants from home landscaping and adjacent habitat lands, especially those that quickly spread through waterways, displacing important native species.


Diana Ruiz

Invasive Giant Reed (*Arrundo donax)* is being removed from Temescal Creek.

DO NOT PLANT

Giant reed	*Arundo donax*
Salt Cedar	*Tamarix chinensis*
Tree of Heaven	*Ailanthus altissima*
Red apple, heartleaf iceplant	*Aptenia cordifolia*
Fountain grass (yellow)	*Pennisetum setaceum*
Castor bean	*Ricinus communis*
Periwinkle	*Vinca major*
Peruvian (Calif.) pepper tree	*Schinus molle*
Brazilian pepper tree	*Schinus terebinthifolius*
Mexican fan palm	*Washingtonia robusta*
Sweet fennel	*Foeniculum vulgare*
Pampas grass/Jubata grass	*Cortaderia jubata/selloana*
Common iceplant	*Mesembryanthemum crystallinum*
Myoporum species	

Contact your local Resource Conservation District for help identifying invasive species and for removal of exotic weeds from waterways. Visit the California Invasive Plant Council web site for suggested plants to replace invasives. (See the *Resources Directory* insert for contact information.)

Protect Water Quality


Diana Ruiz

Make sure that the water that flows off your property is clean.

- Prevent trash, debris, and waste of any kind from washing off homesites and streets into gutters, storm drains, and dry washes. These drainage-ways empty into streams that flow to the Santa Ana River, and ultimately, the ocean.
- Evaluate the flow of runoff over your property. Place manure, barnyard bedding, and debris in areas where water does not pool or flow, or reuse the waste as fertilizer or mulch. Check with your local municipality for ordinances concerning the disposal of manure and bedding.
- Use care when applying fertilizers, pesticides, and herbicides on your property. Read labels “before you buy and before you apply” for directions, application rates, and disposal. Apply the correct amount at the proper time, for example, not during plant dormancy.

Praying mantis

Ladybird beetle

Lacewing

Photos by Greg Balmer

- Reduce or eliminate the use of pesticides by using “beneficial insects” (ladybugs, praying mantids, lacewings, etc.) If you must use a pesticide, use one with a *least-toxic* rating, such as insecticidal soaps, horticultural oils, pyrethrin-based insecticides, and insect growth regulators.
- Control erosion to prevent sediment from entering runoff.
- If you have a septic system, inspect and maintain it. Poorly placed and neglected septic systems contaminate groundwater and streams.

Pollutants that flow from residential and urban areas contaminate surface water and the water that percolates into underground water basins (aquifers). Much of our local water supply is pumped from underground aquifers, so keeping runoff clean is essential.

To report any non-emergency crime, such as dumping, please call your City Police or County Sheriff Departments. To report illegal grading or dumping in waterways, contact your City or County Code Enforcement Department. (See the *Resources Directory* insert for contact numbers.)

Dispose of waste in its proper place.

- Read product labels, and dispose of household hazardous wastes (oil based paints, pesticides, antifreeze, motor oil, batteries, flourescent bulbs, etc.) in prescribed ways and at designated disposal sites or community collection events, not on the ground or in a storm drain inlet. Whenever possible, reduce the use of hazardous materials in and around your home. Call the *Only Rain Down the Storm Drain* program for disposal dates and locations. (See the *Resources Directory* insert for contact numbers.) You can also recycle automotive fluids, tires, and batteries at car repair businesses.
- Dispose of trash at sanitary landfills.
- Compost yard and other organic wastes.

Diana Ruiz

Better yet:

Reduce,
Reuse,
Recycle.

Provide Space for Habitat, Fire, and Flood Protection

Robert Calvo

Siting Homes Near Waterways
If you are building next to a waterway, leave a buffer between the waterway and your *human habitat* area of graded pads, structures, and ornamental landscaping. *Wildlife habitat* land includes areas beyond buildings, yards, and defensible space (fire safety zones), generally to be left undisturbed for wildlife. A buffer between the human habitat and a waterway provides space for habitat, flood waters, and for wildlife escape during high water.

The buffer or "setback" distance will vary according to site conditions, however a minimum 100-foot setback from the **top edge** of a waterway, not from the water itself, is recommended. This allows space for creek/stream meander and high water flows. The banks of creeks and streams "meander", which means they are constantly "wandering" or relocating. Meander naturally occurs when flows cause erosion of channel banks and deposition of sediment.

As land is converted to urban uses, the volume of flow in waterways increases. Impervious surfaces from streets, roofs, and parking lots increase the amount of runoff, erosion and pollutants that degrade water quality.

Frank Heyming

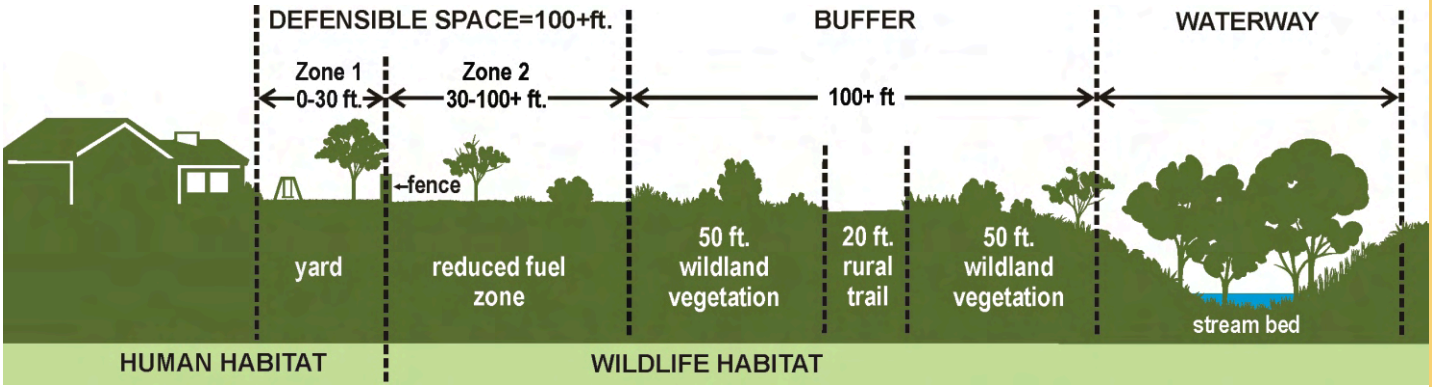
A house pad fills an important tributary to an waterway.

Many people are not aware of the vulnerability of natural ecosystems, nor are they aware that it is illegal to grade or alter a waterway without an assessment and permits from resource agencies and municipalities. If you propose an activity that will impact a stream, river, or lake, the California Department of Fish and Game (DFG) requires completion of a Streambed Alteration Agreement. Depending on the activity you are proposing, you may need to obtain a permit, agreement, or other authorization from one or more government agencies. Notify DFG, U.S. Army Corps of Engineers, and the Santa Ana Regional Water Quality Control Board during early planning, prior to beginning a project that will:

- use material from a streambed;
- divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake;
- result in the disposal or deposition of debris, waste, or other natural material where it can pass into any river, stream, or lake.

A Streambed Alteration Agreement is also required for streams that flow intermittently, such as dry washes and waterways with subsurface flow.

It is essential that landowners do not confine, or encroach on waterways. Keep buildings, septic systems, horses, livestock, fencing, agricultural and ornamental plantings out of waterways and away from channel banks.



When building homes In fire-prone areas, avoid ridge tops and canyons. Set buildings back from the edge of steep slopes. Create a minimum distance of 100-feet of *defensible space,* a managed area around a home, where the amount of fuel (dead plants, dry leaves, wood) has been reduced. Consult with your local fire department or the California Department of Forestry and Fire Protection for fire safety and weed abatement information.
(Please see *Resources Directory* insert).

Habitat-friendly Yards


Len Nunney

Landscape with Locals. Not just any California native plant is suitable for landscapes near habitat lands. Local native plants are the safest because they have unique characteristics that have helped them survive in their specific environments. Gardening with local flora helps maintain the *genetic integrity* of local plants and ecosystems. It helps maintain regional variation in vegetation and wildlife.

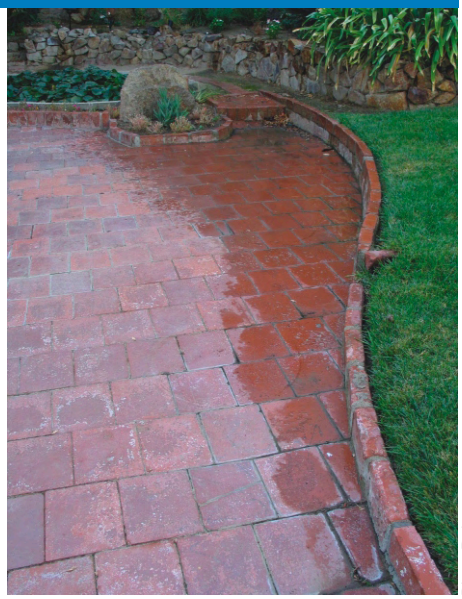
Why is regional variation important? If plants from other areas crossbreed with local natives, scientists fear that local populations would lose some of the unique characteristics that are important for success in this region. Their genetic material would no longer be unique and regionally identifiable. Plant interbreeding could reduce biological diversity, *biodiversity*, in the gene pool. There are important interactions between native plants, microorganisms, and the animals that use them, some of which are critical to the reproduction and survival of native plants and animals.

Create habitat in your yard for urban-adapted wildlife. Even if you live in the heart of a city, consider gardening for urban-adapted wildlife by providing a reliable water source and **local** native plants that provide food, shelter, and nesting sites. Each small patch of yard provides a stepping-stone of habitat from wildlands across the city. A patchwork of *habitat-yards* creates an urban ecosystem that more closely mimics our predevelopment, native landscape. When linked together, those patches cumulatively support biodiversity. To host a variety of native birds and butterflies in your yard, select plants that flower and fruit at different times of the year. Prune trees and shrubs in fall and early winter, rather than spring, to avoid destroying bird nests.

Benefits of landscaping with local native plants:

- **Most native plants are drought tolerant, so they require less water.**
- **Natives rarely require fertilizers.**
- **Patches of habitat support urban-adapted wildlife, such as birds, bats and insects that help pollinate plants.**
- **Natives rarely require pesticides. Native plants provide their own natural pest control by attracting beneficial insects that prey on troublesome bugs.**
- **Local natives help preserve *genetic diversity* and the integrity of local ecosystems.**

Water-wise Landscapes Conserve Water



Diana Ruiz

Reduce water-use by replacing unnecessary lawn areas with native or drought-tolerant plants and with hardscape (hard surfaces), such as walkways and patios of concrete, brick, stone, decomposed granite, and permeable paving. For places where you do need a lawn, such as play areas, plant a low water-use turf variety.

When selecting a plant, find out:

- Is it water-thirsty or drought-tolerant?
- When is its growing season; when will it need water?

Most* local native plants are dormant or slow-growing during the hot, dry summers; their growth occurs during our rainy season. Once established, many survive with rainfall alone. This is the opposite for non-native, ornamental landscapes that grow slowly, or not at all during winter, but require irrigation throughout the summer.

- Group plants with similar watering needs together, and install water-saving irrigation systems (drip, micro-sprayers) to apply the correct amount for each *hydro-zone* or plant grouping. Trees require deep irrigation and may need separate irrigation lines.
- Readjust your irrigation schedule for season and weather conditions. Turn off automatic systems when it's raining. Don't run sprinklers when the wind is blowing. Water deeply and only when needed. Water plants in the early morning or evening. Adjust irrigation systems to water soil, not concrete and pavement.
- Apply mulch (bark, compost, sawdust, gravel) to reduce evaporation from the soil surface and to control weeds.

For information about conserving water in landscapes and using native and drought tolerant plants, refer to plant databases, such as the one at bewaterwise.com. The website will also help you create a customized watering schedule for your yard. (See the *Resources Directory* insert for booklist and websites.)

*Not all native plants are dormant during summer: local riparian plants are the exception. They need water year round, as they are suited for waterways. Streamside vegetation, along dry or flowing waterways, is referred to as riparian.

Fire-wise Landscaping

Create a minimum distance of 100 ft. of *defensible space*, a landscape that deprives fire of fuel. Use fire-resistant plants and remove plants that are highly volatile.

Zone 1: Lean, Clean and Green

Zone 1 is from 0-30 ft. out from buildings. (See diagram on prior page.)
Grow plants that are small or succulent, such as irrigated lawns or ground covers and low growing, high-moisture shrubs. If you use native plants, use those that can be trimmed back during the dry season or that stay small with little trimming. Native plants that tolerate summer watering (see native plant lists) should be kept well hydrated.*

- Keep plants well hydrated to help them resist fire. Well-trimmed and watered plants are less likely to ignite than desiccated plants that have a buildup of dry stems and leaves.
- Fire needs fuel to burn, so remove any unnecessary plant materials. Prune dead wood and clean the landscape of dead plants, dry leaves, dry brush, firewood, and combustibles.
- Strategically place hard surfaces in your landscape, such as concrete, brick, or stone patios, driveways, pools, walls, and non-flammable decks, to interrupt the spread of fire to buildings.

Zone 2: Reduced Fuel

Create the reduced fuel zone beginning 30 ft. from buildings and extending 100 ft. or more, depending on steepness of slope and type/density of vegetation.

- Selectively remove large shrubby plants and dense groupings. Thin overcrowded plants. Mow grasses and weedy vegetation while they are green.
- Carefully remove excess plants without disturbing the soil; mow instead of disc, to prevent erosion and invasion of non-native plants.
- In chaparral plant communities, after thinning, reduce old, woody growth by cutting plants to their bases every few years, during the summer dormancy. Young plant tissues have higher moisture content and are less flammable. The heavy pruning eliminates mature, highly flammable vegetation but maintains root systems to protect the soil from erosion.
- Low branches and plants growing under trees create “ladders” for fire to climb. Eliminate ladder fuels, plants that serve as a link between grass and treetops. Prune the lower branches from the lower 1/3 of trees and shrubs. For trees or shrubs taller than 18 feet, prune the lower branches 6 feet above the ground. Remove dead leaves, twigs, and branches.
- In general, remove shrubs that are growing below trees, unless there is a space between the top of the shrub to the lowest branch of the tree that is three times the height of the shrub.

Remove plants that ignite easily and burn hot, such as those with volatile oils (sages) and those that accumulate fine woody branches or many small, dry leaves (chamise). In Zone 1, remove highly volatile plants (partial list below). In Zone 2, remove or widely space volatile plant types, including:

Chamise, *Adenostoma fasciculata*
Brittlebrush, *Encelia farinosa*
California buckwheat, *Eriogonum fasciculatum*
White sage, *Salvia apiana*
Some Eucalyptus and Acacia

Black sage, *Salvia mellifera*
Woolly blue curls, *Trichostema lanatum*
Mountain blue curls, *Trichostema parishii*
Red Shank, *Adenostoma sparsifolium*
All Pine, Cypress, Juniper, and Cedar species.

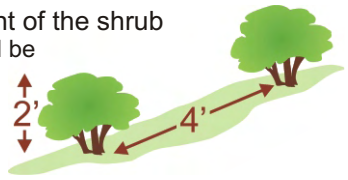
*For best results with native plants, water on overcast days during summer and fall.

Create Space Between Plants

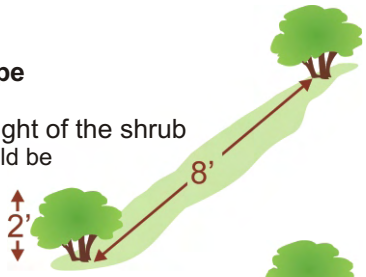
Shrubs

From edge of one shrub to the edge of the next.

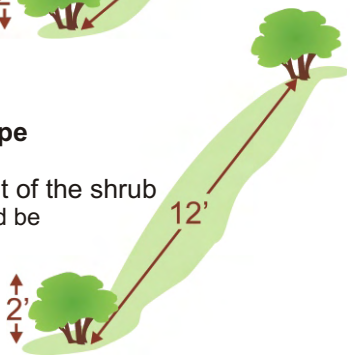
Flat to mild slope
(0% to 20% slope)
Two times (2x) the height of the shrub
(Two shrubs 2' high should be spaced 4' apart)



Mild to moderate slope
(20% to 40% slope)
Four times (4x) the height of the shrub
(Two shrubs 2' high should be spaced 8' apart)



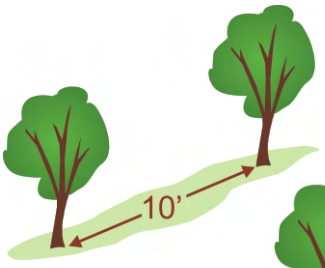
Moderate to steep slope
(greater than 40% slope)
Six times (6x) the height of the shrub
(Two shrubs 2' high should be spaced 12' apart)



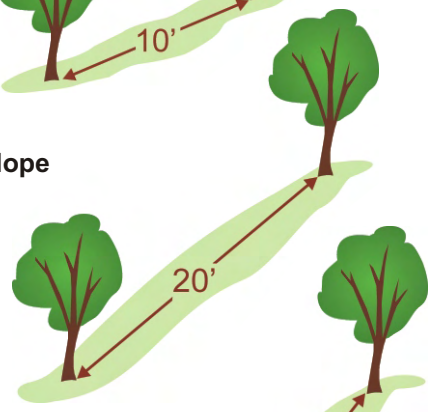
Trees

From edge of one tree canopy to the edge of the next.

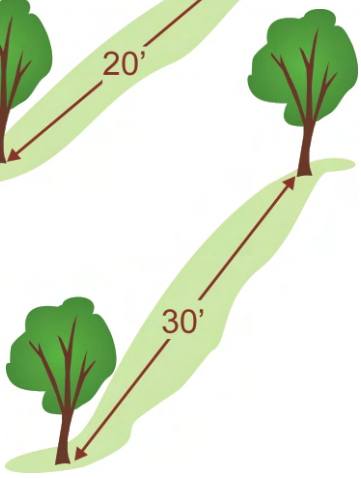
Flat to mild slope
(0% to 20% slope)



Mild to moderate slope
(20% to 40% slope)



Moderate to steep slope
(greater than 40% slope)



Horizontal clearance information from the California Department of Forestry and Fire Protection.

Prevent erosion and stabilize eroding areas. If you have exposed soil surfaces, cover with mulch, and landscape as soon as possible. (Plants break the impact of falling rain, and their roots hold soil in place.) Eroding soil becomes sediment in runoff water, which pollutes waterways. Disturbed soil also encourages the growth of non-native weed species.

Retain thinned, deep-rooted native plants to anchor the soil and maintain slope stability. Generally, tall plants have deep, broad root systems. A goal of fire-wise landscaping is to maximize rooting depth while minimizing fuel volume.

Diana Ruiz

For site-specific advice, contact your local Resource Conservation District (RCD) or the USDA Natural Resources Conservation Service (NRCS). For recommendations of native grasses for erosion control, contact the California Native Grasslands Society. (See the *Resources Directory* insert for contact information.)

Native Plants for Defensible Space Landscaping in the Inland Empire

If you prefer to create a landscape of native, low water-use plants, use these lists to design a yard that is fire-wise. Maintenance is essential; dead and dry plant material must be removed during dry, summer dormancy. Some native plants cannot tolerate irrigation during their summer dormancy, so may die if watered too frequently. Some need only infrequent, deep watering to remain hydrated during the dry summer and fall. The low-growing, low-fuel volume plants are suitable for Zone 1 (0-30 ft.) and beyond. Larger shrubs and trees, for Zone 2 (30-100+ ft.), must be widely spaced (see diagram on previous page).

Shrubs for Zone 2

Shrubs that need or tolerate water during summer.

Carpenteria, *Carpenteria californica*
Western redbud, *Cercis occidentalis*
Toyon, *Heteromeles arbutifolia*
Nevin's barberry, *Mahonia nevinii*
Coffeeberry, *Rhamnus californica*
Golden current, *Ribes aureum.*
California wild rose, *Rosa californica*
Western bridalwreath, *Spiraea douglasii*
Squawbush, *Rhus trilobata*


UDSA-NRCS PLANTS Database
Coffeeberry

Shrubs that do not usually tolerate water during summer.

Low shrubs

Bladder pod, *Isomeris arborea*
Bush monkeyflower, *Mimulus aurantiacus*
Chaparral honeysuckle, *Lonicera subspicata*
Hollyleaf redberry, *Rhamnus illicifolia*
Redberry, *Rhamnus crocea*
Yellow bush-penstemon, *Keckiella antirrhinoides*


Paul Aigner
Yellow bush-penstemon

Tall, deep-rooted shrubs that stay green during summer.

Bigberry manzanita, *Arctostaphylos glauca*
Thick-leaved lilac, *Ceanothus crassifolius*
Buck brush, *Ceanothus cuneatus*
Hairy California lilac, *Ceanothus oliganthus*
Mountain mahogany, *Cercocarpus betuloides*
Laurel sumac, *Malosma laurina*
Scrub oak, *Quercus berberidifolia*
Sugarbush, *Rhus ovata*
Lemonade berry, *Rhus integrifolia*
California Flannel bush, *Fremontodendron californicum*


Arlee M.Montalvo
Sugarbush

Trees for Zone 2

Trees that tolerate occasional water during summer.

Catalina cherry, *Prunus illicifolia* ssp. *Lyonii*
Coast live oak, *Quercus agrifolia*
Valley oak, *Quercus lobata*
Engelman oak, *Quercus engelmannii*

Trees that need water during summer.

Big leaf maple, *Acer macrophyllum*
White alder, *Alnus rombifolia*
So. California walnut, *Juglans californica*
California sycamore, *Platanus racemosa*
California black oak, *Quercus kelloggii*
Canyon live oak, *Quercus chrysolepis*
Willows: *Salix laevigata, S. gooddingii*
California bay laurel, *Umbellularia californica*


J. S. Peterson @ UDSA-NRCS
Big leaf maple

Low-growing, (low fuel volume) Plants for Zones 1 and 2

Perennial herbs that tolerate or need water during summer

Yarrow, *Achillea millifolium*
Columbine, *Aquilegia formosa*
Douglas iris, *Iris douglasiana*
Deer grass, *Muhlenbergia rigens*
Calif. blue-eyed grass, *Sisyrinchium bellum*
Meadow rue, *Thalictrum fendleri* var. *polycarpum*
Yerba mansa, *Anemopsis californica*
Coral bells, *Heuchera* ssp.
Common monkey flower, *Mimulus guttatus*
Scarlet bugler, *Penstemon centranthifolius*
California goldenrod, *Solidago californica*
Hedge nettle, *Stachys bullata*
Slender sedge, *Carex praegracilis*
Narrow-leaved milkweed, *Asclepias fascicularis*


Arlee M.Montalvo
Narrow-leaved milkweed

Succulents, Ground Covers, and Low Shrubs

Keep hydrated; if needed, water monthly during summer.

San Diego sedge, *Carex spissa*
Wild lilac, *Ceanothus griseus 'horizontalis'*
California fuchsia, *Epilobium canum =Zauschneria*
Golden yarrow, *Eriophyllum confertiflorum*
Lance-leaved live-forever, *Dudleya lanceolata*
Chalk dudleya, *Dudleya pulverulenta*
Parry's nolina, *Nolina parryi*
Creeping sage, *Salvia sonomensis*
Creeping snowberry, *Symphoricarpos mollis*
Chaparral yucca, *Yucca whipplei = Hesperoyucca whipplei*
Valley cholla, *Opuntia parryi*
Coastal prickly pear, *Opuntia littoralis*


Arlee M.Montalvo
Chaparral yucca

Annuals or summer-dormant perennials

No need for water during summer. There is little, if any, plant material above ground to burn.

California poppy, *Eschscholzia californica*
Larkspurs, delphinium, *Delphinium parryi, D.cardinale*
Wild Canterbury-bell, *Phacelia minor*
California figwort, *Scrophularia californica*
Baby blue eyes, *Nemophila menziesii*
Royal penstemon, *Penstemon spectabilis*
Lupine, *Lupinus* species *(L. bicolor, L. succulentus, L. truncatus, L. sparsiflorus*)


Arlee M.Montalvo
Baby blue eyes

Habitat Land Stewards

If you live near conservation easement land or a waterway, there are ways that you can help. Be observant of activities that might be harmful to your nearby habitat lands, or form a *habitat-watch* group in your neighborhood. Like a neighborhood-watch, property owners help look out for neighborhood habitat and waterways, report illegal activity, and help educate neighbors about human impacts. For help forming a *habitat-watch* group, contact your local Resource Conservation District or the Riverside Land Conservancy.

RCRCD
RIVERSIDE-CORONA RESOURCE CONSERVATION DISTRICT

This publication was developed by the Riverside-Corona Resource Conservation District. www.RCRCD.com
1-07

Helpful telephone numbers and links:

Riverside County Water Agencies

City of Banning	(951) 922-3130
City of Beaumont/Cherry Valley	(951) 845-9581
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
City of Corona	(951) 736-2263
City of Hemet	(951) 765-3710
City of Norco	(951) 270 5607
City of Riverside Public Works	(951) 351-6140
City of San Jacinto	(951) 654-4041
Coachella Valley Water District	(760) 398-2651
Desert Water Agency (Palm Springs)	(760) 323-4971
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley Municipal Water District	(951) 674 3146
Elsinore Water District	(951) 674-2168
Farm Mutual Water Company	(951) 244-4198
Idyllwild Water District	(951) 659-2143
Indio Water Authority	(760) 391-4129
Jurupa Community Services District	(951) 685-7434
Lee Lake Water	(951) 658-3241
Mission Springs Water	(760) 329-6448
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
Riverside Co. Service Area #51	(760) 227-3203
Rubidoux Community Services District	(951) 684-7580
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

REPORT ILLEGAL STORM DRAIN DISPOSAL

1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

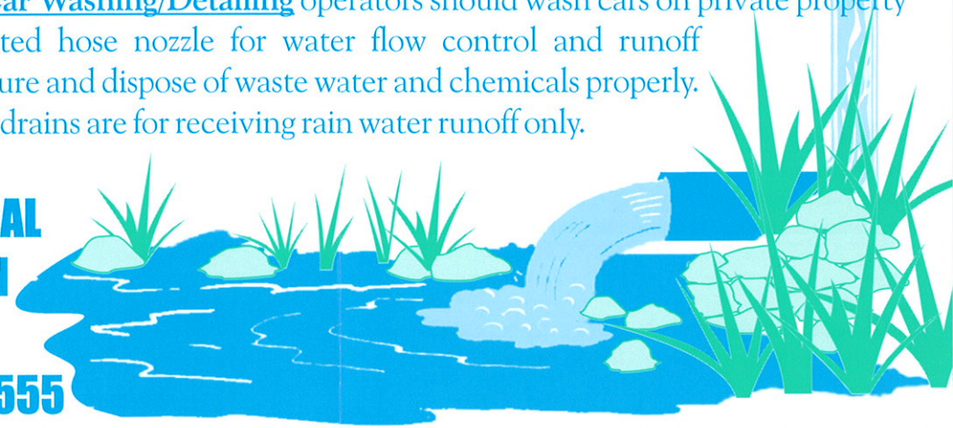
Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry rain water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555



Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep storm water clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing wash water to the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal,
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them for being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlet by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Saltwater Pools

- Salt water pools, although different from regular pools, are in fact, sanitized using chlorine. A salt-chlorine generator separates the chlorine and sodium molecules in salt and reintroduces them into the pool water. The same harmful effects of chlorine still apply.
- A salt water pool is still maintained with chemicals such as Muriatic acid, soda ash and sodium carbonate to help keep a proper pH, total Alkalinity, Calcium Hardness and Stabilizer levels.

- It may be illegal to discharge salt water to land. The salt may kill plants and the build-up of salt in soil puts animals, plants, and groundwater at risk. Consult your city representatives to determine local requirements regarding salt water drainage.

NEVER put unused chemicals into the trash, onto the ground or down a storm drain.

IMPORTANT: The discharge of pollutants into the street, gutter, storm drain system or waterways - without a permit or waiver - is strictly prohibited by local ordinances, state and federal law. Violations may result in monetary fines and enforcement actions.

Helpful telephone numbers and links

Riverside County Water Agencies:

City of Banning	(951) 922-3130
City of Beaumont/Cherry Valley	(951) 845-9581
City of Blythe	(760) 922-6161
City of Coachella	(760) 398-3502
City of Corona	(951) 736-2263
City of Hemet	(951) 765-3710
City of Norco	(951) 270 5607
City of Riverside Public Works	(951) 351-6140
City of San Jacinto	(951) 654-4041
Coachella Valley Water District	(760) 398-2651
Desert Water Agency (Palm Springs)	(760) 323-4971
Eastern Municipal Water District	(951) 928-3777
Elsinore Valley Municipal Water District	(951) 674 3146
Elsinore Water District	(951) 674-2168
Farm Mutual Water Company	(951) 244-4198
Idyllwild Water District	(951) 659-2143
Indio Water Authority	(760) 391-4129
Jurupa Community Services District	(951) 685-7434
Lee Lake Water	(951) 658-3241
Mission Springs Water	(760) 329-6448
Rancho California Water District	(951) 296-6900
Ripley, CSA #62	(760) 922-4951
Riverside Co. Service Area #51	(760) 227-3203
Rubidoux Community Services District	(951) 684-7580
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(951) 789-5000
Yucaipa Valley Water District	(909) 797-5117

CALL 1-800-506-2555 to:

- Report clogged storm drains or illegal storm drain disposal from residential, industrial, construction and commercial sites into public streets, storm drains and/or water bodies.
- Find out about our various storm drain pollution prevention materials.
- Locate the dates and times of Household Hazardous Waste (HHW) Collection Events.
- Request adult, neighborhood, or classroom presentations.
- Locate other County environmental services.
- Receive grasscycling information and composting workshop information.

Or visit our
Riverside County Flood Control and Water Conservation District
website at: www.rcflood.org

Other links to additional storm drain pollution information:

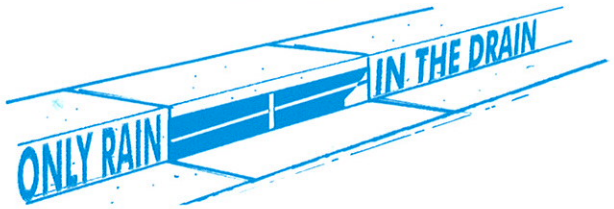
- County of Riverside Environmental Health: www.rivcoeh.org
- State Water Resources Control Board: www.waterboards.ca.gov
- California Stormwater Quality Association: www.casqa.org
- United States Environmental Protection Agency (EPA): www.epa.gov/compliance/assistance (compliance assistance information)

Riverside County's, "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

Guidelines for Maintaining your...

Swimming Pool, Jacuzzi and Garden Fountain

Where does the water go?



Pool, Jacuzzi and Fountain wastewater and rain water runoff (also called stormwater) that reach streets can enter the storm drain and be conveyed directly into local streams, rivers and lakes.

A storm drain's purpose is to prevent flooding by carrying rain water away from developed areas. Storm drains are not connected to sanitary sewers systems and treatment plants!

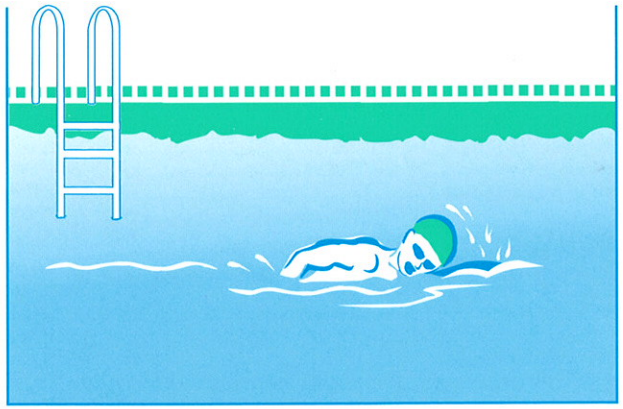
Wastewater, from residential swimming pools, Jacuzzis, fishponds and fountains, often contains chemicals used for sanitizing or cleansing purposes. Toxic chemicals (such as chlorine or copper-based algaecides) may pollute the environment when discharged into a storm drain system.

The Cities and County of Riverside have adopted ordinances that prohibit the discharge of wastewater to the street and storm drain system.

Discharge Regulations

Regulatory requirements for discharging wastewater from your pool may differ from city to city. Chlorinated water should not be discharged into the street, storm drain or surface waters. Check with your water agency to see if disposal to the sanitary sewer line is allowed for pool discharges (see reverse for Riverside County sewer agencies).

If allowed, a hose can be run from the pool Jacuzzi, or fountain to the private sewer cleanout, washing machine drain or a sink or bathtub.



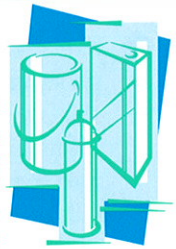
If you cannot discharge to the sewer, you may drain your fountain, pool, or jacuzzi to your landscaping by following these guidelines:

First, reduce or eliminate solids (e.g. debris, leaves or dirt) in the pool water and allow the chemicals in the pool water to dissipate before draining the pool (this could take up to 7 days, verify using a home pool test kit).

Second, slowly drain to a landscaped area away from buildings or structures. Control the flow to prevent soil erosion; it may take more than one day to empty. Do not allow sediment to enter the street, gutter or storm drain.

Maintenance & Chemicals

Cleaning Filters



Filter rinse water and backwash must be discharged to the sanitary sewer, on-site septic tank and drain field system (if properly designed and adequately sized), or a seepage pit. Alternatively, rinse water or backwash may be diverted to landscaped or dirt areas. Filter media and other non-hazardous solids should be picked up and disposed of in the trash.

Algaecides

Avoid using copper-based algaecides unless absolutely necessary. Control algae with chlorine, organic polymers or other alternatives to copper-based pool chemicals. Copper is a heavy metal that can be toxic to aquatic life when you drain your pool.

Chemical Storage and Handling

- Use only the amount indicated on product labels
- Store chlorine and other chemicals in a covered area to prevent runoff. Keep out of reach of children and pets.
- Chlorine kits, available at retail swimming pool equipment and supply stores, should be used to monitor the chlorine and pH levels before draining your pool.
- Chlorine and other pool chemicals should never be allowed to flow into the gutter or storm drain system.

Take unwanted chemicals to a Household Hazardous Waste (HHW) Collection Event. There's no cost for taking HHW items to collection events – it's FREE! Call **1-800-506-2555** for a schedule of HHW events in your community.

Stormwater Pollution Found in Your Area!

This is not a citation.

This is to inform you that our staff found the following pollutants in the storm sewer system in your area. This storm sewer system leads directly to

_____ .

- ❑ Motor oil
- ❑ Oil filters
- ❑ Antifreeze/ transmission fluid
- ❑ Paint
- ❑ Solvent/degreaser
- ❑ Cooking grease
- ❑ Detergent
- ❑ Home improvement waste (concrete, mortar)
- ❑ Pet waste
- ❑ Yard waste (leaves, grass, mulch)
- ❑ Excessive dirt and gravel
- ❑ Trash
- ❑ Construction debris
- ❑ Pesticides and fertilizers
- ❑ Other

_____

For more information or to report an illegal discharge of pollutants, please call:

Riverside County Residents, Call . . .
1-800-506-2555

WHEN IT RAINS
IT DRAINS

EPA
United States
Environmental Protection
Agency

www.epa.gov/npdes/stormwater

EPA 833-F-03-002
April 2003

Stormwater runoff is precipitation from rain or snowmelt that flows over the ground. As it flows, it can pick up debris, chemicals, dirt, and other pollutants and deposit them into a storm sewer system or waterbody.

Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

Remember: Only Rain Down the Drain

To keep the stormwater leaving your home or workplace clean, follow these simple guidelines:

- Use pesticides and fertilizers sparingly
- Repair auto leaks.
- Dispose of household hazardous waste, used auto fluids (antifreeze, oil, etc.), and batteries at designated collection or recycling locations.
- Clean up after your pet.
- Use a commercial car wash or wash your car on a lawn or other unpaved surface.
- Sweep up yard debris rather than hosing down areas. Compost or recycle yard waste when possible.
- Clean paint brushes in a sink, not outdoors. Properly dispose of excess paints through a household hazardous waste collection program.
- Sweep up and properly dispose of construction debris like concrete and mortar.

FACTS

for Home and Property Owners

on Stream Stabilization

Homeowners living adjacent to streams, lakes and rivers may be impacted by stream bank erosion or sediment deposition that can occur due to natural processes or man-made causes. However, efforts to mitigate these impacts in, or adjacent to watercourses can negatively affect native plants and animals, lessen a watercourse's ability to convey storm flows, and cause flooding. Below are some facts to keep our watercourses free of obstructions and information on actions a homeowner should take before attempting to protect their property:

- In some cases, alteration of a watercourse may be prohibited by local land-use regulations, e.g., a "drainage easement", "flowage easement", "floodplain" or "Environmental Constraint Sheet." You should contact your local City or County Building Agency or Grading Department to determine if these limitations apply to you.

- In cases where alterations are not prohibited, grading, filling-in or otherwise altering a watercourse-even those that flow intermittently, such as dry washes that only flow when it rains – may require approval from one or more of the following agencies:

REGULATING AGENCY	APPROVAL	CONTACT
Local (City, County) land use authority *	• Grading Permit, • Floodplain Review	White pages under City/County Government
California Department of Fish and Game*	• Fish and Game Section 1602 Agreements	www.dfg.ca.gov
US Army Corps of Engineers*	• Clean Water Act Section 404 Permit	www.usace.army.mil
California State Water Resources Control Board*	• Clean Water Act Section 401 Water Quality Certification or Waste Discharge Requirements	www.swrcb.ca.gov

- Property owners should **CONTACT EACH REGULATING AGENCY** (listed above) for the necessary approval(s) **BEFORE:**

1. ***Removing*** soil, rock or plant material from a streambed or the bank of a stream;
2. ***Placing*** any waste, material (dirt, rubble) or structures (dams, revetments) within or on the bank of a stream;
3. ***Diverting, obstructing***, or otherwise modifying the bed, channel, or bank of any river, stream or lake;
4. ***Disposing*** *or* ***depositing*** debris, liquid or solid waste, soil or other material that may be conveyed into a wash, stream, river or lake; or
5. ***Armoring*** *or* ***stabilizing*** a stream bank against stream bank erosion.

More ..... Stream Stabilization

Some other examples of regulated activities include construction of road crossings, vegetation removal, construction of corrals and storing manure. Property owners are responsible for obtaining all necessary approvals prior to commencing any of the aforementioned activities.

- The Natural Resources Conservation Service (NRCS) makes onsite recommendations (as of this writing, free of charge) to private land owners for effective erosion controls. For help in protecting your property from natural watercourses please contact:

Natural Resources Conservation Service (NRCS)	PHONE NO.
Moreno Valley	(951) 656-6800
Blythe service Center	(760) 922-3446
Indio Service Center	(760) 347-7658

*Service fees may be applicable.

- ***YOU*** **can help:**

Protect water quality - prevent trash, debris and waste of any kind from washing off home sites and streets into gutters, storm drains and dry washes. These watercourses empty into streams that flow to rivers.

County-wide Service Information

- Household hazardous wastes (oil-based paints, pesticides, antifreeze, motor oil, batteries and fluorescent bulbs) must never be disposed of in or near watercourses. You may find your nearest household hazardous waste disposal site by calling **(800) 304-2226 or** on the web **at www.rivcowm.org**

- Report illegal grading or dumping in watercourses by contacting your City or County Code Enforcement Department, or call **(800) 506-2555.**

- Report a non-emergency crime such as dumping by contacting your City Police or County Sherriff's Department, or call **(800) 506-2555.**