# Project Specific Water Quality Management Plan

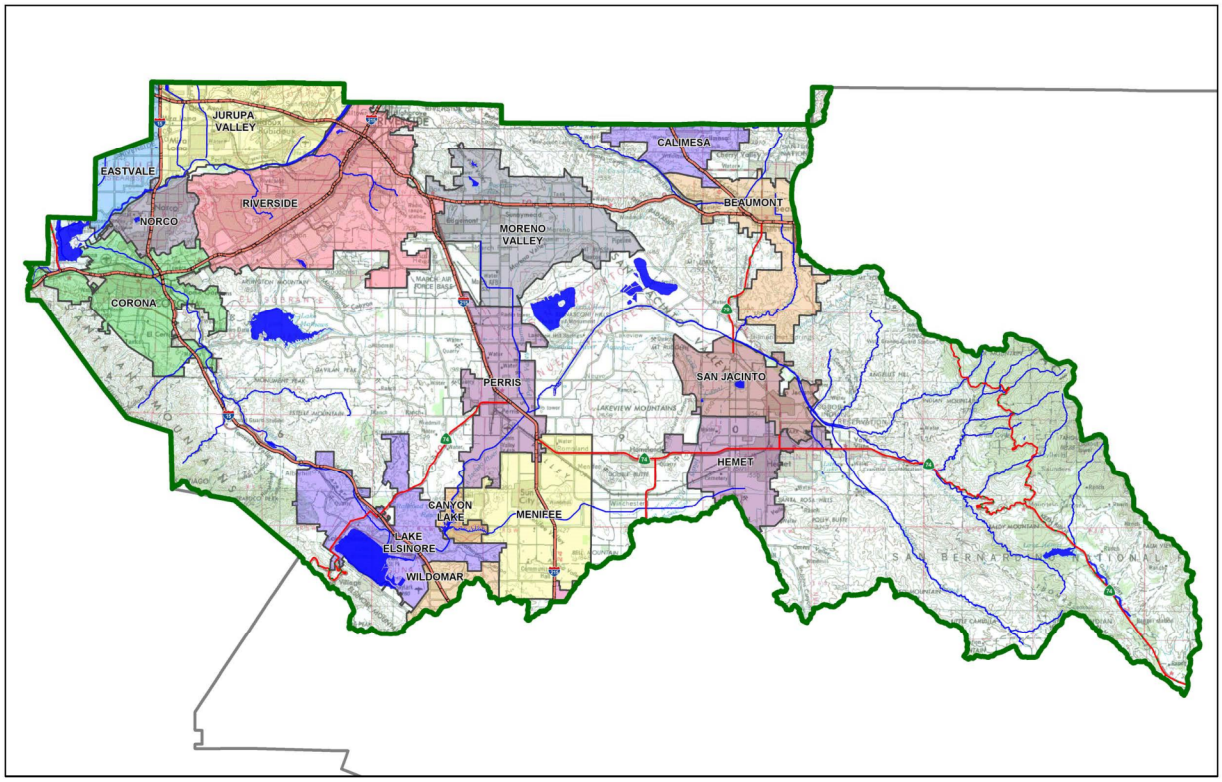
*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

5261 ARLINGTON AVE

**Project Title:** Arlington Mixed Use Project: 5261 Arlington Avenue, Riverside

**Public Works No:** GP-2022-16929

**Design Review/Case No:** PR-2022-001252




**Contact Information:**

**Prepared for:**
FOULGER-PRATT
136 Calle De Los Molinos
San Clemente, CA 92672
Tel: (949) 596-9572
Attn: Jamie Chapman

☒ **Preliminary**
☐ **Final**

**Original Date Prepared**: August 2, 2022

**Revision Date(s)**: 4/14/2023

*Prepared for Compliance with*
*Regional Board Order No*. **R8-2010-0033**
**Template revised June 30, 2016**

**Prepared by:** PSOMAS
1650 Spruce Street, Suite 400
Riverside, CA 92507
Tel: (951) 300-2805
Attn. David I. Brotchie

## OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for entity to Riverside Property Owner, LLC by PSOMAS for the Arlington Avenue Mixed Use project.

This WQMP is intended to comply with the requirements of City of Riverside for Design Review of 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 the city of Riverside Water Quality Ordinance (Municipal Code Section 14.12.315).

"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

05/04/2023
Date

Bryan Faulger
Owner's Printed Name

Authorized Person
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

05/04/2023
Date

Psomas – David I. Brotchie
Preparer's Printed Name

Senior Project Manager, PE C62005
Preparer's Title/Position

Preparer's Licensure:

REGISTERED PROFESSIONAL ENGINEER
DAVID I. BROTCHIE
No. C62005
CIVIL
STATE OF CALIFORNIA

## Table of Contents

Section A: Project and Site Information ..... 5
A.1 Maps and Site Plans ..... 6
A.2 Identify Receiving Waters ..... 6
A.3 Additional Permits/Approvals required for the Project: ..... 6
Section B: Optimize Site Utilization (LID Principles) ..... 7
Section C: Delineate Drainage Management Areas (DMAs) ..... 8
Section D: Implement LID BMPs ..... 9
D.1 Infiltration Applicability ..... 9
D.2 Harvest and Use Assessment ..... 11
D.3 Bioretention and Biotreatment Assessment ..... 12
D.4 Feasibility Assessment Summaries ..... 13
D.5 LID BMP Sizing ..... 13
Section E: Alternative Compliance (LID Waiver Program) ..... 16
Section F: Hydromodification ..... 16
F.1 Hydrologic Conditions of Concern (HCOC) Analysis ..... 16
F.2 HCOC Mitigation ..... 17
Section G: Source Control BMPs ..... 19
Section H: Construction Plan Checklist ..... 21
Section I: Operation, Maintenance and Funding ..... 22

## List of Tables

Table A.2 Identification of Receiving Waters ..... 6
Table A.3 Other Applicable Permits ..... 6
Table C.1 DMA Classifications ..... 8
Table C.2 Type 'A', Self-Treating Areas ..... 8
Table C.3 Type 'B', Self-Retaining Areas ..... 8
Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas ..... 8
Table C.5 Type 'D', Areas Draining to BMPs ..... 9
Table D.1 Infiltration Feasibility ..... 9
Table D.2 LID Prioritization Summary Matrix ..... 13
Table D.3 DCV Calculations for LID BMPs ..... 13-15
Table G.1 Permanent and Operational Source Control Measures ..... 19
Table H.1 Construction Plan Cross-reference ..... 21

## List of Appendices

Appendix 1: Maps and Site Plans ..... 23-28
Appendix 2: Construction Plans ..... 29-34
Appendix 3: Soils Information ..... 35-148
Appendix 4: Historical Site Conditions ..... 149
Appendix 5: LID Infeasibility ..... 150
Appendix 6: BMP Design Details ..... 151-163
Appendix 7: Hydromodification ..... 15264-189
Appendix 8: Source Control ..... 189-200
Appendix 9: O&M ..... 200-205
Appendix 10: Educational Materials ..... 206-266

# Section A: Project and Site Information

This project is a proposal to demolish an existing retail department building and at grade parking lot and construct 388 residential units across 27 buildings with a leasing office, a new grocery store, and a retail unit with on-site at-grade parking, roadways, amenities, and landscape within a 17.43-acre site in the City of Riverside. The project is expected to dedicate a 5-foot strip of land to the City. The approximate area after the dedication is 17.37 acres. The site is located on the northeast corner of the Intersection of Arlington Avenue and Streeter Avenue in the City of Riverside. Stormwater from the developed site will be captured in a biotreatment system due to infeasibility of infiltration and harvest and use. The proposed condition site strives to mimic the existing drainage patterns to the existing storm drain system on Streeter Street via street gutter system or direct pipe connection. The existing bank parcel is excluded from the site.

The existing condition of the site consists of an existing retail building and at-grade parking lot. The adjacent neighboring property consists of a bank with at grading parking that will remain protected in place and is not part of this project.

| PROJECT INFORMATION | |
|---|---|
| Type of Project: | Mixed Use Multi Family Retail |
| Planning Area: | Ward 3, City of Riverside, County of Riverside |
| Community Name: | Magnolia Center |
| Development Name: | Arlington Avenue Mixed Use Project |
| **PROJECT LOCATION** | |
| Latitude & Longitude (DMS): LAT: 33° 56’ 55” N, LONG: 117° 25’ 2” W | |
| Project Watershed and Sub-Watershed: Santa Ana Reach 3; | |
| Gross Acres: 17.43 acres | |
| APN(s): 0226-180-015-1 | |
| Map Book and Page No.: MB 226 / 18 | |
| **PROJECT CHARACTERISTICS** | |
| Proposed or Potential Land Use(s) | Multi Family Mixed Use |
| Proposed or Potential SIC Code(s) | 1520 |
| Area of Impervious Project Footprint (SF) | 546,678 S.F. |
| Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement | 546,678 S.F. |
| 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 Footprint (SF) | 753,153 sf |
| Is the project located within any MSHCP Criteria Cell? | ☐ Y ☒ N |
| If so, identify the Cell number: | |
| Are there any natural hydrologic features on the project site? | ☐ Y ☒ N |
| Is a Geotechnical Report attached? | ☒ Y ☐ N |
| If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D) | N/A |
| What is the Water Quality Design Storm Depth for the project? | 0.58 in |

## A.1 Maps and Site Plans

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

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling
- BMP Locations (Lat/Long)

## 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 |
|---|---|---|---|
| ***Santa Ana River, Reach 3*** | ***Copper, Indicator Bacteria, Lead*** | ***AGR, GWR, REC1, REC2, WARM, WILD, RARE*** | ***1.20 MILES*** |
| ***Santa Ana River, Reach 2*** | | ***AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN*** | |
| ***Santa Ana River, Reach 1*** | | ***REC1, REC2*** | |

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

**Table A.2** Other Applicable Permits

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

# Section B: Optimize Site Utilization (LID Principles)

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

*Yes, this site strives to keep the drainage proceeding to the western property line, with discharges to multiple City storm drain systems. The existing lot drains into two existing 30" storm drains and one existing 33" storm drain within Streeter Ave. From there, the stormwater collected in the municipally maintained stormwater system discharges into a flood control channel. Stormwater from the Mixed Use development footprint is integrated into the site landscaping pretreating the stormwater through biotreatment with modular wetlands before discharging directly into the City storm drains in Streeter Ave. The current site has minimal landscape and is approximately 99% impervious.*

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

*Vegetation has been identified, however, the vegetation that exists within the development footprint is minimal and is proposed for demolition to fit within the new site plan. The existing vegetation does not meet current development standards and will need to be removed. New drought tolerant landscaping is proposed through the site, which will significantly increase the pervious area.*

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

*A preliminary geotechnical study was performed and reported low percolation rates. The soil characteristics, as investigated by the geotechnical engineer, does not support on-site infiltration. The soils report is attached. The development proposes to install modular wetlands to treat the stormwater.*

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

*Yes, landscape is proposed to surround the impervious portion of the site decreasing the impervious area from 99% to approximately 72%. Development flows will be reduced due to an increase in pervious area, resulting in a lower runoff coefficient.*

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

*Yes, drainage from the building roofs and interior roadways will be collected and sent to modular wetland biotreatment BMP which is integrated with the landscape design for treatment prior to discharging into the City's storm drain system.*

# Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, 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) | Area (Sq. Ft.) | DMA Type |
|---|---|---|---|
| R1E | Concrete or Asphalt/Roofs | 89,924 | D |
| R1E | Ornamental Landscape | 34,969 | A |
| C1S | Concrete or Asphalt/Roofs | 29,558 | D |
| C1S | Ornamental Landscape | 11,495 | A |
| C2S | Concrete or Asphalt/Roofs | 49,980 | D |
| C2S | Ornamental Landscape | 19,437 | A |
| R1C | Concrete or Asphalt/Roofs | 144,895 | D |
| R1C | Ornamental Landscape | 56,328 | A |
| R1W | Concrete or Asphalt/Roofs | 83,446 | D |
| R1W | Ornamental Landscape | 32,452 | A |
| R2W | Concrete or Asphalt/Roofs | 140,009 | D |
| R2W | Ornamental Landscape | 54,446 | A |

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*
[2]*If multi-surface provide back-up*

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

| DMA Name or ID | Area (Sq. Ft.) | Stabilization Type | Irrigation Type (if any) |
|---|---|---|---|
| **R1E** | 34,969 | Landscape | Per Landscape Architect's Approved Plans |
| **C1S** | 11,495 | Landscape | Per Landscape Architect's Approved Plans |
| **C2S** | 19,437 | Landscape | Per Landscape Architect's Approved Plans |
| **R1C** | 56,328 | Landscape | Per Landscape Architect's Approved Plans |
| **R1W** | 32,452 | Landscape | Per Landscape Architect's Approved Plans |
| **R2W** | 54,446 | Landscape | Per Landscape Architect's Approved Plans |

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

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

**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 | Impervious fraction | Product | DMA name /ID | Area (square feet) | Ratio |
| | [A] | | [B] | [C] = [A] x [B] | | [D] | [C]/[D] |
| N/A | | | | | | | |

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

| DMA Name or ID | BMP Name or ID |
|---|---|
| R1E | Biotreatment |
| C1S | Biotreatment |
| C2S | Biotreatment |
| R1C | Biotreatment |
| R1W | Biotreatment |
| R2W | Biotreatment |

*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

### Geotechnical Report

A Geotechnical Report is required by the City of Riverside to confirm present and past site characteristics that may affect the use of Infiltration BMPs, see Appendix 3.

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

### Infiltration Feasibility

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

**Table D.1** Infiltration Feasibility

| Does the project site… | YES | NO |
|---|---|---|
| …have any DMAs with a seasonal high groundwater mark shallower than 10 feet? | | X |
| If Yes, list affected DMAs: | | |
| …have any DMAs located within 100 feet of a water supply well? | | X |
| If Yes, list affected DMAs: | | |

| | | |
|---|---|---|
| …have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact? | X | |
| If Yes, list affected DMAs:<br><br>All DMAs are affected. Per the geotechnical report, allowing storm water to infiltration the on-site soil increases the potential for settlement, liquefaction and water-related damage to structures/improvements and it has been recommend to be avoided where possible. | | |
| …have measured in-situ infiltration rates of less than 1.6 inches / hour? | X | |
| If Yes, list affected DMAs:<br><br>All DMAs are affected. Preliminary infiltration measured test results range from 0.0 in/hr to 0.1 in/hr. Based on the preliminary assessment, the site does not appear to favor infiltration as a BMP measure. | | |
| …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:<br><br>Preliminary infiltration test results do not support an infiltration BMP. There was also a concern of potential negative impacts such as liquefaction, settlement, and water-related damages to structures. | | |

## D.2 Harvest and Use Assessment

Please check what applies*:*

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

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

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

☒None of the Above.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none 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*: 4.9 acres

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

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

*Total Area of Impervious Surfaces:* 12.55 acres

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

*Enter your EIATIA factor*: 0.68

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*: 8.53 acres

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

| Minimum required irrigated area (Step 4) | Available Irrigated Landscape (Step 1) |
|---|---|
| 8.53 acres | 4.9 acres |

### Toilet Use Feasibility

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

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

*Projected Number of Daily Toilet Users: Approximately 1000*

*Project Type: Approx 75% Residential and Approx 25% Commercial*

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: 12.55 acres*

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

*Enter your TUTIA factor: 108 (weighted)*

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: 1355*

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) |
|---|---|
| 1355 | 1000 |

### 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

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 per Section 3.4.2 of the WQMP Guidance Document.

## 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.

☐ None of the above

## 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 | |
| R1E | ☐ | ☐ | ☐ | ☒ | ☐ |
| C1S | ☐ | ☐ | ☐ | ☒ | ☐ |
| C2S | ☐ | ☐ | ☐ | ☒ | ☐ |
| R1C | ☐ | ☐ | ☐ | ☒ | ☐ |
| R1W | ☐ | ☐ | ☐ | ☒ | ☐ |
| R2W | ☐ | ☐ | ☐ | ☒ | ☐ |

## D.5 LID BMP Sizing

**Table D.3** DCV Calculations for LID BMPs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Biotreatment* | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| R1E | 89,924 | Concrete or Asphalt/Roofs | 1.00 | 0.89 | 80,212 | *Rainfall Intensity (in/hr)* | *Design Flow, $Q_{BMP}$ (cubic feet/sec)* | *Proposed Flow on Plans (cubic feet/sec)* |
| R1E | 34,696 | Ornamental Landscape | 0.10 | 0.11 | 3,863 | | | |
| | 124,893 | | | | 80,075 | 0.20 | 0.4 | 0.53 |

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Biotreatment* |
|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| C1S | 29,558 | Concrete or Asphalt/Roofs | 1.00 | 0.89 | 26,366 | *Rainfall Intensity (in/hr)* | *Design Flow, $Q_{BMP}$ (cubic feet/sec)* | *Proposed Flow on Plans (cubic feet/sec)* |
| C1S | 11,495 | Ornamental Landscape | 0.10 | 0.11 | 1,270 | | | |
| | *41,053* | | | | *27,636* | *0.20* | *0.1* | *0.13* |

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | ***Biotreatment*** | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| C2S | 49,980 | Concrete or Asphalt/Roofs | 1.00 | 0.89 | 44,582 | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* |
| C2S | 19,437 | Ornamental Landscape | 0.10 | 0.11 | 2,147 | | | |
| | *69,417* | | | | *46,729* | *0.20* | *0.2* | *0.27* |

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | ***Biotreatment*** | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| R1C | 144,895 | Concrete or Asphalt/Roofs | 1.00 | 0.89 | 129,246 | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* |
| R1C | 56,328 | Ornamental Landscape | 0.10 | 0.11 | 6,222 | | | |
| | *201,223* | | | | *135,468* | *0.20* | *0.6* | *0.8* |

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | ***Biotreatment*** | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| R1W | 83,446 | Concrete or Asphalt/Roofs | 1.00 | 0.89 | 74,434 | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* |
| R1W | 32,452 | Ornamental Landscape | 0.10 | 0.11 | 3,585 | | | |
| | *115,898* | | | | *78,019* | *0.20* | *0.4* | *0.53* |

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type | Effective Impervious Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Biotreatment* | | |
|---|---|---|---|---|---|---|---|---|
| | [A] | | [B] | [C] | [A] x [C] | | | |
| R2W | 140,009 | Concrete or Asphalt/Roofs | 1.00 | 0.89 | 124,888 | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* | *Rainfall Intensity (in/hr)* |
| R2W | 54,446 | Ornamental Landscape | 0.10 | 0.11 | 6,014 | | | |
| | *194,455* | | | | *130,902* | *0.20* | *0.6* | *0.8* |

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

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

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

# Section E: Alternative Compliance (LID Waiver Program)

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

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

- *Or* -

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

# 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

**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** | 50min | 55min | 9.5% |
| **Volume (Cubic Feet)** | 27,483 | 24,078 | -13% |

[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.

The 2 Year Storm at the point of compliance will generate 18.58 cfs in pre-developed condition. The 2 Year Storm at the point of compliance will generate 16.44 cfs in post-developed condition, resulting in a 2.14 cfs reduction in peak discharge. A preliminary analysis of the Peak Discharge, Qpeak of a 2-year predevelopment and post development concluded that the Qpeak is reduced in the post development condition. This is due to the decrease in impervious area from 99% to approximately 72%. While the final impervious area will depend on the final design, a significant reduction of imperviousness generally decreases the peak discharge.

**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 Susceptibility Maps.

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

Per HCOC Applicability Map, the project site is within the "applicable area". See HCOC Applicability Map on Appendix 7. The site directly drains into an engineered channel across the street, however, this segment of the facility was not designated as an Engineered, Fully Hardened and Maintained (EFHM) facility. Downstream of this channel is a designated EFHM.

## F.2 HCOC Mitigation

As an alternative to the HCOC Exemption Criteria above, HCOC criteria is considered mitigated if the project meets one of the following conditions, as indicated:

☐ 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.

☐ d. None of the above.

# Section G: Source Control BMPs

The following table identifies the potential sources of runoff pollutants for this project and specifies how they are addressed through permanent controls and operational BMPs:

**Table G.1** Permanent and Operational Source Control Measures

| Potential Sources of Runoff pollutants | Permanent Structural Source Control BMPs | Operational Source Control BMPs |
|---|---|---|
| A. On-site storm drain inlets | -Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. 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.<br>- Provide stormwater pollution prevention information to new site owners, lessees, or operators.<br>- See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com<br>- 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." |
| C. Interior parking garages | -Parking garage floor drains will be plumbed to the sanitary sewer per final plumbing plans. | -Inspect and maintain drains to prevent blockages and overflow. |
| D2. Landscape/<br>Outdoor Pesticide Use | -Final landscape plans will accomplish all of the following:<br>-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.<br>-Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.<br>-Consider using pest-resistant plants, especially adjacent to hardscape.<br>-To ensure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions. | -Maintain landscaping using minimum or no pesticides.<br>- See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at https://www.rcwatershed.org/about/materials-library/ - Provide IPM information to new owners, lessees and operators. |

| | | |
|---|---|---|
| E. Pools, spas, ponds, decorative fountains, and other water features. | Connection will be made according to local requirements. | See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at https://www.rcwatershed.org/about/materials-library/ |
| F. Food service | -A proposed grocery store will be located at the southern portion of the site. The grocery store tenant's operations will comply with local requirements. | See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at https://www.rcwatershed.org/about/materials-library/<br><br>Provide this brochure to new site owners, lessees, and operators. |
| G. Refuse areas | -State how site refuse will be handled and provide supporting detail to what is shown on plans.<br>- State that signs will be posted on or near dumpsters with the words "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 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 |
| M. Loading Docks | The design of the loading dock area will consider minimizing run-on and will design with discharges to the sanitary sewer system. | Move loaded and unloaded items indoors as soon as possible.<br><br>See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com |
| O. Miscellaneous Drain or Wash Water or Other Sources:<br><br>Rooftop Equipment<br><br>Roofing, gutters, and trim | Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. | Provide possible roof drain filters and allow carport runoff to filter thru landscape areas. |
| P. Plazas, sidewalks, and parking lots. | N/A | Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain. |

# Section H: Construction Plan Checklist

**Table H.1** Construction Plan Cross-reference

| BMP No. or ID | BMP Identifier and Description | Plan Sheet Number(s) | Latitude / Longitude |
|---|---|---|---|
| R1E-1 | Biotreatment/ Modular Wetland | WQMP Exhibit | |
| C1S-1 | Biotreatment/ Modular Wetland | WQMP Exhibit | |
| C2S-1 | Biotreatment/ Modular Wetland | WQMP Exhibit | |
| R1C-1 | Biotreatment/ Modular Wetland | WQMP Exhibit | |
| R1W-1 | Biotreatment/ Modular Wetland | WQMP Exhibit | |
| R2W-1 | Biotreatment/ Modular Wetland | WQMP Exhibit | |

# 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.

See Appendix 9 for a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on site, and an agreement assigning responsibility for maintenance and providing for inspections and certification.

**Maintenance Mechanism:** **WQMP Covenant & Agreement**

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

☐ Y ☒ N

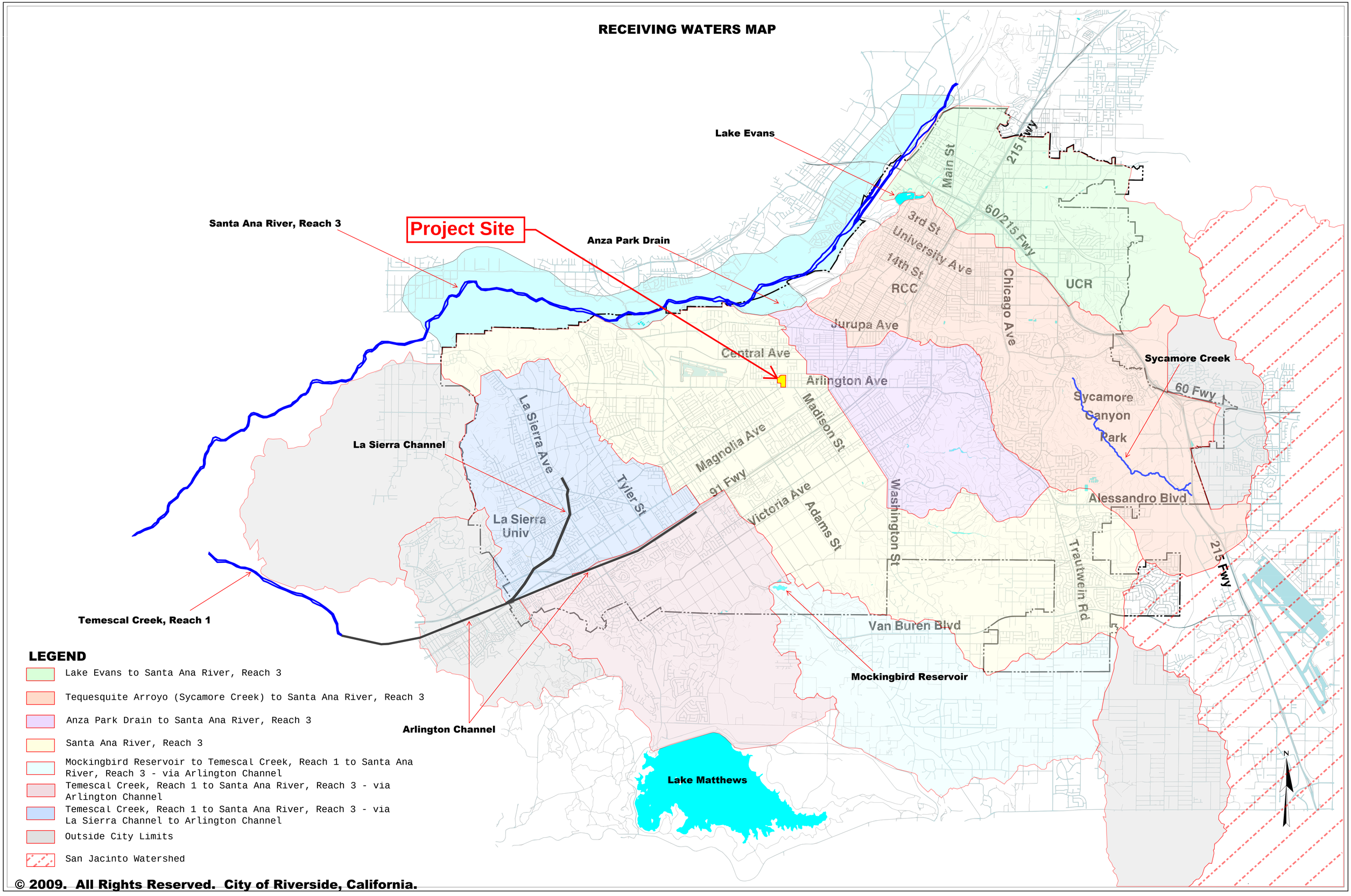
Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

# Appendix 1: Maps and Site Plans

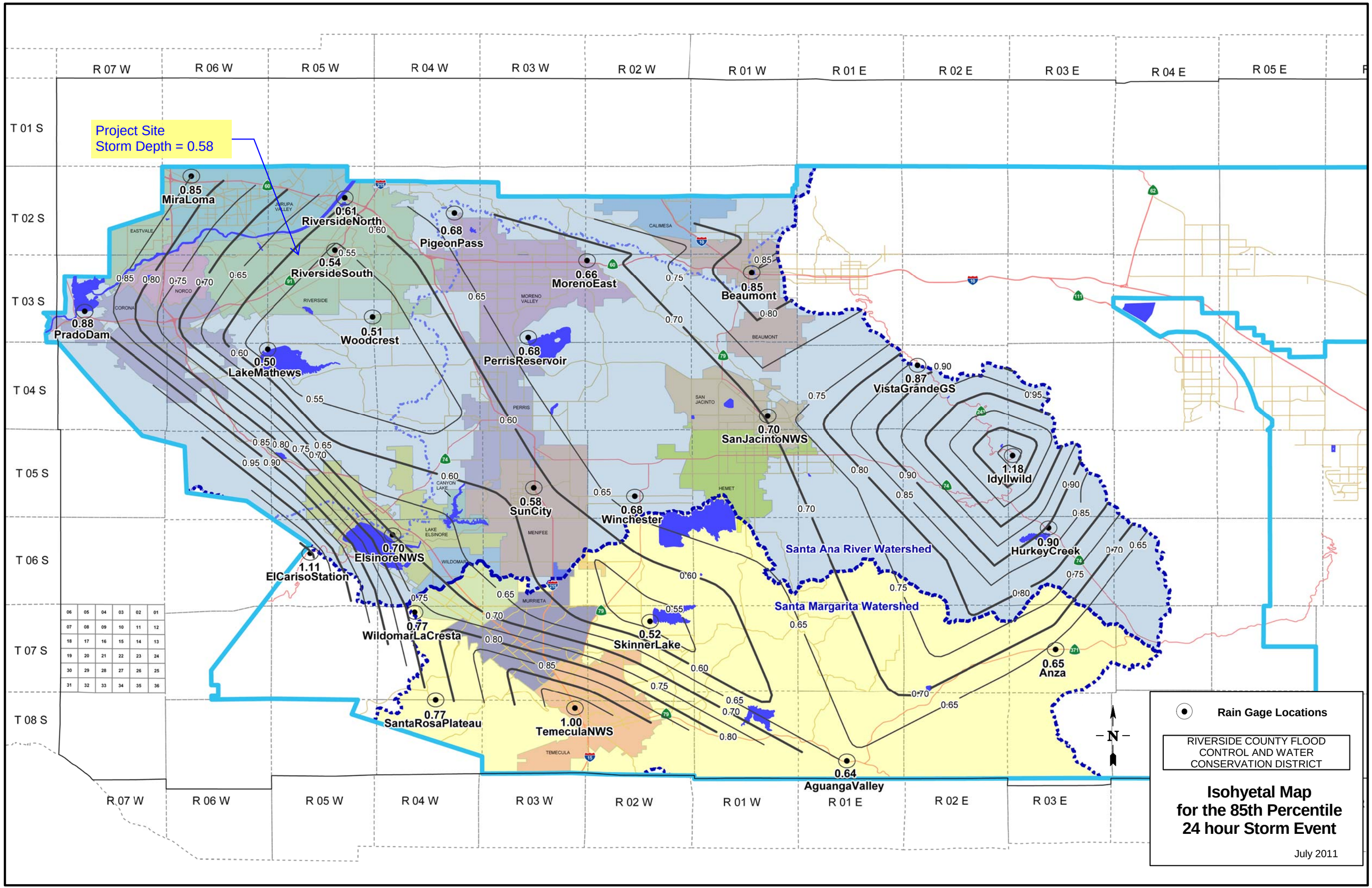
*Location Map, WQMP Site Plan and Receiving Waters Map*

PROJECT LOCATION MAP

# RECEIVING WATERS MAP



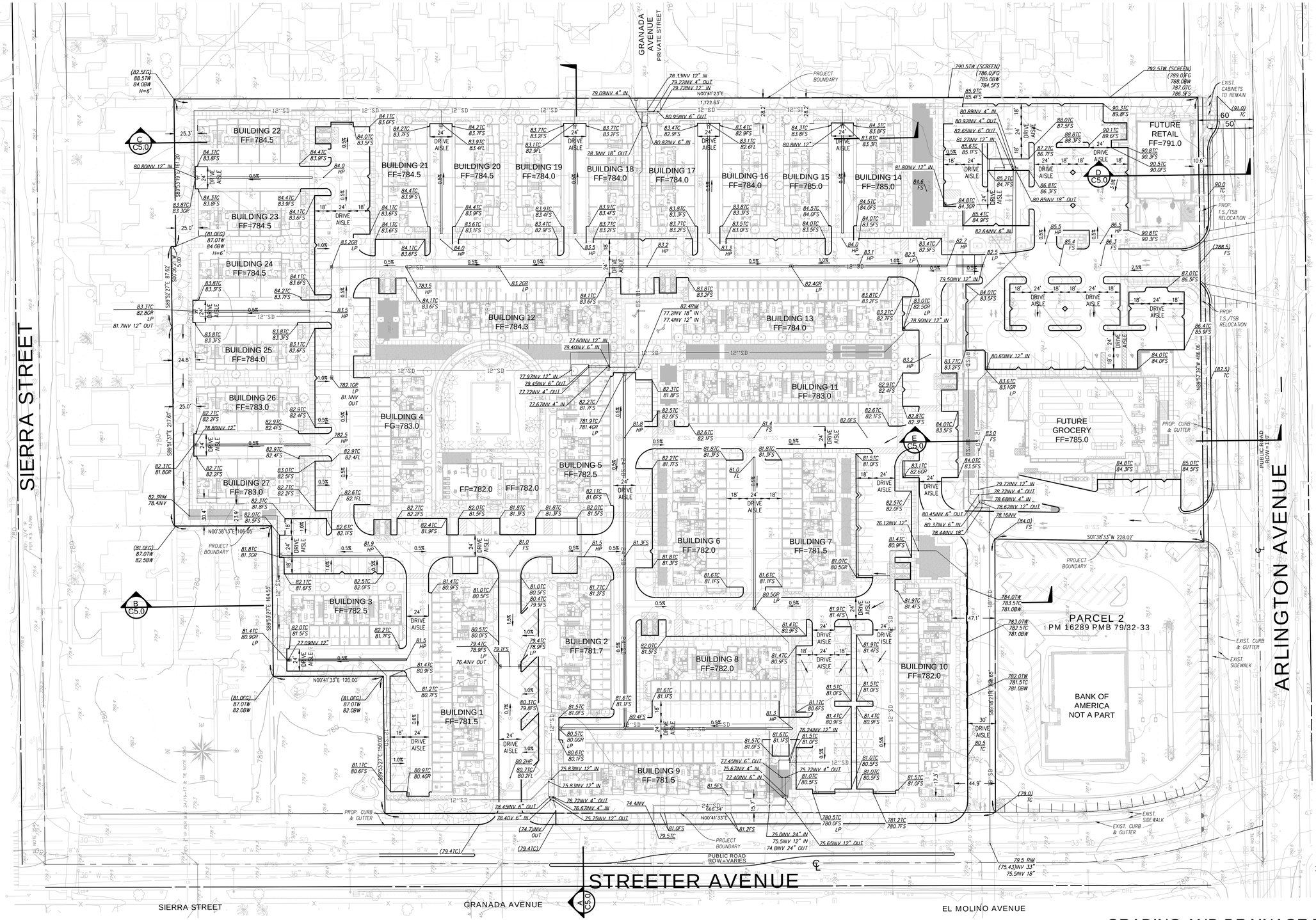

© 2009. All Rights Reserved. City of Riverside, California.


Project Site
Storm Depth = 0.58
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
0.54 RiversideSouth
0.68 PigeonPass
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
0.90 HurkeyCreek
0.70 ElsinoreNWS
1.11 ElCarisoStation
0.77 WildomarLaCresta
0.52 SkinnerLake
0.65 Anza
0.77 SantaRosaPlateau
1.00 TemeculaNWS
0.64 AguangaValley
Santa Ana River Watershed
Santa Margarita Watershed
N
Rain Gage Locations
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
Isohyetal Map for the 85th Percentile 24 hour Storm Event
July 2011

| DMA ID | Project Surface Type | DMA Type | TOTAL AREA (SQ.FT) | PERVIOUS AREA (SQ.FT) | IMPERVIOUS AREA (SQ.FT) | % PERVIOUS | % IMPERVIOUS | Effective Impervious Fraction, If | DMA Runoff Factor | DMA Areas x Runoff Factor | Rainfall Intensity (IN/HR) | Q BMP REQUIRED (CFS) | DESIGN Q PROVIDED (CFS) | PROVIDED Q > REQUIRED Q? | BMP TYPE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R1E | Concrete or Asphalt/Roofs | D | 89,924 | - | 89,924 | 0% | 100% | 1.00 | 0.89 | 80,212 | | | | | |
| R1E | Ornamental Landscape | A | 34,969 | 34,969 | - | 100% | 0% | 0.10 | 0.11 | 3,863 | | | | | **BIO-TREATMENT** |
| **R1E** | **TOTAL** | | **124,893** | | | | | | | **84,075** | 0.20 | **0.4** | **0.53** | **YES** | |
| C1S | Concrete or Asphalt/Roofs | D | 29,558 | - | 29,558 | 0% | 100% | 1.00 | 0.89 | 26,366 | | | | | |
| C1S | Ornamental Landscape | A | 11,495 | 11,495 | - | 100% | 0% | 0.10 | 0.11 | 1,270 | | | | | **BIO-TREATMENT** |
| **C1S** | **TOTAL** | | **41,053** | | | | | | | **27,636** | 0.20 | **0.1** | **0.13** | **YES** | |
| C2S | Concrete or Asphalt/Roofs | D | 49,980 | - | 49,980 | 0% | 100% | 1.00 | 0.89 | 44,582 | | | | | |
| C2S | Ornamental Landscape | A | 19,437 | 19,437 | - | 100% | 0% | 0.10 | 0.11 | 2,147 | | | | | **BIO-TREATMENT** |
| **C2S** | **TOTAL** | | **69,417** | | | | | | | **46,729** | 0.20 | **0.2** | **0.27** | **YES** | |
| R1C | Concrete or Asphalt/Roofs | D | 144,895 | - | 144,895 | 0% | 100% | 1.00 | 0.89 | 129,246 | | | | | |
| R1C | Ornamental Landscape | A | 56,328 | 56,328 | | 100% | 0% | 0.10 | 0.11 | 6,222 | | | | | **BIO-TREATMENT** |
| **R1C** | **TOTAL** | | **201,223** | | | | | | | **135,468** | 0.20 | **0.6** | **0.80** | **YES** | |
| R1W | Concrete or Asphalt/Roofs | D | 83,446 | - | 83,446 | 0% | 100% | 1.00 | 0.89 | 74,434 | | | | | |
| R1W | Ornamental Landscape | A | 32,452 | 32,452 | - | 100% | 0% | 0.10 | 0.11 | 3,585 | | | | | **BIO-TREATMENT** |
| **R1W** | **TOTAL** | | **115,898** | | | | | | | **78,018** | 0.20 | **0.4** | **0.53** | **YES** | |
| R2W | Concrete or Asphalt/Roofs | D | 140,009 | - | 140,009 | 0% | 100% | 1.00 | 0.89 | 124,888 | | | | | |
| R2W | Ornamental Landscape | A | 54,446 | 54,446 | - | 100% | 0% | 0.10 | 0.11 | 6,014 | | | | | **BIO-TREATMENT** |
| **R2W** | **TOTAL** | | **194,455** | | | | | | | **130,902** | 0.20 | **0.6** | **0.8** | **YES** | |

# Appendix 2: Construction Plans

*Grading Plan, Utility Plan, Landscape Plan*




## EARTHWORK:

CUT: 18,376 C.Y
FILL: 18,127 C.Y
NET: 249 C.Y
MAX CUT: 5FT
MAX FILL: 2FT

GRADING AND DRAINAGE PLAN

C3.0

# ARLINGTON MIXED USE

RIVERSIDE, CA

DATE: 8-05-2022
JOB NO.: 2020-055

FOULGER-PRATT

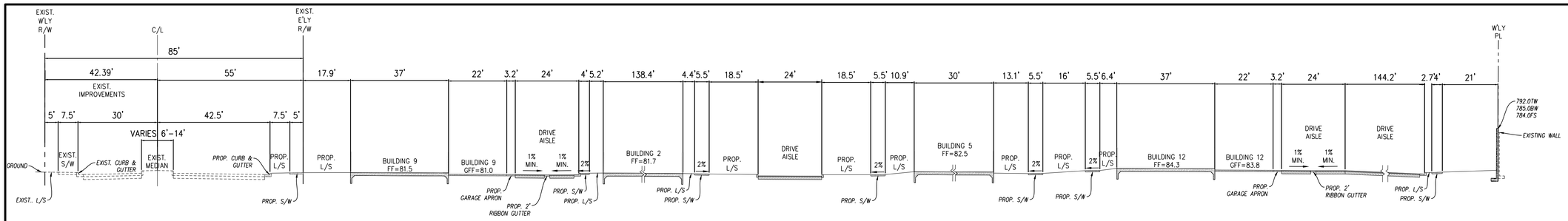
SERITAGE GROWTH PROPERTIES

PSOMAS
1650 SPRUCE STREET, SUITE 400
RIVERSIDE, CA 92507
951.300.2818 www.psomas.com

ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

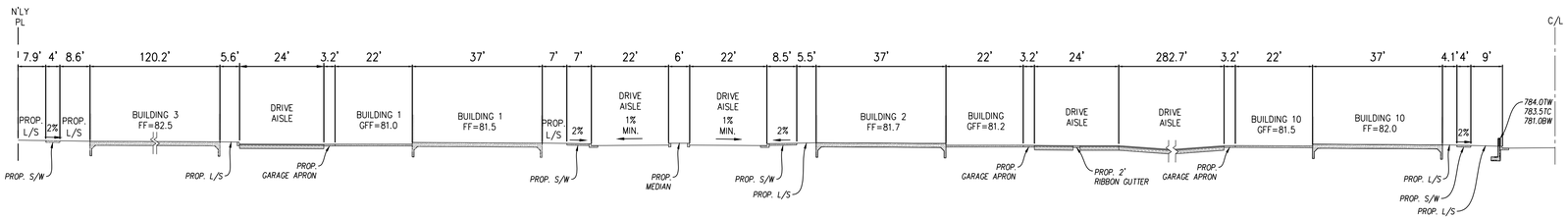
Architecture. Design. Relationships.

4/14/2023 12:52:06 PM R:\4RIV290100\CADD\Design\Sheets\PRELIM\FP-CS-GRD AND DRAINAGE.dwg



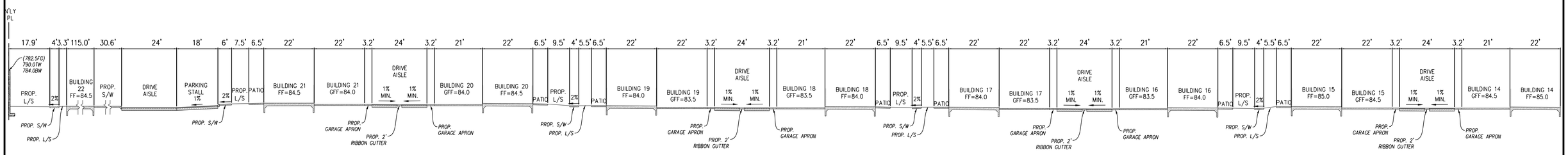

# CROSS SECTION A-A

SCALE: 1"=20'



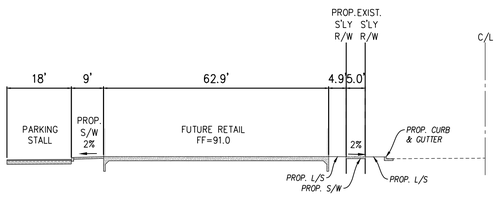

# CROSS SECTION B-B

SCALE: 1"=20'



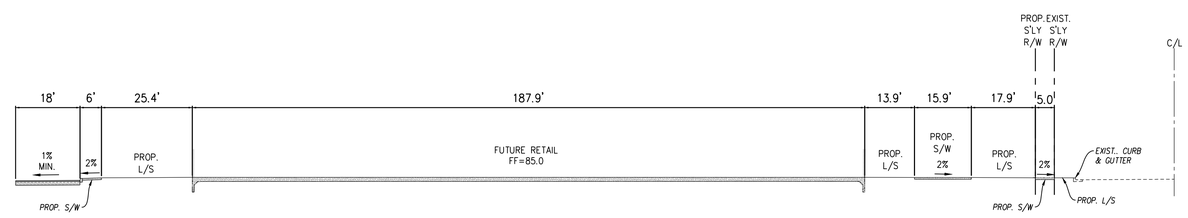

# CROSS SECTION C-C

SCALE: 1"=20'




# CROSS SECTION D-D

SCALE: 1"=20'




# CROSS SECTION E-E

SCALE: 1"=20'

SITE SECTIONS

C5.0

# ARLINGTON MIXED USE

RIVERSIDE, CA

DATE: 8-05-2022
JOB NO.: 2020-055

FOULGER-PRATT

SERITAGE GROWTH PROPERTIES

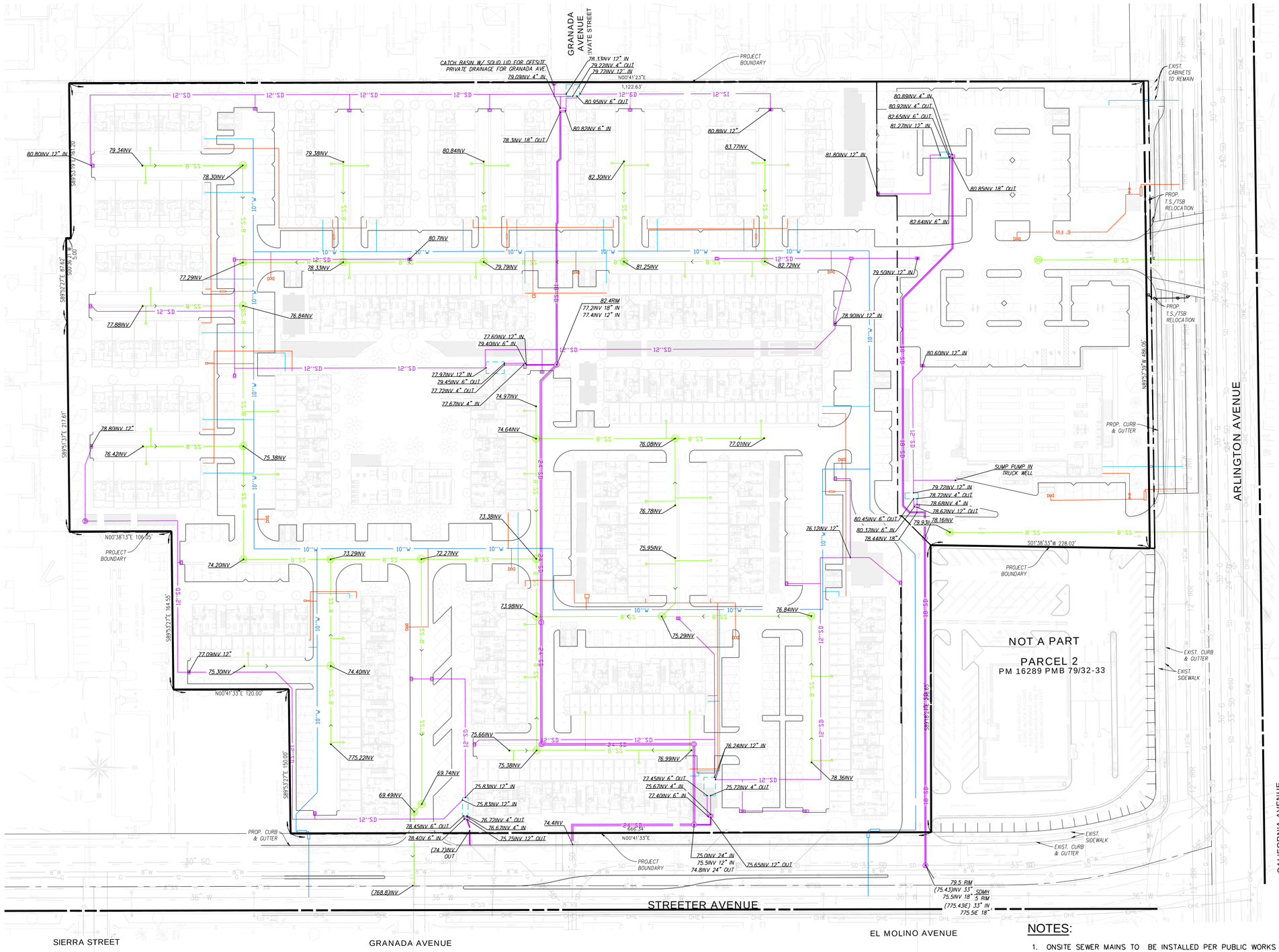
PSOMAS
1650 SPRUCE STREET, SUITE 400
RIVERSIDE, CA 92507
951.300.2818 www.psomas.com

ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.

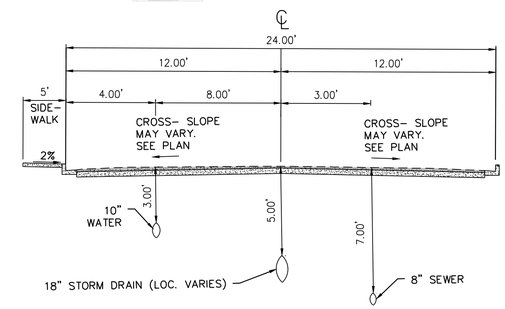
R:\ARIV290100\CADD\Design\Sheets\PRELIM\FP-XSECTION-R.dwg

3/14/2023 4:59:57 PM



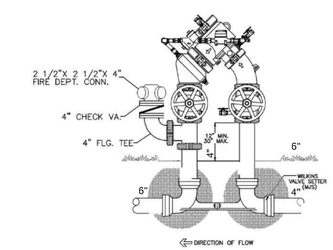

## UTILITY LEGEND:

- PROPOSED SEWER MAIN AND MANHOLE
- SEWER CLEANOUT
- PRIVATE FIRE SERVICE
- PROPOSED WATER MAIN
- 10" METER AND BACKFLOW
- FIRE HYDRANT
- D.C.D.A
- PROPOSED PRE-TREATMENT HDPE STORM DRAIN AND MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED STORM DRAIN CONNECTOR
- PROPOSED STORMWATER BMP
- PROPOSED POST-TREATMENT STORM DRAIN
- EXISTING PRIVATE WATER/FIRE MAIN
- EXISTING EASEMENT
- EXISTING SEWER
- PROPOSED ELECTRICAL PAD




TYPICAL UTILITY PLACEMENT SECTION

NOT TO SCALE




6" ON-SITE DOUBLE DETECTOR CHECK

NOT TO SCALE

NORTH

1"=50'-0" 0 25' 50' 100' 150'

## NOTES:

1. ONSITE SEWER MAINS TO BE INSTALLED PER PUBLIC WORKS STANDARDS. LATERALS AND BUILDING CONNECTIONS PER CURRENT CPC.
2. ONSITE PRIVATE FIRE SYSTEM AND HYDRANT LOCATIONS PER CITY FIRE DEPARTMENT.
3. ONSITE PRIVATE DOMESTIC WATER PER CITY WATER DEPARTMENT.
4. DOMESTIC WATER LATERALS FROM ONSITE PRIVATE WATER MAINS TO BUILDINGS PER CURRENT CPC WITH SUBMETERING AS REQUIRED.

UTILITY PLAN

C4.0

DATE: 8-05-2022
JOB NO.: 2020-055

# ARLINGTON MIXED USE

RIVERSIDE, CA

FOULGER-PRATT

SERITAGE GROWTH PROPERTIES

PSOMAS
1650 SPRUCE STREET, SUITE 400
RIVERSIDE, CA 92507
951.300.2818 www.psomas.com

ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.

R:\4Riv290100\CADD\Design\Sheets\PRELIM\FP-CS-UT.dwg

4/14/2023 12:53:10 PM

## SHEET INDEX


L0.0 LANDSCAPE ILLUSTRATIVE PLAN
L1.0 LANDSCAPE PLAN
L2.0 EXISTING TREE PLAN (EXISTING SITE)
L2.1 EXISTING TREE PLAN (NEW SITE)
L3.0 PLANTING PLAN
L3.1 PLANTING PALETTE
L3.2 PLANTING PALETTE
L4.0 WALL AND FENCE PLAN
L4.1 WALL AND FENCE DETAILS
L4.2 WALL AND FENCE DETAILS


1"=50'-0" SCALE

0 50 100

NORTH

LANDSCAPE ILLUSTRATIVE PLAN

L0.0

# ARLINGTON MIXED USE

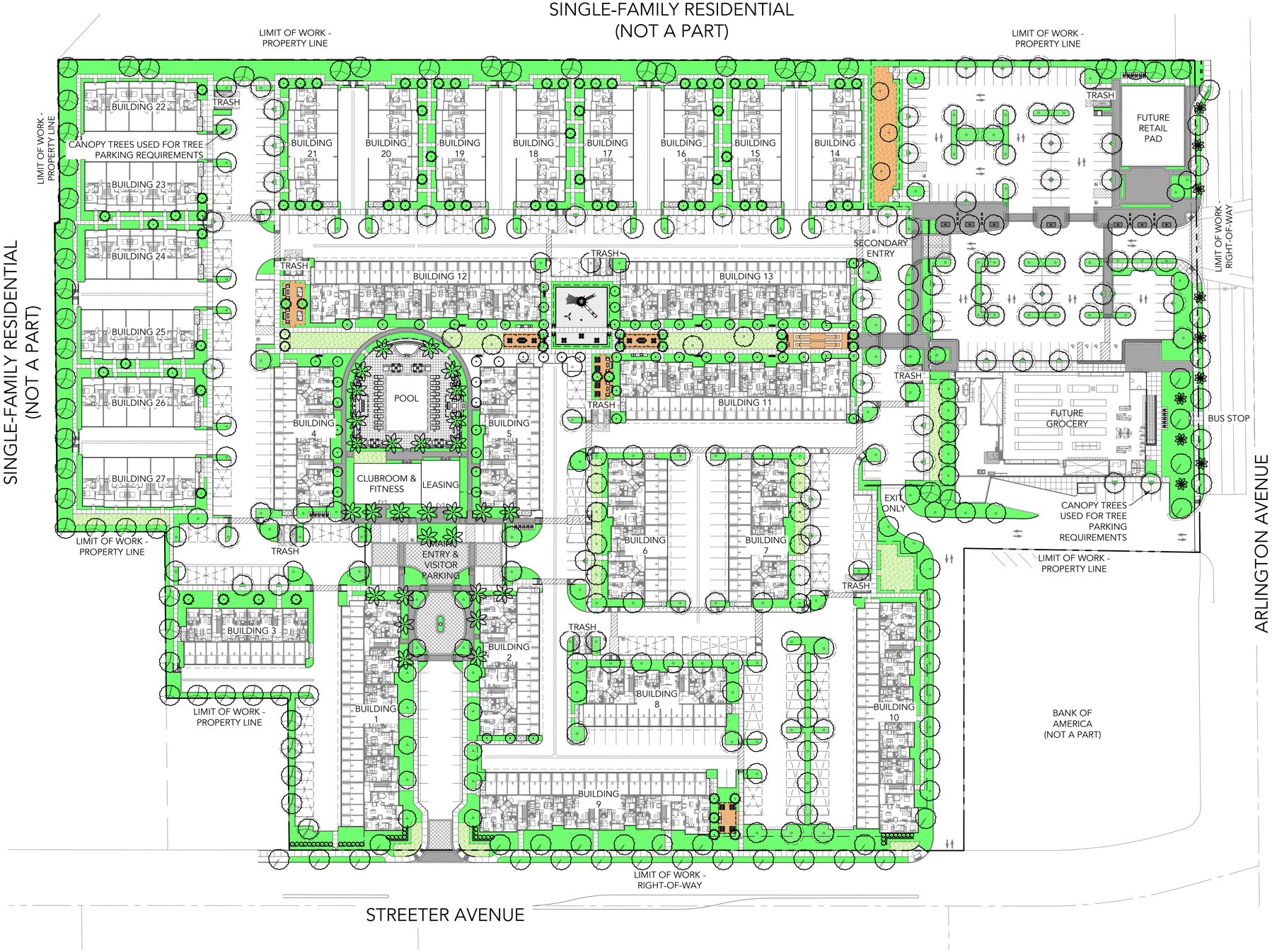
RIVERSIDE, CA

FOULGER PRATT

DATE: 08-05-2022
JOB NO.: 2020-055


ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860


Architecture. Design. Relationships.




1"=50'-0" SCALE

0 50 100

NORTH

## LANDSCAPE ZONES AND PLANT PALETTE

| SYMBOL | BOTANICAL NAME | COMMON NAME | WUCOLS |
|---|---|---|---|
| EXISTING TREES (TO REMAIN): | | | |
| | WASHINGTONIA ROBUSTA | MEXICAN FAN PALM | L |
| ENTRY AND PERIMETER PALM SUCH AS: | | | |
| | ARCHONTOPHOENIX ALEXANDRE | KING PALM | M |
| | BISMARCKIA NOBILIS | BISMARCK PALM | L |
| | HOWEA FORSTERIANA | KENTIA PALM | M |
| | PHOENIX DACTYLIFERA | DATE PALM | L |
| | WASHINGTONIA ROBUSTA | MEXICAN FAN PALM | L |
| ENTRY SPECIMEN TREE SUCH AS: | | | |
| | ARBUTUS X 'MARINA' | MARINA STRAWBERRY TREE | M |
| | CASSIA LEPTOPHYLLA | GOLD MEDALLION TREE | M |
| | CERCIDIUM-PARKINGSONIA HYBRID | MUSEUM PALO VERDE | L |
| | OLEA EUROPAEA | EUROPEAN OLIVE | L |
| | QUERCUS VIRGINIANA | SOUTHERN LIVE OAK | M |
| LOOP ROAD AND PARKING CANOPY TREE SUCH AS: | | | |
| | CUPANIOPSIS ANACARDIOIDES | CARROT WOOD | M |
| | GEIJERA PARVIFLORA | AUSTRALIAN WILLOW | M |
| | PODOCARPUS GRACILIOR | FERN PINE | M |
| | PROSOPIS GLANDULOSA | CHILEAN MESQUITE | L |
| | RHUS LANCEA | AFRICAN SUMAC | L |
| | ULMUS PARVIFOLIA | CHINESE ELM 'TRUE GREEN' | L |
| LARGE ACCENT TREE SUCH AS: | | | |
| | CHITALPA TASHKENTENSIS | CHITALPA | L |
| | JACARANDA MIMOSIFOLIA | JACARANDA | M |
| | PLATANUS X ACERIFOLIA | LONDON PLANETREE | M |
| | PLATANUS RACEMOSA | WESTERN SYCAMORE | M |
| | QUERCUS AGRIFOLIA | COAST LIVE OAK | L |
| | TIPUANA TIPU | TIPU | M |
| PERIMETER SCREENING TREE SUCH AS: | | | |
| | CASSIA LEPTOPHYLLA | GOLD MEDALLION TREE | M |
| | CINNAMOM CAMPHORA | CAMPHOR | M |
| | PINUS CANARIENSIS | CANARY ISLAND PINE | M |
| | PINUS ELDARICA | AFGHAN PINE | L |
| | PINUS HALPENSIS | ALEPPO PINE | L |
| SMALL ACCENT TREE SUCH AS: | | | |
| | ARBUTUS X 'MARINA' | MARINA STRAWBERRY TREE | M |
| | BAUHINIA X BLAKEANA | HONG KONG ORCHID TREE | M |
| | CHILOPSIS LINEARIS | DESERT WILLOW | VL |
| | MAGNOLIA GRANDIFLORA 'LITTLE GEM' | MAGNOLIA 'LITTLE GEM' | M |
| | LAGERSTROEMIA INDICA | CRAPE MYRTLE | M |
| VERTICAL ACCENT TREE SUCH AS: | | | |
| | FICUS NITIDA | INDIAN LAUREL COLUMN | M |
| | PODOCARPUS ELONGATUS 'ICEE BLUE' | 'ICEE BLUE' PODOCARPUS | M |
| | PRUNUS CAROLINIANA 'COMPACTA' | CAROLINA CHERRY | M |
| | STREUTZIA NICOLAI | GIANT BIRD OF PARADISE | M |
| | TRISTANIA CONFERTA | BRISBANE BOX | M |
| SHRUBS SUCH AS: | | | |
| | ALOE X SPECIES | ALOE | L |
| | AGAVE X SPECIES | AGAVE | L |
| | ARBUTUS UNEDO 'COMPACTA' | DWARF STRAWBERRY TREE | L |
| | ASPARAGUS DENSIFLORUS 'MYERS' | FOXTAIL FERN | M |
| | BOUGAINVILLEA 'LA JOLLA' | 'LA JOLLA' BOUGAINVILLEA | L |
| | CALLISTEMON VIMINALIS 'LITTLE JOHN' | WEEPING BOTTLEBRUSH | M |
| | CAREX X SPECIES | SEDGE | L |
| | CARISSA MACROCARPA 'TUTTLE' | 'TUTTLE' DWARF NATAL PLUM | M |
| | CHONDROPETALUM TECTORUM 'EL CAMPO' | 'EL CAMPO' SMALL CAPE RUSH | M |
| | CORDYLINE X SPECIES | CORDYLINE | M |
| | DASYLIRION SPECIES | DESERT SPOON | L |
| | DIANELLA TASMANICA 'VARIEGATA' | VARIEGATED FLAX LILY | M |
| | DIETES GRANDIFLORA | FORTNIGHT LILY | M |
| | JUNCUS PATENS | CALIFORNIA GRAY RUSH | L |
| | LEUCADENDRON X 'SAFARI SUNSHINE' | CONEBUSH | M |
| | LIGUSTRUM JAPONICUM 'TEXANUM' | WAX LEAF PRIVET | M |
| | LOMANDRA X SPECIES | MAT RUSH | M |
| | PEDILANTHUS MACROCARPUS | SLIPPER | VL |
| | PENNISETUM MESSIACUM 'RED BUNNY TAILS' | FOUNTAIN GRASS | L |
| | PHILODENDRON XANADU | XANADU PHILODENDRON | M |
| | PHORMIUM 'DARK DELIGHT' | 'DARK DELIGHT' PURPLE FLAX | M |
| | PITTOSPORUM TOBIRA 'VARIEGATA' | VARIEGATED MOCK ORANGE | M |
| | RHAPHIOLEPIS INDICA 'CLARA' | 'CLARA' INDIAN HAWTHORN | M |
| | RHAPHIOLEPIS UMBELLATA 'MINOR' | YEDDO HAWTHORN | M |
| | SANSEVIERIA TRIFASCIATA | MOTHER-IN-LAW'S TOUNGE | L |
| | SESLERIA X 'GREENLEE' | 'GREENLEE' MOOR GRASS | M |
| | STRELITZIA REGINAE | BIRD OF PARADISE | M |
| | WESTRINGIA FRUTICOSA 'SMOKEY' | 'SMOKEY' WESTRINGIA | L |
| | ZAMIA FURFURACEA | CARDBOARD PALM | M |
| GROUNDCOVERS SUCH AS: | | | |
| | BACCHARIS PILULARIS 'PIGEON POINT' | DWARF COYOTE BRUSH | L |
| | CAREX PRAEGRACILIS | CALIFORNIA FIELD SEDGE | M |
| | CARISSA MACROCARPA 'GREEN CARPET' | 'GREEN CARPET' NATAL PLUM | M |
| | COTONEASTER SPECIES | COTONEASTER | M |
| | FESTUCA GLAUCA 'ELIJAH BLUE' | 'ELIJAH BLUE' FESCUE | M |
| | MYOPORUM PARVIFOLIUM | PROSTRATE MYOPORUM | L |
| | ROSMARINUS OFFICINALIS 'HUNTINGTON CARPET' | 'HUNTINGTON CARPET' ROSEMARY | L |
| | ROSA SPECIES | CARPET ROSE | M |
| | SENECIO SERPENS | BLUE CHALKSTICKS | L |
| | TRADESCANTIA PALLIDA 'PURPLE HEART' | PURPLE QUEEN SPIDERWORT | M |
| TURF SUCH AS: | | | |
| | DWARF TALL FESCUE/FESTUCA ARUNDINACEA | MARATHON II SOD | H |
| | CYNODON DACTYLON | TIFGREEN | H |
| PERMEABLE AREA SUCH AS: | | | |
| | DECOMPOSED GRANITE | | |

TREE PARKING REQUIREMENTS

| | |
|---|---|
| OPEN PARKING PROVIDED | 305 SPACES (OPEN) |
| REQUIRED NUMBER OF TREES (1 TREE FOR EVERY 4 OPEN SPACES) | 77 TREES |
| TOTAL TREES PROVIDED | 95 |

PLANTING PLAN

L3.0

# ARLINGTON MIXED USE

RIVERSIDE, CA

FOULGER PRATT

DATE: 08-05-2022
JOB NO.: 2020-055

ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.

# Appendix 3: Soils Information

*Geotechnical Study and Other Infiltration Testing Data*

ALTA CALIFORNIA
GEOTECHNICAL INC.

170 North Maple Street, Suite 108
Corona, CA 92880
www.altageotechnical.com

**FOULGER-PRATT**
136 Calle de Los Molinos
San Clemente, CA 92672

February 24, 2020
**Proposal No. 1-0312**

Attention: Mr. Jim Ivory

Subject: **GEOTECHNICAL INVESTIGATION**
5261 Arlington Avenue
City of Riverside, California

References: See Appendix A

Dear Mr. Ivory:

Alta California Geotechnical, Inc. (Alta) is pleased to present this geotechnical investigation for the proposed residential and retail development located at 5261 Arlington Avenue, in the City of Riverside, California. This report is based on a recent subsurface investigation conducted by Alta, laboratory testing, and review of the referenced reports and the Site Plan (enclosed Plate 1).

Alta's review of the data and site plan indicates that the proposed development is feasible, from a geotechnical perspective, provided that the recommendations presented in this report are incorporated into the grading and improvement plans and implemented during site development.

Also included in this report are:

- Discussion of the site geotechnical conditions;
- Recommendations for remedial and site grading, including unsuitable soil removals;
- Geotechnical site construction recommendations;
- Foundation design parameters.

If you have any questions or should you require any additional information, please contact the undersigned at (951) 509-7090. Alta appreciates the opportunity to provide geotechnical consulting services for your project.

Sincerely,
Alta California Geotechnical, Inc.

FERNANDO RUIZ
Civil Engineering Associate

JAMES B. COYNE
Engineering Geology Associate

Reviewed By:

SCOTT A. GRAY/RGE 2857
Reg. Exp.: 12-31-20
Registered Geotechnical Engineer
Vice President

REGISTERED PROFESSIONAL ENGINEER
SCOTT A. GRAY
No. 2857
Exp. 12-31-20
GEOTECHNICAL
STATE OF CALIFORNIA

THOMAS J. MCCARTHY/CEG 2080
Reg. Exp.: 9-30-20
Certified Engineering Geologist
Vice President

CERTIFIED ENGINEERING GEOLOGIST
THOMAS J. McCARTHY
No. CEG 2080
Exp. 9-30-20
STATE OF CALIFORNIA

Distribution: (1) Addressee

SAG:-1-0312, February 24th, 2020 (Geo Investigation, 5261 Arlington Avenue, Riverside)

1.0 INTRODUCTION ..... 4
1.1 Purpose ..... 4
1.2 Scope of Work ..... 4
1.3 Report Limitations ..... 5
2.0 PROJECT DESCRIPTION ..... 5
2.1 Site Location and Existing Conditions ..... 5
2.2 Proposed Development ..... 5
3.0 SITE INVESTIGATION ..... 6
3.1 Investigation and Laboratory Testing ..... 6
3.2 Infiltration Testing ..... 6
4.0 GEOLOGIC CONDITIONS ..... 7
4.1 Geologic and Geomorphic Setting ..... 7
4.2 Stratigraphy ..... 7
4.2.1 Artificial Fill - Undocumented (map symbol afu) ..... 7
4.2.2 Young Alluvial Fan Deposits (map symbol Qyf) ..... 7
4.2.3 Old Alluvial Fan Deposits (map symbol Qof) ..... 8
4.3 Geologic Structure ..... 8
4.3.1 Tectonic Framework ..... 8
4.3.2 Regionally Mapped Active Faults ..... 9
4.3.3 Geologic Structure ..... 9
4.4 Groundwater ..... 9
4.5 Earthquake Hazards ..... 9
4.5.1 Local and Regional Faulting ..... 10
4.5.2 Surface Rupture ..... 10
4.5.3 Seismicity ..... 10
4.5.4 Liquefaction ..... 10
4.5.5 Dry Sand Settlement ..... 12
5.0 ENGINEERING PROPERTIES AND ANALYSIS ..... 13
5.1 Materials Properties ..... 13
5.1.1 Excavation Characteristics ..... 13
5.1.2 Compressibility ..... 13
5.1.3 Hydro-Consolidation ..... 13
5.1.4 Expansion Potential ..... 14
5.1.5 Earthwork Adjustments ..... 14
5.1.6 Chemical Analyses ..... 14
5.2 Engineering Analysis ..... 15
5.2.1 Bearing Capacity and Lateral Earth Pressures ..... 15
6.0 CONCLUSIONS AND RECOMMENDATIONS ..... 15
6.1 General Earthwork Recommendations ..... 15

6.1.1 Site Preparation ....15
6.1.2 Unsuitable Soil Removals ....16
6.1.3 Over-excavation of Building Pads ....17
6.1.4 Compaction Standards ....18
6.1.5 Groundwater/Seepage ....18
6.1.6 Documentation of Removals ....18
6.1.7 Treatment of Removal Bottoms ....18
6.1.8 Fill Placement ....19
6.1.9 Mixing ....19
6.1.10 Import Soils ....19
6.1.11 Utility Trenches ....19
6.1.12 Backcut Stability ....20
6.2 Storm Water Infiltration Systems ....21
6.3 Boundary Conditions ....22
7.0 DESIGN CONSIDERATIONS ....22
7.1 Structural Design ....22
7.1.1 Foundations ....23
7.1.2 Conventional Slab/Foundation Systems ....24
7.1.3 Post-Tensioned Slabs/Foundation Design Recommendations ....25
7.2 Moisture Barrier ....26
7.3 Seismic Design ....27
7.4 Pool Design Recommendations ....28
7.5 Fence and Garden Walls ....29
7.6 Footing Excavations ....30
7.7 Retaining Walls ....30
7.8 Exterior Slabs and Walkways ....31
7.8.1 Subgrade Compaction ....32
7.8.2 Subgrade Moisture ....32
7.8.3 Concrete Slab Thickness ....32
7.8.4 Concrete Slab Reinforcement ....32
7.8.5 Control Joints ....32
7.9 Concrete Design ....33
7.10 Corrosion ....33
7.11 Pavement Design ....33
7.12 Site Drainage ....34
8.0 LOT MAINTENANCE ....34
8.1 Lot Drainage ....35
8.2 Burrowing Animals ....35
9.0 FUTURE PLAN REVIEWS ....35
10.0 CLOSURE ....36

10.1 Geotechnical Review ..... 36
10.2 Limitations ..... 36

APPENDIX A: REFERENCES
APPENDIX B: SUBSURFACE INVESTIGATION
APPENDIX C: LABORATORY TESTING
APPENDIX D: LIQUEFACTION ANALYSIS
APPENDIX E: MAINTENANCE CONSIDERATIONS
APPENDIX F: EARTHWORK SPECIFICATIONS
APPENDIX G: GRADING DETAILS

## 1.0 INTRODUCTION

The following report presents Alta's findings, conclusions, and geotechnical recommendations for the proposed residential and retail development located at 5261 Arlington Avenue, in the City of Riverside, California.

### 1.1 Purpose

The purpose of this report is to examine the existing onsite geotechnical conditions and assess the impacts that the geotechnical conditions may have on the proposed development. The property is depicted on the enclosed Site Plan (Plate 1). This report is suitable for use in developing grading plans and engineer's cost estimates.

### 1.2 Scope of Work

Alta's *Scope of Work* for this geotechnical investigation included the following:

- Reviewing the referenced reports and air photos (Appendix A);
- Site geologic mapping;
- Excavating, logging, and sampling twelve (12) hollow-stem auger borings to a maximum depth of 51.5-feet below the existing surface (Appendix B);
- Conducting laboratory testing on samples obtained during our investigation (Appendix C);
- Performing an infiltration study to provide an assessment of the infiltration characteristics of the onsite soil and their impact on storm water disposal;
- Evaluating engineering geologic and geotechnical engineering data, including laboratory data, to develop recommendations for site remedial grading including specialized grading techniques for unsuitable soil removals along the property boundary, import soil, foundations and utilities;
- Preparing this report and accompanying exhibits.

### 1.3 Report Limitations

The conclusions and recommendations presented in this report are based on the field and laboratory information generated during this investigation, and a review of the referenced reports. The information contained in this report is intended to be used for development of grading plans and preliminary construction cost estimates.

## 2.0 PROJECT DESCRIPTION

### 2.1 Site Location and Existing Conditions

The irregular-shaped site is located on the northeast corner of Arlington Avenue and Streeter Avenue in Riverside at an elevation of approximately 775 feet above sea level. There is a former Sears structure and associated parking lot onsite. The site is bounded to the south by Arlington Avenue, to the west by Streeter Avenue, and to the east and north by residential developments.

Review of vintage air photos (Historic Aerials, 2020) indicates that the current development was constructed after 1948 but before 1966. In 1948, a few small structures were present near the western boundary with the site mainly used for agriculture. By 1966, the current development was completed, and the site has remained largely unchanged.

### 2.2 Proposed Development

Based on our review of the Site Plan, the existing structures and parking lot will be demolished, and 18 multi-story residential structures, 2 retail structures, one pool/pool house and associated improvements will be developed. Alta anticipates that remedial grading will be required to develop the site to support the proposed structures with shallow foundations and reinforced concrete slabs-on-grade. Significant height slopes are not anticipated for the project.

## 3.0 SITE INVESTIGATION

### 3.1 Investigation and Laboratory Testing

Alta conducted a subsurface investigation on January 28 and 29, 2020, consisting of the excavation, logging and select sampling of twelve (12) hollow-stem auger borings. The locations of the borings are shown on enclosed Plate 1 and the boring logs are presented in Appendix B.

Laboratory testing was performed on bulk and ring samples obtained during the field investigation. A brief description of the laboratory test procedures and the test results are presented in Appendix C.

### 3.2 Infiltration Testing

It is Alta's understanding that the project may utilize infiltration systems for storm water disposal. Details of the system are not known at this time.

Infiltration testing was undertaken using three (3) borings, P-1 and P-2 which were five (5) feet in depth and P-3 which was ten (10) feet in depth. The testing was performed on January 30, 2020 in general accordance with the County of Riverside WQMP standards. The three test wells were presoaked, and water level readings were recorded every 30 minutes. During the test, the borings were filled with water and measured every 30 minutes until the readings stabilized.

The data was then adjusted to provide an infiltration rate utilizing the Porchet Method. The resulting infiltration rates for P-1, P-2 and P-3 are presented in Table 3-1. The results do not include a factor of safety. Recommendations for infiltration BMP design are presented in Section 6.2.

| Table 3-1-Summary of Infiltration Testing (No Factor of Safety) | | | |
|---|---|---|---|
| Test Designation | P-1 | P-2 | P-3 |
| Approximate Depth of Test | 5 ft | 5 ft | 10 ft |
| Time Interval | 30 minutes | 30 minutes | 30 minutes |
| Radius of Test Hole | 4 inches | 4 inches | 4 inches |
| Tested Infiltration Rate | 0.0 (in/hr) | 0.1 (in/hr) | 0.1 (in/hr) |

## 4.0 GEOLOGIC CONDITIONS

### 4.1 Geologic and Geomorphic Setting

Regionally, the site is located in the Peninsular Ranges geomorphic province, which characterizes the southwest portion of southern California. The Peninsular Ranges province is composed of plutonic and metamorphic rock, lesser amounts of Tertiary volcanic and sedimentary rock, and Quaternary drainage in-fills and sedimentary veneers.

### 4.2 Stratigraphy

Based on our literature review and subsurface investigation, the site is underlain by undocumented artificial fill, and young and old alluvial fan deposits. These geologic units are briefly described below.

#### 4.2.1 Artificial Fill - Undocumented (map symbol afu)

The undocumented artificial fill observed at the site consists mainly of brown silt, clayey silt, and sandy silt in a dry to slightly moist, moderately firm to very stiff condition. The unit was logged to a depth of 2 to 6.5 feet below the ground surface and is underlain by young and old alluvial fan deposits.

#### 4.2.2 Young Alluvial Fan Deposits (map symbol Qyf)

The young alluvial deposits observed at the site consist mainly of light brown, brown, and tannish brown silty clay, clayey silt, sandy silt, and

sand, in a dry to slightly moist, firm to very stiff/dense condition. The unit was logged to a depth of 20 feet below the ground surface and is underlain by old alluvial fan deposits.

#### 4.2.3 Old Alluvial Fan Deposits (map symbol Qof)

The old alluvial deposits observed at the site consist mainly of gray, tan, light brown, and brown clayey sand, silty sandy, sand, and gravelly sand, in a dry to wet, medium dense to very dense condition. The unit was logged to a depth of 51.5 feet below the ground surface.

### 4.3 Geologic Structure

#### 4.3.1 Tectonic Framework

Jennings and Bryant (2010, 1985) defined eight structural provinces within California that have been classified by predominant regional fault trends and similar fold structure. These provinces are in turn divided into blocks and sub-blocks that are defined by "major Quaternary faults." These blocks and sub-blocks exhibit similar structural features. Within this framework, the subject site is located within Structural Province I, which is controlled by the dominant northwest trend of the San Andreas Fault and is divided into two blocks, the Coast Range Block and the Peninsular Range Block. The Peninsular Range Block, on which this site is located, is characterized by a series of parallel, northwest trending faults that exhibit right lateral dip-slip movement. These faults are terminated by the Transverse Range block to the north and extend southward into the Baja Peninsula. These northwest trending faults divide the Peninsular Range block into eight sub-blocks. The site is located on the Riverside sub-block, one of the eight sub-blocks, and it is bounded on the west by the Elsinore fault zone and on the east by the San Jacinto fault zone.

#### 4.3.2 Regionally Mapped Active Faults

Several large, active fault systems, including the Whittier-Elsinore, the San Jacinto, and the San Andreas occur in the region surrounding the site. These fault systems have been studied extensively and in a large part control the geologic structure of southern California.

#### 4.3.3 Geologic Structure

Based upon our site investigation and literature review, the sediments are of Quaternary, and are not folded, or faulted.

### 4.4 Groundwater

Groundwater was encountered during our investigation in Borings B-2, B-4, B-7, and B-8 at a depth between 41 to 43 feet below the ground surface, corresponding to an elevation between 732 to 735 feet above sea level. Several nearby groundwater wells exist within a 2-mile radius of the site. Recent groundwater data recorded from state well numbers 02S05W32B001S, 03S05W03F001S, 03S05W08E002S, 03S05W06Q003S, and 03S05W09E001S in October of 2019 indicates that groundwater ranges from 730 to 756 feet above sea level in the area (CDWR, 2020), roughly corresponding to the elevations observed onsite.

### 4.5 Earthquake Hazards

The subject site is located in southern California, which is a tectonically active area. The type and magnitude of seismic hazards affecting a site are dependent on the distance to the causative fault and the intensity and magnitude of the seismic event. The seismic hazard may be primary, such as surface rupture and/or ground shaking, or secondary, such as liquefaction and/or ground lurching.

### 4.5.1 Local and Regional Faulting

The site is located on the northern portion of the Riverside sub-block, approximately 10.9 miles west of the San Jacinto Fault zone, 11.9 miles east of the Whittier-Elsinore Fault zone, and 17.5 miles west of the San Andreas Fault Zone.

### 4.5.2 Surface Rupture

Active faults are not known to exist within the project and a review of Special Publication 42 indicates the site is not within a California State designated earthquake fault zone. Accordingly, the potential for fault surface rupture on the subject site is very low.

### 4.5.3 Seismicity

Ground shaking hazards caused by earthquakes along other active regional faults do exist. The 2019 California Building Code requires use-modified spectral accelerations and velocities for most structural designs. Seismic design parameters using soil profile types identified in the 2019 California Building Code are presented in Section 7.3.

### 4.5.4 Liquefaction

Seismic agitation of relatively loose saturated sands, silty sands, and some silts can result in a buildup of pore pressure. If the pore pressure exceeds the overburden stresses, a temporary quick condition known as liquefaction can occur. Liquefaction effects can manifest in several ways including: 1) loss of bearing; 2) lateral spread; 3) dynamic settlement; and 4) flow failure. Lateral spreading has typically been the most damaging mode of failure.

In general, the more recent that a sediment has been deposited, the more likely it will be susceptible to liquefaction. Other factors that must

be considered are: groundwater, confining stresses, relative density, and the intensity and duration of seismically-induced ground shaking.

Groundwater was encountered during our subsurface investigation at a depth approximately 41 to 43 feet below the ground surface. The regional groundwater data indicates that high groundwater levels average 40 below the ground surface (CDWR, 2020). The site is located in a low (old alluvial fan deposits) to high (young alluvial fan deposits) potential liquefaction zones and potential subsidence zones designated by Riverside County per the Riverside County Mapping Portal (RCMP, 2020).

Alta performed a liquefaction analysis utilizing data from the hollow-stem auger borings and laboratory test results. A description of Alta's analysis and calculations are presented in Appendix D of this report. A groundwater level of 40 feet below existing ground surface was assumed in the calculations. The results of our findings are discussed below under the headings of the specific types of liquefaction which can be manifested during seismic shaking. Our liquefaction calculations are presented in Appendix D.

- **Loss of Bearing:**
  Liquefaction can potentially cause foundation bearing failure due to ground softening and near-failure in bearing. Based on the depth to groundwater, the potential for loss of bearing is considered nil.
- **Lateral Spreading:**
  The lateral displacement of surficial blocks of sediment can occur as a result of liquefaction in a subsurface layer. The most pervasive forms of lateral spreading typically involve sites located near a "free-face" (large slopes, channels, etc.), however, it has

been noted that lateral spreading can occur on sites with gently sloping (1% or more) ground, such as the subject site.

Determination of the potential for lateral spread is based on the presence of continuous potentially liquefiable soil layers underneath the structures, the presence of lateral confinement, and various analyses such as empirical modeling. Bartlett, Hansen and Youd (2002) states that surface manifestation of lateral spread is typically limited to sites with liquefiable soils within 10 meters (32 feet) of grade, and that sites underlain by soils with $(N1)_{60}$ values 15 and greater do not experience significant displacements from earthquakes with magnitudes less than 8.

Based on the depth to groundwater and the density of the deposits onsite, the potential for lateral spread is considered nil.

- **Settlement:**

  Settlement due to seismic shaking can occur as a result of both liquefaction of saturated sediments or rearrangement of dry sand particles. Our liquefaction analysis was performed utilizing SPT from the hollow-stem auger borings and laboratory test results to analyze the potential amount of settlement. A description of Alta's analysis and calculations are presented in Appendix D of this report. In summary, the analysis showed that the amount of dynamic settlement due to liquefaction is low. Design dynamic settlement parameters are presented in Table 7-1.

- **Flow Failure:**

  Due to the relatively flat nature of the site, and the relatively horizontal deposition of the underlying deposits, the potential for flow failure onsite is considered nil.

### 4.5.5 Dry Sand Settlement

Dry sand settlement is the process of non-uniform settlement of the ground surface during a seismic event. Based on our subsurface investigation and our removal/recompaction recommendations, the potential for dry sand settlement is anticipated to be low and within foundation design tolerances. Design dynamic settlement parameters are presented in Table 7-1.

# 5.0 ENGINEERING PROPERTIES AND ANALYSIS

## 5.1 Materials Properties

Presented herein is a general discussion of the engineering properties of the onsite materials that will be encountered during construction of the proposed project. Descriptions of the soil (Unified Soil Classification System) are presented on the boring logs in Appendix B.

### 5.1.1 Excavation Characteristics

Based on the data provided from the subsurface investigations, it is our opinion that the majority of the onsite materials possess favorable excavation characteristics such that conventional earth moving equipment can be utilized.

### 5.1.2 Compressibility

The artificial fill and upper portions of the young alluvial fan deposits and old alluvial fan deposits onsite are considered compressible and unsuitable to support the proposed improvements. Recommended removal depths are presented in Section 6.1.2.

### 5.1.3 Hydro-Consolidation

Hydro-consolidation is the effect of introducing water into soil that is prone to collapse. Upon loading and initial wetting, the soil structure and apparent strength are altered resulting in almost immediate settlement. That settlement can have adverse impacts on engineered structures, particularly in areas where it is manifested differentially. Differential settlements are typically associated with differential wetting, irregularities in the subsurface soil conditions, or irregular loading patterns.

Based on our laboratory testing (Appendix C), the potential for hydro-collapse onsite is minimal and should be within foundation tolerances upon the completion of the recommended unsuitable soil removals.

### 5.1.4 Expansion Potential

Expansion index testing was performed on samples taken during our subsurface investigation. Based on the results, it is anticipated that the majority of materials onsite are "low" to "medium" in expansion potential (21≤EI≤90, Appendix C) when tested per ASTM D: 4829.

### 5.1.5 Earthwork Adjustments

The values presented in Table 5-1 are deemed appropriate for estimating purposes and may be used in an effort to balance earthwork quantities. As is the case with every project, contingencies should be made to adjust the earthwork balance when grading is in-progress and actual conditions are better defined.

**TABLE 5-1**
**Earthwork Adjustment Factors**

| Geologic Unit | Adjustment Factor Range | Average |
|---|---|---|
| Artificial Fill-undocumented | Shrink 10% to 14% | 12% |
| Young and old alluvial fan deposits | Shrink 6% to 10% | 8% |

### 5.1.6 Chemical Analyses

Chemical testing was performed on samples of material underlying the proposed site. Soluble sulfate test results indicate that the soluble sulfate concentrations of the soils tested are classified as negligible (Category S0) per ACI 318-14.

Negligible chloride levels were detected in the onsite soils. Resistivity testing conducted as part of this investigation, indicates that the soils are corrosive to buried metals (per Romanoff, 1989). Additional discussions

on corrosion are presented in Section 7.9. Corrosion tests results are presented in Appendix C.

### 5.2 Engineering Analysis

Presented below is a general discussion of the engineering analysis methods that were utilized to develop the conclusions and recommendations presented in this report.

#### 5.2.1 Bearing Capacity and Lateral Earth Pressures

Ultimate bearing capacity values were obtained using the graphs and formula presented in NAVFAC DM-7.1. Allowable bearing was determined by applying a factor of safety of at least 3 to the ultimate bearing capacity. Static lateral earth pressures were calculated using Rankine methods for active and passive cases. If it is desired to use Coulomb forces, a separate analysis specific to the application can be conducted.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on Alta's findings during our subsurface investigation, the laboratory test results, our staff's previous experience in the area, it is Alta's opinion that the development of the site is feasible from a geotechnical perspective. Presented below are recommendations that should be incorporated into site development and construction plans.

### 6.1 General Earthwork Recommendations

All grading shall be accomplished under the observation and testing of the project geotechnical consultant in accordance with the recommendations contained herein and the City of Riverside criteria.

#### 6.1.1 Site Preparation

Vegetation, construction debris, and other deleterious materials are unsuitable as structural fill material and should be disposed of off-site

prior to commencing grading/construction. Any septic tanks, seepage pits or wells should be abandoned as per the County of Riverside Department of Health Services.

Existing concrete should be removed prior to the placement of engineered fill. The demolished concrete may be incorporated into compacted, engineered fills after it is crushed to a maximum size of six (6) inches. Prior to placement as engineered fill any protruding steel rebar should be cut from the concrete pieces and disposed of offsite.

Existing asphaltic concrete should be removed prior to the placement of engineered fill. From a geotechnical perspective, this material may be incorporated into compacted, engineered fills after it is crushed to a maximum size of six (6) inches. The crushed asphalt should not be placed under residential structures, but rather, it can be placed in approved non-residential areas, such as streets, parking areas or open space.

These recommendations should be verified by the environmental consultant.

### 6.1.2 Unsuitable Soil Removals

The undocumented artificial fill and the uppermost portions of the young and old alluvial fan deposits onsite are compressible and as such, are not suitable to support the proposed structures. Accordingly, it is recommended to completely remove the undocumented artificial fills and the highly weathered portions of the underlying young and old alluvial deposits across the site and as close to the property boundaries as possible.

It is anticipated that the upper five (5) to seven (7) feet of existing soils will require removal and recompaction, extending a minimum of five (5)

feet horizontally outside the proposed building envelopes. Removal bottoms should be observed by the Project Geotechnical Consultant to make a final determination that suitable (non-weathered, limited porosity) soils have been exposed. Removal bottoms should be tested to determine that the exposed soils have a minimum relative compaction of 85% of the laboratory maximum density (per ASTM test method D-1557). Both observations and tests must be accomplished to determine that suitable bottoms have been exposed. This recommended removal combined with the foundation recommendations presented in Section 7.1 should provide suitable support for the proposed structures.

For fill areas in streets, in general, a minimum removal and recompaction of two (2) feet is recommended, however all undocumented artificial fill shall be removed and recompacted, which may require deeper removals (see boring logs in Appendix B). For cuts deeper than the two (2) feet in street areas, removals are not required provided all the undocumented artificial fill is removed. Cuts less than the thickness of the undocumented fill should extend down to the fan deposits.

The Project Geotechnical Consultant should observe the removal bottom prior to placing fill. If unsuitable soils such as undocumented artificial fill are exposed upon the completion of the removals recommended above, additional removals may be required. Material removed as part of the unsuitable soil removals can be used as artificial fill, provided it is free of deleterious materials.

### 6.1.3 Over-excavation of Building Pads

Footings for structures should be underlain by a minimum of two (2) feet of compacted fill. As such, for building pads where unsuitable soil

removals do not provide the minimum depth of compacted fill, or where design grades and/or remedial grading activities create cut/fill transitions, the cut and shallow fill portions of the building pads should be over-excavated during grading and replaced with compacted fill.

#### 6.1.4 Compaction Standards

All fill and processed natural ground shall be compacted to a minimum relative compaction of 90 percent, as determined by ASTM Test Method: D-1557. Fill material should be moisture conditioned to optimum moisture or above, and as generally discussed in Alta's Earthwork Specification Section presented in Appendix F. Compaction shall be achieved with the use of sheepsfoot rollers or similar kneading type equipment. Mixing and moisture conditioning will be required in order to achieve the recommended moisture conditions.

#### 6.1.5 Groundwater/Seepage

It is anticipated that groundwater will not be encountered during construction. It is possible that perched water conditions could be encountered depending on the time of year construction occurs.

#### 6.1.6 Documentation of Removals

All removal/over-excavation bottoms should be observed and approved by the project Geotechnical Consultant prior to fill placement. Consideration should be given to surveying the removal bottoms and undercuts after approval by the geotechnical consultant and prior to the placement of fill. Staking should be provided in order to verify undercut locations and depths.

#### 6.1.7 Treatment of Removal Bottoms

At the completion of removals/over-excavation, the exposed removal bottom should be ripped to a minimum depth of eight (8) inches,

moisture-conditioned to above optimum moisture content and compacted in-place to the project standards.

**6.1.8 Fill Placement**

After removals, scarification, and compaction of in-place materials are completed, additional fill may be placed. Fill should be placed in eight-inch bulk maximum lifts, moisture conditioned to optimum moisture content or above, compacted and tested as grading/construction progresses until final grades are attained.

**6.1.9 Mixing**

Mixing of materials may be necessary to prevent layering of different soil types and/or different moisture contents. The mixing should be accomplished prior to and as part of compaction of each fill lift.

**6.1.10 Import Soils**

Import soils, if necessary, should consist of clean, structural quality, compactable materials similar to the on-site soils and should be free of trash, debris, or other objectionable materials. The project Geotechnical Consultant should be notified not less than 72 hours in advance of the locations of any soils proposed for import. Import sources should be sampled, tested, and approved by the project Geotechnical Consultant at the source prior to the importation of the soils to the site. The project Civil Engineer should include these requirements on plans and specifications for the project.

**6.1.11 Utility Trenches**

**6.1.11.1 Excavation**

Utility trenches should be supported, either by laying back excavations or shoring, in accordance with applicable OSHA standards. In general, existing site soils are classified as Soil

Types "B" per OSHA standards. Upon completion of the recommended removals and recompaction, the artificial fill will be classified as Soil Type "B". The Project Geotechnical Consulting should be consulted if geologic conditions vary from what is presented in this report.

**6.1.11.2 Backfill**

Trench backfill should be compacted to at least 90 percent of maximum dry density as determined by ASTM D-1557. Onsite soils will not be suitable for use as bedding material but will be suitable for use in backfill provided oversized materials are removed. No surcharge loads should be imposed above excavations. This includes spoil piles, lumber, concrete trucks, or other construction materials and equipment. Drainage above excavations should be directed away from the banks. Care should be taken to avoid saturation of the soils. Compaction should be accomplished by mechanical means. Jetting of native soils will not be acceptable.

**6.1.12 Backcut Stability**

Temporary backcuts, if required during unsuitable soil removals, should be made no steeper than 1:1 without review and approval of the geotechnical consultant. Flatter backcuts may be necessary where geologic conditions dictate and where minimum width dimensions are to be maintained.

Care should be taken during remedial grading operations in order to minimize risk of failure. Should failure occur, complete removal of the disturbed material will be required.

In consideration of the inherent instability created by temporary construction backcuts for removals, it is imperative that grading schedules are coordinated to minimize the unsupported exposure time of these excavations. Once started, these excavations and subsequent fill operations should be maintained to completion without intervening delays imposed by avoidable circumstances. In cases where five-day workweeks comprise a normal schedule, grading should be planned to avoid exposing at-grade or near-grade excavations through a non-work weekend. Where improvements may be affected by temporary instability, either on or offsite, further restrictions such as slot cutting, extending workdays, implementing weekend schedules, and/or other requirements considered critical to serving specific circumstances may be imposed.

## 6.2 Storm Water Infiltration Systems

Municipalities have been increasing the requirement for onsite storm water infiltration, rather than allowing water to enter storm drain systems. From a geotechnical perspective, allowing storm water to infiltrate the onsite soil in concentrated areas increases the potential for settlement, liquefaction, and water-related damage to structures/improvements, such as wet slabs or pumping subgrade, and should be avoided where possible. If infiltration systems are required on this site, care should be taken in designing systems that control the storm water as much as possible.

Preliminary infiltration testing was conducted at the site as part of this investigation, and the methodology is discussed in 3.2. The resulting infiltration rates for P-1, P-2 and P-3 were calculated to be 0.0-inches per hour, 0.1-inches per hour and 0.1-inches per hour, respectively. The results do not include a factor

of safety. Groundwater was encountered during our investigation ranging between 41 to 43 feet below the ground surface.

The Project Geotechnical Consultant should review the final WQMP design prior to construction.

### 6.3 Boundary Conditions

The site is bounded to the south by Arlington Avenue, to the west by Streeter Avenue, and to the east and north by residential developments. Construction of retaining/screen walls along these boundaries may require additional geotechnical recommendations concerning unsuitable soil removals and foundation design parameters. Boundary conditions for the project should be reviewed by the Project Geotechnical Consultant as the design progresses.

## 7.0 DESIGN CONSIDERATIONS

### 7.1 Structural Design

It is anticipated that multi-story wood-framed residential and retail structures with slab on-grade and shallow foundations will be constructed. Upon the completion of rough grading, finish grade samples should be collected and tested in order to provide specific recommendations as they relate to the individual building pad. These test results and corresponding design recommendations should be presented in a final rough grading report. Final slab and foundation design recommendations should be made based upon specific structure sitings, loading conditions, and as-graded soil conditions.

It is anticipated that the majority of onsite soils will possess "low" to "medium" expansion potential when tested in general accordance with ASTM Test Method D: 4829. For budgeting purposes, the following foundation design requirements for a range of potential expansion characteristics are presented.

### 7.1.1 Foundations

Foundations may be preliminary designed based on the values presented in Table 7-1 below.

| Table 7-1<br>Foundation Design Parameters* | |
|---|---|
| Allowable Bearing | 2000 lbs/ft$^2$(assuming a minimum width and embedment of 12-inches). |
| Lateral Bearing | 250 lbs/ft$^2$ at a depth of 12 inches plus 250 lbs/ft$^2$ for each additional 12 inches of embedment to a maximum of 2000 lbs/ft$^2$ |
| Sliding Coefficient | 0.30 |
| Differential Settlement | Dynamic:<br>Differential = 1 inches in 40 feet<br>Static:<br>Differential = 0.5 inches in 40 feet |

*These values may be increased as allowed by Code to resist transient loads such as wind or seismic. Building code and structural design considerations may govern depth and reinforcement requirements and should be evaluated.

### 7.1.2 Conventional Slab/Foundation Systems

Based on the onsite soils conditions and information supplied by the 2019 CBC, conventional slab/foundation systems may be designed in accordance with Tables 7-1 and 7-2.

| TABLE 7-2<br>CONVENTIONAL FOUNDATION DESIGN PARAMETERS | | |
|---|---|---|
| **Expansion Potential** | ***Low*** | ***Medium*** |
| **Soil Category** | I | II |
| **Design Plasticity Index** | 12 | 20 (Expansive per 2019 CBC) |
| **Minimum Footing Embedment** | 12 inches* | 18 inches* |
| *The minimum footing embedments presented herein are based on expansion indexes. The structural engineer should determine minimum embedments based on the number of floors supported by the footings, the structural loading, and the requirements of the latest California Building Code. | | |
| **Minimum Footing Width** | 12-inches-The structural engineer should determine the minimum footing width based on loading and the latest California Building Code. | |
| **Minimum Footing Reinforcement** | No. 4 rebar, two (2) on top, two (2) on bottom | |
| **Minimum Slab Thickness** | 4 inches (actual) | |
| **Minimum Slab Reinforcement** | No. 3 rebar spaced 18 inches on center, each way | No. 3 rebar spaced 15 inches on center, each way |
| **Under-Slab Requirement** | See Section 7.2 | |
| **Slab Subgrade Moisture** | Minimum of 110 percent of optimum moisture to a depth of 12 inches prior to placing concrete. | Minimum of 120 percent of optimum moisture to a depth of 12 inches prior to placing concrete. |
| **Footing Embedment Adjacent to Swales and Slopes** | If exterior footings adjacent to drainage swales are to exist within five (5) feet horizontally of the swale, the footing should be embedded sufficiently to assure embedment below the swale bottom is maintained. Footings adjacent to slopes should be embedded such that at least five- (5) feet is provided horizontally from edge of the footing to the face of the slope. | |

### 7.1.3 Post-Tensioned Slabs/Foundation Design Recommendations

Post-tensioned slabs for the project may be preliminarily designed utilizing the parameters presented in Tables 7-1 and 7-3. The parameters presented herein are based on methodology provided in the Design of Post-Tensioned Slabs-On-Ground, Third Edition, by the Post-Tensioning Institute, in accordance with the 2019 CBC.

**TABLE 7-3**
**POST-TENSION SLAB DESIGN PARAMETERS**

| Category | Expansion Potential | Minimum Embedment | Edge Lift | | Center Lift | |
|---|---|---|---|---|---|---|
| | | | Em (ft) | Ym (inch) | Em (ft) | Ym (inch) |
| I | Low | 12 inches* | 5.4 | 0.61 | 9.0 | 0.26 |
| II | Medium | 18 inches* | 5.5 | 1.10 | 9.0 | 0.46 |

**Slab Subgrade Moisture**

| | |
|---|---|
| Category I | Minimum 110% of optimum moisture to a depth of 12 inches prior to pouring concrete |
| Category II | Minimum 120% of optimum moisture to a depth of 12 inches prior to pouring concrete |

**Embedment***

The minimum footing embedments presented herein are based on expansion indexes. The structural engineer should determine minimum embedments based on the number of floors supported by the footings, the structural loading, and the requirements of the latest California Building Code. If mat slabs are utilized, alternate embedment depths can be provided.

**Moisture Barrier**

A moisture barrier should be provided in accordance with the recommendations presented in Section 7.2

*The parameters presented herein are based on procedures presented in the Design of Post-Tensioned Slabs-On-Ground, Third Edition. No corrections for vertical barriers at the edge of the slab, or for adjacent vegetation have been assumed. The design parameters are based on a Constant Suction Value of 3.9 pF.*

## 7.2 Moisture Barrier

A moisture and vapor retarding system should be placed below the slabs-on-grade in portions of the structure considered to be moisture sensitive and should be capable of effectively preventing the migration of water and reducing the transmission of water vapor to acceptable levels. Historically, a 10-mil plastic membrane, such as Visqueen, placed between two to four inches of clean sand, has been used for this purpose. The use of this system or other systems can be considered, at the discretion of the designer, provided the system reduces the vapor transmission rates to acceptable levels.

## 7.3 Seismic Design

In accordance with the requirements in Section 11.4.8 of ASCE 7-16 for sites with Site Class D and S1 values greater than 0.2, Alta has performed a site-specific ground motion analysis for the subject project. The analysis was performed in accordance with Chapter 21 of ASCE 7-16, the 2019 CBC, and the 2014 USGS Ground Acceleration Maps. The USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/index.php) and the USGS National Seismic Hazard Map source model was utilized to perform the analysis.

The site class was determined based on the subsurface investigation and published geologic maps in the area in general conformance with Chapter 20 of ASCE 7-16. Based on density of the underlying soil, a Site Class of D was selected (shear wave velocity of 259 m/s).

Probabilistic (MCER) ground motions were determined in accordance with Method 1 of Section 21.2.1 of ACE 7-16. At each spectral response period for which the acceleration was computed, ordinates of the probabilistic ground motion response spectrum were determined as the project of the risk coefficient, CR, and the spectral response acceleration from a 5% damped acceleration response spectrum that has a 2% probability of exceedance within a 50-year period. The site specific MCER was taken as the lesser of the probabilistic and deterministic ground motions.

The design response spectrum was determined per Section 21.3 of ASCE 7-16. Design acceleration parameters were determined per Section 21.4 of ASCE 7-16 and the results are presented in Table A. These parameters should be verified by the structural engineer. Additional parameters should be determined by the structural engineer based on the Occupancy Category of the proposed structures.

| TABLE 7-4 Seismic Ground Motion Values<br>2019 CBC and ASCE 7-16 | |
|---|---|
| *Parameter* | *Value* |
| Site Class | D |
| Site Latitude | 33.9476 |
| Site Longitude | -117.4170 |
| Spectral Response Acceleration Parameter, $S_S$ | 1.5 |
| Spectral Response Acceleration Parameter, $S_1$ | 0.574 |
| Site Coefficient, $F_a$ | 1 |
| Site Coefficient, $F_v$<br>(Per Table 11.4-2 of ASCE 7-16. Site Specific Parameters Govern) | 1.7 |
| *Site Specific Parameters Per Chapter 21 of ASCE 7-16* | |
| MCE Spectral Response Acceleration Parameter, $S_{MS}$ | 1.65 |
| MCE Spectral Response Acceleration Parameter, $S_{M1}$ | 1.28 |
| Design Spectral Response Acceleration Parameter, $S_{DS}$ | 1.1 |
| Design Spectral Response Acceleration Parameter, $S_{D1}$ | 0.85 |
| Peak Ground Acceleration, $PGA_M$ | 0.75 |

## 7.4 Pool Design Recommendations

It is anticipated that the proposed pool can be designed for medium expansive conditions. Steel reinforcement may be required within the pool shell and should be verified by the pool designer. The pressure from existing soils that will act of the pool walls that can be utilized in pool design is 45 psf/ft for the active condition.

Where pools are to be constructed in proximity to other structures or subjected to transient loads, the effects of those stresses should be considered in the pool

and/or spa design. The pool/spa should be provided with a pressure release valve system below the bottom.

Pool/spa decking shall have a minimum thickness of four (4) inches (actual). Consideration should be given to underlying the decking with at least six (6) inches of three-quarter- (3/4) inch crushed rock (or other non-expansive materials). Backfill for all conduits and any retaining walls shall be compacted to at least 90 percent of maximum density as determined by ASTM: D 1557.

Subgrade soils below the concrete decking shall be moisture-conditioned to a minimum of 120 percent of optimum moisture to a depth of twelve (12) inches prior to placing concrete. The subgrade soils should be shaped to provide a minimum gradient of one (1) percent away from the pool shell and toward a subsurface drainage system. The subsurface drainage system should be designed to collect subsurface water and discharge it into the area drain system.

The outside edges of the decking should be thickened to provide a perimeter beam that is eight- (8) inches wide and twelve- (12) inches deep. Slabs should be reinforced with a minimum of No. 3 bars at twenty-four (24) inches on center, each way, or an equivalent section of welded wire mesh. Final determination of reinforcement requirements is under the purview of the pool designer. The decking should be separated from the pool/spa coping. Expansion joints should be periodically maintained. Deep tool joints, extending at least one-third (1/3) of the thickness of the slab into the slab, should be provided at a maximum spacing of six (6) feet.

## 7.5 Fence and Garden Walls

Block walls, if used, should be embedded a minimum of 2 feet below the lowest adjacent grade. Construction joints (not more than 20 feet apart) should be

included in the block wall construction. Side yard walls should be structurally separated from the rear yard wall.

## 7.6 Footing Excavations

Soils from the footing excavations should not be placed in slab-on-grade areas unless properly compacted and tested. The excavations should be cleaned of all loose/sloughed materials and be neatly trimmed at the time of concrete placement. The Project Geotechnical Consultant should observe the footing excavations prior to the placement of concrete to determine that the excavations are founded in suitably compacted material.

## 7.7 Retaining Walls

Retaining walls should be founded on engineered fill and should be backfilled with granular soils that allow for drainage behind the wall. Foundations may be designed in accordance with the recommendations presented in Table 7-1, above. Unrestrained walls, free to horizontally move 0.0005H (for dense cohesionless backfill), may be designed to resist lateral pressures imposed by a fluid with a unit weight determined in accordance with the Table 7-5 below. The table also presents design parameters for restrained (at-rest) retaining walls. These parameters may be used to design retaining walls that may be considered as restrained due to the method of construction or location (corner sections of unrestrained retaining walls).

**TABLE 7-5**
**Equivalent Fluid Pressures for 90% Compacted Fill (Select Material)**

| Backfill | Active Pressure (psf/ft) | At-Rest Pressure (psf/ft) |
|---|---|---|
| Level | 35 | 55 |

Per the requirements of the 2019 CBC, the seismic force acting on the retaining walls with backfill exceeding 6-feet in height may be resolved utilizing the formula $16H^2$ lb/lineal ft (H=height of the wall). This force acts at approximately 0.6H

above the base of the wall. The seismic value can be converted as required by the retaining wall engineer. Retaining walls should be designed in general accordance with Section 1807A.2 of the 2019 CBC.

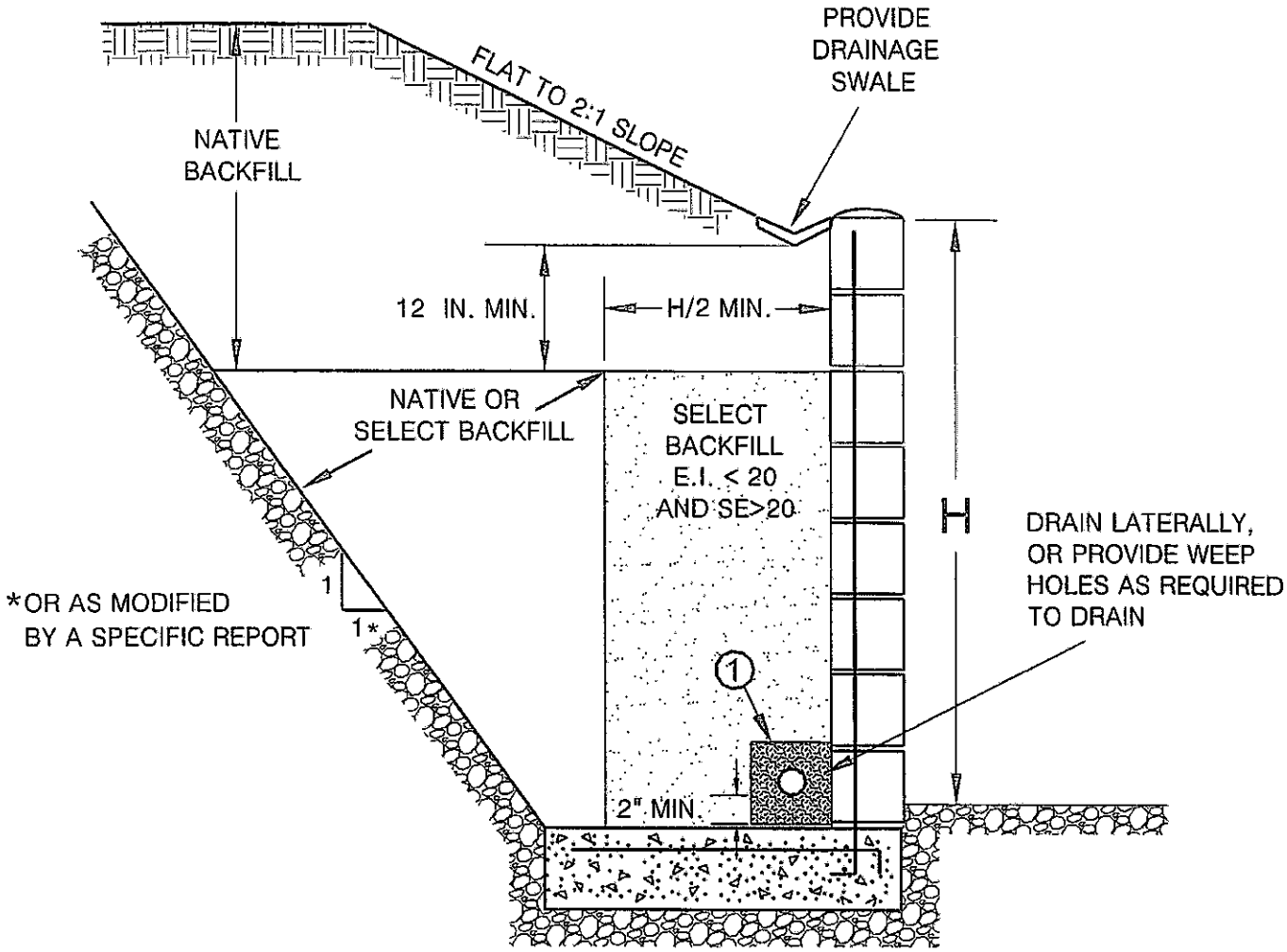
- Restrained retaining walls should be designed for "at-rest" conditions.
- The design loads presented in the above table are to be applied on the retaining wall in a horizontal fashion and as such friction between wall and retained soils should not be allowed in the retaining wall analyses.
- Additional allowances should be made in the retaining wall design to account for the influence of construction loads, temporary loads, and possible nearby structural footing loads.
- Select backfill should be granular, structural quality backfill with a Sand Equivalent of 20 or better and an ASCE Expansion Index of 20 or less. The backfill must encompass the full active wedge area. The upper one foot of backfill should be comprised of native on-site soils (see Plate A).
- The wall design should include waterproofing (where appropriate) and backdrains or weep holes for relieving possible hydrostatic pressures. The backdrain should be comprised of a 4-inch perforated PVC pipe in a 1 ft. by 1 ft., ¾-inch gravel matrix, wrapped with a geofabric. The backdrain should be installed with a minimum gradient of 2 percent and should be outletted to an appropriate location. For subterranean walls this may include drainage by sump pumps.
- No backfill should be placed against concrete until minimum design strengths are achieved.

It should be noted that the allowable bearing and lateral bearing values presented in Table 7-1 are based on level conditions at the toe. Modified design parameters can be presented for retaining walls with sloping condition at the toe. Other conditions should be evaluated on a case by case basis.

## 7.8 Exterior Slabs and Walkways

Exterior concrete slabs and walkways should be designed and constructed in consideration of the following recommendations.

# RETAINING WALL BACKFILL DETAIL




1

PIPE: 4-INCH PERFORATED PVC, SCHEDULE 40, SDR35 OR APPROVED ALTERNATE MINIMUM 8 PERFORATIONS (1/4-IN. DIA.) PER LINEAL FT. IN BOTTOM HALF OF PIPE

ROCK: MINIMUM VOLUME OF 1 CU. FT. OF 3/4-IN. MAX. ROCK PER. LINEAL FOOT OF PIPE, OR APPROVED ALTERNATE

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT

**ALTA CALIFORNIA GEOTECHNICAL, INC .**
VER. 1/10

PLATE A

PATH:S:\Drafting\ALTA GEOTECHNICAL\GRADING DETAILS\PLATE A.dwg

**7.8.1 Subgrade Compaction**

The subgrade below exterior concrete slabs should be compacted to a minimum of 90 percent relative compaction as determined by ASTM Test Method: D 1557.

**7.8.2 Subgrade Moisture**

The subgrade below concrete slabs should be moisture conditioned to a minimum of 110 percent of optimum moisture (low expansion) to 120 percent of optimum moisture (medium expansion) prior to concrete placement.

**7.8.3 Concrete Slab Thickness**

Concrete flatwork and driveways should be designed utilizing four-inch minimum thickness.

**7.8.4 Concrete Slab Reinforcement**

Utilization of reinforcement for flatwork and driveways is subject to a cost/benefit analysis. Reinforcement will decrease the amount of cracking that may occur in flatwork, however, planning for occasional repairs may be more cost effective. Utilizing closely spaced control joints is likely more cost-effective than utilizing reinforcement. The majority of the soils onsite are classified as low to medium in expansion potential. Consideration should be given to reinforcing flatwork with irregular (non-square/rectangular) shapes.

**7.8.5 Control Joints**

Weakened plane joints should be installed on walkways at intervals of approximately eight feet (maximum) or less. Exterior slabs should be designed to withstand shrinkage of the concrete.

## 7.9 Concrete Design

As stated in Section 5.1.6, negligible concentrations of sulfates were detected in the onsite soils (Class S0). Therefore, the use of sulfate resistant concrete is not required per ACI 318-14 at this time. Post-grading conditions should be evaluated and final recommendations made at that time.

## 7.10 Corrosion

Based on preliminary testing, the onsite soils are corrosive to buried metal objects. Buried ferrous metals should be protected against the effects of corrosive soils in accordance with the manufacturer's recommendations. Typical measures may include using non-corrosive backfill, protective coatings, wrapping, plastic pipes, or a combination of these methods. A corrosion engineer should be consulted if specific design recommendations are required by the improvement designer.

Per ACI 318-14, an exposure class of C1 would be applicable to metals encased in concrete (rebar in footings) due to being exposed to moisture from surrounding soils. Per Table 19.3.2.1 of ACI 318-14, the requirements for concrete with an exposure class of C1 are a minimum compressive strength of 2500 psi and a maximum water-soluble chloride ion content in concrete of 0.30 (percent by weight of cement).

## 7.11 Pavement Design

Pavement sections for the proposed streets shall be designed based on laboratory testing conducted on samples taken from the soil subgrade. Preliminarily, based on an assumed R-Value of 10, the pavement may be designed utilizing the sections presented in Table 7-6. These sections should be verified upon the completion of grading, based on R-Value testing. The ultimate pavement section design for public streets is under the City of Riverside's purview.

| Table 7-6<br>Preliminary Pavement Sections | | |
|---|---|---|
| Traffic Index | Pavement Section Options<br>OR | |
| 5.0 | 3-inch AC on 9-inch AB | 4-inch AC on 7-inch AB |
| 5.5 | 3-inch AC on 11-inch AB | 4-inch AC on 8.5-inch AB |
| 6.0 | 3.5-inch AC on 12-inch AB | 4-inch AC on 10.5-inch AB |
| AC-Asphalt Concrete<br>AB-Caltrans Class II Base | | |

Construction of the streets should be accomplished in accordance with the current criteria of the City of Riverside. Prior to the placement of base material, the subgrade should be suitably moisture conditioned, processed and compacted to a minimum 95 percent of the laboratory maximum density (ASTM: D 1557) to at least twelve (12) inches below subgrade. After subgrade compaction, the exposed grade should then be "proof"-rolled with heavy equipment to ensure the grade does not "pump" and is verified as non-yielding. Aggregate base material should be placed on the compacted subgrade and compacted in-place to a minimum 95 percent of the laboratory standard obtained per ASTM: D 1557.

### 7.12 Site Drainage

Positive drainage away from the proposed structures should be provided and maintained. Roof, pad, and lot drainage should be collected and directed away from the structures toward approved disposal areas through drainage terraces, gutters, down drains, and other devices. Design fine grade elevations should be maintained through the life of the structure or if design fine grade elevations are altered, adequate area drains should be installed in order to provide rapid discharge of water, away from structures.

## 8.0 LOT MAINTENANCE

Ongoing maintenance of the improvements is essential to the long-term performance of structures. As such, the owners must implement certain maintenance procedures. The attached " Maintenance and Improvement Considerations" presented in the Appendix D

may be included as part of the sales packet to educate the owners in issues related to drainage, maintenance, improvements, etc. The following recommendations should also be implemented.

### 8.1 Lot Drainage

Roof, pad, and lot drainage should be collected and directed away from structures and slopes and toward approved disposal areas. Design fine grade elevations should be maintained through the life of the structure or if design fine grade elevations are altered, adequate area drains should be installed in order to provide rapid discharge of water, away from structures and slopes. Residents should be made aware that they are responsible for maintenance and cleaning of all drainage terraces, down drains, and other devices that have been installed to promote structure and slope stability.

### 8.2 Burrowing Animals

Owners should undertake a program for the elimination of burrowing animals.

## 9.0 FUTURE PLAN REVIEWS

This report represents a geotechnical review of the site. As the project design for the project progresses, site specific geologic and geotechnical issues should be considered in the design and construction of the project. Consequently, future plan reviews may be necessary. These reviews may include reviews of:

- Grading Plans
- Foundation Plans
- Utility Plans

These plans should be forwarded to the project Geotechnical Consultant for review.

## 10.0 CLOSURE

### 10.1 Geotechnical Review

For the purposes of this report, multiple working hypotheses were established for the project, utilizing the available data and the most probable model is used for the analysis. Future information collected during the proposed grading operations is intended to evaluate the hypothesis and as such, some of the assumptions summarized in this report may need to be changed. Some modifications of the grading recommendations may become necessary, should the conditions encountered in the field differ from the conditions hypothesized in this report.

Plans and sections of the project specifications should be reviewed by Alta to evaluate conformance with the intent of the recommendations contained in this report. If the project description or final design varies from that described in herein, Alta must be consulted regarding the applicability of the recommendations contained herein and whether any changes are required. Alta accepts no liability for any use of its recommendations if the project description or final design varies and Alta is not consulted regarding the alterations.

### 10.2 Limitations

This report is based on the following: 1) the project as presented on the attached plan; 2) the information obtained from Alta's laboratory testing included herein; and 3) from the information presented in the referenced reports. The findings and recommendations are based on the results of the subsurface investigation, laboratory testing, and office analysis combined with an interpolation and extrapolation of conditions between and beyond the subsurface excavation locations. However, the materials adjacent to or beneath those observed may have different characteristics than those observed, and no precise representations are made as to the quality or extent of the materials not

observed. The results reflect an interpretation of the direct evidence obtained. Work performed by Alta has been conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality under similar conditions. No other representation, either expressed or implied, and no warranty or guarantee is included or intended.

The recommendations presented in this report are based on the assumption that an appropriate level of field review will be provided by a geotechnical consultant who is familiar with the design and site geologic conditions. That field review shall be sufficient to confirm that geotechnical and geologic conditions exposed during grading are consistent with the geologic representations and corresponding recommendations presented in this report.

The conclusions and recommendations included in this report are applicable to the specific design of this project as discussed in this report. They have no applicability to any other project or to any other location and any and all subsequent users accept any and all liability resulting from any use or reuse of the data, opinions, and recommendations without the prior written consent of Alta.

Alta has no responsibility for construction means, methods, techniques, sequences, procedures, safety precautions, programs in connection with the construction, acts or omissions of the CONTRACTOR or any other person performing any of the construction, or for the failure of any of them to carry out the construction in accordance with the final design drawings and specifications.

# APPENDIX A

# REFERENCES

## APPENDIX A

### Selected References

1. Bryant, W.A., and Hart, E.W., 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Zoning Act with index to Earthquake Fault Zones Maps, Special Publication 42, interim revision, California Department of Conservation, California Geological Survey.
2. California Code of Regulations, 2016, California Building Code, Title 24, Part 2, Volume 2, Based on the 2012 International Building Code, Effective Date January 1, 2017.
3. California Department of Water Resources, online information: http://www.water.ca.gov/waterdatalibrary/index.cfm.
4. California Geological Survey, 2018, Earthquake Fault Zones, A guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California, Special Publication 42, revised 2018, 83 pages.
5. Cox, B.F., and Morton, D.M., 1978, Preliminary map of surficial materials in northwestern Riverside and southwestern San Bernardino Counties, California: U.S. Geological Survey, Open-File Report OF-78-977, scale 1:48,000.
6. Historic Aerials, 2020, www.historicaerials.com, by NETROnline, Copyright 2009, accessed January 31, 2020, online review of vintage air photos from 1948, 1966, 1967, 1980, 1995, 2003, 2004, 2005, 2009, 2010, 2012, and 2016.
7. Jennings, C.W., and Bryant, W.A., 2010, Fault Activity Map of California: California Geological Survey Geologic Data Map No. 6, map scale 1:750,000.
8. Jennings, C. W., and Bryant, W.A., 2010, An explanatory text to accompany the 1:750,000 scale fault and geologic map of California: California Division of Mines and Geology, special publication 42, revised 1985, 24 p.
9. Jennings, C. W., 1985, An explanatory text to accompany the 1:750,000 scale fault and geologic maps of California: California Division of Mines and Geology, Bulletin 201, 197 p.
10. Morton, D.M. and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30'x60' quadrangles, California: U.S. Geological Survey, Open-File Report OF-2006-1217, scale 1:100,000.
11. Riverside County Mapping Portal. https://gis.rivcoit.org/
12. Romanoff, Melvin, 1989, Underground Corrosion, NBS Circular 579, Reprinted by NACE, Houston, TX, 1989

# APPENDIX B

## Subsurface Investigation

## APPENDIX B

### Subsurface Investigation

Alta's subsurface investigation consisted of excavating, logging, and sampling twelve (12) hollow-stem auger borings. Details of the subsurface investigation are presented in Table B-1. The approximate location of the exploratory excavation is shown on the accompanying Concept Design plan (Plate 1) and the Geotechnical Logs are attached.

***TABLE B-1***
***SURFACE INVESTIGATION DETAILS***

| Equipment | Range of Depths | Sampling Methods | Sample Locations |
|---|---|---|---|
| Hollow-stem auger | Up to 51.5 feet | 1. Bulk<br>2. Ring Samples | 1. Bulk-Select Depth<br>2. Every 5-feet |

## UNIFIED SOIL CLASSIFICATION SYSTEM

| Major Divisions | | grf | ltr | Description |
|---|---|---|---|---|
| Coarse Grained Soils<br>More than 50% retained on No. 200 sieve | Gravel and Gravelly Soils<br>More than 50% of coarse fraction retained on No. 4 sieve | | GW | Well-graded gravels or gravel sand mixtures, little or no fines |
| | | | GP | Poorly-graded gravels or gravel sand mixture, little or no fines |
| | | | GM | Silty gravels, gravel-sand-silt mixtures |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | Sand and Sandy Soils<br>More than 50% of coarse fraction passes on No. 4 sieve | | SW | Well-graded sands or gravelly sands, little or no fines |
| | | | SP | Poorly-graded sands or gravelly sands, little or no fines |
| | | | SM | Silty sands, sand-silt mixtures |
| | | | SC | Clayey sands, and-clay mixtures |

| Major Divisions | | grf | ltr | |
|---|---|---|---|---|
| Fine Grained Soils<br>More than 50% passes on No. 200 sieve | Silts And Clays LL,<50 | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity |
| | | | CL | Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays |
| | | | OL | Organic silts and organic silt-clays of low plasticity |
| | Silts And Clays LL,<50 | | MH | Inorganic silts, micaceous or diatomaceous fine or silty soils, elastic silts |
| | | | VH | Inorganic clays of high plasticity, fat clays |
| | | | OH | Organic clays of medium to high plasticity |
| Highly Organic Soils | | | PT | Peat and other highly organic soils |

BOUNDARY CLASSIFICATION: Soils possessing characteristics of two groups are designated by combinations of group symbols.

## PARTICLE SIZE LIMITS

U.S. STANDARD SERIES SIEVE: 200, 40, 10, 4

CLEAR SQUARE SIEVE OPENINGS: 3/4", 3", 12"

| Silts and Clays | Sand | | | Gravel | | Cobbles | Boulders |
|---|---|---|---|---|---|---|---|
| | Fine | Medium | Coarse | Fine | Coarse | | |

## RELATIVE DENSITY

| Sands and Gravels | Blows/Foot (SPT) |
|---|---|
| Very Loose | <4 |
| Loose | 4-10 |
| Medium Dense | 11-30 |
| Dense | 31-50 |
| Very Dense | >50 |

## CONSISTENCY CLASSIFICATION

| Silts and Clays | Criteria |
|---|---|
| Very Soft | Thumb penetrates soil >1 in. |
| Soft | Thumb penetrates soil 1 in. |
| Firm | Thumb penetrates soil 1/4 in. |
| Stiff | Readily indented with thumbnail |
| Very Stiff | Thumbnail will not indent soil |

## HARDNESS

| Bedrock |
|---|
| Soft |
| Moderately Hard |
| Hard |
| Very Hard |

## LABORATORY TESTS

| Symbol | Test |
|---|---|
| DS | Direct Shear |
| DSR | Direct Shear |
| CON | (Remolded) |
| SA | Sieve Analysis |
| MAX | Maximum Density |
| RV | Resistance (R) Value |
| EI | Expansion Index |
| SE | Sand Equivalent |
| AL | Atterberg Limits |
| CHEM | Chemical Analysis |
| HY | Hydrometer Analysis |

## SOIL MOISTURE

Increasing Visual Moisture Content

Dry - Dry to touch

Moist - Damp, but no visible free water

wet - Visible free water

## SIZE PROPORTIONS

Trace - <5%

Few - 5 to 10%

Some - 15 to 25%

# KEY TO EXPLORATORY BORING LOGS

ALTA CALIFORNIA GEOTECHNICAL INC.

PLATE B

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 779 | BORING DESIG. | B-01 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ML | 3" Asphaltic Concrete over 3" of 3/4" Base<br>**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILT, brown, slightly moist, firm, trace very fine to fine grained sand. | | | | |
| | 775 | R | 7 | | | | 8.5 | 104 | 38 | |
| 5 | | R | 19 | | ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SANDY SILT, very fine grained, brown, slightly moist, very stiff, trace pores. | 13.2 | 114 | 78 | CON, HY |
| | 770 | | | | | | | | | |
| 10 | | R | 20 | | SP | @10.0ft. SAND, medium to coarse grained, brown, dry, medium dense. | 3.6 | 107 | 17 | |
| | 765 | | | | | | | | | |
| 15 | | R | 22 | | | @15.0ft. very fine to fine grained, tannish brown. | 7.5 | 109 | 39 | |
| | 760 | | | | | | | | | |
| 20 | | R | 37 | | CL | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SANDY CLAY, very fine grained, gray with orange mottling, slightly moist, very stiff. | 23.4 | 102 | 99 | |
| | 755 | | | | | | | | | |
| 25 | | R | 45 | | SP | @25.0ft. SAND, fine to coarse grained, tan, dry, dense. | 4.2 | 121 | 30 | |
| | | | | | | TOTAL DEPTH 26 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-1

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 778 | BORING DESIG. | B-02 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | 42 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3" Asphaltic Concrete over 5" of 3/4" Base | | | | |
| | | | | | ML | **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILT, brown, slightly moist, firm, trace very fine to fine grained sand. | | | | |
| | 775 | R | 15 | | | | 15.6 | 111 | 83 | |
| | | | | | CL-ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SILTY CLAY, brown, slightly moist, very stiff, trace very fine grained sand. | | | | |
| | | B | | | | | | | | |
| 5 | | R | 41 | | | | 15.4 | 117 | 98 | DSR, MAX, EI, HY, CHEM |
| | 770 | | | | | | | | | |
| 10 | | R | 18 | | SP | @10ft. SAND, very fine to fine grained, light brown, dry, medium dense. | 4.9 | 109 | 25 | |
| | 765 | | | | | | | | | |
| 15 | | R | 36 | | SC | **OLD ALLUVIAL FAN DEPOSITS**(Qof): CLAYEY SAND, very fine grained, gray, slightly moist, dense, trace calcium carbonates. | 15.4 | 113 | 88 | |
| | 760 | | | | | | | | | |
| 20 | | R | 53 | | SP | @20.0ft. SAND, medium to coarse grained, dry, dense. | 3.3 | 107 | 16 | |
| | 755 | | | | | | | | | |
| 25 | | R | 46 | | | | 2.4 | 102 | 10 | |
| | 750 | | | | | | | | | |
| 30 | | S | 37 | | SM | @30.0ft. SILTY SAND, medium to coarse grained, dry, dense, trace fine gravel <1/2". | | | | SIEVE HY |
| | 745 | | | | | | | | | |
| 35 | | S | 37 | | | | | | | |
| | 740 | | | | | | | | | |
| | | | | | | Continued. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-2

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 778 | BORING DESIG. | B-02 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | 42 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S | 54 | | SP | **OLD ALLUVIAL FAN DEPOSITS**(Qof): Continued; SAND, medium to coarse grained, wet, dense. | | | | SIEVE HY |
| | 735 | | | | | ▼ @42.0ft. GROUNDWATER ENCOUNTERED | | | | |
| 45 | | S | 42 | | | | | | | |
| | 730 | | | | | | | | | |
| 50 | | S | 53 | | | @50.0ft. few fine to coarse gravel <3". | | | | |
| | | | | | | TOTAL DEPTH 51.5 FEET<br>GROUNDWATER ENCOUNTERED AT 42.0 FEET<br>NO CAVING OBSERVED. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-2

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 777 | BORING DESIG. | B-03 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ML | 3" Asphaltic Concrete over 3" of 3/4" Base<br>**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, very fine grained, brown, slightly moist, stiff. | | | | |
| | 775 | R | 10 | | | | 16.5 | 109 | 83 | |
| 5 | | R | 30 | | ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SANDY SILT, very fine to fine grained, brown, slightly moist, very stiff. | 17.0 | 112 | 95 | |
| | 770 | | | | | | | | | |
| 10 | | R | 42 | | ML | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SANDY SILT, very fine grained, tannish gray, dry, stiff, trace pores, trace calcium carbonates. | 15.3 | 93 | 52 | CON, HY |
| | 765 | | | | | | | | | |
| 15 | | R | 41 | | | | 20.2 | 107 | 98 | |
| | 760 | | | | | | | | | |
| 20 | | R | 31 | | | @20.0ft. very fine to medium grained, brown, slightly moist, stiff. | 8.8 | 112 | 49 | |
| | 755 | | | | | | | | | |
| 25 | | R | 42 | | SP | @25.0ft. SAND, fine grained, gray, dry, dense. | 2.7 | 97 | 10 | |
| | | | | | | TOTAL DEPTH 26 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-3

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 776 | BORING DESIG. | B-04 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | 43 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | 775 | | | | ML | 3" Asphaltic Concrete over 3" of 3/4" Base<br>**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, very fine grained, brown, slightly moist, stiff. | | | | |
| | | R | 14 | | | | 16.0 | 110 | 84 | |
| 5 | 770 | R | 31 | | ML | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SANDY SILT, very fine grained, brown, slightly moist, stiff. | 13.1 | 121 | 94 | DS, HY |
| 10 | 765 | R | 33 | | SP | @10.0ft. SAND, very fine to fine grained, tan, dry, dense, trace fine gravel <1/2". | 11.7 | 101 | 49 | |
| 15 | 760 | R | 65 | | SM | @15.0ft. SILTY SAND, very fine grained, gray, dry, very dense, trace pores. | 14.1 | 116 | 88 | |
| 20 | 755 | R | 31 | | SP | @20.0ft. SAND, very fine to fine grained, light brown with orange mottling, slightly moist, dense. | 14.7 | 101 | 61 | |
| 25 | 750 | R | 29 | | | | 5.0 | 98 | 19 | |
| 30 | 745 | S | 38 | | SP | @30.0ft. GRAVELLY SAND, coarse grained, tan, dry, dense, fine gravel <1/2". | | | | |
| 35 | 740 | S | 39 | | | | | | | |
| | | | | | | Continued. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-4

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 776 | BORING DESIG. | B-04 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | 43 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | 735 | S | 48 | | SP | **OLD ALLUVIAL FAN DEPOSITS**(Qof): Continued; orangish tan, wet. | | | | |
| | | | | | | @43.0ft. GROUNDWATER ENCOUNTERED. | | | | |
| 45 | 730 | S | 65 | | | @45.0ft. fine to coarse gravel <3". | | | | |
| 50 | 725 | S | 86 | | | | | | | |
| | | | | | | TOTAL DEPTH 51.5 FEET<br>GROUNDWATER ENCOUNTERED AT 43.0 FEET<br>NO CAVING OBSERVED. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-4

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 775 | BORING DESIG. | B-05 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | 775 | | | | | Highly Weathered Asphaltic Concrete 3" over 4" of 3/4" Base. | | | | |
| | | | | | ML | @0.7ft. **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, very fine grained, brown, slightly moist, stiff. | | | | |
| | | R | 39 | | SM | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SILTY SAND, very fine to fine grained, tan, dry, dense, trace pores, trace calcium carbonates. | 5.6 | 113 | 32 | |
| 5 | 770 | R | 52 | | SP | @5.0ft. SAND, fine to coarse grained, grayish brown, dry, dense. | 6.5 | 128 | 59 | |
| 10 | 765 | R | 41 | | | @10.0ft. very fine to fine grained, gray, some clay. | 7.7 | 98 | 29 | |
| 15 | 760 | R | 48 | | | @15.0ft. grayish brown. | 10.2 | 118 | 68 | |
| 20 | 755 | R | 37 | | | @20.0ft. gray, slightly moist, trace clay | 18.3 | 103 | 80 | |
| 25 | 750 | R | 37 | | | @25.0ft. fine to medium grained, dry. | 2.7 | | | |
| | | | | | | TOTAL DEPTH 26 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-5

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 776 | BORING DESIG. | B-06 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | 775 | | | | ML | 3" Asphaltic Concrete over 2" of 3/4" Base<br>**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, very fine grained, brown, slightly moist, very stiff. | | | | |
| | | R | 16 | | | | 10.9 | 99 | 43 | |
| 5 | 770 | R | 23 | | ML | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SANDY SILT, very fine to fine grained, grayish tan, dry, firm, few calcium carbonates. | 8.2 | 111 | 45 | |
| | | B | | | | | | | | MAX, EI, HY, CHEM |
| 10 | 765 | R | 49 | | SP | @10.0ft. SAND, very fine grained, gray, dry, dense, trace calcium carbonates. | 4.0 | 113 | 23 | |
| 15 | 760 | R | 50 | | | | 7.6 | 108 | 38 | |
| 20 | 755 | R | 51 | | | @20.0ft. fine to medium grained, gray and tan. | 2.8 | 101 | 12 | |
| 25 | 750 | R | 64 | | | | 8.0 | 107 | 38 | |
| | | | | | | TOTAL DEPTH 26 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-6

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 774 | BORING DESIG. | B-07 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | 43 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ML | 3" Asphaltic Concrete over 4" of 3/4" Base<br>**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, very fine grained, brown, slightly moist, stiff. | | | | |
| | 770 | R | 13 | | | | 16.8 | 109 | 86 | |
| 5 | | R | 17 | | ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SANDY SILT, very fine grained, brown, dry, very stiff. | 11.7 | 114 | 69 | |
| | 765 | | | | | | | | | |
| 10 | | R | 35 | | CL | **OLD ALLUVIAL FAN DEPOSITS**(Qof): CLAYEY SILT, very fine grained, brown, slightly moist, stiff, trace pores, some calcium carbonates. | 15.1 | 115 | 91 | CON, HY |
| | 760 | | | | | | | | | |
| 15 | | R | 53 | | | @10.0ft. tannish gray, dry, very dense. | 19.2 | 105 | 89 | |
| | 755 | | | | | | | | | |
| 20 | | R | 40 | | SP | @20.0ft. SAND, very fine grained to fine grained, gray, dry, dense. | 14.4 | 100 | 58 | |
| | 750 | | | | | | | | | |
| 25 | | R | 38 | | | @25.0ft. gray with orange mottling. | 7.9 | 100 | 32 | |
| | 745 | | | | | | | | | |
| 30 | | S | 36 | | SP | @30.0ft. GRAVELLY SAND, medium to coarse grained, gray, dry, medium dense, fine gravel <3/4". | | | | |
| | 740 | | | | | | | | | |
| 35 | | S | 52 | | SP | @35.0ft. SAND, very fine to fine grained, grayish tan, dry, dense. | | | | |
| | 735 | | | | | Continued. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-7

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 774 | BORING DESIG. | B-07 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | 43 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S | 23 | | SP | **OLD ALLUVIAL FAN DEPOSITS**(Qof): Continued; GRAVELLY SAND, coarse grained, gray, wet, medium dense, fine to coarse gravel <3". | | | | |
| | | | | | | ▼ @42.5ft. GROUNDWATER ENCOUNTERED. | | | | |
| | 730 | | | | | | | | | |
| 45 | | S | 44 | | | @45.0ft. fine gravel <1/2". | | | | |
| | 725 | | | | | | | | | |
| 50 | | S | 73 | | | | | | | |
| | | | | | | TOTAL DEPTH 51.5 FEET<br>GROUNDWATER ENCOUNTERED AT 42.5 FEET<br>NO CAVING OBSERVED. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-7

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 774 | BORING DESIG. | B-08 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | 41 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | ML | 3" Asphaltic Concrete over 3" of 3/4" Base<br>**ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILT, brown, slightly moist, stiff, trace clay, trace fine grained sand. | | | | |
| | 770 | R | 10 | | | | 15.1 | 108 | 75 | |
| 5 | | R | 26 | | ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): CLAYEY SILT, brown, slightly moist, very stiff, trave very fine grained, sand, trace pores. | 15.0 | 116 | 92 | CON, HY |
| | 765 | B | | | | | | | | |
| 10 | | R | 27 | | | @10.0ft. some very fine to fine grained sand. | 19.5 | 107 | 95 | |
| | 760 | | | | | | | | | |
| 15 | | R | 42 | | SM | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SILTY SAND, very fine to fine grained, tannish gray, dry, dense, trace clay. | 19.0 | 110 | 97 | |
| | 755 | | | | | | | | | |
| 20 | | R | 29 | | SP | @20.0ft. SAND, very fine to fine grained, tan with orange mottling, dry, medium dense. | 15.2 | 95 | 54 | |
| | 750 | | | | | | | | | |
| 25 | | R | 54 | | | @25.0ft. coarse grained, gray, dry, very dense, trace fine gravel <1/2". | 2.1 | 101 | 9 | |
| | 745 | | | | | | | | | |
| 30 | | S | 29 | | | @30.0ft. very fine to fine grained, slightly moist, medium dense. | | | | |
| | 740 | | | | | | | | | |
| 35 | | S | 30 | | | @35.0ft. some clay. | | | | |
| | 735 | | | | | Continued. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-8

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 774 | BORING DESIG. | B-08 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | 41 | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | S | 35 | | SP | **OLD ALLUVIAL FAN DEPOSITS**(Qof): Continued; | | | | |
| | | | | | | @40.8ft. GRAVELLY SAND, coarse grained, gray, wet, medium dense, fine gravel <3/4". | | | | |
| | | | | | | @41.0ft. GROUNDWATER ENCOUNTERED | | | | |
| | 730 | | | | | | | | | |
| 45 | | S | 69 | | | @45.0ft. very dense. | | | | |
| | 725 | | | | | | | | | |
| 50 | | S | 48 | | | @50.0ft. fine to coarse gravel <3". | | | | |
| | | | | | | TOTAL DEPTH 51.5 FEET<br>GROUNDWATER ENCOUNTERED AT 41.0 FEET<br>NO CAVING OBSERVED. | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-8

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 776 | BORING DESIG. | B-09 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 4" Asphaltic Concrete over 4" of 3/4" Base | | | | |
| | 775 | | | | ML | **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILT, brown, dry, firm, trace fine grained sand, trace gravel <3/4". | | | | |
| | | R | 14 | | | | 14.4 | 108 | 72 | |
| 5 | 770 | R | 25 | | | @5.0ft. very stiff. | 16.1 | 112 | 89 | |
| | | | | | ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): SANDY SILT, fine grained, brown, slightly moist, very stiff, trace clay. | | | | |
| 10 | 765 | R | 21 | | | | 16.8 | 112 | 93 | |
| 15 | 760 | R | 30 | | SC | @15.0ft.CLAYEY SAND, fine to medium grained, brown with orange mottling, slightly moist, medium dense. | 10.5 | 114 | 61 | |
| 20 | 755 | R | 40 | | SC | **OLD ALLUVIAL FAN DEPOSITS**(Qof): CLAYEY SAND, very fine to fine grained, gray with orange mottling, moist, dense. | 26.7 | 91 | 87 | |
| 25 | 750 | R | 84 | | SP | @25.0ft. SAND, medium to coarse grained, tan, dry, very dense. | | | | |
| | | | | | | TOTAL DEPTH 26 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-9

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/28/20 | GROUND ELEV. | 774 | BORING DESIG. | P-01 |
| DATE FINISHED | 1/28/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3" Asphaltic Concrete over 5" of 3/4" Base | | | | |
| | | | | | ML | **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, very fine grained, brown, dry, stiff. | | | | |
| | | | | | SM | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SILTY SAND, very fine to fine grained, tan, dry, dense. | | | | |
| | 770 | | | | | | | | | |
| 5 | | | | | | TOTAL DEPTH 5 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

GROUNDWATER
SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-10

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 772 | BORING DESIG. | P-02 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Highly Weathered Asphaltic Concrete 3" over 4" of 3/4" Base. | | | | |
| | | | | | ML | **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SILT, brown, slightly moist, stiff, trace very fine grained sand. | | | | |
| | 770 | | | | SM | @1.0ft. concrete debris | | | | |
| | | | | | | **OLD ALLUVIAL FAN DEPOSITS**(Qof): SILTY SAND, very fine to fine grained, tan, dry, dense. | | | | |
| 5 | | | | | | TOTAL DEPTH 5 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

PLATE B-11

# GEOTECHNICAL BORING LOG



| | | | | | |
|---|---|---|---|---|---|
| PROJECT NO. | 1-0312 | PROJECT NAME | 5261 Arlington | | |
| DATE STARTED | 1/29/20 | GROUND ELEV. | 777 | BORING DESIG. | P-03 |
| DATE FINISHED | 1/29/20 | GW DEPTH (FT) | | LOGGED BY | JC |
| DRILLER | 2R | DRIVE WT. | 140 lbs. | NOTE | |
| TYPE OF DRILL RIG | 8" Hollow Stem Auger | DROP | 30 in. | | |

| DEPTH (Feet) | ELEV | SAMPLE TYPE | BLOWS | LITHOLOGY | GROUP SYMBOL | GEOTECHNICAL DESCRIPTION | MOISTURE CONT (%) | DRY (pcf) DENSITY | SAT-URATION (%) | OTHER TESTS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | SM | **ARTIFICIAL FILL-UNDOCUMENTED**(afu): SANDY SILT, fine grained, brown, slightly moist, medium dense, with roots. | | | | |
| | 775 | | | | | | | | | |
| 5 | | | | | | | | | | |
| | 770 | | | | ML | **YOUNG ALLUVIAL FAN DEPOSITS**(Qyf): CLAYEY SILT, brown, moist, firm to stiff. | | | | |
| 10 | | | | | | TOTAL DEPTH 10.0 FEET<br>NO GROUNDWATER ENCOUNTERED<br>NO CAVING OBSERVED | | | | |

SAMPLE TYPES:
- R RING (DRIVE) SAMPLE
- S SPT (SPLIT SPOON) SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE

▼ GROUNDWATER
► SEEPAGE
J: JOINTING C: CONTACT
B: BEDDING F: FAULT
S: SHEAR RS: RUPTURE SURFACE

Alta California Geotechnical, Inc.

P.N. 1-0312

# APPENDIX C

## Laboratory Testing

## LABORATORY TESTING

The following laboratory tests were performed on a representative sample in accordance with the applicable latest standards or methods from the ASTM, California Building Code (CBC) and California Department of Transportation.

### Classification

Soils were classified with respect to the Unified Soil Classification System (USCS) in accordance with ASTM D-2487 and D-2488.

### Particle Size Analysis

Modified hydrometer testing was conducted to aid in classification of the soil. The results of the particle size analysis are presented in Table C.

### Maximum Density/Optimum Moisture

The maximum dry density and optimum moisture content of two representative bulk samples were evaluated in accordance with ASTM D-1557. The results are summarized in Table C.

### Expansion Index Tests

Two (2) expansion index tests were performed to evaluate the expansion potential of typical on-site soil. Testing was carried out in general conformance with ASTM Test Method D-4829. The results are presented in Table C.

### Consolidation Tests

Consolidation testing was performed on four (4) relatively "undisturbed" soil samples at their natural moisture content in accordance with procedures outlined in ASTM D-2435. The samples were placed in a consolidometer and loads were applied incrementally in geometric progression. The samples (2.42-inches in diameter and 1-inch in height) were permitted to consolidate under each load increment until the slope of the characteristic linear secondary compression portion of the thickness versus log of time plot was apparent. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical

compression to the original 1-inch height. The consolidation test results are shown on Plates C-1 through C-4.

**Direct Shear Testing**

Direct shear testing in general conformance with ASTM test method D 3080, was performed on one sample remolded to 90% of the maximum density, and on one relatively "undisturbed" sample. The results of these tests are presented on Plates C-5 and C-6.

**Sieve Analyses**

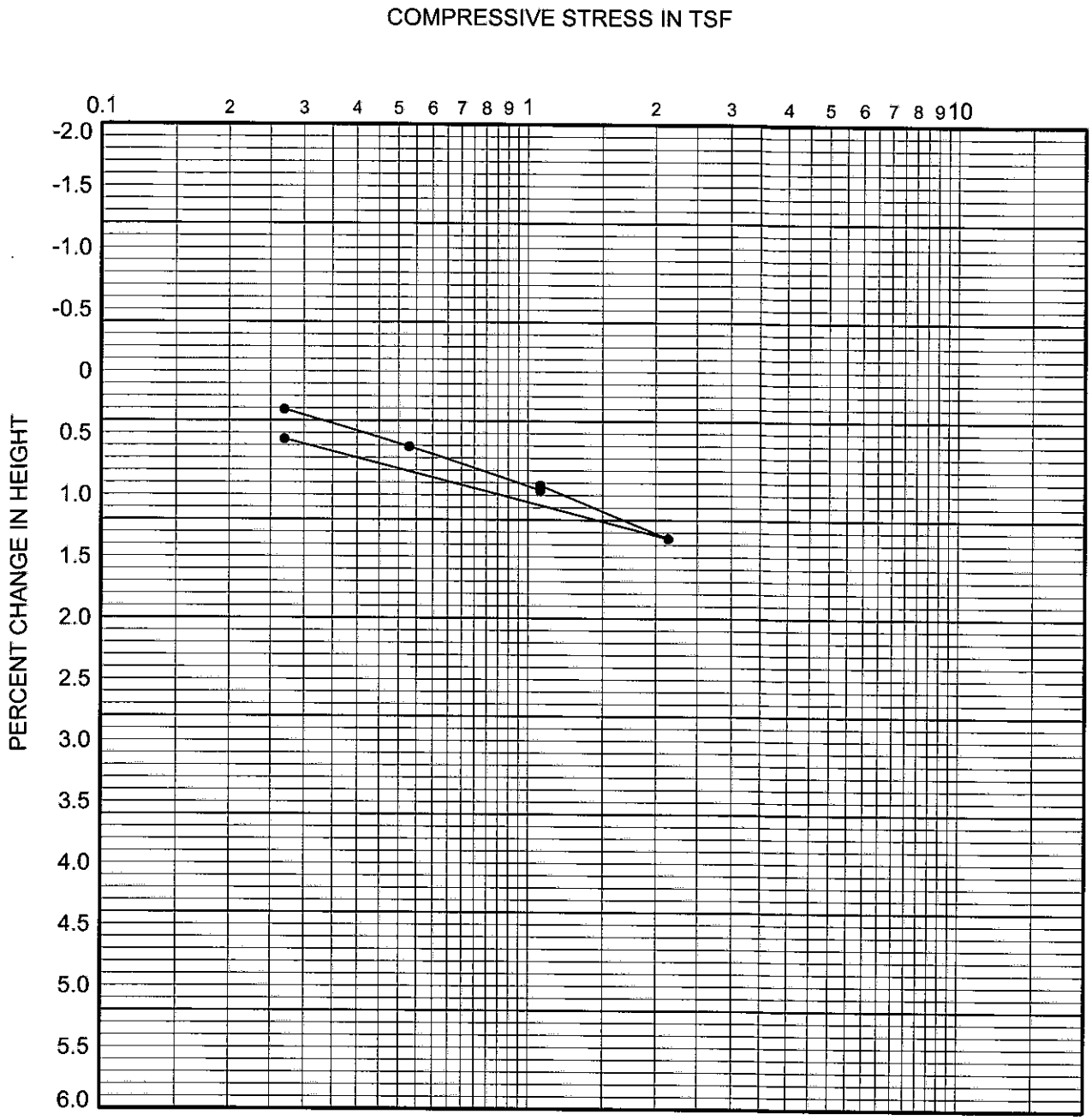
Sieve analysis testing, in general conformance with ASTM test method D 6913, was performed on two select samples. The results of these tests are presented on Plates C-7 and C-8.

**Chemical Analyses**

Chemical testing was performed on two select samples. The results of these tests (sulfate content, resistivity, chloride content and pH) are presented on Table C.

# TABLE C
# SUMMARY OF LABORATORY TEST DATA
# P.N. 1-0312

| BORING | DEPTH (FEET) | SOIL DESCRIPTION | GROUP SYMBOL | MAXIMUM DENSITY (PCF) | OPTIMUM MOISTURE CONTENT (%) | DIRECT SHEAR | PLUS NO.4 SEIVE (plus 4.76mm) (%) | SAND (4.76mm-0.075mm) (%) | SILT (0.075mm-0.005mm) (%) | CLAY (minus 0.005mm) (%) | EXPANSION INDEX UBC 18-2 | CONSOL | OTHER TESTS REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-01 | 5 | Sandy Silt (Qyf) | ML | | | | 0 | 30 | 50 | 20 | | SEE PLATE C-1 | |
| B-02 | 4.5 | Silty Clay (Qyf) | CL | 128.7 | 9.9 | SEE PLATE C-5 | 1 | 24 | 49 | 26 | 53 | | Sulf: ND, Chlor: 15ppm, pH:8.2, Res.: 2500 ohm cm |
| B-02 | 30 | Silty Sand (Qof) | SM | | | | 16 | 66 | 12 | 8 | | | |
| B-02 | 40 | Sand (Qof) | SP | | | | 0 | 92 | 4 | 4 | | | |
| B-03 | 10 | Sandy Silt (Qof) | ML | | | | 0 | 21 | 73 | 6 | | SEE PLATE C-2 | |
| B-04 | 5 | Sandy Silt (Qof) | ML | | | SEE PLATE C-6 | 0 | 33 | 40 | 27 | | | |
| B-06 | 8 | Sandy Silt (Qof) | ML | 126.5 | 10.3 | | 4 | 44 | 30 | 22 | 31 | | Sulf: 110 ppm, Chlor: 15ppm, pH:8.4, Res.: 2200 ohm cm |
| B-07 | 10 | Clayey Silt (Qof) | ML | | | | 0 | 20 | 46 | 34 | | SEE PLATE C-3 | |
| B-08 | 5 | Clayey Silt (Qyf) | ML | | | | 0 | 20 | 56 | 24 | | SEE PLATE C-4 | |




| boring | depth (ft.) | dry density (pcf) | in situ moist. (%) | in situ satur. (%) | -200 sieve (%) | group symbol | typical names |
|---|---|---|---|---|---|---|---|
| B-01 | 5.0 | 114 | 13.2 | 78 | 70 | ML | Sandy Silt (Qyf) |

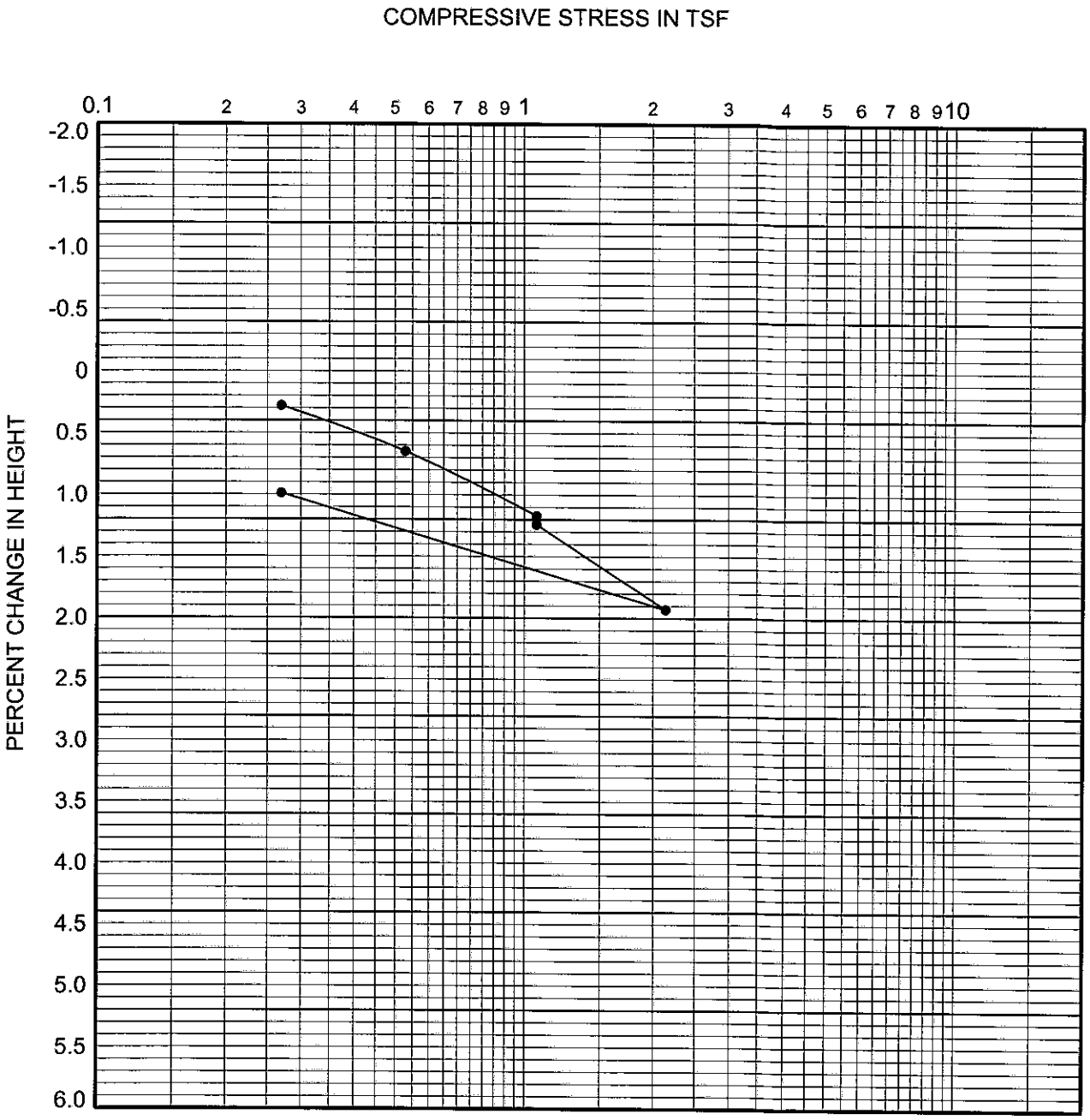
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

**Alta California Geotechnical, Inc.**

P.N. 1-0312

PLATE C-1




| boring | depth (ft.) | dry density (pcf) | in situ moist. (%) | in situ satur. (%) | -200 sieve (%) | group symbol | typical names |
|---|---|---|---|---|---|---|---|
| B-03 | 10.0 | 93 | 15.3 | 52 | 79 | ML | Sandy Silt (Qof) |

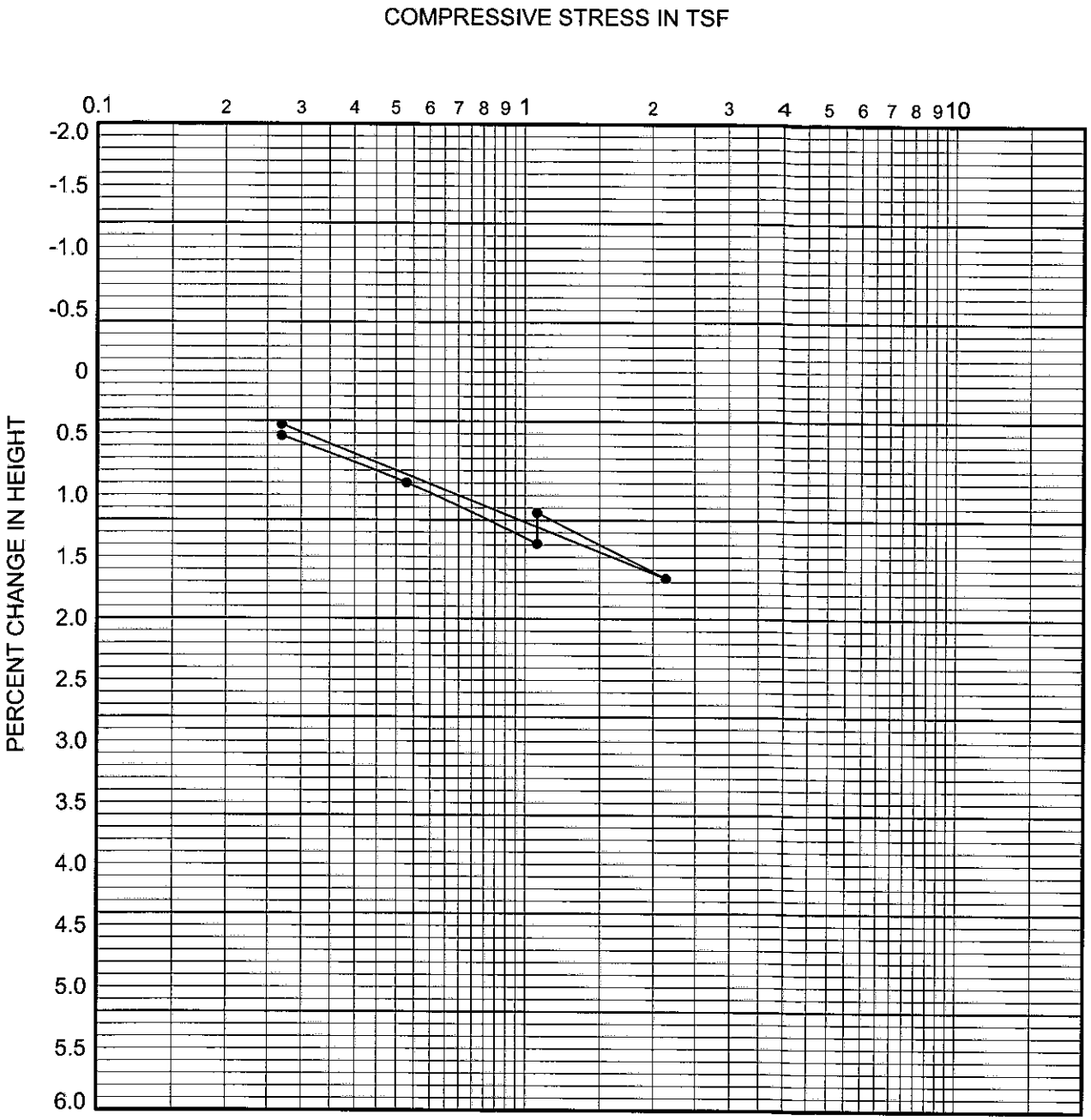
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

**Alta California Geotechnical, Inc.**

P.N. 1-0312

PLATE C-2




| boring | depth (ft.) | dry density (pcf) | in situ moist. (%) | in situ satur. (%) | -200 sieve (%) | group symbol | typical names |
|---|---|---|---|---|---|---|---|
| B-07 | 10.0 | 115 | 15.1 | 91 | 80 | ML | Clayey Silt (Qof) |

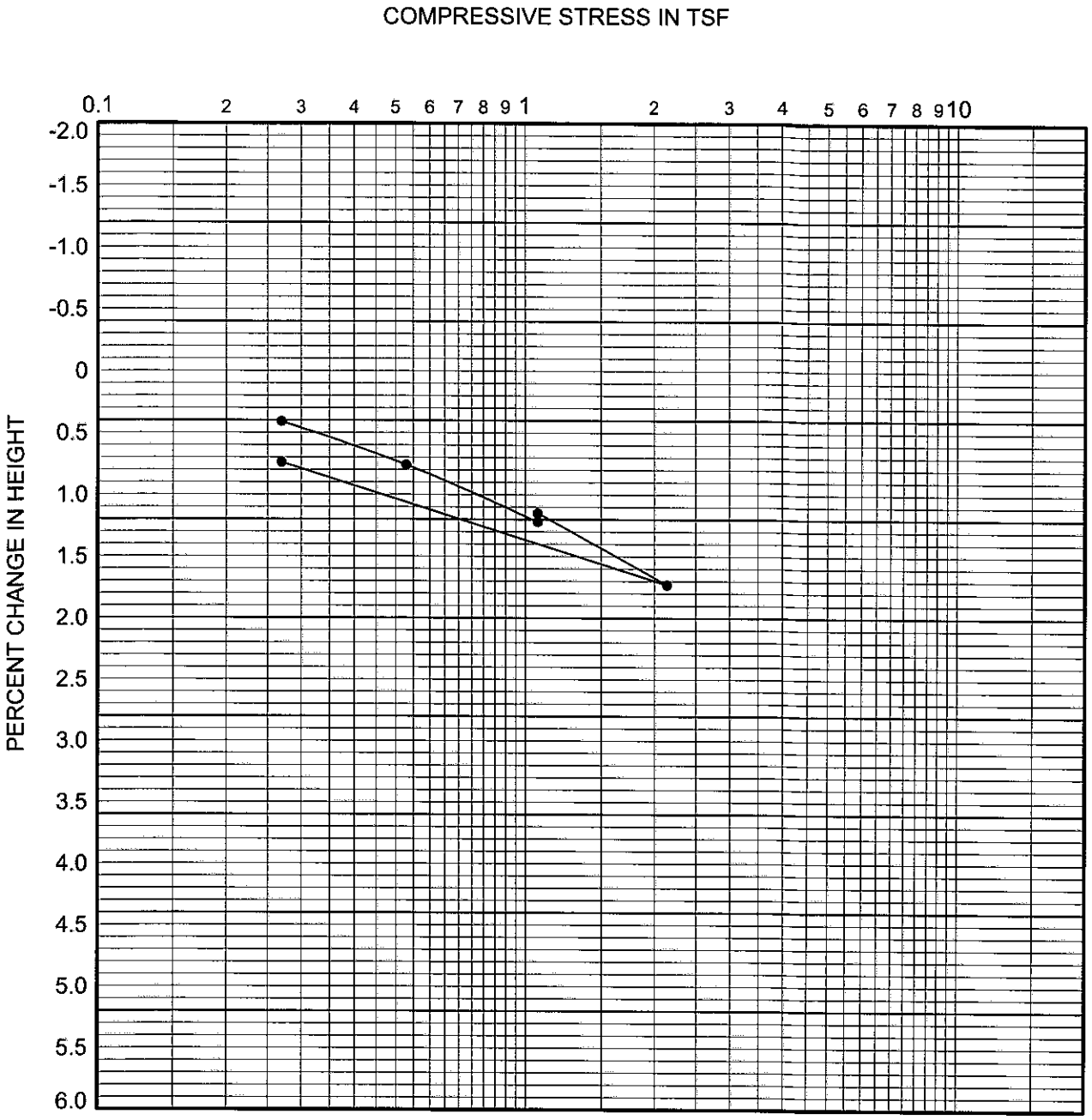
REMARKS: WATER ADDED AT 1.07 TSF

CONSOLIDATION CURVE

**Alta California Geotechnical, Inc.**

P.N. 1-0312

PLATE C-3




| boring | depth (ft.) | dry density (pcf) | in situ moist. (%) | in situ satur. (%) | -200 sieve (%) | group symbol | typical names |
|---|---|---|---|---|---|---|---|
| B-08 | 5.0 | 116 | 15.0 | 92 | 80 | ML | Clayey Silt (Qyf) |

REMARKS: WATER ADDED AT 1.07 TSF

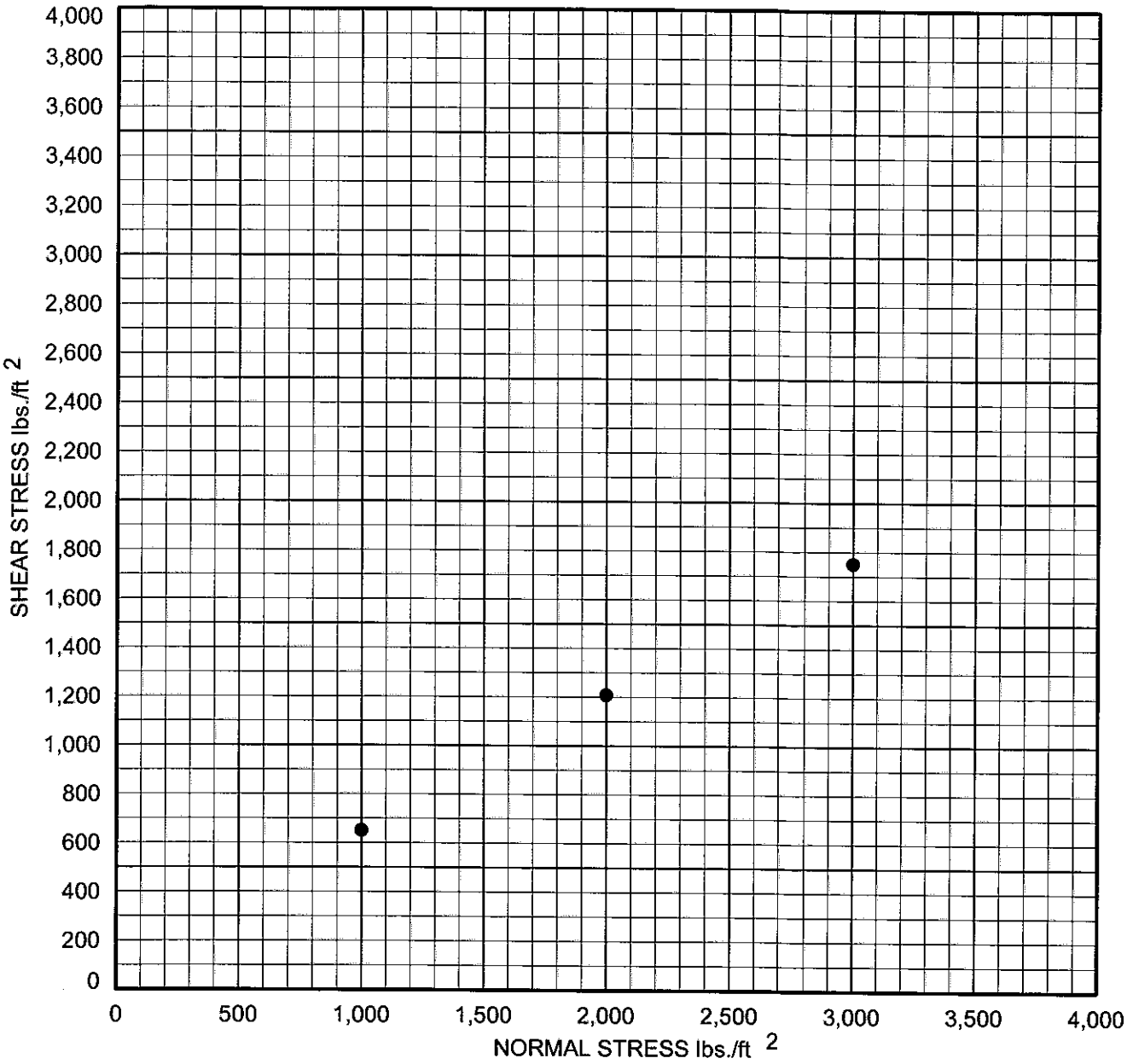
CONSOLIDATION CURVE

**Alta California Geotechnical, Inc.**

P.N. 1-0312

PLATE C-4

DIRECT SHEAR TEST
Remolded at 90% Relative Compaction




| boring | depth (ft.) | dry density (pcf) | in situ moist. (%) | -200 sieve (%) | group symbol | typical names |
|---|---|---|---|---|---|---|
| B-02 | 4.5 | | | 75 | CL | Silty Clay (Qyf) |

| | | |
|---|---|---|
| COHESION | 100 | psf. |
| FRICTION ANGLE | 28.0 | degrees |

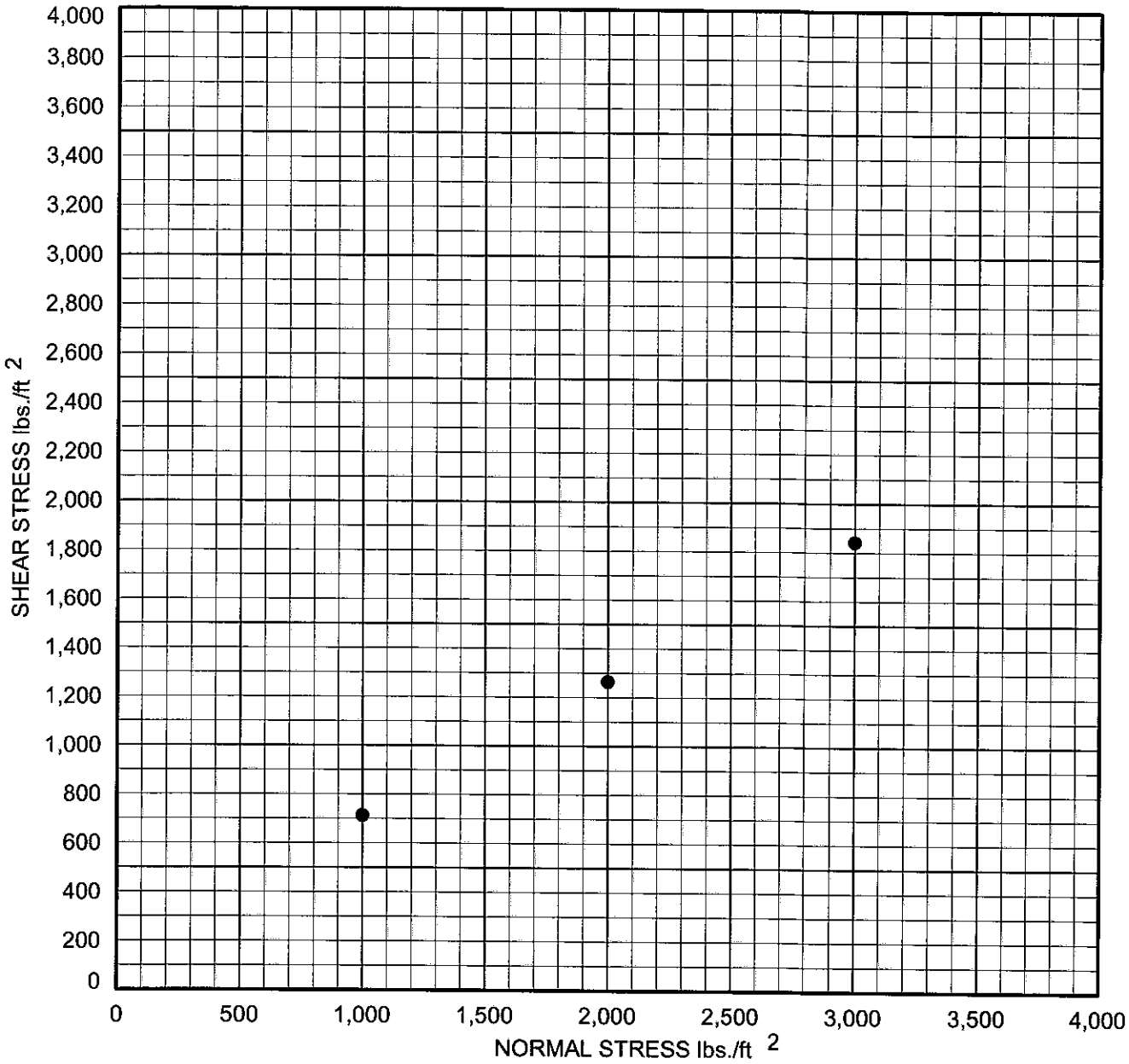
DIRECT SHEAR TEST

**Alta California Geotechnical, Inc.**

P.N. 1-0312

PLATE C-5

# DIRECT SHEAR TEST
Undisturbed




| boring | depth (ft.) | dry density (pcf) | in situ moist. (%) | -200 sieve (%) | group symbol | typical names |
|---|---|---|---|---|---|---|
| B-04 | 5.0 | 121 | 13.1 | 67 | ML | Sandy Silt (Qof) |

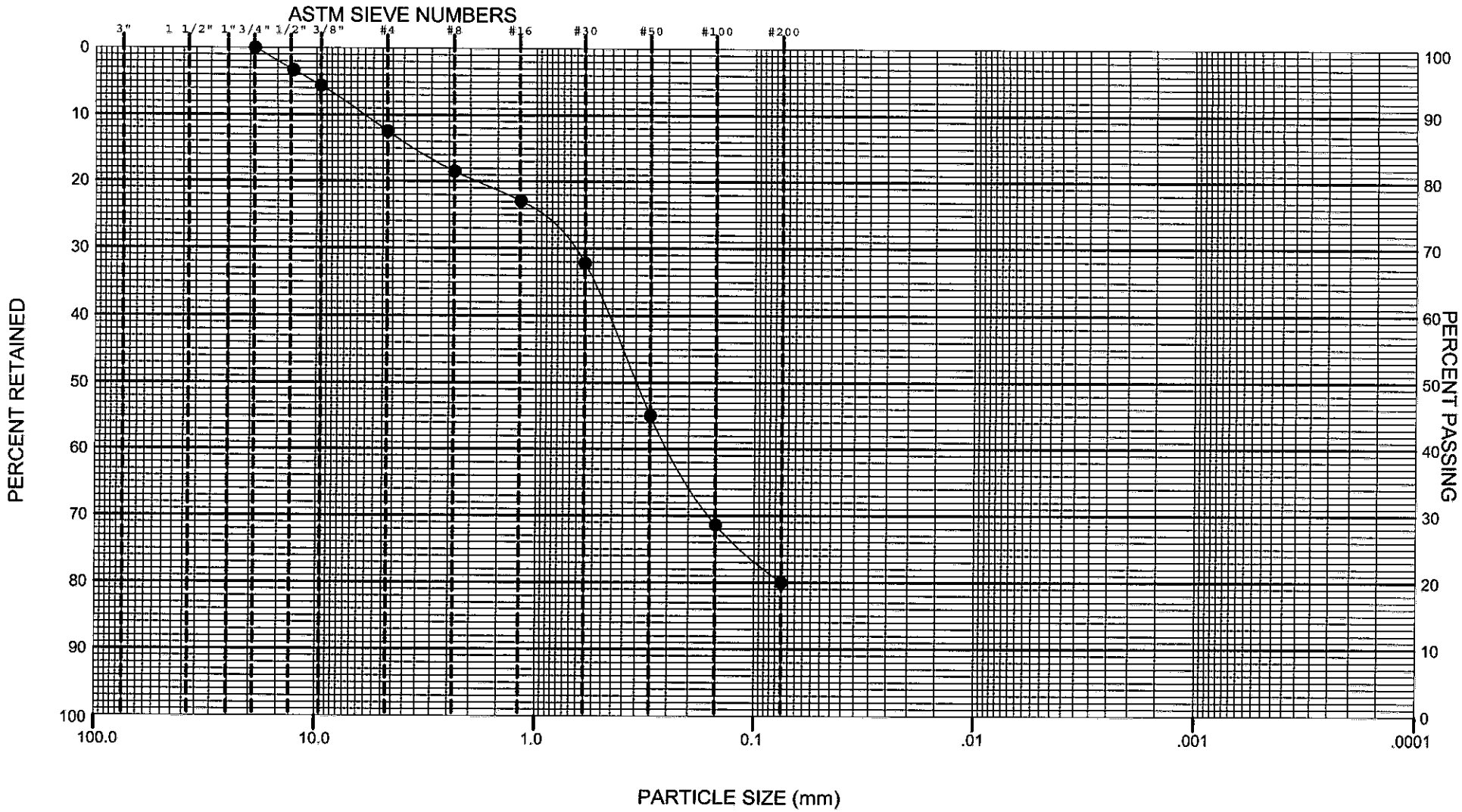
| | | |
|---|---|---|
| COHESION | 145 | psf. |
| FRICTION ANGLE | 30.0 | degrees |

DIRECT SHEAR TEST

**Alta California Geotechnical, Inc.**

P.N. 1-0312

PLATE C-6



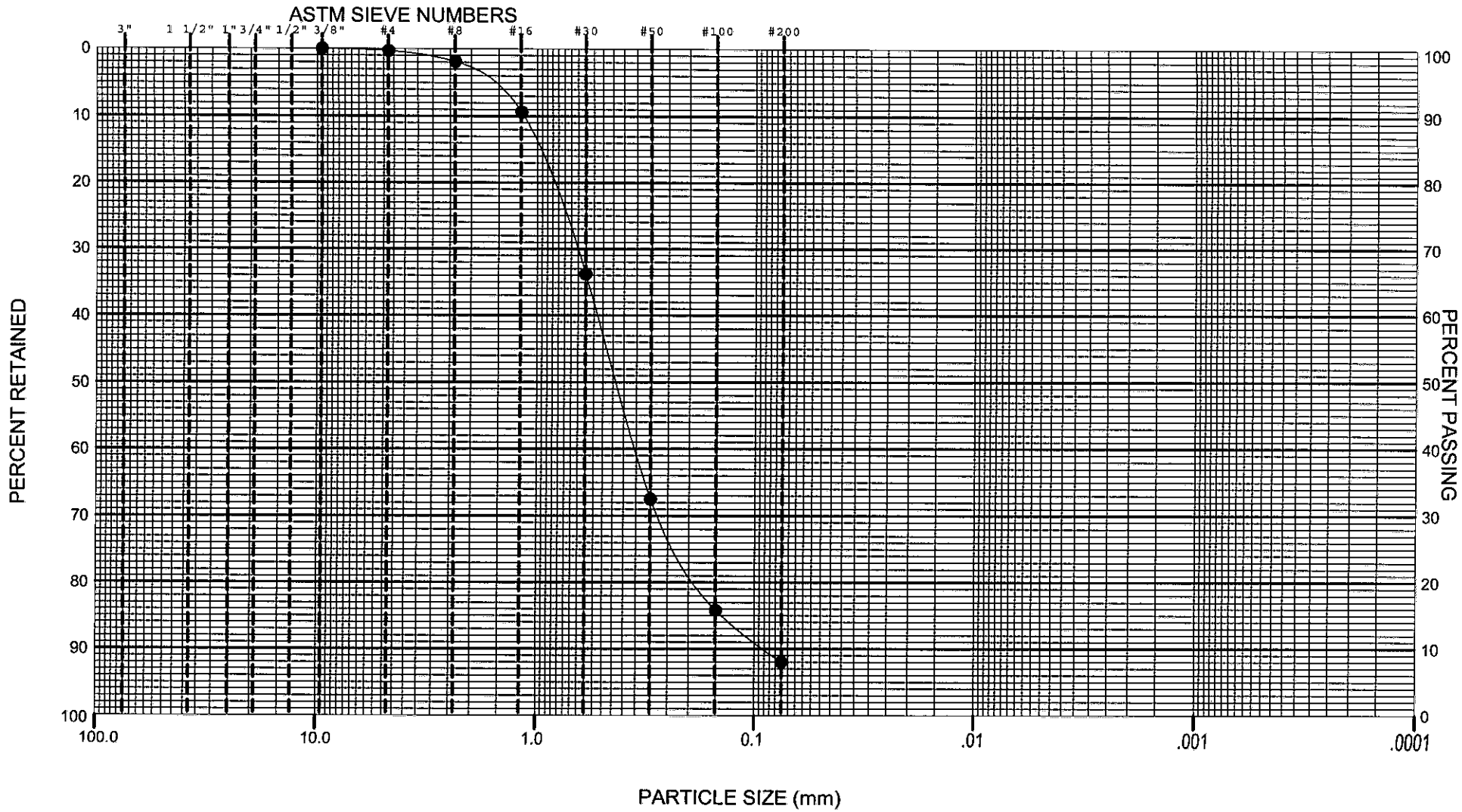

| GRAVEL | SAND | | | SILT | CLAY | COLLOIDS |
|---|---|---|---|---|---|---|
| | COARSE | MEDIUM | FINE | | | |

| symbol | boring or trench | depth(ft.) | L.L. | P.L. | sand equiv. | % passing #200 sieve | group symbol | typical names |
|---|---|---|---|---|---|---|---|---|
| ● | B-02 | 30 | | | | 20.0 | SM | Silty Sand (Qof) |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

GRAIN SIZE DISTRIBUTION

**Alta California Geotechnical, Inc.**

P.N. 1-0312 PLATE C-7




| symbol | boring or trench | depth(ft.) | L.L. | P.L. | sand equiv. | % passing #200 sieve | group symbol | typical names |
|---|---|---|---|---|---|---|---|---|
| ● | B-02 | 40 | | | | 8.0 | SP | Sand (Qof) |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

GRAIN SIZE DISTRIBUTION

**Alta California Geotechnical, Inc.**

P.N. 1-0312 PLATE C-8

# APPENDIX D

## Liquefaction Analysis

# APPENDIX D

## LIQUEFACTION ANALYSIS

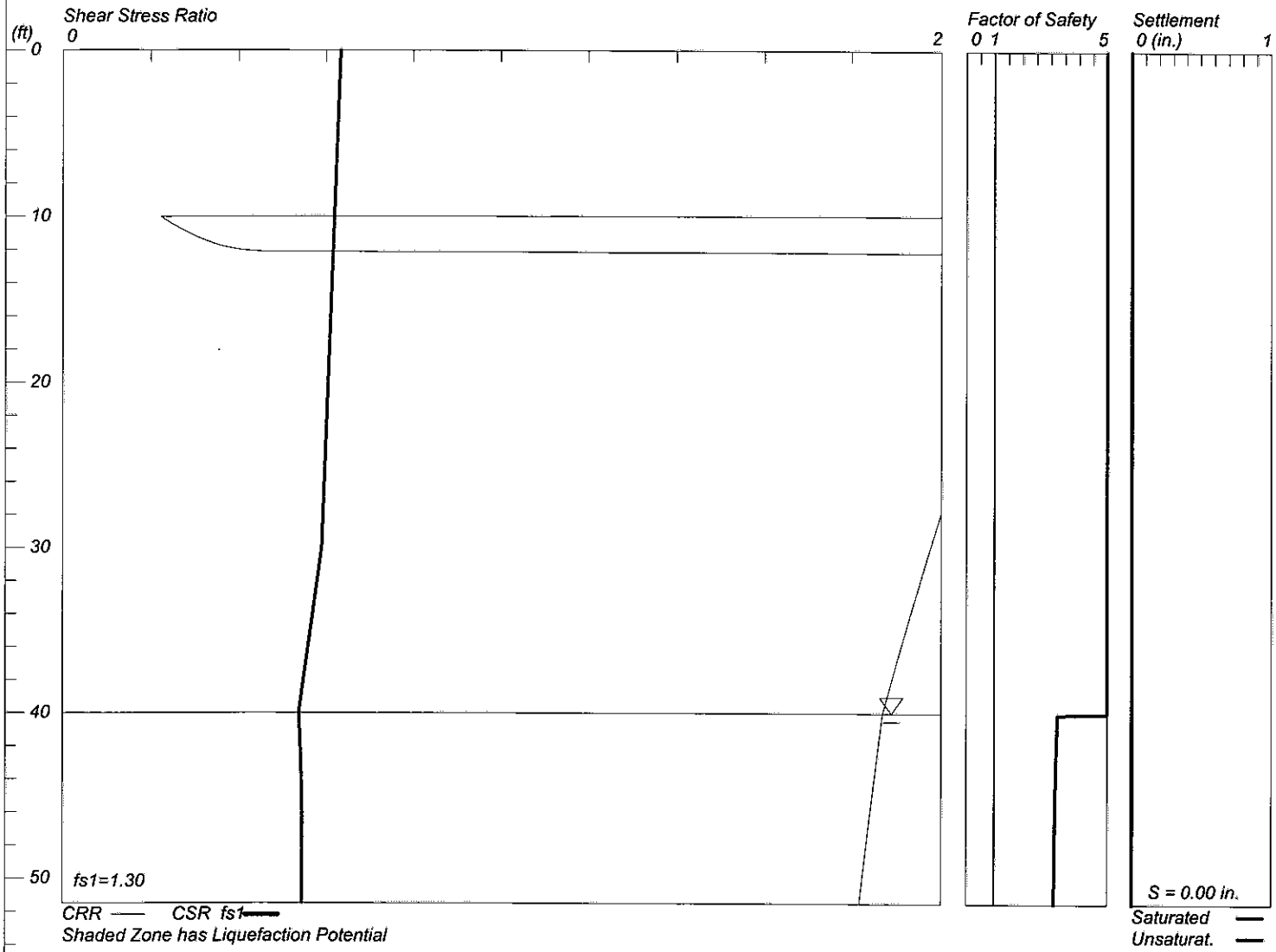
A liquefaction analysis was performed for the site based on SPT data gained from the hollow stem auger drilling. The Ishihara/Yoshimine method to analyze dynamic settlement for the SPT data. The calculations used the following constants: 0.75g for site acceleration, 7.7 for the magnitude of the earthquake, and a groundwater depth of 40 feet below existing grade. A factor of safety of 1.3 was utilized. The results are presented on Plate D-1 through D-4.

# LIQUEFACTION ANALYSIS

## 5261 Arlington Avenue

***Hole No.=B-2 Water Depth=40 ft Surface Elev.=777***

***Magnitude=7.7***
***Acceleration=0.75g***



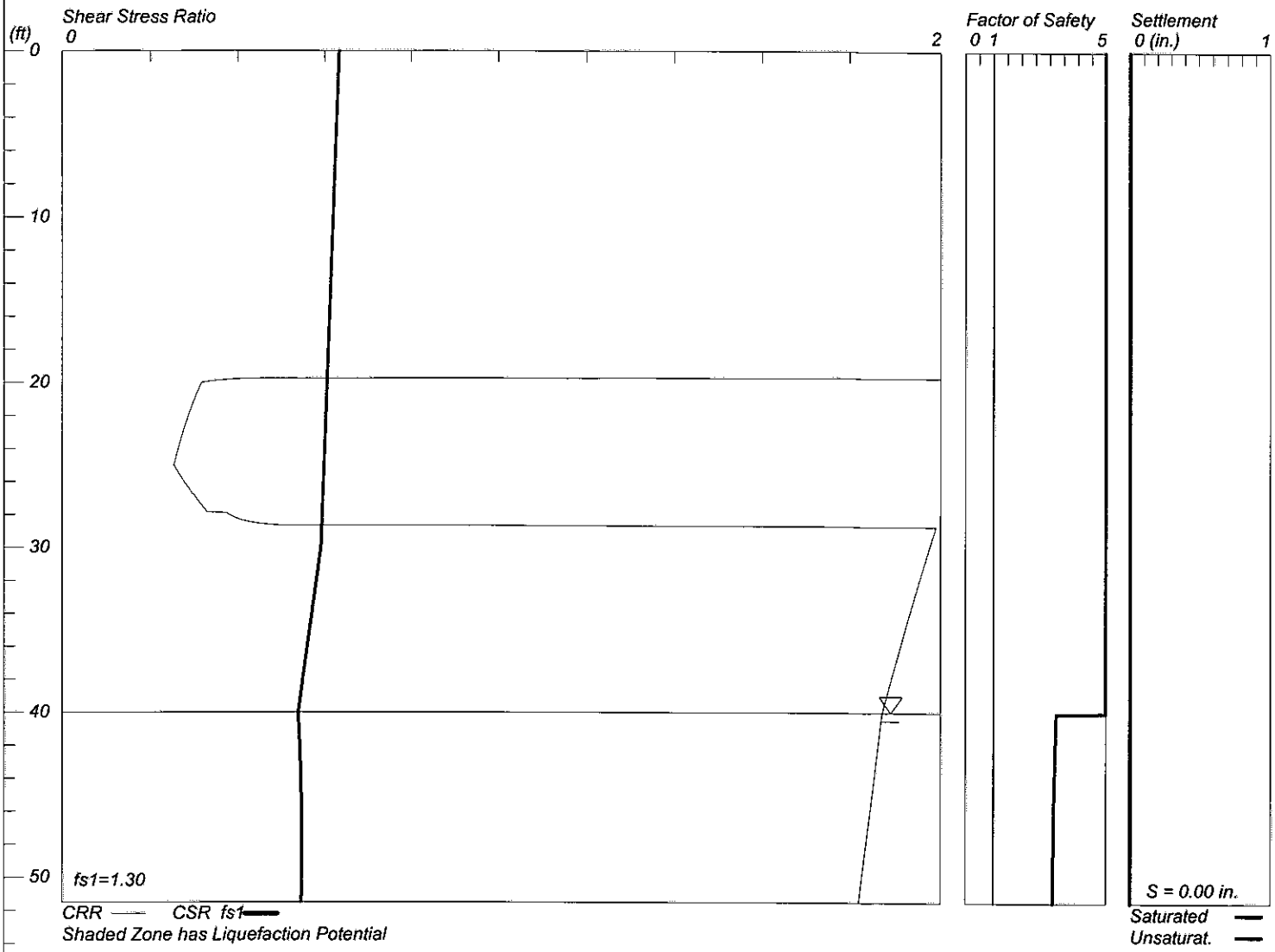

LiquefyPro CivilTech Software USA www.civiltech.com

# LIQUEFACTION ANALYSIS

## 5261 Arlington Avenue

***Hole No.=B-4 Water Depth=40 ft Surface Elev.=777***

***Magnitude=7.7***
***Acceleration=0.75g***



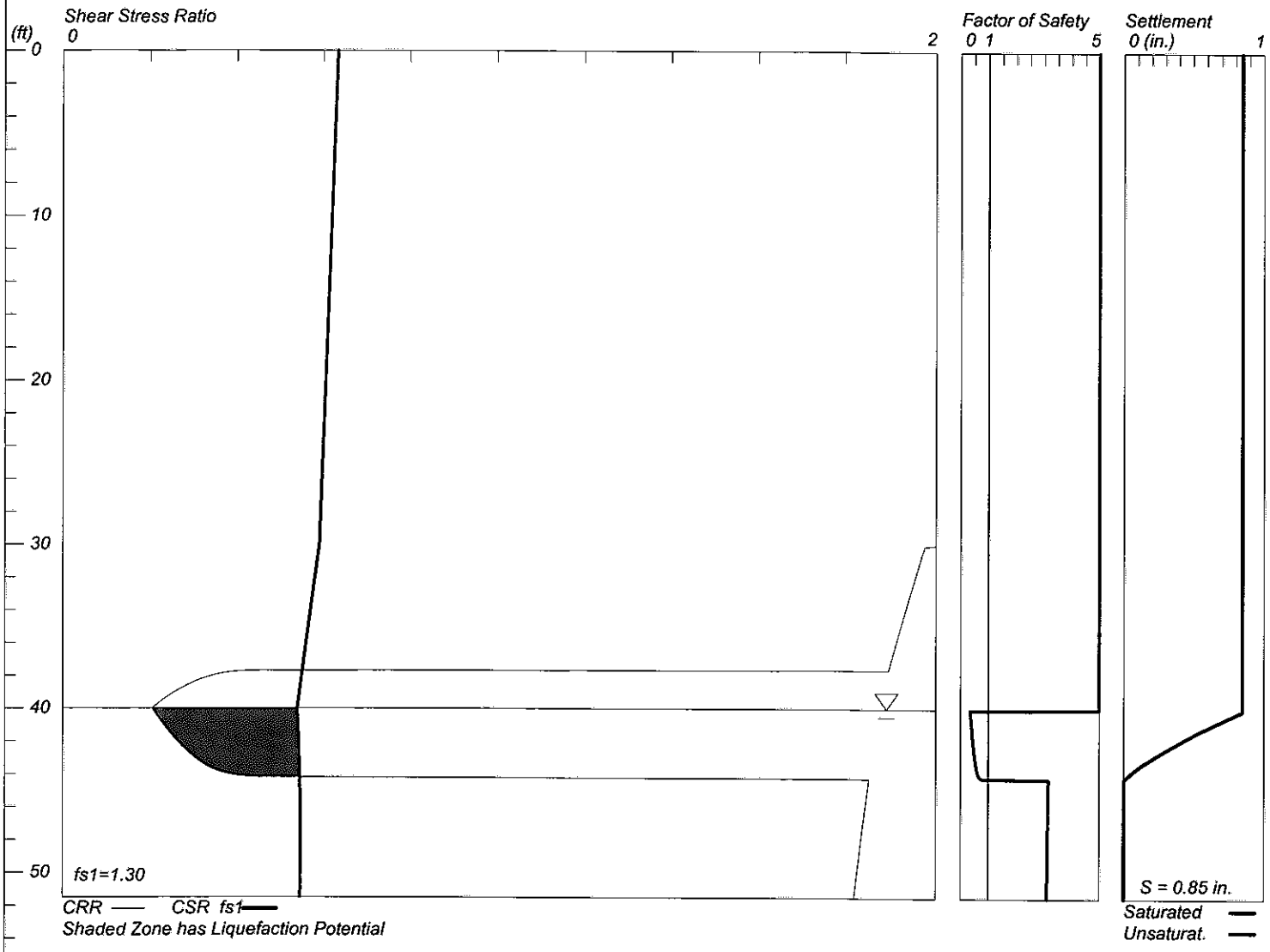

LiquefyPro CivilTech Software USA www.civiltech.com

# LIQUEFACTION ANALYSIS

## 5261 Arlington Avenue

***Hole No.=B-7 Water Depth=40 ft Surface Elev.=777***

***Magnitude=7.7***
***Acceleration=0.75g***



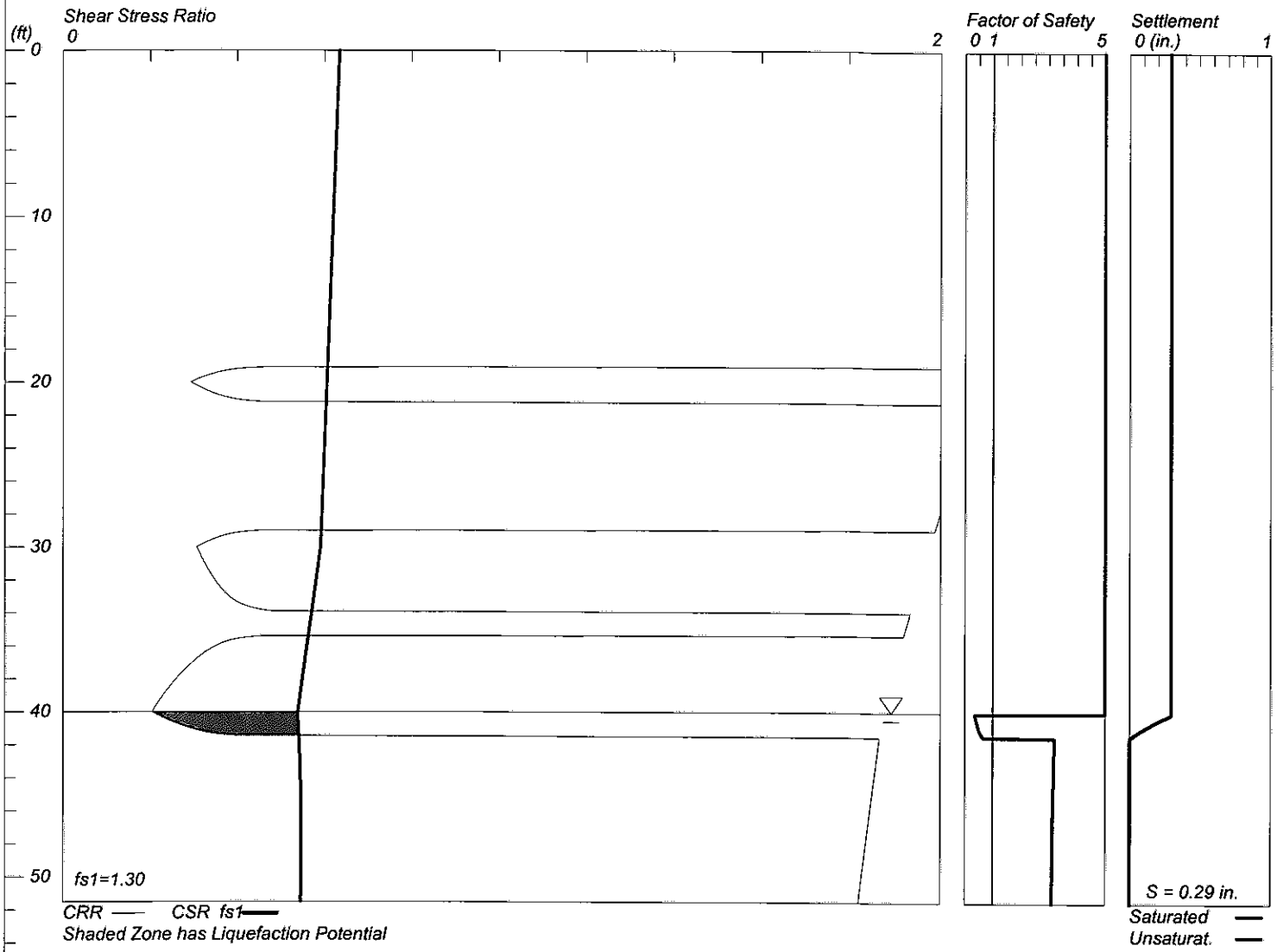

LiquefyPro CivilTech Software USA www.civiltech.com

# LIQUEFACTION ANALYSIS

## 5261 Arlington Avenue

***Hole No.=B-8 Water Depth=40 ft Surface Elev.=777***

***Magnitude=7.7***
***Acceleration=0.75g***




LiquefyPro CivilTech Software USA www.civiltech.com

# APPENDIX E

## Maintenance and Improvement Considerations

## MAINTENANCE AND IMPROVEMENT CONSIDERATIONS

### General

Owners purchasing property must assume a certain degree of responsibility for improvements and for maintaining conditions around their home. Of primary importance from a geotechnical standpoint are maintaining drainage patterns and minimizing the soil moisture variation below all improvements. Such design, construction and owner maintenance provisions may include:

- Employing contractors for improvements who design and build in recognition of local building codes and specific site soils conditions.
- Establishing and maintaining positive drainage away from all foundations, walkways, driveways, patios, and other improvements.
- Avoiding the construction of planters adjacent to structural improvements. Alternatively, planter sides/bottoms can be sealed with an impermeable membrane and drained away from the improvements via subdrains into approved disposal areas.
- Sealing and maintaining construction/control joints within concrete slabs and walkways to reduce the potential for moisture infiltration into the subgrade soils.
- Utilizing landscaping schemes with vegetation that requires minimal watering. Watering should be done in a uniform manner, as equally as possible on all sides of the foundation, keeping the soil "moist" but not allowing the soil to become saturated.
- Maintaining positive drainage away from structures and providing roof gutters on all structures with downspouts that are designed to carry roof runoff directly into area drains or discharged well away from the foundation areas.
- Avoiding the placement of trees closer to the proposed structures than a distance of one-half the mature height of the tree.
- Observation of the soil conditions around the perimeter of the structure during extremely hot/dry or unusually wet weather conditions so that modifications can be made in irrigation programs to maintain relatively uniform moisture conditions.

### Sulfates

Owners should be cautioned against the import and use of certain inorganic fertilizers, soil amendments, and/or other soils from offsite sources in the absence of specific information relating to their chemical composition. Some fertilizers have been known to leach sulfate compounds into soils and increase the sulfate concentrations to potentially detrimental levels.

**Site Drainage**

- The owners should be made aware of the potential problems that may develop when drainage is altered through construction of hardscape improvements. Ponded water, drainage over the slope face, leaking irrigation systems, overwatering, or other conditions which could lead to ground saturation must be avoided.
- No water should be allowed to flow over the slopes. No alteration of pad gradients should be allowed that would prevent pad and roof runoff from being directed to approved disposal areas.
- Drainage patterns have been established at the time of the fine grading should be maintained throughout the life of the structure. No alterations to these drainage patterns should be made unless designed by qualified professionals in compliance with local code requirements and site-specific soils conditions.

**Slope Drainage**

- Residents should be made aware of the importance of maintaining and cleaning all interceptor ditches, drainage terraces, down drains, and any other drainage devices, which have been installed to promote slope stability.
- Subsurface drainage pipe outlets may protrude through slope surfaces and/or wall faces. These pipes, in conjunction with the graded features, are essential to slope and wall stability and must be protected in-place. They should not be altered or damaged in any way.

**Planting and Irrigation of Slopes**

- Seeding and planting of the slopes should be planned to achieve, as rapidly as possible, a well-established and deep-rooted vegetal cover requiring minimal watering.
- It is the responsibility of the landscape architect to provide such plants initially and of the residents to maintain such planting. Alteration of such a planting scheme is at the resident's risk.
- The resident is responsible for proper irrigation and for maintenance and repair of properly installed irrigation systems. Leaks should be fixed immediately.
- Sprinklers should be adjusted to provide maximum uniform coverage with a minimum of water usage and overlap. Overwatering with consequent wasteful runoff and serious ground saturation must be avoided.
- If automatic sprinkler systems are installed, their use must be adjusted to account for seasonal and natural rainfall conditions.

**Burrowing Animals**

- Residents must undertake a program to eliminate burrowing animals. This must be an ongoing program in order to promote slope stability.

**Owner Improvement**

Owner improvements (pools, spas, patio slabs, retaining walls, planters, etc.) should be designed to account for the terrain of the project, as well as expansive soil conditions and chemical characteristics. Design considerations on any given lot may need to include provisions for differential bearing materials, ascending/descending slope conditions, bedrock structure, perched (irrigation) water, special geologic surcharge loading conditions, expansive soil stresses, and long-term creep/settlement.

All owner improvements should be designed and constructed by qualified professionals utilizing appropriate design methodologies, which account for the on-site soils and geologic conditions. Each lot and proposed improvement should be evaluated on an individual basis.

**Setback Zones**

Manufactured slopes maybe subject to long-term settlement and creep that can manifest itself in the form of both horizontal and vertical movement. These movements typically are produced as a result of weathering, erosion, gravity forces, and other natural phenomenon. A setback adjacent to slopes is required by most building codes, including the California Building Code. This zone is intended to locate and support the residential structures away from these slopes and onto soils that are not subject to the potential adverse effects of these natural phenomena.

The owner may wish to construct patios, walls, walkways, planters, swimming pools, spas, etc. within this zone. Such facilities may be sensitive to settlement and creep and should not be constructed within the setback zone unless properly engineered. It is suggested that plans for such improvements be designed by a professional engineer who is familiar with grading ordinances and design and construction requirements. In addition, we recommend that the

designer and contractor familiarize themselves with the site specific geologic and geotechnical conditions on the specific lot.

# APPENDIX F

## Earthwork Specifications

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
**EARTHWORK SPECIFICATIONS**

These specifications present the generally accepted standards and minimum earthwork requirements for the development of the project. These specifications shall be the project guidelines for earthwork except where specifically superseded in preliminary geology and soils reports, grading plan review reports or by the prevailing grading codes or ordinances of the controlling agency.

## A. GENERAL

1. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications.

2. The project Geotechnical Engineer and Engineering Geologist, or their representatives, shall provide observation and testing services, and Geotechnical consultation for the duration of the project.

3. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Geotechnical Engineer/Engineering Geologist.

4. It is the Contractor's responsibility to prepare the ground surface to receive fill to the satisfaction of the Geotechnical Engineer and to place, spread, mix, moisture condition, and compact the fill in accordance with the job specifications and as required by the Geotechnical Engineer. The Contractor shall also remove all material considered by the Geotechnical Engineer to be unsuitable for use in the construction of engineered fills.

5. The Contractor shall have suitable and sufficient equipment in operation to handle the amount of fill being placed. When necessary, equipment will be shut down temporarily in order to permit the proper preparation of fills.

## B. PREPARATION OF FILL AREAS

1. Excessive vegetation and all deleterious material should be disposed of offsite as required by the Geotechnical Engineer.

   Existing fill, soil, alluvium or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed and hauled from the site. Where applicable, the Contractor may obtain the

approval of the Soils Engineer and the controlling authorities for the project to dispose of the above described materials, or a portion thereof, in designated areas onsite.

After removal of the deleterious materials have been accomplished, earth materials deemed unsuitable in their natural, in-place condition, shall be removed as recommended by the Geotechnical Engineer/Engineering Geologist.

2. Upon achieving a suitable bottom for fill placement, the exposed removal bottom shall be disced or bladed by the Contractor to the satisfaction of the Geotechnical Engineer. The prepared ground surfaces shall then be brought to the specified moisture content mixed as required, and compacted and tested as specified. In localities where it is necessary to obtain the approval of the controlling agency prior to placing fill, it will be the Contractor's responsibility to contact the proper authorities to visit the site.

3. Any underground structure such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines or other structures not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer and/or the controlling agency for the project.

## C. ENGINEERED FILLS

1. Any material imported or excavated on the property may be utilized as fill, provided the material has been determined to be suitable by the Geotechnical Engineer. Deleterious materials shall be removed from the fill as directed by the Geotechnical Engineer.

2. Rock or rock fragments less than twelve inches in the largest dimension may be utilized in the fill, provided they are not placed in concentrated pockets and the distribution of the rocks is approved by the Geotechnical Engineer.

3. Rocks greater than twelve inches in the largest dimension shall be taken offsite, or placed in accordance with the recommendations of the Geotechnical Engineer in areas designated as suitable for rock disposal.

4. All materials to be used as fill, shall be tested in the laboratory by the Geotechnical Engineer. Proposed import materials shall be approved by the Geotechnical Engineer 48 hours prior to importation.

5. The fill materials shall be placed by the Contractor in lifts, that when compacted, shall not exceed six inches. Each lift shall be spread evenly and shall be

thoroughly mixed to achieve a near uniform moisture condition and a uniform blend of materials.

All compaction shall be achieved at or above the optimum moisture content, as determined by the applicable laboratory standard. The Contractor will be notified if the fill materials are too wet or too dry to achieve the required compaction standard.

6. When the moisture content of the fill material is below the limit specified by the Geotechnical Engineer, water shall be added and the materials shall be blended until a uniform moisture content, within specified limits, is achieved. When the moisture content of the fill material is above the limits specified by the Geotechnical Engineer, the fill materials shall be aerated by discing, blading, mixed with dryer fill materials, or other satisfactory methods until the moisture content is within the specified limits.

7. Each fill lift shall be compacted to the minimum project standards, in compliance with the testing methods specified by the controlling governmental agency, and in accordance with recommendations of the Geotechnical Engineer.

   In the absence of specific recommendations by the Geotechnical Engineer to the contrary, the compaction standard shall be the most recent version of ASTM:D 1557.

8. Where a slope receiving fill exceeds a ratio of five-horizontal to one-vertical, the fill shall be keyed and benched through all unsuitable materials into sound bedrock or firm material, in accordance with the recommendations and approval of the Geotechnical Engineer.

9. Side hill fills shall have a minimum key width of 15 feet into bedrock or firm materials, unless otherwise specified in the soil report and approved by the Geotechnical Engineer in the field.

10. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency and/or with the recommendations of the Geotechnical Engineer and Engineering Geologist.

11. The Contractor shall be required to maintain the specified minimum relative compaction out to the finish slope face of fill slopes, buttresses, and stabilization fills as directed by the Geotechnical Engineer and/or the governing agency for the project. This may be achieved by either overbuilding the slope and cutting

back to the compacted core; by direct compaction of the slope face with suitable equipment; or by any other procedure which produces the required result.

12. The fill portion of fill-over-cut slopes shall be properly keyed into rock or firm material; and the fill area shall be stripped of all soil or unsuitable materials prior to placing fill.

    The design cut portion of the slope should be made first and evaluated for suitability by the Engineering Geologist prior to placement of fill in the keyway above the cut slope.

13. Pad areas in cut or natural ground shall be approved by the Geotechnical Engineer. Finished surfaces of these pads may require scarification and recompaction, or over excavation as determined by the Geotechnical Engineer.

## D. CUT SLOPES

1. The Engineering Geologist shall observe all cut slopes and shall be notified by the Contractor when cut slopes are to be started.

2. If, during the course of grading, unforeseen adverse or potentially adverse geologic conditions are encountered, the Engineering Geologist and Soil Engineer shall investigate, analyze and make recommendations to remediate these problems.

3. Non-erodible interceptor swales shall be placed at the top of cut slopes that face the same direction as the superjacent, prevailing drainage.

4. Unless otherwise specified in specific geotechnical reports, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

5. Drainage terraces shall be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the Geotechnical Engineer or Engineering Geologist.

## E. GRADING CONTROL

1. Fill placement shall be observed and tested by the Geotechnical Engineer and/or his representative during grading.

   Field density tests shall be made by the Geotechnical Engineer and/or his representative to evaluate the compaction and moisture compliance of each fill lift. Density tests shall be conducted at intervals not to exceed two feet of fill

height. Where sheepsfoot rollers are used, the fill may be disturbed to a depth of several inches. Density determinations shall be taken in the compacted material below the disturbed surface at a depth determined by the Geotechnical Engineer or his representative.

2. Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction, or improper moisture content is in evidence, that particular layer or portion thereof shall be reworked until the required density and/or moisture content has been attained. Additional fills shall not be placed over an area until the previous lift of fill has been tested and found to meet the density and moisture requirements for the project and the previous lift is approved by the Geotechnical Engineer.

3. When grading activities are interrupted by heavy rains, fill operations shall not be resumed until field observations and tests by the Geotechnical Engineer indicate the moisture content and density of the fill are within the specified limits.

4. During construction, the Contractor shall properly grade all surfaces to maintain good drainage and prevent the ponding of water. The Contractor shall take remedial action to control surface water and to prevent erosion of graded areas until such time as a permanent drainage and erosion devices have been installed.

5. Observation and testing by the Geotechnical Engineer and/or his representative shall be conducted during filling and compacting operations in order that he will be able to state in his opinion that all cut and filled areas are graded in accordance with the approved specifications.

6. Upon the completion of grading activities and after the Geotechnical Engineer and Engineering Geologist have finished their observations of the work, final reports shall be submitted. No further excavation or fill placement shall be undertaken without prior notification of the Geotechnical Engineer and/or Engineering Geologist.

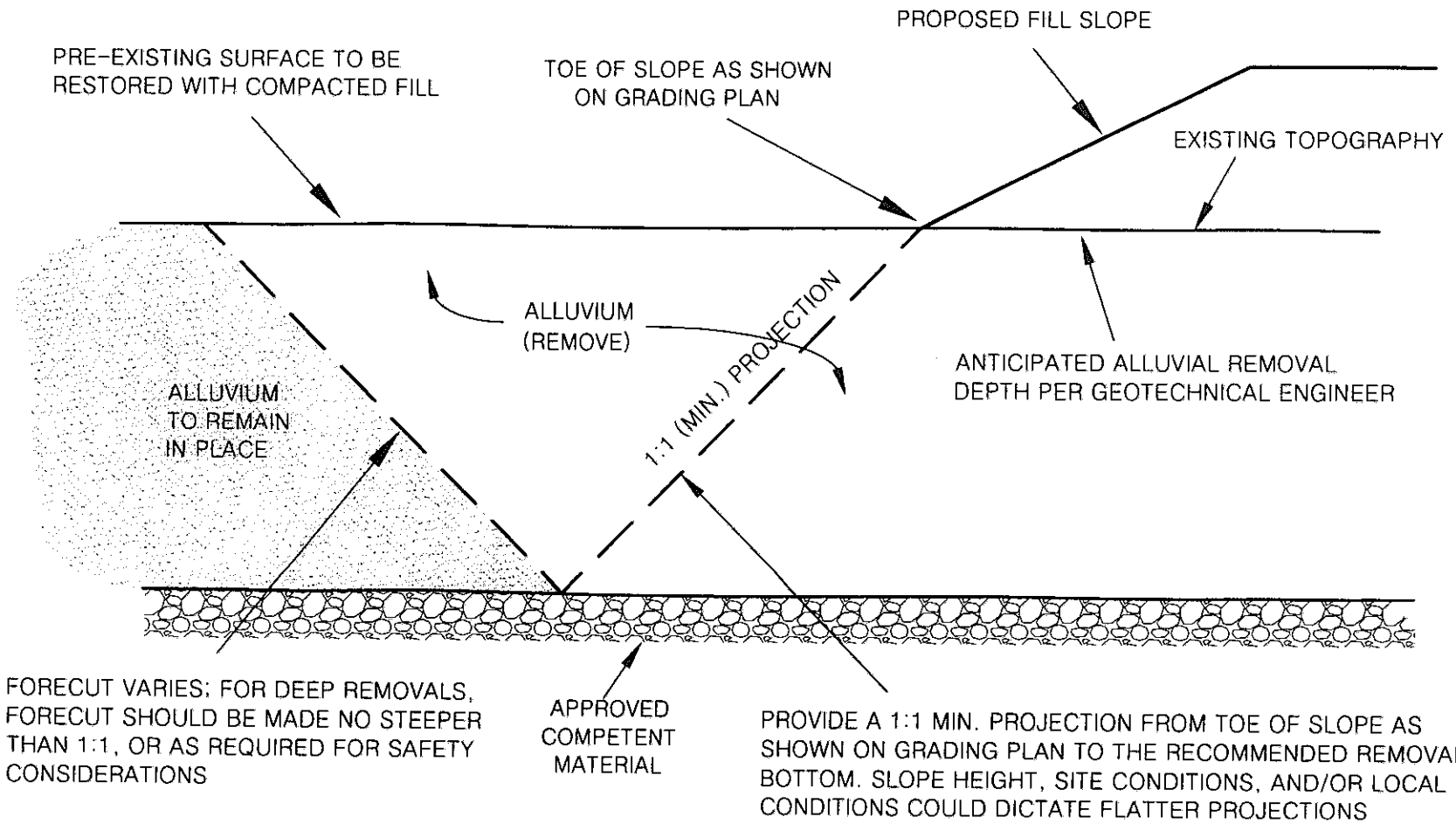
## F. FINISHED SLOPES

All finished cut and fill slopes shall be planted and irrigated and/or protected from erosion in accordance with the project specifications, governing agencies, and/or as recommended by a landscape architect.

# APPENDIX G

## Grading Details

# DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON

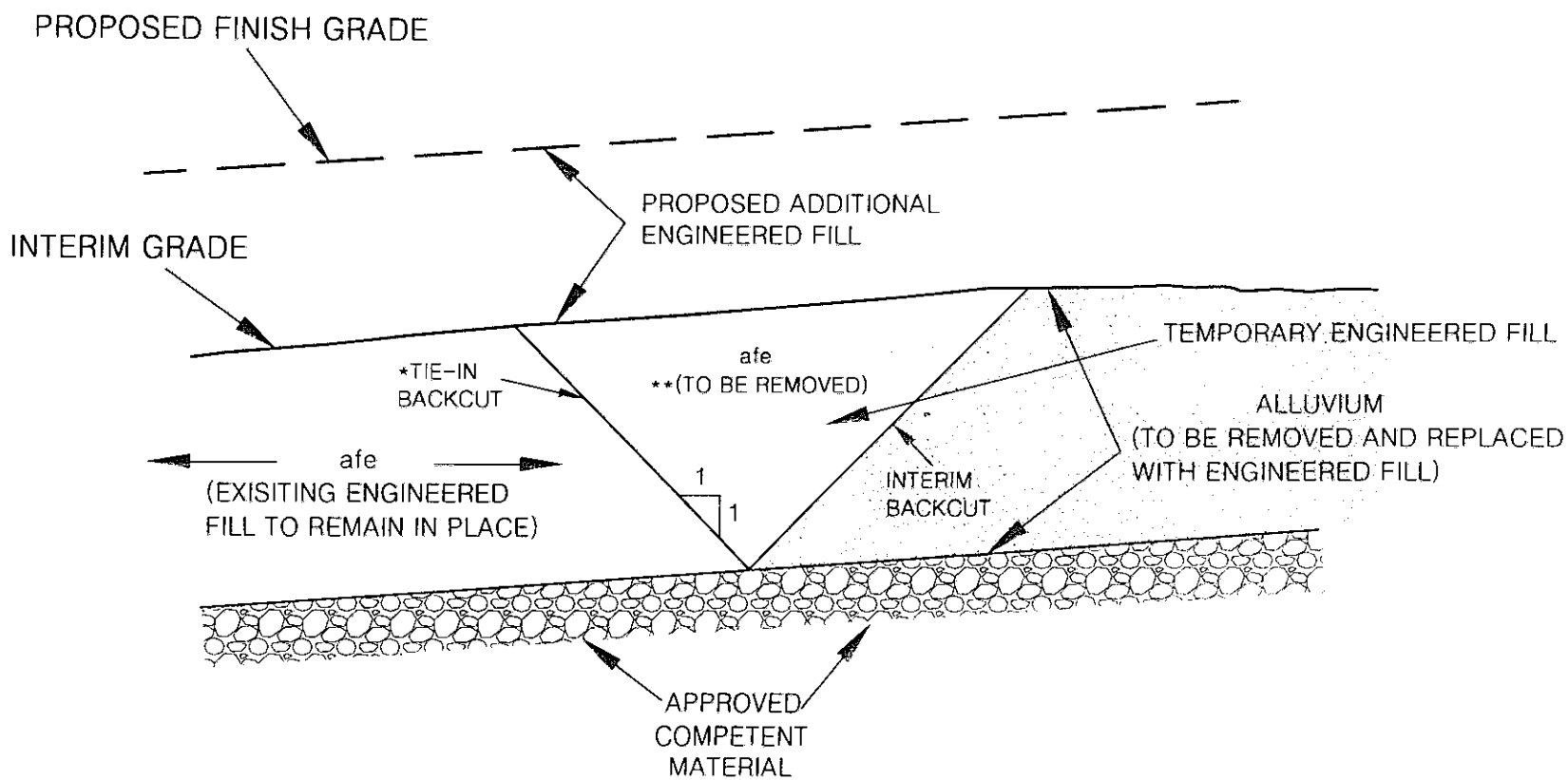



**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/12

PLATE G-1

PATH: C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-1.dwg

# REMOVAL ADJACENT TO EXISTING FILL




*INITIATE 1:1 TIE-IN BACKCUT TO INTERCEPT TOE OF INTERIM BACKCUT

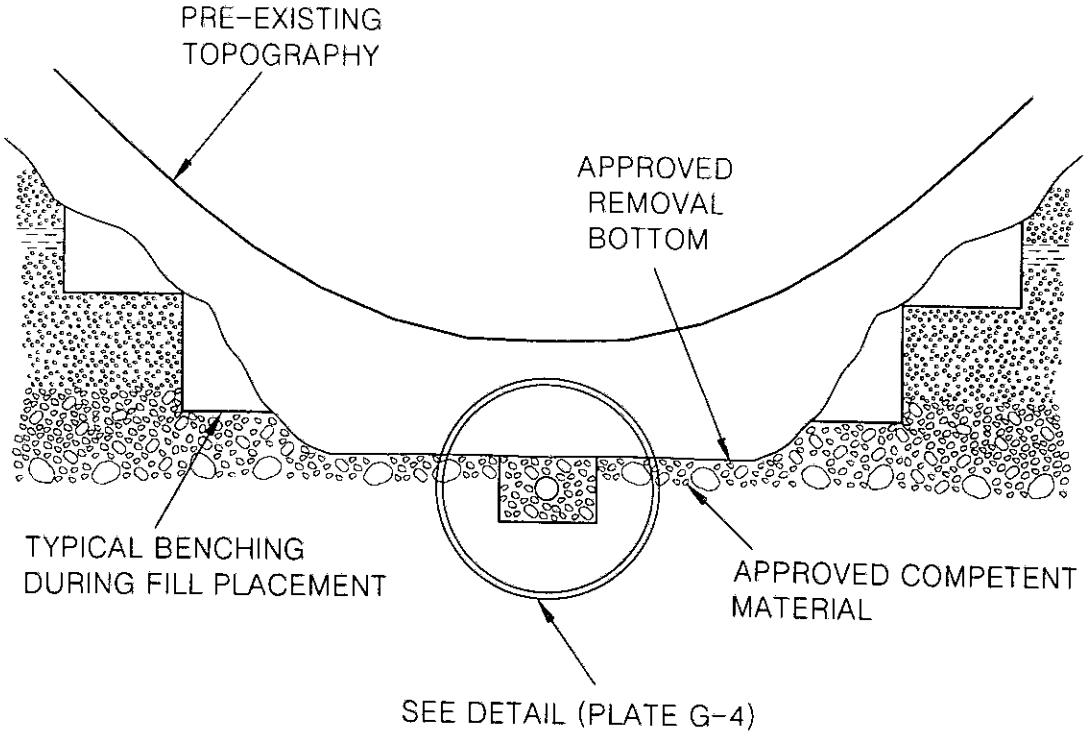
**AS PART OF TIE-IN FOR ADDITIONAL ENGINEERED FILL

ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

PLATE G-2

PATH:C:\Users\Jlnks\Desktop\Drafting\GRADING DETAILS\G-2.dwg

# CANYON SUBDRAIN

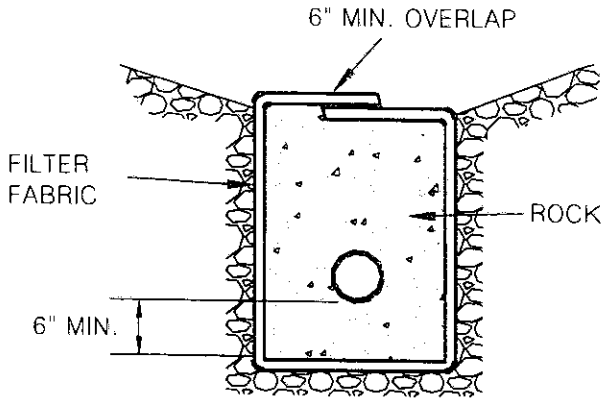



ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

PLATE G-3

PATH: C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-3.dwg

# CANYON SUBDRAIN DETAIL




PERFORATED PIPE SURROUNDED WITH ROCK AND FILTER FABRIC

ROCK: MIN. VOLUME OF 9 CU.FT. PER LINEAR FT. OF 3/4 IN. MAX. ROCK

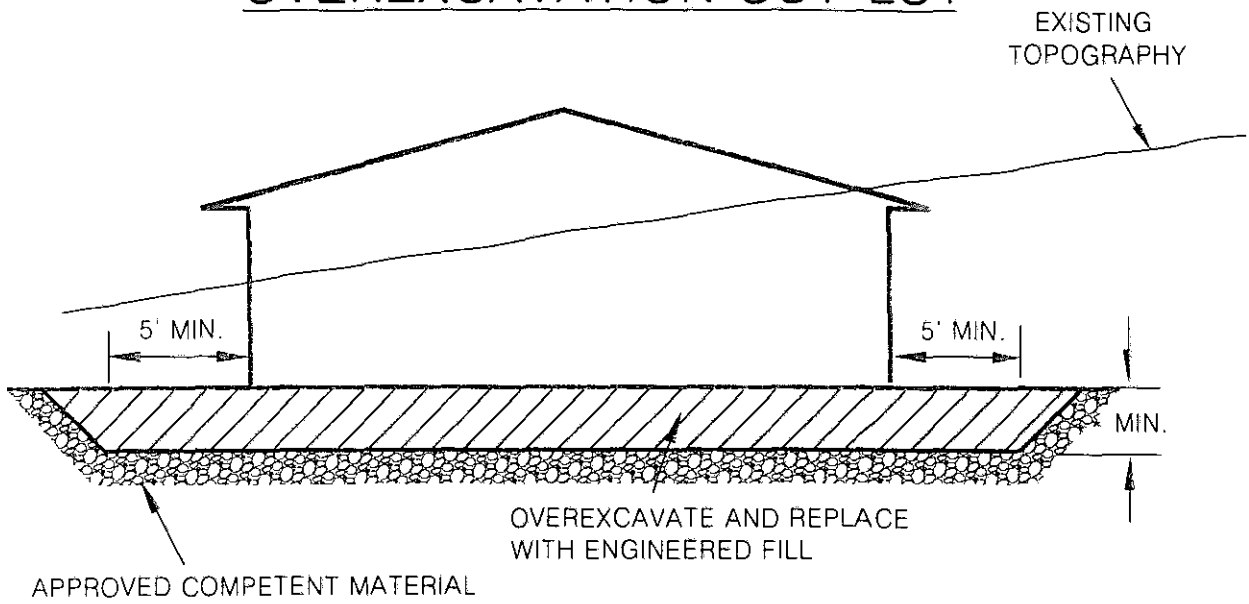
PIPE: 6 IN. ABS OR PVC PIPE WITH A MINIMUM OF 8 PERFORATIONS (1/4-IN. DIA.) PER LINEAL FT. IN BOTTOM HALF OF PIPE ASTM D2751, SDR 35, OR ASTM D3034 OR ASTM D1527, SCHD. 40 ASTM D1785, SCHD. 40

FILTER FABRIC: MIRAFI 140 FILTER FABRIC OR APPROVED EQUIVALENT

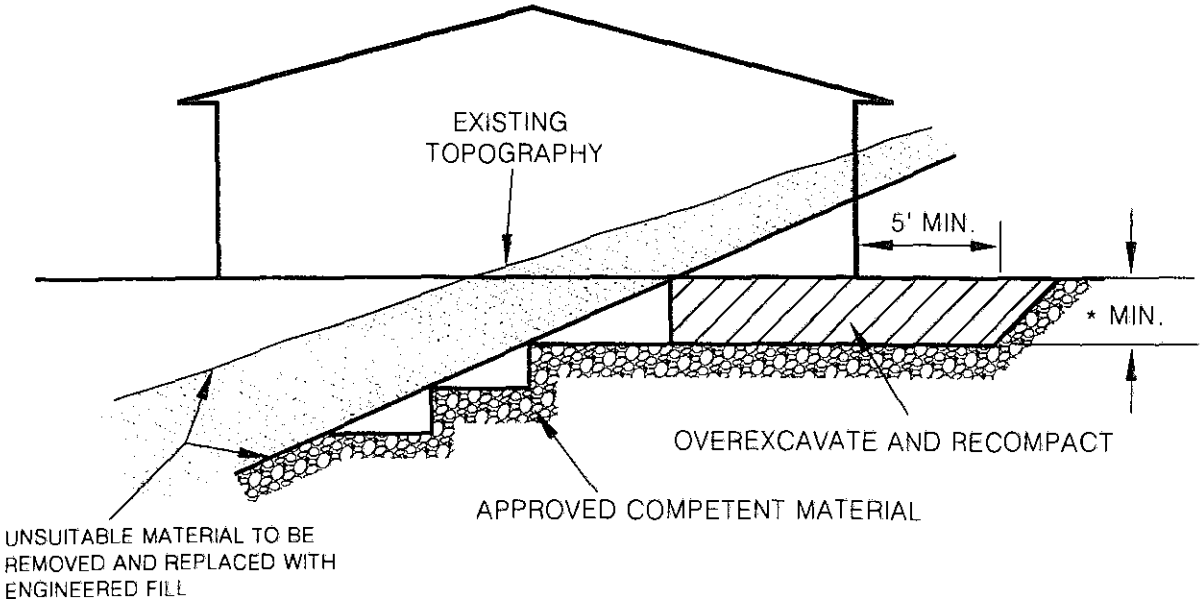
NOTES:

1. FOR CONTINUOUS RUN IN EXCESS OF 500. FT USE 8 IN. DIA. PIPE
2. ENGINEERED FILL PLACED BELOW DRAINS SHALL BE COMPACTED TO 93% OF THE LABORATORY MAXIMUM DRY DENSITY (ASTM:D1557)

# OVEREXCAVATION CUT LOT




# CUT-FILL LOT (TRANSITION)




*NOTE ALL BUILDING PADS SHALL BE OVER EXCAVATED TO A MINIMUM OF ⅓ OF THE MAXIMUM DEPTH OF FILL BELOW THE BUILDING PAD TO A MAXIMUM OF 17 FEET (SEE PLATE G-16)

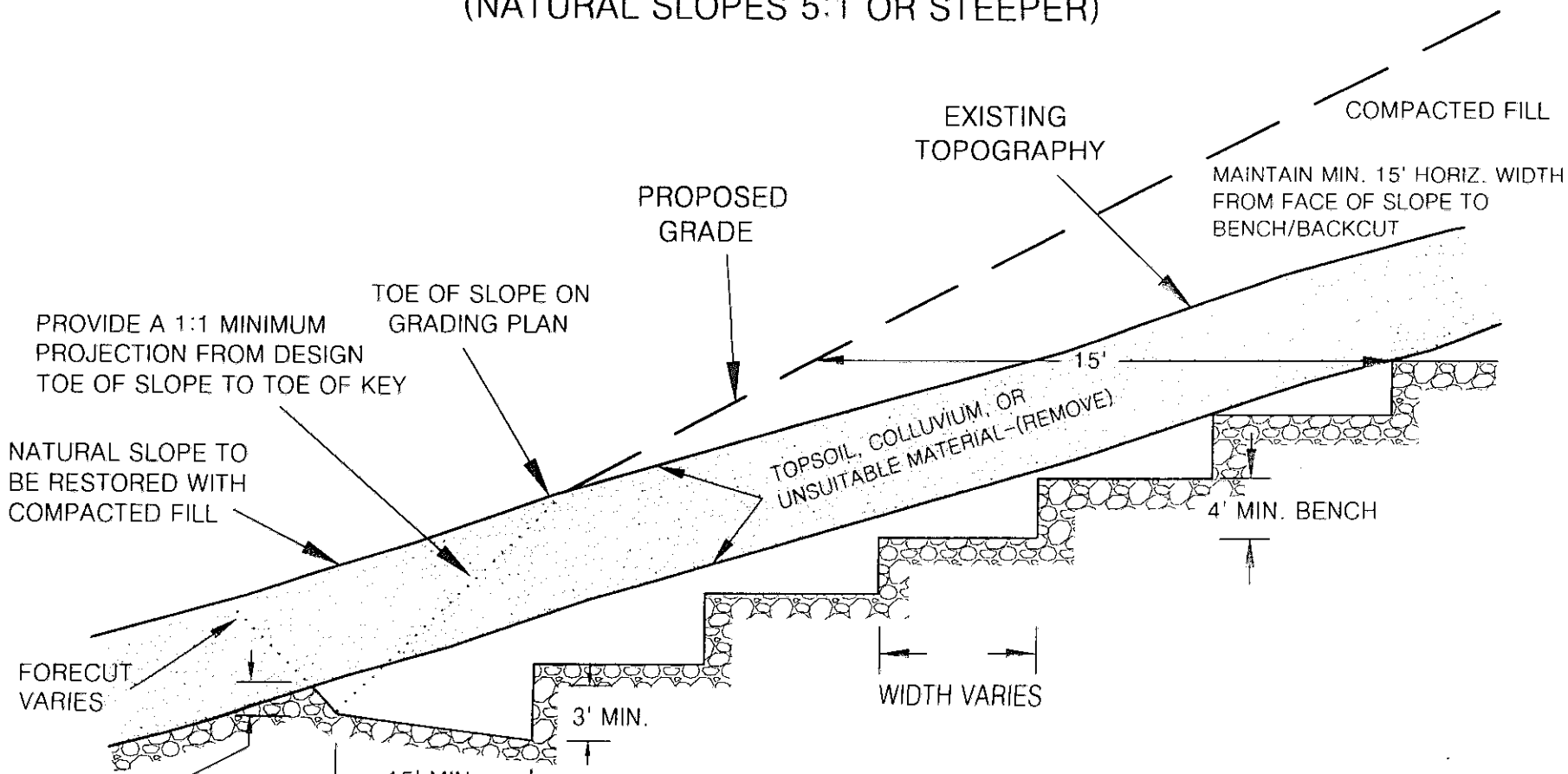
**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/12

PLATE G-5

PATH: C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-5.dwg

# SIDE HILL SLOPE FILL DETAIL

## (NATURAL SLOPES 5:1 OR STEEPER)




NOTES:

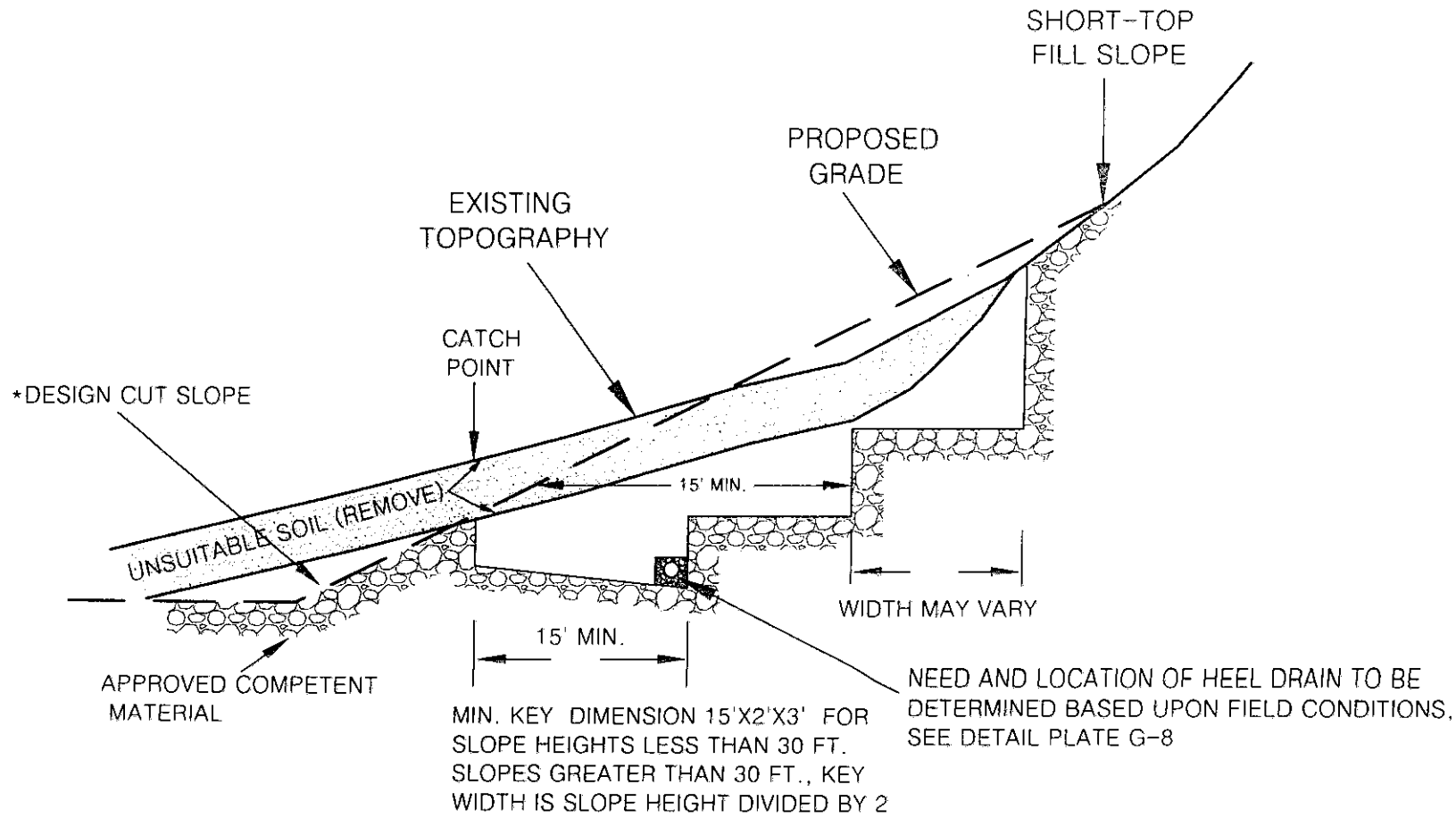
1. WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, SEE PLATE G-1. WHERE THE NATURAL SLOPE APPROACHES OR EXCEEDS THE DESIGN SLOPE RATIO, SPECIAL RECOMMENDATIONS WILL BE PROVIDED BY THE GEOTECHNICAL ENGINEER.
2. THE NEED FOR AND PLACEMENT OF DRAINS WILL BE DETERMINED BY THE GEOTECHNICAL ENGINEER OR GEOLOGIST BASED UPON EXPOSED FIELD CONDITIONS.

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 1/18

PLATE G-6

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-6.dwg

# FILL OVER CUT SLOPE DETAIL




*THE CUT PORTION OF THE SLOPE SHOULD BE EXCAVATED AND EVALUATED BY THE ENGINEERING GEOLOGIST/GEOTECHNICAL ENGINEER PRIOR TO CONSTRUCTING THE FILL SLOPE

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 1/18

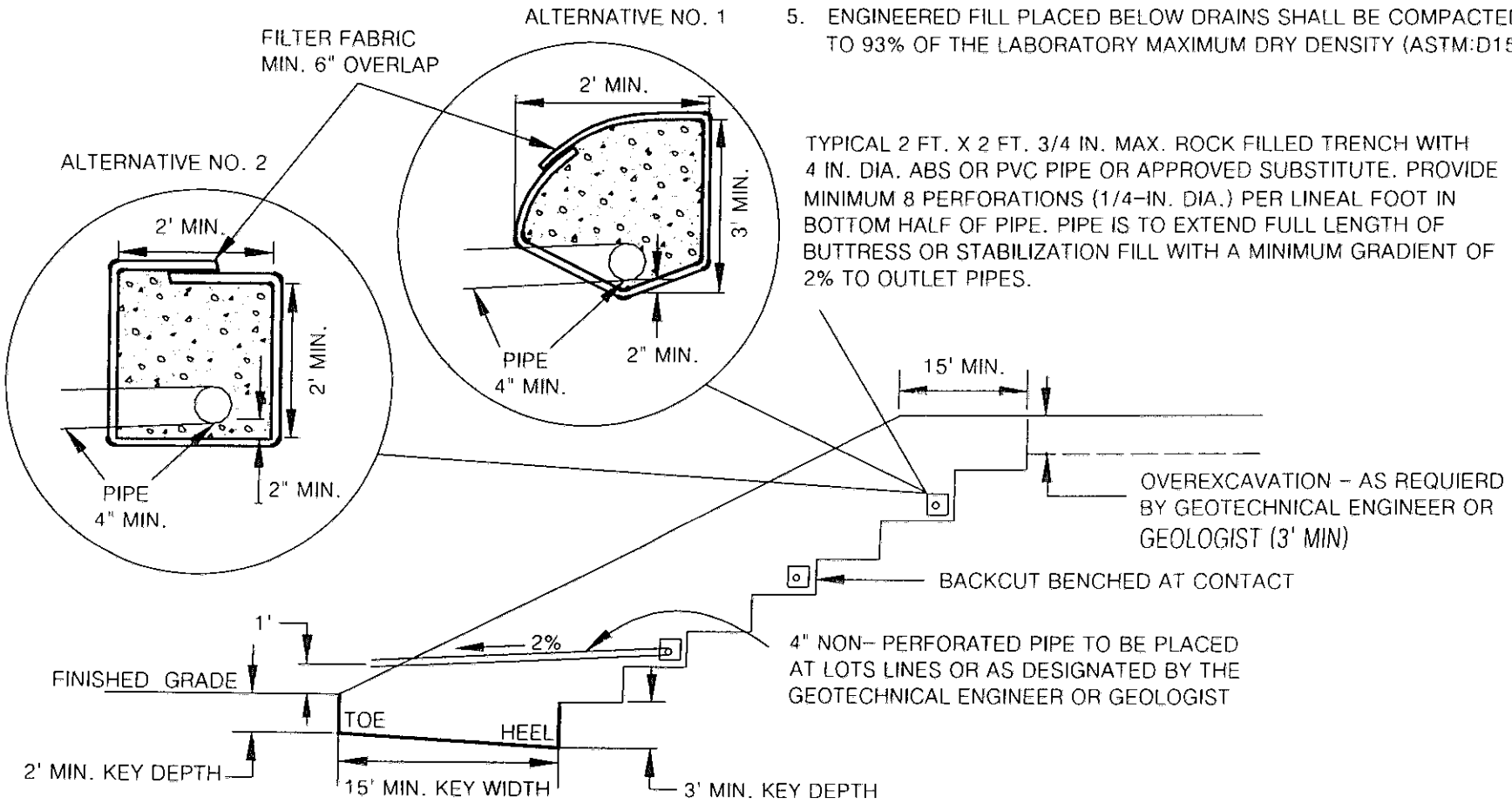
PLATE G-7

PATH: C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-7 (Tom 10-6-17).dwg

# STABILIZATION/BUTTRESS FILL BACKDRAIN

NOTE:

1. ASTM D2751, SDR 35, OR ASTM D3034 OR ASTM D1527, SCHD. 40 ASTM D1785, SCHD. 40
2. SOLID PIPE OUTLETS TO BE PROVIDED EVERY 100 FT. AND JOINED TO PERFORATED BACKDRAIN PIPE WITH "L" OR "T"s. MIN. 2% GRADIENT.
3. GRAVEL TRENCH TO BE FILLED WITH 3/4 IN. MAXIMUM ROCK
4. THE NECESSITY FOR UPPER TIER BACKDRAINS SHALL BE DETERMINED IN THE FIELD BY THE GEOTECHNICAL ENGINEER OR GEOLOGIST. UPPER TIER OUTLETS SHOULD DRAIN INTO PAVED TERRACE DRAINS.
5. ENGINEERED FILL PLACED BELOW DRAINS SHALL BE COMPACTED TO 93% OF THE LABORATORY MAXIMUM DRY DENSITY (ASTM:D1557)



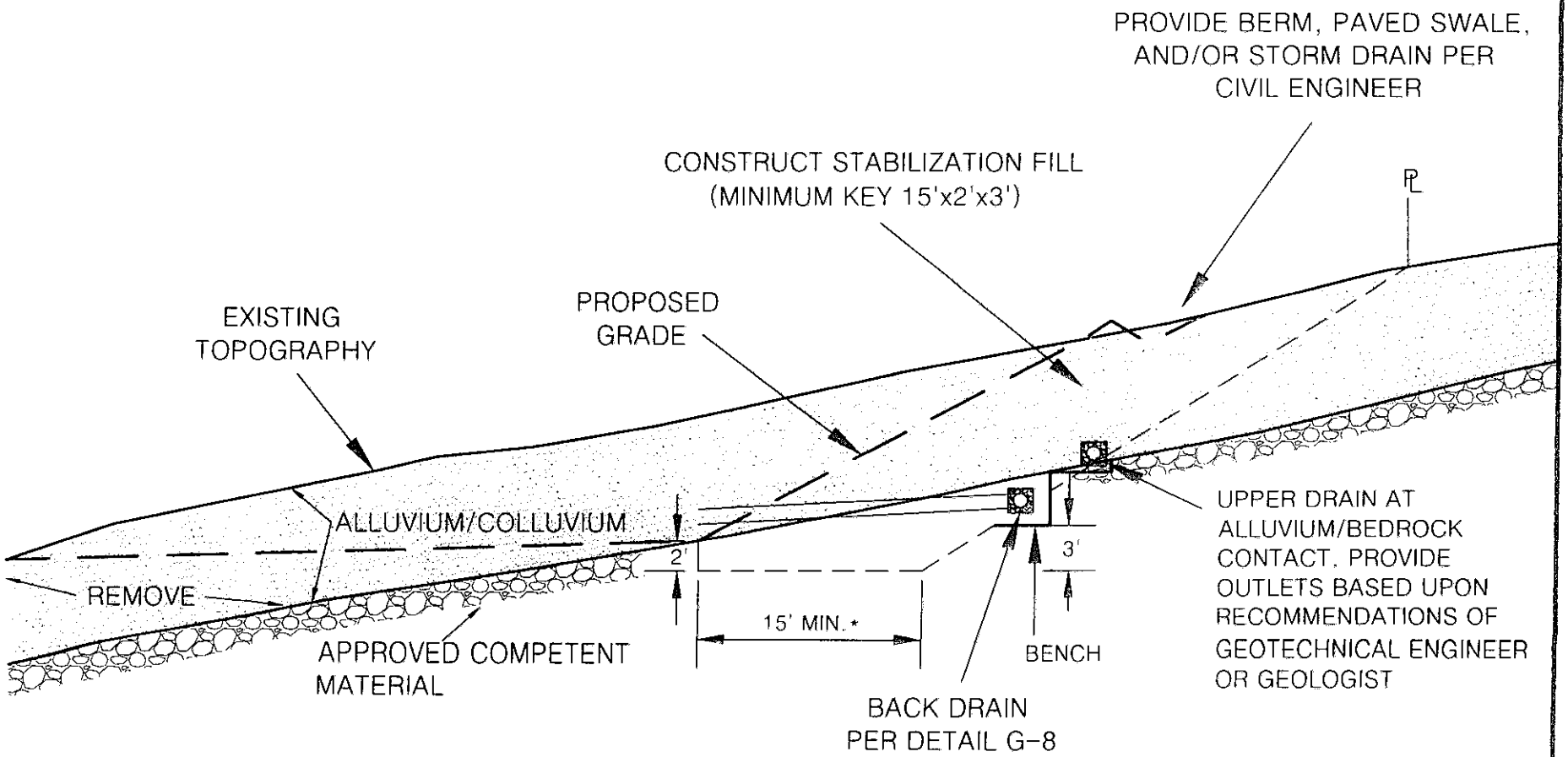

TYPICAL 2 FT. X 2 FT. 3/4 IN. MAX. ROCK FILLED TRENCH WITH 4 IN. DIA. ABS OR PVC PIPE OR APPROVED SUBSTITUTE. PROVIDE MINIMUM 8 PERFORATIONS (1/4-IN. DIA.) PER LINEAL FOOT IN BOTTOM HALF OF PIPE. PIPE IS TO EXTEND FULL LENGTH OF BUTTRESS OR STABILIZATION FILL WITH A MINIMUM GRADIENT OF 2% TO OUTLET PIPES.

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/12

PLATE G-8

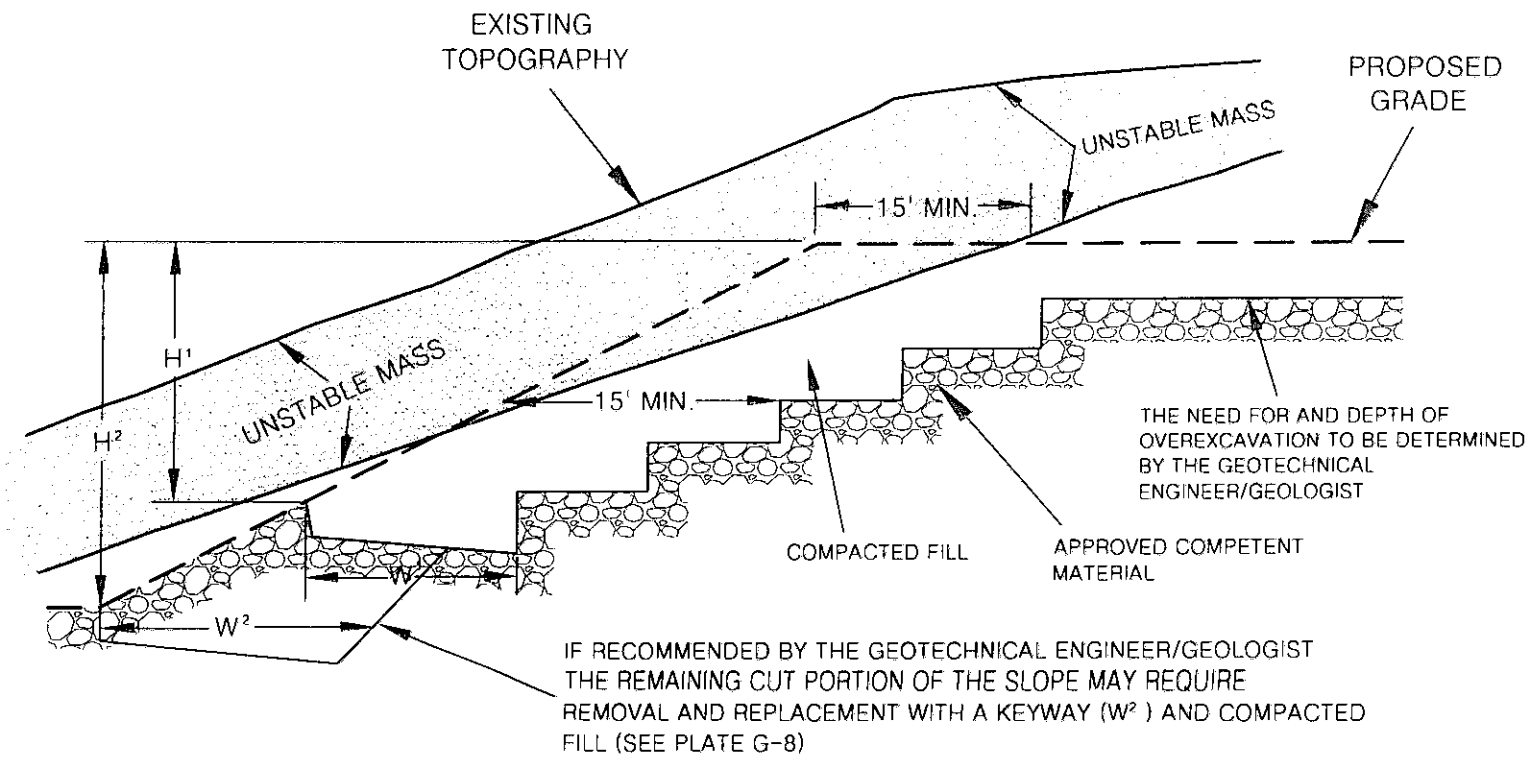
PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-8.dwg

# STABILIZATION FILL
## (UPSLOPE ALLUVIATED AREA)




* FOR SLOPE HEIGHTS LESS THAN 30 FT. SLOPES GREATER THAN 30 FT., KEY WIDTH IS SLOPE HEIGHT DIVIDED BY 2

# SELECTIVE GRADING DETAIL FOR STABILIZATION FILL
# UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE




NOTES:

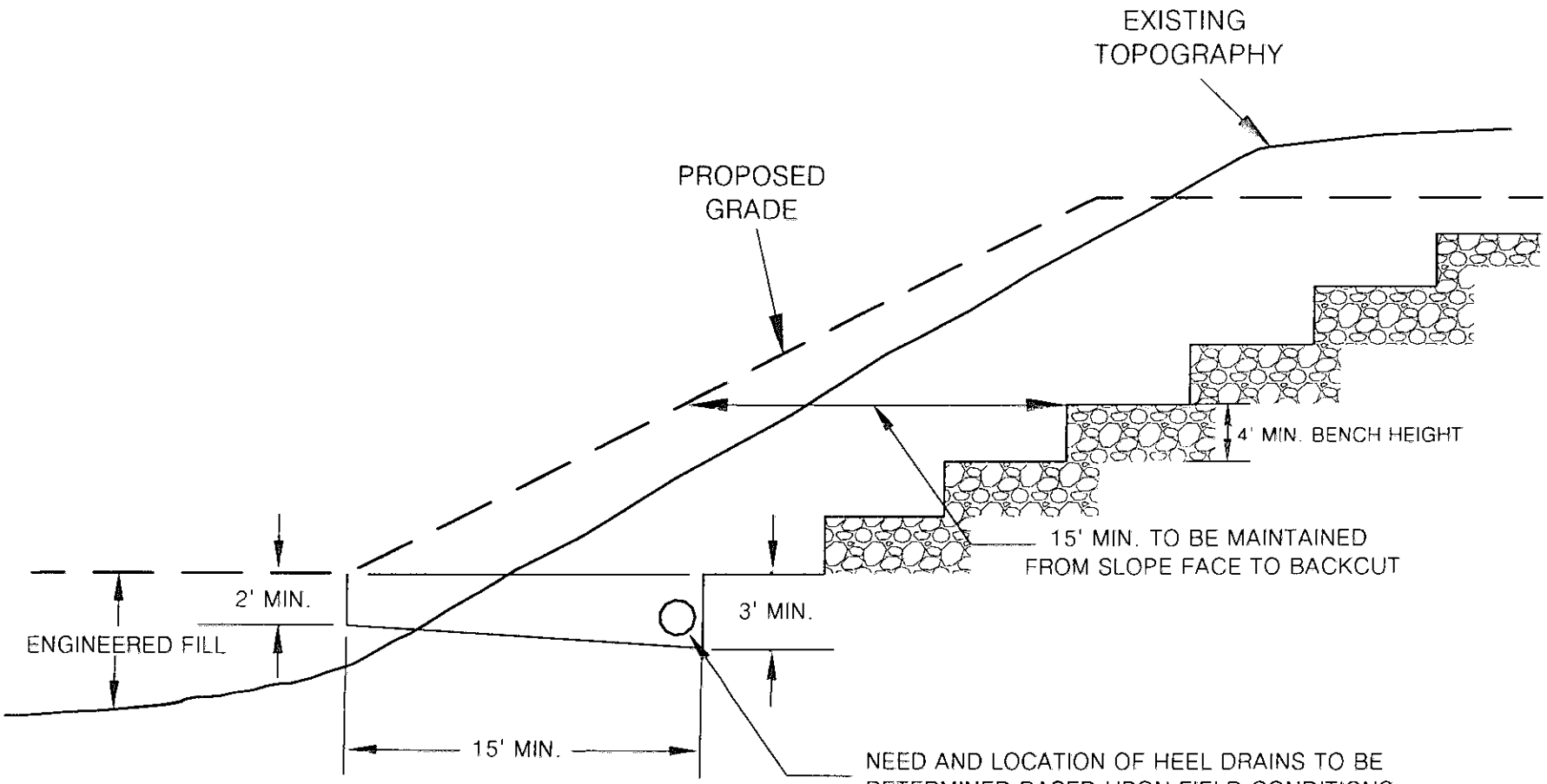
1. BACKDRAINS ARE NOT REQUIRED UNLESS SPECIFIED.
2. "W" SHALL BE EQUIPMENT WIDTH (15') FOR SLOPE HEIGHT LESS THAN 25 FEET. FOR SLOPES GREATER THAN 25 FEET, "W" SHALL BE DETERMINED BY THE PROJECT GEOTECHNICAL ENGINEER/GEOLOGIST. AT NO TIME SHALL "W" BE LESS THAN H/2.

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/12

PLATE G-10

PATH: C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-10.dwg

# SKIN FILL SLOPE OVER NATURAL GROUND



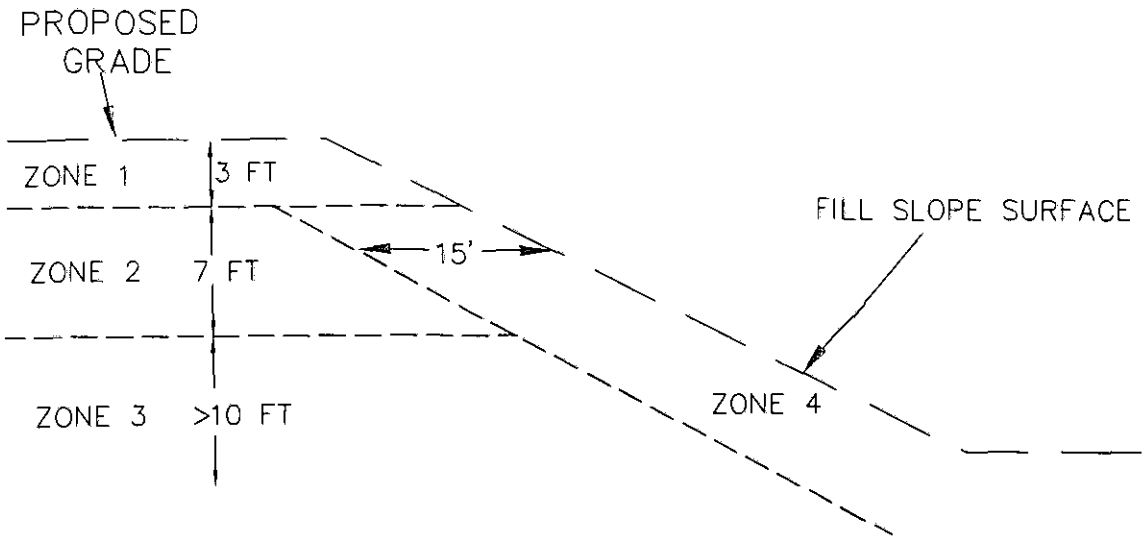

MIN. KEY DIMENSIONS 15'X2'X3' FOR SLOPE HEIGHTS LESS THAN 30 FT. SLOPES GREATER THAN 30 FT., KEY WIDTH IS SLOPE HEIGHT DIVIDED BY 2

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 1/18

PLATE G-11

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-11.dwg

# DETAIL FOR MAXIMUM PARTICLE DIMENSION




| ZONE | DEPTH | PARTICLE MAX. DIMENSION | PLACEMENT METHOD |
|---|---|---|---|
| 1 | 0-3 ft. | ≤1.0 ft. | STANDARD OR CONVENTIONAL COMPACTION METHODS (SEE EARTHWORK SPECIFICATIONS) |
| 2 | 3-10 ft. | ≤2.0 ft. | ROCK BLANKETS (SEE PLATE G-13) |
| 3 | >10 ft. | ≤8.0 ft. | ROCK BLANKETS (PLATE G-13)<br>ROCK WINDROW (PLATE G-14)<br>INDIVIDUAL ROCK BURIED (PLATE G-15) |
| 4 | 15 HORIZONTAL FEET FROM FILL SLOPE FACE | ≤1.0 ft. | STANDARD OR CONVENTIONAL COMPACTION METHODS (SEE EARTHWORK SPECIFICATIONS) |

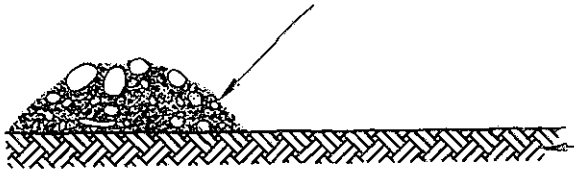
**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 2/15

PLATE G-12

PATH: C:\Users\scott\Dropbox (Alta CA Geotechnical)\Alta Server\To Jinks\Drafting\GRADING DETAILS\G-12.dwg

# ROCK BLANKET DETAILS

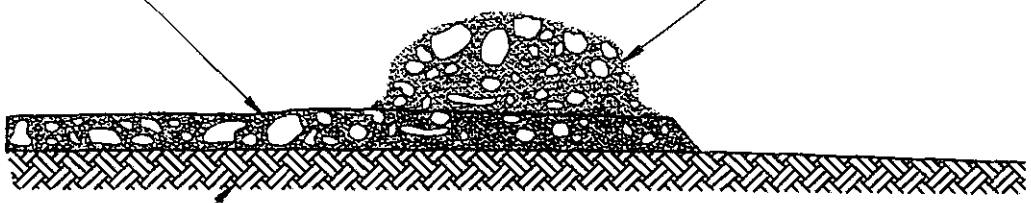
LOOSE PILE 1
LOOSE, DUMPED ROCK, GRAVEL AND SAND MIXTURE REMOVE FRAGMENTS LARGER THAT 2 FEET FOR ISOLATED BURIAL (PLATE G-15) OR WINDROW (PLATE G-10)



APPROVED BOTTOM, OR TOP OF PREVIOUSLY APPROVED BLANKET FILL

COMPACT PILE 1
SPREAD LOOSE PILE FORWARD WITH HEAVY TRACKED DOZER (D-8 OR LARGER). HEAVILY WATER, TRACK, AND APPLY ADDITIONAL SAND AND GRAVEL AS NECESSARY TO FILL VOIDS AND CREATE A DENSE MATRIX OF ROCK, COBBLES, GRAVEL AND SAND (2 FOOT MAXIMUM THICKNESS)

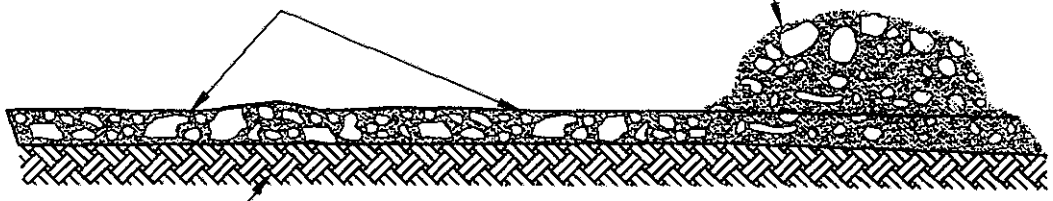
LOOSE PILE 2
DUMP SUCCESSIVE PILES OF LOOSE ROCK, GRAVEL AND SAND MIXTURE ON FORWARD EDGE OF PREVIOUSLY COMPACTED LIFT WITH TRUCKS AND/OR SCRAPERS. USE PREVIOUS LIFT TO ACCESS AND FURTHER COMPACT PILE 1.



APPROVED BOTTOM, OR TOP OF PREVIOUSLY APPROVED BLANKET FILL

LOOSE PILE 3
DUMP SUCCESSIVE PILES OF LOOSE ROCK, GRAVEL AND SAND MIXTURE ON FORWARD EDGE OF PREVIOUSLY COMPACTED LIFT WITH TRUCKS AND/OR SCRAPERS. USE PREVIOUS LIFT TO ACCESS AND FURTHER COMPACT EXISTING BLANKET.

COMPACTED PILES 1 AND 2



APPROVED BOTTOM, OR TOP OF PREVIOUSLY APPROVED BLANKET FILL

OBSERVATION TESTING AND APPROVAL PROCEDURES

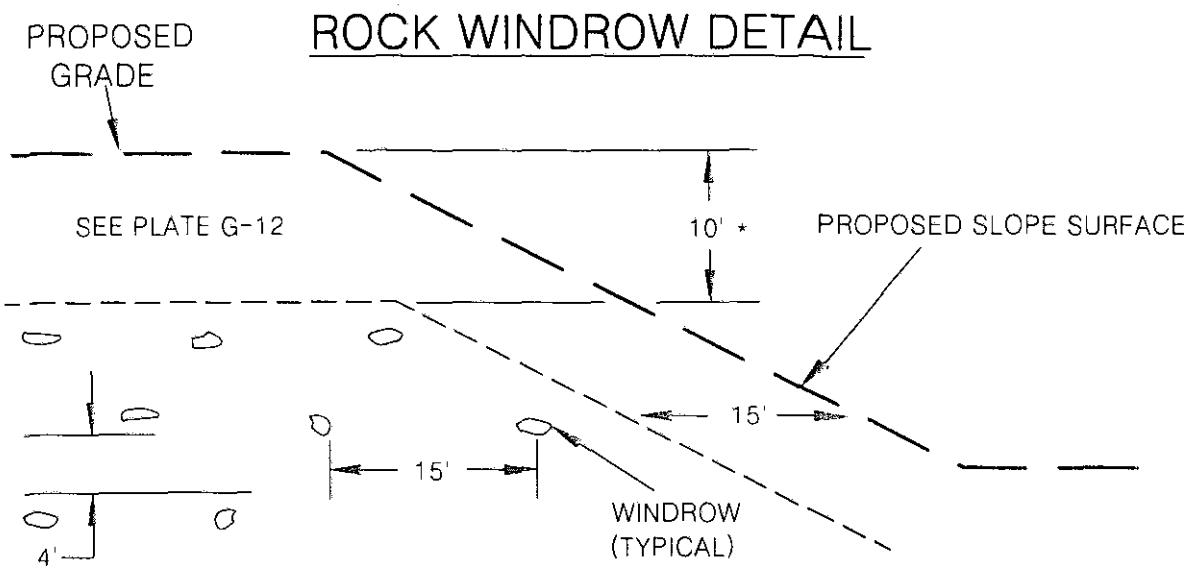
OBSERVE EQUIPMENT. SCRAPERS AND TRUCKS SHOULD BE FULLY SUPPORTED ON BLANKET WITHOUT SIGNIFICANT YIELDING. EXCAVATE TEST/OBSERVATION PITS TO CONFIRM EXISTENCE OF MIXTURE OF VARIOUS PARTICLE SIZES, WITHOUT SIGNIFICANT VOIDS, AND FORMING A DENSE, COMPACTED FILL MATRIX. TEST BY ASTM D1556, D2922 AND/OR D3017 WHEN APPROPRIATE. RECORD LIMITS AND ELEVATION OF BLANKET. ALL FILL AND COMPACTION OPERATIONS TO BE CONDUCTED UNDER THE OBSERVATION OF THE GEOTECHNICAL ENGINEER. SUBSEQUENT LIFTS TO BE APPLIED ONLY AFTER OBSERVATION AND CONFIRMATION OF SUITABILITY OF FILL AND RELEASE BY THE GEOTECHNICAL ENGINEER. BLANKETS TO BE CONSTRUCTED IN ACCORDANCE WITH PLATE G-12.

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
**VER. 3/12**

PLATE G-13

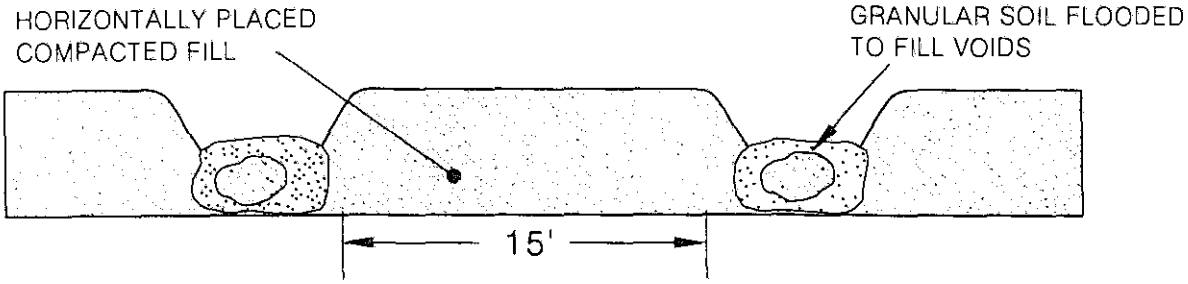
**PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-13.dwg**

# ROCK WINDROW DETAIL



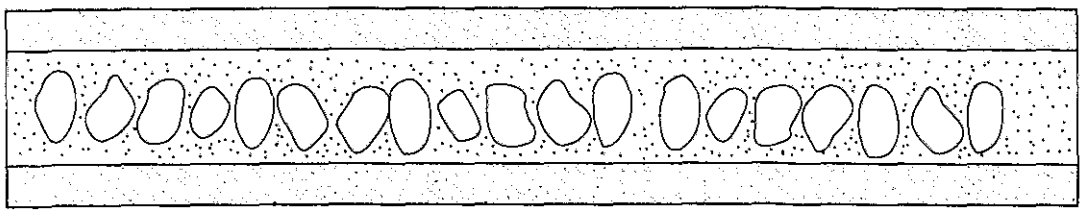

NOTE: OVERSIZED MATERIAL SHOULD BE REMOVED FROM THE 15' CLEAR ZONES WITH SPECIAL EQUIPMENT, SUCH AS A ROCK RAKE, PRIOR TO PLACING THE NEXT FILL LIFT.
*VARIANCES TO THE ABOVE ROCK HOLD DOWN MAY BE GRANTED SUBJECT TO APPROVAL BY THE OWNER, GEOTECHNICAL ENGINEER, AND GOVERNING AGENCY

# TYPICAL WINDROW DETAIL (END VIEW)




NOTE: COMPACTED FILL SHALL BE BROUGHT UP TO A HIGHER ELEVATION ALONG EACH WINDROW SO GRANULAR SOIL CAN BE FLOODED IN A "TRENCH CONDITION".

# PROFILE VIEW

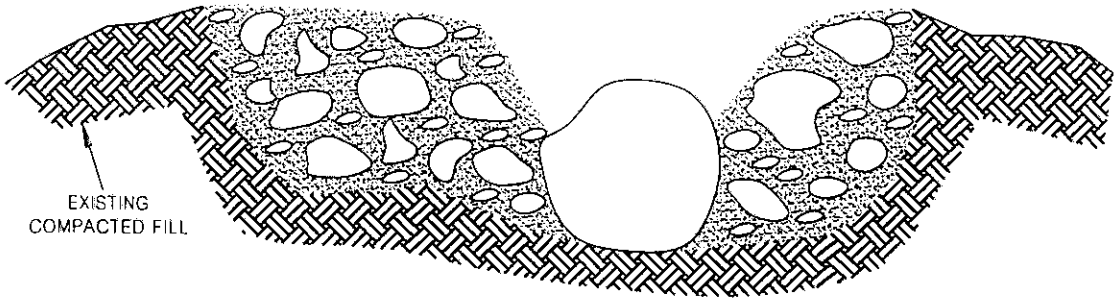


ALTA CALIFORNIA GEOTECHNICAL, INC.
VER. 3/12

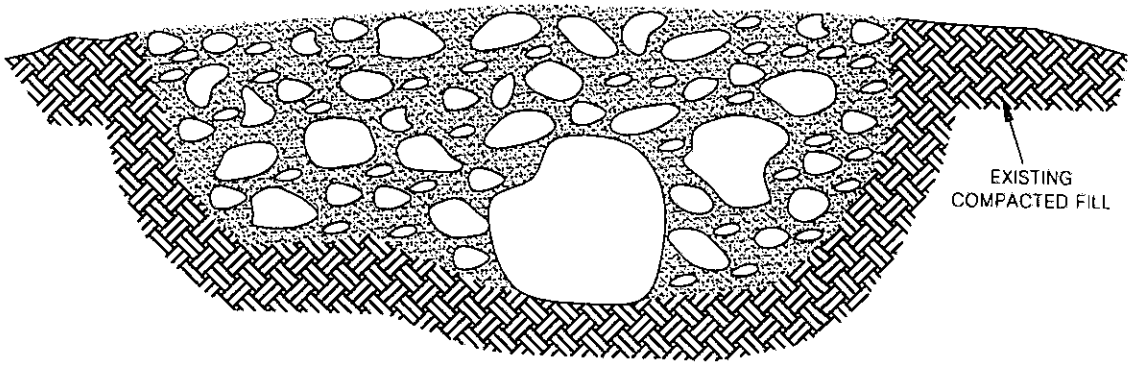
PLATE G-14

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-14.dwg

# ISOLATED ROCK BURIAL DETAILS

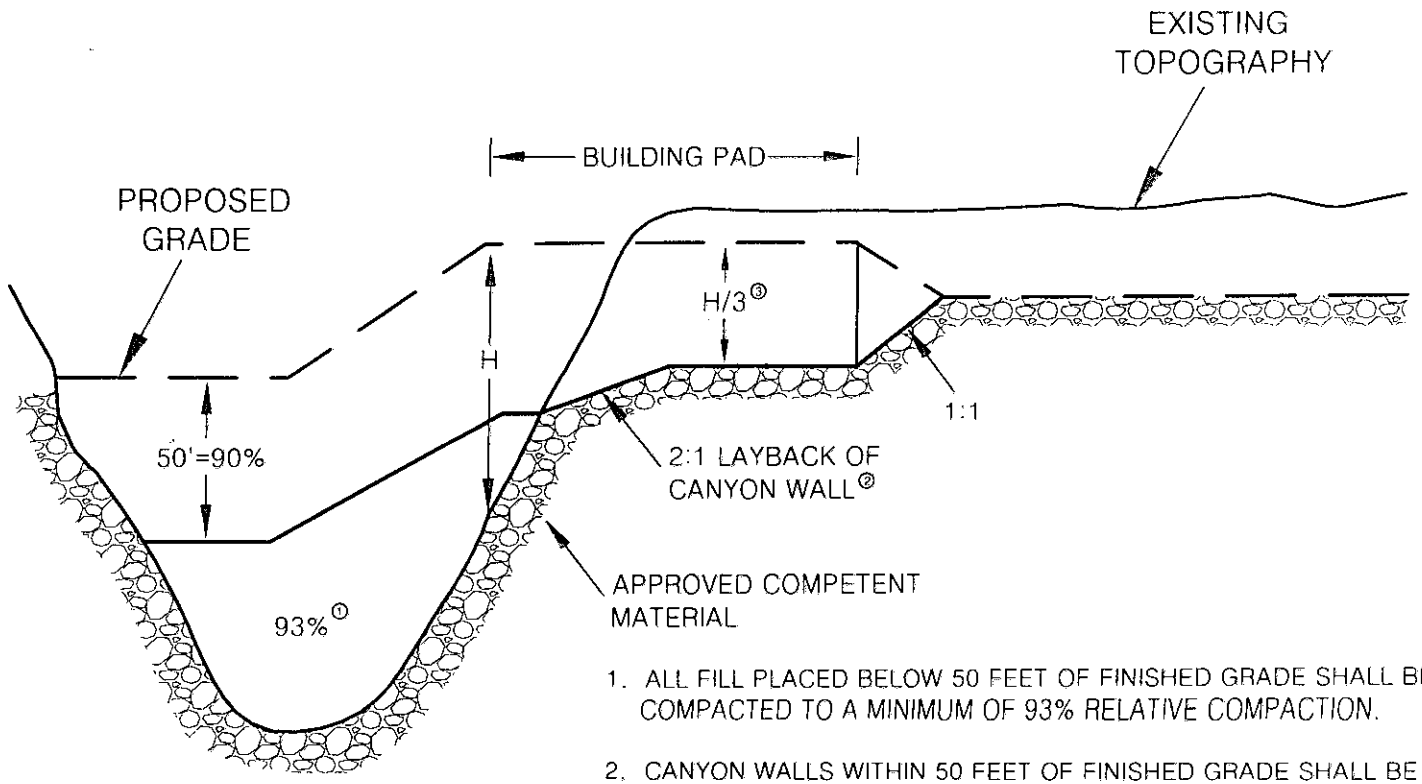



EXCAVATE HOLE INTO EXISTING FILL PRISM, PLACE BOULDER (< 8 feet in maximum dimension) INTO EXISTING COMPACTED FILL. SURROUND WITH SAND, GRAVEL, COBBLES AND WATER HEAVILY. TRACK WITH D8 OR LARGER EQUIPMENT UNTIL RESULTING FILL FULLY SUPPORTS EQUIPMENT. OBSERVE AND/OR TEST IN ACCORDANCE WITH ASTM D1556, D2922 OR D3017. ROCKS LARGER THAN 8 FEET SHALL BE FURTHER REDUCED IN SIZE BY SECONDARY BREAKING.



# RELATIVE COMPACTION VS. DEPTH

## CANYON WALL LAY BACK
## DIFFERENTIAL FILL OVEREXCAVATION DETAILS




1. ALL FILL PLACED BELOW 50 FEET OF FINISHED GRADE SHALL BE COMPACTED TO A MINIMUM OF 93% RELATIVE COMPACTION.

2. CANYON WALLS WITHIN 50 FEET OF FINISHED GRADE SHALL BE LAID BACK TO A SLOPE RATIO OF 2:1 OR FLATTER.

3. ALL BUILDING PADS SHALL BE OVER EXCAVATED TO A MINIMUM OF 1/3 OF THE MAXIMUM DEPTH OF FILL BELOW THE BUILDING PAD TO A MAXIMUM OF 17 FEET.

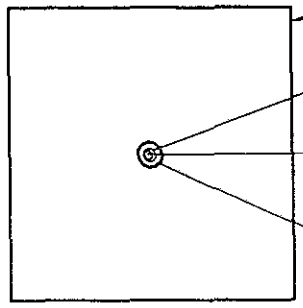
4. IF THE 2:1 LAY BACK OF THE CANYON WALL IS IMPRACTICAL, THEN AS AN ALTERNATIVE THE INCREASED COMPACTION STANDARDS IN NOTE 1 SHOULD BE EXTENDED UP TO H/3 AND THE LAY BACK WILL NOT BE REQUIRED.

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/12

PLATE G-16

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-16.dwg

# SETTLEMENT PLATE DETAIL

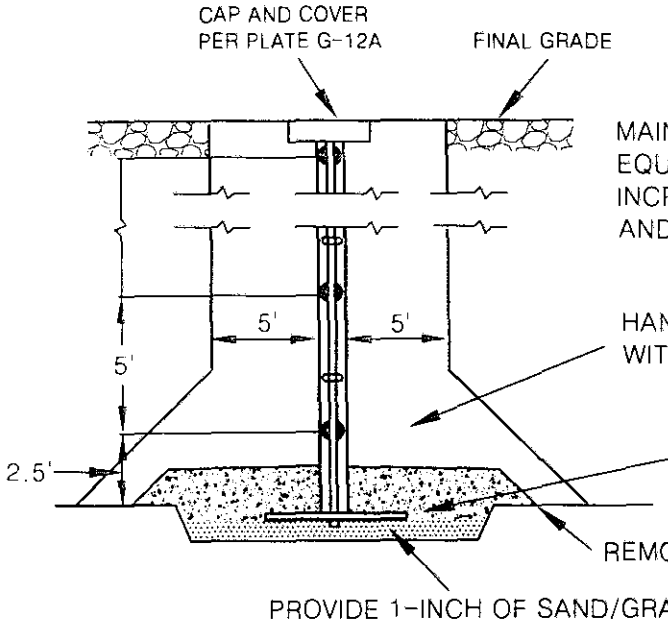


2'X2' X 1/4" STEEL PLATE

STANDARD 3/4" PIPE NIPPLE, WELDED TOP AND UNDERSIDE OF PLATE.

3/4" DIA. X 5' LONG GALVANIZED PIPE, STANDARD PIPE THREADS TOP AND BOTTOM. EXTENSIONS THREADED BOTH ENDS AND ADDED IN 5' INCREMENTS.

3" DIA. SCHEDULE 40 PVC, ADD IN 5' INCREMENTS, GLUE JOINTS.




NOTES:

1) LOCATIONS OF SETTLEMENT PLATES SHALL BE CLEARLY MARKED AND READILY VISIBLE (RED FLAGGED) TO EQUIPMENT OPERATORS.

2) CONTRACTOR SHALL MAINTAIN 10' HORIZONTAL CLEARANCE FOR HEAVY EQUIPMENT WITHIN 5' (VERTICAL) OF PLATE BASE. FILL WITHIN CLEARANCE AREA SHALL BE HAND COMPACTED TO PROJECT SPECIFICATIONS OR COMPACTED BY ALTERNATIVE APPROVED BY THE GEOTECHNICAL ENGINEER.

3) AFTER 5' (VERTICAL) OF FILL IS IN PLACE, CONTRACTOR SHALL MAINTAIN 5' HORIZONTAL EQUIPMENT CLEARANCE. FILL IN CLEARANCE AREA SHALL BE HAND COMPACTED (OR APPROVED ALTERNATIVE) IN VERTICAL INCREMENTS NOT TO EXCEED 2 FEET.

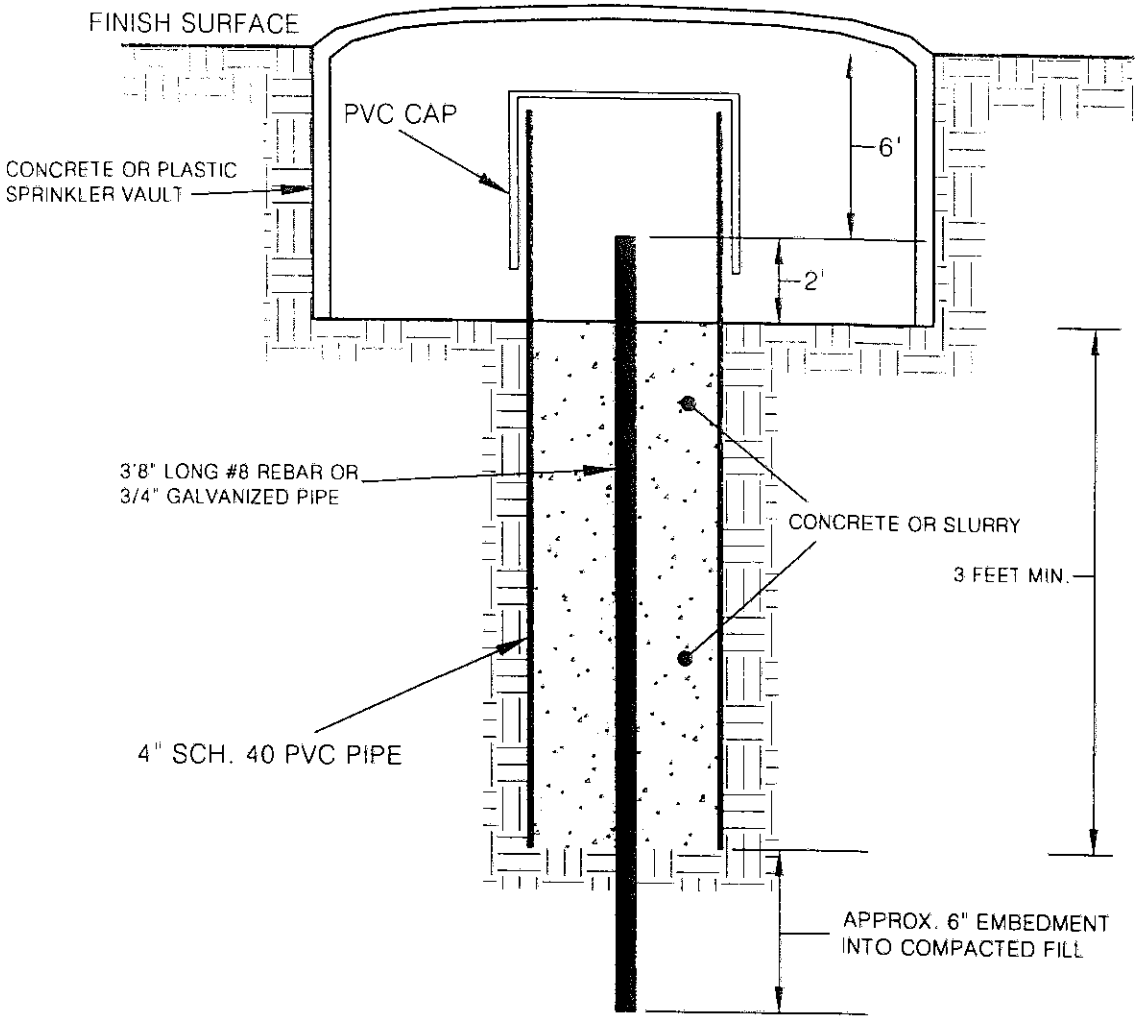
4) IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE OR EXTENSION RESULTING FROM EQUIPMENT OPERATING WITHIN PRESCRIBED CLEARANCE AREA, CONTRACTOR SHALL IMMEDIATELY NOTIFY GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATE AND EXTENSION RODS TO WORKING ORDER.

**ALTA CALIFORNIA GEOTECHNICAL, INC .**
VER. 3/12

PLATE G-17

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-17.dwg

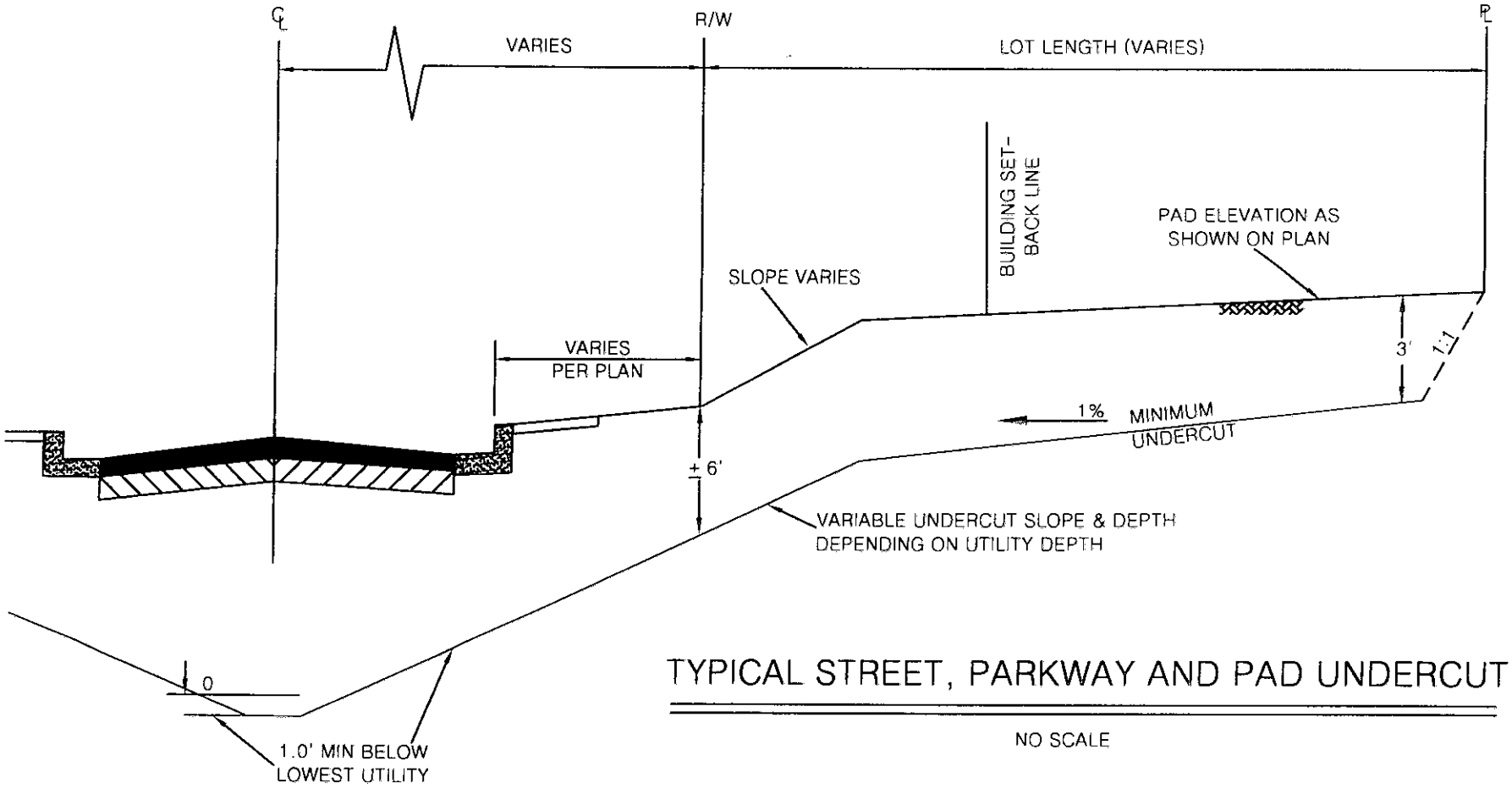
# SURFACE SETTLEMENT MONUMENT DETAIL




**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/12

PLATE G-18

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-18.dwg




# TYPICAL STREET, PARKWAY AND PAD UNDERCUT

NO SCALE

**ALTA CALIFORNIA GEOTECHNICAL, INC.**
VER. 3/13

PLATE G-19

PATH:C:\Users\Jinks\Desktop\Drafting\GRADING DETAILS\G-19.dwg

5261 Arlington Ave | Riverside, CA 92504

0' 50' 100' 200'

SCALE: 1" = 100'

| Unit Mix | Units | % | Space per DU | Parking Spaces Req. |
|---|---|---|---|---|
| 1BR | 128 | 36% | 1.5 | 192 |
| 2BR | 115 | 32% | 2 | 230 |
| 3BR | 117 | 33% | 2 | 234 |
| Total | 360 | 100% | | 656 |

## LEGEND

afu - Artificial Fill-Undocumented

Qyf - Young Alluvial Fan Deposits (Bracketed where Buried)

Qof - Old Alluvial Fan Deposits (Bracketed where Buried)

B-1 - Approx. Location of Boring

P-1 - Approx. Location of Infiltration Test

- Approx. Location of Buried Geologic Contact

| RETAIL TOTAL | Area |
|---|---|
| Pad 1 | 4,460 SF |
| Pad 2 | 11,715 SF |
| Total | 16,175 SF |

| Parking Designation | Parking Spaces |
|---|---|
| Outdoor Walk-Up Residential | 500 |
| Tuck-under Indoor Tandem | 80 |
| Outdoor Tandem | 80 |
| Residential Parking Total | 660 |
| Retail Parking | 96 |
| Total Parking Spaces | 756 |

PLATE 1

ALTA CALIFORNIA GEOTECHNICAL, INC.
170 N. MAPLE STREET, STE 108, CORONA, CA 92880
TELEPHONE: (951)509-7090
PROJECT NUMBER:1-0312 DATE: 2-24-2020

steinberg hart

SERITAGE GROWTH PROPERTIES

RIVERSIDE | YIELD STUDY

SITEPLAN
04.10.2019

ALTA CALIFORNIA
GEOTECHNICAL INC.

170 North Maple Street, Suite 108
Corona, CA 92880
www.altageotechnical.com

**FOULGER-PRATT**
136 Calle de Los Molinos
San Clemente, CA 92672

April 14, 2023
**Project No. 1-0312**

Attention: Mr. Jim Ivory

Subject: ***WQMP SETBACK RECOMMENDATIONS***
Arlington Mixed Use
5261 Arlington Avenue
City of Riverside, California

Reference: Alta California Geotechnical, Inc., 2020, Geotechnical Investigation, 5261 Arlington Avenue, City of Riverside, California, dated February 24, 2020 (Project Number 1-0312).

Dear Mr. Ivory:

Presented herein are Alta California Geotechnical, Inc.'s (Alta) WQMP system setback recommendations for the Arlington Mixed Use project, located at 5261 Arlington Avenue, in the City of Riverside, California. This letter is based on a review of the site plan, review of the proposed modular wetland systems, and the recommendations presented in the referenced report.

It is our understanding that modular wetland systems shall be utilized for WQMP purposes for the subject site, which are bio-treatment systems that do not allow the water to infiltrate into the underlying soils. The site plan indicates these systems shall be placed in close proximity to the proposed structures. From a geotechnical perspective, these systems shall be setback horizontally from the proposed structures such that a 1:1 projection from the bottom of the proposed structure footings extends below the proposed modular systems. Alternatively, footings for the proposed structures can be deepened to provide the recommended projection.

Alta California Geotechnical, Inc. appreciates the opportunity to be of service to you and your organization. Should you have any questions or need additional information, please contact the undersigned at our Corona office.

Sincerely,
Alta California Geotechnical, Inc.

SCOTT A. GRAY/RGE 2857
Reg. Exp.: 12-31-24
Registered Geotechnical Engineer
President

Distribution: (1) Addressee

SAG: LM: 1-0312, April 14, 2023 (Setback Recommendations, Arlington)

# Appendix 4: Historical Site Conditions

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

The site is currently developed with an at-grade paved surface parking lot that surrounds the existing Sears Retail Department Store and Automotive Center which has plans to shut down and vacate the site. The parking lot consists of asphalt paved surfaces, minimal landscape planting areas, parking lot lighting poles and utilities. The property boundary conditions consist of block screen wall along the north and east property lines that separate the site from the existing residential lots. Although physically incorporated into the site, the Bank in the southwest corner of the site is on a separate parcel and the existing improvements will remain. There are no physical boundaries between the two parcels and their adjacencies function as one with site access, utilities and drainage. The site is serviced by below-ground wet and dry utilities within the property as well as within the adjacent properties and surrounding public street networks.

# Appendix 5: LID Infeasibility

*LID Technical Infeasibility Analysis*

**N/A**

# Appendix 6: BMP Design Details

*BMP Sizing, Design Details and other Supporting Documentation*

# **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 | Psomas | Date | 4/14/2023 |
| Designed by | NT | Case No | |
| Company Project Number/Name | 4RIV290100 | | |

## BMP Identification

BMP NAME / ID: R1E

*Must match Name/ID used on BMP Design Calculation Sheet*

## Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

## Drainage Management Area Tabulation

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

DMAs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type (use pull-down menu) | Effective Imperivous Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Design Rainfall Intensity (in/hr)* | *Design Flow Rate (cfs)* | *Proposed Flow Rate (cfs)* |
|---|---|---|---|---|---|---|---|---|
| *R1E* | *89,924* | *Concrete or Asphalt* | *1* | *0.89* | *80212.2* | | | |
| *R1E* | *34,969* | *Ornamental Landscaping* | *0.1* | *0.11* | *3862.6* | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | |

# **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 | Psomas | Date | 4/14/2023 |
| Designed by | NT | Case No | |
| Company Project Number/Name | 4RIV290100 | | |

## BMP Identification

BMP NAME / ID: C1S

*Must match Name/ID used on BMP Design Calculation Sheet*

## Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

## Drainage Management Area Tabulation

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

DMAs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type (use pull-down menu) | Effective Imperivous Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Design Rainfall Intensity (in/hr)* | *Design Flow Rate (cfs)* | *Proposed Flow Rate (cfs)* |
|---|---|---|---|---|---|---|---|---|
| *C1S* | *29,558* | *Concrete or Asphalt* | *1* | *0.89* | *26365.7* | | | |
| *C1S* | *11,495* | *Ornamental Landscaping* | *0.1* | *0.11* | *1269.7* | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | **41053** | ***Total*** | | | **27635.4** | **0.20** | ***0.1*** | ***0.13*** |

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 | Psomas | Date | 4/14/2023 |
| Designed by | NT | Case No | |
| Company Project Number/Name | 4RIV290100 | | |

## BMP Identification

BMP NAME / ID: C2S

*Must match Name/ID used on BMP Design Calculation Sheet*

## Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

## Drainage Management Area Tabulation

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

DMAs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type (use pull-down menu) | Effective Imperivous Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Design Rainfall Intensity (in/hr)* | *Design Flow Rate (cfs)* | *Proposed Flow Rate (cfs)* |
|---|---|---|---|---|---|---|---|---|
| *C2S* | *49,980* | *Concrete or Asphalt* | *1* | *0.89* | *44582.2* | | | |
| *C2S* | *19,437* | *Ornamental Landscaping* | *0.1* | *0.11* | *2147* | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | **69417** | | ***Total*** | | **46729.2** | **0.20** | ***0.2*** | ***0.27*** |

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 | Psomas | Date | 4/14/2023 |
| Designed by | NT | Case No | |
| Company Project Number/Name | 4RIV290100 | | |

## BMP Identification

BMP NAME / ID: R1C

*Must match Name/ID used on BMP Design Calculation Sheet*

## Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

## Drainage Management Area Tabulation

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

DMAs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type (use pull-down menu) | Effective Imperivous Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Design Rainfall Intensity (in/hr)* | *Design Flow Rate (cfs)* | *Proposed Flow Rate (cfs)* |
|---|---|---|---|---|---|---|---|---|
| *R1C* | *144,895* | *Concrete or Asphalt* | *1* | *0.89* | *129246.3* | | | |
| *R1C* | *56,328* | *Ornamental Landscaping* | *0.1* | *0.11* | *6221.9* | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | |

# **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 | Psomas | Date | 4/14/2023 |
| Designed by | NT | Case No | |
| Company Project Number/Name | 4RIV290100 | | |

## BMP Identification

BMP NAME / ID: R1W

*Must match Name/ID used on BMP Design Calculation Sheet*

## Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

## Drainage Management Area Tabulation

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

DMAs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type (use pull-down menu) | Effective Imperivous Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Design Rainfall Intensity (in/hr)* | *Design Flow Rate (cfs)* | *Proposed Flow Rate (cfs)* |
|---|---|---|---|---|---|---|---|---|
| *R1W* | *83,446* | *Concrete or Asphalt* | *1* | *0.89* | *74433.8* | | | |
| *R1W* | *32,452* | *Ornamental Landscaping* | *0.1* | *0.11* | *3584.6* | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | |

# **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 | Psomas | Date | 4/14/2023 |
| Designed by | NT | Case No | |
| Company Project Number/Name | 4RIV290100 | | |

## BMP Identification

BMP NAME / ID: R2W

*Must match Name/ID used on BMP Design Calculation Sheet*

## Design Rainfall Depth

Design Rainfall Intensity: I = 0.20 in/hr

## Drainage Management Area Tabulation

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

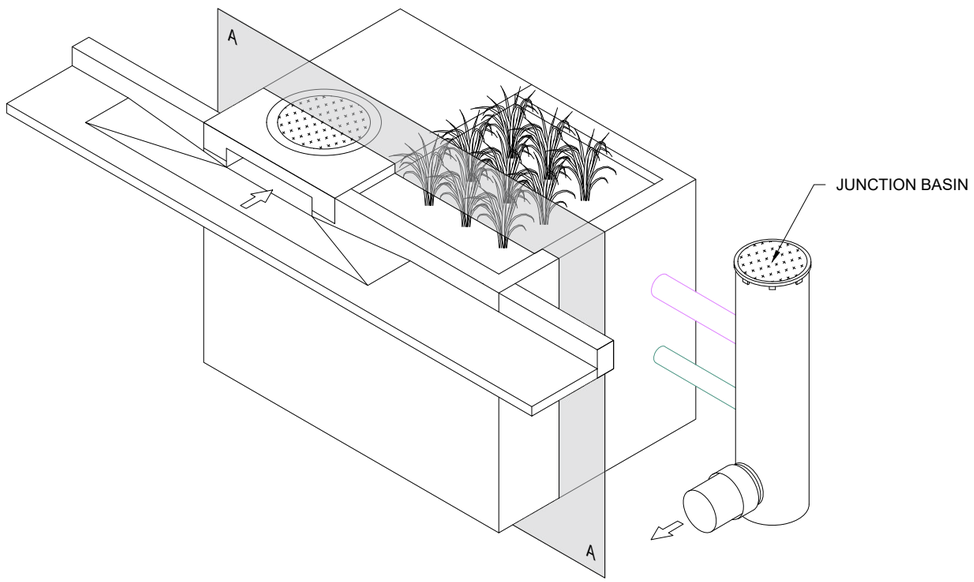
DMAs

| DMA Type/ID | DMA Area (square feet) | Post-Project Surface Type (use pull-down menu) | Effective Imperivous Fraction, $I_f$ | DMA Runoff Factor | DMA Areas x Runoff Factor | *Design Rainfall Intensity (in/hr)* | *Design Flow Rate (cfs)* | *Proposed Flow Rate (cfs)* |
|---|---|---|---|---|---|---|---|---|
| *R2W* | *140,009* | *Concrete or Asphalt* | *1* | *0.89* | *124888* | | | |
| *R2W* | *54,446* | *Ornamental Landscaping* | *0.1* | *0.11* | *6014* | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | **194455** | ***Total*** | | | **130902** | **0.20** | ***0.6*** | ***0.8*** |

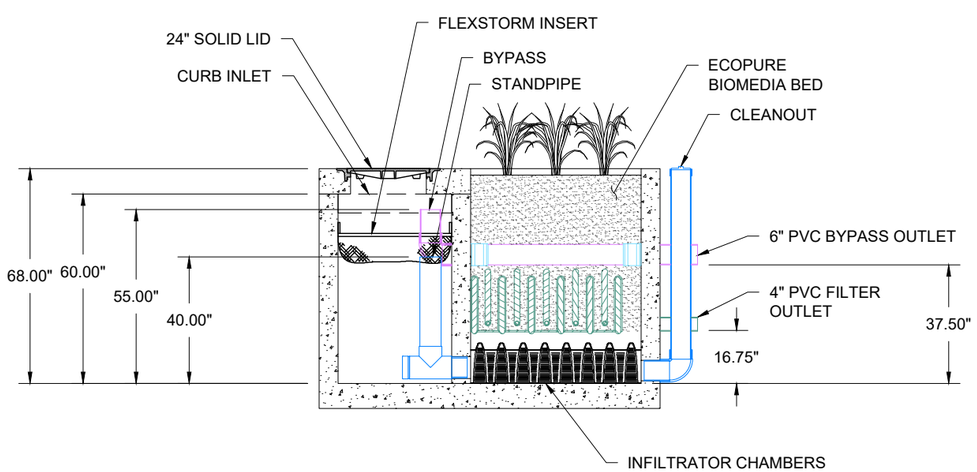
Notes:

## ONLINE SITE LAYOUT - CURB INLET

FOR LOW FLOW APPLICATIONS USING INTERNAL BYPASS
*CLEANOUTS OMITTED FROM LAYOUT FOR CLARITY



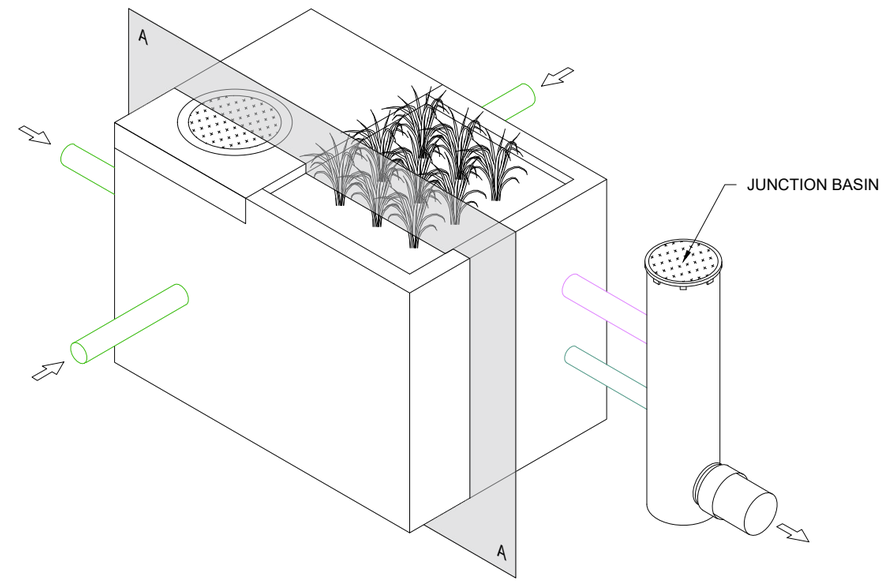

**NOTES:**
1. THROAT INLET SHOWN. GRATED CURB INLET NOT AVAILABLE.
2. PLANTINGS SHOULD BE DROUGHT RESISTANT, FULL SUNLIGHT PLANTS (GRASS, SHRUBS, AND ORNAMENTAL).
3. FOR DESIGNS THAT REQUIRE A SUMP DEPTH GREATER THAN 68" PLEASE CONTACT ADS.



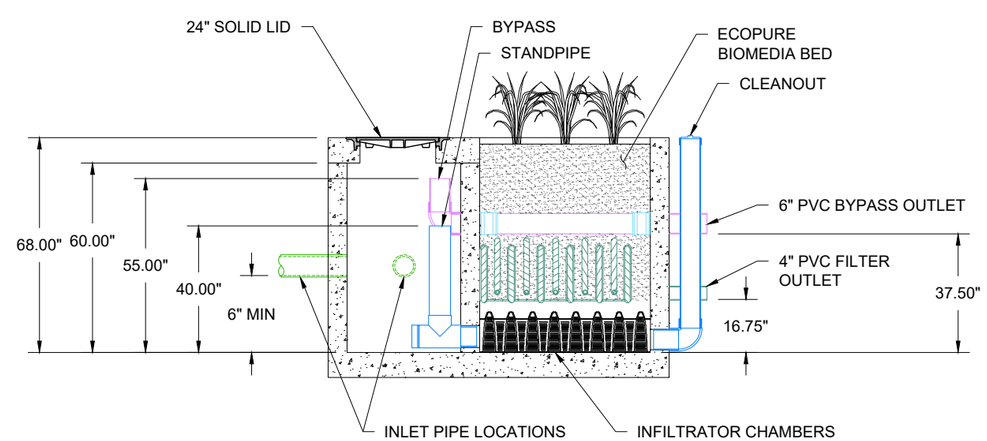

**SECTION A-A**
NTS

## ONLINE SITE LAYOUT - PIPE INLET

FOR LOW FLOW APPLICATIONS USING INTERNAL BYPASS
*CLEANOUTS OMITTED FROM LAYOUT FOR CLARITY




**NOTES:**
1. PLANTINGS SHOULD BE DROUGHT RESISTANT, FULL SUNLIGHT PLANTS (GRASS, SHRUBS, AND ORNAMENTAL).
2. FOR DESIGNS THAT REQUIRE A SUMP DEPTH GREATER THAN 68" PLEASE CONTACT ADS.




**SECTION A-A**
NTS

ECOPURE™
STANDARD ONLINE DETAILS

DATE: 8/01/22 | DRAWN: KLJ
PROJECT #: N/A | CHECKED: ----

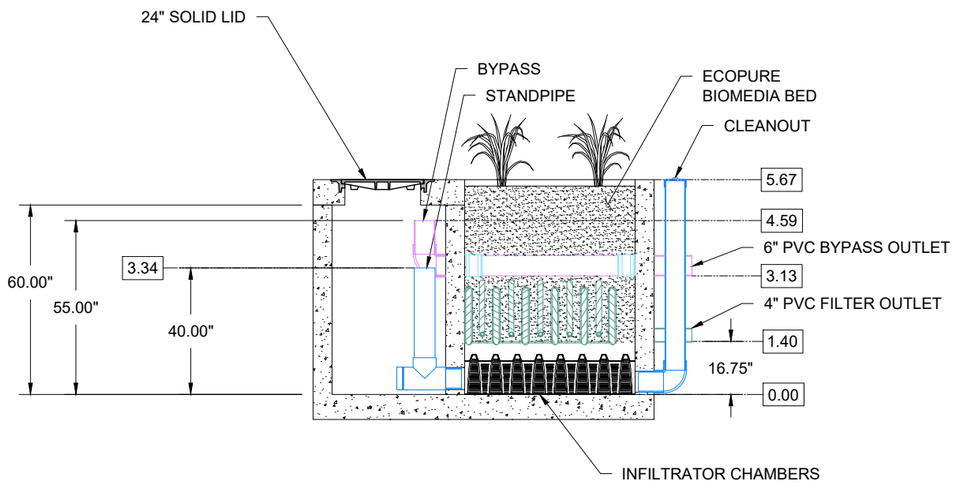
| DATE | DRWN | CHKD | DESCRIPTION |
|---|---|---|---|

**EcoPure™ Biofilter**
Stormwater Media Filters

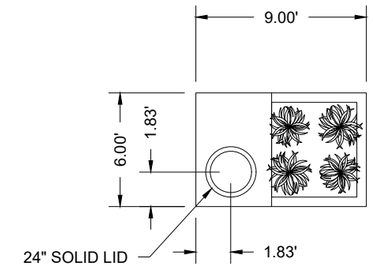
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

NOT TO SCALE

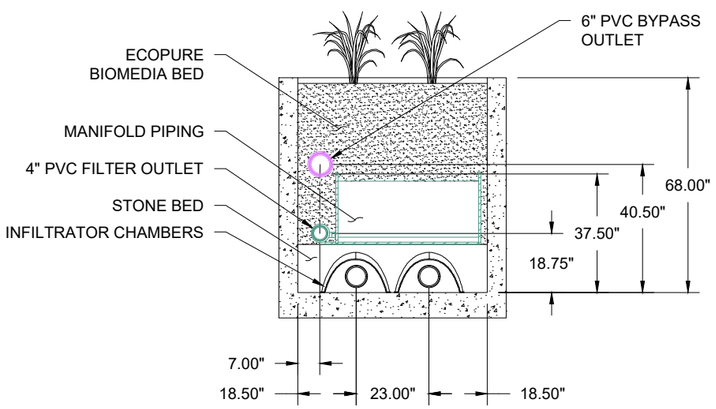
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



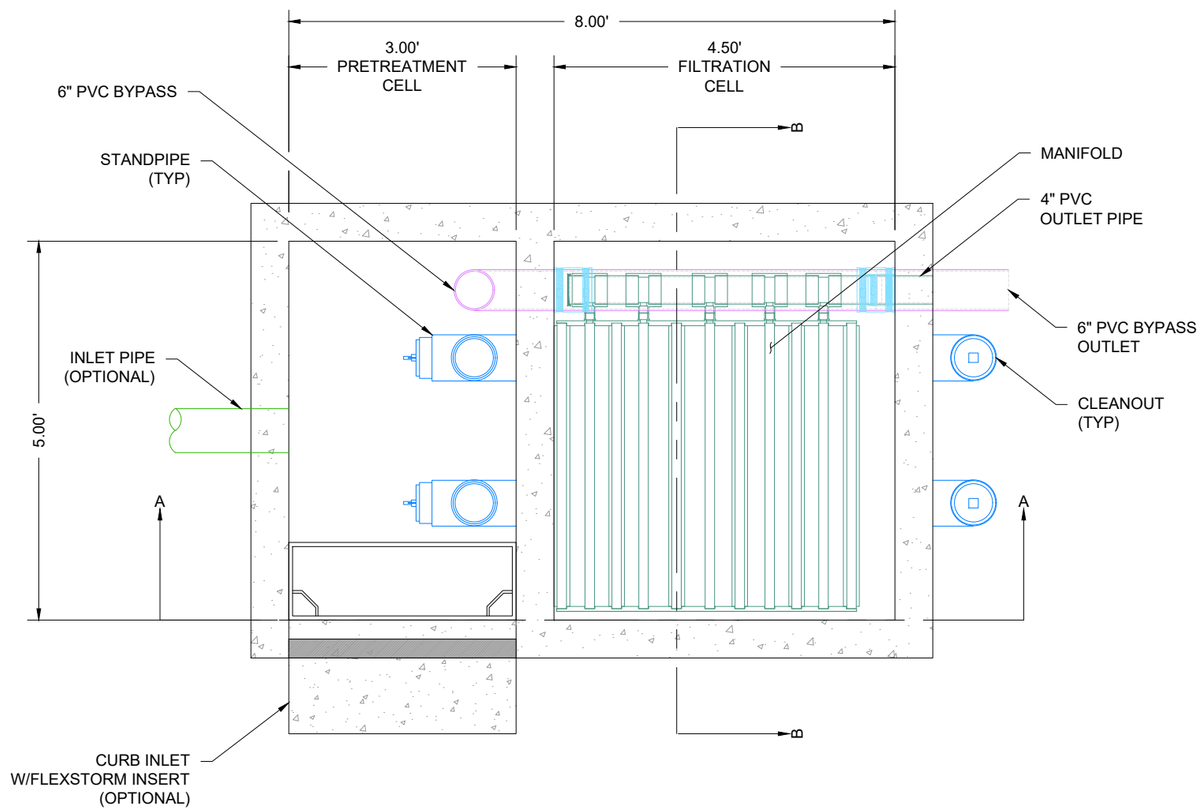

## SECTION A-A
NTS




## TOP SLAB PLAN VIEW
NTS / PIPE CONNECTIONS NOT SHOWN




## SECTION B-B
NTS




## PLAN VIEW
NTS

| ECOPURE BIOFILTER 60 | |
|---|---|
| WATER QUALITY FLOW RATE | 0.13 CFS |
| EFFECTIVE LOADING RATE | 1 GPM/SF |
| DRAINAGE AREA | 0.324 ACRES |
| TREATED SEDIMENT CAPACITY | 194.5 LBS |

THE ECOPURE BIOFILTER™ IS A BIOFILTRATION STORMWATER TREATMENT TECHONOLOGY RELIES ON PHYSICAL, CHEMICAL AND BIOLOGICAL MECHANISMS TO REMOVE TOTAL SUSPENDED SOLIDS, TOTAL PHOSPHORUS, TOTAL NITROGEN, HEAVY METALS, OIL and GREASE, TRASH AND BACTERIA. THE ECOPURE SYSTEM PROVIDES LINEAR TREATMENT DESIGN WITH AN UPFRONT PRETREATMENT CHAMBER.

ECOPURE BIOFILTER
60
STANDARD DETAIL

DATE: 6/08/22 DRAWN: KLJ
PROJECT #: CHECKED: KLJ

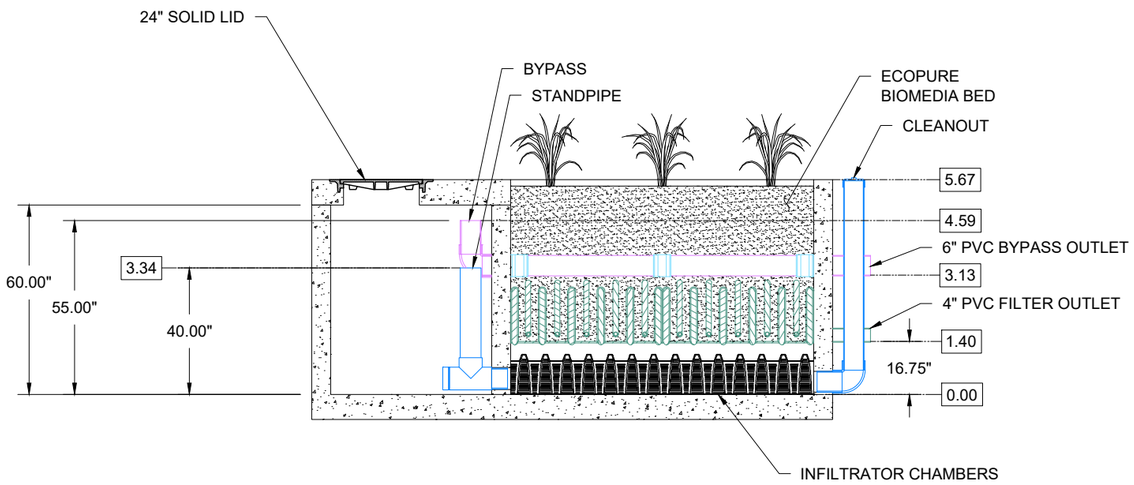
| DATE | DRWN | CHKD | DESCRIPTION |
|---|---|---|---|

**EcoPure™ Biofilter**
Stormwater Media Filters

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

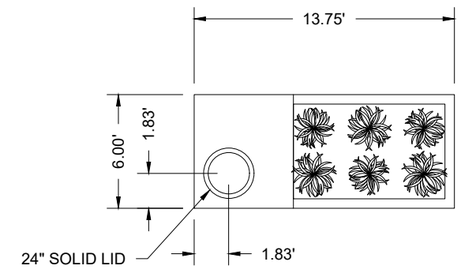
NOT TO SCALE

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



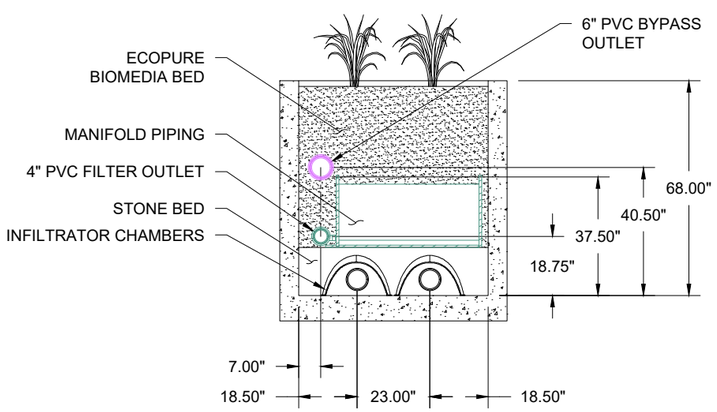

## SECTION A-A

NTS



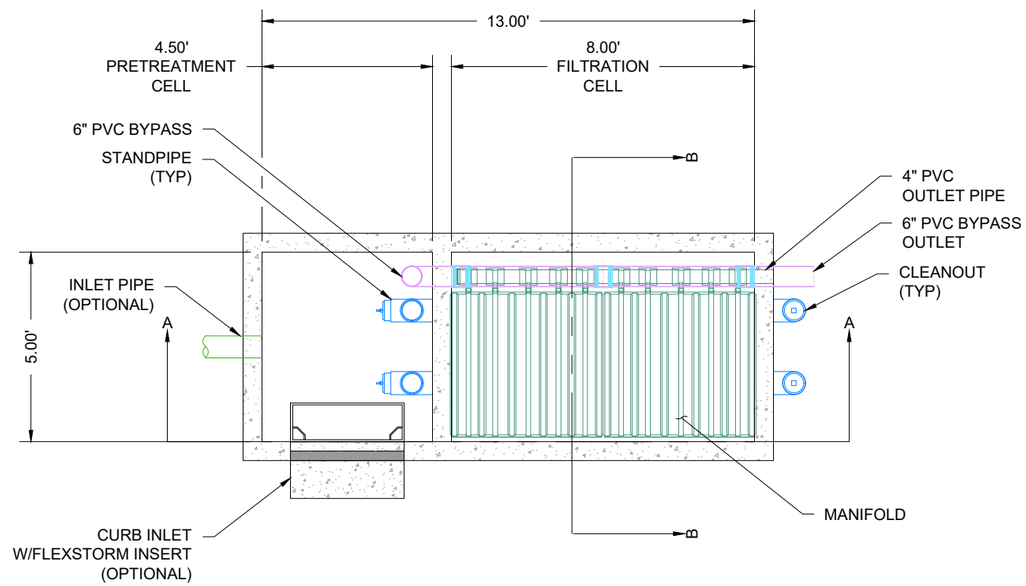

## TOP SLAB PLAN VIEW

NTS / PIPE CONNECTIONS NOT SHOWN




## SECTION B-B

NTS




## PLAN VIEW

NTS

| ECOPURE BIOFILTER 120 | |
|---|---|
| WATER QUALITY FLOW RATE | 0.27 CFS |
| EFFECTIVE LOADING RATE | 1 GPM/SF |
| DRAINAGE AREA | 0.648 ACRES |
| TREATED SEDIMENT CAPACITY | 389 LBS |

THE ECOPURE BIOFILTER™ IS A BIOFILTRATION STORMWATER TREATMENT TECHONOLOGY RELIES ON PHYSICAL, CHEMICAL AND BIOLOGICAL MECHANISMS TO REMOVE TOTAL SUSPENDED SOLIDS, TOTAL PHOSPHORUS, TOTAL NITROGEN, HEAVY METALS, OIL and GREASE, TRASH AND BACTERIA. THE ECOPURE SYSTEM PROVIDES LINEAR TREATMENT DESIGN WITH AN UPFRONT PRETREATMENT CHAMBER.

ECOPURE BIOFILTER
120
STANDARD DETAIL

DATE: 6/08/22 DRAWN: KLJ
PROJECT #: CHECKED: KLJ

| DATE | DRWN | CHKD | DESCRIPTION |
|---|---|---|---|

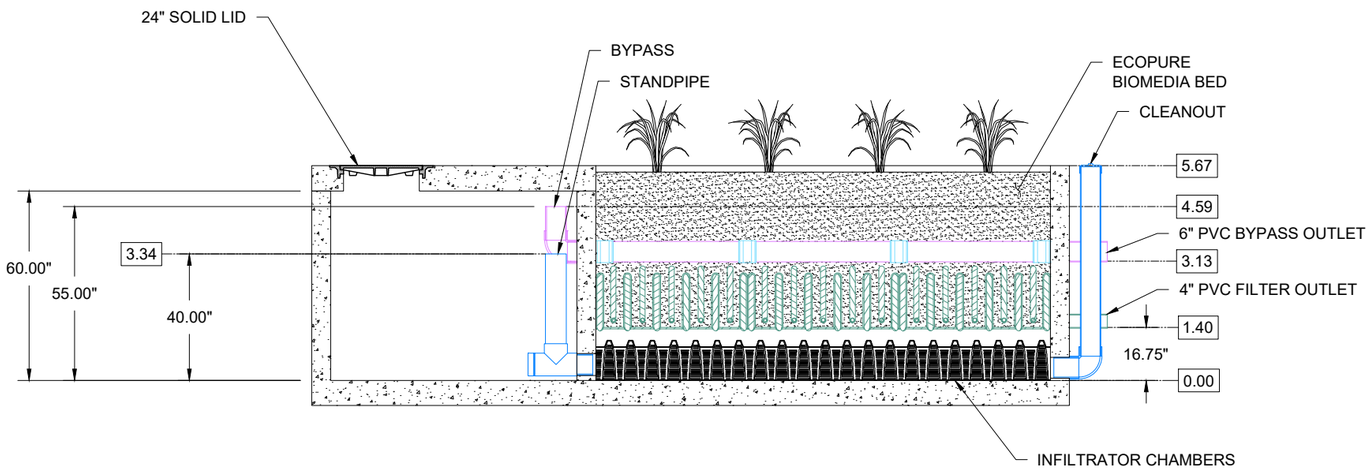
**EcoPure™ Biofilter**
Stormwater Media Filters

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

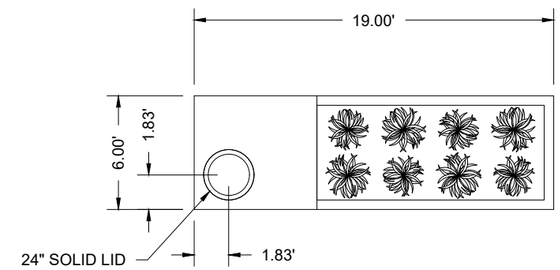
NOT TO SCALE

SHEET 1 OF 1

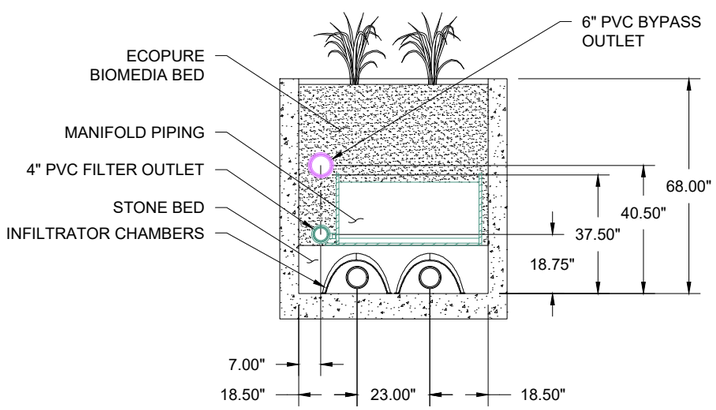
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



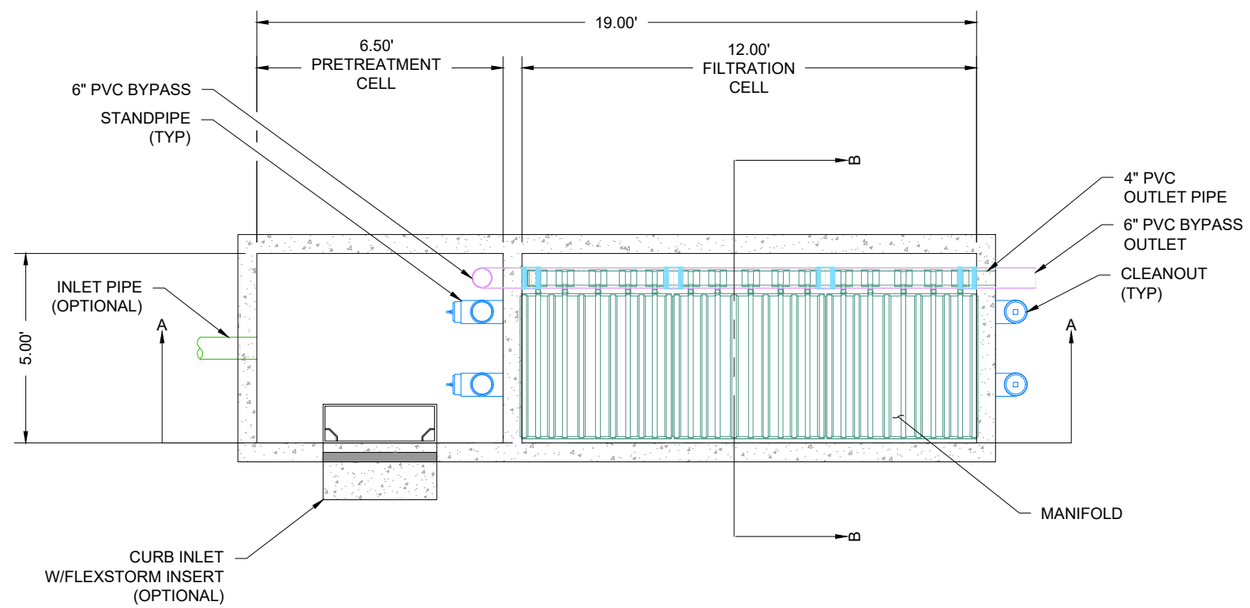

## SECTION A-A
NTS




## TOP SLAB PLAN VIEW
NTS / PIPE CONNECTIONS NOT SHOWN




## SECTION B-B
NTS




## PLAN VIEW
NTS

| ECOPURE BIOFILTER 180 | |
|---|---|
| WATER QUALITY FLOW RATE | 0.40 CFS |
| EFFECTIVE LOADING RATE | 1 GPM/SF |
| DRAINAGE AREA | 0.972 ACRES |
| TREATED SEDIMENT CAPACITY | 583.5 LBS |
| | |

THE ECOPURE BIOFILTER™ IS A BIOFILTRATION STORMWATER TREATMENT TECHONOLOGY RELIES ON PHYSICAL, CHEMICAL AND BIOLOGICAL MECHANISMS TO REMOVE TOTAL SUSPENDED SOLIDS, TOTAL PHOSPHORUS, TOTAL NITROGEN, HEAVY METALS, OIL and GREASE, TRASH AND BACTERIA. THE ECOPURE SYSTEM PROVIDES LINEAR TREATMENT DESIGN WITH AN UPFRONT PRETREATMENT CHAMBER.

ECOPURE BIOFILTER
180
STANDARD DETAIL

DATE: 6/08/22 DRAWN: KLJ
PROJECT #: CHECKED: KLJ

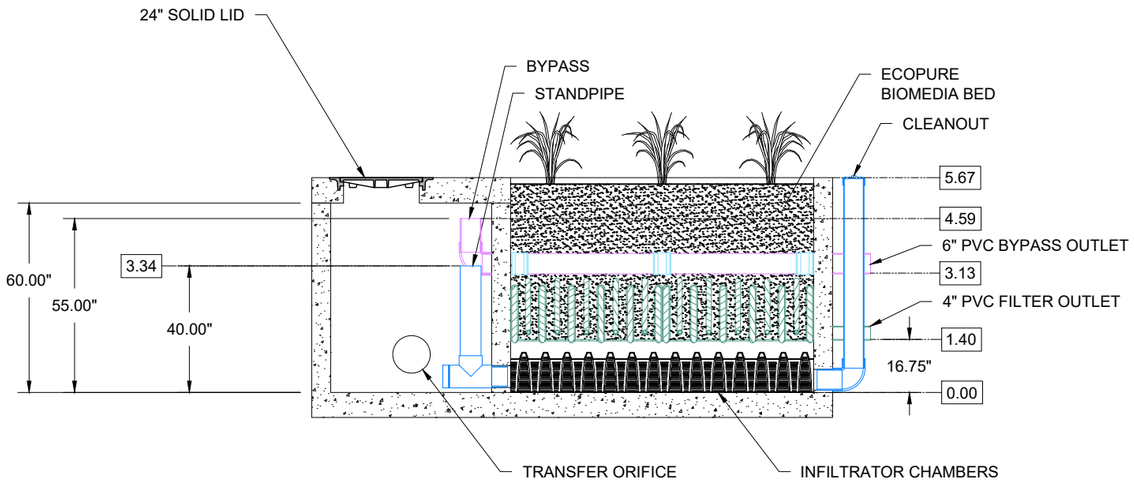
| DATE | DRWN | CHKD | DESCRIPTION |
|---|---|---|---|

**EcoPure™ Biofilter**
Stormwater Media Filters

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

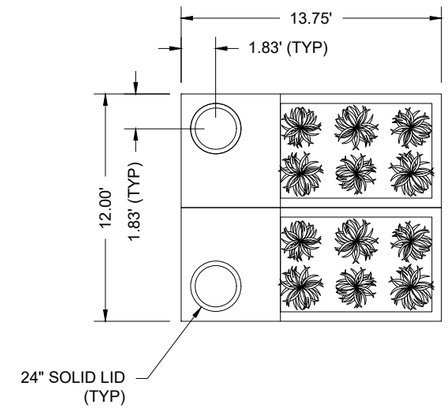
NOT TO SCALE

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



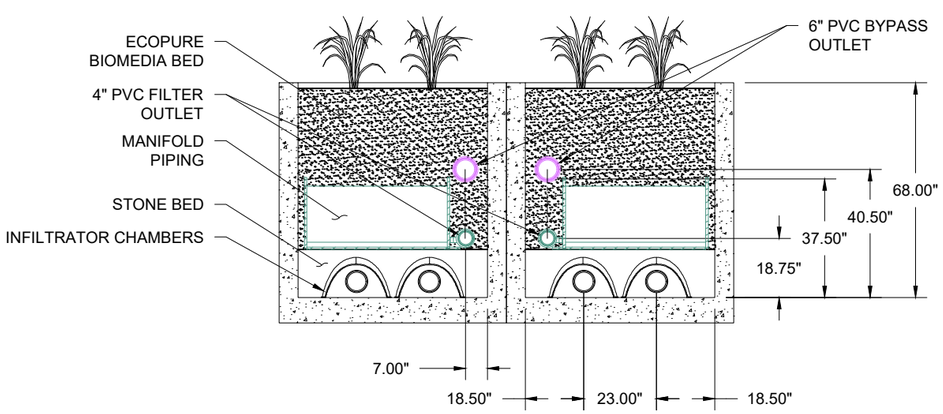

## SECTION A-A

NTS



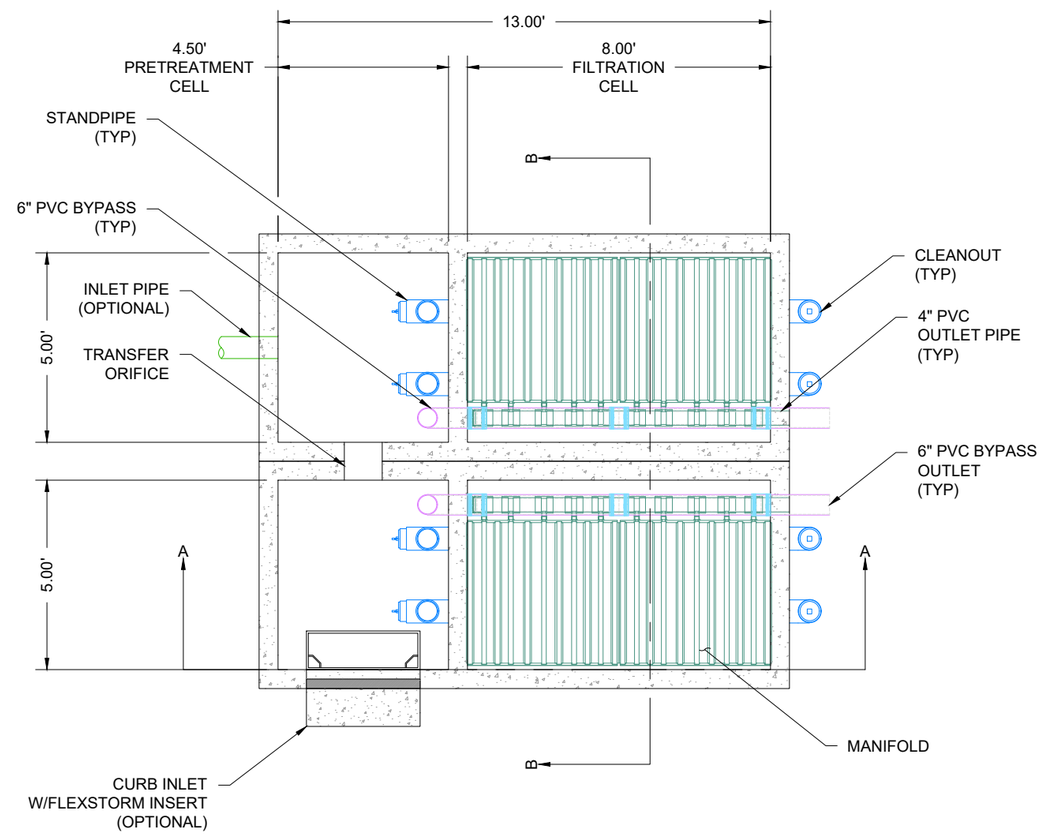

## TOP SLAB PLAN VIEW

NTS / PIPE CONNECTIONS NOT SHOWN




## SECTION B-B

NTS




## PLAN VIEW

NTS

| ECOPURE BIOFILTER 240 | |
|---|---|
| WATER QUALITY FLOW RATE | 0.53 CFS |
| EFFECTIVE LOADING RATE | 1 GPM/SF |
| DRAINAGE AREA | 1.297 ACRES |
| TREATED SEDIMENT CAPACITY | 778 LBS |
| | |

THE ECOPURE BIOFILTER™ IS A BIOFILTRATION STORMWATER TREATMENT TECHONOLOGY RELIES ON PHYSICAL, CHEMICAL AND BIOLOGICAL MECHANISMS TO REMOVE TOTAL SUSPENDED SOLIDS, TOTAL PHOSPHORUS, TOTAL NITROGEN, HEAVY METALS, OIL and GREASE, TRASH AND BACTERIA. THE ECOPURE SYSTEM PROVIDES LINEAR TREATMENT DESIGN WITH AN UPFRONT PRETREATMENT CHAMBER.

ECOPURE BIOFILTER
240
STANDARD DETAIL

DATE: 6/08/22 DRAWN: KLJ
PROJECT #: CHECKED: KLJ

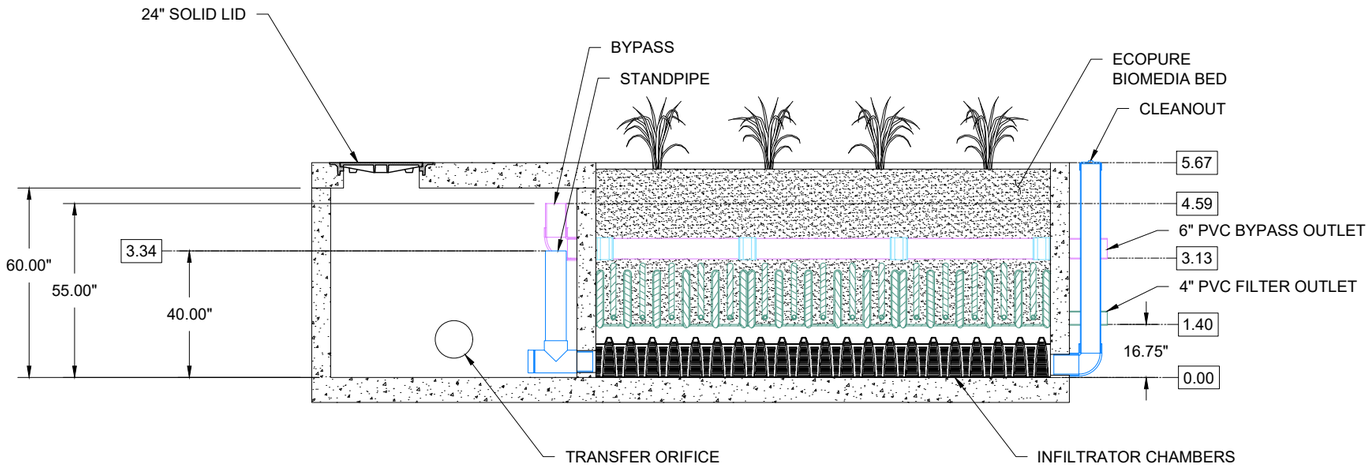
| DATE | DRWN | CHKD | DESCRIPTION |
|---|---|---|---|

**EcoPure™ Biofilter**
Stormwater Media Filters

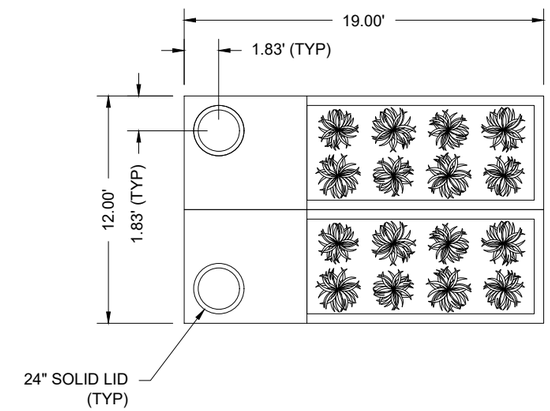
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

NOT TO SCALE

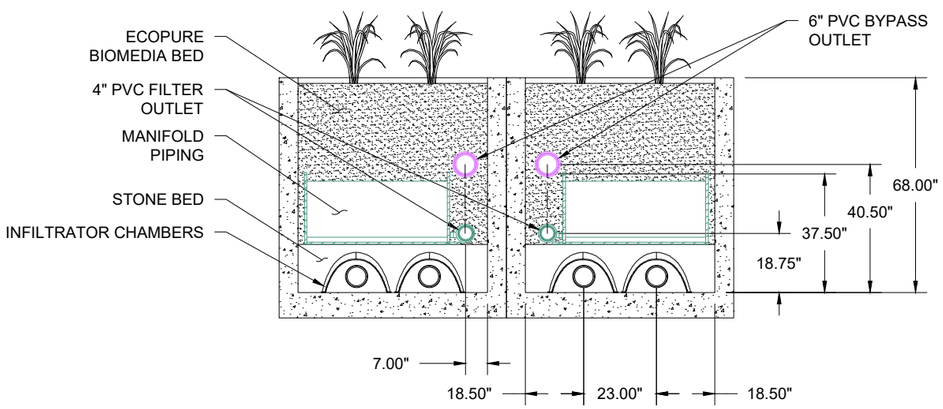
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



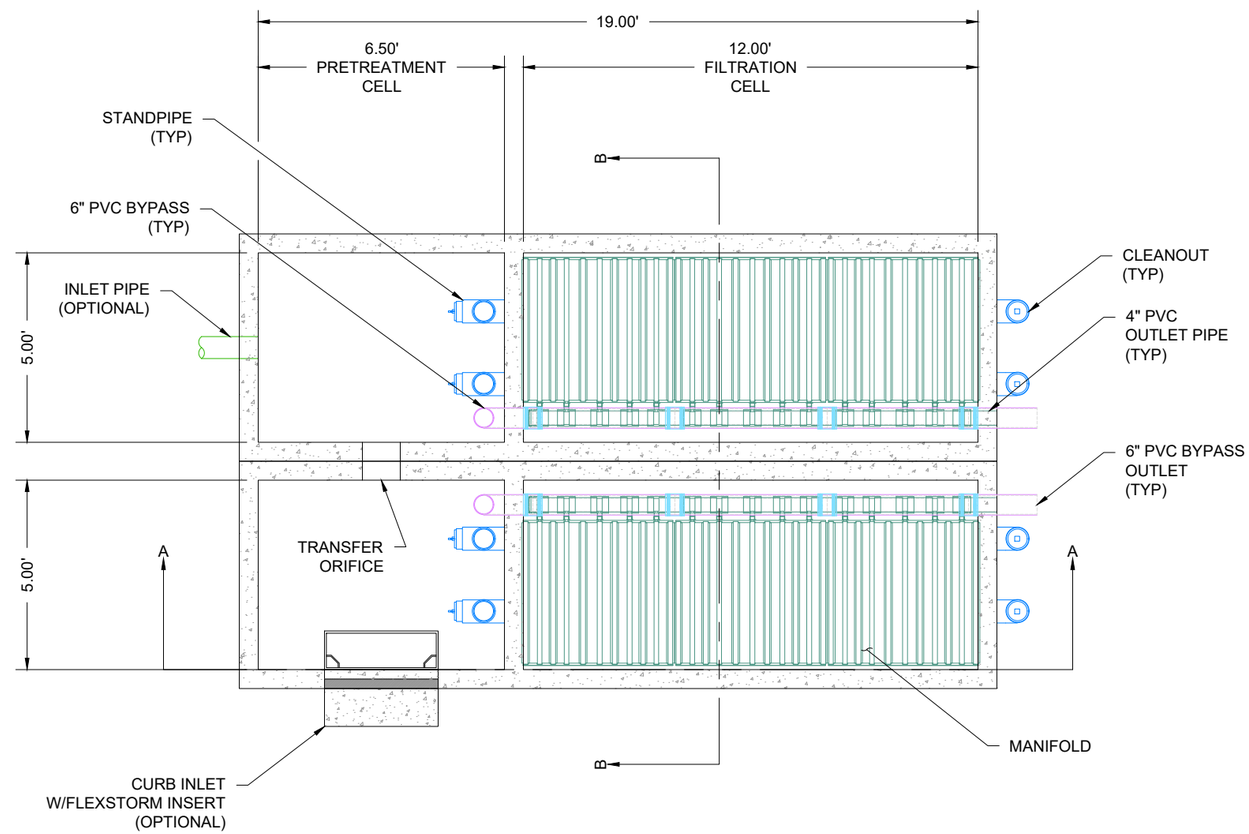

## SECTION A-A
NTS




## TOP SLAB PLAN VIEW
NTS / PIPE CONNECTIONS NOT SHOWN




## SECTION B-B
NTS




## PLAN VIEW
NTS

| ECOPURE BIOFILTER 360 | |
|---|---|
| WATER QUALITY FLOW RATE | 0.80 CFS |
| EFFECTIVE LOADING RATE | 1 GPM/SF |
| DRAINAGE AREA | 1.945 ACRES |
| TREATED SEDIMENT CAPACITY | 1,167 LBS |
| | |

THE ECOPURE BIOFILTER™ IS A BIOFILTRATION STORMWATER TREATMENT TECHONOLOGY RELIES ON PHYSICAL, CHEMICAL AND BIOLOGICAL MECHANISMS TO REMOVE TOTAL SUSPENDED SOLIDS, TOTAL PHOSPHORUS, TOTAL NITROGEN, HEAVY METALS, OIL and GREASE, TRASH AND BACTERIA. THE ECOPURE SYSTEM PROVIDES LINEAR TREATMENT DESIGN WITH AN UPFRONT PRETREATMENT CHAMBER.

ECOPURE BIOFILTER
360
STANDARD DETAIL

DATE: 6/08/22 DRAWN: KLJ
PROJECT #: CHECKED: KLJ

| DATE | DRWN | CHKD | DESCRIPTION |
|---|---|---|---|

**EcoPure™ Biofilter**
Stormwater Media Filters

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

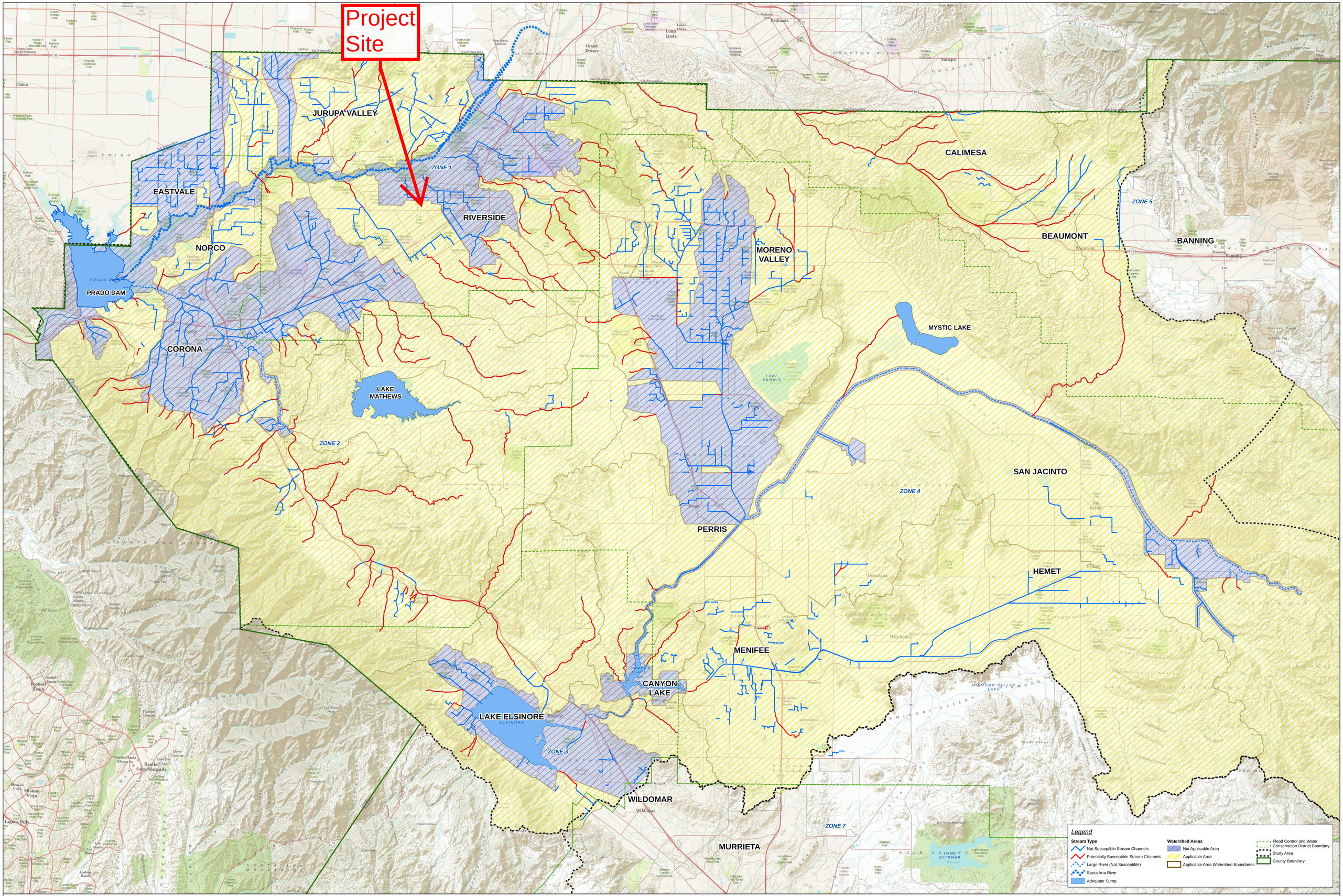
NOT TO SCALE

SHEET 1 OF 1

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

# Appendix 7: Hydromodification

*Supporting Detail Relating to Hydrologic Conditions of Concern*




# HCOC Applicability Map

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

Map 2

**Riverside County Pre Development Flow Calculations**

Riverside County Flood Control and Water Conservation District Hydrology
Rational Method Calculation Form

**Condition:** Pre Development
**Frequency:** 10-yr
**Calculated By:** NT 3/14/2023

**Project: Arlington Mixed Use, Riverside, CA**

| Drainage Area | Soil Group | Development | Area (sf) | Area (acre) | I10 (in/hr) | C | Q10 ($ft^3/s$) | Q10 ($ft^3/s$) | Slope | Section | V (ft/s) | L (ft) | H (ft) | T (min) | T (min) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX-1A | C | Commercial | 94,023 | 2.16 | 2.23 | 0.89 | 4.28 | 4.28 | - | - | - | 300 | 3.5 | 7.3 | 7.3 | Initial Area (Plate D-3) |
| EX-1B | C | Commercial | 207,600 | 4.77 | 1.90 | 0.89 | 8.06 | 12.34 | 0.010 | 18" Conc Pipe | 5.52 | 815 | 8.0 | 2.5 | 9.8 | Assume 18" @ 1% Conc Pipe |
| | | | | | | | | | | | | | | | | |
| | | | | | Adjust Q to Tc = 13.5 min. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| **TOTAL - Point 1** | | | | **6.92** | | | | **10.33** | | | | | | | **13.5** | Peak Q at Tp = 13.5 min. |

| Drainage Area | Soil Group | Development | Area (sf) | Area (acre) | I10 (in/hr) | C | Q10 ($ft^3/s$) | Q10 ($ft^3/s$) | Slope | Section | V (ft/s) | L (ft) | H (ft) | T (min) | T (min) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX-2A | B | Commercial | 58,296 | 1.34 | 2.22 | 0.87 | 2.58 | 2.58 | - | - | - | 210 | 1.0 | 7.4 | 7.4 | Initial Area (Plate D-3) |
| EX-2B + EX-2C | B | Commercial | 301,203 | 6.91 | 1.59 | 0.89 | 9.78 | 12.36 | 0.008 | 18" Conc Pipe | 4.27 | 1560 | 12.5 | 6.1 | 13.5 | Assume 18" @ 0.8% Conc Pipe |
| | | | | | | | | | | | | | | | | |
| **TOTAL - Point 2** | | | | **8.25** | **1.59** | | | **12.36** | | | | | | | **13.5** | |

| Drainage Area | Soil Group | Development | Area (sf) | Area (acre) | I10 (in/hr) | C | Q10 ($ft^3/s$) | Q10 ($ft^3/s$) | Slope | Section | V (ft/s) | L (ft) | H (ft) | T (min) | T (min) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EX-3A | B | Commercial | 97,888 | 2.25 | 2.23 | 0.87 | 4.36 | 4.36 | - | - | - | 359 | 6.0 | 7.3 | 7.3 | Initial Area (Plate D-3) |
| - | B | Commercial | - | 2.25 | 1.97 | 0.87 | 3.85 | 3.85 | 0.0036 | 18" Conc Pipe | 2.86 | 325 | - | 1.9 | 9.2 | 33" RCP @ 0.36% Conc Pipe |
| | | | | | | | | | | | | | | | | |
| | | | | | Adjust Q to Tc = 13.5 min. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| **TOTAL - Point 3** | | | | **2.25** | | | | **3.11** | | | | | | | **13.5** | Peak Q at Tp = 13.5 min. |

**Notes**

1 Intensity data per standard Riverside area (Plate D-4.1)
2 Runoff coefficient per standard "Urban Landscaping" "C" curves (Plates D-5.2 and D-5.3)
3 Site is located within Soil Group B and C as classified by Hydrologic Soils Graoup Map for Riverside - West (Plate C-1.16).

**ADJUSTMENTS TO POINT 1**

Adjust $T_B$ to $T_A$ = 13.5 min
$Q_B$ = 12.34 cfs (Flow at Tc = 9.8 min)
$I_A$ = 1.59 in/hr (intensity at Tc = 13.5 min)
$I_B$ = 1.90 in/hr (intensity at Tc = 9.8 min)

$Q_{ADJUSTED}$ = 12.34 x ( 1.59 / 1.9 )

**$Q_{ADJUSTED}$ = 10.33 cfs**

**ADJUSTMENTS TO POINT 3**

Adjust $T_B$ to $T_A$ = 13.5 min
$Q_B$ = 3.85 cfs (Flow at Tc = 9.2 min)
$I_A$ = 1.59 in/hr (intensity at Tc = 13.5 min)
$I_B$ = 1.97 in/hr (intensity at Tc = 9.2 min)

$Q_{ADJUSTED}$ = 3.85 x ( 1.59 / 1.97 )

**$Q_{ADJUSTED}$ = 3.11 cfs**

**TOTAL DISCHARGE FROM SITE = 10.33 + 12.36 + 3.11**

**TOTAL PRE-DEVELOPMENT DISCHARGE FROM SITE = 25.80 CFS @ Tc = 13.5 MIN**

**Riverside County Pre Development Flow Calculations**

Riverside County Flood Control and Water Conservation District Hydrology
Rational Method Calculation Form

**Project: Arlington Mixed Use, Riverside, CA**

**Condition:** Post Development
**Frequency:** 10-yr
**Calculated By:** NT 3/14/2023

| Drainage Area | Soil Group | Development | Area (sf) | Area (acre) | I10 (in/hr) | C | Q10 ($ft^3/s$) | Q10 ($ft^3/s$) | Slope | Section | V (ft/s) | L (ft) | H (ft) | T (min) | T (min) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PR-1A | C | Commercial (90% Impervious) | 10,485 | 0.24 | 2.34 | 0.89 | 0.50 | 0.50 | - | - | - | 135 | 0.5 | 6.7 | 6.7 | Initial Area (Plate D-3) |
| PR-1B | C | Apartment (72% Impervious) | 111,748 | 2.57 | 1.62 | 0.83 | 3.45 | 3.95 | 0.002 | 12" HDPE | 2.17 | 815 | - | 6.3 | 13.0 | DMAs: R1W and R2W |
| - | - | - | 0 | 0.00 | 1.52 | 0 | 0.00 | 3.95 | 0.003 | 30" RCP | 3.04 | 130 | - | 0.7 | 13.7 | At Flood Control Basin |
| | | | | | | | | | | | | | | | | |
| | | | | | Adjust Q to Tc = 14.3 min. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| **TOTAL - Point 1** | | | | **2.81** | | | | **3.66** | | | | | | | **14.3** | Peak Q at Tp = 14.3 min. |

| Drainage Area | Soil Group | Development | Area (sf) | Area (acre) | I10 (in/hr) | C | Q10 ($ft^3/s$) | Q10 ($ft^3/s$) | Slope | Section | V (ft/s) | L (ft) | H (ft) | T (min) | T (min) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PR-2A | C | Commercial (90% Impervious) | 10,466 | 0.24 | 2.32 | 0.89 | 0.50 | 0.50 | - | - | - | 131 | 0.7 | 8.2 | 8.2 | Initial Area (Plate D-3) |
| PR-2B | C | Apartment (72% Impervious) | 113,984 | 2.62 | 1.86 | 0.84 | 4.09 | 4.59 | 0.005 | 12" HDPE | 3.80 | 579 | - | 2.5 | 10.7 | DMAs: R1E, R2E, and R3E |
| PR-2C | C | Apartment (72% Impervious) | 199,674 | 4.58 | 1.52 | 0.83 | 5.78 | 10.37 | 0.003 | 18" RCP | 5.20 | 265 | - | 0.8 | 11.5 | DMAs: R1C and R2C |
| PR-2D | B | Apartment (72% Impervious) | 93,221 | 2.14 | 1.43 | 0.79 | 2.42 | 12.79 | 0.003 | 24" RCP | 4.07 | 643 | - | 2.6 | 14.1 | DMAs: R3W and R4W |
| - | - | - | 0 | 0.00 | 1.41 | 0 | 0.00 | 12.79 | 0.004 | 30" RCP | 5.35 | 73 | - | 0.2 | 14.3 | At Flood Control Basin |
| | | | | | | | | | | | | | | | | |
| **TOTAL - Point 2** | | | | **9.58** | | | | **12.79** | | | | | | | **14.3** | Peak Q at Tp = 14.3 min. |

| Drainage Area | Soil Group | Development | Area (sf) | Area (acre) | I10 (in/hr) | C | Q10 ($ft^3/s$) | Q10 ($ft^3/s$) | Slope | Section | V (ft/s) | L (ft) | H (ft) | T (min) | T (min) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PR-3A | B | Commercial (90% Impervious) | 13,490 | 0.31 | 2.42 | 0.88 | 0.66 | 0.66 | - | - | - | 215 | 6.7 | 6.8 | 6.8 | Initial Area (Plate D-3) |
| PR-3B | B | Apartment (72% Impervious) | 111,609 | 2.56 | 1.56 | 0.8 | 3.20 | 3.86 | 0.003 | 18" RCP | 3.20 | 737 | - | 3.8 | 10.6 | DMAs: R1W and R2W |
| - | - | - | 0 | 0.00 | 1.46 | 0 | 0.00 | 3.86 | 0.003 | 33" RCP | 3.66 | 389 | - | 1.8 | 12.4 | At Flood Control Basin |
| | | | | | | | | | | | | | | | | |
| | | | | | Adjust Q to Tc = 14.3min. | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| **TOTAL - Point 1** | | | | **2.87** | | | | **3.73** | | | | | | | **14.3** | Peak Q at Tp = 14.3 min. |

**Notes**

1 Intensity data per standard Riverside area (Plate D-4.1)
2 Runoff coefficient per standard "Urban Landscaping" "C" curves (Plates D-5.2 and D-5.3)
3 Site is located within Soil Group B and C as classified by Hydrologic Soils Graoup Map for Riverside - West (Plate C-1.16).

**ADJUSTMENTS TO POINT 1**

Adjust $T_B$ to $T_A$ = 14.3 min
$Q_B$ = 3.95 cfs (Flow at Tc = 13.7 min)
$I_A$ = 1.41 in/hr (intensity at Tc = 14.3 min)
$I_B$ = 1.52 in/hr (intensity at Tc = 13.7 min)

$Q_{ADJUSTED}$ = 3.95 x ( 1.41 / 1.52 )

**$Q_{ADJUSTED}$ = 3.66 cfs**

**ADJUSTMENTS TO POINT 3**

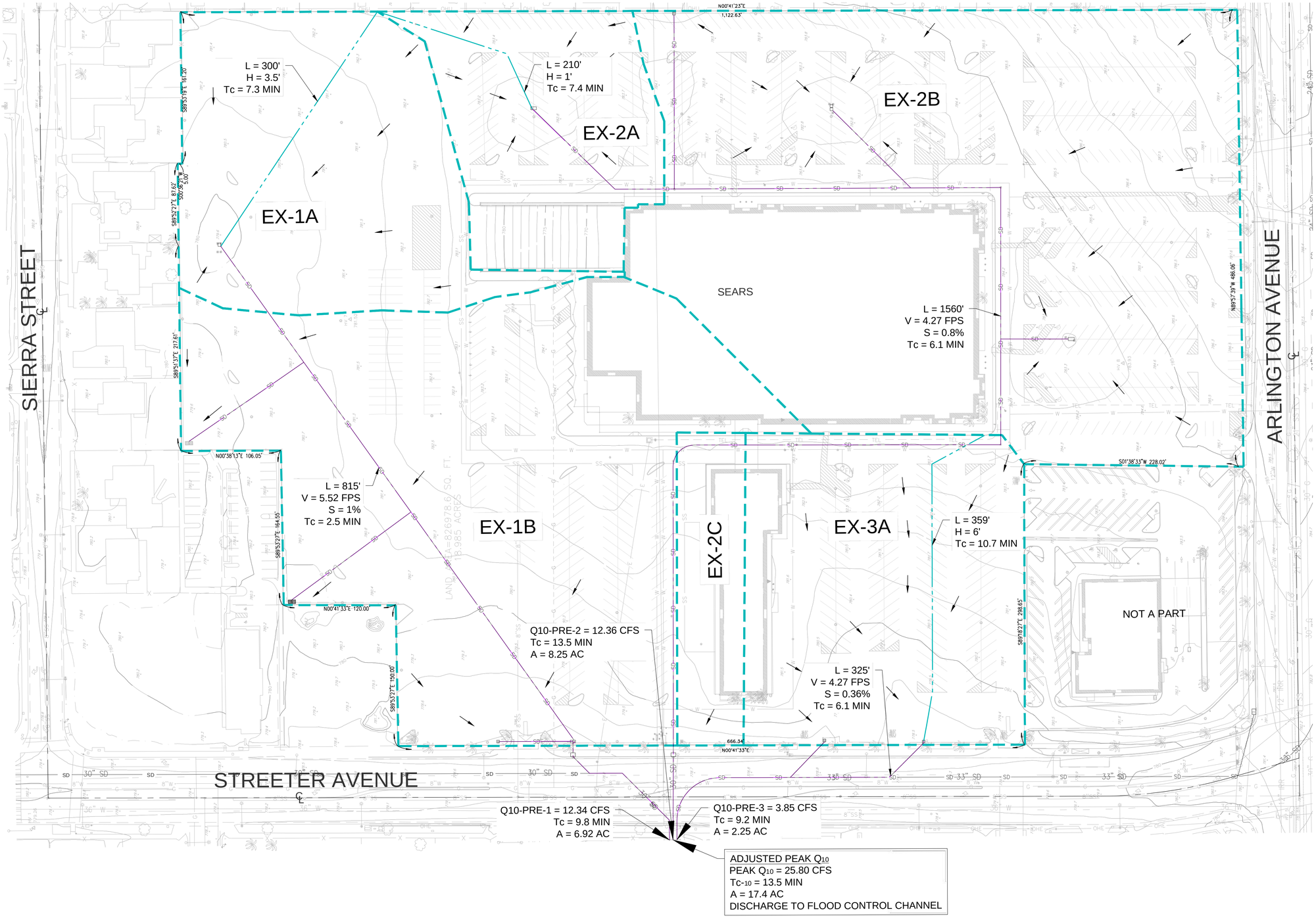
Adjust $T_B$ to $T_A$ = 14.3 min
$Q_B$ = 3.86 cfs (Flow at Tc = 12.4 min)
$I_A$ = 1.41 in/hr (intensity at Tc = 14.3 min)
$I_B$ = 1.46 in/hr (intensity at Tc = 12.4 min)

$Q_{ADJUSTED}$ = 3.86 x ( 1.41 / 1.46 )

**$Q_{ADJUSTED}$ = 3.73 cfs**

**TOTAL DISCHARGE FROM SITE = 3.66 + 12.79 + 3.73**

**TOTAL POST-DEVELOPMENT DISCHARGE FROM SITE = 20.18 CFS @ Tc = 14.3 MIN**




PRE DEVELOPMENT HYDROLOGY

# ARLINGTON MIXED USE

RIVERSIDE, CA

DATE: 8-02-2022
JOB NO.: 2020-055

FOULGER-PRATT

SERITAGE GROWTH PROPERTIES

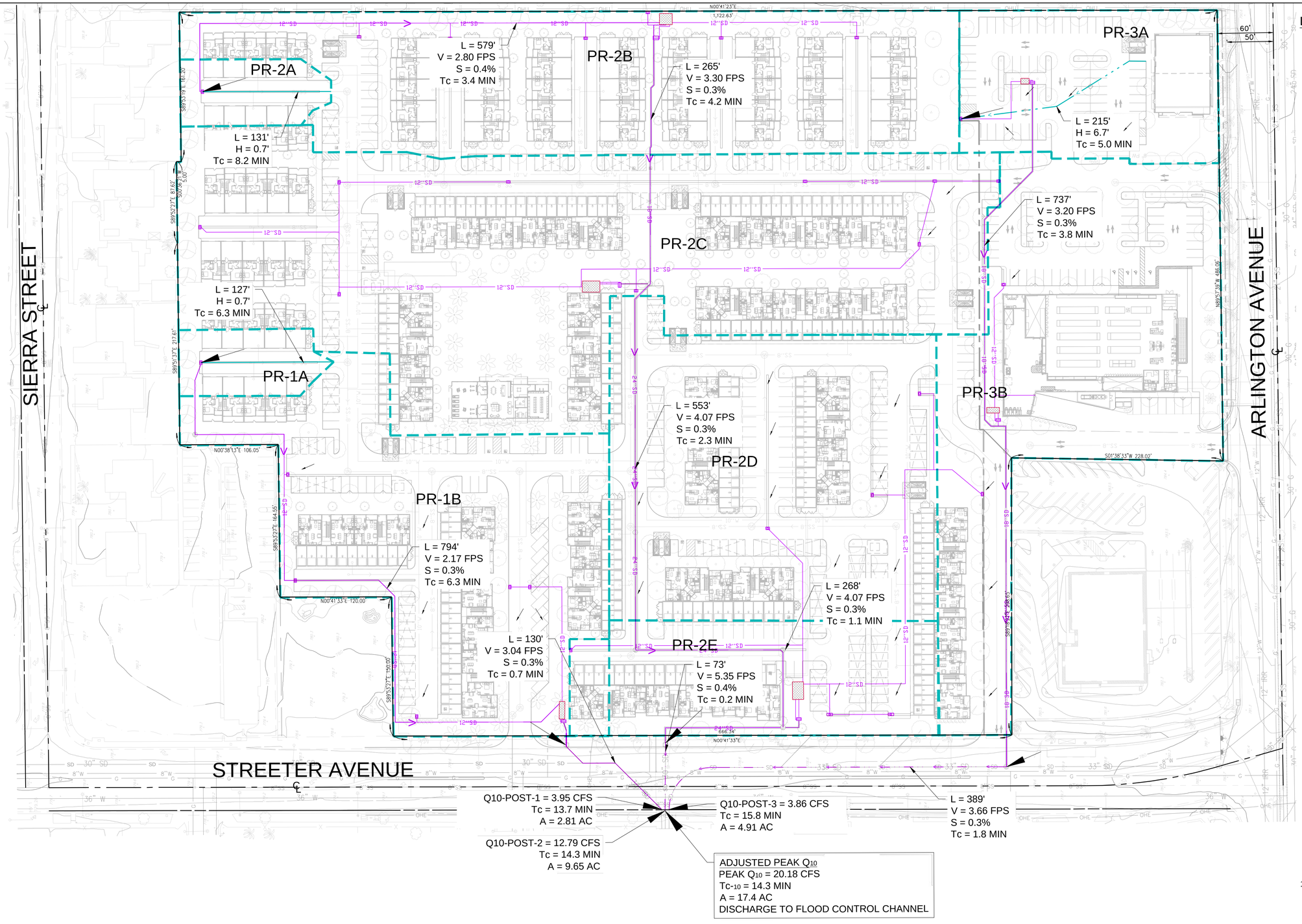
PSOMAS
1650 SPRUCE STREET, SUITE 400
RIVERSIDE, CA 92507
951.300.2818 www.psomas.com

ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.

R:\4RIV290100\CADD\Design\Exhibits\FP-EXH-HYD-EX.dwg

8/1/2022 3:30:38 PM




POST DEVELOPMENT HYDROLOGY

# ARLINGTON MIXED USE

RIVERSIDE, CA

DATE: 8-05-2022
JOB NO.: 2020-055

FOULGER-PRATT

SERITAGE GROWTH PROPERTIES

PSOMAS
1650 SPRUCE STREET, SUITE 400
RIVERSIDE, CA 92507
951.300.2818 www.psomas.com

ARCHITECTS ORANGE
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.

R:\4RIV290100\CADD\Design\Exhibits\FP-EXH-HYD-PR.dwg

4/14/2023 1:02:13 PM

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                Study date  03/15/23 File: EXARLINGTON112.out


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

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


Program License Serial Number 6538

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

 English Units used in output format



--------------------------------------------------------------------
EXISTING POINT 1
ARLINGTON
03/15/2023

-------------------------------------------------------------------
Drainage Area =       6.92(Ac.)  =      0.011 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       6.92(Ac.)  =      0.011 Sq. Mi.
Length along longest watercourse =    1115.00(Ft.)
Length along longest watercourse measured to centroid =     708.00(Ft.)
Length along longest watercourse =      0.211 Mi.
Length along longest watercourse measured to centroid =      0.134 Mi.
Difference in elevation =       5.50(Ft.)
Slope along watercourse =     26.0448 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.050 Hr.
Lag time =     3.00 Min.
25% of lag time =     0.75 Min.
40% of lag time =     1.20 Min.
Unit time =     5.00 Min.
Duration of storm = 1 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        6.92            0.50                    3.46

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        6.92            1.00                    6.92
```

```
STORM EVENT (YEAR) =    2.00
Area Averaged 2-Year Rainfall =    0.500(In)
Area Averaged 100-Year Rainfall =    1.000(In)

Point rain (area averaged) =    0.500(In)
Areal adjustment factor =   99.99 %
Adjusted average point rain =    0.500(In)

Sub-Area Data:
Area(Ac.)         Runoff Index   Impervious %
     6.920           56.00         0.900
 Total Area Entered =      6.92(Ac.)


RI    RI   Infil. Rate Impervious   Adj. Infil. Rate  Area%     F
AMC2 AMC-2     (In/Hr)    (Dec.%)     (In/Hr)      (Dec.)    (In/Hr)
56.0  56.0      0.511     0.900        0.097       1.000      0.097
                                                  Sum (F) =   0.097
Area averaged mean soil loss (F) (In/Hr) =  0.097
Minimum soil loss rate ((In/Hr)) =  0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) =   0.180
---------------------------------------------------------------------
Slope of intensity-duration curve for a 1 hour storm =0.5500
---------------------------------------------------------------------

                U n i t  H y d r o g r a p h
                        VALLEY S-Curve
---------------------------------------------------------------
                Unit Hydrograph Data
---------------------------------------------------------------------
Unit time period   Time % of lag   Distribution   Unit Hydrograph
    (hrs)                           Graph %            (CFS)
---------------------------------------------------------------------
    1   0.083        166.620         36.969              2.578
    2   0.167        333.241         45.769              3.192
    3   0.250        499.861         10.303              0.719
    4   0.333        666.481          4.370              0.305
    5   0.417        833.102          2.589              0.181
                                 Sum = 100.000   Sum=       6.974
-----------------------------------------------------------------------


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

  Unit Time   Pattern   Storm Rain     Loss rate(In./Hr)     Effective
       (Hr.)  Percent   (In/Hr)         Max   |   Low        (In/Hr)
   1   0.08     3.30      0.198       (  0.097)       0.036        0.162
   2   0.17     4.20      0.252       (  0.097)       0.045        0.207
   3   0.25     4.40      0.264       (  0.097)       0.048        0.216
   4   0.33     4.80      0.288       (  0.097)       0.052        0.236
   5   0.42     5.20      0.312       (  0.097)       0.056        0.256
   6   0.50     6.20      0.372       (  0.097)       0.067        0.305
   7   0.58     6.80      0.408       (  0.097)       0.073        0.335
   8   0.67     8.80      0.528       (  0.097)       0.095        0.433
   9   0.75    13.90      0.834          0.097    (  0.150)        0.737
```

```
 10   0.83    31.40      1.884          0.097    (  0.339)        1.787
 11   0.92     7.20      0.432       (  0.097)       0.078        0.354
 12   1.00     3.80      0.228       (  0.097)       0.041        0.187
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =     5.2
       Flood volume = Effective rainfall      0.43(In)
        times area       6.9(Ac.)/[(In)/(Ft.)] =       0.3(Ac.Ft)
       Total soil loss =      0.07(In)
       Total soil loss =     0.038(Ac.Ft)
       Total rainfall =      0.50(In)
       Flood volume =       10916.1 Cubic Feet
       Total soil loss =        1642.9 Cubic Feet
       ---------------------------------------------------------------------
        Peak flow rate of this hydrograph =      7.431(CFS)
       ---------------------------------------------------------------------
       +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           1 - 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       0.0029      0.42  VQ        |         |         |         |
   0+10       0.0101      1.05  |V  Q     |         |         |         |
   0+15       0.0193      1.33  |  V Q    |         |         |         |
   0+20       0.0296      1.50  |   VQ    |         |         |         |
   0+25       0.0411      1.66  |     Q   |         |         |         |
   0+30       0.0540      1.88  |      QV |         |         |         |
   0+35       0.0687      2.13  |       Q V         |         |         |
   0+40       0.0861      2.53  |         Q  V      |         |         |
   0+45       0.1113      3.66  |         |   Q  V  |         |         |
   0+50       0.1625      7.43  |         |         |    V   Q|         |
   0+55       0.2131      7.34  |         |         |        Q|   V     |
   1+ 0       0.2351      3.20  |         | Q       |         |      V  |
   1+ 5       0.2456      1.53  |     Q   |         |         |        V|
   1+10       0.2495      0.57  | Q       |         |         |        V|
   1+15       0.2504      0.12  Q         |         |         |        V|
   1+20       0.2506      0.03  Q         |         |         |         V
-----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                Study date  03/15/23 File: EXARLINGTON212.out


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

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


Program License Serial Number 6538

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

 English Units used in output format



--------------------------------------------------------------------
EXISTING POINT 2
ARLINGTON
03/15/2023

-------------------------------------------------------------------
Drainage Area =       8.25(Ac.)  =      0.013 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       8.25(Ac.)  =      0.013 Sq. Mi.
Length along longest watercourse =    1770.00(Ft.)
Length along longest watercourse measured to centroid =     730.00(Ft.)
Length along longest watercourse =      0.335 Mi.
Length along longest watercourse measured to centroid =      0.138 Mi.
Difference in elevation =       5.50(Ft.)
Slope along watercourse =     16.4068 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.066 Hr.
Lag time =     3.95 Min.
25% of lag time =     0.99 Min.
40% of lag time =     1.58 Min.
Unit time =     5.00 Min.
Duration of storm = 1 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        8.25            0.50                    4.13

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        8.25            1.00                    8.25
```

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 0.500(In)
Area Averaged 100-Year Rainfall = 1.000(In)

Point rain (area averaged) = 0.500(In)
Areal adjustment factor = 99.99 %
Adjusted average point rain = 0.500(In)

Sub-Area Data:

| Area(Ac.) | Runoff Index | Impervious % |
|---|---|---|
| 8.250 | 56.00 | 0.900 |

Total Area Entered = 8.25(Ac.)

| RI AMC2 | RI AMC-2 | Infil. Rate (In/Hr) | Impervious (Dec.%) | Adj. Infil. Rate (In/Hr) | Area% (Dec.) | F (In/Hr) |
|---|---|---|---|---|---|---|
| 56.0 | 56.0 | 0.511 | 0.900 | 0.097 | 1.000 | 0.097 |
| | | | | | Sum (F) = | 0.097 |

Area averaged mean soil loss (F) (In/Hr) = 0.097
Minimum soil loss rate ((In/Hr)) = 0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

---

Slope of intensity-duration curve for a 1 hour storm =0.5500

---

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 | 126.555 | 27.068 | 2.251 |
| 2 | 0.167 | 253.110 | 48.461 | 4.029 |
| 3 | 0.250 | 379.666 | 12.764 | 1.061 |
| 4 | 0.333 | 506.221 | 5.735 | 0.477 |
| 5 | 0.417 | 632.776 | 3.175 | 0.264 |
| 6 | 0.500 | 759.331 | 1.752 | 0.146 |
| 7 | 0.583 | 885.886 | 1.044 | 0.087 |
| | | | Sum = 100.000 | Sum= 8.314 |

---

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 | 3.30 | 0.198 | ( 0.097) | 0.036 | 0.162 |
| 2 | 0.17 | 4.20 | 0.252 | ( 0.097) | 0.045 | 0.207 |
| 3 | 0.25 | 4.40 | 0.264 | ( 0.097) | 0.048 | 0.216 |
| 4 | 0.33 | 4.80 | 0.288 | ( 0.097) | 0.052 | 0.236 |
| 5 | 0.42 | 5.20 | 0.312 | ( 0.097) | 0.056 | 0.256 |
| 6 | 0.50 | 6.20 | 0.372 | ( 0.097) | 0.067 | 0.305 |
| 7 | 0.58 | 6.80 | 0.408 | ( 0.097) | 0.073 | 0.335 |

```
  8   0.67     8.80      0.528       (  0.097)       0.095        0.433
  9   0.75    13.90      0.834          0.097    (  0.150)        0.737
 10   0.83    31.40      1.884          0.097    (  0.339)        1.787
 11   0.92     7.20      0.432       (  0.097)       0.078        0.354
 12   1.00     3.80      0.228       (  0.097)       0.041        0.187
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =     5.2
       Flood volume = Effective rainfall      0.43(In)
        times area       8.3(Ac.)/[(In)/(Ft.)] =       0.3(Ac.Ft)
       Total soil loss =      0.07(In)
       Total soil loss =     0.045(Ac.Ft)
       Total rainfall =      0.50(In)
       Flood volume =       13014.0 Cubic Feet
       Total soil loss =        1958.6 Cubic Feet
       --------------------------------------------------------------------
        Peak flow rate of this hydrograph =      9.145(CFS)
       --------------------------------------------------------------------
       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           1 - 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       0.0025      0.37  VQ        |         |         |         |
    0+10       0.0102      1.12  |V  Q     |         |         |         |
    0+15       0.0205      1.49  | V  Q    |         |         |         |
    0+20       0.0322      1.70  |   V Q   |         |         |         |
    0+25       0.0453      1.90  |     VQ  |         |         |         |
    0+30       0.0601      2.15  |       Q |         |         |         |
    0+35       0.0771      2.47  |        QV         |         |         |
    0+40       0.0970      2.88  |         |QV       |         |         |
    0+45       0.1247      4.03  |         |     Q   |         |         |
    0+50       0.1781      7.75  |         |         |  V      |Q        |
    0+55       0.2411      9.14  |         |         |         | V   Q   |
    1+ 0       0.2706      4.29  |         |      Q  |         |     V   |
    1+ 5       0.2862      2.27  |        Q|         |         |       V |
    1+10       0.2930      0.98  |  Q      |         |         |        V|
    1+15       0.2965      0.51  | Q       |         |         |        V|
    1+20       0.2982      0.26  |Q        |         |         |        V|
    1+25       0.2986      0.06  Q         |         |         |        V|
    1+30       0.2988      0.02  Q         |         |         |         V
-----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                Study date  03/15/23 File: EXARLINGTON312.out


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

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


Program License Serial Number 6538

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

 English Units used in output format



--------------------------------------------------------------------
EXISTING POINT 3
ARLINGTON
03/15/2023

-------------------------------------------------------------------
Drainage Area =       2.25(Ac.)  =      0.004 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       2.25(Ac.)  =      0.004 Sq. Mi.
Length along longest watercourse =     359.00(Ft.)
Length along longest watercourse measured to centroid =     180.00(Ft.)
Length along longest watercourse =      0.068 Mi.
Length along longest watercourse measured to centroid =      0.034 Mi.
Difference in elevation =       5.50(Ft.)
Slope along watercourse =     80.8914 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.016 Hr.
Lag time =     0.93 Min.
25% of lag time =     0.23 Min.
40% of lag time =     0.37 Min.
Unit time =     5.00 Min.
Duration of storm = 1 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        2.25            0.50                    1.13

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        2.25            1.00                    2.25
```

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 0.500(In)
Area Averaged 100-Year Rainfall = 1.000(In)

Point rain (area averaged) = 0.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 0.500(In)

Sub-Area Data:

| Area(Ac.) | Runoff Index | Impervious % |
|---|---|---|
| 2.250 | 56.00 | 0.900 |

Total Area Entered = 2.25(Ac.)

| RI AMC2 | RI AMC-2 | Infil. Rate (In/Hr) | Impervious (Dec.%) | Adj. Infil. Rate (In/Hr) | Area% (Dec.) | F (In/Hr) |
|---|---|---|---|---|---|---|
| 56.0 | 56.0 | 0.511 | 0.900 | 0.097 | 1.000 | 0.097 |
| | | | | | Sum (F) = | 0.097 |

Area averaged mean soil loss (F) (In/Hr) = 0.097
Minimum soil loss rate ((In/Hr)) = 0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

---

Slope of intensity-duration curve for a 1 hour storm =0.5500

---

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 | 534.909 | 72.572 | 1.646 |
| 2 | 0.167 | 1069.818 | 27.428 | 0.622 |
| | | Sum = | 100.000 | Sum= 2.268 |

---

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 | 3.30 | 0.198 | ( 0.097) | 0.036 | 0.162 |
| 2 | 0.17 | 4.20 | 0.252 | ( 0.097) | 0.045 | 0.207 |
| 3 | 0.25 | 4.40 | 0.264 | ( 0.097) | 0.048 | 0.216 |
| 4 | 0.33 | 4.80 | 0.288 | ( 0.097) | 0.052 | 0.236 |
| 5 | 0.42 | 5.20 | 0.312 | ( 0.097) | 0.056 | 0.256 |
| 6 | 0.50 | 6.20 | 0.372 | ( 0.097) | 0.067 | 0.305 |
| 7 | 0.58 | 6.80 | 0.408 | ( 0.097) | 0.073 | 0.335 |
| 8 | 0.67 | 8.80 | 0.528 | ( 0.097) | 0.095 | 0.433 |
| 9 | 0.75 | 13.90 | 0.834 | 0.097 | ( 0.150) | 0.737 |
| 10 | 0.83 | 31.40 | 1.884 | 0.097 | ( 0.339) | 1.787 |
| 11 | 0.92 | 7.20 | 0.432 | ( 0.097) | 0.078 | 0.354 |
| 12 | 1.00 | 3.80 | 0.228 | ( 0.097) | 0.041 | 0.187 |

```
                (Loss Rate Not Used)
    Sum =     100.0                                    Sum =     5.2
       Flood volume = Effective rainfall      0.43(In)
        times area       2.3(Ac.)/[(In)/(Ft.)] =       0.1(Ac.Ft)
       Total soil loss =      0.07(In)
       Total soil loss =     0.012(Ac.Ft)
       Total rainfall =      0.50(In)
       Flood volume =        3549.5 Cubic Feet
       Total soil loss =         534.2 Cubic Feet
       ---------------------------------------------------------------------
        Peak flow rate of this hydrograph =      3.401(CFS)
       ---------------------------------------------------------------------
       +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           1 - 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       0.0018      0.27  VQ        |         |         |         |
    0+10       0.0049      0.44  |QV       |         |         |         |
    0+15       0.0082      0.49  |Q  V     |         |         |         |
    0+20       0.0118      0.52  | Q  V    |         |         |         |
    0+25       0.0157      0.57  | Q    V  |         |         |         |
    0+30       0.0203      0.66  | Q      V|         |         |         |
    0+35       0.0254      0.74  | Q       | V       |         |         |
    0+40       0.0317      0.92  |  Q      |    V    |         |         |
    0+45       0.0419      1.48  |    Q    |         V         |         |
    0+50       0.0654      3.40  |         |  Q      |         | V       |
    0+55       0.0770      1.70  |     Q   |         |         |      V  |
    1+ 0       0.0807      0.53  | Q       |         |         |        V|
    1+ 5       0.0815      0.12  Q         |         |         |        V|
-----------------------------------------------------------------------
```

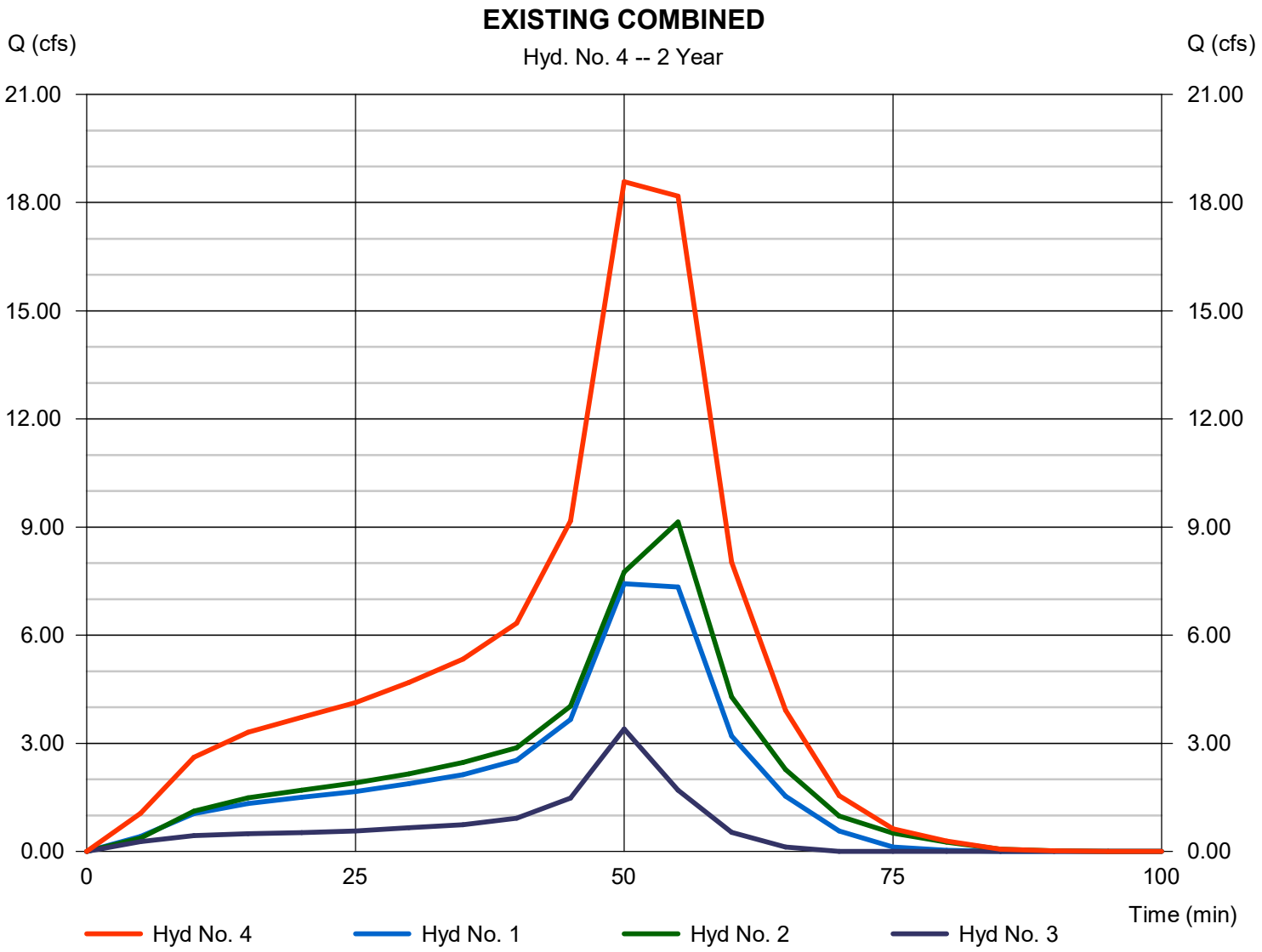
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 03 / 15 / 2023

## Hyd. No. 4

EXISTING COMBINED

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 18.58 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 50 min |
| Time interval | = 5 min | Hyd. volume | = 27,483 cuft |
| Inflow hyds. | = 1, 2, 3 | Contrib. drain. area | = 0.000 ac |



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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                Study date  03/15/23 File: POSTARLINGTON112.out


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

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


Program License Serial Number 6538

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

 English Units used in output format



--------------------------------------------------------------------
POST POINT 1
ARLINGTON
03/15/2023

-------------------------------------------------------------------
Drainage Area =       2.81(Ac.)  =      0.004 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       2.81(Ac.)  =      0.004 Sq. Mi.
Length along longest watercourse =     921.00(Ft.)
Length along longest watercourse measured to centroid =     524.00(Ft.)
Length along longest watercourse =      0.174 Mi.
Length along longest watercourse measured to centroid =      0.099 Mi.
Difference in elevation =       2.50(Ft.)
Slope along watercourse =     14.3322 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.046 Hr.
Lag time =     2.79 Min.
25% of lag time =     0.70 Min.
40% of lag time =     1.12 Min.
Unit time =     5.00 Min.
Duration of storm = 1 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        2.81            0.50                    1.41

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        2.81            1.00                    2.81
```

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 0.500(In)
Area Averaged 100-Year Rainfall = 1.000(In)

Point rain (area averaged) = 0.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 0.500(In)

Sub-Area Data:

| Area(Ac.) | Runoff Index | Impervious % |
|---|---|---|
| 2.810 | 56.00 | 0.900 |

Total Area Entered = 2.81(Ac.)

| RI AMC2 | RI AMC-2 | Infil. Rate (In/Hr) | Impervious (Dec.%) | Adj. Infil. Rate (In/Hr) | Area% (Dec.) | F (In/Hr) |
|---|---|---|---|---|---|---|
| 56.0 | 56.0 | 0.511 | 0.900 | 0.097 | 1.000 | 0.097 |
| | | | | | Sum (F) = | 0.097 |

Area averaged mean soil loss (F) (In/Hr) = 0.097
Minimum soil loss rate ((In/Hr)) = 0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

---

Slope of intensity-duration curve for a 1 hour storm =0.5500

---

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 | 179.330 | 39.590 | 1.121 |
| 2 | 0.167 | 358.660 | 44.834 | 1.270 |
| 3 | 0.250 | 537.990 | 9.690 | 0.274 |
| 4 | 0.333 | 717.320 | 3.978 | 0.113 |
| 5 | 0.417 | 896.651 | 1.908 | 0.054 |
| | | | Sum = 100.000 | Sum= 2.832 |

---

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 | 3.30 | 0.198 | ( 0.097) | 0.036 | 0.162 |
| 2 | 0.17 | 4.20 | 0.252 | ( 0.097) | 0.045 | 0.207 |
| 3 | 0.25 | 4.40 | 0.264 | ( 0.097) | 0.048 | 0.216 |
| 4 | 0.33 | 4.80 | 0.288 | ( 0.097) | 0.052 | 0.236 |
| 5 | 0.42 | 5.20 | 0.312 | ( 0.097) | 0.056 | 0.256 |
| 6 | 0.50 | 6.20 | 0.372 | ( 0.097) | 0.067 | 0.305 |
| 7 | 0.58 | 6.80 | 0.408 | ( 0.097) | 0.073 | 0.335 |
| 8 | 0.67 | 8.80 | 0.528 | ( 0.097) | 0.095 | 0.433 |
| 9 | 0.75 | 13.90 | 0.834 | 0.097 | ( 0.150) | 0.737 |

```
 10   0.83    31.40      1.884          0.097    (  0.339)        1.787
 11   0.92     7.20      0.432       (  0.097)       0.078        0.354
 12   1.00     3.80      0.228       (  0.097)       0.041        0.187
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =     5.2
       Flood volume = Effective rainfall      0.43(In)
        times area       2.8(Ac.)/[(In)/(Ft.)] =       0.1(Ac.Ft)
       Total soil loss =      0.07(In)
       Total soil loss =     0.015(Ac.Ft)
       Total rainfall =      0.50(In)
       Flood volume =        4432.9 Cubic Feet
       Total soil loss =         667.1 Cubic Feet
       ---------------------------------------------------------------------
        Peak flow rate of this hydrograph =      3.114(CFS)
       ---------------------------------------------------------------------
       +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           1 - 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       0.0013      0.18  Q         |         |         |         |
   0+10       0.0043      0.44  |Q        |         |         |         |
   0+15       0.0081      0.55  | QV      |         |         |         |
   0+20       0.0123      0.61  | Q V     |         |         |         |
   0+25       0.0170      0.68  | Q   V   |         |         |         |
   0+30       0.0223      0.77  |  Q    V |         |         |         |
   0+35       0.0283      0.87  |  Q      |V        |         |         |
   0+40       0.0354      1.04  |   Q     |  V      |         |         |
   0+45       0.0458      1.52  |     Q   |       V |         |         |
   0+50       0.0673      3.11  |         | Q       |     V   |         |
   0+55       0.0875      2.94  |         |Q        |         |   V     |
   1+ 0       0.0962      1.26  |    Q    |         |         |      V  |
   1+ 5       0.1001      0.58  | Q       |         |         |        V|
   1+10       0.1014      0.19  Q         |         |         |        V|
   1+15       0.1017      0.04  Q         |         |         |        V|
   1+20       0.1018      0.01  Q         |         |         |         V
----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                Study date  03/15/23 File: POSTARLINGTON212.out


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

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


Program License Serial Number 6538

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

 English Units used in output format



--------------------------------------------------------------------
POST POINT 2
ARLINGTON
03/15/2023

-------------------------------------------------------------------
Drainage Area =       9.58(Ac.)  =      0.015 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       9.58(Ac.)  =      0.015 Sq. Mi.
Length along longest watercourse =    1796.00(Ft.)
Length along longest watercourse measured to centroid =     898.00(Ft.)
Length along longest watercourse =      0.340 Mi.
Length along longest watercourse measured to centroid =      0.170 Mi.
Difference in elevation =       4.00(Ft.)
Slope along watercourse =     11.7595 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.076 Hr.
Lag time =     4.58 Min.
25% of lag time =     1.14 Min.
40% of lag time =     1.83 Min.
Unit time =     5.00 Min.
Duration of storm = 1 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        9.58            0.50                    4.79

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        9.58            1.00                    9.58
```

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 0.500(In)
Area Averaged 100-Year Rainfall = 1.000(In)

Point rain (area averaged) = 0.500(In)
Areal adjustment factor = 99.99 %
Adjusted average point rain = 0.500(In)

Sub-Area Data:

| Area(Ac.) | Runoff Index | Impervious % |
|---|---|---|
| 9.580 | 56.00 | 0.900 |

Total Area Entered = 9.58(Ac.)

| RI AMC2 | RI AMC-2 | Infil. Rate (In/Hr) | Impervious (Dec.%) | Adj. Infil. Rate (In/Hr) | Area% (Dec.) | F (In/Hr) |
|---|---|---|---|---|---|---|
| 56.0 | 56.0 | 0.511 | 0.900 | 0.097 | 1.000 | 0.097 |
| | | | | | Sum (F) = | 0.097 |

Area averaged mean soil loss (F) (In/Hr) = 0.097
Minimum soil loss rate ((In/Hr)) = 0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

---

Slope of intensity-duration curve for a 1 hour storm =0.5500

---

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 | 109.197 | 21.998 | 2.124 |
| 2 | 0.167 | 218.394 | 48.820 | 4.714 |
| 3 | 0.250 | 327.591 | 14.402 | 1.390 |
| 4 | 0.333 | 436.788 | 6.585 | 0.636 |
| 5 | 0.417 | 545.984 | 3.657 | 0.353 |
| 6 | 0.500 | 655.181 | 2.291 | 0.221 |
| 7 | 0.583 | 764.378 | 1.344 | 0.130 |
| 8 | 0.667 | 873.575 | 0.902 | 0.087 |
| | | | Sum = 100.000 | Sum= 9.655 |

---

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 | 3.30 | 0.198 | ( 0.097) | 0.036 | 0.162 |
| 2 0.17 | 4.20 | 0.252 | ( 0.097) | 0.045 | 0.207 |
| 3 0.25 | 4.40 | 0.264 | ( 0.097) | 0.048 | 0.216 |
| 4 0.33 | 4.80 | 0.288 | ( 0.097) | 0.052 | 0.236 |
| 5 0.42 | 5.20 | 0.312 | ( 0.097) | 0.056 | 0.256 |
| 6 0.50 | 6.20 | 0.372 | ( 0.097) | 0.067 | 0.305 |

```
  7   0.58     6.80      0.408       (  0.097)       0.073        0.335
  8   0.67     8.80      0.528       (  0.097)       0.095        0.433
  9   0.75    13.90      0.834          0.097    (  0.150)        0.737
 10   0.83    31.40      1.884          0.097    (  0.339)        1.787
 11   0.92     7.20      0.432       (  0.097)       0.078        0.354
 12   1.00     3.80      0.228       (  0.097)       0.041        0.187
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =     5.2
       Flood volume = Effective rainfall      0.43(In)
        times area       9.6(Ac.)/[(In)/(Ft.)] =       0.3(Ac.Ft)
       Total soil loss =      0.07(In)
       Total soil loss =     0.052(Ac.Ft)
       Total rainfall =      0.50(In)
       Flood volume =       15111.8 Cubic Feet
       Total soil loss =        2274.3 Cubic Feet
       ---------------------------------------------------------------------
        Peak flow rate of this hydrograph =     10.719(CFS)
       ---------------------------------------------------------------------
       +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           1 - 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        5.0      10.0      15.0      20.0
  ----------------------------------------------------------------------
    0+ 5       0.0024      0.34  Q         |         |         |         |
    0+10       0.0107      1.20  |VQ       |         |         |         |
    0+15       0.0221      1.66  | VQ      |         |         |         |
    0+20       0.0353      1.91  |  QV     |         |         |         |
    0+25       0.0501      2.15  |   QV    |         |         |         |
    0+30       0.0668      2.43  |   Q  V  |         |         |         |
    0+35       0.0861      2.80  |    Q   V|         |         |         |
    0+40       0.1085      3.26  |     Q   | V       |         |         |
    0+45       0.1392      4.46  |       Q |     V   |         |         |
    0+50       0.1964      8.30  |         |     Q   | V       |         |
    0+55       0.2702     10.72  |         |         |Q        |V        |
    1+ 0       0.3068      5.31  |         Q         |         |    V    |
    1+ 5       0.3270      2.94  |    Q    |         |         |      V  |
    1+10       0.3364      1.37  | Q       |         |         |       V |
    1+15       0.3417      0.77  |Q        |         |         |        V|
    1+20       0.3448      0.44  Q         |         |         |        V|
    1+25       0.3464      0.24  Q         |         |         |        V|
    1+30       0.3468      0.06  Q         |         |         |        V|
    1+35       0.3469      0.02  Q         |         |         |         V
-----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                Study date  03/15/23 File: POSTARLINGTON312.out


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

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


Program License Serial Number 6538

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

 English Units used in output format



--------------------------------------------------------------------
POST POINT 3
ARLINGTON
03/15/2023

-------------------------------------------------------------------
Drainage Area =       2.87(Ac.)  =      0.004 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment =       2.87(Ac.)  =      0.004 Sq. Mi.
Length along longest watercourse =     952.00(Ft.)
Length along longest watercourse measured to centroid =     476.00(Ft.)
Length along longest watercourse =      0.180 Mi.
Length along longest watercourse measured to centroid =      0.090 Mi.
Difference in elevation =      12.00(Ft.)
Slope along watercourse =     66.5546 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time =    0.034 Hr.
Lag time =     2.03 Min.
25% of lag time =     0.51 Min.
40% of lag time =     0.81 Min.
Unit time =     5.00 Min.
Duration of storm = 1 Hour(s)
User Entered Base Flow =     0.00(CFS)

2 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        2.87            0.50                    1.44

100 YEAR Area rainfall data:


Area(Ac.)[1]       Rainfall(In)[2]      Weighting[1*2]
        2.87            1.00                    2.87
```

STORM EVENT (YEAR) = 2.00
Area Averaged 2-Year Rainfall = 0.500(In)
Area Averaged 100-Year Rainfall = 1.000(In)

Point rain (area averaged) = 0.500(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 0.500(In)

Sub-Area Data:

| Area(Ac.) | Runoff Index | Impervious % |
|---|---|---|
| 2.870 | 56.00 | 0.900 |

Total Area Entered = 2.87(Ac.)

| RI AMC2 | RI AMC-2 | Infil. Rate (In/Hr) | Impervious (Dec.%) | Adj. Infil. Rate (In/Hr) | Area% (Dec.) | F (In/Hr) |
|---|---|---|---|---|---|---|
| 56.0 | 56.0 | 0.511 | 0.900 | 0.097 | 1.000 | 0.097 |
| | | | | | Sum (F) = | 0.097 |

Area averaged mean soil loss (F) (In/Hr) = 0.097
Minimum soil loss rate ((In/Hr)) = 0.049
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.180

---

Slope of intensity-duration curve for a 1 hour storm =0.5500

---

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 | 245.895 | 50.355 | 1.456 |
| 2 | 0.167 | 491.789 | 40.309 | 1.166 |
| 3 | 0.250 | 737.684 | 7.156 | 0.207 |
| 4 | 0.333 | 983.579 | 2.180 | 0.063 |
| | | | Sum = 100.000 | Sum= 2.892 |

---

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 | 3.30 | 0.198 | ( 0.097) | 0.036 | 0.162 |
| 2 | 0.17 | 4.20 | 0.252 | ( 0.097) | 0.045 | 0.207 |
| 3 | 0.25 | 4.40 | 0.264 | ( 0.097) | 0.048 | 0.216 |
| 4 | 0.33 | 4.80 | 0.288 | ( 0.097) | 0.052 | 0.236 |
| 5 | 0.42 | 5.20 | 0.312 | ( 0.097) | 0.056 | 0.256 |
| 6 | 0.50 | 6.20 | 0.372 | ( 0.097) | 0.067 | 0.305 |
| 7 | 0.58 | 6.80 | 0.408 | ( 0.097) | 0.073 | 0.335 |
| 8 | 0.67 | 8.80 | 0.528 | ( 0.097) | 0.095 | 0.433 |
| 9 | 0.75 | 13.90 | 0.834 | 0.097 | ( 0.150) | 0.737 |
| 10 | 0.83 | 31.40 | 1.884 | 0.097 | ( 0.339) | 1.787 |

```
 11   0.92     7.20      0.432       (  0.097)       0.078        0.354
 12   1.00     3.80      0.228       (  0.097)       0.041        0.187
                (Loss Rate Not Used)
    Sum =     100.0                                   Sum =     5.2
       Flood volume = Effective rainfall      0.43(In)
        times area       2.9(Ac.)/[(In)/(Ft.)] =       0.1(Ac.Ft)
       Total soil loss =      0.07(In)
       Total soil loss =     0.016(Ac.Ft)
       Total rainfall =      0.50(In)
       Flood volume =        4527.5 Cubic Feet
       Total soil loss =         681.4 Cubic Feet
       --------------------------------------------------------------------
        Peak flow rate of this hydrograph =      3.574(CFS)
       --------------------------------------------------------------------
       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                           1 - 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       0.0016      0.24  Q         |         |         |         |
    0+10       0.0050      0.49  |Q        |         |         |         |
    0+15       0.0091      0.59  | QV      |         |         |         |
    0+20       0.0135      0.65  | Q  V    |         |         |         |
    0+25       0.0184      0.71  | Q    V  |         |         |         |
    0+30       0.0240      0.81  |  Q     V|         |         |         |
    0+35       0.0302      0.91  |  Q      |V        |         |         |
    0+40       0.0378      1.10  |   Q     |   V     |         |         |
    0+45       0.0493      1.67  |     Q   |       V |         |         |
    0+50       0.0739      3.57  |         |   Q     |       V |         |
    0+55       0.0931      2.78  |         |Q        |         |    V    |
    1+ 0       0.1007      1.10  |   Q     |         |         |       V |
    1+ 5       0.1034      0.40  |Q        |         |         |        V|
    1+10       0.1039      0.06  Q         |         |         |        V|
    1+15       0.1039      0.01  Q         |         |         |         V
-----------------------------------------------------------------------
```

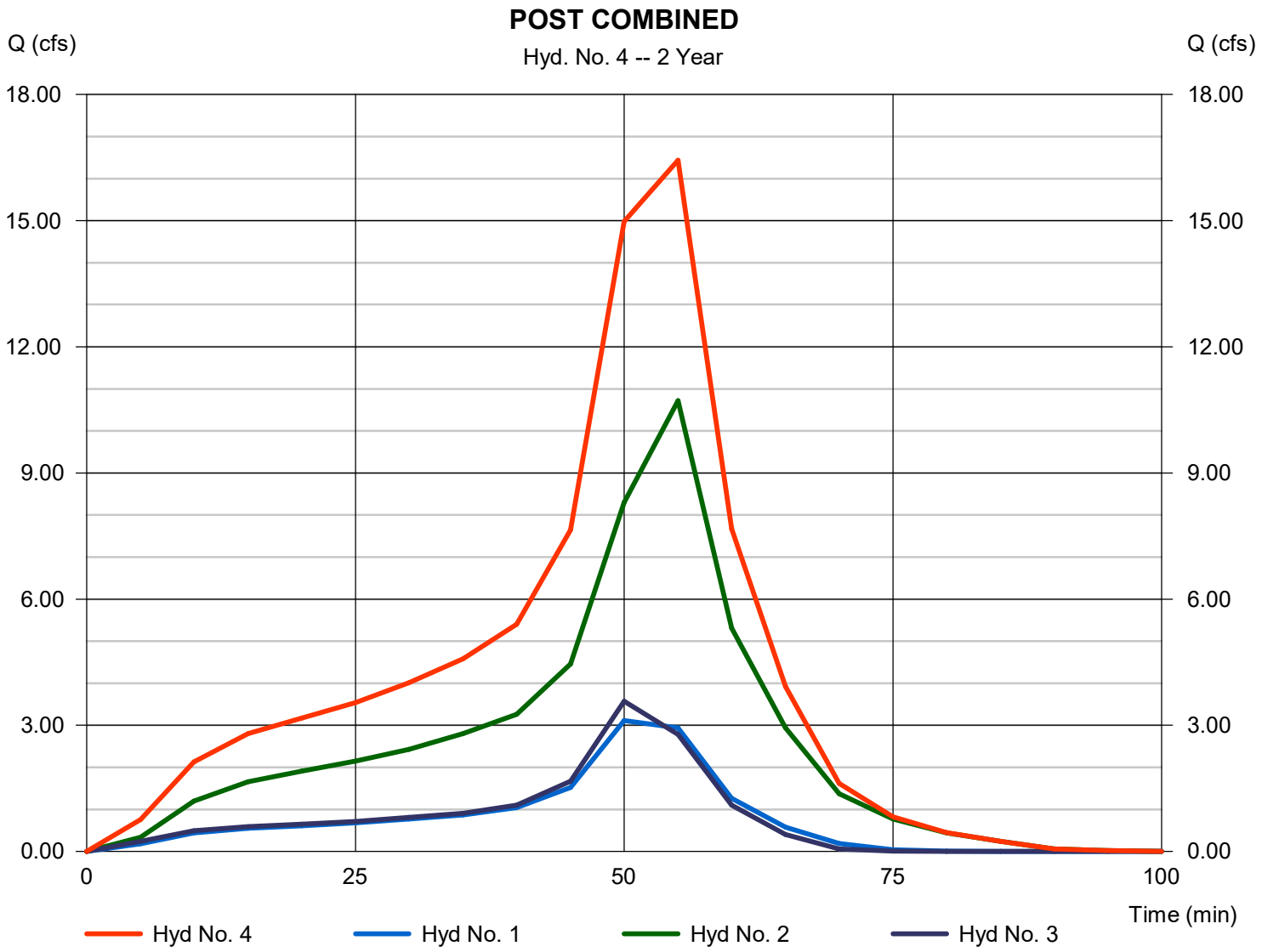
# Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2021 Wednesday, 03 / 15 / 2023

## Hyd. No. 4

POST COMBINED

| | | | |
|---|---|---|---|
| Hydrograph type | = Combine | Peak discharge | = 16.44 cfs |
| Storm frequency | = 2 yrs | Time to peak | = 55 min |
| Time interval | = 5 min | Hyd. volume | = 24,078 cuft |
| Inflow hyds. | = 1, 2, 3 | Contrib. drain. area | = 0.000 ac |



# Appendix 8: Source Control

*Pollutant Sources/Source Control Checklist*

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☒ Provide stormwater pollution prevention information to new site owners, lessees, or operators.<br><br>☒ See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com<br><br>☒ Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains." |
| ☐ B. Interior floor drains and elevator shaft sump pumps | | ☐ State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer. | ☐ Inspect and maintain drains to prevent blockages and overflow. |
| ☒ C. Interior parking garages | | ☒ State that parking garage floor drains will be plumbed to the sanitary sewer. | ☒ Inspect and maintain drains to prevent blockages and overflow. |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☒ Show self-retaining landscape areas, if any.<br><br>☒ 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.<br><br>☐ Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.<br><br>☒ 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.<br><br>☒ Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.<br><br>☒ Consider using pest-resistant plants, especially adjacent to hardscape.<br><br>☒ To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions. | ☒ Maintain landscaping using minimum or no pesticides.<br><br>☒ See applicable operational BMPs in "What you should know for…..Landscape and Gardening" at http://rcflood.org/stormwater/Downloads/LandscapeGardenBrochure.pdf<br><br>☒ Provide IPM information to new owners, lessees and operators. |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>☒ 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:<br><br>☒ Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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/ |

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:<br>☐ Hazardous Waste Generation<br>☐ Hazardous Materials Release Response and Inventory<br>☐ California Accidental Release (CalARP)<br>☐ Aboveground Storage Tank<br>☐ Uniform Fire Code Article 80 Section 103(b) & (c) 1991<br>☐ Underground Storage Tank www.cchealth.org/groups/hazmat / | ☐ See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included in WQMP Table and Narrative |
|---|---|---|---|
| ☐ J. Vehicle and Equipment Cleaning | ☐ Show on drawings as appropriate:<br><br>(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.<br><br>(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shutoff to discourage such use).<br><br>(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.<br><br>(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):<br><br>☐ 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/<br><br>☐ Car dealerships and similar may rinse cars with water only. |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>☐ 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:<br><br>☐ 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.<br><br>☐ 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.<br><br>☐ 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/ |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☐ 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.<br><br>☐ 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.

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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.<br><br>☐ 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.<br><br>☐ 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.<br><br>☒ See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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<br><br>☐ Boiler drain lines<br><br>☐ Condensate drain lines<br><br>☒ Rooftop equipment<br><br>☐ Drainage sumps<br><br>☒ Roofing, gutters, and trim.<br><br>☐ 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.<br><br>☐ 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.<br><br>☒ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.<br><br>☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.<br><br>☐ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.<br><br>☐ Include controls for other sources as specified by local reviewer. | |

STORMWATER POLLUTANT SOURCES / SOURCE CONTROL CHECKLIST

| 1<br>Potential Sources of Runoff Pollutants | 2<br>Permanent Controls—Shown on WQMP Drawings | 3<br>Permanent Controls—Listed in WQMP Table and Narrative | 4<br>Operational BMPs—Included 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 wash water 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*

# EcoPure BioFilter™
# Maintenance Guide

The ADS EcoPure BioFilter system requires periodic inspection and maintenance for it to operate at the design efficiency. The inspection process helps in deciding when and what level of maintenance will be needed to bring the unit up to or near peak efficiency. As with ADS' other water quality products, the maintenance cycle of the EcoPure BioFilter system will be driven mostly by the actual solids and trash/debris load brought into the system.

ADS recommends inspecting the EcoPure BioFilter quarterly for the first year of service, and after every significant storm event occurring during the first six months. The definition of a significant storm event will vary depending on the geographic area, but if the event is greater than 1" (25 mm) of intensity within an hour or 3" (75 mm) within a 24-hour period, the system should be inspected. After the first year, systems should be inspected at least bi-annually and ideally before the spring or rainy season and after the summer season, or prior to fall or winter seasons. It is recommended that some general "good housekeeping" maintenance be performed at the beginning of the rainy or spring season every year. Since the stormwater solids concentration (mg/L as TSS) can be variable, it is possible that the maintenance cycle could be more or less than the projected duration.

For most maintenance needs, the EcoPure BioFilter planting component follows the practices used for handling standard bioretention systems (i.e., general landscaping, cover management, and replacement planting of surface plants).

It may be advisable to "water" or irrigate the EcoPure BioFilter plant area in geographical regions experiencing droughts or prolong periods without rainfall during the first year of service. Watering the plant life will help to ensure the plants can take hold and be established for future growth and treatment capabilities.

## Inspection and General Maintenance Equipment

The following is a list of equipment recommended for inspection and general maintenance.

- Personal Protection Equipment (pants, steel-toed shoes, safety glasses, gloves, safety vest, hard hat, etc.)
- Manhole Hook
- Traffic Cones and Signage
- Stadia Rod and Tape Measure
- Inspection Operation and Maintenance Log or other recording method (included at end of guide)
- Flashlight
- Trash Removal "Net" Device
- Shovel, rake, broom and trash receptacle
- Vactor Truck (if more extensive maintenance is required)
- Light Duty Construction Equipment (if bioretention media replacement is required)

## General Inspection and Maintenance Procedures

Routine inspection will ensure that the system is performing at optimal conditions and that the risk of public flooding is low. EcoPure BioFilter inspection involves a visual inspection of the plant surface area, structure inlet, pretreatment cell, clean-out ports, and the tertiary cell (if applicable for Metals Removal). This can all be done at the surface and requires no confined space entry into the EcoPure BioFilter unit. An Inspection O&M log should be used, and dates and weather conditions should be noted.

If the EcoPure BioFilter is located in a traffic area (i.e. roadway or automobile travel way), and inspection is not possible without entering the vehicular area, safety measures should be employed -- safety cones setup, etc. -- prior to performing the inspection and maintenance.

## Inspection and Maintenance for the Pretreatment Cell and Chamber Cavity

For inspection of the pretreatment cell, the manhole cover should be safely removed (i.e., using a manhole hook). A visual inspection of the condition of the surface concrete and any inlet grates should be noted. If grates are missing or inlets are damaged, contact ADS for recommendation of repair. The suspended trash grate area should be relatively clear of debris. If excessive debris is observed, a trash capture net should be employed, and debris removed. Next a stadia rod should be sent down to the bottom of the pretreatment cell and the level of debris should be recorded in the maintenance log. The trash “tray” will have to be unfolded and opened to allow this to happen. The trash screen has lifting “ports” to pull up and fold the horizontal portion of the screen to the sides of the unit. At the sides, there are “locking” tabs to hold the screen panels to the concrete wall. When the debris in the sump reaches 10” (250mm) in average depth, a Vactor truck should be used to remove the accumulated sump debris. Employing a Vactor track for cleaning the pretreatment cell follows the typical guidelines used for cleaning underground BMPs, e.g., hydrodynamic stormwater devices.

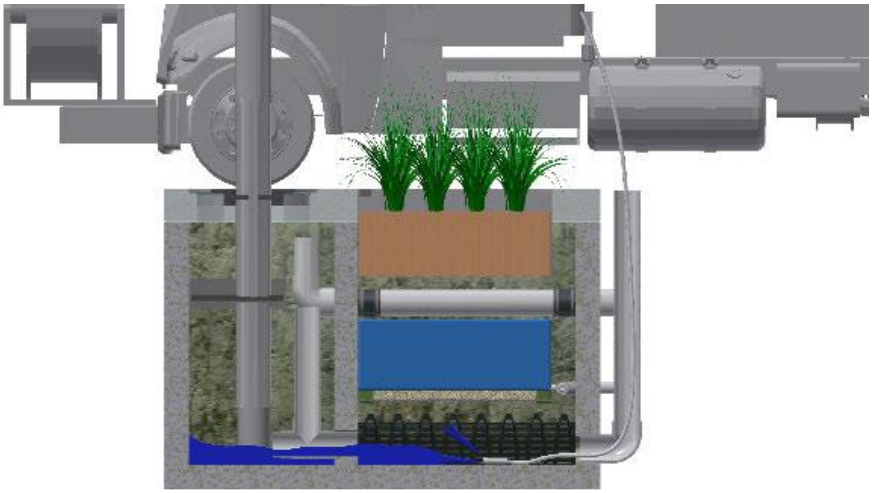
For inspection and cleaning of the chamber section of the EcoPure BioFilter (open cavity under the media cell), it is generally recommended that if the 10” (250mm) sediment mark has been reached in the pre-treatment cell, the owner or O&M contractor should backwash the chamber section of the media cell. With the pre-treatment cell cleaned and dewatered, the cleanout risers should be exercised and low-pressure water (60-80 psi) should be introduced to force and move sediment within the chamber cavities into the pretreatment cell. (The riser tees have a removable cap or “duckbill” valve to facilitate a “bottom” exit at the floor of the chamber cell to the pretreatment cell).

Once it is deemed that most of the chamber “floor” sediment from the planting cell has been backflushed, the introduction of the “cleaning” water flow should cease. The pretreatment cell should be vacuumed dry (during this backflushing procedure), the trash rack reinstalled/repositioned, and the manhole cover replaced. The backflushing process may require confined space entry and all rules and precautions should be adhered to, based on the local jurisdiction regulations or requirements.

## Inspection and Maintenance for the Planting and Bioretention Media Layer and Optional Third Cell

A visual inspection of the general appearance of the EcoPure BioFilter should be performed, and notes should be taken detailing the condition of the surface plant life, invasive species intrusion, vandalism, erosion in the planting area and any signs of standing water or

disturbed or “shifted” surface soil bed area. This general system condition should be noted in the inspection/maintenance log.



If the plant life and surface media show signs of distress, general landscaping O&M should be performed, i.e., raking, weeding (removal of invasive plants), and general planting replacement to maximize the cover area in the planting bed/media treatment cell. If ponding of water is present in the media treatment cell and the last rain event was greater than 24 hours prior, further inspection should be performed to ensure the effluent pipe is not blocked.

All blocked pipes should be cleared and cleaned. If the inspection results in the conclusion that the bio media bed is compromised or has reached its service life, total replacement of the media treatment cell is recommended.

When a “three-cell” EcoPure BioFilter is installed, an inspection of the third cell can be conducted. Removal of the manhole cover for this cell should be performed similar to the pretreatment cell with appropriate safety precautions. A visual inspection with a flashlight will inspect the appearance of the metals media bed. If visual sediment is observed on the surface of the metals media or the media bed appears to have been greatly disturbed during preceding storm events (i.e., media or visual water line up the sides of the concrete walls, 12”-18” (300-450 mm) from the base or resting media surface), further inspection during a storm event should be undertaking to see if the system is going into bypass. If bypass is occurring during a normal 1-2 year storm event, media replacement may be recommended. ADS Field Engineering can assist with this analysis. It is generally agreed if the second or bio-media cell media is at the end of it’s service life, that the metals bay media is as well and should be replaced.

ADS should be contacted for material specifications and replacement parts. Media cell replacement will involve utilizing small construction excavation equipment.

Disposal of material from the pretreatment cell, trash debris rack, and chamber cavity should be in accordance with the local municipality’s requirements. Typically, traditional municipal landfills can be used for disposal of solids and trash obtained from servicing the EcoPure BioFilter. The same disposal methods should be used if the media cell is replaced. Call ADS at 800-821-6710 for further information.

## EcoPure BioFilter Inspection and O&M Log Sheet

**Project Name:** _____

**Location:** _____

| Date | Inspection or O&M | Observation/Actions | Operator comments and general description | Inspector |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

**adspipe.com**

1-800-821-6710

ADS "Terms and Conditions of Sale" are available on the ADS website, www.ads-pipe.com
The ADS logo, EcoPure BioFilter™ and the Green Stripe are registered trademarks of Advanced Drainage Systems, Inc.
© 2021 Advanced Drainage Systems, Inc. MG1.03 2/21 CS

# Appendix 10:Educational Materials

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

1. "A Citizen's Guide to Understanding Stormwater" EPA 833-B-00-002.
2. Stormwater Pollution What You Should Know for "Outdoor Cleaning Activities and Non-point Source Discharges" Riverside County Flood Control
3. "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" Riverside County Flood Control
4. "Tips for Landscape and Gardening" Riverside County Flood Control
5. "Food Service Industry Best Practices: Restaurants, Mobile Food Trucks, Grocery Stores, Bakeries, Delicatessens" Riverside County Flood Control
6. CASQA Handouts

    SC-10 Non-Stormwater Discharges

    SC-30 Outdoor Loading/Unloading

    SC-34 Waste Handling and Disposal

    SC-41 Building and Grounds Maintenance

    SC-43 Parking/Storage Area Maintenance

    SC-44 Drainage System Maintenance

    SD-10 Site Design & Landscape Planning

    SD-11 Roof Runoff Controls

    SD-12 Efficient Irrigation

    SD-32 Trash Storage Areas

WHEN IT RAINS IT DRAINS

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

EPA United States Environmental Protection Agency

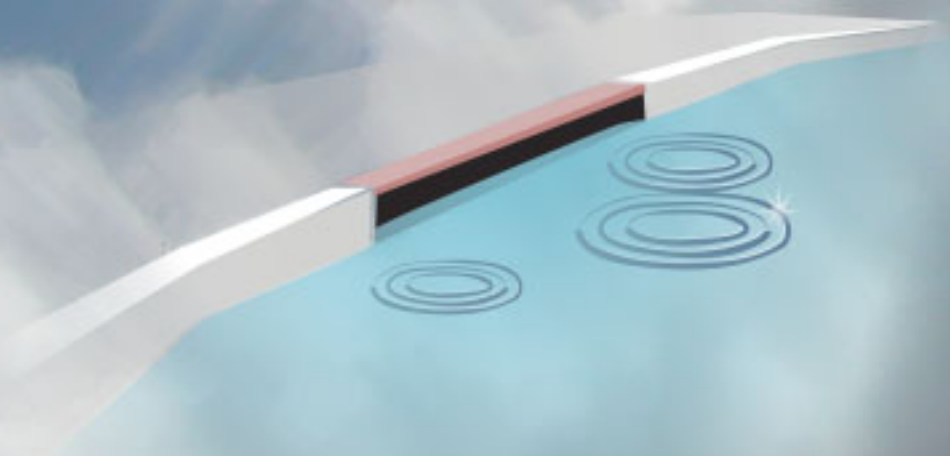
EPA 833-B-03-002

January 2003

THE YEAR OF CLEAN WATER
Celebration & Recommitment

Internet Address (URL) • HTTP://www.epa.gov
Recycled/Recyclable • Printed With Vegetable Oil Based Inks on 100% Postconsumer, Process Chlorine Free Recycled Paper

# After the Storm



## A Citizen's Guide to Understanding Stormwater

WHEN IT RAINS IT DRAINS

# What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

# Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

# The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.

- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.

- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

# Stormwater Pollution Solutions

## Residential

*Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.*

### Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

### Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

### Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

### Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

*Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.*

## Residential landscaping

**Permeable Pavement**—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

**Rain Barrels**—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

**Rain Gardens and Grassy Swales**—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

**Vegetated Filter Strips**—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

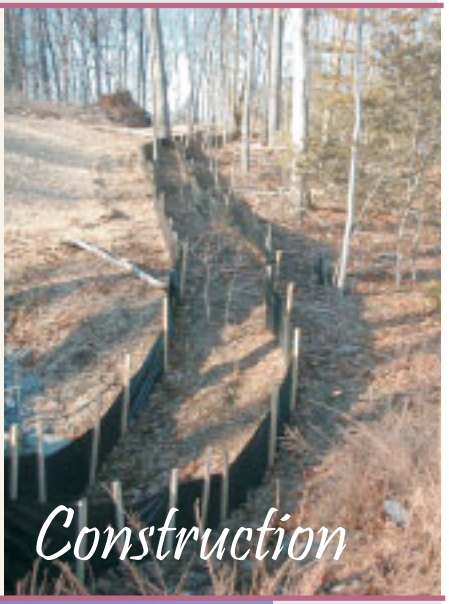
## Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



## Construction

## Agriculture

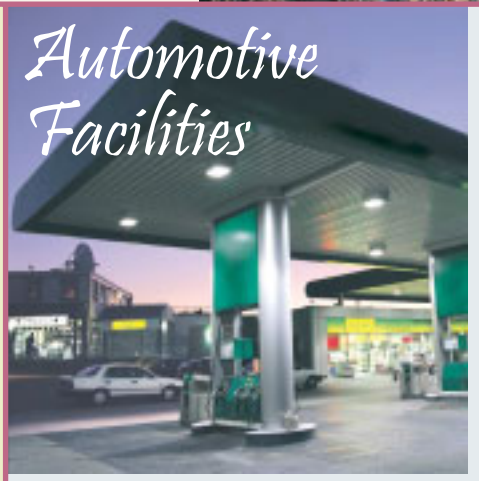
Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

## Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.



## Automotive Facilities

Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

## Helpful telephone numbers and links:

### Riverside County Stormwater Protection Partners

| | |
|---|---|
| Flood Control District | (951) 955-1200 |
| County of Riverside | (951) 955-1000 |
| 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 |
| Cathedral City | (760) 770-0327 |
| City of Coachella | (760) 398-4978 |
| 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 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) 361-0900 |
| City of San Jacinto | (951) 654-7337 |
| City of Temecula | (951) 694-6444 |
| City of Wildomar | (951) 677-7751 |

**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

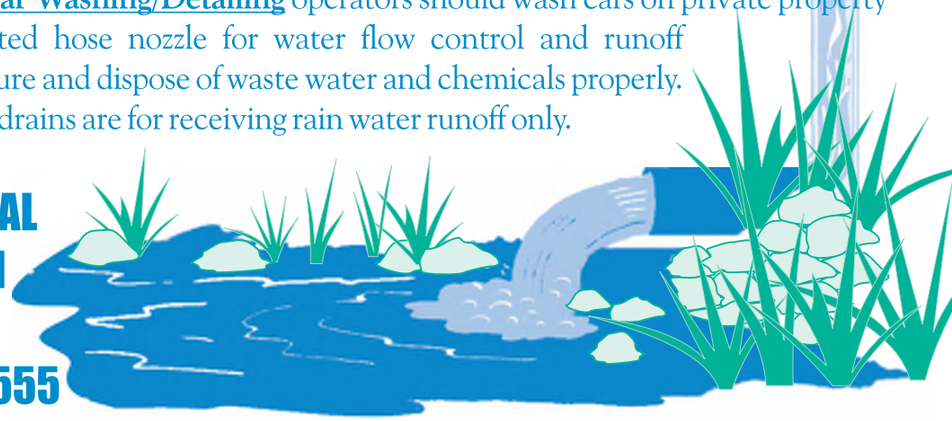
# Do you know where street flows actually go?

## 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 stormwater 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 of wash water into 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.

...ONLY RAIN... DOWN THE 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 with 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 inlets 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)

ONLY RAIN DOWN THE STORM DRAIN

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!

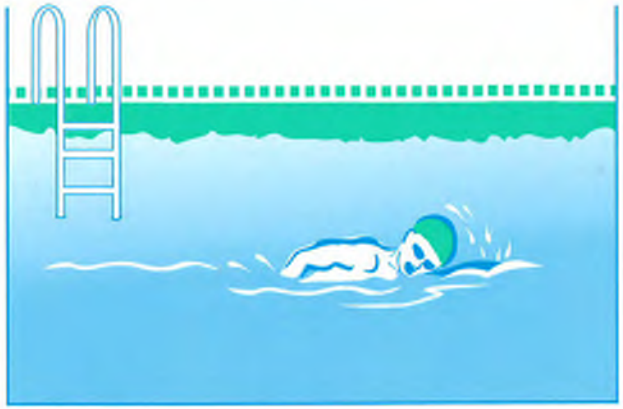
Wastewater, from residential swimming pools, Jacuzzis, fishponds and fountains, often contains chemicals used for sanitizing or cleansing purposes. Toxic chemicals (such as chlorine or copper-based algaecides) may pollute the environment when discharged into a storm drain system.

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.

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.**

## We ♥ our Watershed!

A clean and healthy watershed is important to all of us.

Trash, debris, chemicals and other contaminants from business activities often make their way into the Riverside County storm drain system. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife.

## Did you know?

There is a difference between storm drains and sewers.

Storm drains capture rainwater and flow directly to our rivers, lakes and streams – untreated.

Sewers capture and collect water from sinks, toilets and floor drains, and then it is processed and treated before it is released into the environment.

For more information about how you can protect our watershed, please visit:
**www.rcwatershed.org**

## Questions?

If you have questions about Best Management Practices, or if you have questions about illicit dumping and stormwater pollution visit the Pollution Prevention website: rcwatershed.org.

For more information on requirements for all retail food facilities go to Riverside County Environmental Health's website: rivcoeh.org

RIVERSIDE COUNTY
WATERSHED PROTECTION

Riverside County Watershed Protection Program is managed by Riverside County Flood Control & Water Conservation District in partnership with 27 Cities, the County of Riverside and the Coachella Valley Water District.

OUR MISSION
"To protect, preserve and enhance the quality of Riverside County watersheds by fostering a community-wide commitment to clean water."

# Watershed Protection

## Food Service Industry Best Practices

**Restaurants**
**Mobile Food Trucks**
**Grocery Stores**
**Bakeries**
**Delicatessens**

# Best Kitchen Practices

## Recycle Oil & Grease

- Never put oil or grease down the drain. Contain grease and oil by using covered grease storage containers or installing a grease interceptor.
- Never overfill your grease storage container or transport it without a cover.
- Grease control devices must be emptied and cleaned by permitted companies and according to manufacturer's specifications.
- Keep maintenance records on site.
- For a list of oil/grease recycling companies, contact CalRecycle www.calrecycle.ca.gov or contact your local sanitation district.

## Managing Spills

- Clean food spills in loading and trash areas by using absorbent materials and sweeping then mopping.
- Discharge mop water into the sewer through a grease interceptor.
- Have spill containment and cleanup kits available.
- To report serious toxic spills, call 911.

## Handling Toxic Chemicals

- Dispose of all unwanted toxics materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash!
- Use non-toxic cleaning products whenever possible.
- For information on hazardous waste transporters, call (888) 722-4234.

## Dumpster Areas

- Keep dumpster lids closed and the areas around them clean.
- Do not fill with liquid waste or hose them out.
- Call your trash hauler to replace any dumpsters that are damaged or leaking.

## Cleaning & Maintenance

- Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to a sanitary sewer.
- Sweep outside areas and put the debris in trash containers DO NOT hose down or sweep into the parking lot or street.
- Outside eating areas and sidewalks may not be hosed down or pressure washed UNLESS the following standards are met:
  - ✓ Use dry cleanup methods prior to any pressure washing – absorbing with kitty litter, sweeping, vacuuming, scraping off dried debris.
  - ✓ Wash waters must be captured for proper disposal: collected waters should be discharged to a sanitary drain.
  - ✓ DO NOT use any chemicals or detergents.
  - ✓ DO NOT wash or pour water in a parking lot, alley, sidewalk or street.

## Mobile Food Trucks

- The potential for generating stormwater pollution as part of a mobile food business requires special attention. Cleaning activities are required to be conducted at an approved fixed location with a connection to a sanitary sewer. For more information contact Riverside County Environmental Health at (888) 722-4234.
- Do not discharge wash water into storm drains.
- Clean on a properly equipped wash pad and drain wastewater to a sanitary sewer system.

## Food Waste Disposal

- Scrape food waste off of plates, pots and food prep areas and dispose of in the trash.
- Food scraps often contain grease, which can clog sewer pipes and result in costly sewer backups and overflows.
- Never put food waste down the drain.

RECYCLE
USED OIL

# Non-Stormwater Discharges SC-10

Graphic by: Margie Winter

## Objectives

- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

| | |
|---|---|
| Sediment | ☑ |
| Nutrients | ☑ |
| Trash | ☑ |
| Metals | ☑ |
| Bacteria | ☑ |
| Oil and Grease | ☑ |
| Organics | ☑ |
| Oxygen Demanding | ☑ |

## Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

## Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

the field staff must be trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

***Suggested Protocols***

**Fixed Facility**

*General*

- Post "No Dumping" signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.

*Illicit Connections*

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

*Visual Inspection and Inventory*

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

*Review Infield Piping*

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

*Smoke Testing*

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.

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

*Dye Testing*

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

*TV Inspection of Storm Sewer*

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

*Illegal Dumping*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

**Field Program**

*General*

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.

*Field Inspection*

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

*Recommended Complaint Investigation Equipment*

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

- Educational materials

*Reporting*

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

*Enforcement*

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
  - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
  - Provide information regarding BMPs to the responsible party, where appropriate.
  - Begin enforcement procedures, if appropriate.
  - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

***Training***

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

***Spill Response and Prevention***

- See SC-11 Spill Prevention Control and Clean Up

***Other Considerations***

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

## Requirements

***Costs***

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

***Maintenance***

Not applicable

## Supplemental Information

### *Further Detail of the BMP*

*What constitutes a "non-stormwater" discharge?*

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

*Permit Requirements*

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

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

*Illegal Dumping*

- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties

*Outreach*

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There we a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

*What constitutes a "non-stormwater" discharge?*

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

*Permit Requirements*

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence

of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

*Storm Drain Stenciling*

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

*Oil Recycling*

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

***Household Hazardous Waste***

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

***Training***

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

### *Other Considerations*

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling element and a HHW element within their integrated waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

### *Examples*

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel "Do Not Disturb" signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

### References and Resources

http://www.stormwatercenter.net/

California's Nonpoint Source Program Plan http://www.co.clark.wa.us/pubworks/bmpman.pdf

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

Orange County Stormwater Program,
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (http://www.projectcleanwater.org)

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF

# Outdoor Loading/Unloading SC-30

## Description

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

## Approach

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

### *General Pollution Prevention Protocols*

- ☐ Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- ☐ Limit exposure of material to rainfall whenever possible.
- ☐ Prevent stormwater run-on.
- ☐ Check equipment regularly for leaks.

### *Good Housekeeping*

- ☐ Develop an operations plan that describes procedures for loading and/or unloading.
- ☐ Conduct loading and unloading in dry weather if possible.

| Objectives |
|---|
| ▪ *Cover* |
| ▪ *Contain* |
| ▪ *Educate* |
| ▪ *Reduce/Minimize* |
| ▪ *Product Substitution* |

| Targeted Constituents | |
|---|---|
| *Sediment* | ✓ |
| *Nutrients* | ✓ |
| *Trash* | |
| *Metals* | ✓ |
| *Bacteria* | |
| *Oil and Grease* | ✓ |
| *Organics* | ✓ |

| Minimum BMPs Covered | |
|---|---|
| *Good Housekeeping* | ✓ |
| *Preventative Maintenance* | |
| *Spill and Leak Prevention and Response* | ✓ |
| *Material Handling & Waste Management* | ✓ |
| *Erosion and Sediment Controls* | |
| *Employee Training Program* | ✓ |
| *Quality Assurance Record Keeping* | ✓ |

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION®

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

### *Spill Response and Prevention Procedures*

- Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

### *Material Handling and Waste Management*

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.
- Perform work area clean-up and dry sweep after daily operations.

### *Employee Training Program*

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

### *Quality Assurance and Record Keeping*

- Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.
- Keep accurate logs of daily clean-up operations.

## Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- ☐ Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- ☐ It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

## Potential Capital Facility Costs and Operation & Maintenance Requirements

### *Facilities*

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

### *Maintenance*

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- ☐ Conduct regular inspections and make repairs and improvements as necessary.
- ☐ Check loading and unloading equipment regularly for leaks.
- ☐ Conduct regular broom dry-sweeping of area. Do not wash with water.

## Supplemental Information

### *Loading and Unloading of Liquids*

- ☐ Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer,

treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - ✓ The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.
  - ✓ The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - ✓ Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - ✓ Drip pan systems should be installed between the rails to collect spillage from tank cars.

## References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations.* Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315.* Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations.* Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program, *Best Management Practices for Industrial Storm Water Pollution Control.* Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: *Best Management Practices*. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

# Waste Handling & Disposal SC-34

## Objectives

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

## Description

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

## Targeted Constituents

| | |
|---|---|
| Sediment | ☑ |
| Nutrients | ☑ |
| Trash | ☑ |
| Metals | ☑ |
| Bacteria | ☑ |
| Oil and Grease | ☑ |
| Organics | ☑ |
| Oxygen Demanding | ☑ |

## Approach

### *Pollution Prevention*

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

***Suggested Protocols***

*General*

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

*Controlling Litter*

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

*Waste Collection*

- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage or leaks regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Place waste containers under cover if possible.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc. may not be

disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

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

*Good Housekeeping*

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

*Chemical/Hazardous Wastes*

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers protected from vandalism, and in compliance with fire and hazardous waste codes.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.

*Runon/Runoff Prevention*

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

*Inspection*

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

***Training***

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

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.
- Vehicles transporting waste should have spill prevention equipment that can prevent spills during transport. The spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

***Other Considerations***

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

## Requirements

***Costs***

- Capital and operation and maintenance costs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

***Maintenance***

- None except for maintaining equipment for material tracking program.

## Supplemental Information

***Further Detail of the BMP***

*Land Treatment System*

- Minimize the runoff of polluted stormwater from land application of municipal waste on-site by:
  - Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, there is a closed drainage system.
  - Avoiding application of waste to the site when it is raining or when the ground is saturated with water.
  - Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site.
  - Maintaining adequate barriers between the land application site and the receiving waters. Planted strips are particularly good.
  - Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins.
  - Performing routine maintenance to ensure the erosion control or site stabilization measures are working.

## References and Resources

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

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

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

# Building & Grounds Maintenance SC-41

## Objectives

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

## Targeted Constituents

| | |
|---|---|
| Sediment | ☑ |
| Nutrients | ☑ |
| Trash | ☑ |
| Metals | ☑ |
| Bacteria | ☑ |
| Oil and Grease | ☑ |
| Organics | ☑ |
| Oxygen Demanding | ☑ |

## Description

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

## Approach

### *Pollution Prevention*

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.
- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

### *Suggested Protocols*

*Pressure Washing of Buildings, Rooftops, and Other Large Objects*

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

*Landscaping Activities*

- Do not apply any chemicals (insecticide, herbicide, or fertilizer) directly to surface waters, unless the application is approved and permitted by the state.
- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.
- Check irrigation schedules so pesticides will not be washed away and to minimize non-stormwater discharge.

*Building Repair, Remodeling, and Construction*

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paint brushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. In which case you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

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

*Mowing, Trimming, and Planting*

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water; do not put it in the storm drain, pour over landscaped areas.

- Use hand or mechanical weeding where practical.

*Fertilizer and Pesticide Management*

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Follow manufacturers' recommendations and label directions. Pesticides must never be applied if precipitation is occuring or predicted. Do not apply insecticides within 100 feet of surface waters such as lakes, ponds, wetlands, and streams.

- Use less toxic pesticides that will do the job, whenever possible. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.
- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

*Inspection*

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

***Training***

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

***Spill Response and Prevention***

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

***Other Considerations***

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

## Requirements

### *Costs*

- Overall costs should be low in comparison to other BMPs.

### *Maintenance*

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

## Supplemental Information

### *Further Detail of the BMP*

*Fire Sprinkler Line Flushing*

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

## References and Resources

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

King County - ftp://dnr.metrokc.gov/wlr/dss/spcm/Chapter%203.PDF

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) -
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

# Parking/Storage Area Maintenance SC-43

## Objectives

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

## Targeted Constituents

| | |
|---|---|
| Sediment | ☑ |
| Nutrients | ☑ |
| Trash | ☑ |
| Metals | ☑ |
| Bacteria | ☑ |
| Oil and Grease | ☑ |
| Organics | ☑ |
| Oxygen Demanding | ☑ |

## Description

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

## Approach

### *Pollution Prevention*

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

### *Suggested Protocols*

*General*

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

*Controlling Litter*

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

*Surface cleaning*

- Use dry cleaning methods (e.g. sweeping or vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- If water is used follow the procedures below:
  - Block the storm drain or contain runoff.
  - Wash water should be collected and pumped to the sanitary sewer or discharged to a pervious surface, do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- When cleaning heavy oily deposits:
  - Use absorbent materials on oily spots prior to sweeping or washing.
  - Dispose of used absorbents appropriately.

*Surface Repair*

- Pre-heat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination form contacting stormwater runoff.
- Cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc., where applicable. Leave covers in place until job is complete and until all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

*Inspection*

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

### *Training*

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

### *Spill Response and Prevention*

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and countermeasure (SPCC) plan up-to-date, nad implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

### *Other Considerations*

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

## Requirements

### *Costs*

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

### *Maintenance*

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

## Supplemental Information

***Further Detail of the BMP***

*Surface Repair*

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

## References and Resources

http://www.stormwatercenter.net/

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

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality control Board. July 1998 (Revised February 2002 by the California Coastal Commission).

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

# Drainage System Maintenance SC-44

**Objectives**

- Cover
- Contain
- Educate
- Reduce/Minimize

**Targeted Constituents**

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

## Description

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

## Approach

### *Pollution Prevention*

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

### *Suggested Protocols*

*Catch Basins/Inlet Structures*

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

CASQA
California Stormwater Quality Association

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

*Storm Drain Conveyance System*

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

*Pump Stations*

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

*Open Channel*

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

*Illicit Connections and Discharges*

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

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

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

*Illegal Dumping*

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

### *Training*

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

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

***Spill Response and Prevention***

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

***Other Considerations (Limitations and Regulations)***

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

## Requirements

***Costs***

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

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

***Maintenance***

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

## Supplemental Information

***Further Detail of the BMP***

*Storm Drain Flushing*

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

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

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

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

## References and Resources

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

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

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

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

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

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

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

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

# Site Design & Landscape Planning SD-10

**Design Objectives**

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

## Description

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

## Approach

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

## Suitable Applications

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

## Design Considerations

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

CASQA
California Stormwater Quality Association

# SD-10 Site Design & Landscape Planning

***Designing New Installations***

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

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

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

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

*Conserve Natural Areas during Landscape Planning*

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

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

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

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

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

- Preserve riparian areas and wetlands.

*Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit*

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

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

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

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

*Protection of Slopes and Channels during Landscape Design*

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

### *Redeveloping Existing Installations*

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

# SD-10 Site Design & Landscape Planning

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

### Other Resources

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

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

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

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

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

# Roof Runoff Controls SD-11

Rain Garden

**Design Objectives**

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

## Description

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

## Approach

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

## Suitable Applications

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

## Design Considerations

### *Designing New Installations*

*Cisterns or Rain Barrels*

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

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

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

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

*Dry wells and Infiltration Trenches*

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

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

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

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

*Pop-up Drainage Emitter*

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

*Foundation Planting*

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

### *Redeveloping Existing Installations*

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

## Supplemental Information

### *Examples*

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

## Other Resources

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

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

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

# Efficient Irrigation SD-12

**Design Objectives**

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

## Description

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

## Approach

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

## Suitable Applications

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

## Design Considerations

### *Designing New Installations*

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

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

CASQA
California Stormwater Quality Association

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

***Redeveloping Existing Installations***

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

## Other Resources

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

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

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

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

# Trash Storage Areas SD-32

**Design Objectives**

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

## Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

## Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

## Suitable Applications

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

## Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

### *Designing New Installations*

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

CASQA California Stormwater Quality Association

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

### *Redeveloping Existing Installations*

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

## Additional Information

### *Maintenance Considerations*

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

## Other Resources

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

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

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

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