DRAFT

Preliminary Low Impact Development Report (LID)

For

MT SAC PARKING STRUCTURE

<u>PREPARED FOR:</u>

Mt. SAC
Facilities Planning & Management
1100 N. Grand Ave
Walnut, CA 91789

<u>PREPARED BY:</u>

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LID Report Prepared: September 14, 2

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Expires: 03/31/20

TABLE OF CONTENTS

1.0 INTRODUCTION 4
1.1 SITE AND PROJECT DESCRIPTION 4

2.0 DESIGNATED PROJECT REQUIREMENT 4
2.1 DETERMINATION FOR PERMANENT BMP REQUIREMENT 5

2.2 DESIGN PROCESS CHART BREAKDOWN 6

3.0 SITE ASSESSMENT AND DESIGN CONSIDERATIONS 8
3.1 VICINITY MAP 8

3.2 PROJECT SUMMARY INFORMATION 9

3.3 WATERSHED 9

3.4 GEOTECHNICAL CONDITIONS 10

3.5 GEOTECHNICAL HAZARDS 10

3.6 SITE DESIGN PRINCIPLES 10

4.0 SOURCE CONTROL MEASURES 12
5.0 STORMWATER QUALITY DESIGN VOLUME CALCULATIONS 18
5.1 DESIGN STORM EVENT 18

5.2 STORMWATER QUALITY DESIGN VOLUME (SWQDv) 19

6.0 STORMWATER QUALITY CONTROL MEASURES 20
6.1 BIOFILTRATION BASIN SIZING 20

7.0 HYDROMODIFICATION 21
8.0 STORMWATER QUALITY CONTROL MEASURE MAINTENANCE 21
8.1 MAINTENANCE RESPONSIBILITY 21

8.2 INSPECTION AND MAINTENANCE FOR SOURCE CONTROL MEASURES 21

8.3 INSPECTION AND MAINTENANCE FOR STORM QUALITY MEASURES 22

8.4 INSPECTION AND MAINTENANCE FREQUENCY 23

8.5 RECORD KEEPING REQUIREMENTS 23

9.0 SUMMARY 24

APPENDICES

APPENDIX A – VICINITY MAP

APPENDIX B – BMP SITE PLAN

APPENDIX C – COUNTY OF LOS ANGELES HYDROLOGY MAPS

APPENDIX D – HYDROCALC OUTPUT - 85TH PERCENTILE STORM

APPENDIX E – STORMWATER QUALITY DESIGN MEASURE CALCULATIONS

APPENDIX F – BMP FACT SHEETS

APPENDIX G – BMP OPERATIONS & MAINTENANCE MANUAL

APPENDIX H – COVENANT AND AGREEMENT

APPENDIX I – GEOTECHNICAL REPORT (FOR REFERENCE ONLY)

OWNER'S CERTIFICATION

This Low Impact Development Report (LID) for the Mt. SAC Parking Structure Project prepared for Mt. SAC by BKF Engineers. This LID Report is intended to comply with the requirements of the City of Walnut, County of Los Angeles, requiring the preparation of a project specific LID Report.

I certify under penalty of law that this document and all attachments were prepared under my jurisdiction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for the gathered information, to the best of my knowledge and belief, the information submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the County of Los Angeles Low Impact Development Standards Manual, and the intent of the stormwater and urban runoff NPDES Permit and Waste Discharge Requirements for the County of Los Angeles, Los Angeles County Flood Control District and the incorporated Cities of Los Angeles County under the jurisdiction of the Los Angeles Regional Water Quality Control Board. A copy of this LID Report will be maintained at the project site/office.

This LID Report will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party having responsibility for implementing portions of this LID Report. At least one copy of the approved and certified copy of this LID Report shall be available on the subject property in perpetuity. Once the undersigned transfers its interest in the property, its successors-in-interest shall bear the aforementioned responsibility to implement and amend the LID Report.

	BKF Engineers
Owner/Engineer of Record's Signature	Company
	4675 MacArthur Court, Suite 400
Bruce Kirby, P.E.	Newport Beach, CA 92660
Printed Name/Title	Company Address
(949) 526-8460	
Telephone No.	Date

1.0 INTRODUCTION

This Low Impact Development Report (LID) summarizes storm water protection requirements for the Mt. SAC Parking Structure (herein referred to as "the project").

This LID Report describes the permanent storm water Best Management Practices (BMPs) that will be incorporated into the project in order to mitigate the impacts of pollutants in storm water runoff from the proposed project. For the purposes of post-construction storm water quality management, the project will follow the guidelines and requirements set forth in the County of Los Angeles "Low Impact Development Standards Manual" dated February 2014 (herein "LID Manual").

Project Applicant: Mt. SAC
1100 N. Grand Ave
Walnut, CA 91789

1.1 SITE AND PROJECT DESCRIPTION

The subject site is located in the City of Walnut, Los Angeles County, California. The proposed parking structure will be located at Parking Lot S within the campus of Mt. SAC and is bounded by Temple Avenue to the north, Bonita Avenue to the east, Stadium Way to the south and Ball Park to the west. The existing site is currently a surface level asphalt parking lot with 268 parking spaces and landscaped areas. The project will consist of:

- Removal of pavement, parking lot lighting, and trees
- Construction of a four level, 775 space parking structure
- Installation of stormwater treatment basin

The existing parking lot has an average slope of 2.2% draining from the north corner of the parking lot to the south corner. Drainage sheet flows along the existing ground contours and is discharged at the driveways entrances on Stadium Way.

Drainage for the proposed parking structure is designed so that the roof drains convey stormwater from the west side and outlet into the biofiltration basin on the west corner of the project site. The remaining treatment is provided by a stormwater planter on the north side of the parking structure.

2.0 DESIGNATED PROJECT REQUIREMENT

Requirements for permanent BMPs are determine based on the criteria set forth in the LID Manual. Projects are identified by four categories:

- Designated Project
- Non-Designated Project
- Small-Scale Non-Designated Project
- Large-Scale Non-Designated Project

2.1 DETERMINATION FOR PERMANENT BMP REQUIREMENT

The project is considered a **"Designated Project,"** based on the LID Manual. The project meets the following requirements to be a Designated Project:

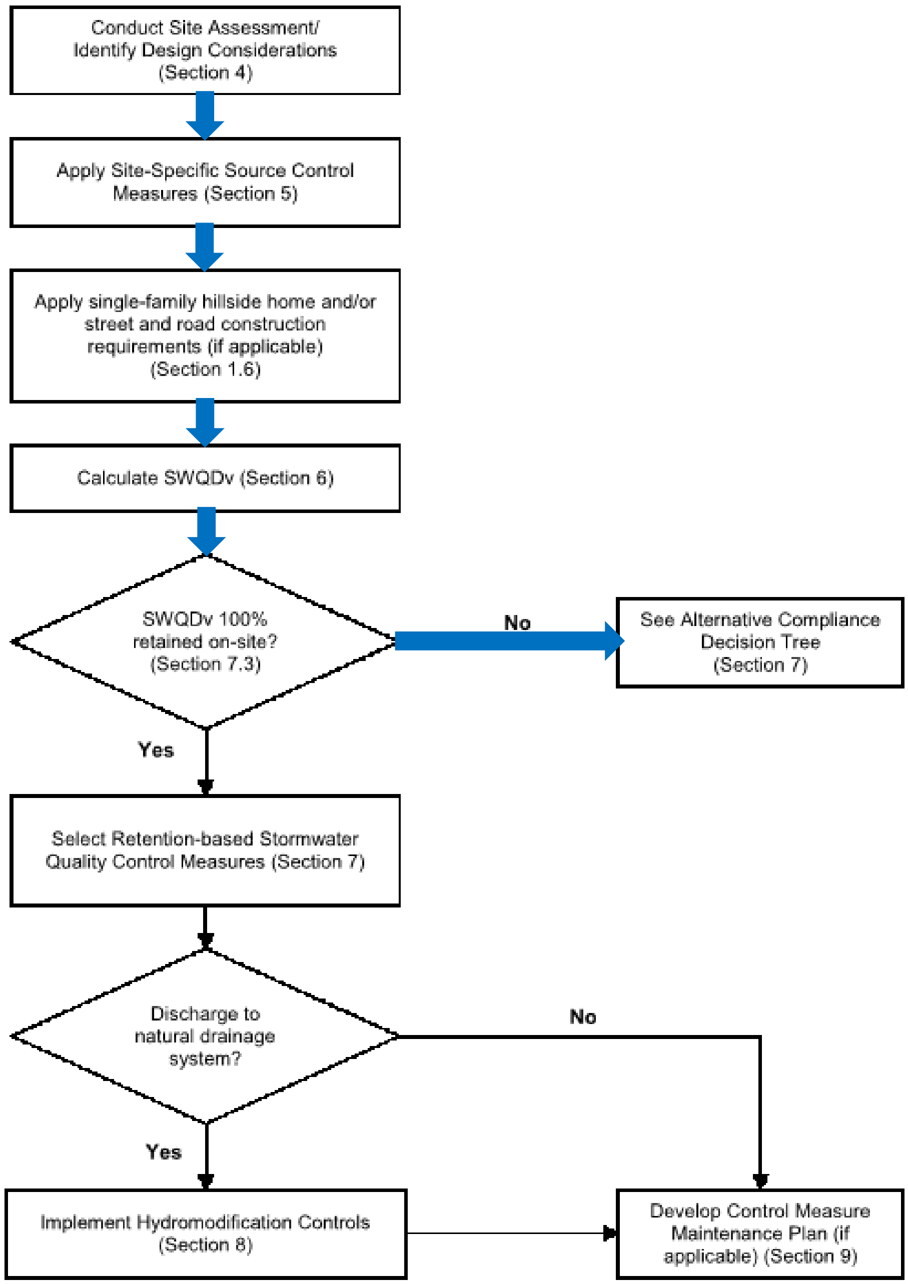
1. Parking lots with 5,000 square feet or more of impervious surface area, or with 25 or more parking spaces

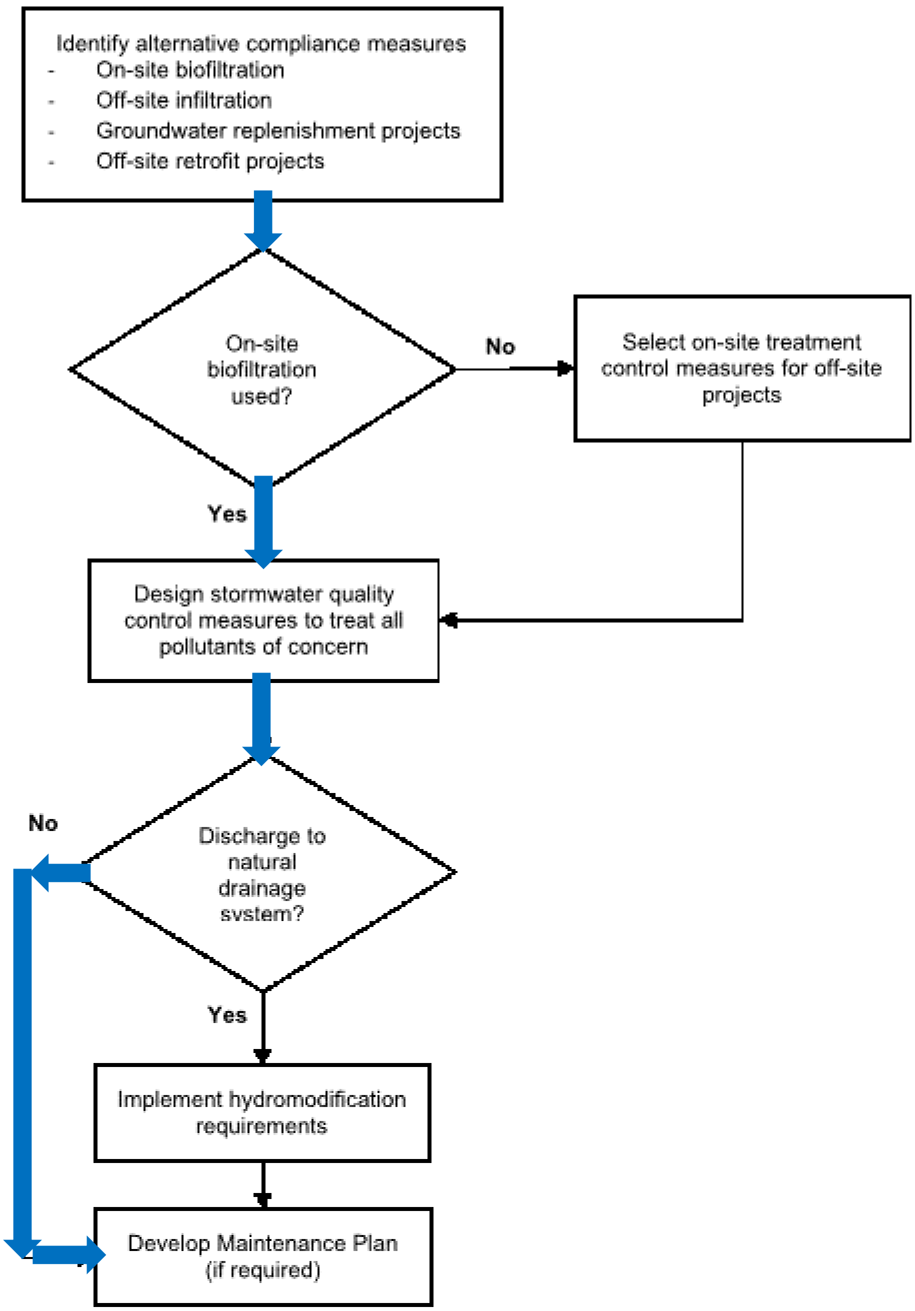
All "Designated Projects" must retain 100 percent of the Storm Water Quality Design Volume (SWQDv) on-site through infiltration, evapotranspiration, stormwater runoff harvest and use, or a combination thereof unless it is demonstrated that it is technical infeasible to do so.

Based on the percolation test performed by Converse Consultants on August 21, 2018 at the Parking Lot S Area of Mt. SAC, an infiltration rate of 0.13 in/hr and 0.2 in/hr was observed at the two test locations.

The project will provide treatment for the SWQDv as outlined in the Design Process Chart Breakdown in Section 2.2. For this project site, a biofiltration basin will be utilized to treat 1.5 times the SWQDv using biofiltration. See Section 5.0, Section 6.0 and **Appendix E** for more information and calculations.

2.2 DESIGN PROCESS CHART BREAKDOWN

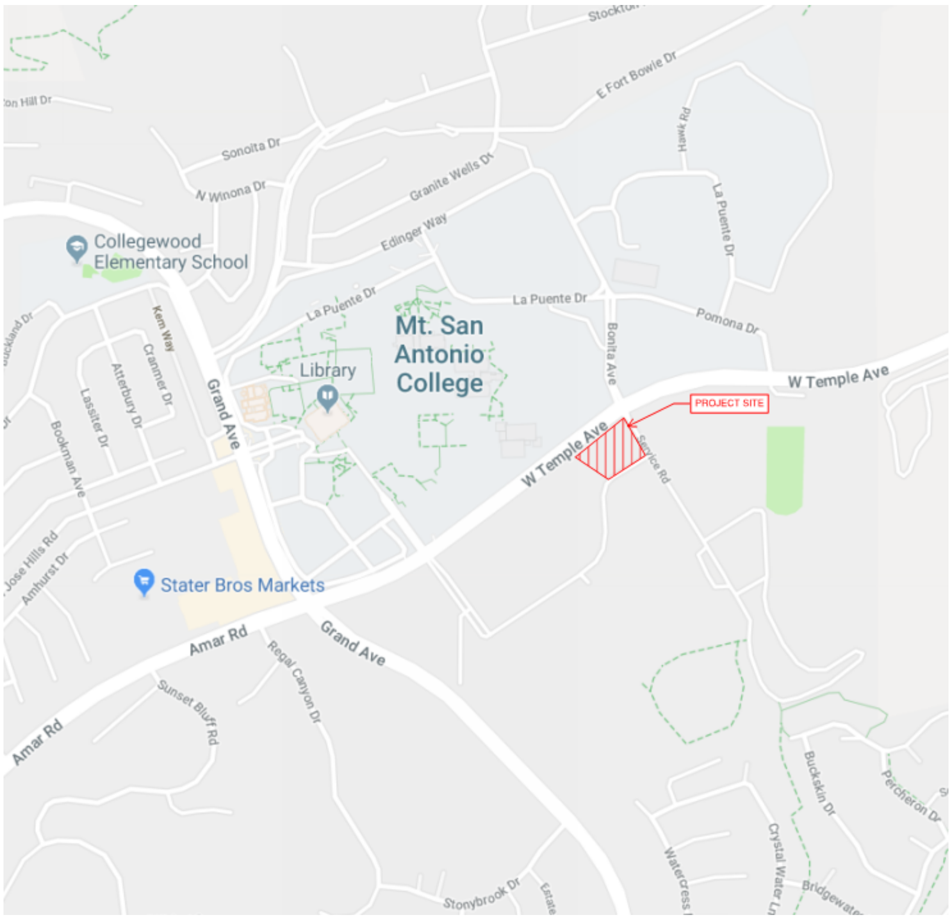



Identify alternative compliance measures
- On-site biofiltration
- Off-site infiltration
- Groundwater replenishment projects
- Off-site retrofit projects
On-site biofiltration used?
No
Select on-site treatment control measures for off-site projects
Yes
Design stormwater quality control measures to treat all pollutants of concern
Discharge to natural drainage system?
No
Yes
Implement hydromodification requirements
Develop Maintenance Plan (if required)

3.0 SITE ASSESSMENT AND DESIGN CONSIDERATIONS

This section discusses the steps taken for assessing the project site conditions and identifying design considerations to determine appropriate stormwater quality control measures for the project.

3.1 VICINITY MAP



3.2 PROJECT SUMMARY INFORMATION

Pre-Project

The existing land use for the project is currently a fully developed parking lot covered in asphalt pavement. There are no offsite drainage areas that discharge storm water onto the project site in the pre-project condition.

The existing parking lot has an average slope of 2.2% draining from the north corner of the parking lot to the south corner. Drainage sheet flows along the existing ground contours and is discharged at the driveways entrances on Stadium Way.

Post-Project

In post-project conditions, the project site consists of a new parking structure in place of the existing parking lot. Storm water runoff at the roof level of the new parking structure will drain towards a series of inlet grates which convey the captured stormwater through internal storm drain pipes within the parking structure and discharges into underground storm drain pipe on the west side of the parking structure.

The runoff is then routed into the biofiltration basin to the west where the SWQDv will be treated and released through an underdrain into the proposed storm drain that discharges via parkway culvert on Stadium Way.

Summary of Impervious Area

Condition	Impervious Area (Acres)	Pervious Area (Acres)	Total Area (Acres)	Percent Impervious (%)
Pre-Project	2.59	1.27	3.86	67%
Post-Project	3.12	0.74	3.86	80.8%

Percent Area Impervious Created or Replaced

(Post Project Impervious Area/ Pre Project Impervious Area) * 100 = (3.12 acres / 2.59 acres) *100 = 120%

The "Percent Area Impervious Created or Replaced" found was 120%. Since the impervious area created or replaced for the new development is greater than 50% of the impervious area of the previously existing development, the proposed development is required to retain 100% the SWQDv or provide biofiltration for 150% of the SWQDv for the entire site.

3.3 WATERSHED

The proposed development is located within the San Gabriel Watershed and is part of the San Gabriel River Watershed Management Area (SGRWMA). Surface flow from the project enters the municipal storm drain system which outlets into the San Gabriel River and ultimately discharges into the Pacific Ocean.

Region: Los Angeles Regional Water Quality Control Board (LARWQCB)

Receiving Water:	San Gabriel River
Watershed:	San Jose Creek
303(d) Listing:	Ammonia, Coliform Bacteria, pH, Total Dissolved Solids, Toxicity

3.4 GEOTECHNICAL CONDITIONS

Geotechnical information outlined below was taken from the Geotechnical Report prepared by Converse Consultants dated October 23, 2017.

Topography: The project site surface drainage sheet flows across an existing parking lot in the southerly direction at an average slope of 2.2%.

Geologic Setting: Based on the geotechnical investigation, the earth materials encountered consisted of existing fill soils placed during previous site grading operations, natural alluvial soils and sedimentary bedrock of the Puente Formation. The project site area is covered by a layer of fill soils underlain by the alluvial soils and interbedded layers of sandstone, pebble conglomerate, siltstone, and claystone sedimentary bedrock of the Puente Formation. These earth materials consist primarily of silty sands, clayey sands, sands, silts and clays.

Groundwater: Local zones of groundwater seepage were encountered during subsurface exploration in the alluvium and bedrock at depths ranging from approximately 23 feet bgs in boring BH-3 to approximately 36.8 feet bgs in BH-7. Groundwater and groundwater seepage should be anticipated during deep excavations.

3.5 GEOTECHNICAL HAZARDS

Geotechnical information outlined below was taken from the Geotechnical Report prepared by Converse Consultants on October 23, 2017.

The site is located within a mapped Seismic Hazard Zone for liquefaction. Liquefaction analyses were performed for the upper 50 feet below ground surface. Based on the results of liquefaction analyses indicate the project is susceptible to liquefaction.

3.6 SITE DESIGN PRINCIPLES

Site design can protect sensitive environmental features. The intention of site design principles is to reduce stormwater peak flows and volumes and other impacts associated with land development. The following text discusses the low impact development BMPs outlined in the LID Manual with respect to the project. Italicized text is taken directly from the LID Manual and reproduced for this report. Portions of the italicized text are condensed from the LID Manual. Immediately following and written in regular text, will be the response as it applies to the project.

Site Planning

- *Project applicants must implement a holistic approach to site design in order to develop a more hydraulically-functional site, help to maximize the effectiveness of on-site retention, and integrate stormwater management throughout the project site. Early project site planning can identify physical site constraints, reduce costs of downstream stormwater quality control measures, and prevent potential project site re-design.*

  Response:
  The project site layout conforms to natural landforms.

Protect and Restore Natural Areas

- *Conservation of natural areas, soils, and vegetation helps to retain numerous functions of pre-development hydrology, including rainfall interception, infiltration, and evapotranspiration. Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Sensitive areas, such as streams and their buffers, floodplains, wetlands, steep slopes, and highly-permeable soils, should be protected and/or restored. Slopes can be a major source of sediment and should be properly protected and stabilized. Locating development in less sensitive areas of a project site and conserving naturally vegetated areas can minimize environmental impacts from stormwater runoff.*

  Response:
  The site is currently developed and mostly paved, and therefore there is no opportunity to preserve existing trees or vegetation. The proposed site will include new landscaping and new trees.

Minimize Impervious Area

- *The potential for discharge of pollutants in stormwater runoff from a project site increases as the percentage of impervious area within the project site increases because impervious areas increase the volume and rate of stormwater runoff. Pollutants deposited on impervious areas are easily mobilized and transported by stormwater runoff. Minimizing impervious area through site design is an important method to reducing the pollutant load in stormwater runoff. In addition to the environmental and aesthetic benefits, a highly pervious site may allow reduction of potential downstream conveyance and stormwater quality control measures, yielding savings in development costs. Minimizing impervious area will also reduce the stormwater runoff coefficient, which is directly proportional to the volume of stormwater runoff that must be retained on-site.*

  Response:
  The project incorporates landscaping/vegetated areas onsite to minimize the impervious footprint.

4.0 SOURCE CONTROL MEASURES

Source control measures are designed to prevent pollutants from contacting stormwater runoff or prevent discharge of contaminated stormwater runoff to the storm drain system and/or receiving water. This section describes structural type, source control measures that will be considered for implementation in conjunction with appropriate non-structural source control measures. The following text discusses the source control measures BMPs from the LID Manual with respect to the project. Italicized text is taken directly from the LID Manual, and reproduced for this report. Portions of the italicized text are condensed from the LID Manual. Immediately following and written in regular text, will be the response as it applies to the project. For more information regarding the Source Control Measures outlined below, see Appendix D from the LID Manual.

S-1: Storm Drain Message and Signage

- *Signs with language and/or graphical icons that prohibit illegal dumping, must be posted at designated public access points along channels and streams within the project area. Consult with Los Angeles County Department of Public Works (LACDPW) staff to determine specific signage requirements for channels and streams.*

- *Storm drain message markers, placards, concrete stamps, or stenciled language/icons (e.g., "No Dumping – Drains to the Ocean") are required at all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping. Signs should be placed in clear sight facing anyone approaching the storm drain inlet or catch basin from either side (see Figure D-1 and Figure D-2). LACDPW staff should be contacted to determine specific requirements for types of signs and methods of application. A stencil can be purchased for a nominal fee from LACDPW Building and Safety Office by calling (626) 458-3171. All storm drain inlet and catch basin locations must be identified on the project site map.*

Response:
All catch basins with open grates within the project site will be stenciled.

S-2: Outdoor Material Storage

- *Design specifications for material storage areas are regulated by local building and fire codes, ordinances, and zoning requirements. Source control measures presented in the LID Manual are intended to enhance and be consistent with local code and ordinance requirements while addressing stormwater runoff concerns. The design specifications, presented in Table D-2 in the LID Manual, must be incorporated into the design of outdoor material storage areas when stored materials could contribute pollutants to the storm drain system. The level of controls required varies relative to the risk category of the material stored.*

  Response:
  The project does not propose any outdoor material storage areas. If these conditions change, it is the responsibility of the project site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-3: Outdoor Trash Storage and Waste Handling Area

- *Wastes from commercial and industrial sites are typically hauled away for disposal by either public or commercial carriers that may have design or access requirements for waste storage areas. Design specifications for waste handling areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. The design specifications, listed below in Table D-3, are recommendations and are not intended to conflict with requirements established by the waste hauler. The design specifications are intended to enhance local codes and ordinances while addressing stormwater runoff concerns. The waste hauler should be contacted prior to the design of trash storage and collection areas to determine established and accepted guidelines for designing trash collection areas. All hazardous waste must be handled in accordance with the legal requirements established in Title 22 of the California Code of Regulations. Conflicts or issues should be discussed with LACDPW staff.*

  Response:
  The project site does propose storage areas for trash storage areas. Therefore, the outdoor trash storage area will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-4: Outdoor Loading/Unloading Dock Area

- *Design specifications for outdoor loading/unloading dock areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. Additionally, individual businesses may have their own design or access requirements for loading docks. Design specifications presented in this fact sheet are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns. The design specifications presented in Table D-4 are not intended to conflict with requirements established by individual businesses, but should be followed to the maximum extent practicable.*

  Response:
  The project does not propose any outdoor loading and unloading dock areas. If these conditions change, it is the responsibility of the project site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-5: Outdoor Vehicle/Equipment Repair/Maintenance Area

- *Design specifications for vehicle and equipment repair/maintenance areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. The design specifications presented in this fact sheet are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns. The design specifications required for vehicle and equipment repair/maintenance areas are presented in Table D-5. All wash water and hazardous and toxic wastes must be prevented from entering the storm drain system.*

  Response:
  The project does not propose any outdoor vehicle equipment repair areas, or outdoor vehicle maintenance areas. If these conditions change, it is the responsibility of the project site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-6: Outdoor Vehicle/Equipment/Accessory Washing Area

- *Design specifications for vehicle/equipment/accessory washing areas are regulated by local building and fire codes and current County ordinances and zoning requirements. The design specifications presented in Table D-6 are intended to enhance and be consistent with these requirements while addressing stormwater runoff concerns. All wash water and hazardous and toxic wastes must be prevented from entering the storm drain system.*

  Response:
  The project does not propose any outdoor vehicle equipment areas or outdoor vehicle accessory washing areas. If these conditions change, it is the responsibility of the project

site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-7: Fuel and Maintenance Area

- *Design specifications for fuel and maintenance areas are regulated by local building and fire codes and current County ordinances and zoning requirements. The design specifications presented in Table D-7 are intended to enhance and be consistent with these code and ordinance requirements while addressing stormwater runoff concerns.*

  Response:
  The project does not propose any fuel and maintenance areas. If these conditions change, it is the responsibility of the project site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-8: Landscape Irrigation Practices

- *Choose plants that minimize the need for fertilizer and pesticides.*
- *Group plants with similar water requirements and water accordingly.*
- *Use mulch to minimize evaporation and erosion.*
- *Include a vegetative boundary around project site to act as a filter.*
- *Design the irrigation system to only water areas that need it.*
- *Install an approved subsurface drip, pop-up, or other irrigation system. The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.*
- *Install rain sensors to shut off the irrigation system during and after storm events.*
- *Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.*
- *If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).*
- *For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.*
- *Implement Integrated Pest Management practices*
- *For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.*

  Response:
  Irrigation practices and systems for the project will be designed pursuant to the guidelines shown above and in the LID Manual.

S-9: Building Material Selection

Lumber

- *Decks and other house components constructed using pressure-treated wood that is typically treated using arsenate, copper, and chromium compounds are hazardous to the environment. Pressure-treated wood may be replaced with cement-fiber or vinyl.*

Roofs, Fencing, and Metals

- *Minimizing the use of copper and galvanized (zinc-coated) metals on buildings and fencing can reduce leaching of these pollutants into stormwater runoff. The following building materials are conventionally made of galvanized metals:*
    - *Metal roofs*
    - *Chain-link fencing and siding*
    - *Metal downspouts, vents, flashing, and trim on roofs.*

  Architectural use of copper for roofs and gutters should be avoided. As an alternative to copper and galvanized materials, coated metal products are available for both roofing and gutter application. Vinyl-coated fencing is an alternative to traditional galvanized chain-link fences. These products eliminate contact of bare metal with precipitation or stormwater runoff, and reduce the potential for stormwater runoff contamination. Roofing materials are also made of recycled rubber and plastic. Green roofs may be an option. Green roofs use vegetation such as grasses and other plants as an exterior surface. The plants reduce the velocity of stormwater runoff and absorb water to reduce the volume of stormwater runoff. One potential problem with using green roofs in the Los Angeles County area is the long, hot and dry summers, which may kill the plants if they are not watered. See the Green Roof Fact Sheet (RET- 7) in Appendix E of the LID Manual.

Response:
Building material selection will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-10: Animal Care and Handling Facilities

- *Site barns, corrals, and pastures on property that drains away from the storm drain system and receiving waters.*
- *Locate animal washing areas, pastures, horse riding areas, stalls, or cages at least 50 feet away from storm drains, domestic wells, septic tank or leach field sites, and receiving waters.*
- *Design berms, gutters, or grassed ditches to divert stormwater runoff away from animal area, storm drain system, and receiving waters.*
- *Cover animal enclosures (i.e., stables) to protect them from precipitation.*
- *Prevent animals from entering sensitive environmental areas.*
- *Regularly sweep or shovel animal holding areas.*

  Response:
  The project does not propose any animal care or handling facilities. If these conditions change, it is the responsibility of the project site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

S-11: Outdoor Horticulture Areas

- *Do not allow wash water from the horticulture area to drain directly to the storm drain system or receiving waters*

  Response:
  The project does not propose outdoor horticulture areas. If these conditions change, it is the responsibility of the project site owner/operator to ensure that outdoor materials storage will be designed pursuant to the guidelines outlined above and in the LID Manual.

5.0 STORMWATER QUALITY DESIGN VOLUME CALCULATIONS

Current water quality requirements are based on treating a specific volume of stormwater runoff from the project site (stormwater quality design volume [SWQDv]). By treating the SWQDv, it is expected that pollutant loads, which are typically higher during the beginning of storm events, will be reduced or prevented from reaching the receiving waters.

5.1 DESIGN STORM EVENT

The design storm, for which the SWQDv is calculated, is defined as the greater of:

- *The 0.75-inch, 24-hour rain-event; or*
- *The 85th percentile, 24-hour rain event as determined from the Los Angeles County 85th percentile precipitation isoheytal map.*

It was determined that the 85th percentile, 24-hour rain event will be the design storm for which the SWQDv will be calculated for this project site as shown below.

The 85th percentile, 24-hour rain = 1.0-inch > 0.75-inches **[Use the 85th percentile]**

Note:
The 85th percentile, 24-hour rain event precipitation was found using the Los Angeles County Hydrology Map GIS Viewer, see **Appendix C**.

5.2 STORMWATER QUALITY DESIGN VOLUME (SWQDV)

The project site was determined to be a Designated Project, therefore the project site is required to retain 100% of the SWQDv on-site or provide biotreatment for 1.5 times the SWQDv. The SWQDv for the site was calculated using the HydroCalc software developed by Los Angeles County Department of Public Works (LACDPW). The software completes the full MODRAT calculation process and produces the peak stormwater runoff flow rates and volumes for single subareas. HydroCalc is limited to watersheds and project areas up to 40 acres.

The SWQDv required to be treated is summarized below.

HydroCalc Analysis – 85TH Percentile Storm

Input Parameters

Project Name	MT SAC Parking
Subarea ID	DMA A
Area (ac)	3.86
Flow Path Length (ft)	410.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.808
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.2974
Undeveloped Runoff Coefficient (Cu)	0.4286
Developed Runoff Coefficient (Cd)	0.8095
Time of Concentration (min)	22.0
Clear Peak Flow Rate (cfs)	0.9291
Burned Peak Flow Rate (cfs)	0.9291
24-Hr Clear Runoff Volume (ac-ft)	0.2402
24-Hr Clear Runoff Volume (cu-ft)	10465.1586

6.0 STORMWATER QUALITY CONTROL MEASURES

Stormwater quality control measures are required to augment site design principles and source control measures to reduce the volume of stormwater runoff and potential pollution loads in stormwater runoff to the maximum extent practicable. Stormwater quality control measures are designed to handle the frequent, smaller storm events, or the initial volume of stormwater runoff from larger storm events (typically referred to as first flush events). The first flush of larger storm events is the initial period of the storm where stormwater runoff typically carries the highest concentration and loads of pollutants. Small, frequent storm events represent most of the total annual average precipitation in the County. The LID Ordinance requires that all Designated Projects retain the SWQDv on-site using retention-based stormwater quality control measures (infiltration and/or stormwater runoff harvest and use) or biofiltrate 1.5 times the SWQDv if infiltration is not feasible.

All the stormwater quality control measures outlined in the LID Manual were evaluated. It was determined that the most practicable treatment BMP for the project will be the following:

- (1) Biofiltration Basin
- (1) Stormwater Planter

6.1 BIOFILTRATION BASIN SIZING

Stormwater runoff is intercepted by a series of inlet drains centered at the upper most level of the parking structure, conveyed via interior storm drain pipes, and discharged into out the west side of the parking structure into a biofiltration basin and stormwater planter to the north. The biofiltration basin and stormwater planter are designed to treat 1.5 times the SWQDv for the project site. Overflow for excess stormwater will be conveyed through the overflow riser in the basin into underground storm drain pipe and discharged through a parkway culvert on Stadium Way. Calculations for the biofiltration basin are available in **Appendix E**.

7.0 HYDROMODIFICATION

All Designated projects located within natural drainage systems that have not been improved or drainage systems that are tributary to a natural drainage system are required to implement hydromodification controls.

Projects may be exempt from implementation of hydromodification control measures where assessments of downstream channel conditions and proposed discharge hydrology indicate adverse hydromodification effects to beneficial uses of natural drainage systems are unlikely.

The proposed project has been determined to be **EXEMPT** from hydromodification requirements since it is discharges to concrete-lined channels. Therefore the site does not have any adverse hydromodification impacts to natural drainage systems.

8.0 STORMWATER QUALITY CONTROL MEASURE MAINTENANCE

Continued effectiveness of stormwater quality control measures specified in the LID Standards Manual depends on on-going inspection and maintenance. All publicly maintained stormwater quality control measures must have easements for access and maintenance or be in lots dedicated to the County in fee title. To ensure that such maintenance is provided, LACDPW may require the submittal of a Maintenance Plan and execution of a Maintenance Agreement with the owner/operator of stormwater quality control measures. The property owner or his/her designee is responsible for complying with the Maintenance Agreement outlined in the LID Manual. A copy of the Maintenance Agreement is provided in **Appendix H.**

8.1 MAINTENANCE RESPONSIBILITY

The Owner of the project site is the site operator and will be the party responsible to ensure implementation and funding of maintenance of permanent BMPs.

It is anticipated that the owner of the project will manage multiple separate maintenance contracts for different types of maintenance (e.g., landscape maintenance vs. maintenance of the BMPs). Throughout this section, the owner of the project is the “party responsible to ensure implementation and funding of maintenance of permanent BMPs.” The party who actually performs the activities is the “inspector,” “maintenance contractor,” or “maintenance operator.”

8.2 INSPECTION AND MAINTENANCE FOR SOURCE CONTROL MEASURES

The following source control measures for the project requires permanent maintenance:

- Storm Drain Message and Signage
- Outdoor Trash Storage and Waste Handling
- Landscape Irrigation Practices

The discussions below provide inspection criteria, maintenance indicators, and maintenance activities for the above listed source control measures that require permanent maintenance.

S-1 Storm Drain Message and Signage
Legibility and visibility of markers and signs should be maintained (e.g., signs should be repainted or replaces as necessary). If required by the City, the owner/operator or homeowner's association shall enter into a maintenance agreement with the agency or record deed restriction upon the property title to maintain the legibility of placards and signs.

S-3 Outdoor Trash Storage and Waste Handling Area
The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor trash storage and waste handling areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between the City and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-8 Landscape Irrigation Practices
Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Failure to properly maintain building and property may subject the property owner to citation.

8.3 INSPECTION AND MAINTENANCE FOR STORM QUALITY MEASURES

The following storm quality measure for the project requires permanent maintenance:

- (1) Biofiltration Basin
- (1) Stormwater Planter

The discussions below provide inspection criteria, maintenance indicators, and maintenance activities for the above listed storm quality measure that require permanent maintenance according to manufacturer recommendations. These proprietary systems shall be inspected and maintained per manufacturer specifications and recommendations. See **Appendix G** for the Operations and Maintenance of each BMP listed above.

8.4 INSPECTION AND MAINTENANCE FREQUENCY

The Table below lists the BMPs to be inspected and maintained and the minimum frequency of inspection and maintenance activities.

BMP	Inspection Frequency	Maintenance Frequency
Storm Drain Message and Signage	Monthly	Routine maintenance of marker and sign legibility and visibility. See Section 8.2.
Outdoor Trash Storage and Waste Handling	Monthly	Routine maintenance of structure and waste water within the trash area. See Section 8.2.
Landscape Irrigation Practices	Monthly	Routine trimming and trash removal; monthly non-routine maintenance as-needed based on maintenance indicators in Section 8.2.
Biofiltration Basin	Annual and after major storm events	Routine maintenance to clean the biofiltration basin of sediments, trash, and debris. As-needed maintenance based on maintenance indicators as outlined in **Appendix G**.
Stormwater Planter	Annual and after major storm events	Routine maintenance to clean the stormwater planter of sediments, trash, and debris. As-needed maintenance based on maintenance indicators as outlined in **Appendix G**.

The frequencies given in the Summary Table of Inspection and Maintenance Frequency are minimum recommended frequencies for inspection and maintenance activities for the project. Typically, the frequency of maintenance required for permanent BMPs is site and drainage area specific. If it is determined during the regularly scheduled inspection and/or routine maintenance that a BMP requires more frequent maintenance (e.g., to remove accumulated trash) it may be necessary to increase the frequency of inspection and/or routine maintenance. If it is determined during the regularly scheduled inspection that the maintenance thresholds are consistently met or exceeded, it may be necessary to increase the frequency of inspection and routine maintenance.

8.5 RECORD KEEPING REQUIREMENTS

The party responsible to ensure implementation and funding of maintenance of permanent BMPs shall maintain records documenting the inspection and maintenance activities. The records must be kept a minimum of 5 years and shall be made available to the City of Walnut for inspection upon request at any time.

9.0 SUMMARY

This Low Impact Development Report (LID) summarizes the permanent storm water management features proposed for the project site that will collectively meet the requirements set forth in the LID Manual. The project meets the hydromodification exemption criteria and is not required to implement hydromodification management facilities as discussed in Section 7.0 of this report.

The project is a “Designated Project,” based on the LID Manual as discussed in Section 2.1.

Based on the “anticipated” pollutants of concern that may be generated on-site and identification of receiving waters that are listed as impaired on the 2010 CWA Section 303(d) List of Water Quality Limited Segments, the following are the project pollutants of concern: Ammonia, Coliform Bacteria, pH, Total Dissolved Solids, and Toxicity as outlined in Section 3.3 of this report.

In addition to treatment control BMPs, the project will incorporate source control BMPs which are described in Section 4.0 and Section 6.0.

The project includes a proposed network of storm water management features that will utilize source control measures to meet the requirements for stormwater quality design measure. The following list provides a summary of stormwater quality design measures selected for the project site:

- (1) Biofiltration Basin
- (1) Stormwater Planter

The above stormwater quality design measure was selected for the project and provide “High” removal efficiency for the targeted pollutants of concern as discussed in Section 3.3 and Section 6.1.

The stormwater quality design measure maintenance in Section 8.0 of this report provides inspection criteria, maintenance indicators, and maintenance activities for the above-listed BMPs that require permanent maintenance.

This report accompanies a set of construction drawings and specifications which detail the construction, operation, and maintenance of the proposed Low Impact Development (LID) design elements for this site.

APPENDIX A

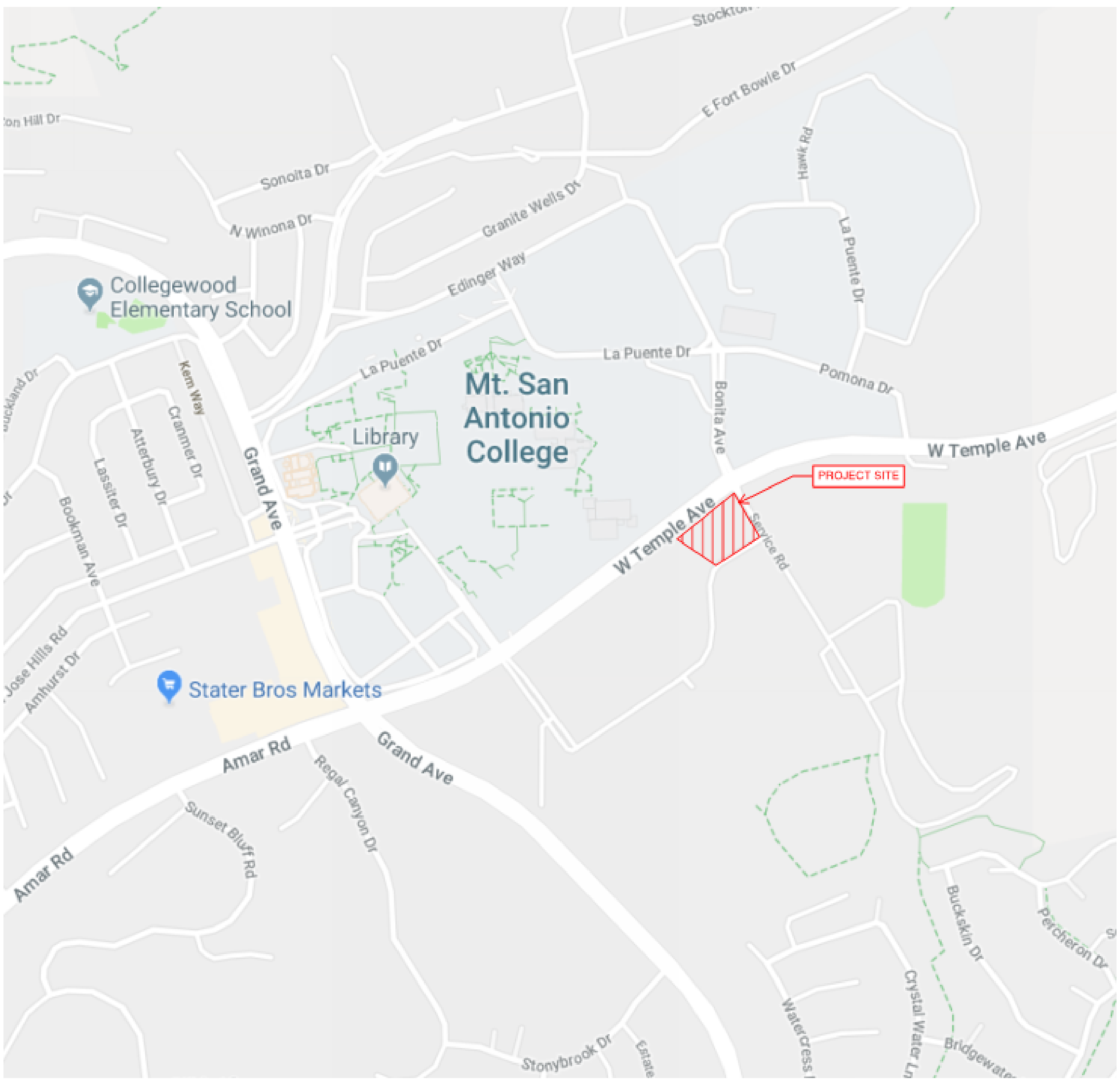
VICINITY MAP

Vicinity Map

For

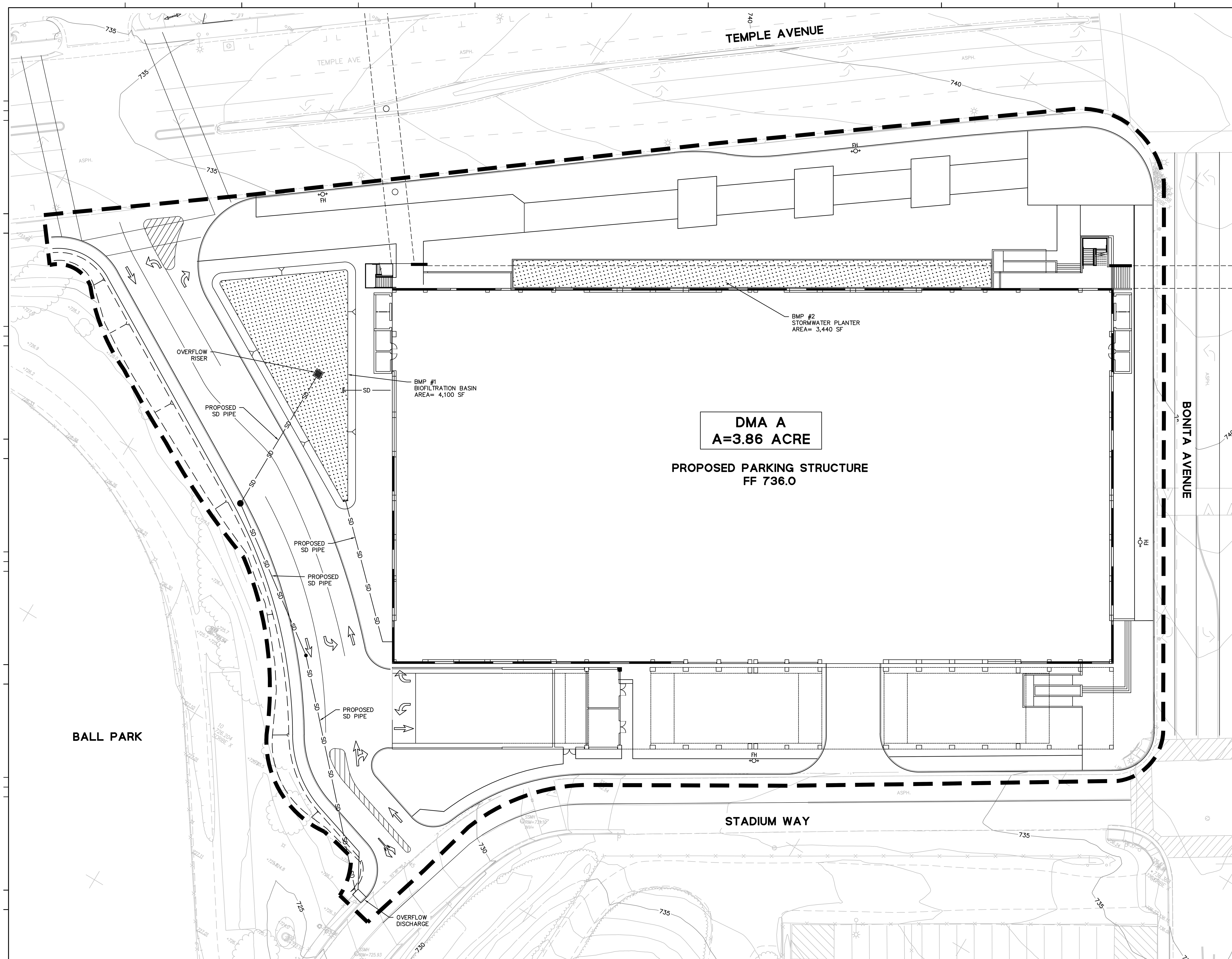
Mt SAC Parking Structure

N. Grand Ave
Walnut, CA 91789

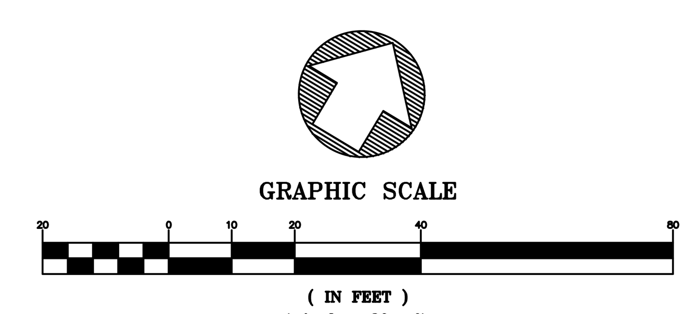


APPENDIX B

BMP SITE PLAN



TREATMENT SUMMARY					
DRAINAGE MANAGEMENT AREA	AREA (ACRES)	LID BMP USED	V_M (CU-FT)	MIN BMP AREA (SQ-FT)	BMP AREA PROVIDED (SQ-FT)
DMA A-1	2.12	BIORETENTION BASIN (BMP#1)	8,634	4,063	4,100
DMA A-2	1.74	STORMWATER PLANTER (BMP#2)	7,065	3,325	3,440
	3.86		15,699	7,388	7,540



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o: 949. 675. 6442

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IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
FILE:
A# 0 3 -
AC ________ FLS ________ SS ________
DATE ________

PROJECT TITLE
PARKING STRUCTURE LOT S

MT. SAC
Mt. San Antonio College
1100 N. GRAND AVENUE
WALNUT, CA 91789

SUBMITTALS		
#	DATE	DESCRIPTION
	07/23/2018	DD SUBMITTAL

PROJECT IDENTIFICATION
THESE DRAWINGS ORIGINALLY CREATED IN AUTODESK REVIT V. 2015
THE ORIGINAL SIZE OF THIS SHEET IS 30" X 42".

DRAWN BY -

CHECKED BY -

SHEET TITLE
BM□ SITE □LAN

SHEET NUMBER
A□□ENDI□ B

APPENDIX C

COUNTY OF LOS ANGELES HYDROLOGY MAPS

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dpw.lacounty.gov

search our site..

Hydrology Map

A GIS viewer application to view the data for the hydrology manual.

LAYERS

- 50yr Two Tenths (Rainfall)
- DPA Zones
- Soils 2004
- Final 85th Percentile, 24-hr Rainfall
- Final 95th Percentile, 24-hr Rainfall
- 1-year, 1-hour Rainfall Intensity

SEARCH

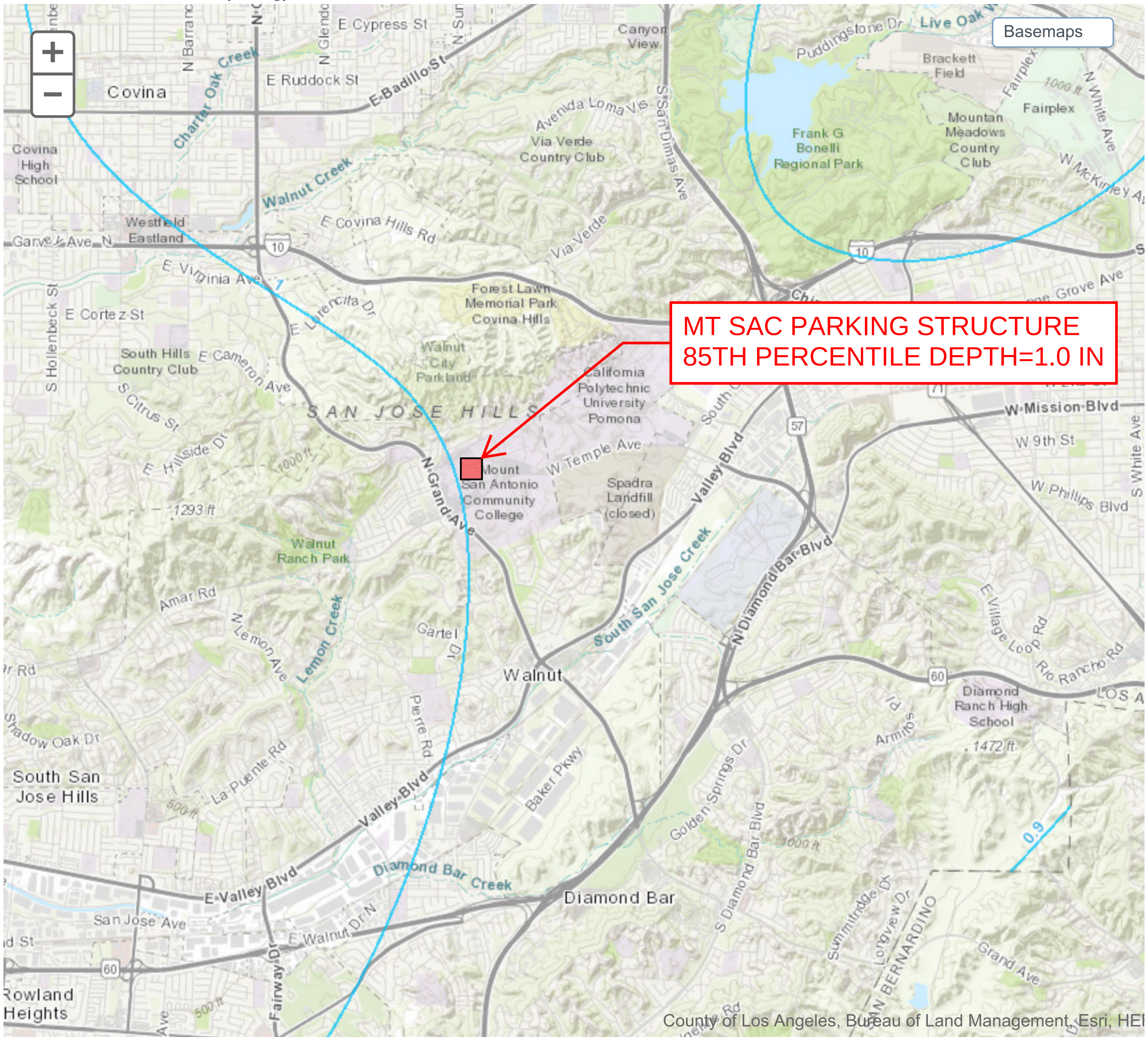
Enter Address, Cross Street, or Parcel No.:
(ex: 900 S. Fremont Ave., Fremont@Valley, 5342005904)

mt sac

Search

Address Search Results:

mt sac



Map Tips

Department of Public Works
dpw.lacounty.gov

search our site..

Hydrology Map

A GIS viewer application to view the data for the hydrology manual.

LAYERS

- [ ] 50yr Two Tenths (Rainfall)
- [ ] DPA Zones
- [x] Soils 2004
- [ ] Final 85th Percentile, 24-hr Rainfall
- [ ] Final 95th Percentile, 24-hr Rainfall
- [ ] 1-year, 1-hour Rainfall Intensity

SEARCH

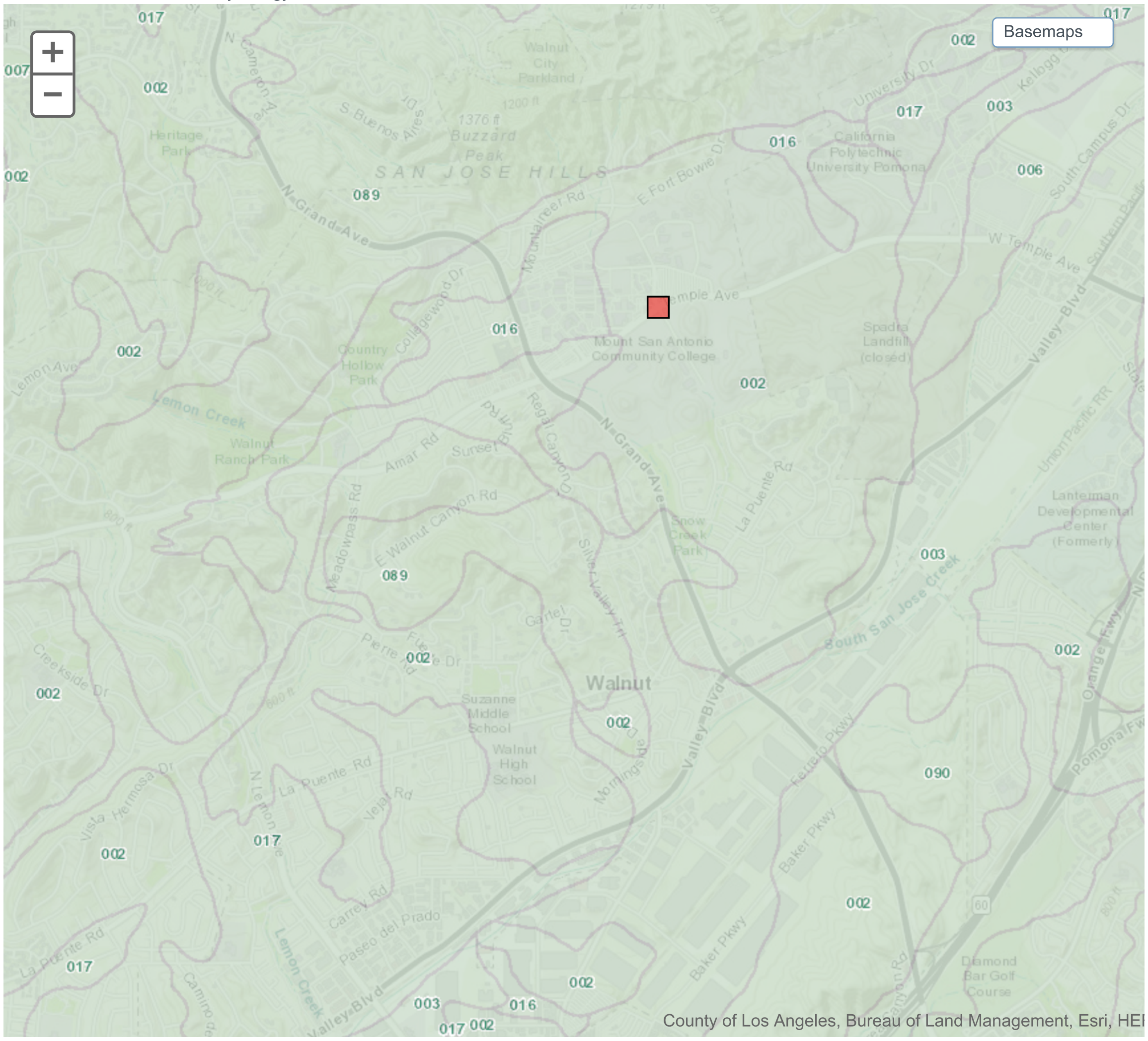
Enter Address, Cross Street, or Parcel No.:
(ex: 900 S. Fremont Ave., Fremont@Valley, 5342005904)

w temple ave and service rd, walnut

Search

Address Search Results:

w temple ave and service rd walnut



Map Tips

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APPENDIX D

HYDROCALC OUTPUT - 85TH PERCENTILE STORM

Peak Flow Hydrologic Analysis

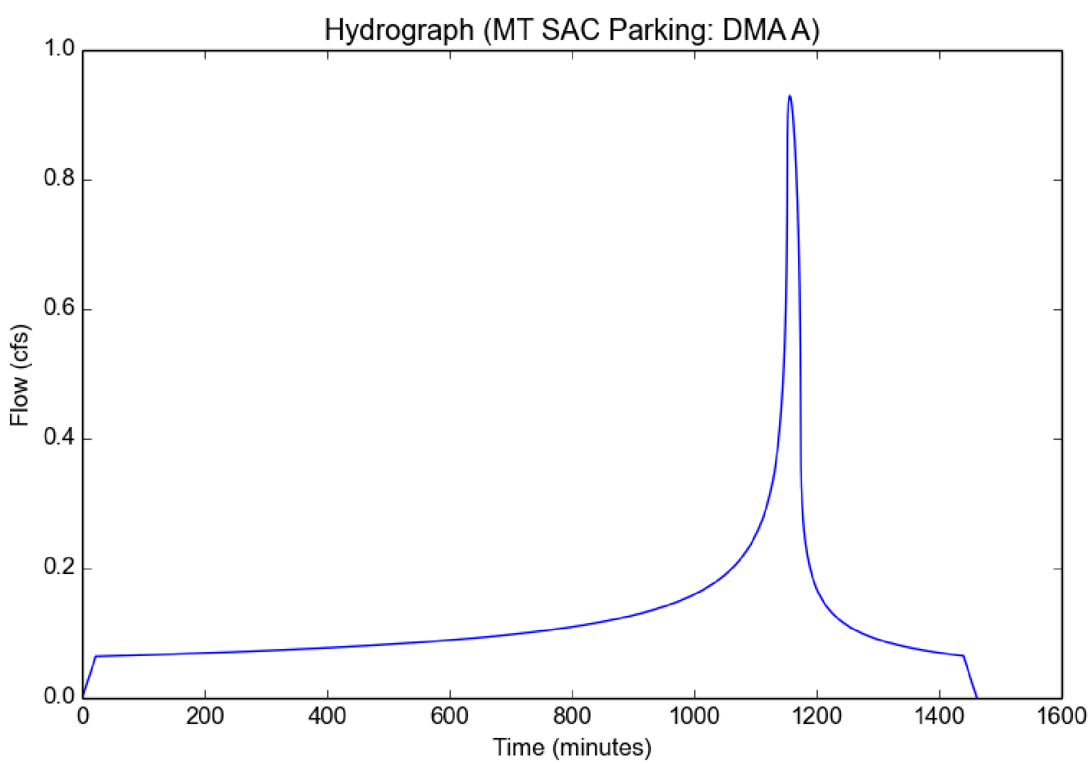
File location: C:/Users/chas/Desktop/MT SAC Parking - DMA A.pdf
Version: HydroCalc 1.0.3

Input Parameters

Project Name	MT SAC Parking
Subarea ID	DMA A
Area (ac)	3.86
Flow Path Length (ft)	410.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.808
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.2974
Undeveloped Runoff Coefficient (Cu)	0.4286
Developed Runoff Coefficient (Cd)	0.8095
Time of Concentration (min)	22.0
Clear Peak Flow Rate (cfs)	0.9291
Burned Peak Flow Rate (cfs)	0.9291
24-Hr Clear Runoff Volume (ac-ft)	0.2402
24-Hr Clear Runoff Volume (cu-ft)	10465.1586



APPENDIX E

STORMWATER QUALITY DESIGN MEASURE CALCULATIONS

Stormwater Quality Design Measure Calculations

Date: **9/27/2018**
Job No.: **172138**
Project: **Mt SAC Parking Structure**

Description and Assumptions:

** Based on County of Los Angeles Low Impact Development Standard Manual*

Design Frequency = 85th Percentile, 24-Hour Rain Event

STORMWATER QUALITY DESIGN CALCS FOR BMP#1 & 2

Area Summary

Surface Type	Area (sf)	Area (acres)
Impervious	135,739	3.12
Pervious	32,254	0.74
TOTAL	**167,993**	**3.86**

Stormwater Quality Design Volume (SWQDv)

85th Percentile SWQDv per HydroCalc Output in Appendix D= 10,466 ft^3

HydroCalc Design Volume (SWQDv) output is an accepted value per section 6.3 in the LA County Low Impact Development Standards Manual

** Section 7.4 of the County of Los Angeles Low Impact Development Standard Manual*

Givens:

SWQDv = 10,466 ft^3

1. Calculate the design volume (V_{design})

Since a Biofiltration system will be utilized downstream, the SWQDv found needs to be multiplied by 1.5.

Vdesign= 1.5 x SWQDv

V_m = 15,699 cu-ft *(See Appendix D for Hydrocalc Analysis)*

1. Determine $K_{sat,design}$

$K_{sat,design}$ = (5 in/hr)/2

$K_{sat,design}$ = 2.5 in/hr

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Newport Beach, California 92660

Step 3: Determine ponding depth, d_p

$d_p = (K_{sat,design} \times T)/12$

Where:

d_p = Ponding depth (ft)

$K_{sat,design}$ = Design infiltration rate of filter media (in/hr)

T = Required surface drain time (hrs)

d= 10 ft

Use max ponding depth of 1.5 ft

Step 4: Calculate the BMP Surface Area

$A_{min} = V_{design}/[(T_{fill}K_{sat,design}/12)+d_p]$

Where

A_{min} = Design infiltrating area [ft^2]

T_{fill} = Time to fill to maximum ponding depth with water [hrs], Assume a max of 3 hours

T= 3 hrs

dp = Ponding depth [ft]

d_p = 1.5 ft

$\boxed{A_{min} = 7388 \text{ sq-ft}}$

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4675 MacArthur Court, Suite 400
Newport Beach, California 92660

APPENDIX F

BMP FACT SHEETS

BIO-1: Biofiltration

Definition

A biofiltration area is a vegetated shallow depression that is designed to receive and treat stormwater runoff from downspouts, piped inlets, or sheet flow from adjoining paved areas. A shallow ponding zone is provided above the vegetated surface for temporary storage of stormwater runoff. During storm events, stormwater runoff accumulates in the ponding zone and gradually infiltrates the surface and filters through the biofiltration soil media before being collected by an underdrain system.

Stormwater runoff treatment occurs through a variety of natural mechanisms as stormwater runoff filters through the vegetation root zone. In biofiltration areas, microbes and organic material in the biofiltration soil media help promote the adsorption of pollutants (e.g., dissolved metals and petroleum hydrocarbons) into the soil matrix. Plants utilize soil moisture and promote the drying of the soil through transpiration. Biofiltration areas are typically planted with native, drought-tolerant plant species that do not require fertilization and can withstand wet soils for at least 96 hours.

A schematic of a typical biofiltration area is presented in Figure E-7.

LID Ordinance Requirements

Biofiltration can be used as an alternative compliance measure.

Pollutant of Concern	Treated by Biofiltration?
Suspended solids	No
Total phosphorus	No
Total nitrogen	Yes
Total Kjeldahl nitrogen	Yes
Cadmium, total	No
Chromium, total	Yes
Copper, total	No
Lead, total	Yes
Zinc, total	No

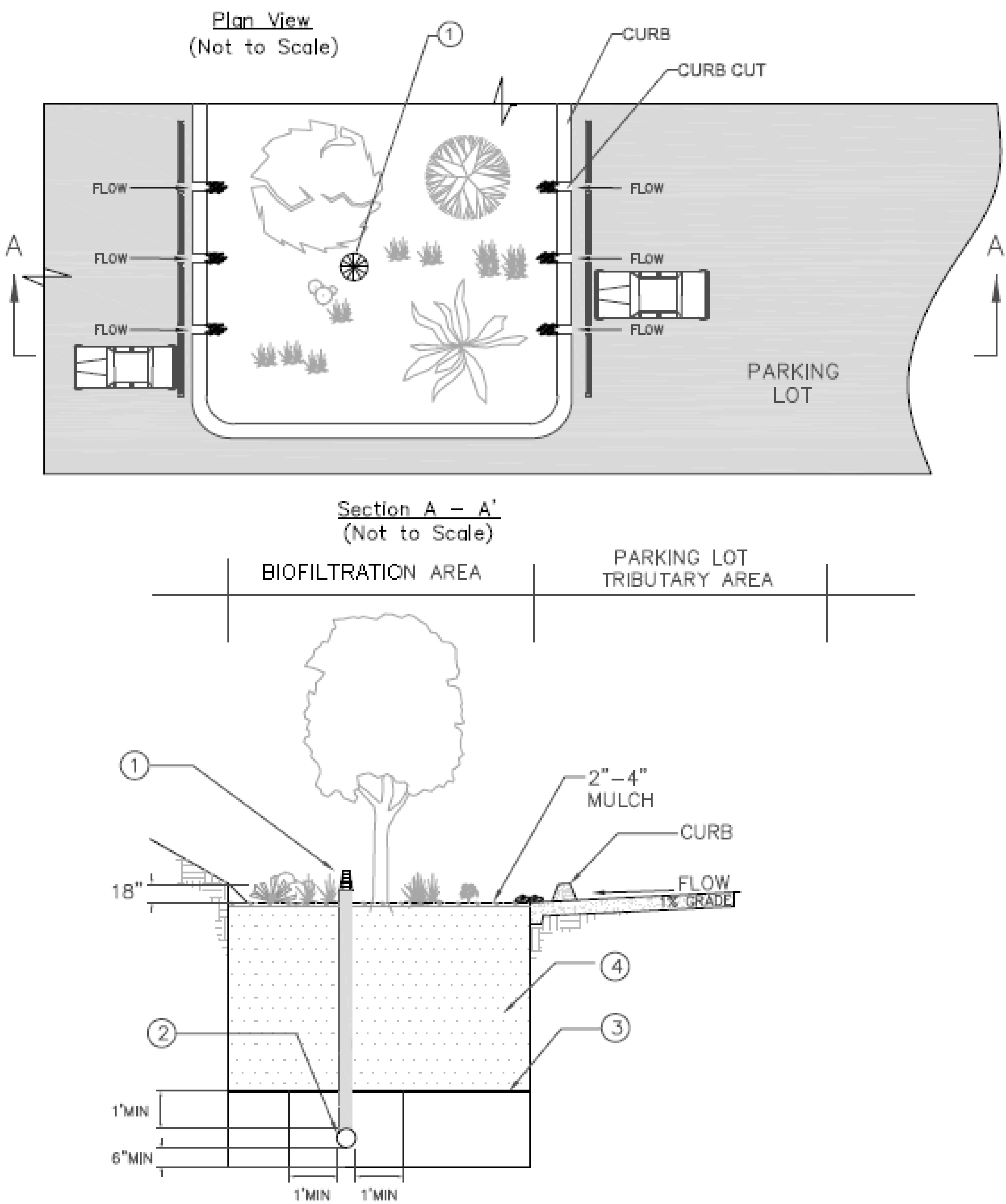
Source: Treatment Best Management Practices Performance, Los Angeles Regional Water Quality Control Board, December 9, 2013.

Advantages

- Has a low cost for installation
- Enhances site aesthetics
- Requires little maintenance

Disadvantages

- May require individual owner/tenants to perform maintenance



NOTES

1. OVERFLOW DEVICE: VERTICAL RISER OR EQUIVALENT.
2. PERFORATED 6" MIN PVC PIPE UNDERDRAIN SYSTEM. WHERE SOIL CONDITIONS ALLOW, OMIT THE UNDERDRAIN AND INSTALL AN APPROPRIATELY SIZED GRAVEL DRAINAGE LAYER (TYPICALLY A WASHED 57 STONE) BENEATH THE PLANTING MEDIA FOR ENHANCED INFILTRATION.
3. OPTIONAL CHOKING GRAVEL LAYER.
4. 2' MIN PLANTING MIX; 3' PREFERRED.

Figure E-7. Biofiltration Area Schematic

General Constraints and Implementation Considerations

- Biofiltration areas can be applied in various settings including, but not limited to:
    - Individual lots for rooftop, driveway, and other on-site impervious surface
    - Shared facilities located in common areas for individual lots
    - Areas within loop roads or cul-de-sacs
    - Landscaped parking lot islands
    - Within right-of-ways along roads
    - Common landscaped areas in apartment complexes or other multi-family housing designs
    - Parks and along open space perimeter
- If tire curbs are provided and parking stalls are shortened, cars are allowed to overhang the biofiltration area.
- Biofiltration areas must be located sufficiently far from structure foundations to avoid damage to structures (as determined by a certified structural or geotechnical engineer).
- Any parking areas bordering the biofiltration area must be monolithically poured concrete or deepended curb concrete to provide structural stability to the adjacent parking section.
- Geomembrane liners must be used in areas subject to spills or pollutant hot spots.
- During construction activities should avoid compaction of native soils below planting media layer or gravel zone.
- Stormwater runoff must be diverted around the biofiltration area during the period of vegetation establishment. If diversion is not feasible, the graded and seeded areas must be protected with suitable sediment controls (i.e., silt fences).All damaged areas should be repaired, seeded, or re-planted immediately.
- The general landscape irrigation system should incorporate the biofiltration area, as applicable.

Design Specifications

The following sections describe the design specifications for biofiltration areas.

Geotechnical

Due to the potential to contaminate groundwater, cause slope instability, impact surrounding structures, and potential for insufficient infiltration capacity, an extensive geotechnical site investigation must be conducted during the site planning process to verify site suitability for biofiltration. All geotechnical investigations must be performed according to the most recent GMED Policy GS 200.1. Soil infiltration rates and the groundwater table depth must be evaluated to ensure that conditions are satisfactory for proper operation of a biofiltration area. The project applicant must demonstrate through infiltration testing, soil logs, and the written opinion of a licensed civil engineer that sufficiently permeable soils exist on-site to allow the construction of a properly functioning biofiltration system.

Biofiltration areas are appropriate for soils with a minimum corrected in-situ infiltration rate of 0.3 in/hr. The geotechnical report must determine if the proposed project site is suitable for a biofiltration area and must recommend a design infiltration rate (see "Design Infiltration Rate" under the "Sizing" section). The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move through the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Pretreatment

Pretreatment refers to design features that provide settling of large particles before stormwater runoff enters a stormwater quality control measure in order to reduce the long-term maintenance burden. Pretreatment should be provided to reduce the sediment load entering a biofiltration area in order to maintain the infiltration rate of the biofiltration area. To ensure that biofiltration areas are effective, the project applicant must incorporate pretreatment devices that provide sediment removal (e.g., vegetated swales, vegetated filter strips, sedimentation manholes, and proprietary devices). The use of at least two pretreatment devices is highly recommended for biofiltration areas.

Geometry

- Biofiltration areas must be sized to capture and treat 1.5 times the SWQDv that is not reliably retained on the project site with an 18-inch maximum ponding depth.
- The planting soil depth must be a minimum of two feet, although three feet is preferred. The planting soil depth should provide a beneficial root zone for the chosen vegetation and adequate water storage for the stormwater runoff. A deeper planting soil depth will also provide a smaller surface area footprint.
- A gravel storage layer below the biofiltration area soil media is required to provide adequate temporary storage to retain 1.5 times the SWQDv that is not reliably retained on the project site and to promote infiltration.

Sizing

Biofiltration areas are sized using a simple sizing method where 1.5 times the SWQDv that is not reliably retained on the project site must be completely filtered within 96 hours. If the incoming stormwater runoff flow rate is lower than the long term filtration rate, above ground storage does not need to be provided. If the incoming stormwater runoff flow rate is higher than the long term filtration rate, above ground storage shall be provided (see steps below).

Step 1: Calculate the design volume

Biofiltration areas should be sized to capture and treat 1.5 times the portion of the SWQDv (see Section 6 for SWQDv calculation procedures) that is not reliability retained on the project site, as calculated by the equation below:

$$V_B = 1.5 \times (SWQDv - V_R)$$

Where:

V_B = Biofiltration volume [ft^3];
SWQDv = Stormwater quality design volume [ft^3]; and
V_R = Volume of stormwater runoff reliably retained on-site [ft^3].

Step 2: Calculate the design infiltration rate

Determine the corrected in-situ infiltration rate (f_{design}) of the native soil using the procedures described in the most recent GMED Policy GS 200.1.

Step 3: Calculate the surface area

Select a surface ponding depth (d) that satisfies the geometric criteria and meets the site constraints. Selecting a deeper ponding depth (up to 1.5 ft) generally yields a smaller footprint, however, it will require greater consideration for public safety, energy dissipation, and plant selection.

Calculate the time for the selected ponding depth to filter through the planting media using the following equation:

$$\mathrm{d} = t_p \times \frac{\mathrm{f}_{\mathrm{design}}}{12}$$

Where:

d = Ponding depth (max 1.5 ft) [ft];
t_p = Required detention time for surface ponding (max 96 hr) [hr]; and
f_{design} = Design infiltration rate [in/hr].

If t_p exceeds 96 hours, reduce surface ponding depth (d). In nearly all cases, t_p should not approach 96 hours unless f_{design} is low.

Calculate the required infiltrating surface (filter bottom area) using the following equation:

$$A = \frac{V_B}{d}$$

Where:

A = Bottom surface area of biofiltration area [ft^2];
V_B = Biofiltration design volume [ft^3]; and
d = Ponding depth (max 1.5 ft) [ft].

Flow Entrance and Energy Dissipation

Maintain a minimum slope of 1 percent for pervious surfaces and 0.5 percent for impervious surfaces to the biofiltration area inlet. The following types of flow entrance can be used for biofiltration cells:

- Level spreaders (i.e., slotted curbs) can be used to facilitate sheet flow.
- Dispersed, low velocity flow across a landscape area. Dispersed flow may not be possible given space limitations or if the biofiltration area is controlling roadway or parking lot flows where curbs are mandatory.
- Dispersed flow across pavement or gravel and past wheel stops for parking areas.
- Flow spreading trench around perimeter of biofiltration area. May be filled with pea gravel or vegetated with 3:1 side slopes similar to a swale. A vertical-walled open trench may also be used at the discretion of LACDPW.
- Curb cuts for roadside or parking lot areas, if approved by LACDPW: curb cuts should include rock or other erosion controls in the channel entrance to dissipate energy. Flow entrance should drop two to three inches from curb line and provide an area for settling and periodic removal of sediment and coarse material before flow dissipates to the remainder of the biofiltration area.
- Piped entrances, such as roof downspouts, should include rock, splash blocks, or other erosion controls at the entrance to dissipate energy and disperse flows.
- Woody plants (trees, shrubs, etc.) can restrict or concentrate flows and can be damaged by erosion around the root ball and must not be placed directly in the entrance flow path.

Drainage

Biofiltration areas must be designed to drain below the planting soil in less than 96 hours. Soils must be allowed to dry out periodically in order to restore hydraulic capacity to receive stormwater runoff from subsequent storm events, maintain infiltration rates, maintain adequate soil oxygen levels for healthy soil biota and vegetation, and provide proper soil conditions for biodegradation and retention of pollutants.

Underdrain

Biofiltration areas require an underdrain to collect and discharge stormwater runoff that has been filtered through the soil media, but not infiltrated, to another stormwater quality control measure, storm drain system, or receiving water. The underdrain must have a mainline diameter of eight inches using slotted PVC SDR 26 or PVC C9000. Slotted PVC allows for pressure water cleaning and root cutting, if necessary. The slotted pipe should have two to four rows of slots cut perpendicular to the axis of the pipe or at right angles to the pitch of corrugations. Slots should be 0.04 to 0.1 inches wide with a length of 1 to 1.25 inches. Slots should be longitudinally-spaced such that the pipe has a minimum of one square inch opening per lineal foot and should face down.

The underdrain should be placed in a gravel envelope (Class 2 Permeable Material per Caltrans Spec. 68-1.025) that measures three feet wide and six inches deep. The underdrain is elevated from the bottom of the biofiltration area by six inches within the gravel envelope to create a fluctuating anaerobic/aerobic zone below the underdrain to facilitate denitrification within the anaerobic/anoxic zone and reduce nutrient concentrations. The top and sides of the underdrain pipe should be covered with gravel to a minimum depth of 12 inches. The underdrain and gravel envelope should be covered with a geomembrane liner to prevent clogging. The following aggregate should be used for the gravel envelope:

Particle Size (ASTM D422)	% Passing by Weight
¾ inch	100%
¼ inch	30-60%
#8	20-50%
#50	3-12%
#200	0-1%

Underdrains should be sloped at a minimum of 0.5 percent and must drain freely to an approved discharge point.

Rigid non-perforated observation pipes with a diameter equal to the underdrain diameter should be connected to the underdrain to provide a clean-out port as well as an observation well to monitor drainage rates. The wells/clean-outs should be connected to the perforated underdrain with the appropriate manufactured connections. The wells/clean-outs should extend six inches above the top elevation of the biofiltration area mulch, and should be capped with a lockable screw cap. The ends of underdrain pipes not terminating in an observation well/clean-out should also be capped.

Hydraulic Restriction Layer

Lateral infiltration pathways may need to be restricted due to the close proximity of roads, foundations, or other infrastructure. A geomembrane liner, or other equivalent waterproofing, may be placed along the vertical walls to reduce lateral flows. This geomembrane liner must have a minimum thickness of 30 mils and meet the requirements of Table E-12. Generally, waterproof barriers should not be placed on the bottom of the biofiltration unit, as this would prevent incidental infiltration which is important to meeting the required pollutant load reduction.

Table E-12. Geomembrane Liner Specifications for Biofiltration Areas

Parameter	Test Method	Specifications
Material		Nonwoven geomembrane liner
Unit weight		8 oz/yd^3 (minimum)
Filtration rate		0.08 in/sec (minimum)
Puncture strength	ASTM D-751 (Modified)	125 lbs (minimum)
Mullen burst strength	ASTM D-751	400 lb/in^2 (minimum)
Tensile strength	AST D-1682	300 lbs (minimum)
Equiv. opening size	US Standard Sieve	No. 80 (minimum)

Planting/Storage Media

- The planting media placed in the biofiltration area should achieve a long-term, in-place infiltration rate of at least 5 in/hr. Higher infiltration rates of up to 12 in/hr are permissible. The biofiltration soil media must retain sufficient moisture to support vigorous plant growth.
- The planting media mix must consist of 60 to 80 percent sand and 20 to 40 percent compost.
- Sand should be free of wood, waste, coatings such as clay, stone dust, carbonate, or any other deleterious material. All aggregate passing the No. 200 sieve size should be non-plastic. Sand for biofiltration should be analyzed by an accredited laboratory using #200, #100, #40, #30, #16, #8, #4, and 3/8 sieves (ASTM D422 or as approved by the local permitting authority) and meet the following gradations (Note: all sand complying with ASTM C33 for fine aggregate comply with the gradation requirements listed below):

Particle Size (ASTM D422)	% Passing by Weight
3/8 inch	100%
#4	90-100%
#8	70-100%
#16	40-95%
#30	15-70%
#40	5-55%
#110	0-15%
#200	0-5%

Note: The gradation of the sand component of the biofiltration soil media is believed to be a major factor in the infiltration rate of the media mix. If the desired hydraulic conductivity of the biofiltration soil media cannot be achieved within the specified proportions of sand and compost (#2), then it may be necessary to utilize sand at the coarser end of the range specified minimum percent passing.

- Compost should be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes, or other organic material not including manure or biosolids meeting standards developed by the USCC. The product shall be certified through the USCC STA Program (a compost testing and information disclosure program). Compost quality shall be verified via a laboratory analysis to be:
  - Feedstock materials must be specified and include one or more of the following: landscape/yard trimmings, grass clippings, food scraps, and agricultural crop residues.
  - pH between 6.5 and 8.0 (may vary with plant palette)
  - Organic Matter: 35 to 75 percent dry weight basis
  - Carbon and Nitrogen Ratio: 15:1 < C:N < 25:1
  - Maturity/Stability: Compost must have a dark brown color and a soil-like odor. Compost exhibiting a sour or putrid smell, containing recognizable grass or leaves, or is hot (120°F) upon delivery or rewetting is not acceptable.
  - Toxicity: any one of the following measures is sufficient to indicate non-toxicity:
    - NH_4:NH_3 < 3
    - Ammonium < 500 ppm, dry weight basis
    - Seed germination > 80 percent of control
    - Plant trials > 80 percent of control
    - Solvita® > 5 index value
  - Nutrient content:
    - Total Nitrogen content ≥ 0.9 percent preferred
    - Total Boron should be < 80 ppm; soluble boron < 2.5 ppm
  - Salinity: < 6.0 mmhos/cm
  - Compost for biofiltration area should be analyzed by an accredited laboratory using #200, ¼-inch, ½-inch, and 1-inch sieves (ASTM D422) and meet the gradation requirements in the table below:

Particle Size (ASTM D422)	% Passing by Weight
1 inch	99-100
½ inch	90-100
¼ inch	40-90
#200	2-10

Tests should be sufficiently recent to represent the actual material that is anticipated to be delivered to the site. If processes or sources used by the supplier have changed significantly since the most recent testing, new tests should be requested.

The gradation of compost used in biofiltration soil media is believed to play an important role in the saturated infiltration rate of the media. To achieve a higher saturated infiltration rate, it may be necessary to utilize compost at the coarser end of the range (minimum percent passing). The percent passing the #200 sieve (fines) is believed to be the most important factor in hydraulic conductivity.

In addition, coarser compost mix provides more heterogeneity of the biofiltration soil media, which is believed to be advantageous for more rapid development of soil structure needed to support healthy biological processes. This may be an advantage for plant establishment with lower nutrient and water input.

- Biofiltration soil media not meeting the above criteria should be evaluated on a case-by-case basis. Alternative biofiltration soil media must meet the following specifications:

  "Soils for biofiltration facilities must be sufficiently permeable to infiltrate stormwater runoff at a minimum of rate of 5 in/hr during the life of the facility, and provide sufficient retention of moisture and nutrients to support healthy vegetation." The following steps shall be followed by LACDPW to verify that alternative biofiltration soil media mixes meet the specification:

  - Submittals – The applicant must submit to LACDPW for approval:
    - A sample of mixed biofiltration soil media.
    - Certification from the soil supplier or an accredited laboratory that the biofiltration soil media meets the requirements of this specification.
    - Certification from an accredited geotechnical testing laboratory that the biofiltration soil media has an infiltration rate between 5 and 12 in/hr.
    - Organic content test results of the biofiltration soil media. Organic content test shall be performed in accordance with the Testing Methods for the Examination of Compost and Composting (TMECC) 05.07A, "Loss-On-Ignition Organic Matter Method".
    - Organic grain size analysis results of mixed biofiltration soil media performed in accordance with ASTM D422, Standard Test Method for Particle Size Analysis of Soils.
    - A description of the equipment and methods used to mix the sand and compost to produce the biofiltration soil media.
  - The name of the testing laboratory(ies) and the following information:

        - Contact person(s)
        - Address(es)
        - Phone contact(s)
        - E-mail address(es)
        - Qualifications of laboratory(ies) and personnel including date of current certification by STA, ASTM, or approved equal.
    - Biofiltration soils shall be analyzed by an accredited laboratory using #200 and ½-inch sieves (ASTM D422 or as approved by LACDPW), and meet the gradation described in the table below:

Particle Size (ASTM D422)	% Passing by Weight
½ inch	97-100
#200	2-5

- Biofiltration soil media shall be analyzed by an accredited geotechnical laboratory for the following tests:
    - Moisture – density relationships (compaction tests) must be conducted on biofiltration soil media. Biofiltration soil media for the permeability test shall be compacted to 85 to 90 percent of the maximum dry density (ASTM D1557).
    - Constant head permeability testing in accordance with ASTM D2434 shall be conducted on a minimum of two samples with a 6-inch mold and vacuum saturation.
- Mulch is recommended for the purpose of retaining moisture, preventing erosion, and minimizing weed growth. Projects subject to the California Model Water Efficiency Landscaping Ordinance (or comparable local ordinance) will be required to provide at least 2 inches of mulch. Aged mulch, also called compost mulch, reduces the ability of weeds to establish, keeps soil moist, and replenishes soil nutrients. Biofiltration areas must be covered with two to four inches (average three inches) of mulch at the start and an annual placement (preferably in June after weeding) of one to two inches of mulch beneath plants.
- The planting media design height must be marked appropriately, such as a collar on the overflow device or with a stake inserted two feet into the planting media and notched, to show biofiltration surface level and ponding level.

Vegetation

Prior to installation, a licensed landscape architect must certify that all plants, unless otherwise specifically permitted, conform to the standards of the current edition of American Standard for Nursery Stock as approved by the American Standards Institute, Inc. All plant grades shall be those established in the current edition of American Standards for Nursery Stock.

- Shade trees must have a single main trunk. Trunks must be free of branches below the following heights:

CALIPER (in)	Height (ft)
1½-2½	5
3	6

- Plants must be tolerant of summer drought, ponding fluctuations, and saturated soil conditions for 96 hours.
- It is recommended that a minimum of three types of tree, shrubs, and/or herbaceous groundcover species be incorporated to protect against facility failure due to disease and insect infestations of a single species.
- Native plant species and/or hardy cultivars that are not invasive and do not require chemical inputs must be used to the maximum extent practicable.

The biofiltration area should be vegetated to resemble a terrestrial forest community ecosystem, which is dominated by understory trees, a shrub layer, and herbaceous ground cover. Select vegetation that:

- Is suited to well-drained soil;
- Will be dense and strong enough to stay upright, even in flowing water;
- Has minimum need for fertilizers;
- Is not prone to pests and is consistent with Integrated Pest Management practices; and
- Is consistent with local water conservation ordinance requirements.

Irrigation System

Provide an irrigation system to maintain viability of vegetation, if applicable. The irrigation system must be designed to local code or ordinance specifications.

Restricted Construction Materials

The use of pressure-treated wood or galvanized metal at or around a biofiltration area is prohibited.

Overflow Device

An overflow device is required at the 18-inch ponding depth. The following, or equivalent, should be provided:

- A vertical PVC pipe (SDR 26) to act as an overflow riser.
- The overflow riser(s) should be eight inches or greater in diameter, so it can be cleaned without damage to the pipe.

- The inlet to the riser should be at the ponding depth (18 inches for fenced biofiltration areas and 6 inches for areas that are not fenced), and be capped with a spider cap to exclude floating mulch and debris. Spider caps should be screwed in or glued (e.g., not removable). The overflow device should convey stormwater runoff in excess of 1.5 times the SWQDv that is not reliably retained on the project site to an approved discharge location (another stormwater quality control measure, storm drain system, or receiving water).

Maintenance Requirements

Maintenance and regular inspections are important for proper function of biofiltration areas. Biofiltration areas require annual plant, soil, and mulch layer maintenance to ensure optimal infiltration, storage, and pollutant removal capabilities. In general, biofiltration maintenance requirements are typical landscape care procedures and include:

- Irrigate plants as needed during prolonged dry periods. In general, plants should be selected to be drought-tolerant and not require irrigation after establishment (two to three years).
- Inspect flow entrances, ponding area, and surface overflow areas periodically, and replace soil, plant material, and/or mulch layer in areas if erosion has occurred. Properly-designed facilities with appropriate flow velocities should not cause erosion except potentially during in extreme events. If erosion occurs, the flow velocities and gradients within the biofiltration area and flow dissipation and erosion protection strategies in the pretreatment area and flow entrance should be reassessed. If sediment is deposited in the biofiltration area, identify the source of the sediment within the tributary area, stabilize the source, and remove excess surface deposits.
- Prune and remove dead plant material as needed. Replace all dead plants, and if specific plants have a high mortality rate, assess the cause and, if necessary, replace with more appropriate species.
- Remove weeds as needed until plants are established. Weed removal should become less frequent if the appropriate plant species are used and planting density is attained.
- Select the proper soil mix and plants for optimal fertility, plant establishment, and growth to preclude the use of nutrient and pesticide supplements. By design, biofiltration facilities are located in areas where phosphorous and nitrogen levels are often elevated such that these should not be limiting nutrients. Addition of nutrients and pesticides may contribute pollutant loads to receiving waters.
- In areas where heavy metals deposition is likely (i.e., tributary areas to industrial, vehicle dealerships/repair, parking lots, roads), replace mulch annually. In areas where metals deposition is less likely (i.e., residential lots), replace or add mulch as needed to maintain a two to three inch depth at least once every two years.

- Analyze soil for fertility and pollutant levels if necessary. Biofiltration soil media are designed to maintain long-term fertility and pollutant processing capability.
- Eliminate standing water to prevent vector breeding.
- Inspect overflow devices for obstructions or debris, which should be removed immediately. Repair or replace damaged pipes upon discovery.
- Inspect, and clean if necessary, the underdrain.

A summary of potential problems that need to be addressed by maintenance activities is presented in Table E-13.

The County requires execution of a maintenance agreement to be recorded by the property owner for the on-going maintenance of any privately-maintained stormwater quality control measures. The property owner is responsible for compliance with the maintenance agreement. A sample maintenance agreement is presented in Appendix H.

Table E-13. Biofiltration Troubleshooting Summary

Problem	Conditions When Maintenance Is Needed	Maintenance Required
Vegetation	Overgrown vegetation	Mow and prune vegetation as appropriate.
	Presence of invasive, poisonous, nuisance, or noxious vegetation or weeds	Remove this vegetation and plant native species as needed.
Trash and Debris	Trash, plant litter, and dead leaves present	Remove and properly dispose of trash and debris.
Irrigation (if applicable)	Not functioning correctly	Check irrigation system for clogs or broken lines and repair as needed.
Inlet/Overflow	Inlet/overflow areas clogged with sediment and/or debris	Remove material.
	Overflow pipe blocked or broken	Repair as needed.
Erosion/Sediment Accumulation	Splash pads or spreader incorrectly placed Presence of erosion or sediment accumulation	Check inlet structure to ensure proper function. Repair, or replace if necessary, the inlet device. Repair eroded areas with gravel as needed. Re-grade the biofiltration area as needed.
Contaminants and Pollution	Any evidence of oil, gasoline, contaminants, or other pollutants	Remove any evidence of visual contamination from floatables such as oil and grease.
Standing water	Standing water observed more than 96 hours after storm event	Inspect, and clean as needed, the underdrain to ensure proper function. Clear clogs as needed. Remove and replace planter media (sand, gravel, topsoil, mulch) and vegetation.

APPENDIX G

BMP OPERATIONS & MAINTENANCE MANUAL

APPENDIX H

COVENANT AND AGREEMENT

RECORDING REQUESTED BY
AND MAIL TO:

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUILDING AND SAFETY DIVISION
900 S. FREMONT AVENUE, 3RD FLOOR
ALHAMBRA, CA 91803-1331

Space above this line is for Recorder's use

COVENANT AND AGREEMENT REGARDING THE MAINTENANCE OF LOW IMPACT DEVELOPMENT (LID) & NATIONAL POLLUTANTS DISCHARGE ELIMINATION SYSTEM (NPDES) BMPs

The undersigned, ____ ("Owner"), hereby certifies that it owns the real property described as follows ("Subject Property"), located in the County of Los Angeles, State of California:

LEGAL DESCRIPTION

ASSESSOR'S ID #___________________TRACT NO.___________________LOT NO.__________________________

ADDRESS: ____

____

Owner is aware of the requirements of the County of Los Angeles' Green Building Standards Code, Title 31, Section 4.106.4 (LID), and National Pollutant Discharge Elimination System (NPDES) permit. The following post-construction BMP features have been installed on the Subject Property:

- □ Porous pavement
- □ Cistern/rain barrel
- □ Infiltration trench/pit
- □ Bioretention or biofiltration
- □ Rain garden/planter box
- □ Disconnect impervious surfaces
- □ Dry Well
- □ Storage containers
- □ Landscaping and landscape irrigation
- □ Green roof
- □ Other ____

____

The location, including GPS x-y coordinates, and type of each post-construction BMP feature installed on the Subject Property is identified on the site diagram attached hereto as Exhibit 1.

Owner hereby covenants and agrees to maintain the above-described post-construction BMP features in a good and operable condition at all times, and in accordance with the LID/NPDES Maintenance Guidelines, attached hereto as Exhibit 2.

Owner further covenants and agrees that the above-described post-construction BMP features shall not be removed from the Subject Property unless and until they have been replaced with other post-construction BMP features in accordance with County of Los Angeles' Green Building Standards Code, Title 31 and NPDES permit.

Owner further covenants and agrees that if Owner hereafter sells the Subject Property, Owner shall provide printed educational materials to the buyer regarding the post-construction BMP features that are located on the Subject Property, including the type(s) and location(s) of all such features, and instructions for properly maintaining all such features.

Owner makes this Covenant and Agreement on behalf of itself and its successors and assigns. This Covenant and Agreement shall run with the Subject Property and shall be binding upon owner, future owners, and their heirs, successors and assignees, and shall continue in effect until the release of this Covenant and Agreement by the County of Los Angeles, in its sole discretion.

Owner(s):

By:__________________________________ Date:__________________________________

By:__________________________________ Date:__________________________________

(PLEASE ATTACH NOTARY)

REFERENCE

PLAN CHECK NO.: ____________________________________ DISTRICT OFFICE NO.:_______________________

ATTACHMENTS

RECORDING REQUEST BY AND MAIL TO:

County of Los Angeles
Department of Public Works

Building and Safety – Drainage and Grading Section
Land Development – Drainage and Grading Section

P.O. Box 1460
Alhambra, California 91802-1460

Space above this line is for Recorder's use

COVENANT FOR MAINTENANCE OF WATER QUALITY (WQ) DEVICES

I (we) ______________________________________, hereby certify that I (we) am (are) the legal owner(s) of Tract # _____, and as such owners for the mutual benefit of future purchasers, their heirs, successors, and assigns, do hereby fix the following protective conditions to which their property, or portions thereof, shall be held, sold and/or conveyed.

That owner(s) shall maintain the WQ system shown on attached Exhibit A map and on Grading Plan GPC # ____________, on file in the office of the Director of Public Works, in a good and functional condition at least once a year and retain proof of the inspection. The owner(s) shall perform this responsibility, unless the County discharges this obligation through a subsequently recorded written instrument.

The undersigned also covenants and agrees for himself, his heirs, successors, and assigns, to indemnify, defend, and save harmless the County, its agents, officers and employees from and against any and all liability, expenses, including defense costs and legal fees, and claims for damages of any nature whatsoever, including, but not limited to, bodily injury, death, personal injury, or property damage arising from or connected with the construction or maintenance of said work.

Owner(s):

By: ____ Date: ______________________

By: ____ Date: ______________________

APPENDIX I

GEOTECHNICAL REPORT (FOR REFERENCE ONLY)

Converse Consultants

Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

GEOTECHNICAL STUDY REPORT
Proposed Parking Structure at Parking Lot S
Mt. San Antonio College
Walnut, California

Converse Project No. 17-31-247-01

Prepared For:

Mt. San Antonio College
Facilities Planning & Management
1100 North Grand Avenue, Building 23
Walnut, California 91789

Prepared By:

Converse Consultants
717 South Myrtle Avenue
Monrovia, California 91016

October 23, 2017

October 23, 2017

Mr. Gary Gidcumb
Mt. San Antonio College
Facilities Planning & Management
1100 North Grand Avenue, Building 23
Walnut, California 91789

Subject: **GEOTECHNICAL STUDY REPORT**
Proposed Parking Structure at Parking Lot S
Mt. San Antonio College
Walnut, Los Angeles County, California
Converse Project No. 17-31-247-01

Dear Mr. Gidcumb:

Converse Consultants (Converse) has prepared this geotechnical study report to present the findings, conclusions and recommendations of our geologic and geotechnical study for the Proposed Parking Structure Project located at Student Parking Lot S at Mt. San Antonio College (Mt. SAC) in Walnut, California. In accordance with California Education Code, Sections 17212 and 81033, this report was prepared consistent with the current edition of California Building Code, Title 24, Chapter 16A and Chapter 18A; California Administrative Code, Part 1, Title 24, CCR, Section 4-317 (e) and CGS Note 48-Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals and Essential Services Buildings, for design and for the Division of the State Architect (DSA) submittal purposes. Converse evaluated the nature and engineering properties of the subsurface soils and sedimentary bedrock to provide recommendations for site earthwork, foundation design, grading, and construction for the proposed development. Our services were performed in accordance with our proposal dated August 10, 2017.

We appreciate the opportunity to be of continued service to Mt. San Antonio College. If you should have any questions, please do not hesitate to contact us at (626) 930-1200.

Sincerely,

CONVERSE CONSULTANTS

Sivathasan

Siva K. Sivathasan, PhD, PE, GE, DGE, QSD, F. ASCE
Senior Vice President / Principal Engineer

Dist: 5Addressee

PROFESSIONAL CERTIFICATION

This report for the Proposed Parking Structure Project at Student Parking Lot S located within the campus of Mt. San Antonio College in the City of Walnut, Los Angeles County, California, has been prepared by the staff of Converse under the professional supervision of the individuals whose seals and signatures appear hereon.

The findings, recommendations, specifications or professional opinions contained in this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice in this area of Southern California. There is no warranty, either expressed or implied.

In the event that changes to the property occur, or additional, relevant information about the property is brought to our attention, the conclusions contained in this report may not be valid unless these changes and additional relevant information are reviewed, and the recommendations of this report are modified or verified in writing.

Parameswaran Ariram, EIT
Senior Staff Engineer

PROFESSIONAL GEOLOGIST
MARK B. SCHLUTER
No. 1415
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Mark B. Schluter, PG, CEG, CHG
Senior Engineering Geologist

18

Siva K. Sivathasan, PhD, PE, GE, DGE, QSD, F. ASCE
Senior Vice President / Principal Engineer

EXECUTIVE SUMMARY

The following is a summary of our geotechnical investigation, conclusions and recommendations, as presented in the body of this report, please refer to the appropriate sections of the report for complete conclusions and recommendations. In the event of a conflict between this summary and the report, or an omission in the summary, the report shall prevail.

- The proposed project consists of a 3-story parking structure to be constructed on existing Student Parking Lot S. The parking structure footprint measures approximately 380 feet long and 220 to 260 feet wide and is approximately 89,820 square feet. The parking structure consists of three (3) above-ground parking levels and will be founded on shallow spread foundations.

- Eight (8) exploratory borings (BH-1 through BH-8) were drilled within the project site from August 16 to August 24, 2017. The borings were advanced using a truck-mounted drill rig with an 8-inch diameter hollow-stem auger to depths ranging from 20.5 to 51.5 feet below the existing ground surface (bgs). Boring Nos. BH-4, BH-5, BH-6, BH-7 and BH-8 encountered refusal to sampler penetration and refusal to drilling penetration in hard sedimentary bedrock along the southern side of the proposed structure.

- Ten (10) exploratory Cone Penetration Tests (CPT-1 through CPT-10) were advanced to depths of 8 to 42 feet below the existing ground surface within the project site on September 6, 7 and 8, 2017. CPT Nos. CPT-1, CPT-2, CPT-3, CPT-5, CPT-6, CPT-7, CPT-8, CPT-9, and CPT-10 encountered very dense/stiff soil and sedimentary bedrock conditions, and were stopped short of their planned depths.

- There are no known active faults projecting toward or extending across the proposed site. The project site is not located within a currently designated State of California Earthquake Fault Zone (formerly Alquist-Priolo Special Studies Zones) for surface fault rupture.

- The site is located within a mapped Seismic Hazard Zone for liquefaction. The results of liquefaction analyses indicate the project site is susceptible to liquefaction. The estimated potential liquefaction-induced settlement ranges from 0.91 to 2.88 inches with potential differential settlement ranging from 0.46 to 1.44 inches. The project structural engineer should consider the effects of seismically-induced settlement in the foundation design.

- Local zones of groundwater seepage were encountered during subsurface exploration in the alluvium and bedrock at depths ranging from approximately 23 feet bgs in boring BH-3 to approximately 36.8 feet bgs in BH-7. Groundwater and groundwater seepage should be anticipated during deep excavations.

- Variable thicknesses of undocumented fill soils were encountered in the borings. The undocumented fill is not considered suitable for slab or foundation support.

- Over-excavation and re-compaction of the undocumented fill soils, upper alluvium and sedimentary bedrock is recommended for site grading to provide a minimum 5-foot-thick compacted fill blanket beneath the building foundations and floor slab. The over-excavation and re-compaction is recommended to extend approximately 7 feet to 10 feet below ground surface and 10 feet beyond the edge of the parking structure foundations. A geofabric reinforcement layer is recommended at the bottom of the deeper 10-foot depths of over-excavation to reduce differential settlements between the underlying alluvium and shallow sedimentary bedrock areas.

- The upper undocumented fill soils and natural granular soils consisting of silty sands should be segregated, stockpiled and saved during excavation for later reuse beneath the footings and floor slab to prevent mixing with the underlying fine-grained, potentially expansive, silts and clays.

- Shallow spread and continuous footings founded on compacted fill are considered suitable for structure support provided the recommendations in this report are incorporated into the project plans and specifications, and are followed during site construction.

- Based on the proposed plan, over-excavation and re-compaction of the undocumented fills and upper alluvial soils is required for the building pad to achieve the planned finished grades.

- Different earth materials should be anticipated at excavation bottoms for the planned floor levels. In order to provide a relative uniform bearing material below shallow foundations, over-excavation and re-compaction below the bottom of foundations and slab-on-grades is recommended. We recommend the shallow foundations should be supported on a minimum 5-foot-thick layer of compacted fill benched into undisturbed native soil and bedrock materials for the building pad.

- On-site clayey soils with an expansion index exceeding 20 should not be re-used for compaction within 2 feet below the proposed foundations. Soils containing organic materials should not be used as structural fill. The extent of removal should be determined by the geotechnical representative based on soil observations made during grading.

- Site soils have “negligible” concentrations of water soluble sulfates.

- In general, the soluble sulfate concentration, pH and chloride content are not in the corrosive range. However, the minimum saturated resistivity is in the corrosive range to ferrous metal. Protections of underground metal pipe should be considered. Since the soluble sulfate concentrations tested for this project are less than 2,000 ppm in the soil, mitigation measures to protect concrete in contact with the soils are not anticipated.

- The earth materials at the site should be excavatable with conventional heavy-duty earth moving and trenching equipment. The on-site materials contain about 5 to 10 percent gravel up to 3 inches in maximum dimension. Larger gravels, cobbles and boulders may exist at the site. Localized areas of harder, cemented and resistant bedrock units and layers (pebble conglomerates, sandstone layers, siliceous layers, etc.) may be encountered during excavation and grading and should be anticipated. Bedrock hardness will increase with depth within the sandstone (Tpss) and pebble conglomerate (Tpcg) layers. Earthwork and grading should be performed with suitable grading equipment for hard, cemented and gravelly materials.

Results of our investigation indicate that the site is suitable from a geotechnical standpoint for the proposed development, provided that the recommendations contained in this report are incorporated into the design and construction of the project

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 SITE AND PROJECT DESCRIPTION 2

2.1 Site Description 2
2.2 Project Description 2

3.0 SCOPE OF WORK 3

3.1 Site Reconnaissance 3
3.2 Subsurface Exploration 3
3.3 Laboratory Testing 4
3.4 Engineering Analyses and Report 4

4.0 GEOLOGIC CONDITIONS 5

4.1 Regional Geology 5
4.2 Subsurface Profile of Subject Site 5
4.3 Groundwater 7
4.4 Subsurface Variations 7

5.0 FAULTING AND SEISMIC HAZARDS 8

5.1 Seismic Characteristics of Nearby Faults 8
5.2 Seismic History 10
5.3 Surface Fault Rupture 11
5.4 Liquefaction and Seismically-Induced Settlement 11
5.5 Lateral Spreading 11
5.6 Seismically-Induced Slope Instability 12
5.7 Earthquake-Induced Flooding 12
5.8 Tsunami and Seiches 12
5.9 Volcanic Eruption Hazard 12

6.0 SEISMIC ANALYSIS 13

6.1 CBC Seismic Design Parameters 13
6.2 Site-Specific Response Spectra 13

7.0 GEOTECHNICAL EVALUATIONS AND CONCLUSIONS 17

8.0 EARTHWORK AND SITE GRADING RECOMMENDATIONS 19

8.1 General Evaluation 19
8.2 Over-Excavation/Removal 19
8.3 Structural Fill 22
8.4 Excavatability 22
8.5 Expansive Soil 23
8.6 Shrinkage and Subsidence 23
8.7 Subgrade Preparation 24

9.0 DESIGN RECOMMENDATIONS 25

9.1 Shallow Foundations 25
9.2 Modulus of Subgrade Reaction 26

9.3 LATERAL EARTH PRESSURE 26
9.4 SLABS-ON-GRADE 27
9.5 SOIL CORROSIVITY EVALUATION 27
9.6 FLEXIBLE PAVEMENT 28
9.7 RIGID PAVEMENT 29
9.8 SITE DRAINAGE 30

10.0 CONSTRUCTION RECOMMENDATIONS 31

10.1 GENERAL 31
10.2 TEMPORARY EXCAVATIONS 31
10.3 SHORING DESIGN 32

11.0 PLAN REVIEW AND CONSTRUCTION INSPECTION SERVICES 35

12.0 CLOSURE 36

13.0 REFERENCES 37

TABLES

Page No.
Table No. 1, Summary of Regional Faults 9
Table No. 2, CBC Seismic Design Parameters 13
Table No. 3, 2016 CBC Mapped Acceleration Parameters 14
Table No. 4, Probabilistic Response Spectrum Data 14
Table No. 5, Site-Specific Response Spectrum Data 15
Table No. 6, Site-Specific Seismic Design Parameters 16
Table No. 7, Lateral Earth Pressures for Retaining Wall Design 26
Table No. 8, Soil Corrosivity Test Results 27
Table No. 9, Flexible Pavement Structural Sections 28
Table No. 10, Rigid Pavement Structural Sections 29
Table No. 11, Slope Ratios for Temporary Excavation 31

DRAWINGS

Following Page No.
Drawing No. 1, Site Location Map 1
Drawing No. 2, Site Plan and Approximate Location of CPTs and Borings 1
Drawing No. 3, Regional Geologic Map 5
Drawing No. 4, Geologic Cross Section A-A' 7
Drawing No. 5, Geologic Cross Section B-B' 7
Drawing No. 6, Geologic Cross Section C-C' 7
Drawing No. 7, Geologic Cross Section D-D' 7
Drawing No. 8, Southern California Regional Fault Map 8
Drawing No. 9, Epicenters Map of Southern California Earthquakes (1800-1999) 10
Drawing No. 10, Seismic Hazard Zones Map 11
Drawing No. 11, Site-Specific Response Spectrum Data 15
Drawing No. 12, Recommended Limits of Over-excavation and Re-compaction with Geofabric Reinforcement 20

APPENDICES

Appendix A ....Field Exploration and Cone Penetration Test Data
Appendix B ....Laboratory Testing Program
Appendix C .... Liquefaction/Seismic Settlement Analysis
Appendix D ....Earthwork Specifications

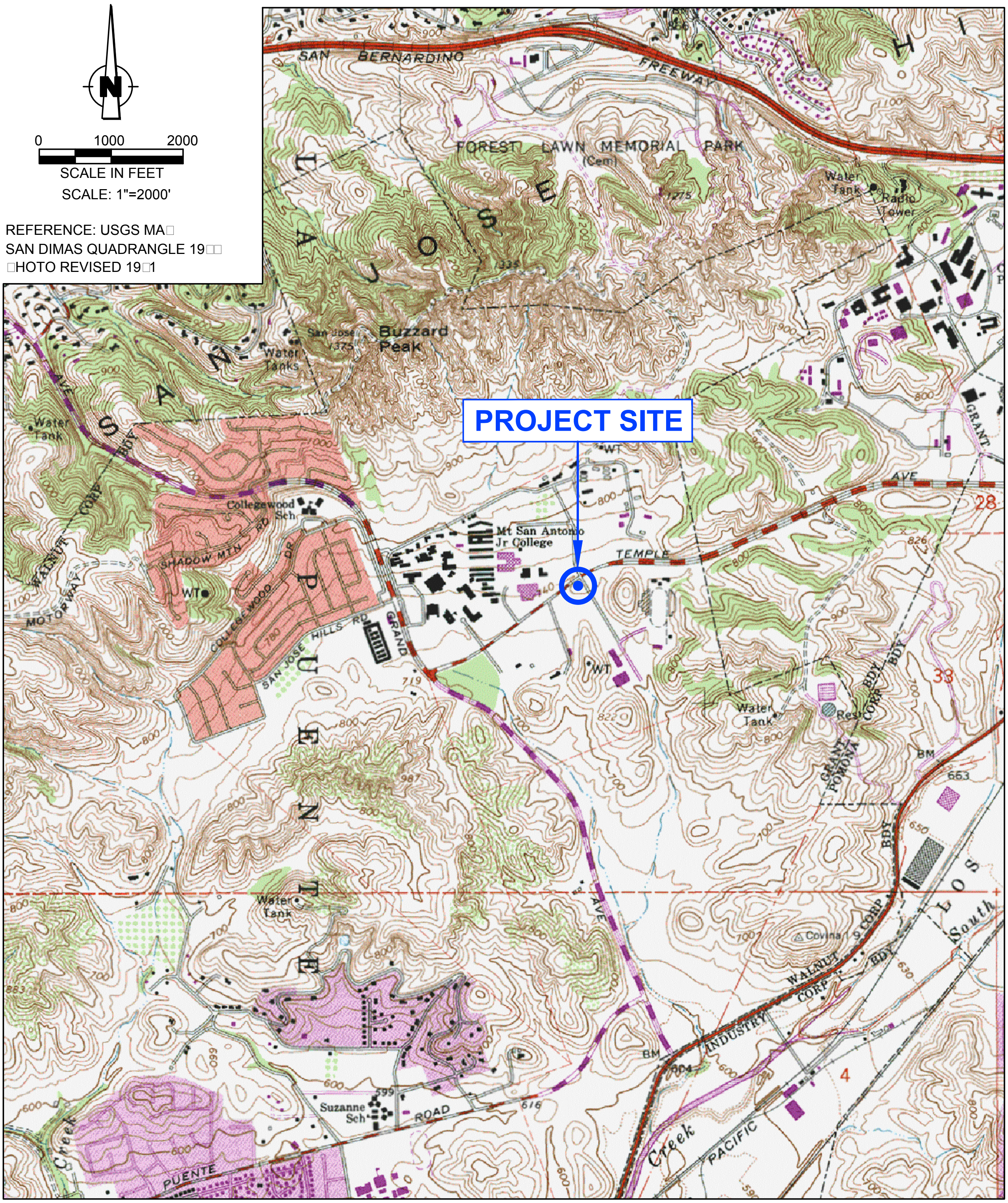
1.0 INTRODUCTION

This report contains the findings and recommendations of our geotechnical study performed at the site of the proposed Parking Structure at Parking Lot S located within the campus of Mt. San Antonio College, in the City of Walnut, Los Angeles County, California, as shown on Drawing No. 1, *Site Location Map*.

The purpose of the investigation was to generate a report for design and the Department of State Architect (DSA) submittal purposes, consistent with current edition of California Education Code, Sections 17212 and 81033, California Building Code, Title 24 CCR, Sections 4-317, 1803 and 1804 and CGS Note 48-Checklist for the review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals and Essential Services Buildings.

We have used a site plan provided to us by your office as a reference for this project. The site plan is included in this report as Drawing No. 2, *Site Plan and Approximate Location of CPTs and Borings*.

This report is written for the project described herein and is intended for use solely by Mt. San Antonio College and its design team. It should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.



SITE LOCATION MAP

MT. SAN ANTONIO COLLEGE
LOT S STRUCTURE
WALNUT, CALIFORNIA

Project No.

17-31-247-01

Drawing No.

1

Converse Consultants

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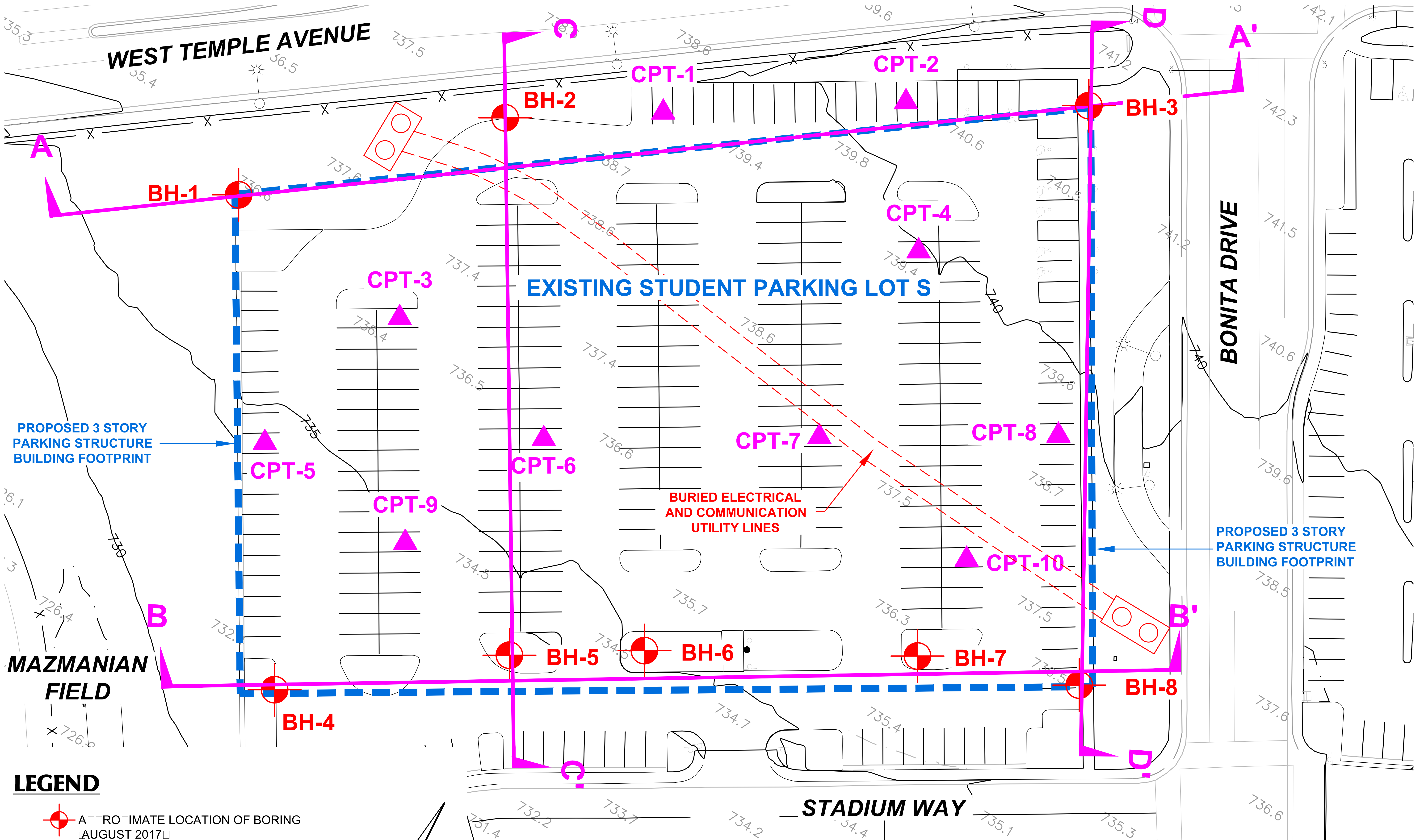


LEGEND

APPROXIMATE LOCATION OF BORING (AUGUST 2017)

APPROXIMATE LOCATION OF CPT (SEPTEMBER 2017)

GEOLOGIC CROSS SECTION A-A', B-B', C-C', AND D-D'

0 40 80
APPROXIMATE SCALE IN FEET

SITE PLAN AND APPROXIMATE LOCATION OF CPTs AND BORINGS

Converse Consultants

MT. SAN ANTONIO COLLEGE
LOT S STRUCTURE
WALNUT, CALIFORNIA

Project No.	Drawing No.
17-31-247-01	2

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Description

The proposed parking structure project is located at the current Student Parking Lot S located on at the southwest corner of the intersection of West Temple Avenue and Bonita Drive in Mt. San Antonio College. The existing parking lot dimensions are approximately 380 feet east-west by 310 feet north-south. The Student Parking Lot S is currently asphalt paved with concrete curbs and gutters and provides the campus with parking facilities. The site is bordered by West Temple Avenue to the north, Bonita Drive to the east, Stadium Way with hardscape to the south and the Mt. SAC Mazmanian baseball field to the west.

The subject site for the proposed parking structure has surface elevations ranging from approximately 730 to 741 feet relative to mean-sea-level (MSL) respectively, with surface gradients flowing down gradient toward the southwest. The site coordinates are: North latitude: 34.04599 degrees, West longitude: 117.84056 degrees.

The site coordinates were centered on the subject sites and used to calculate the earthquake ground motions. Review of the Engineering Geology and Seismology for Public Schools and Hospitals in California, indicates that accuracy to within a few hundred meters of these coordinates is sufficient for the computation of the earthquake ground motion of the project site.

2.2 Project Description

The proposed Parking Structure at Parking Lot S consists of one new three-level parking structure building. The parking structure footprint measures approximately 380 feet long and 220 to 260 feet wide and is approximately 89,820 square feet. The structural loads are not known at this time, but are anticipated to be moderate. The structure is planned to be founded on shallow spread foundations or concrete mat foundations. The project site is shown on Drawing No. 2, *Site Plan and Approximate Location of CPTs and Borings*.

3.0 SCOPE OF WORK

The scope of our work included a site reconnaissance, subsurface exploration with soil sampling, laboratory testing, engineering analysis, and preparation of this report.

3.1 Site Reconnaissance

During the site reconnaissance from August 14 to August 15, 2017, the surface conditions were noted and the locations of the borings were determined so that drill rig and Cone Penetration Test (CPT) rig access to all the locations was available. The borings and CPT soundings were located using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used. The proposed boring and CPT test sites were scanned by a private utility locator using electrical and ground penetrating radar systems to screen each site for buried utility lines. Underground Service Alert (USA) of Southern California was then notified of our proposed drilling and CPT test locations at least 48 hours prior to initiation of the subsurface field work.

3.2 Subsurface Exploration

Eight (8) exploratory borings (BH-1 through BH-8) were drilled within the project site from August 16 to August 24, 2017. The borings were advanced using a truck mounted drill rig with an 8- inch diameter hollow stem auger to depths ranging from 20.5 to 51.5 feet below the existing ground surface (bgs). It should be noted that borings were hand augered to depths of 5 feet below ground surface to locate and avoid underground utilities in the area. Each boring was visually logged by a Converse engineer and sampled at regular intervals and at changes in subsurface soils. Detailed descriptions of the field exploration and sampling program are presented in Appendix A, *Field Exploration*. California Modified Sampler (Ring samples), Standard Penetration Test (SPT) samples, and bulk soil samples were obtained for laboratory testing.

Standard Penetration Tests (SPTs) were performed in selected borings at selected intervals using a standard (1.4 inches inside diameter and 2.0 inches outside diameter) split-barrel sampler. The SPT sampler was driven into the ground with successive drops of a 140-pound hammer falling 30 inches by means of a mechanically driven drop hammer. The number of successive drops of the driving weight (“blows”) required for every 6-inches of penetration of the sampler are shown on the Logs of Borings in the “blows column. The bore holes were then backfilled and compacted with soil cuttings by reverse spinning of the auger following the completion of drilling and patched with asphalt patch where necessary to match existing conditions.

Ten (10) Cone Penetration Test soundings (CPT-1 through CPT-10) were advanced to depths of 8 feet to 42 feet below ground surface within project site on September 6, 7 and 8, 2017 by Kehoe Testing and Engineering using a 30-ton (4 axle) CPT rig. The cone penetration testing consisted of pushing an instrumented cone-tipped probe into the ground while simultaneously recording the resistance to penetration at the cone tip and along the friction sleeve. The test holes were stopped at plan depths or when the cone tip encountered refusal to penetration. The test holes were then backfilled with bentonite crumbles, periodically hydrated with clean water and tamped. The top portion of the test hole was then patched with asphalt patch to match the existing pavement surface.

The approximate locations of the exploratory borings and CPT test soundings are shown in Drawing No. 2, *Site Plan and Approximate Location of CPTs and Borings*. Detailed descriptions of the field exploration and sampling program are presented in Appendix A, *Field Exploration*.

3.3 Laboratory Testing

Representative samples of the site soils were tested in the laboratory to aid in the classification and to evaluate relevant engineering properties. The tests performed included:

- In Situ Moisture Contents and Dry Densities (ASTM Standard D2216)
- Grain Size Distribution (ASTM Standard C136)
- Fines Content/Passing No. 200 Sieve (ASTM D1140)
- Maximum Dry Density and Optimum-Moisture Content Relationship (ASTM Standard D1557)
- Direct Shear (ASTM Standard D3080)
- Consolidation (ASTM Standard D2435)
- R-value (ASTM Standard D2844)
- Soil Corrosivity Tests (Caltrans 643, 422, 417, and 532)

For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*. For *in-situ* moisture and density data, see the Logs of Borings in Appendix A, *Field Exploration*.

3.4 Engineering Analyses and Report

Data obtained from the exploratory fieldwork and laboratory-testing program were analyzed and evaluated. This report was prepared to provide the findings, conclusions and recommendations developed during our investigation and evaluation.

4.0 GEOLOGIC CONDITIONS

4.1 Regional Geology

The proposed project site is located in the San Jose Hills along the western edge of the Pomona Valley within the Transverse Ranges geomorphic province of California along the northern terminus of the Peninsular Ranges Province.

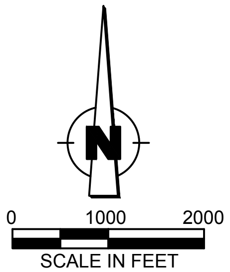
The Pomona Valley is situated at the junction of the two major convergent fault systems: 1) Northwest-trending high angle strike slip faults of the San Andreas system projecting from the northern terminus of the Peninsular Ranges Province, and 2) East-trending low angle reverse or reverse-oblique faults bounding the south margin of the Transverse Ranges. Faults in group one include the Palos Verdes, Newport-Inglewood, Whittier-Elsinore and San Jacinto fault zones. Group two faults include the Malibu-Santa Monica, Hollywood, Raymond, Sierra Madre and Cucamonga fault zones.

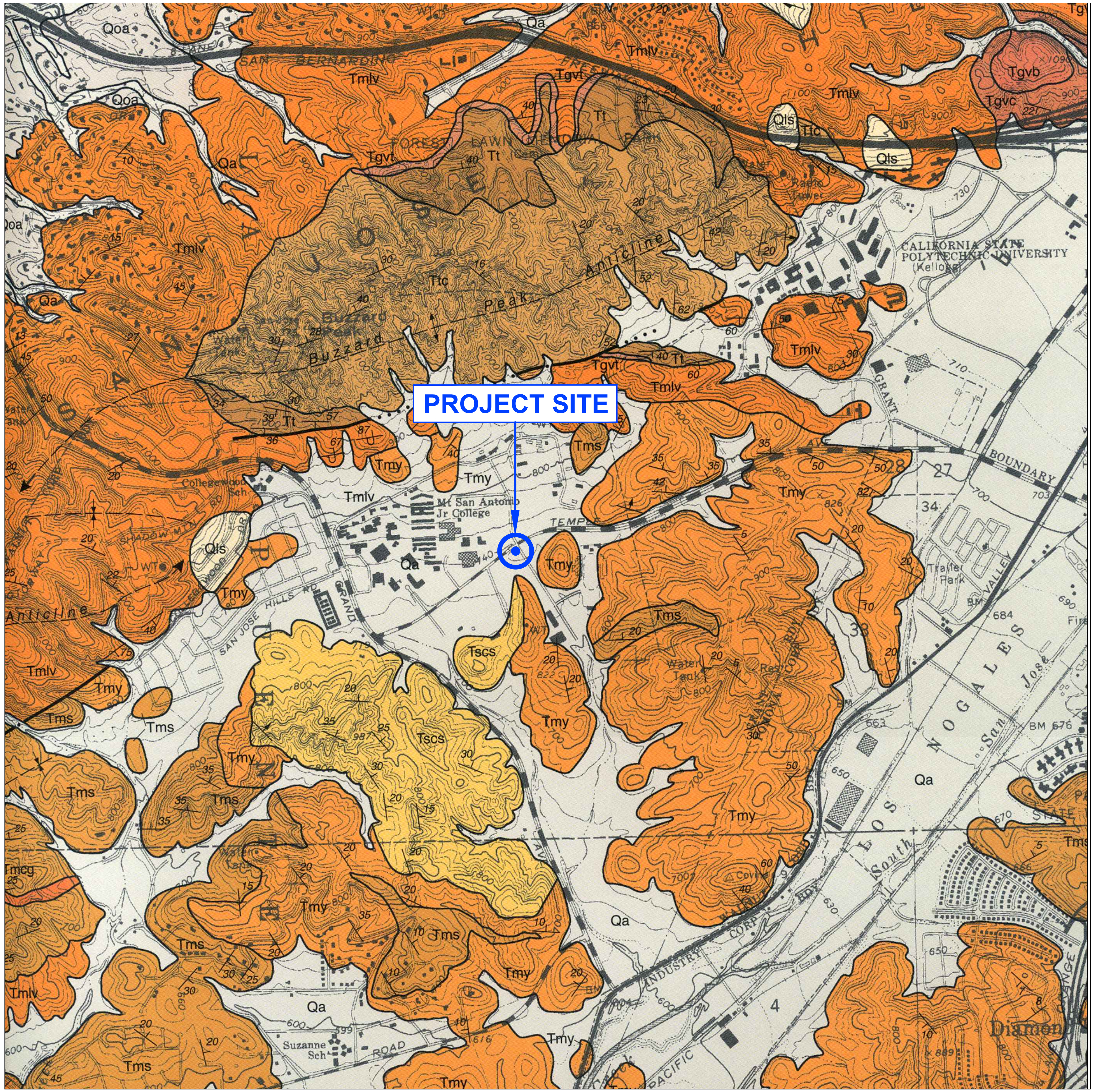
The Pomona Valley basin is bounded to the north by the San Jose fault and to the southwest by the Chino-Central Avenue fault. These two fault systems do not exhibit significant evidence of surface movement within Holocene time (0-11,700 years before present) and are not considered active based on current geologic information. The San Jose and Chino-Central Avenue faults are considered Late Quaternary age faults, having exhibited displacement and movement within the past approximately 130,000 years.

The Geologic Map of the San Dimas and Ontario Quadrangles prepared by Thomas W. Dibblee, Jr. (DF-91, dated July 2002) was reviewed. The map shows the location of Mt. San Antonio College campus within an alluvial basin surrounded by hillsides consisting of sedimentary bedrock of the Monterey (Puente) Formation. No faults are shown running through or projecting through the project site. Low lying sedimentary bedrock hillsides are depicted south and east of the subject site and have been mapped as (Tmy)-Yorba Shale Member consisting of thinly bedded, diatomaceous, semi-siliceous clay shale, siltstone and minor sandstone and (Tscs) Sycamore Canyon Formation consisting of light gray sandstone that includes conglomerate and siltstone. A portion of the map by Thomas W. Dibblee has been reproduced and is shown as Drawing No. 3, *Regional Geologic Map.*

4.2 Subsurface Profile of Subject Site

The earth materials encountered during our investigation consist of existing fill soils placed during previous site grading operations, natural alluvial soils and sedimentary bedrock of the Puente Formation. The project site area is covered by a layer of fill soils underlain by the alluvial soils and interbedded layers of sandstone, pebble conglomerate, siltstone, and claystone sedimentary bedrock of the Puente Formation. These earth materials consist primarily of silty sands, clayey sands, sands, silts and clays. Each of these earth materials is described in more detail below.





SAN DIMAS AND ONTARIO MAP (DF-91)

LEGEND

af | Qg | Qa

SURFICIAL SEDIMENTS

af *artificial fill*
Qg *alluvial gravel and sand of stream channels, some artificially channelized*
Qa *alluvial gravel and sand of valley areas*

Qls

LANDSLIDE AND TALUS RUBBLE

— *UNCONFORMITY* —

Qoa | Qog

OLDER, DISSECTED SURFICIAL SEDIMENTS

Qoa *low remnants of elevated alluvial gravel*
Qog *high remnants of elevated older alluvial gravel, including coarse boulder gravel*

— *UNCONFORMITY* —

SEDIMENTARY AND VOLCANIC ROCKS

Tscg | Tscs

SYCAMORE CANYON FORMATION

Sycamore Canyon Formation (uppermost member of Puente Formation of Durham & Yerkes 1964, Tan 1998) shallow marine clastic; latest Miocene age.
Tscg conglomerate, light gray, of cobbles and pebbles of plutonic rocks in sandstone matrix.
Tscs sandstone, light gray, similar to **Tms**. Includes some conglomerate similar to **Tscg,** and siltstone.

Tm | Tmy | Tmcg | Tms | Tmlv

MONTEREY (PUENTE) FORMATION

Monterey Formation (Puente form of Eldridge & Arnold, 1907, Durham & Yerkes 1964: Tan 1998, marine biogenic & clastic; late Miocene age, (Mohnian Stage))
Tm *unassigned shale; similar to* ***Tmlv*** *&* ***Tmly***
Tmy *Yorba shale Member – light gray, thin bedded, diatomaceous, semi-siliceous to clay shale, siltstone, minor sandstone; fish scales.*
Tmcg *conglomerate facies of cobbles & pebbles of plutonic rocks in sandstone matrix lenses in unit* ***Tms****, deposited as submarine deltas.*
Tms *Soquel sandstone facies, partly intertongued into* ***Tmy*** *&* ***Tmlv****, light gray to tan, moderately lithified, bedded, arkosic, contains concretions, some interbedded silty shale, derived from plutonic terrane & deposited as submarine fans, unfossiliferous*
Tmlv *La Vida Shale Member, white, weathered; thin bedded, platy, siliceous shale, clay shale, and siltstone, some strata of tan dolomite and sandstone; fish scales, foraminifera.*

Tt | Ttc

TOPANGA FORMATION

(of Shelton, 1955; Tan. 1998; marine clastic; middle Miocene age, unfossiliferous, locally intertongued into Glendora volcanics). age late ? Miocene
Tt *sandstone, light gray to tan, moderately lithified, bedded, arkosic, locally pebbly, includes interbedded siltstone or clay shale.*
Ttc *conglomerate (Buzzard Peak Conglomerate member of Woodford et al. 1946, light gray to tan, semi-lithified, vaguely bedded, composed of cobbles and pebbles of mostly plutonic rocks in sandstone matrix.*

Tgv | Tgvc | Tgvb | Tgvp | Tgvt | Tgva | Tgvr | Tgve

GLENDORA VOLCANIC ROCKS

Glendora Volcanics (of Shelton, 1955, Tan, 1999; extrusive volcanic rocks; middle Miocene age locally intertongued into Topanga Formation). (radiometric age ±16 MA (Weigand, P.W., oral communication 2001)
Tgv *undifferentiated volcanic rock, mostly brown andesitic flows and breccias*
Tgvc *volcanic conglomerate, gray to brown, of volcanic detritus.*
Tgvb *basalt flows, gray to black, massive to vesicular.*
Tgvp *basaltic pelagonitic tuff & pillow lavas.*
Tgvt *rhyolitic tuff breccia, tan to white*
Tgva *andesite flows and flow breccias, brown, porphyritic, massive.*
Tgvr *rhyolitic-dacitic flows, tan to light brown, aphanitic, massive to flow-banded, hard, fractured*
Tgve *rhyolite-dacite breccia exposed only at Elephant Hill.*

— *UNCONFORMITY* —

CRYSTALLINE BASEMENT ROCKS

GRANITIC ROCKS

Tmda

MOUNTAIN MEADOWS DACITE

Mountain Meadows dacite (of Shelton 1955, Tan, 1999 intrusive into qd; early Miocene? Age)
Mda *dacite light gray, hard, massive, fine grained, contains small feldspar phenocrysts and biotite flakes.*

qd | qdb

QUARTZ DIORITIC PLUTONIC ROCKS

quartz diorite: plutonic igneous rock, late Mesozoic- Cretaceous age
qd *biotite quartz diorite, light gray, massive.*
qdb *Bonsall Tonalite of Larsen 1948 similar to* ***qd****, but slightly qneissoid & contains dark gray fine grained xenoliths elongated parallel to gneissoid structure up to 9 in. long.*

Holocene
Pleistocene
QUATERNARY
Miocene
TERTIARY
CENOZOIC
CEOUS
ZOIC

REFERENCE: THOMAS W. DIBBLE, Jr. (DF-91)
SAN DIMAS QUADRANGLE
AND ONTARIO QUADRANGLE (2002)

REGIONAL GEOLOGIC MAP

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WALNUT, CALIFORNIA

Project No. 17-31-247-01

Drawing No. 3

Fill Soils

An undocumented fill layer of variable thickness was encountered in all of the soil borings drilled between August 16 to August 24, 2017, within the subject site. The depth of the fill ranges from approximately three (3) to eight (8) feet in thickness. Deeper fill soils may be encountered at the project site. The observed fill soils consist primarily of silty sand, clayey sand and clayey silt. Most of the fill soils appear to have been locally derived from the general site area. Documentation concerning the placement and degree of compaction of the fill soils was not available.

Alluvium

Alluvial deposits were encountered underlying the fill material at the project site. The native soil encountered in the borings consists of clayey sands, sandy clays, sandy silts, silty clays, silts and clays with occasional gravels and cobbles. The deepest alluvium was located on the east side of the project site along Bonita Drive. Sampling blow-counts correlate from loose and medium stiff to dense and very stiff. Dark brown, fine-grained silts and clays were encountered above the alluvium / bedrock contact. These natural soil materials are potentially expansive and not recommended for use as fill directly below footings and slabs. The soils also include occasional fragments of weathered bedrock. We expect that some cobbles and rocks are larger in size than the largest observed, (approximately four (4) inches in the maximum dimension) and were broken down in the hollow stem auger soil cuttings. Based on our previous experience and knowledge of the area, and materials encountered during subsurface exploration, cobbles greater than eight (8) inches and occasional boulders may be buried in the alluvial sediments below the site.

Sandstone, Pebble Conglomerate, Siltstone and Claystone Bedrock (Tmy and Tscs)

The project site on Parking Lot S is partially underlain by shallow sedimentary bedrock of Puente Formation (Tmy and Tscs) consisting of interbedded sandstone, pebble conglomerate, siltstone, and claystone layers. A hillside bedrock ridge descends northward beneath the southern side of the project site. The bedrock layers range from generally thinly bedded to thick and massive, and display varying degrees of cementation and hardness. The bedrock is weathered near the alluvium/bedrock contact and becomes less weathered and medium hard to hard with depth.

Sandstone and Pebble Conglomerate Bedrock (Tscs)

Hard sandstone and conglomerate bedrock layers consisting of gravel and cobble-sized rocks in a cemented sandstone matrix (Tscs) were encountered at shallow depths along the south side of the project site. The sandstone and conglomerate layers can be thick and massive and may contain boulder sized hard rock materials. Boring Nos. BH-4, BH-5, BH-6, BH-7 and BH-8 encountered refusal to sampler penetration and refusal to drilling penetration in the hard and cemented sedimentary bedrock layers along the southern side of the proposed parking structure. Cone Penetration Tests (CPT-3, CPT-5, CPT-6, CPT-7, CPT-8, CPT-9 and CPT-10 encountered very dense/stiff soil and sedimentary bedrock conditions and were stopped short of their planned depths. The sandstone and conglomerate bedrock materials were observed to be hard and will be more difficult to excavate during grading and construction.

Drawing No.4, *Geologic Cross Section A-A'*, Drawing No.5, *Geologic Cross Section B-B'*, Drawing No.6, *Geologic Cross Section C-C'* and Drawing No.7, *Geologic Cross Section D-D'*, have been drawn across the subject site to illustrate the subsurface conditions beneath the project site. For additional information on the subsurface conditions, see the Logs of Boring Data in Appendix A, *Field Exploration*.

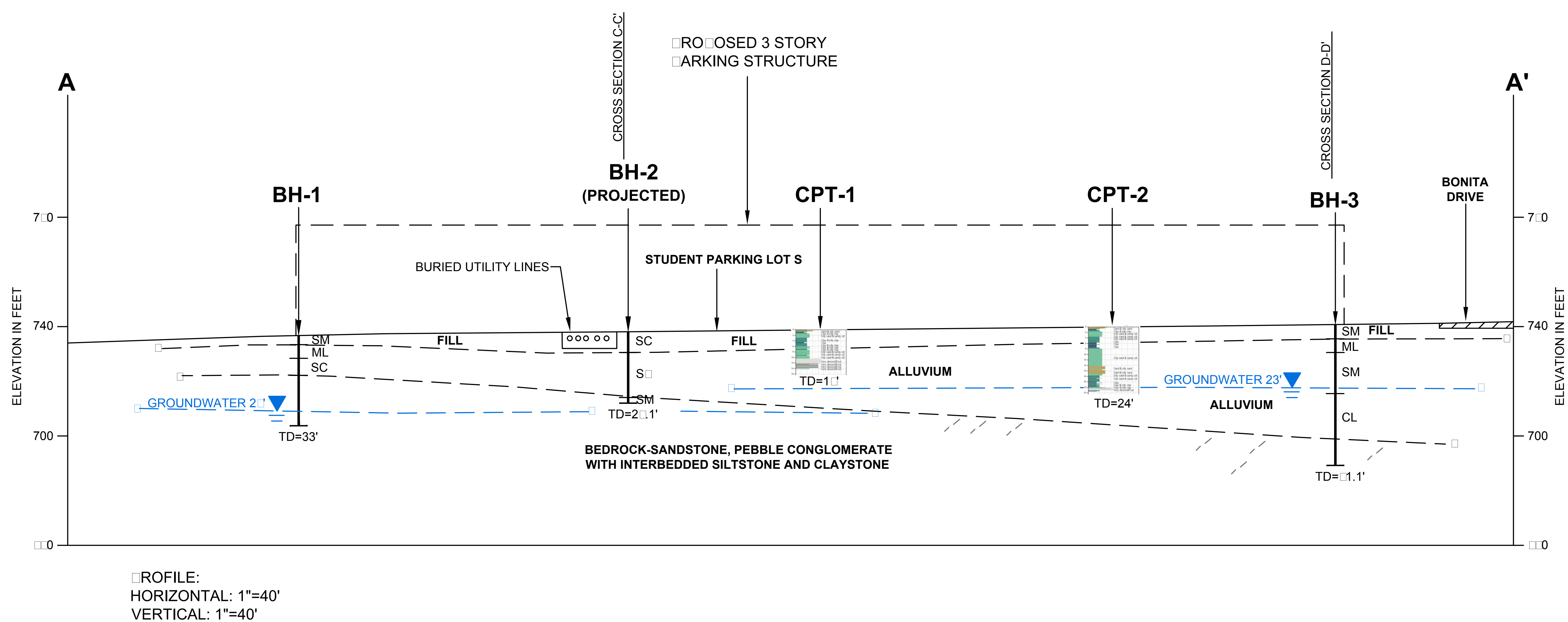
4.3 Groundwater

Local zones of groundwater seepage and groundwater were encountered during subsurface exploration in the alluvium and bedrock at depths ranging from approximately 23 feet below ground surface in boring BH-3 to approximately 36.8 feet in boring BH-7. The regional groundwater table is not expected to be encountered during the planned grading and construction. However, the possibility of groundwater being encountered during future grading and deeper excavations cannot be completely precluded.

Wet weather periods may produce groundwater seepage in the bedrock fractures and along less permeable layers from upslope infiltration of rainfall, surface flow, runoff and storm water recharge and should be anticipated during grading and construction. Local zones of perched groundwater may be present within the near-surface deposits due to buried alluvial channel features, channel remnants, alluvium/bedrock contacts, local recharge conditions or during the rainy season. In general, groundwater levels fluctuate with the seasons. Groundwater conditions below any given site vary depending on numerous factors including seasonal rainfall, local irrigation, storm water recharge and groundwater pumping, among other factors.

4.4 Subsurface Variations

Based on results of the subsurface exploration and our experience with the subject area, some variations in the continuity and nature of subsurface conditions within the project site are anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material at the site, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations. If, during construction, subsurface conditions different from those presented in this report are encountered, this office should be notified immediately so that recommendations can be modified, if necessary.



GEOLOGIC CROSS SECTION A-A′

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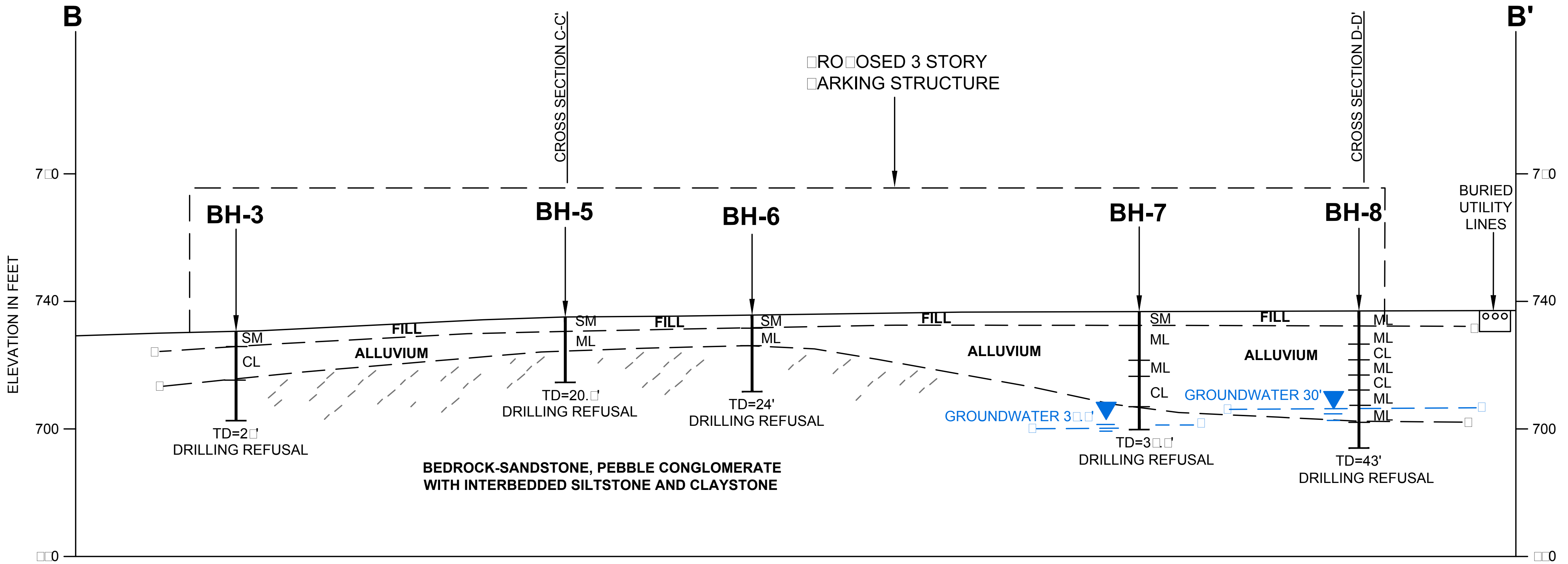
Project No.	Drawing No.
17-31-247-01	4



□ROFILE:
HORIZONTAL: 1"=40'
VERTICAL: 1"=40'

GEOLOGIC CROSS SECTION B-B′

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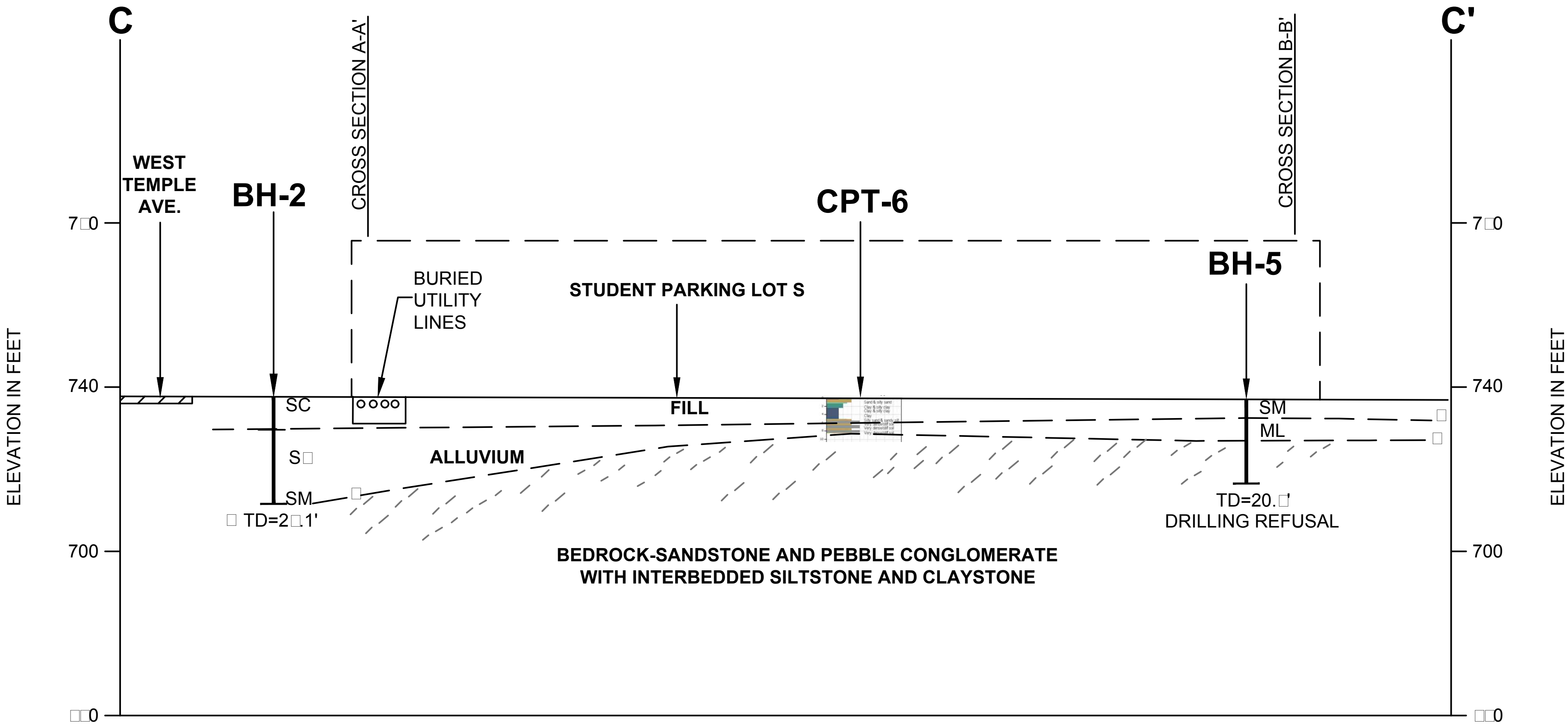
WALNUT, CALIFORNIA

Project No.	Drawing No.
17-31-247-01	5



ROFILE:
HORIZONTAL: 1"=40'
VERTICAL: 1"=40'

GEOLOGIC CROSS SECTION C-C'

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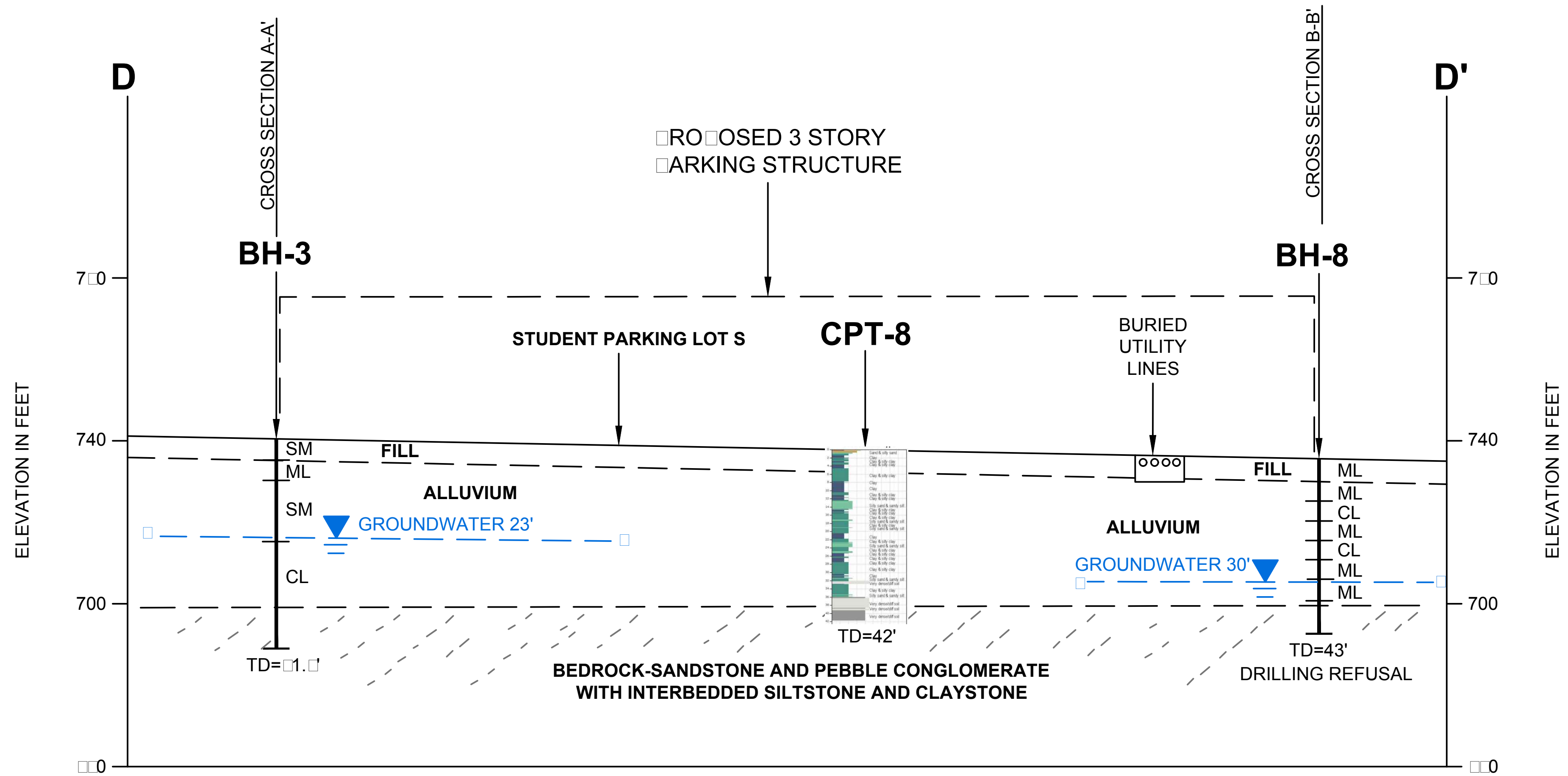
Project No.	Drawing No.
17-31-247-01	6



PROFILE:
HORIZONTAL: 1"=40'
VERTICAL: 1"=40'

GEOLOGIC CROSS SECTION D-D'

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LOT S STRUCTURE
WALNUT, CALIFORNIA

Project No.	Drawing No.
17-31-247-01	7

5.0 FAULTING AND SEISMIC HAZARDS

Geologic hazards are defined as geologically related conditions that may present a potential danger to life and property. Typical geologic hazards in Southern California include earthquake ground shaking, fault surface rupture, liquefaction and seismically induced settlement, lateral spreading, landslides, earthquake induced flooding, tsunamis and seiches, and volcanic eruption hazard.

Results of a site-specific evaluation for each type of possible seismic hazards are discussed in the following sections.

5.1 Seismic Characteristics of Nearby Faults

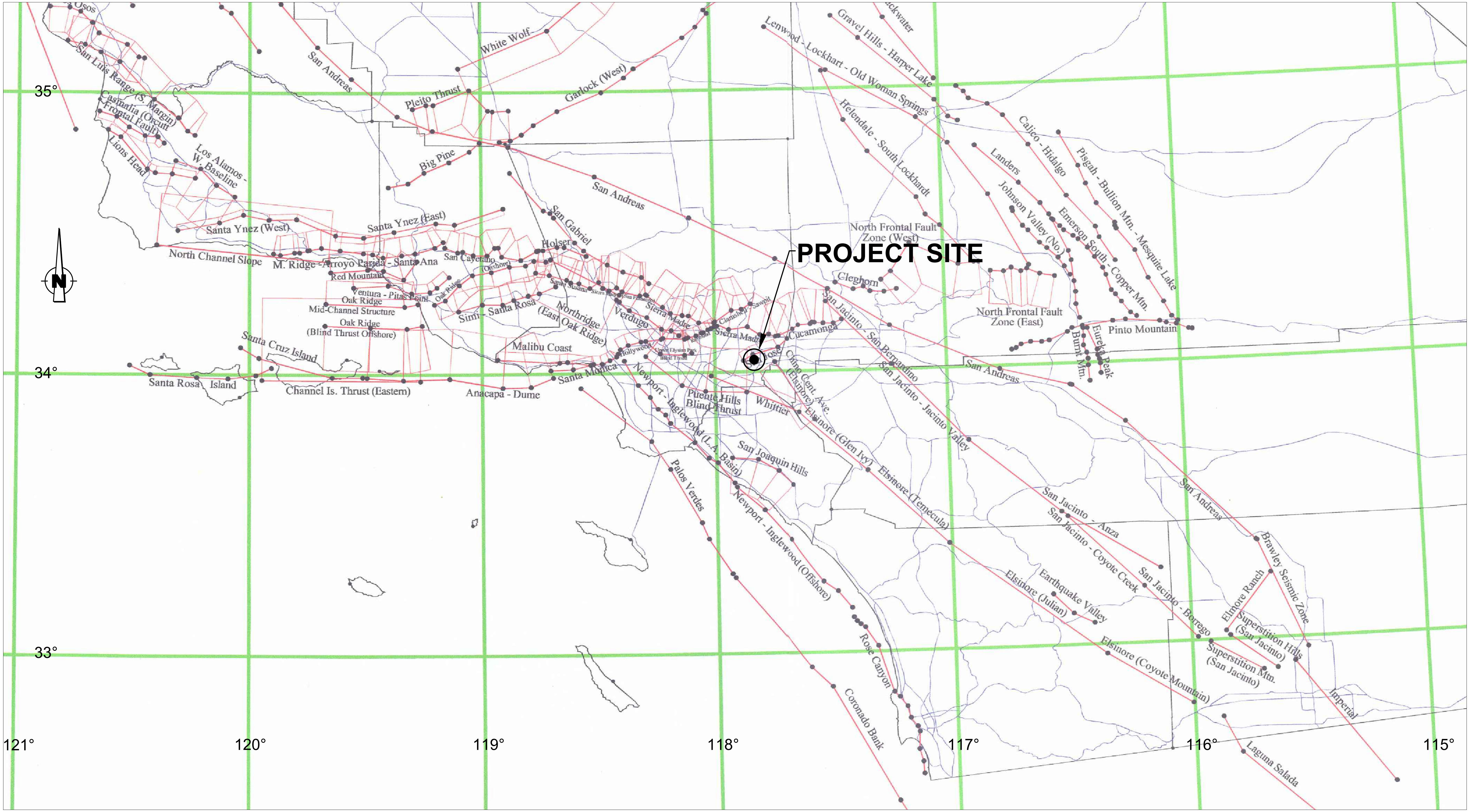
No surface faults are known to project through or towards the site. The closest known faults to the project site with mappable surface expressions are the San Jose Fault (0.8 kilometers to the north) and Chino-Central Avenue (Elsinore) Fault (6.9 kilometers to the east/ southeast). The concealed Puente Hills Blind Thrust Fault (Coyote Hills segment) along with other regional faults were included as active fault sources for the probabilistic seismic hazard analysis for the site. The approximate locations of these local active faults with respect to the project site are tabulated on Table No. 1, *Summary of Regional Faults,* and are shown on Drawing No. 3, *Regional Geological Map* and Drawing No. 8, *Southern California Regional Fault Map*.

The Pomona Valley Basin is bounded to the north by the San Jose Fault and to the southwest by the Chino-Central Avenue faults. These two fault systems do not exhibit evidence of surface movement within Holocene time and are not considered active based on current geologic information. The San Jose and Chino-Central Avenue faults are considered Late Quaternary, having exhibited displacement and movement within the past 738,000 years.

<u>San Jose Fault</u>

The San Jose Fault lies along the southern flank of the northeast trending San Jose Hills. The fault trends northeast and dips to the north. The mapped trace of the San Jose Fault is located approximately 0.8 kilometer north of the project site.

Geotechnical investigations performed on the campus of California State Polytechnic University at Pomona (Geocon, 2001) indicated that the San Jose is an active reverse separation fault. Because of the lack of success in previous fault trench excavations, Geocon based its conclusions on a series of closely spaced boreholes along several traverses across a subtle topographic bench on the campus. They discovered two shallowly to moderately north-dipping thrust faults with the most recent displacement being about 1 meter and occurred since 3500 yrs. B.P. on the basis of radiocarbon dating



REFERENCE: PORTION OF CGS 2002 CALIFORNIA FAULT MODEL
MODIFIED FOR USE WITH FRISKSP AND EQFAULT
BY THOMAS F. BLAKE, AUGUST 2004

FAULT SOURCES

BLIND THRUST FAULT, POLYGONS INDICATE RUPTURE PLANES AND DIP DIRECTION

SOUTHERN CALIFORNIA REGIONAL FAULT MAP

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Project No. 17-31-247-01

Drawing No. 8

of faulted alluvium. These findings would show this segment of the fault is active, but is a reverse separation fault south of the San Jose Hills (Yeats, 2004).

Chino-Central Avenue Faults

The Chino and Central Avenue faults trend northwest along the southwest portion of the Chino Basin. The fault ties along the northeast edge of the Puente Hills. The Chino and Central Avenue faults are considered part of the Elsinore fault which is one of the major right lateral strike slip faults of the Peninsular Ranges geomorphic province. The Elsinore fault splits near Prado Dam into the Chino-Central Avenue and Whittier faults. The Chino-Central Avenue faults are two separate fault strands that strike northwest. The Chino fault dips southwest and is at least 18 km in length. The Central Avenue fault is about 8 km in length and concealed by younger alluvial deposits. The Chino and Central Avenue faults converge southward into the much larger Elsinore fault system.

The July 29, 2008 Chino Hills earthquake was a magnitude 5.5 earthquake event that caused moderate ground shaking and some minor damage to the Mt. San Antonio College campus buildings. The earthquake epicenter was located approximately 15 miles southeast of the campus beneath the Chino Hills and at a depth of approximately 9.1 miles (14.6 km) below ground surface.

As is the case for most areas of Southern California, ground-shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site.

Table No. 1, *Summary of Regional Faults,* summarizes selected data of known faults capable of seismic activity within 50 kilometers of the site. The data presented below was calculated using EQFAULT Version 3.0 with updated fault data from “The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al., 2003)”, Appendix A, and other published geologic data.

Table No. 1, Summary of Regional Faults

Fault Name and Section	Approximate * Distance to Site (kilometers)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
San Jose*	0.8	6.4	0.50
Chino-Central Ave. (Elsinore)	6.9	6.7	1.00
Elysian Park Blind Thrust*	8.2	6.7	1.50
Puente Hills Blind Thrust**	8.3	7.3	0.70
Sierra Madre*	9.6	7.2	2.00
Whittier	12.6	6.8	2.50
Cucamonga*	13.8	6.9	5.00
Clamshell-Sawpit	19.5	6.5	0.50

Fault Name and Section	Approximate * Distance to Site (kilometers)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
Raymond	19.6	6.5	1.50
Verdugo*	28.6	6.9	0.50
Elsinore-Glen Ivy	29.1	6.8	5.00
Compton Thrust	29.9	6.8	1.50
Hollywood	36.2	6.4	1.00
San Jacinto – San Bernardino	38.0	6.7	12.00
San Andreas – 1857 Rupture*	39.1	7.4	30.00
San Andreas – Mojave*	39.1	7.4	30.00
Newport-Inglewood (L.A. Basin)*	39.6	7.1	1.00
San Andreas – San Bernardino*	41.0	7.5	24.00
San Andreas – Southern*	41.0	7.2	25.00
Cleghorn*	45.7	6.7	2.00
Sierra Madre (San Fernando)*	48.4	6.7	2.00

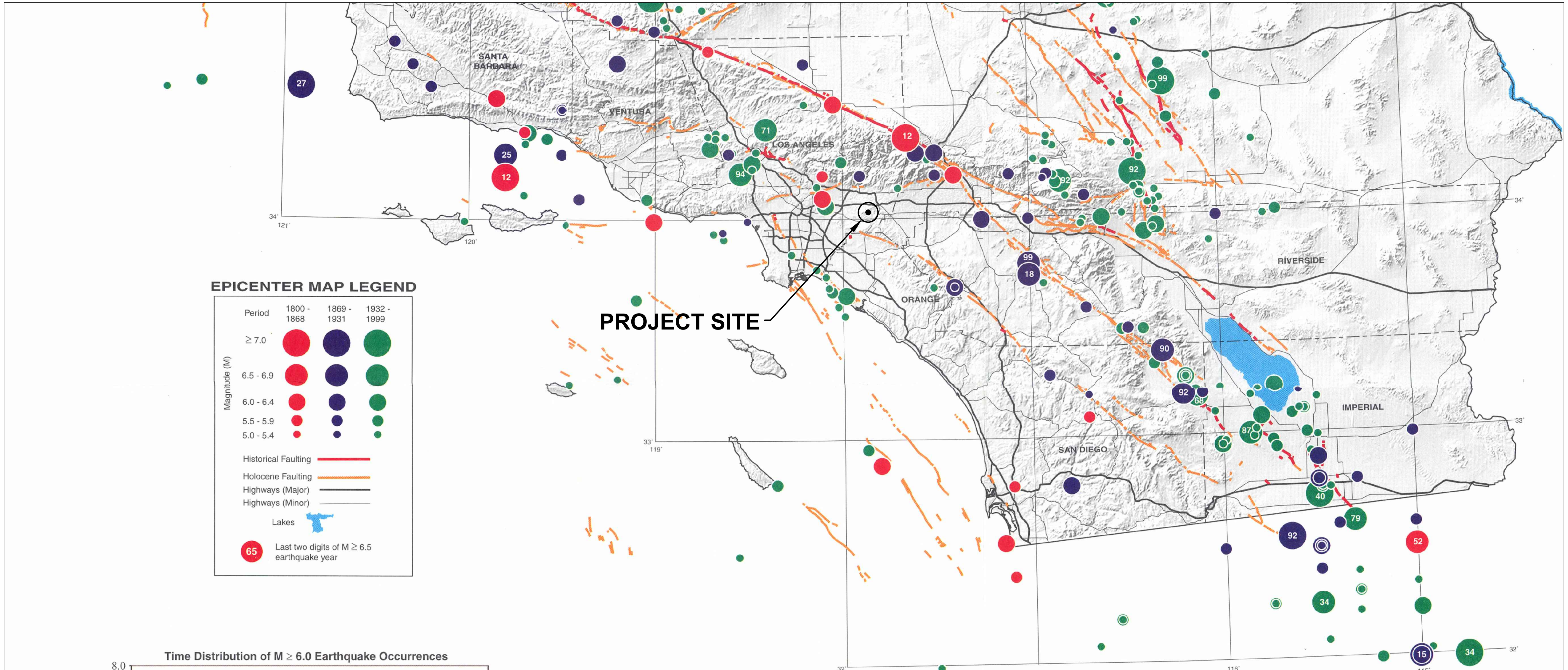
*****Review of published geologic data and mapping including Appendix A of the 2002 California Fault Parameters Report (Cao et al., 2003). Distance from the site to nearest subsurface projection, per Shaw et al., 2002.

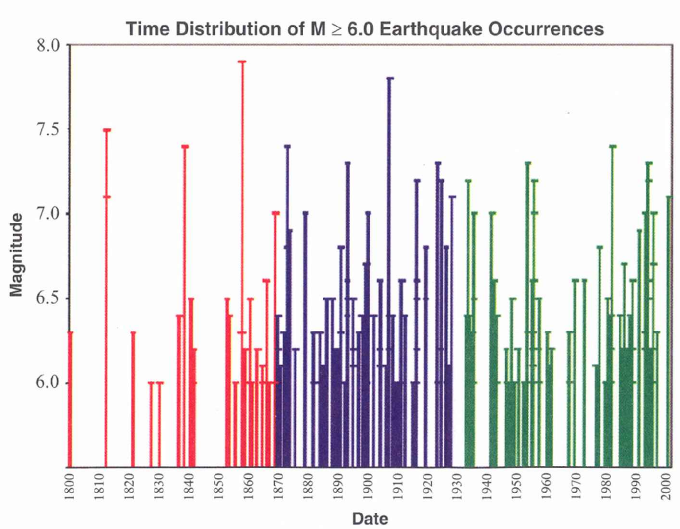
5.2 Seismic History

An analysis of the seismic history of the site was conducted using the computer program EQSEARCH, (Blake, 2000), and attenuation relationships proposed by Boore et al. (1997) for alluvium soil conditions. The Southern California Earthquake Catalog with the Southern California Earthquake Center was also utilized (SCEC, 2011).

Based on the analysis of seismic history, the number of earthquakes with a moment magnitude of 5.0 or greater occurring within a distance of 100 kilometers was 169, since the year 1800. Based on the analysis, the largest earthquake-induced ground acceleration affecting the site since the year 1800 is a 7.0 magnitude earthquake in 1858 with a calculated ground acceleration of 0.24g at the site.

Review of recent seismological and geophysical publications indicates that the seismic hazard for the Pomona Basin is high. The Pomona Basin is bounded by active regional faults on all sides and underlain by alluvial sediments and buried thrust faults. The seismic hazard for the Pomona Basin was illustrated by the 1971 San Fernando, 1987 Whittier Narrows, 1991 Sierra Madre and 1994 Northridge earthquakes. The epicenters for these earthquakes are shown on Drawing No. 9, *Epicenters Map of Southern California Earthquakes (1800-1999).*





Main Sources of Information

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Toppozada, T.R. and Branum, D.M. (in press). California M ≥ 5.5 earthquakes, history and areas damaged, *in* Lee, W.H., Kanamori, H. and Jennings, P., International Handbook of Earthquake and Engineering Seismology, International Association of Seismology and Physics of the Earth's Interior.

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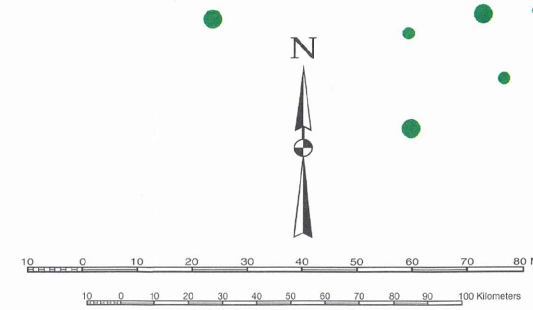
UC Berkeley/USGS earthquake catalog, http://quake.geo.berkeley.edu/ncedc/catalog-search.html. Northern California earthquake catalog and phase data, Northern California Seismic Network, U.S. Geological Survey, Menlo Park; Berkeley Seismological Laboratory, University of California, Berkeley, California.



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MINES AND GEOLOGY
CALIFORNIA CONSERVATION

REFERENCE: □ORTION OF E□ICENTERS AND AREAS DAMAGED BY M□□ CALIFORNIA EARTHQUAKES, 1□00-1999 CALIFORNIA DE□ARTMENT OF CONSERVATION, MA□ SHEET 49 DATED 2000.

EPICENTER MAP OF SOUTHERN CALIFORNIA EARTHQUAKES (1800-1999)

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Project No.	Drawing No.
17-31-247-01	9

5.3 Surface Fault Rupture

The project site is not located within a currently designated State of California Earthquake Fault Zone (formerly Alquist-Priolo Special Studies Zones) for surface fault rupture. The Alquist-Priolo Earthquake Fault Zoning Act requires the California Geological Survey to zone “active faults” within the State of California. An “active fault” has exhibited surface displacement with Holocene time (within the last 11,000 years) hence constituting a potential hazard to structures that may be located across it. Public school structures are required to be set-back at least 50 feet from an active fault. The active fault set-back distance is measured perpendicular from the dip of the fault plane. Based on a review of existing geologic information, no known active faults project through or toward the site. The potential for surface rupture resulting from the movement of the nearby major faults is considered remote.

5.4 Liquefaction and Seismically-Induced Settlement

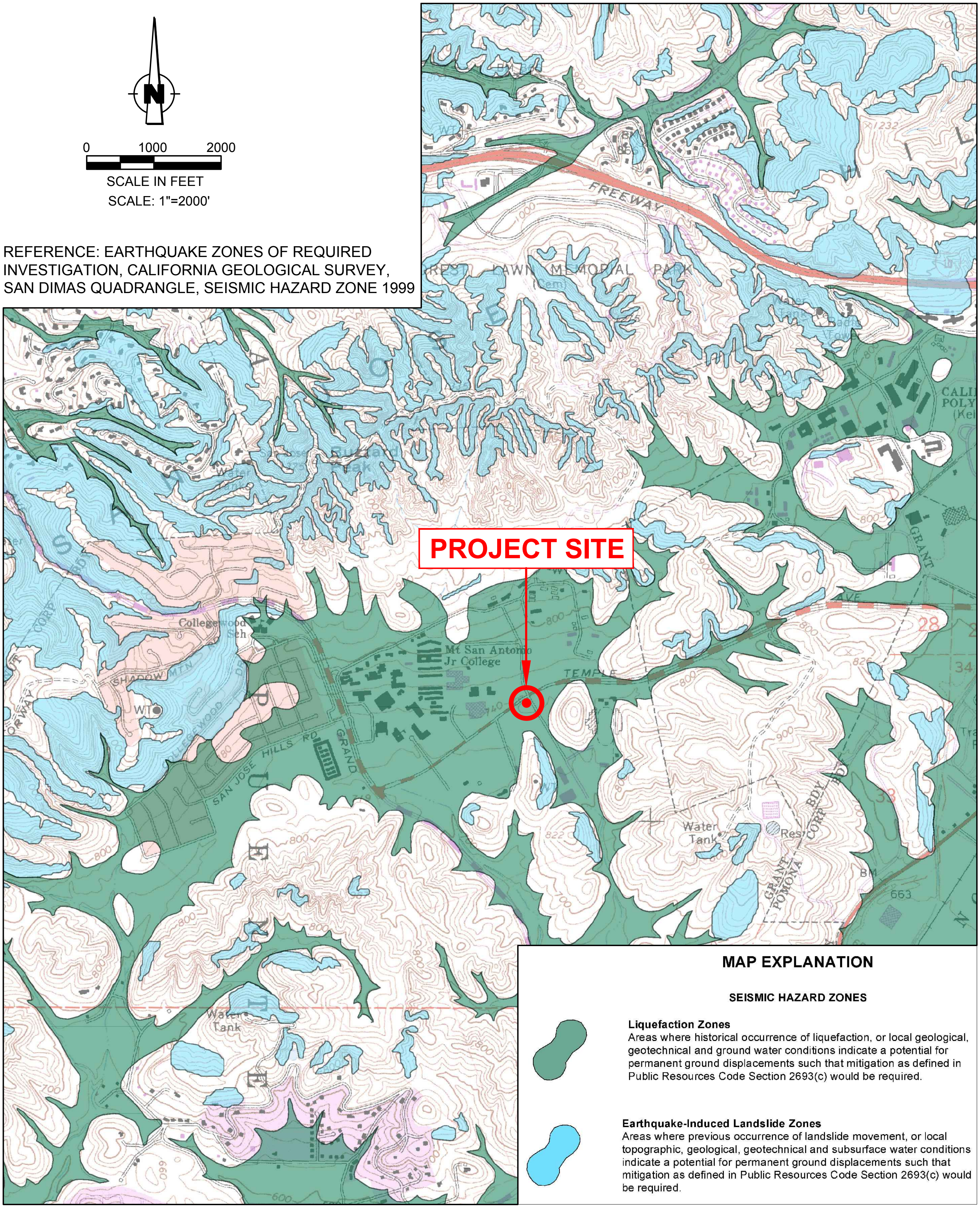
Liquefaction is the sudden decrease in the strength of cohesionless soils due to dynamic or cyclic shaking. Saturated soils behave temporarily as a viscous fluid (liquefaction) and, consequently, lose their capacity to support the structures founded on them. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase. Liquefaction potential has been found to be the greatest where the groundwater level and loose sands occur within 50 feet of the ground surface.

The site is located within a potential liquefaction zone per the State of California Seismic Hazard Zones Map for the San Dimas Quadrangle as shown in Drawing No. 10, *Seismic Hazard Zones Map*. Liquefaction analyses were performed using *LiquefyPro,* Version 5.8d, 2009, by Civil Tech Software for the upper 50 feet below ground surface utilizing Boring BH-3 and CPT No. 8. The results of the liquefaction analysis and a summary of the methods used are presented in Appendix C, *Liquefaction/Seismic Settlement Analysis*.

The results of liquefaction analyses indicate the project site is susceptible to liquefaction. The estimated potential liquefaction induced settlement ranges from 0.91 to 2.88 inches with potential differential settlement ranging from 0.46 to 1.44 inches. The project structural engineer should consider the effects of seismically-induced settlement in the foundation design.

5.5 Lateral Spreading

Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the



REFERENCE: EARTHQUAKE ZONES OF REQUIRED INVESTIGATION, CALIFORNIA GEOLOGICAL SURVEY, SAN DIMAS QUADRANGLE, SEISMIC HAZARD ZONE 1999

MAP EXPLANATION

SEISMIC HAZARD ZONES

Liquefaction Zones
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

Earthquake-Induced Landslide Zones
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

SEISMIC HAZARD ZONES MAP

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WALNUT, CALIFORNIA

Project No.	Drawing No.
17-31-247-01	10

I:\ACADDRAWINGS\17\31\247\LOT-S\17-31-247-01-LOTS-SEISMICHAZARD.DWG project site and in the immediate vicinity of the site is gently sloping to the southwest, with no significant nearby slopes or embankments. Under these circumstances, the potential for lateral spreading at the subject site is considered negligible.

5.6 Seismically-Induced Slope Instability

Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes. The project site is also not shown with any earthquake-induced landslide areas due to the gently, southwest sloping ground condition of the site topography. In the absence of significant ground slopes, the potential for seismically induced landslides to affect the proposed site is considered to be very low.

5.7 Earthquake-Induced Flooding

Review of the Flood Insurance Rate Map (FIRM), Map Number 0637C1725F, Panel 1725 of 2350, dated September 26, 2008, from the FEMA Map Service Center Viewer, indicates that the site is in an area designated as Zone D, “Areas in which flood hazards are undetermined, but possible.” Due to the absence of groundwater at shallow depths, distance of the subject site from large bodies of water and regional flood control structures, the potential for flooding at the subject site is considered remote. The potential of earthquake induced flooding of the subject site is considered to be remote.

5.8 Tsunami and Seiches

Tsunamis are seismic sea waves generated by fault displacement or major ground movement. Based on the location of the site from the ocean (over 20 kilometers), tsunamis do not pose a hazard. Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on site location away from lakes and reservoirs, seiches do not pose a hazard.

5.9 Volcanic Eruption Hazard

There are no known volcanoes near the site. According to Jennings (1994), the nearest potential hazards from future volcanic eruptions is the Amboy Crater-Lavic Lake area located in the Mojave Desert more than 120 miles east/northeast of the site. Volcanic eruption hazards are not present.

6.0 SEISMIC ANALYSIS

6.1 CBC Seismic Design Parameters

Seismic parameters based on the 2016 California Building Code are calculated using the United States Geological Survey *U.S. Seismic Design Maps* website application and the site coordinates (34.04599 degrees North Latitude, 117.84056 degrees West Longitude). The seismic parameters are presented below.

Table No. 2, CBC Seismic Design Parameters

Seismic Parameters	2016 CBC
Site Class	D
Mapped Short period (0.2-sec) Spectral Response Acceleration, S_S	2.185 g
Mapped 1-second Spectral Response Acceleration, S_1	0.780 g
Site Coefficient (from Table 1613.5.3(1)), F_a	1.0
Site Coefficient (from Table 1613.5.3(2)), F_v	1.3
MCE 0.2-sec period Spectral Response Acceleration, S_{MS}	2.185 g
MCE 1-second period Spectral Response Acceleration, S_{M1}	1.014 g
Design Spectral Response Acceleration for short period, S_{DS}	1.457 g
Design Spectral Response Acceleration for 1-second period, S_{D1}	0.676 g
Seismic Design Category	D

6.2 Site-Specific Response Spectra

A site-specific response spectrum was developed for the project for a Maximum Considered Earthquake (MCE), defined as a horizontal peak ground acceleration that has a 2 percent probability of being exceeded in 50 years (return period of approximately 2,475 years). The controlling source was determined to be the USGS 2008 California Gridded Source, with an MCE of Mw 7.0 and a deterministic peak ground acceleration (PGA) of 1.01g.

In accordance with ASCE 7-10, Section 21.2 the site-specific response spectra can be taken as the lesser of the probabilistic maximum rotated component of MCE ground motion and the 84th percentile of deterministic maximum rotated component of MCE ground motion response spectra. The design response spectra can be taken as 2/3 of site-specific MCE response spectra, but should not be lower than 80 percent of CBC general response spectra. The risk coefficient C_R has been incorporated at each spectral response period for which the acceleration was computed in accordance with ASCE 7-10, Section 21.2.1.1.

The 2016 CBC mapped acceleration parameters are provided in the following table. These parameters were determined using the United States Geological Survey *U.S.*

Seismic Design Maps website application, and in accordance with ASCE 7-10 Sections 11.4, 11.6, 11.8 and 21.2.

Table No. 3, 2016 CBC Mapped Acceleration Parameters

Site Class	C	Seismic Design Category	IV
S_s	2.185	C_{RS}	1.012
S_1	0.780	C_{R1}	1.023
F_a	1	$0.08\ F_v/F_a$	0.104
F_v	1.3	$0.4\ F_v/F_a$	0.520
S_{MS}	2.185	T_0	0.093
S_{M1}	1.014	T_S	0.464
S_{DS}	1.457	T_L	8
S_{D1}	0.676		

A Site-Specific response analysis, using faults within 200 kilometers of the sites, was developed using the computer program EZ-FRISK by Risk Engineering (v. 7.62) and the 2008 USGS Fault Model database. Attenuation relationships proposed by Boore and Atkinson (2008), Campbell and Bozorgnia (2008), Chiou and Youngs (2008) were used in the analysis. These attenuation relationships are based on Next Generation Attenuation (NGA) project model. Maximum rotated components were determined using Huang (2008) method. An average shear wave velocity at upper 30 meters of soil profile (V_{s30}) of 390 meters per second, depth to bedrock of with a shear wave velocity 1,000 meters per second at 150 meters below grade, and depth of bedrock where the shear wave velocity is 2,500 meters per second at 3,000 meters below grade were selected for EZ-Frisk Analysis.

The probabilistic response spectrum results and peak ground acceleration for each attenuation relationship are presented in the following table.

Table No. 4, Probabilistic Response Spectrum Data

Attenuation Relationship	Probabilistic Mean	Boore-Atkinson (2008)	Campbell-Bozorgnia (2008)	Chiou-Youngs (2007)
Peak Ground Acceleration (g)	0.966	0.909	0.910	1.056
Spectral Period (sec)	**2% in 50yr Probabilistic Spectral Acceleration (g)**			
0.03	1.040	0.987	0.979	1.138
0.05	1.187	1.095	1.130	1.318
0.10	1.712	1.570	1.637	1.908
0.20	2.144	1.998	2.077	2.337
0.30	2.036	1.936	1.918	2.210

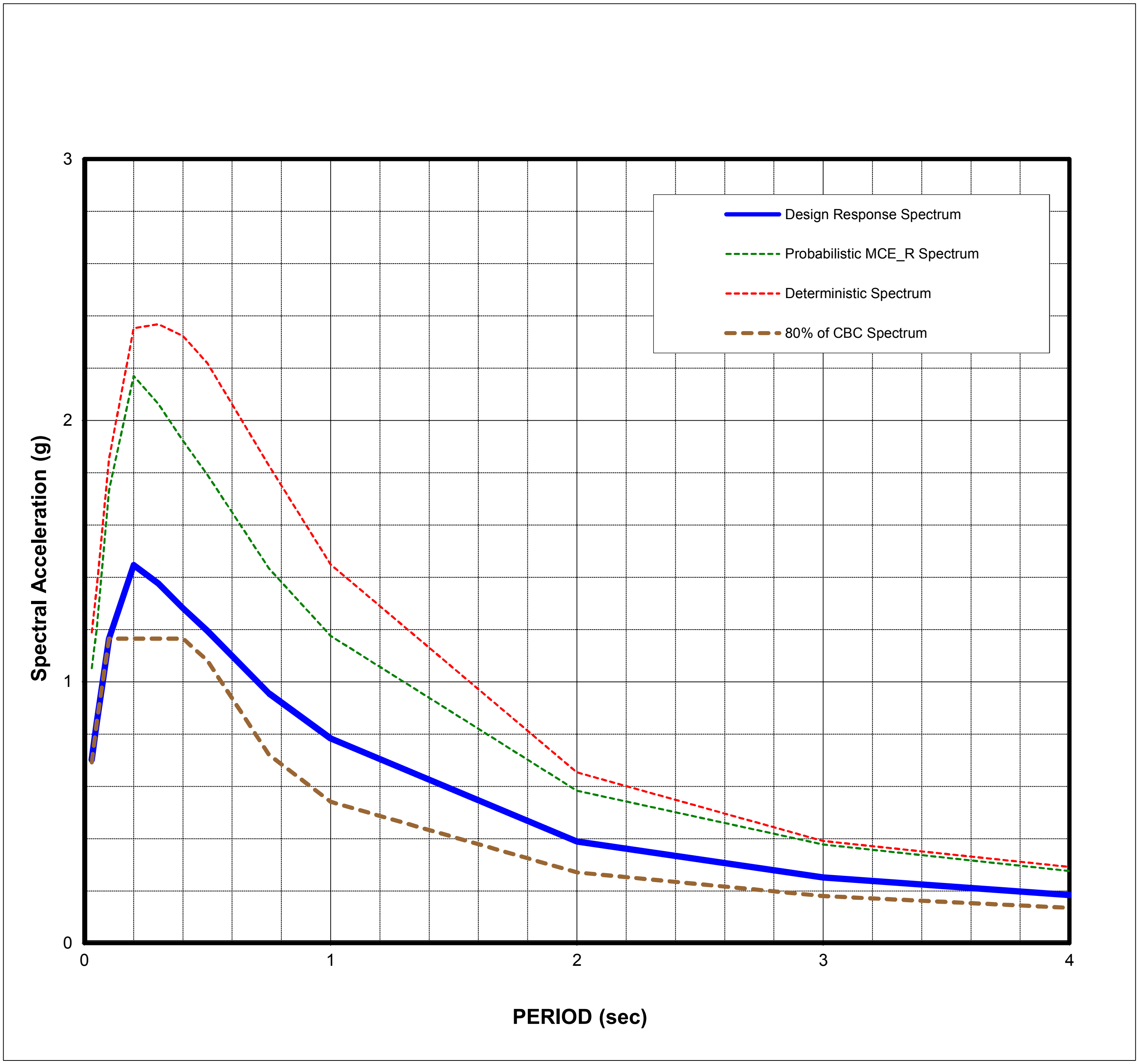
Spectral Period (sec)	2% in 50yr Probabilistic Spectral Acceleration (g)			
0.40	1.894	1.854	1.785	2.027
0.50	1.764	1.737	1.702	1.851
0.75	1.406	1.418	1.357	1.442
1.00	1.149	1.136	1.119	1.193
2.00	0.570	0.601	0.569	0.535
3.00	0.369	0.398	0.371	0.330
4.00	0.270	0.286	0.283	0.234

Applicable response spectra data are presented in the table below and on Drawing No. 11, *Site-Specific Design Response Spectrum.* These curves correspond to response values obtained from above attenuation relations for horizontal elastic single-degree-of-freedom systems with equivalent viscous damping of 5 percent of critical damping.

Table No. 5, Site Specific Response Spectrum Data

Period (sec)	2% in 50yr Probabilistic Spectral Acceleration (g)	Risk Coefficient C_R	Probabilistic MCE_R Spectral Acceleration (g)	84th Percentile Deterministic MCE Response Spectra, (g)	Deterministic CBC Lower Level, (g)	Site Specific MCE_R Spectral Acceleration (g)	80% CBC Design Response Spectrum	Site Specific Design Spectral Acceleration (g)
0.03	1.040	1.012	1.052	1.189	0.260	1.052	0.692	**0.70**
0.05	1.187	1.012	1.201	1.358	0.433	1.201	0.843	**0.84**
0.10	1.712	1.012	1.733	1.854	0.865	1.733	1.165	**1.17**
0.20	2.144	1.012	2.170	2.353	1.500	2.170	1.165	**1.45**
0.30	2.036	1.013	2.063	2.368	1.500	2.063	1.165	**1.38**
0.40	1.894	1.015	1.922	2.323	1.500	1.922	1.165	**1.28**
0.50	1.764	1.016	1.792	2.219	1.500	1.792	1.082	**1.19**
0.75	1.406	1.020	1.434	1.827	1.040	1.434	0.721	**0.96**
1.00	1.149	1.023	1.175	1.449	0.780	1.175	0.541	**0.78**
2.00	0.570	1.023	0.583	0.653	0.390	0.583	0.270	**0.39**
3.00	0.369	1.023	0.377	0.391	0.260	0.377	0.180	**0.25**
4.00	0.270	1.023	0.276	0.292	0.195	0.276	0.135	**0.18**

The site-specific design response parameters are provided in the following table. These parameters were determined from Design Response Spectra presented in table above, and following guidelines of ASCE Section 21.4.



Note: Calculated using EZFRISK program Risk Engineering, version 7.62
and USGS 2008 fault model database.

SITE-SPECIFIC DESIGN RESPONSE SPECTRUM

Mt. SAC Transit Center Parking Lot S

1100 N. Grand Avenue, Walnut, CA 91789

For : Mt. San Antonio College

Project Number:

17-31-247-01

Converse Consultants

Drawing No.

11

Table No. 6, Site-Specific Seismic Design Parameters

Parameter	Value (5% Damping)	Lower Limit, 80% of CBC Design Spectra
Site-Specific 0.2-Second Period Spectral Response Acceleration, S_{MS}	2.170	1.748
Site-Specific 1-Second Period Spectral Response Acceleration, S_{M1}	1.175	0.811
Site-Specific Design Spectral Response Acceleration for Short Period, S_{DS}	1.446	1.165
Site-Specific Design Spectral Response Acceleration for 1-Second Period, S_{D1}	0.784	0.541

7.0 GEOTECHNICAL EVALUATIONS AND CONCLUSIONS

Based on the results of our background review, subsurface exploration, laboratory testing, geotechnical analyses, and understanding of the planned site re-development, it is our opinion that the proposed project is feasible from a geotechnical standpoint, provided the following conclusions and recommendations are incorporated into the project plans, specifications, and are followed during site construction.

The following is a summary of the major geologic and geotechnical factors to be considered for the planned project:

- There are no known active faults projecting toward or extending across the proposed site. The project site is not located within a currently designated State of California Earthquake Fault Zone (formerly Alquist-Priolo Special Studies Zones) for surface fault rupture.

- The site is located within a mapped Seismic Hazard Zone for liquefaction. Liquefaction analyses were performed for the upper 50 feet below ground surface utilizing BH-3 and CPT-8. Based on the results of liquefaction analyses indicate the project site is susceptible to liquefaction. The estimated potential liquefaction induced settlement is on the order of 2.88 inches with potential differential settlement of 1.44 inches.

- Local zones of groundwater seepage and groundwater were encountered during subsurface exploration at depths ranging from approximately 23 feet bgs in boring BH-3 to approximately 36.8 feet bgs in BH-7. Groundwater and groundwater seepage should be anticipated during deep excavations.

- Shallow spread and continuous footings are considered suitable for structure support provided the recommendations in this report are incorporated into the project plans, specifications, and are followed during site construction.

- Variable thickness undocumented fill soils were encountered in the borings. The undocumented fill is not considered suitable for any slab or foundation support.

- Based on the proposed plan, cut-and-fill grading operations are required to achieve the planned finished grades.

- Over-excavation and re-compaction of the undocumented fill soils and upper alluvium is recommended for site grading to provide a compacted fill blanket beneath the building foundations and floor slab. The over-excavation and re-compaction is recommended to extend from approximately 7-feet to 10-feet below ground surface and 10-feet beyond the edge of the parking structure foundations. A geofabric reinforcement layer is recommended at the bottom of the deeper 10-foot over-excavation to reduce differential settlements between the underlying alluvium and shallow sedimentary bedrock areas.

- Different earth materials should be anticipated at the bottom of excavations. In order to provide a relative uniform bearing material below shallow foundations, over-excavation and re-compaction of existing alluvium and bedrock below the bottom of foundations and slab-on-grades are recommended. We recommend the spread foundations and slab-on-grades be supported on a minimum 5-foot thick layer of compacted fill that is be benched into native earth materials.

- The undocumented fills and natural granular soils consisting of silty sands should be segregated, stockpiled and saved during excavation for later reuse beneath the footings and floor slab to prevent mixing with the underlying fine-grained, potentially expansive, silts and clays.

- On-site clayey soils with an expansion index exceeding 20 should not be re-used for compaction within 2 feet below the proposed foundations or for retaining wall backfill. Soils containing organic materials should not be used as structural fill. The extent of removal should be determined by the geotechnical representative based on soil observation during grading.

- Site soils have “negligible” concentrations of water soluble sulfates.

- In general, the pH value, chloride content, and saturated resistivity of the site soils are in the non-corrosive range. However, the saturated resistivity of samples taken at BH-4 indicates a “Corrosive” potential to ferrous metals.

- The earth materials at the site should be excavatable with conventional heavy-duty earth moving and trenching equipment. The on-site materials contain about 5 to 10 percent gravel up to 3 inches in maximum dimension. Larger gravels, cobbles and possible boulders may exist at the site. Localized areas of harder, cemented and resistant bedrock units and layers may be encountered in the excavation and should be anticipated. Earthwork should be performed with suitable equipment for gravelly materials and for hard, cemented, bedrock materials.

- The planned structure might have different structure heights and foundation elevations. Differential vertical and lateral deflections between structures should be anticipated. We recommend cold joints on slabs and walls at the transition between structures or where needed determined by the structural engineer should be constructed.

8.0 EARTHWORK AND SITE GRADING RECOMMENDATIONS

8.1 General Evaluation

Based on our field exploration, laboratory testing, and analyses of subsurface conditions at the site, remedial grading is required to prepare the site for support of the proposed parking structure. The subject site has slight slope to the southwest. It is anticipated that the site preparation will include over-excavation and re-compaction of the upper earth materials. To reduce potential differential settlements, variations in the soil types, degree of compaction, and thickness of the compacted fill, the thickness of compacted fill placed underneath the footings should be kept uniform. A geofabric reinforcement layer is recommended at the bottom of the deeper 10-foot depths of over-excavation to reduce differential between the underlying alluvium and shallow sedimentary bedrock areas.

Site grading recommendations provided below are based on our experience with similar projects in the area and our evaluation of this investigation.

Site preparation will require removal of existing pavements, structures, footings, slabs, sidewalks, curbs, trees and other improvements with their foundations and existing underground structures, vaults and utility lines. Buried electrical and communication main lines cross the parking lot to provide service to the south end of the campus and will have to be properly relocated. Top soils containing organic rich materials are not acceptable for reuse as compacted fill soils beneath the parking structure footings and floor slab.

The site soils can be excavated utilizing conventional heavy-duty earth-moving equipment. The excavated site soils, free of vegetation, shrub and debris, may be placed as compacted fill in structural areas after proper processing. The upper undocumented fill soils and natural granular soils consisting of silty sands should be segregated, stockpiled and saved during excavation for later reuse beneath the footings and floor slabs to prevent mixing with the underlying fine-grained, potentially expansive, silts and clays. Rocks larger than three (3) inches in the largest dimension should not be placed as fill. Rocks larger than one (1) inch should not be placed within the upper 12 inches of subgrade soils.

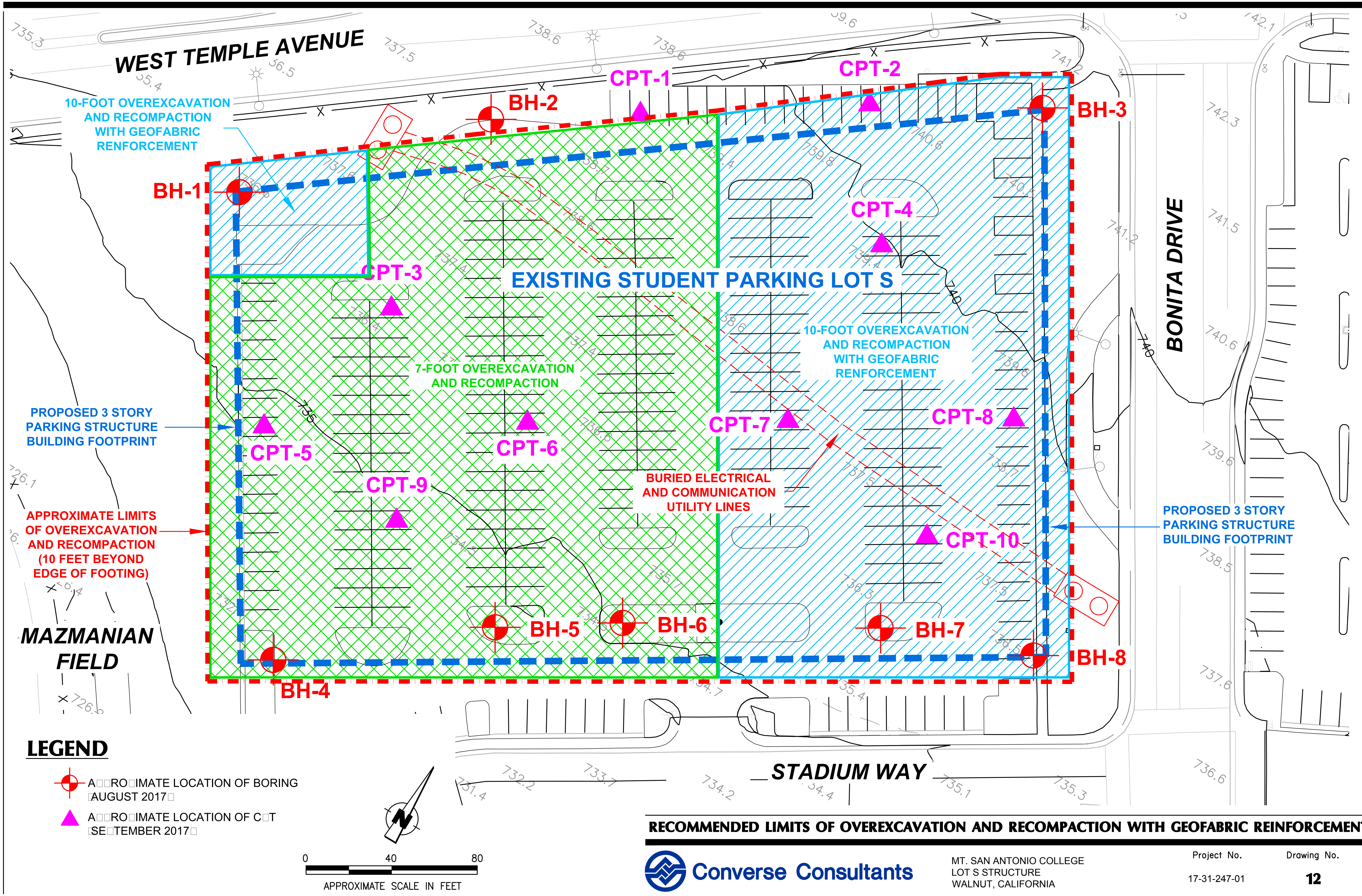
On-site clay and silt soils and with an expansion index exceeding 20 should not be re-used for compaction within 2 feet below the proposed foundations, floor slabs or for retaining wall backfill. Soils containing organic materials should not be used as structural fill. The extent of removal should be determined by the geotechnical representative based on soil observations made during grading.

8.2 Over-Excavation/Removal

Over-excavation and re-compaction of the undocumented fill soils, upper alluvium and sedimentary bedrock is recommended for site grading to provide a minimum 5-foot thick layer of compacted fill beneath the bottom of the building foundations and floor slabs. Different earth materials will be encountered at the bottom of the excavations. In order to provide a relative uniform bearing material below parking structure foundations and floor slabs, and reduce differential settlements between the underlying alluvium and shallow sedimentary bedrock earth materials, over-excavation and re-compaction below the foundations and slab-on-grades is recommended. The over-excavation and re-compaction should extend approximately 7-feet to 10-feet below ground surface and 10-feet beyond the edge of the parking structure foundations. Drawing No.12, *Recommended Limits of Over-excavation and Re-compaction with Geofabric Reinforcement*, shows the approximate limits and depths of over-excavation and re-compaction for the proposed parking structure. A geofabric reinforcement layer (Mirafi HP 570 or equivalent) is recommended at the bottom of the deeper 10-foot depths of over-excavation to reduce potential differential settlements between the underlying alluvium and shallow bedrock areas.

The bottom and edges of the excavations shall be cleaned, squared-off and leveled. If loose, soft, disturbed or otherwise unsuitable soil materials are encountered at the bottom of excavations, deeper removals will be required until firm and unyielding native soils are encountered. The final bottom surfaces and limits of all excavations shall be observed and approved by the project geotechnical engineer or his representative prior to placing compacted fill. The bottoms should be proof rolled with a loaded, heavy, rubber tired piece of grading equipment to identify any remaining loose or soft bottom areas. The bottom of excavation shall be observed, evaluated and approved during grading to determine that suitable firm and unyielding soils have been encountered. The exposed bottom shall then be scarified 6-8 inches in depth, mixed, moisture conditioned or dried back as necessary, and compacted to 90% relative maximum dry density compaction prior to smoothing and leveling for placement of the bottom geosynthetic reinforcement layer.

A geofabric reinforcement layer consisting of Mirafi HP 570 or equivalent, shall be placed across the prepared bottom of the deeper 10-foot depths of over-excavation as shown on Drawing No.12, *Recommended Limits of Over-Excavation and Re-compaction with Geofabric Reinforcement*. The bottom layer of Mirafi HP 570 geotextile reinforcement, or equivalent, shall be laid across the prepared soil subgrade in accordance with the manufacture’s recommendations and project specifications. A minimum 1-foot side-to-side overlap should be provided for each fabric layer in accordance with project and manufacturer’s specifications. An approximately 2-inch thick layer of moisture conditioned fill should be placed between the overlapping geotextile fabric layers to increase friction resistance between the overlapping sections of geotextile fabric. The installation should be observed and documented by the geotechnical engineer or his designated representative prior to backfill grading. Once placement of the geotextile reinforcement layers have been observed and documented by the geotechnical engineer or his designated representative, moisture conditioned backfill soils can be carefully placed, spread smoothed and level over the geotextile reinforcement layer without disturbing the geotextile layers or their positions. The remaining fill soils should then be placed, mixed, moisture conditioned and compacted to 90% relative compaction in 6-inch to 8-inch lifts



RECOMMENDED LIMITS OF OVEREXCAVATION AND RECOMPACTION WITH GEOFABRIC REINFORCEMENT

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WALNUT, CALIFORNIA

Project No.	Drawing No.
17-31-247-01	12

and compacted in accordance with project specifications to bring the fill soils up to plan grades.

We recommend a minimum 5 feet of onsite soils and bedrock below the bottom of foundations and floor slabs should be removed, moisture-conditioned if necessary and replaced as compacted fill for parking structure. All undocumented fill should be removed and replaced with compacted fill.

The excavations to remove undocumented fills, alluvium and bedrock to proposed subgrade levels should be extended to ten (10) feet laterally beyond the building limits and appendages where space is available. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. Thickness of compacted fill underneath the buildings should not vary significantly. After the required removals have been made, the exposed native earth materials shall be excavated to provide a minimum 5-foot thick zone of structural fill for the support of footings, slabs-on-grade, and exterior flatwork.

For retaining walls, we recommend over-excavation be at least 5 feet below existing grade and 2 feet laterally beyond the foot prints, where space is available.

The exposed bottom of the over-excavation area should be scarified at least 6 inches, moisture conditioned as needed to near-optimum moisture content, and compacted to 90 percent relative compaction. Over-excavation should not undermine adjacent off-site improvements. Remedial grading should not extend within a projected 1:1 (horizontal to vertical) plane projected down from the outer edge of adjacent off-site improvements. If loose, yielding soil conditions are encountered at the excavation bottom, the following options can be considered:

a. Over-excavate until reach firm bottom.
b. Scarify or over-excavate additional 18 inches deep, and then place at least 18-inch-thick compacted base material (CAB or equivalent) to bridge the soft bottom. Base should be compacted to 90% relative compaction.
c. Over-excavate additional 18 inches deep, and then place a layer of geofabric i.e. Mirafi HP570, X600 or equivalent), place 18-inch-thick compacted base material (CAB or equivalent) to bridge the soft bottom. Base should be compacted to 90% relative compaction. An additional layer of geofabric may be needed on top of base depending on the actual site conditions.

The actual depth of removal should be based on recommendations and observation made during grading by the project geotechnical engineer or his designated representative. Therefore, some variations in the depth and lateral extent of over-excavation recommended in this report should be anticipated.

Site grading may result in transition lines with cut and/or fill conditions. This transition line would require special grading considerations. Detailed site grading recommendations are provided in the following sections.

8.3 Structural Fill

The approved bottom of the excavations should be scarified to a depth of at least six (6) inches. The scarified soils should be moisture conditioned and mixed to within three (3) percent of optimum moisture content for granular soils and to approximately three (3) percent above the optimum content to near-optimum moisture content for the fine-grained soils. Scarified soil shall be compacted to a minimum 90 percent of the laboratory maximum dry density as determined by the ASTM Standard D1557 test method to produce a firm and unyielding surface.

All structural fill should be placed on competent, scarified and compacted native materials as determined by a geotechnical engineer or his designated representative and in accordance with the specifications presented in this section.

Excavated site soils, free of deleterious materials and rock fragments larger than three (3) inches in the largest dimension, should be suitable for placement as compacted fill. Any import fill should be tested and approved by Converse. The import fill should have an expansion potential less than 20.

Prior to compaction, fill materials should be thoroughly mixed and moisture conditioned when necessary, within three (3) percent of the optimum moisture for granular soils and at approximately three (3) percent above the optimum moisture for fine-grained soils. All fill, if not specified otherwise elsewhere in this report, should be compacted to at least 90 percent of the laboratory dry density in accordance with the ASTM Standard D1557 test method. The amount of processing required for proper moisture conditioning and mixing at the site will depend on the seasonal variations in the in-situ moisture conditions, the depth of cut, the equipment, weather and the processing method.

Fill exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be keyed and benched into competent materials. The height and width of the benches shall be at least two (2) feet.

8.4 Excavatability

Based on our field exploration, the earth materials at the site should be excavatable with conventional heavy-duty earth moving and trenching equipment. The onsite materials contain about 5 to 30 percent gravels up to 3 inches in maximum dimension. Larger gravels, cobbles and possible boulders may exist at the site. The sandstone pebble conglomerate bedrock materials are cemented and moderately hard to hard. The excavation and rippability of these hard bedrock materials will be more difficult and should be anticipated during grading. Many of the soil borings drilled for the project site encountered difficult drilling and/or refusal in the sandstone and conglomerate bedrock materials along the south half of the project site. Standard Penetration Tests (SPT) blow counts in the sandstone and conglomerate bedrock materials were high and often times met refusal to sampler penetrations. Boring Nos. BH-4, BH-5, BH-6, BH-7 and BH-8 encountered refusal to sampler penetration and drilling penetration in hard sedimentary bedrock materials at shallow depths along the southern side of the project site. Localized areas of very hard bedrock requiring single shank ripping or hydraulic breakers should be anticipated. Directional ripping and downsizing breakers may be required in cemented sandstone and conglomerate beds. Earthwork should be performed with suitable equipment for gravelly materials and for hard and cemented bedrock materials.

8.5 Expansive Soil

Based on our laboratory testing results, the on-site fine-grained silt and clay earth materials are considered to have a low to moderate expansion potential. Medium to high expansion potential in fine-grained silt and clay materials may be anticipated. The on-site soil materials will be mixed during the grading and the expansion potential might change. Therefore, the expansion potential of site soils should be verified after the grading as slabs, foundations and pavement placed directly on expansive subgrade soil will likely crack over time.

To mitigate the expansive soils, on-site clayey soils with an Expansion Index higher than 20 should not be re-used for compaction within 2 feet below the proposed foundations, floor slabs or for retaining wall backfill. The extent of removal should be determined by the geotechnical representative based on soil observation during grading.

There are several alternative mitigation measures that can be utilized to improve expansive soils at the site. Some mitigation measures include:

- Removing about two (2) feet of the underlying soils throughout the site, and replacing with imported non-expansive sandy soil materials.

- Reinforce footings and place thicker concrete slabs with moisture barriers.

- Lime treat the upper two (2) feet of the subgrade soils.

8.6 Shrinkage and Subsidence

The shrinkage and/or bulkage would depend on, among other factors, the depth of cut and/or fill, and the grading method and equipment utilized. For preliminary estimation, bulking and shrinkage factors for various units of earth material at the site may be taken as presented below:

- The approximate shrinkage factor for the upper ten (10) feet of alluvial soils is estimated to range from ten (10) to twenty (20) percent.

- Subsidence would depend on the construction methods including type of equipment utilized. For estimation purposes, ground subsidence may be taken as 0.20 feet.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.

8.7 Subgrade Preparation

Final subgrade soils for structures and streets should be uniform and non-yielding. To obtain a uniform subgrade, soils should be well mixed and uniformly compacted. The subgrade soils should be non-expansive and well-drained. The near-surface site soils should be free draining. We recommend that at least the upper two (2) inches of subgrade soils underneath the slab-on-grade should be comprised of well-drained granular soils such as sands, gravel or crushed aggregate satisfying the following criteria:

- Maximum size ≤ 0.5 inches
- Percent passing U.S. #200 sieve ≤ 12 percent
- Sand equivalent ≥ 30

The subgrade soils should be moisture conditioned before placing concrete.

The various design recommendations provided in this section are based on the assumptions that in preparing the site, the earthwork and site grading recommendations provided in this report will be followed. The proposed buildings may be supported by shallow continuous and isolated square footings.

9.0 DESIGN RECOMMENDATIONS

9.1 Shallow Foundations

9.1.1 Vertical Capacity

Continuous and square footings should be founded at least 24 inches below lowest adjacent final grade on the recommended earth materials. A minimum footing width of 24 inches is recommended for continuous and square footings. The net allowable dead plus live load bearing value for isolated square and continuous footings is 2,500 psf. The net allowable bearing pressure can be increased by 400 psf for each additional foot of excavation depth and width up to a maximum value of 4,000 psf.

The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity.

9.1.2 Lateral Capacity

Resistance to lateral loads can be provided by friction acting at the base of the foundation and by passive earth pressure. A coefficient of friction of 0.35 may be assumed with normal dead load forces. An allowable passive earth pressure of 250 psf per foot of depth up to a maximum of 2,500 psf may be used for footings poured against properly compacted fill or undisturbed stiff natural soils. The values of coefficient of friction and allowable passive earth pressure include a factor of safety of 1.5.

9.1.3 Settlement

The static settlement of structures supported on continuous and/or spread footings founded on compacted fill will depend on the actual footing dimensions and the imposed vertical loads. Most of the footing settlement at the project site is expected to occur immediately after the application of the load. Based on the maximum allowable net bearing pressures presented above, static settlement is anticipated to be less than 1.0 inch. Differential settlement is expected to be up to one-half of the total settlement over a 30-foot span.

9.1.4 Dynamic Increases

Bearing values indicated above are for total dead load and frequently applied live loads. The above vertical bearing may be increased by 33% for short durations of loading which will include the effect of wind or seismic forces. The allowable passive pressure may be increased by 33% for lateral loading due to wind or seismic forces.

9.2 Modulus of Subgrade Reaction

For the subject project, design of the structures supported on compacted fill subgrade prepared in accordance with the recommendations provided in this report may be based on a soil modulus of subgrade reaction of (k_s) of 150 pounds per square inch per inch.

9.3 Lateral Earth Pressure

The proposed retaining walls are anticipated to be up to 25 feet in height. The earth pressure behind any buried wall depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure. The following fluid pressures are recommended for vertical walls with no hydrostatic pressure, no surcharge, and level backfill.

Table No. 7, Lateral Earth Pressures for Retaining Wall Design

Wall Type	Equivalent Fluid Pressure (pcf)
	Level Backfill
Cantilever Wall (Active pressure)	30 (Triangular Distribution)
Restrained Wall (At-rest pressure)	50 (Triangular Distribution)

The recommended lateral pressures assume that the walls are fully back-drained to prevent build-up of hydrostatic pressure. Adequate drainage could be provided by means of permeable drainage materials wrapped in filter fabric installed behind the walls. The drainage system should consist of perforated pipe surrounded by free draining, uniformly graded, ¾ -inch washed, permeable aggregate material, and wrapped in filter fabric such as Mirafi 140N or equivalent, and should extend to about 2 feet below the finished grade. The filter fabric should overlap approximately 12 inches or more at the joints. The subdrain pipe should consist of perforated, four-inch diameter, Schedule 40 PVC or rigid ABS (SDR-35), or equivalent, with perforations placed down. Alternatively, a prefabricated drainage composite system such as the Miradrain G100N or equivalent can be used. The subdrain should be connected to surface drain or sump pump.

In addition, walls with inclined backfill should be designed for an additional equivalent fluid pressure of one (1) pound per cubic foot for every two (2) degrees of slope inclination. Walls subjected to surcharge loads located within a distance equal to the height of the wall should be designed for an additional uniform lateral pressure equal to one-third or one-half the anticipated surcharge load for unrestrained or restrained walls, respectively. These values are applicable for backfill placed between the wall stem and an imaginary plane rising 45 degrees from below the edge (heel) of the wall footings.

Cantilever retaining walls greater than 12 feet, as measured from the surface, should be designed to resist additional earth pressure caused by seismic ground shaking. A dynamic earth pressure of 18H (psf), based on an inverted triangular distribution, can be used for design of wall.

9.4 Slabs-on-Grade

Slabs-on-grade should have a minimum thickness of five inches for support of nominal ground-floor live loads without hydrostatic uplift pressures. Minimum reinforcement for slabs-on-grade should be No. 3 reinforcing bars, spaced at 18 inches on-center each way. The thickness and reinforcement of more heavily-loaded slabs will be dependent upon the anticipated loads and should be designed by a structural engineer.

Slabs should be designed and constructed as promulgated by the American Concrete Institute (ACI) and the Portland Cement Association (PCA). Prior to the slab pour, all utility trenches should be properly backfilled and compacted. Care should be taken during concrete placement to avoid slab curling.

In areas where a moisture-sensitive floor covering (such as vinyl tile or carpet) is used, slabs should be protected by at least a 10-mil-thick moisture barrier between the slab and compacted subgrade that meets the performance criteria of ASTM E 1745 Class A material. Polyethylene sheets should be overlapped a minimum of six inches, and should be taped or otherwise sealed.

9.5 Soil Corrosivity Evaluation

Converse retained the Environmental Geotechnology Laboratory, Inc., located in Arcadia, California, to test one (1) selected soil sample taken in the general area of the proposed structures. The tests included minimum resistivity, pH, soluble sulfates, and chloride content, with the results summarized on the following table:

Table No. 8, Soil Corrosivity Test Results

Boring No.	Sample Depth (feet)	pH (Caltrans 643)	Soluble Chlorides (Caltrans 422) ppm	Soluble Sulfate (Caltrans 417) (%)	Saturated Resistivity (Caltrans 532) Ohm-cm
BH-4	10	8.17	115	0.006	2,100

Based on our review of soil corrosivity test results (see Appendix B), the soluble sulfate concentration, pH, and chloride content are not in the corrosive range to concrete in accordance with the Caltrans Corrosive Guidelines (2012). However, the minimum saturated resistivity is in the corrosive range to ferrous metal. Protections of underground metal pipe should be considered. Since the soluble sulfate concentrations tested for this project are less than 2,000 ppm in the soil, mitigation measures to protect concrete in contact with the soils are not anticipated. Type I or II Portland Cement may be used for the construction of the foundations and slabs.

The test results presented herein are considered preliminary. Additional testing and evaluation of the as-graded soils is recommended. A corrosion engineer may be consulted for appropriate mitigation procedures and construction design, if needed. Conventional corrosion mitigation measures may include the following:

- Steel and wire concrete reinforcement should have at least three inches of concrete cover where cast against soil, unformed. Below-grade ferrous metals should be given a high-quality protective coating, such as 18-mil plastic tape, extruded polyethylene, coal-tar enamel, or Portland cement mortar.

- Below-grade metals should be electrically insulated (isolated) from above-grade metals by means of dielectric fittings in ferrous utilities and/or exposed metal structures breaking grade.

9.6 Flexible Pavement

The flexible pavement structural section design recommendations were performed in accordance with the method contained in the *CALTRANS Highway Design Manual*, Chapter 630 without the factor of safety. No specific traffic study was performed to determine the Traffic Index (TI) for the proposed project, therefore a wide range of TI values were evaluated.

Due to various earth materials encountered at the site, flexible pavement structural section recommendations are prepared for both subgrade soils. We recommend that the project structural engineer consider the traffic loading conditions at various locations and select the appropriate pavement sections from the following table:

Table No. 9, Flexible Pavement Structural Sections

Design R-value	Design TI	Asphalt Concrete (AC) Over Aggregate Base (AB) Structural Sections		Full AC Structural Section
		AC (inches)	AB (inches)	AC (inches)
46	4	3.0	4.5	5.0
	5	4.0	4.5	5.0
	6	5.0	4.5	6.5
	7	6.0	4.5	8.0
	8	7.0	4.5	8.0
	9	8.0	4.5	9.5

Base material shall conform to requirements for Crushed Miscellaneous Base (CMB) or equivalent and should be placed in accordance with the requirements of the Standard Specifications for Public Works Construction (SSPWC, latest Edition).

Asphaltic materials should conform to Section 203-1, "Paving Asphalt," of the Standard Specifications for Public Works Construction (SSPWC, latest Edition) and should be placed in accordance with Section 302-5, "Asphalt Concrete Pavement," of the SSPWC, 2012 edition.

Positive drainage should be provided away from all pavement areas to prevent seepage of surface and/or subsurface water into the pavement base and/or subgrade.

9.7 Rigid Pavement

Rigid pavement design recommendations were provided in accordance with the Portland Cement Association's (PCA) Southwest Region Publication P-14, *Portland Cement Concrete Pavement (PCCP) for Light, Medium, and Heavy Traffic*. We recommend that the project structural engineer consider the loading conditions at various locations and select the appropriate pavement sections from the following table:

Table No. 10, Rigid Pavement Structural Sections

Design R-Value	Design Traffic Index (TI)	PCCP Pavement Section (inches)
46	5.0	6.50
	6.0	6.50
	7.0	7.00
	8.0	7.00
	9.0	7.25

The pavement sections presented in the table are based on a minimum 28-day Modulus of Rupture (M-R) of 550 psi and a compressive strength of 3,000 psi. The third point method of testing beams should be used to evaluate modulus of rupture. The concrete mix design should contain a minimum cement content of 5.5 sacks per cubic yard. Recommended maximum and minimum values of slump for pavement concrete are three (3) inches and one (1) inch, respectively.

Transverse contraction joints should not be spaced more than 15 feet and should be cut to a depth of ¼ the thickness of the slab. Longitudinal joints should not be spaced more than 12 feet apart. A longitudinal joint is not necessary in the pavement adjacent to the curb and gutter section.

All outside edges should conform to Section 201 of the Standard Specifications for Public Works Construction (SSPWC, latest edition), and should be constructed in accordance with Section 302-6 of the SSPWC. Pavement subgrade should be prepared in accordance with Section 9.7 of this report.

The PCCP materials should conform to Section 201 of the Specifications for Public Works Construction and should be constructed in accordance with Section 302-6 of the SSPWC.

Positive drainage should be provided away from all pavement areas to prevent seepage of surface and/or subsurface water into the pavement base and/or subgrade.

9.8 Site Drainage

Adequate positive drainage should be provided away from the structures to prevent ponding and to reduce percolation of water into structural backfill. We recommend that the landscape area immediately adjacent to the foundation shall be designed sloped away from the building with a minimum 5% slope gradient for at least 10 feet measured perpendicular to the face of the wall. Impervious surfaces within 10 feet of the building foundation shall be sloped a minimum of 2 percent away from the building per 2016 CBC.

Planters and landscaped areas adjacent to the building perimeter should be designed to minimize water infiltration into the subgrade soils. Gutters and downspouts should be installed on the roof, and runoff should be directed to the storm drain through non-erosive devices. Lower level walkways and open patio areas may require special drainage provisions and sump pumps to provide suitable drainage.

10.0 CONSTRUCTION RECOMMENDATIONS

10.1 General

Site soils should be excavatable using conventional heavy-duty excavating equipment. Temporary sloped excavation is feasible if performed in accordance with the slope ratios provided in Section 11.2, *Temporary Excavations*. Existing utilities should be accurately located and either protected or removed as required. For steeper temporary construction slopes or deeper excavations, shoring should be provided by the contractor as necessary, to protect the workers in the excavation.

10.2 Temporary Excavations

Based on the materials encountered in the exploratory borings, sloped temporary excavations may be constructed according to the slope ratios presented in Table No. 11, *Slope Ratios for Temporary Excavation*. Any loose utility trench backfill or other fill encountered in excavations will be less stable than the native soils. Temporary cuts encountering loose fill or loose dry sand may have to be constructed at a flatter gradient than presented in the following table:

Table No. 11, Slope Ratios for Temporary Excavation

Maximum Depth of Cut (feet)	Maximum Slope Ratio* (horizontal: vertical)
0 – 5	vertical
5 – 10	1:1
10 +	1.5:1

*Slope ratio assumed to be uniform from top to toe of slope.

Surfaces exposed in slope excavations should be kept moist but not saturated to retard raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including construction, should not be placed within five (5) feet of the unsupported trench edge. The above maximum slopes are based on a maximum height of six (6) feet of stockpiled soils placed at least five (5) feet from the trench edge.

For steeper temporary construction slopes or deeper excavations, shoring should be provided by the contractor as necessary, to protect the workers in the excavation.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

If the excavation occurs near existing structures, special construction considerations would be required during excavation to protect these existing structures during construction. The proposed excavation should not cause loss of bearing and/or lateral supports of the existing structures.

10.3 Shoring Design

Temporary shoring will be required for the recommended excavation due to space limitations and property line boundaries and because of nearby existing structures or facilities and traffic loading. Temporary shoring may consist of the use of a trench box (where feasible), or conventional soldier piles and lagging. Shoring should ultimately be designed by a qualified structural engineer considering the recommendations below in their final design and others which are applicable.

Drilled excavations for soldier piles, which are recommended to create the proposed 40-foot-high excavation, may require the use of drilling fluids to prevent caving and to maintain an opened hole for pile installation. Casing may be needed if granular earth material is located behind the existing retaining wall.

10.3.1 Cantilevered Shoring

Cantilevered shoring systems may include soldier piles with lagging to maintain temporary support of vertical wall excavations. Shoring design must consider the support of adjacent underground utilities and/or structures, and should consider the effects of shoring deflection on supported improvements. Due to sandy nature of on-site soils, some caving during the drilling of soldier-pile borings should be anticipated. A soldier pile system will require continuous lagging to control caving and sloughing in the excavation between soldier piles.

Temporary cantilevered shoring should be designed to resist a lateral earth pressure equivalent to a fluid density of 32 pounds per cubic foot (pcf) for non-surcharged condition. This pressure is valid only for shoring retaining level ground. This equivalent fluid pressure is valid only for shoring supporting level ground.

In addition to the lateral earth pressure, surcharge pressures due to miscellaneous loads, such as soil stockpiles, vehicular traffic or construction equipment located adjacent to the shoring, should be included in the design of the shoring. A uniform lateral pressure of 100 psf should be included in the upper 10 feet of the shoring to account for normal vehicular and construction traffic within 10 feet of the trench excavation. Surcharge pressures from the existing structures should be added to the above earth pressures for surcharges within a horizontal distance less than or equal to the wall height. Surcharge coefficients of 50% of any uniform vertical surcharge should be added as a horizontal earth pressure for shoring design. All shoring should be designed and installed in accordance with state and federal safety regulations.

The minimum embedment depth for piles is ten (10) feet from the lowest adjacent grade into firm alluvium, below the bottom of the excavation. Vertical skin friction against soldier piles for may be taken as 350 psf. Fixity may be assumed at two (2) feet below the excavation into firm native alluvium or bedrock. For the design of soldier piles spaced at least 3.0 diameters on-center, the passive resistance of the soils adjacent to the piles may be assumed to be 300 psf per foot of embedment depth. Soldier pile members placed in drilled holes should be properly backfilled with a sand/cement slurry or lean concrete in order to develop the required passive resistance.

Caving soils should be anticipated between the piles. To limit local sloughing, caving soils can be supported by continuous lagging or guniting. The lagging between the soldier piles may consist of pressure-treated wood members or solid steel sheets. In our opinion, steel sheeting is expected to be more expedient than wood lagging to install. Although soldier piles and any bracing used should be designed for the full-anticipated earth pressures and surcharge pressures, the pressures on the lagging are less because of the effect of arching between the soldier piles. Accordingly, the lagging between the piles may be designed for a nominal pressure of up to a maximum of 350 psf. All lumber to be left in the ground should be treated in accordance with Section 204-2 of the "Standard Specifications for Public Works Construction" (Latest Edition).

10.3.2 Tie-Back Shoring

A tie-back soldier-pile shoring system may be used to maintain temporary support of deep vertical walled excavations. Braced or tied-back shoring, retaining a level ground surface, should be designed for a uniform pressure of 20H psf, where H is the height of the retained cut in feet.

Surcharge pressures should be added to this earth pressure for surcharges within a distance from the top of the shoring less than or equal to the shoring height. A surcharge coefficient of 50 percent of any uniform vertical surcharge should be added as a horizontal shoring pressure for braced shoring. A uniform lateral pressure of 100 psf should be included in the upper 10 feet of the shoring to account for normal vehicular and construction traffic within 10 feet of the trench excavation.

<u>Tie-Backs</u>

For design of tie-back shoring, it should be assumed that the potential wedge of failure is determined by a plane at 30 degrees from the vertical, through the bottom of the excavation. Tie-back anchors may be installed at angles of 15 to 40 degrees below a horizontal plane. Tie-back installation and testing guidelines and procedures are presented in Appendix E, *"Guide Specifications for Installation and Acceptance of Tie-back Anchors".* Soil friction values, for estimating the allowable capacity of drilled friction anchors, may be computed using the following equation:

q = 40H ; *$q \leq$ 500 pounds-per-square-foot (psf)*

where:
H = average depth of anchor below ground surface, shown on Figure No. 12, *Schematic Tie-Back Design*
q = anchor surface area resistance, in psf (excluding tip),

Only the frictional resistance developed beyond the assumed failure plane should be included in the tie-back design for resisting lateral loads. After shoring/tie-back is no longer needed to support the excavation, stress should be carefully released and shoring system including tieback may be able to be left in place.

All shoring and tie-back should be designed by experienced California licensed Civil Engineer and installed by experienced contractors. Shoring/tie-back design should also be reviewed by a geotechnical consultant to verify the soil parameters used in the design are in conformance with geotechnical report.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by a competent person employed by the contractor. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

It is recommended that Converse review plans and specifications for proposed shoring and that a Converse representative observes the installation of shoring. A licensed surveyor should be retained to establish monuments on shoring and the surrounding ground prior to excavation. Such monuments should be monitored for horizontal and vertical movement during construction. Results of the monitoring program should be provided immediately to the project Structural (shoring) Engineer and Converse for review and evaluation. Adjacent building elements should be photo-documented prior to construction.

11.0 PLAN REVIEW AND CONSTRUCTION INSPECTION SERVICES

This report has been prepared to aid in evaluation of the site, to prepare site-grading recommendations, and to assist the civil/structural engineer in the design of the proposed developments. It is recommended that this office be provided the opportunity to provide final site grading and design recommendations once the final grading plan is available.

All site grading and earthwork should be completed under the observation and testing of a qualified geotechnical consultant to verify compliance with the recommendations set forth in this report. All ground surfaces should be examined and approved by the project geotechnical consultant prior to placing any fill and/or structure. All footing excavations should be observed prior to placement of steel and concrete to see that footings are founded on satisfactory compacted soils and that excavations are free of loose, disturbed or deleterious materials.

12.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our conclusions and recommendations are based on the results of the field and laboratory investigations, combined with an interpolation and extrapolation of soil conditions between and beyond boring locations. If conditions encountered during construction appear to be different from those shown by the borings, this office should be notified.

Design recommendations given in this report are based on the assumption that the earthwork and site grading recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the final site grading and actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

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Appendix A

Field Exploration
and
Cone Penetration Test Data

APPENDIX A: FIELD EXPLORATION

Our field investigation included a site reconnaissance of the site and a subsurface exploration program consisting of drilling soil borings and performing Cone Penetration Test (CPT) soundings. During the site reconnaissance on August 14, 2017, the surface conditions were noted and the locations of the borings were determined. The borings were located using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used.

Eight (8) borings (BH-1 through BH-8) were drilled from August 16 to August 24, 2017, extending between depths of approximately 20.5 to 51.5 feet below the existing ground surface (bgs). The borings were advanced using a truck mounted drill rig with an 8-inch diameter hollow stem auger for soil sampling. Soils and bedrock were logged by a Converse engineer and classified in the field by visual examination in accordance with the Unified Soil Classification System. The field descriptions have been modified where appropriate to reflect the laboratory test results.

Ring samples of the subsurface materials were obtained at frequent intervals in the exploratory borings using a drive sampler (2.4-inches inside diameter and 3.0-inches outside diameter) lined with sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches, using an automatic hammer. Samples were retained in brass rings (2.4-inches inside diameter and 1.0-inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Blow counts for each sample interval are presented on the logs of borings. Bulk samples of typical soil types were also obtained.

Standard Penetration Tests (SPT) were also performed using a standard (1.4-inches inside diameter and 2.0-inches outside diameter) split-barrel sampler. The mechanically driven hammer for the SPT sampler was 140 pounds, failing 30 inches for each blow. The recorded blow counts for every six inches for a total of 1.5 feet of sampler penetration are shown on the Logs of Borings in the “BLOWS" column. The standard penetration test was performed in accordance with the ASTM Standard D1586 test method. The soil retrieved from the spoon sampler was carefully sealed in waterproof plastic containers for shipment to the laboratory.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Changes in material conditions that occur between driven samples are indicated in the logs at the top of the next drive sample. A key to soil symbols and terms is presented as Drawing No. A-1, *Soil Classification Chart*. The logs of the exploratory boring are presented in Drawing Nos. A-2a through A-18b, *Log of Borings*.

The cone penetration testing (CPT) conducted for this project consisted of pushing an instrumented Vertek cone-tipped probe into the ground while simultaneously recording the resistance to penetration at the cone tip and along the friction sleeve. The cone penetration testing described in this report was conducted in general accordance with the current ASTM specifications (ASTM D5778-95 and D3441-94) using an electronic cone penetrometer.

Ten (10) Cone Penetration Test soundings (CPT-1 through CPT-10) were advanced to depths of 8 to 42 feet below ground surface within the project site on September 6, 7, and 8th, 2017 by Kehoe Testing and Engineering using a 30-ton (4 axle) CPT rig. The test holes were stopped at plan depths or when the cone tip encountered refusal to penetration. CPT Nos. CPT-1, CPT-2, CPT-3, CPT-5, CPT-6, CPT-7, CPT-9 and CPT-10 encountered very dense / stiff soil and hard sedimentary bedrock conditions and were stopped short of their planned depths. The test holes were then backfilled with bentonite crumbles, periodically hydrated with clean water and tamped. The top portion of the test hole was then patched with asphalt patch and tamped to match existing pavement surfaces.

The Cone Penetration Test (CPT) test logs are presented at the end of Appendix A.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

STANDARD PENETRATION TEST
Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method

DRIVE SAMPLE 2.42" I.D. sampler.

DRIVE SAMPLE No recovery

BULK SAMPLE

GRAB SAMPLE

GROUNDWATER WHILE DRILLING

GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS

TEST TYPE
(Results shown in Appendix B)

CLASSIFICATION	
Plasticity	pi
Grain Size Analysis	ma
Passing No. 200 Sieve	wa
Sand Equivalent	se
Expansion Index	ei
Compaction Curve	max
Hydrometer	h

STRENGTH	
Pocket Penetrometer	p
Direct Shear	ds
Direct Shear (single point)	ds*
Unconfined Compression	uc
Triaxial Compression	tx
Vane Shear	vs
Consolidation	c
Collapse Test	col
Resistance (R) Value	r
Chemical Analysis	ca
Electrical Resistivity	er

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

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Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **A-1**

Log of Boring No. BH-1

Dates Drilled: 8/17/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 737 | Depth to Water (ft): 28

Depth (ft)	SUMMARY OF SUBSURFACE CONDITIONS	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
	This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.				
0	**FILL (Af):** **SILTY SAND (SM):** gravel, brown.				ma
3	**ALLUVIUM (Qal):** **SANDY SILT (ML):** with gravel, brown.				
5		5/6/7	9	121	
8	**CLAYEY SAND (SC):** fine to medium-grained, fine trace gravels, dark brown.	4/6/5	9	107	
10					ds
14	**BEDROCK-PUENTE FORMATION:** **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained, with gravel and cobble size rocks, rocks hard, some siltstone and claystone, weathered to intact, medium hard to hard, cemented, yellowish white				
15		21/13/50(4")	10	114	
20		26/15/18			
25	-no recovery	50(4")			sampler refusal
28	-groundwater at 28 feet.				
30		50(5")			spt refusal
33	End of boring at 33 feet. Groundwater encountered at 28 feet. Borehole backfilled with soil cuttings, patched and tamped on 8-17-17.				

Converse Consultants

Project Name: MT. SAN ANTONIO COLLEGE PARKING LOT S WALNUT, CALIFORNIA

Project No.: 17-31-247-01

Figure No.: A-2

Log of Boring No. BH-2

Dates Drilled: 8/24/2017 | Logged by: DA | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 738 | Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **CLAYEY SAND (SC):** fine to medium-grained, some gravel, brown.						c
5			■		6/11/17	5	110	
		ALLUVIUM (Qal): **GRAVELLY SAND (SP):** medium to coarse-grained, gravels, possible cobbles, black.						
10			■		15/50(3")			
15		-increasing amount of gravel, gravel lenses, gravels hard, subrounded	■		50(3")			
20			■		50(4")			
25		**SILTY SAND (SM):** fine-grained, reddish brown.	■		46/38/50(1")			
		End of boring at 26.1 feet. Groundwater not encountered during drilling. Borehole backfilled with soil cuttings, patched and tamped on 8-24-17.						

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Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **A-3**

Log of Boring No. BH-3

Dates Drilled: 8/17/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 741 | Depth to Water (ft): 23.4

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **SILTY SAND (SM):** clay silt with sand and gravel, brown.						max.wa
5		**ALLUVIUM (Qal):** **SILT (ML):** with gravel, dark brown.			4/6/5	11	114	
10		**SILTY SAND (SM):** fine trace gravels, moist, brown.			3/4/3	9	118	
15					3/5/7			wa
20					9/16/9			
		-groundwater						
25					8/13/16	7	115	wa
		SILTY CLAY (CL): wet, with gravels, dark brown.						
30					6/9/12			

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Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No.
17-31-247-01

Figure No.
A-4a

Log of Boring No. BH-3

Dates Drilled: 8/17/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 741 | Depth to Water (ft): 23.4

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SANDY CLAY (CL): with gravels, brown.			11/20/30			wa
40					50(5")			spt refusal
		BEDROCK-PUENTE FORMATION: **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained, with gravel and cobble size rocks, rocks hard, some siltstone and claystone, weathered to intact, medium hard to hard, cemented						
45					50(4")	9	107	sampler refusal
50					50(6")			sampler refusal

End of boring at 51.5 feet.
Groundwater encountered at 23.4 feet.
Borehole backfilled with soil cuttings, patched and tamped on 8-17-17.

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Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **A-4b**

Log of Boring No. BH-4

Dates Drilled: 8/16/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 732 | Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **SILTY SAND (SM):** fine to medium-grained, with clay and gravels, brown.						
5		**ALLUVIUM (Qal):** **SILTY CLAY (CL):** with gravel, dark brown.	■		7/6/6	9	118	
10			■		30/50(4")			
15		**BEDROCK-PUENTE FORMATION:** **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained, with gravel and cobble size rocks, rocks hard, weathered to intact, medium hard to hard, cemented, yellowish white	■		33/50(4")			
20			☒		22/35/50			
25		bedrock, yellowish white, hard, cemented	■		50/60	6	134	
		-hard drilling; refusal						
		End of boring at 28 feet due to drilling refusal. Groundwater not encountered during drilling. Borehole backfilled with soil cuttings, patched and tamped on 8-16-17.						

Log of Boring No. BH-5

Dates Drilled: 8/16/2017 Logged by: RAM Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 735 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
0		**FILL (Af):** **SILTY SAND (SM):** with sand and clay, gravels and rocks, light brown.		X				r
5		**ALLUVIUM (Qal):** **SANDY SILT (ML):** brown.	■		20/50(6")	17	110	ds
10		**BEDROCK-PUENTE FORMATION:** **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained, with gravel and cobble size rocks, rocks hard, subrounded, weathered to intact, medium to hard to hard, cemented, yellowish brown	■		50(4")	4	112	
15			■		20/50(6")			
20		-hard drilling: refusal	X		50(6")			spt refusal
		End of boring at 20.5 feet due to drilling refusal. Groundwater not encountered during drilling. Borehole backfilled with soil cuttings, patched and tamped on 8-16-17.						

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **A-6**

Log of Boring No. BH-6

Dates Drilled: 8/16/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 735 | Depth to Water (ft): NOT ENCOUNTERED

SUMMARY OF SUBSURFACE CONDITIONS

This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.

Depth (ft)	Description	Samples: Drive	Samples: Bulk	Blows/6"	Moisture (%)	Dry Unit Wt. (pcf)	Other
0–5	**FILL (Af):** **SILTY SAND (SM):** gravels, light brown.		X				c,wa
5	**ALLUVIUM (Qal):** **SILT (ML):** small fine trace gravels, dark brown.	X		10/24/30	7	122	
10	**BEDROCK-PUENTE FORMATION:** **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained with gravel and cobble size rocks, rocks hard, subrounded, weathered to intact, medium hard to hard, cemented, yellowish white	X		27/50(6")			
15		X		50(3")			se sampler refusal
20		X (spt)		50(6")			spt refusal
24	-hard drilling: refusal	X		50(5")			sampler refusal

End of boring at 24 feet due to drilling refusal.
Groundwater not encountered during drilling.
Borehole backfilled with soil cuttings, patched and tamped on 8-16-17.

Log of Boring No. BH-7

Dates Drilled: 8/16/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 736 | Depth to Water (ft): 36.8

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
0		**FILL (Af):** **SILTY SAND (SM):** fine gravel, brown.						ma
5		**ALLUVIUM (Qal):** **SANDY SILT (ML):** with gravel, brown.			9/10/13			
10					8/12/18			
15		**SILT (ML):** fine trace gravel, brown.			5/6/17	12	118	
20		**CLAY (CL):** with fine trace gravel, dark brown.			4/5/7	12	110	
25					50(6")	6	127	
30		**BEDROCK-PUENTE FORMATION:** **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained with gravel and cobble size rocks, rocks hard, subrounded, weathered to intact, medium hard to hard, cemented, yellowish light brown			53/39/50			

Converse Consultants

Project Name: MT. SAN ANTONIO COLLEGE, PARKING LOT S, WALNUT, CALIFORNIA

Project No.: 17-31-247-01

Figure No.: A-8a

Log of Boring No. BH-7

Dates Drilled: 8/16/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 736 | Depth to Water (ft): 36.8

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		<u>BEDROCK-PUENTE FORMATION:</u> **SANDSTONE AND PEBBLE CONGLOMERATE** medium hard to hard -hard drilling: refusal	■		50(5")	5	134	
		End of boring at 39 feet due to drilling refusal. Groundwater encountered at 36.8 feet. Borehole backfilled with soil cuttings, patched and tamped on 8-16-17.						

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **A-8b**

Log of Boring No. BH-8

Dates Drilled: 8/16/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 737 | Depth to Water (ft): 30

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af): **CLAYEY SILT (ML):**.						
5		**ALLUVIUM (Qal):** **CLAYEY SILT (ML):** dark brown.			3/6/9	10	107	ds
10		**SANDY CLAY (CL):** coarse sand and gravel, brown to dark brown.			6/7/6	11	119	
15		**SILT (ML):** with gravel, brown.			5/6/8	13	117	
20		**SILTY CLAY (CL):** with gravel, brown.			3/2/3			
25		**SANDY SILT (ML):** brown.			5/5/5	15	112	
		groundwater seepage						
30		**SILT (ML):** brown.			4/8/12			

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **A-9a**

Log of Boring No. BH-8

Dates Drilled: 8/16/2017 | Logged by: RAM | Checked By: MBS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 737 | Depth to Water (ft): 30

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		BEDROCK-PUENTE FORMATION: **SANDSTONE AND PEBBLE CONGLOMERATE** sand, fine to coarse-grained, with gravels and cobble size rocks, rocks hard, subrounded, some siltstone and claystone, weathered to intact, medium to hard to hard, cemented, yellowish brown	■		10/21/50			
40			☒		30/50(5")			spt refusal
		-hard drilling: refusal						

End of boring at 43 feet due to drilling refusal.
Groundwater encountered at 30 feet.
Borehole backfilled with soil cuttings, patched and tamped on 8-16-17.

Converse Consultants

Project Name: MT. SAN ANTONIO COLLEGE, PARKING LOT S, WALNUT, CALIFORNIA

Project No.: 17-31-247-01

Figure No.: A-9b

Cone Penetration Test Data

SUMMARY

OF

CONE PENETRATION TEST DATA

Project:

Mount San Antonio College (Lot S)
1100 N. Grand Avenue
Walnut, CA
September 6-8, 2017

Prepared for:

Mr. Ram Ariram
Converse Consultants
717 S. Myrtle Avenue
Monrovia, CA 91016
Office (626) 930-1200 / Fax (626) 930-1212

Prepared by:

KTE

KEHOE TESTING & ENGINEERING
5415 Industrial Drive
Huntington Beach, CA 92649-1518
Office (714) 901-7270 / Fax (714) 901-7289
www.kehoetesting.com

TABLE OF CONTENTS

1. INTRODUCTION

2. SUMMARY OF FIELD WORK

3. FIELD EQUIPMENT & PROCEDURES

4. CONE PENETRATION TEST DATA & INTERPRETATION

APPENDIX

- CPT Plots
- CPT Classification/Soil Behavior Chart
- Interpretation Output (CPeT-IT)
- CPeT-IT Calculation Formulas

SUMMARY

OF

CONE PENETRATION TEST DATA

1. INTRODUCTION

This report presents the results of a Cone Penetration Test (CPT) program carried out for the Mount San Antonio College (Lot S) project located at 1100 N. Grand Avenue in Walnut, California. The work was performed by Kehoe Testing & Engineering (KTE) on September 6-8, 2017. The scope of work was performed as directed by Converse Consultants personnel.

2. SUMMARY OF FIELD WORK

The fieldwork consisted of performing CPT soundings at ten locations to determine the soil lithology. Groundwater measurements and hole collapse depths provided in **TABLE 2.1** are for information only. The readings indicate the apparent depth to which the hole is open and the apparent water level (if encountered) in the CPT probe hole at the time of measurement upon completion of the CPT. KTE does not warranty the accuracy of the measurements and the reported water levels may not represent the true or stabilized groundwater levels.

LOCATION	DEPTH OF CPT (ft)	COMMENTS/NOTES:
CPT-1	14	Refusal, hole open to 14.0 ft (dry)
CPT-2	23	Refusal, hole open to 23.0 ft (dry)
CPT-3	11	Refusal, hole open to 10.6 ft (dry)
CPT-4	27	Refusal, hole open to 27.0 ft (dry)
CPT-5	16	Refusal, hole open to 15.9 ft (dry)
CPT-6	8	Refusal, hole open to 9.0 ft (dry)
CPT-7	24	Refusal, hole open to 24.0 ft (dry)
CPT-8	42	Refusal, groundwater @ 23.5 ft
CPT-9	11	Refusal, hole open to 10.0 ft (dry)
CPT-10	42	Refusal, groundwater @ 25.0 ft

TABLE 2.1 - Summary of CPT Soundings

3. FIELD EQUIPMENT & PROCEDURES

The CPT soundings were carried out by **KTE** using an integrated electronic cone system manufactured by Vertek. The CPT soundings were performed in accordance with ASTM standards (D5778). The cone penetrometers were pushed using a 30-ton CPT rig. The cone used during the program was a 15 cm^2 cone and recorded the following parameters at approximately 2.5 cm depth intervals:

- Cone Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (u)
- Inclination
- Penetration Speed

The above parameters were recorded and viewed in real time using a laptop computer. Data is stored at the KTE office for up to 2 years for future analysis and reference. A complete set of baseline readings was taken prior to each sounding to determine temperature shifts and any zero load offsets. Monitoring base line readings ensures that the cone electronics are operating properly.

4. CONE PENETRATION TEST DATA & INTERPRETATION

The Cone Penetration Test data is presented in graphical form in the attached Appendix. These plots were generated using the CPeT-IT program. Penetration depths are referenced to ground surface. The soil classification on the CPT plots is derived from the attached CPT Classification Chart (Robertson) and presents major soil lithologic changes. The stratigraphic interpretation is based on relationships between cone resistance (qc), sleeve friction (fs), and penetration pore pressure (u). The friction ratio (Rf), which is sleeve friction divided by cone resistance, is a calculated parameter that is used along with cone resistance to infer soil behavior type. Generally, cohesive soils (clays) have high friction ratios, low cone resistance and generate excess pore water pressures. Cohesionless soils (sands) have lower friction ratios, high cone bearing and generate little (or negative) excess pore water pressures.

Tables of basic CPT output from the interpretation program CPeT-IT are provided for CPT data averaged over one foot intervals in the Appendix. We recommend a geotechnical engineer review the assumed input parameters and the calculated output from the CPeT-IT program. A summary of the equations used for the tabulated parameters is provided in the Appendix.

It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and u. In these situations, experience, judgement and an assessment of the pore pressure data should be used to infer the soil behavior type.

If you have any questions regarding this information, please do not hesitate to call our office at (714) 901-7270.

Sincerely,

KEHOE TESTING & ENGINEERING

Richard W. Koester, Jr.
General Manager

09/13/17-kk-8632-2

APPENDIX

Kehoe Testing and Engineering
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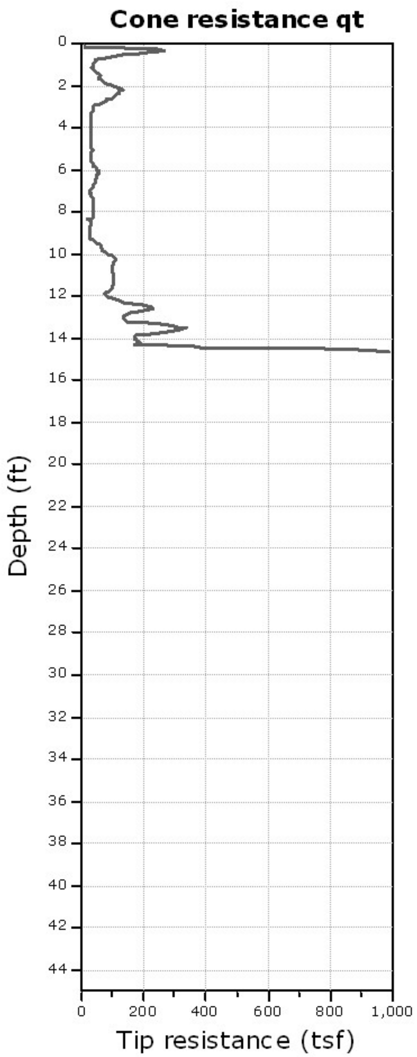
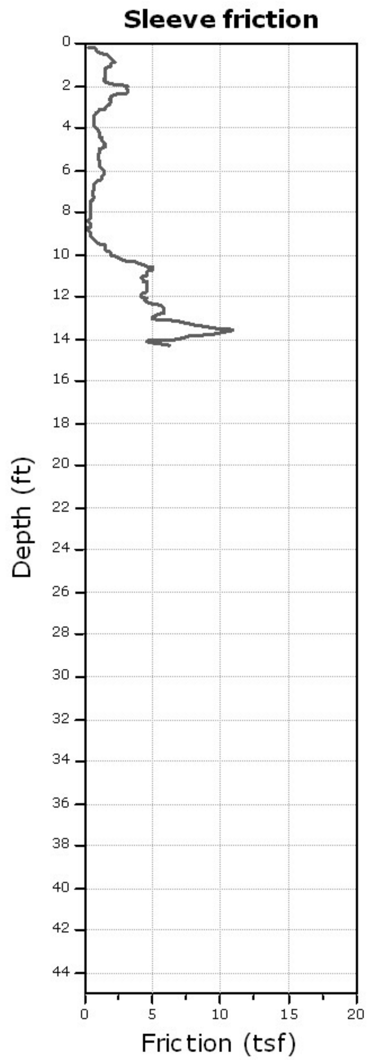
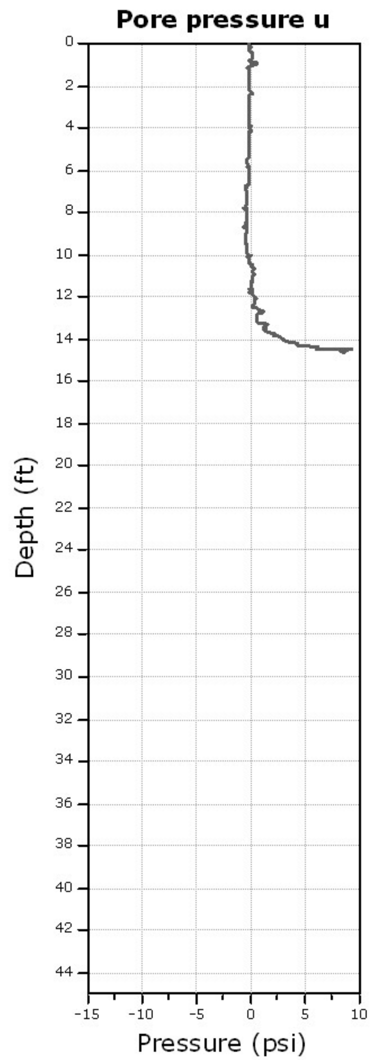
CPT-1

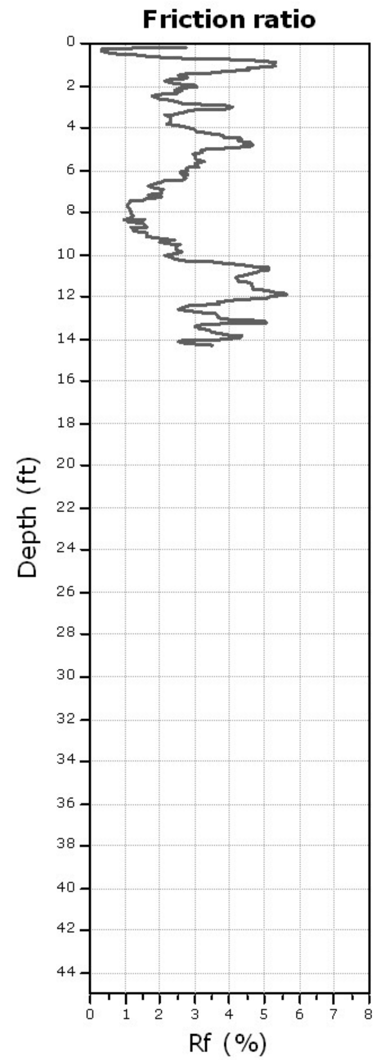
Project: Converse Consultants/Mount San Antonio College (Lot S)
Location: 1100 N. Grand Ave Walnut, CA

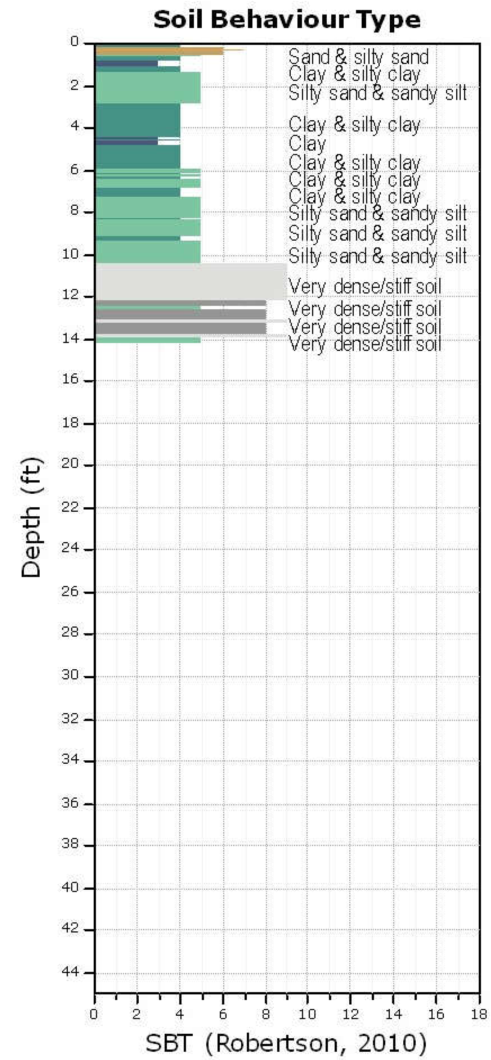
Total depth: 14.63 ft, Date: 9/6/2017
Cone Type: Vertek











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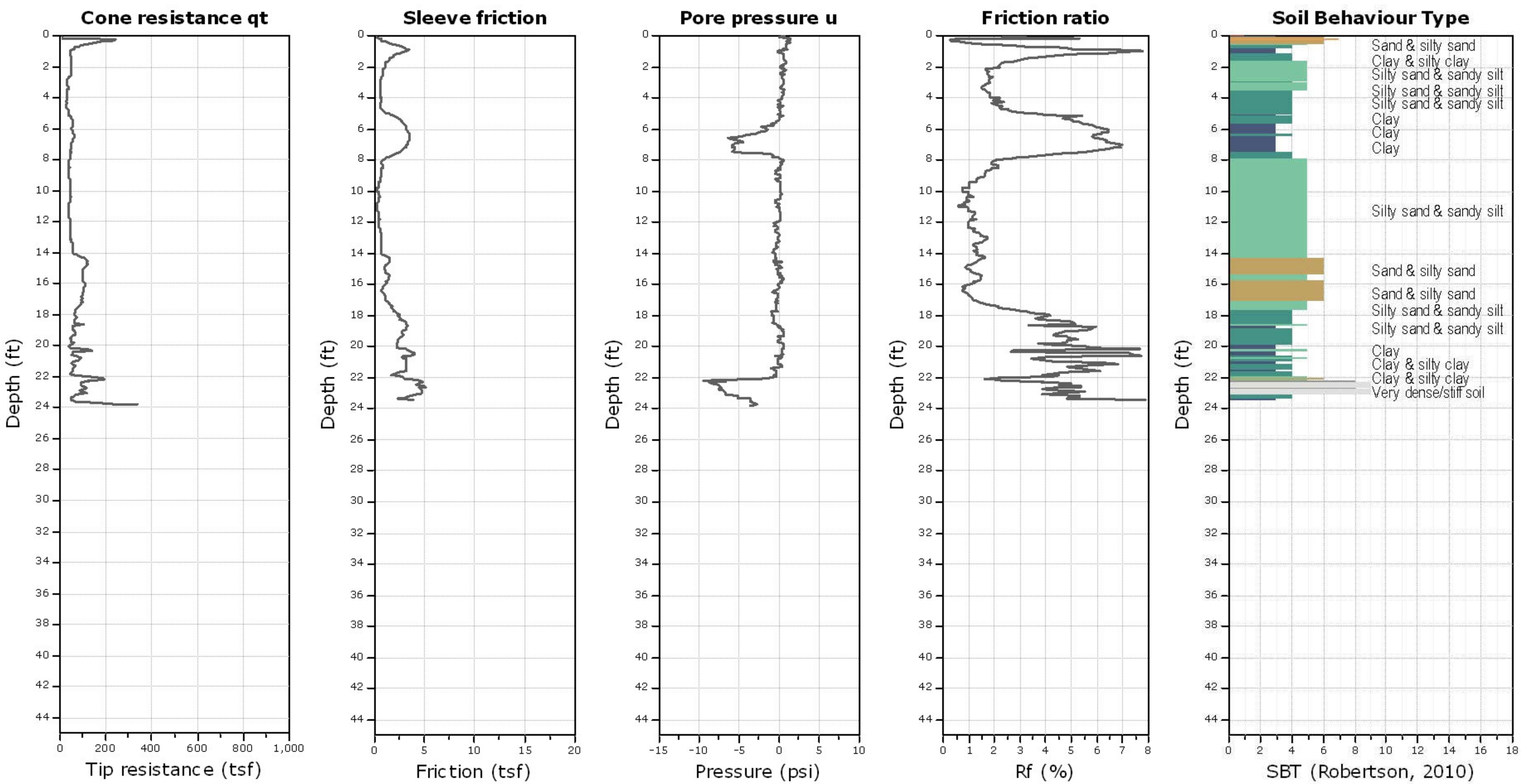
CPT-2

Project: Converse Consultants/Mount San Antonio College (Lot S)
Location: 1100 N. Grand Ave Walnut, CA

Total depth: 23.82 ft, Date: 9/6/2017
Cone Type: Vertek



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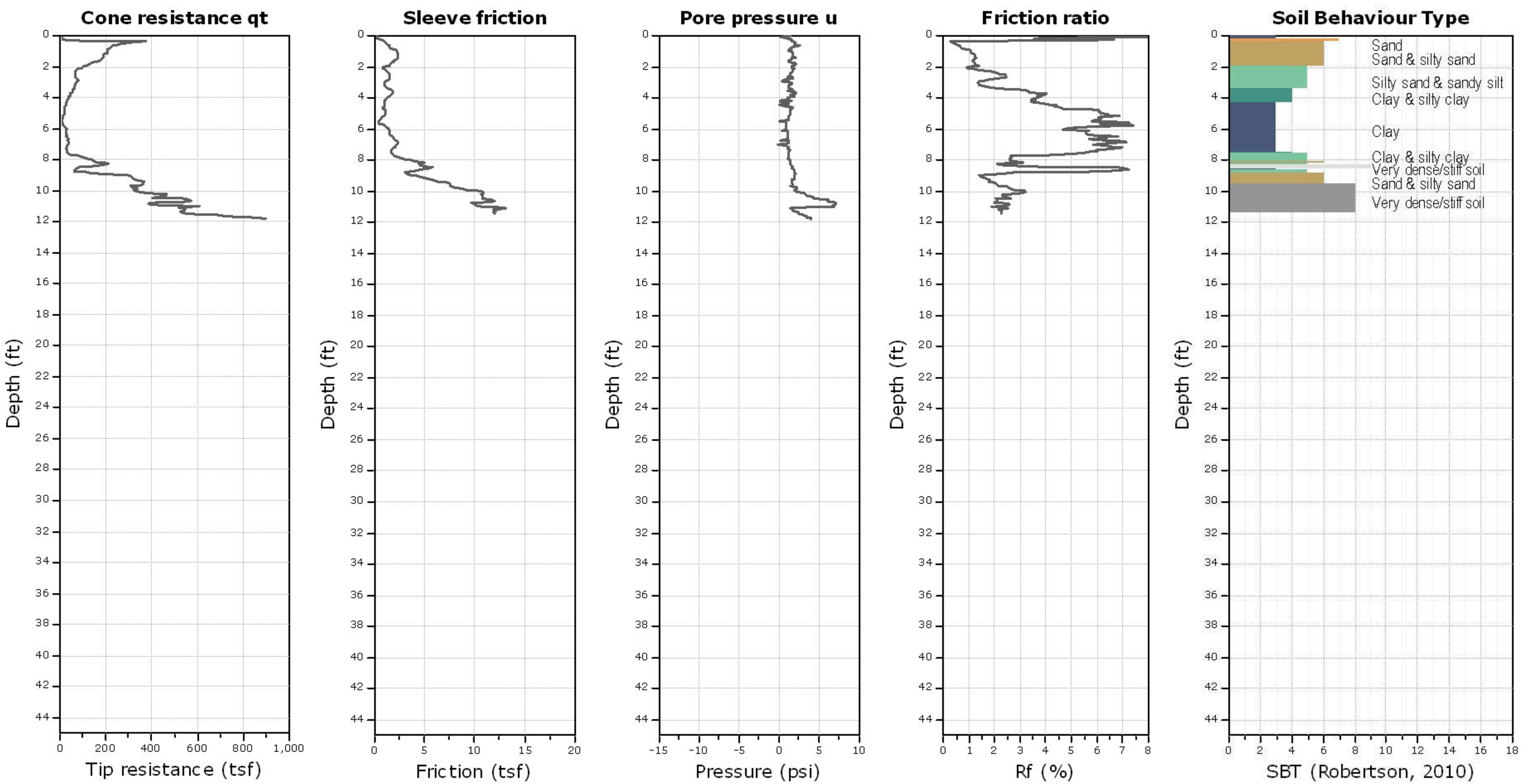
CPT-3

Project: Converse Consultants/Mount San Antonio College (Lot S)
Location: 1100 N. Grand Ave Walnut, CA

Total depth: 11.82 ft, Date: 9/8/2017
Cone Type: Vertek



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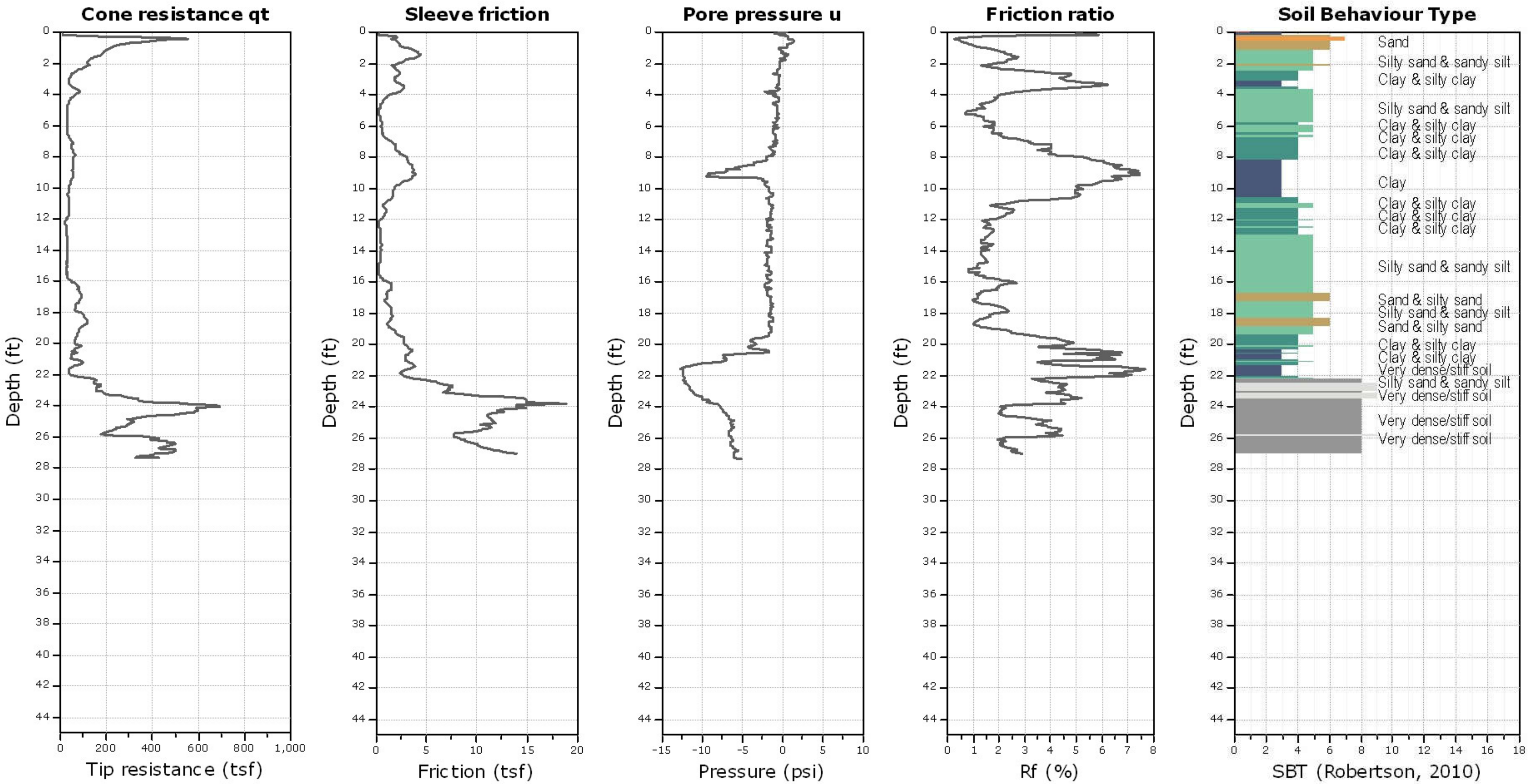
CPT-4

Project: **Converse Consultants/Mount San Antonio College (Lot S)**

Location: **1100 N. Grand Ave Walnut, CA**

Total depth: 27.37 ft, Date: 9/7/2017

Cone Type: Vertek



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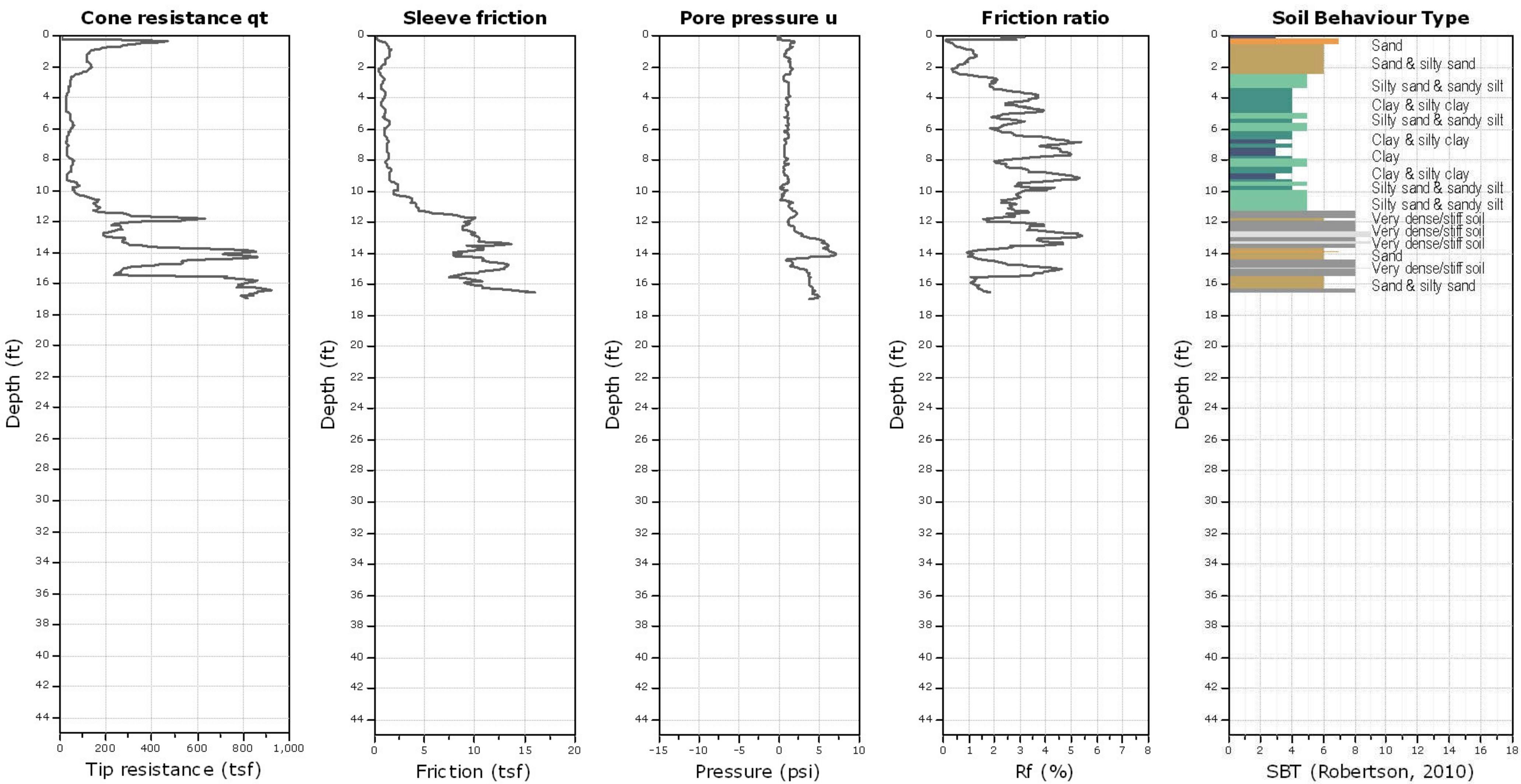
CPT-5

Project: **Converse Consultants/Mount San Antonio College (Lot S)**
Location: **1100 N. Grand Ave Walnut, CA**

Total depth: 16.94 ft, Date: 9/6/2017
Cone Type: Vertek



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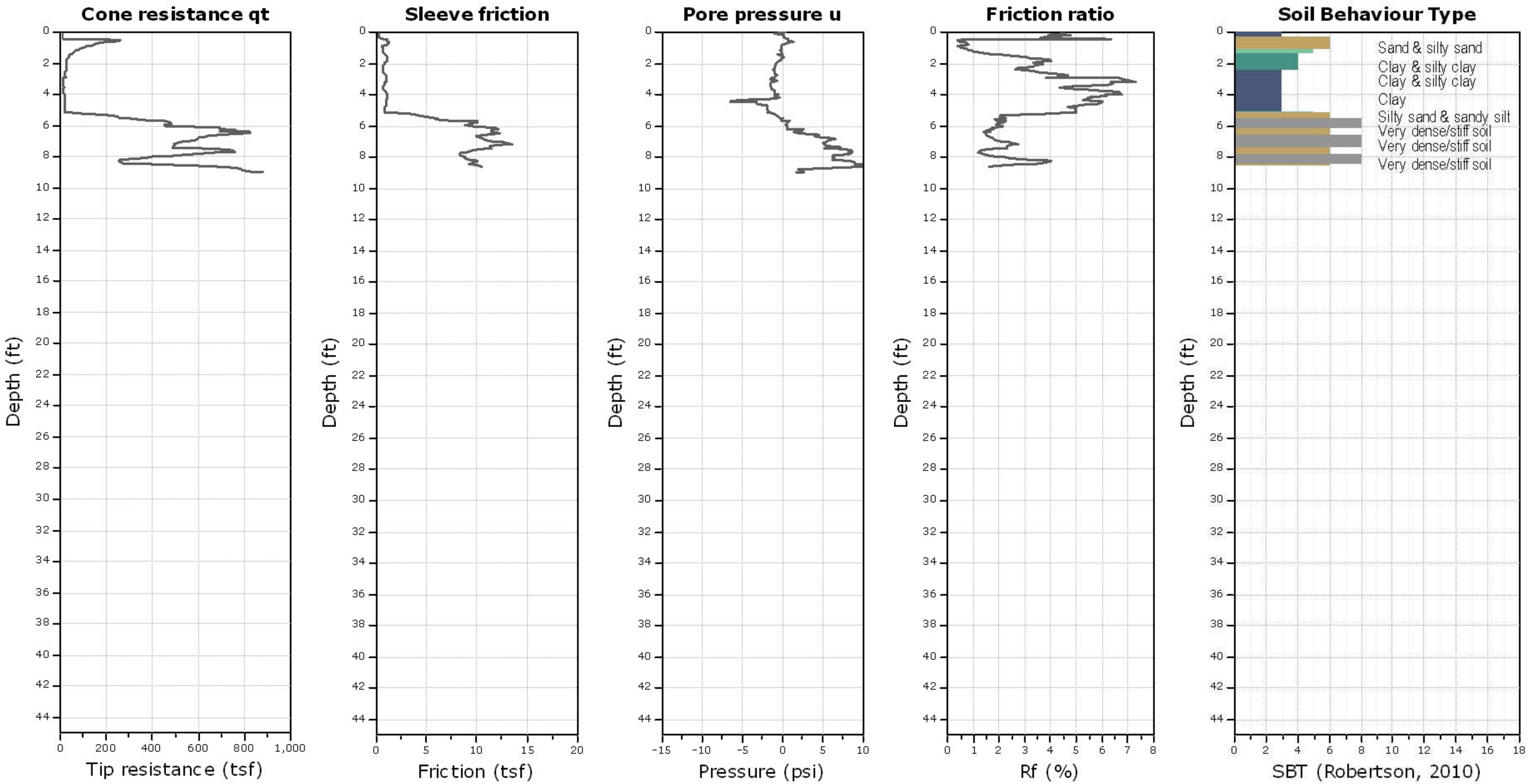
CPT-6

Project: **Converse Consultants/Mount San Antonio College (Lot S)**
Location: **1100 N. Grand Ave Walnut, CA**

Total depth: 8.99 ft, Date: 9/8/2017
Cone Type: Vertek



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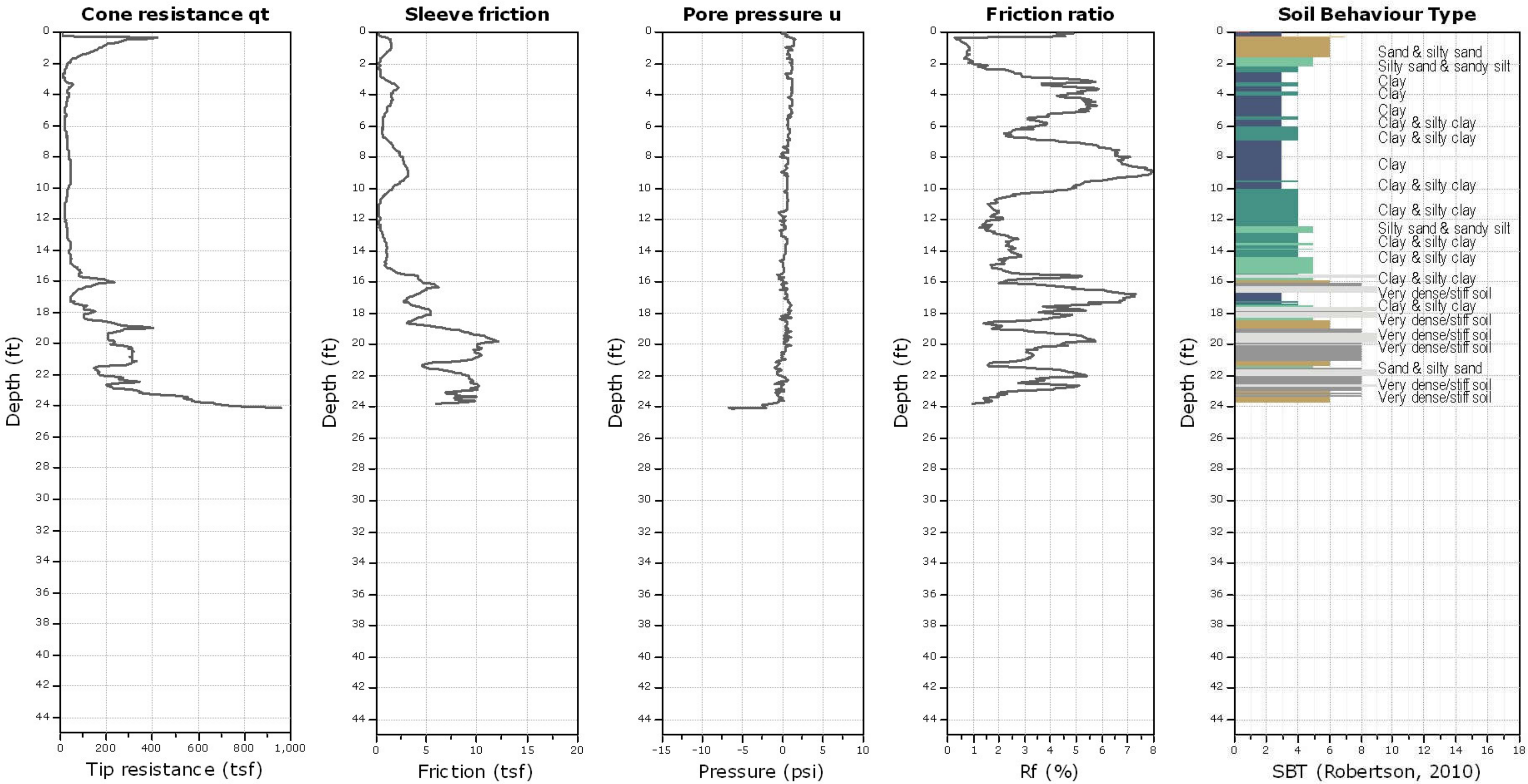
CPT-7

Project: **Converse Consultants/Mount San Antonio College (Lot S)**
Location: **1100 N. Grand Ave Walnut, CA**

Total depth: 24.15 ft, Date: 9/7/2017
Cone Type: Vertek



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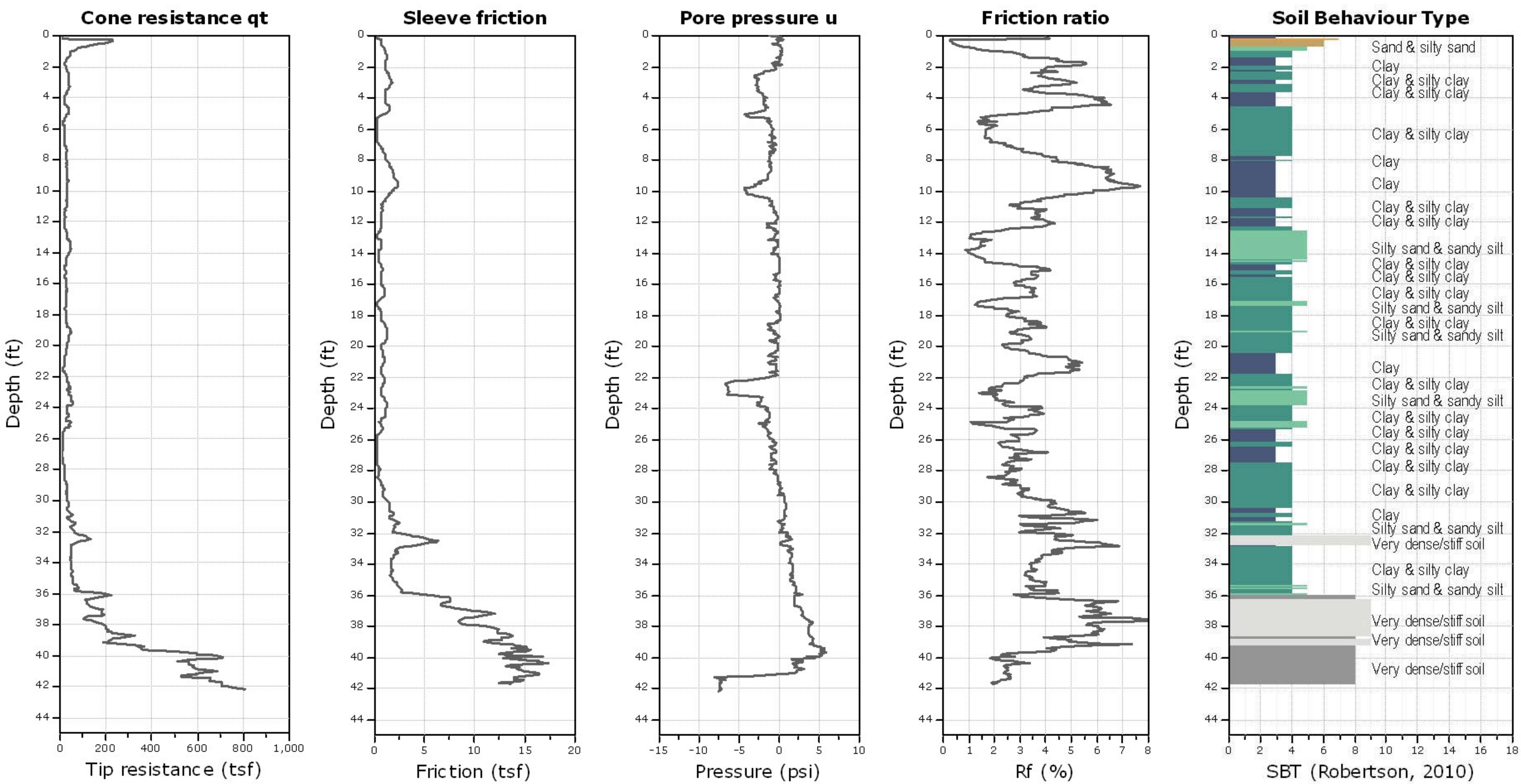
CPT-8

Project: **Converse Consultants/Mount San Antonio College (Lot S)**
Location: **1100 N. Grand Ave Walnut, CA**

Total depth: 42.13 ft, Date: 9/7/2017
Cone Type: Vertek



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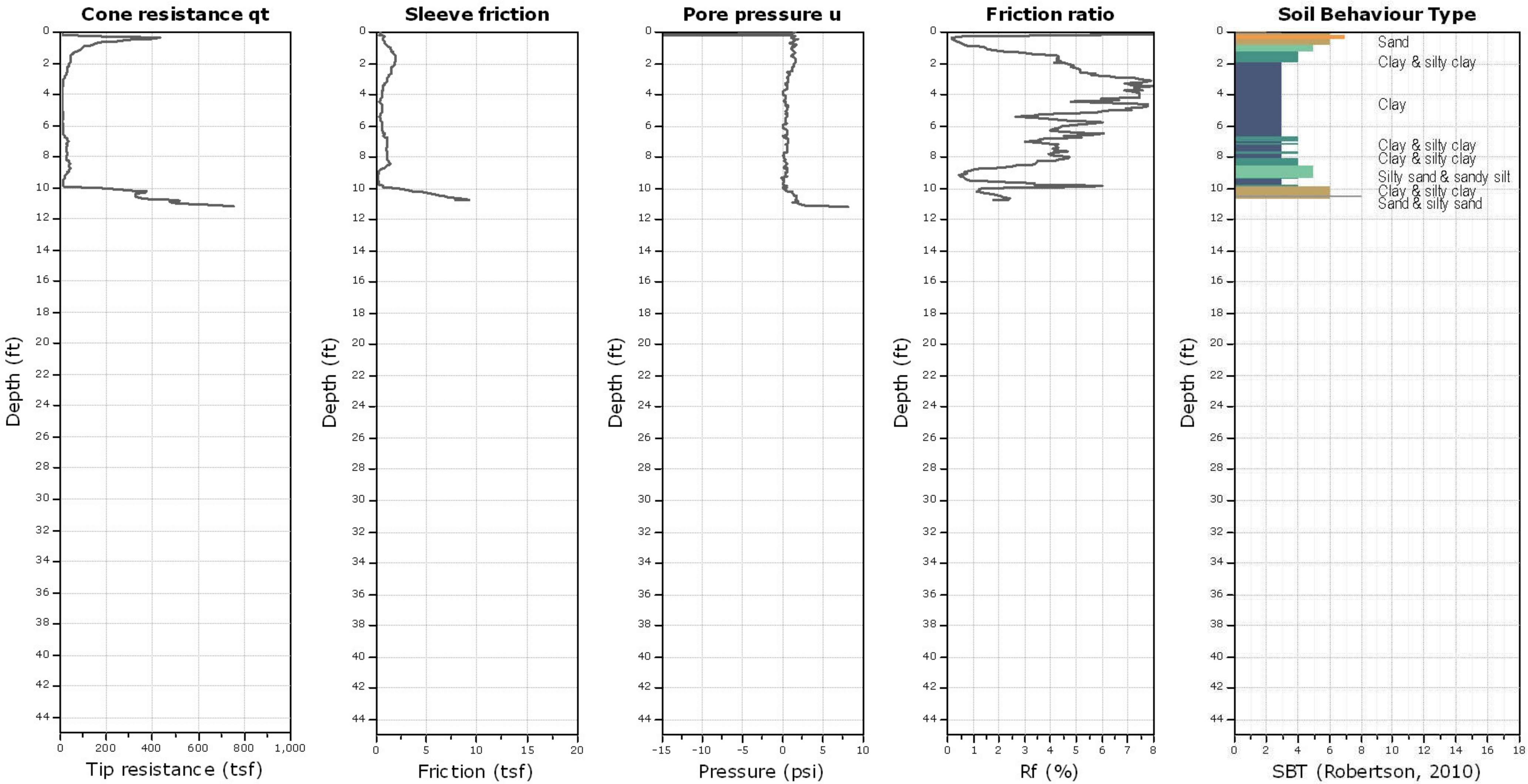
CPT-9

Project: Converse Consultants/Mount San Antonio College (Lot S)
Location: 1100 N. Grand Ave Walnut, CA

Total depth: 11.16 ft, Date: 9/8/2017
Cone Type: Vertek



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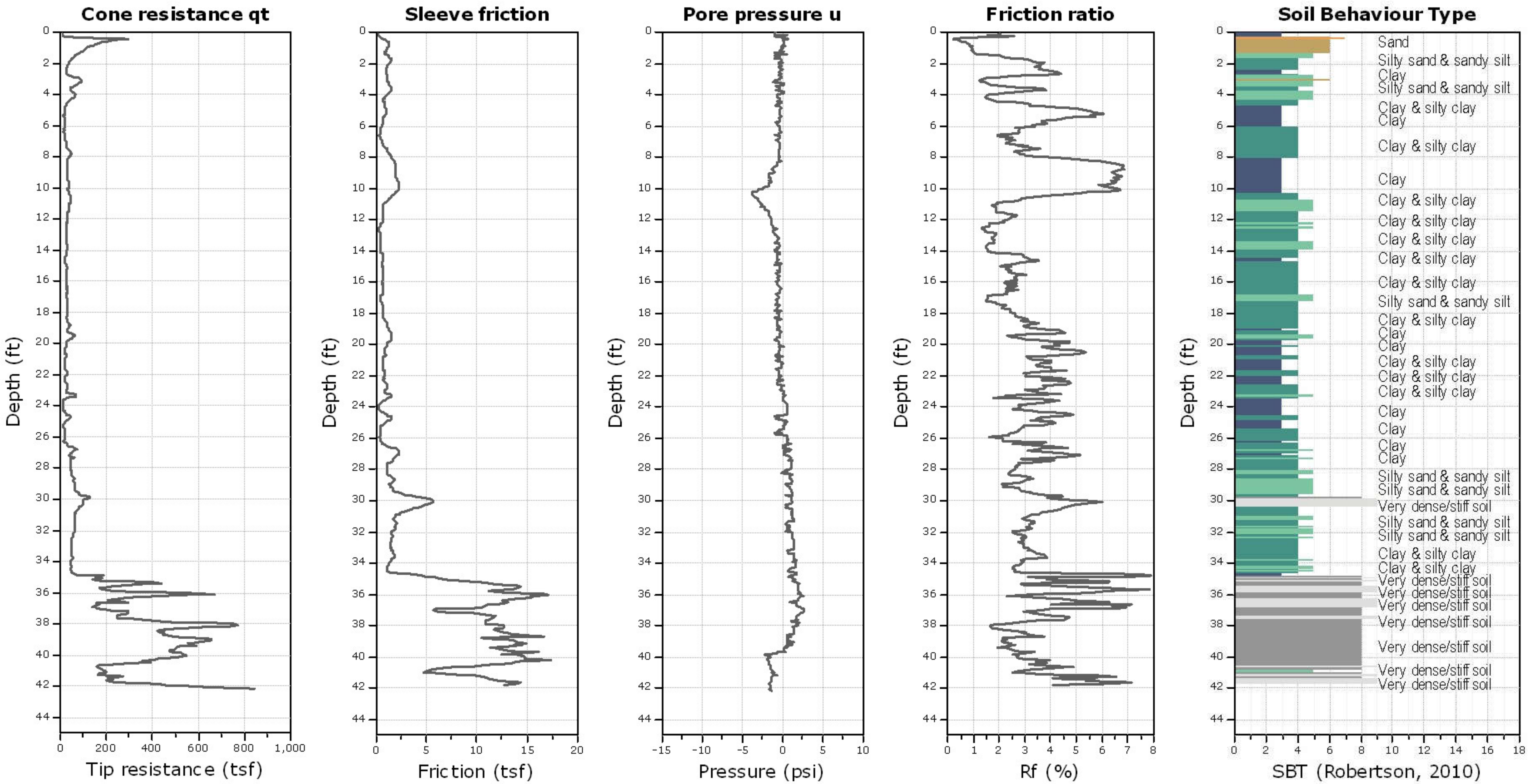
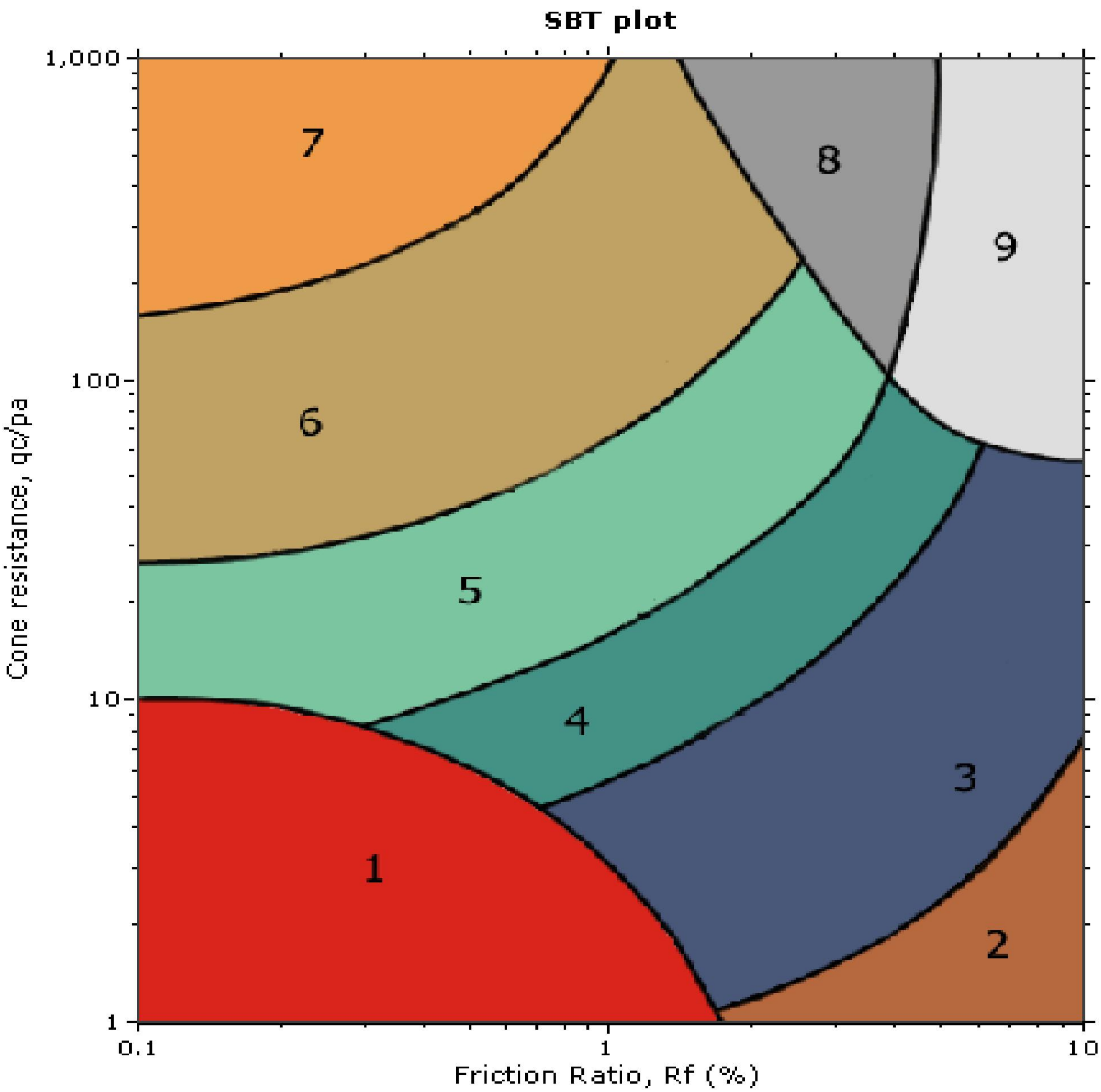
CPT-10

Project: **Converse Consultants/Mount San Antonio College (Lot S)**

Location: **1100 N. Grand Ave Walnut, CA**

Total depth: 42.13 ft, Date: 9/7/2017
Cone Type: Vertek





SBT legend

- 1. Sensitive fine grained
- 2. Organic material
- 3. Clay to silty clay
- 4. Clayey silt to silty clay
- 5. Silty sand to sandy silt
- 6. Clean sand to silty sand
- 7. Gravely sand to sand
- 8. Very stiff sand to clayey sand
- 9. Very stiff fine grained

	CPT-1	In situ data										Basic output data													
Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	37.59	1.78	0.51	-0.19	37.6	4.72	4	2.7	123.32	0.06	0	0.06	608.41	4.73	0	9	0.68	6.99	2.18	247.88	0.6	20.76	3
2	94.3	1.67	-0.19	0.03	94.3	1.77	5	2.11	125.12	0.12	0	0.12	757.62	1.77	0	6	0.54	3.17	1.79	281.74	-0.11	51.19	7
3	41.25	1.46	-0.1	0.48	41.25	3.54	4	2.58	122.12	0.19	0	0.19	221.72	3.56	0	8	0.71	3.42	2.23	132.6	-0.04	26.3	5
4	29.03	0.84	-0.06	0.55	29.03	2.88	4	2.64	117.17	0.24	0	0.24	118.06	2.9	0	5	0.74	2.95	2.3	80.14	-0.02	29.79	5
5	33	1.25	-0.1	0.63	33	3.8	4	2.67	120.45	0.3	0	0.3	107.51	3.83	0	4	0.77	2.62	2.39	80.98	-0.02	23.92	5
6	48.66	0.94	-0.19	0.65	48.66	1.93	5	2.35	119.29	0.36	0	0.36	132.77	1.95	0	5	0.68	2.06	2.13	93.98	-0.04	41.12	7
7	25.69	0.63	-0.39	0.43	25.68	2.44	4	2.63	114.77	0.42	0	0.42	59.98	2.48	0	5	0.78	2.06	2.4	49.19	-0.07	30.83	5
8	35.71	0.42	-0.39	0.22	35.71	1.17	5	2.33	112.6	0.48	0	0.48	73.81	1.19	0	5	0.69	1.73	2.14	57.62	-0.06	48.89	7
9	26	0.73	-0.47	0.33	26	2.81	4	2.67	115.92	0.54	0	0.54	47.56	2.87	0	4	0.83	1.75	2.49	42.22	-0.06	27.31	5
10	85	2.72	-0.2	0.5	85	3.19	5	2.33	128.42	0.6	0	0.6	140.76	3.22	0	5	0.72	1.51	2.22	120.27	-0.02	28.51	5
11	102.97	4.8	0.1	0.5	102.97	4.67	9	2.4	133.06	0.67	0	0.67	153.56	4.7	0	9	0.76	1.42	2.31	137.6	0.01	20.61	3
12	83.23	4.91	0.41	0.37	83.23	5.9	9	2.54	132.7	0.73	0	0.73	112.62	5.95	0	9	0.82	1.35	2.46	105.55	0.04	16.56	3
13	131.37	7.41	0.48	0.22	131.38	5.64	9	2.4	136.83	0.8	0	0.8	163.06	5.68	0	9	0.79	1.24	2.35	153.58	0.04	17.36	3
14	175.75	7.31	3.14	0.71	175.79	4.16	8	2.22	137.28	0.87	0	0.87	201.18	4.18	0	8	0.73	1.15	2.19	190.65	0.26	23.15	5
15	100.46	0	-2.06	-0.28	100.43	0	0	0	87.36	0.91	0	0.91	108.98	0	0	0	1	1.16	4.06	108.98	-0.16	169.97	0

	CPT-2	In situ data										Basic output data											
Depth (ft)	**qc (tsf)**	**fs (tsf)**	**u (psi)**	**Other**	**qt (tsf)**	**Rf(%)**	**SBT**	**Ic SBT**	**ã (pcf)**	**ó,v (tsf)**	**u0 (tsf)**	**ó',vo (tsf)**	**Qt1**	**Fr (%)**	**Bq**	**SBTn**	**n**	**Cn**	**Ic**	**Qtn**	**U2**	**I(B)**	**Mod. SBTn**
1	40.2	2.19	-0.18	0.47	40.2	5.45	3	2.72	125.03	0.06	0	0.06	641.68	5.46	0	9	0.7	7.18	2.21	272.55	-0.2	18.12	3
2	48.35	1.15	0.38	0.47	48.35	2.38	5	2.41	120.75	0.12	0	0.12	392.23	2.38	0	5	0.62	3.83	2.01	174.68	0.22	38	7
3	29.14	0.63	0.58	0.41	29.14	2.15	4	2.56	115.08	0.18	0	0.18	160.58	2.16	0	5	0.68	3.36	2.17	91.84	0.23	37.9	7
4	28.82	0.52	0.39	0.47	28.83	1.81	4	2.51	113.71	0.24	0	0.24	120.5	1.83	0	5	0.69	2.8	2.17	75.78	0.12	41.16	7
5	38.12	1.36	0.19	0.43	38.12	3.56	4	2.61	121.39	0.3	0	0.3	126.92	3.59	0	5	0.75	2.59	2.33	92.44	0.05	25.49	5
6	50.33	3.03	-1.54	0.47	50.32	6.02	3	2.69	127.94	0.36	0	0.36	138	6.06	0	9	0.8	2.37	2.46	111.67	-0.31	16.29	3
7	47.72	2.92	-5.7	0.27	47.65	6.14	3	2.71	127.55	0.43	0	0.43	110.91	6.19	-0.01	9	0.82	2.12	2.51	94.56	-0.96	15.95	3
8	40.1	1.46	0.47	0.37	40.11	3.65	4	2.6	122.05	0.49	0	0.49	81.41	3.69	0	4	0.79	1.85	2.42	69.38	0.07	24.35	5
9	38.95	0.63	0.19	0.21	38.95	1.61	5	2.38	115.78	0.54	0	0.54	70.53	1.63	0	5	0.72	1.62	2.22	58.68	0.03	41.44	7
10	42.29	0.42	0.19	0.36	42.3	0.99	5	2.23	113.02	0.6	0	0.6	69.36	1	0	5	0.68	1.47	2.1	57.82	0.02	53.01	7
11	34.88	0.42	-0.15	0.3	34.88	1.2	5	2.34	112.55	0.66	0	0.66	52.05	1.22	0	5	0.73	1.42	2.23	45.8	-0.02	44.32	7
12	42.82	0.52	-0.23	0.41	42.81	1.22	5	2.28	114.68	0.71	0	0.71	58.89	1.24	0	5	0.72	1.32	2.19	52.7	-0.02	46.32	7
13	42.29	0.63	-0.19	0.19	42.29	1.48	5	2.33	115.98	0.77	0	0.77	53.73	1.51	0	5	0.75	1.26	2.26	49.63	-0.02	41.15	7
14	56.7	1.04	-0.58	0.18	56.7	1.84	5	2.29	120.44	0.83	0	0.83	67.07	1.87	0	5	0.74	1.19	2.24	63.07	-0.05	38.89	7
15	100.98	1.46	-0.36	0.35	100.98	1.45	5	2.03	124.31	0.9	0	0.9	111.81	1.46	0	6	0.66	1.12	2	105.54	-0.03	51.54	7
16	107.04	1.25	-0.1	0.38	107.04	1.17	6	1.95	123.32	0.96	0	0.96	110.87	1.18	0	6	0.63	1.07	1.94	106.85	-0.01	59.55	7
17	91.06	1.25	-0.21	0.38	91.06	1.38	5	2.05	122.93	1.02	0	1.02	88.42	1.39	0	5	0.68	1.03	2.05	87.34	-0.01	50.81	7
18	60.05	2.4	-0.87	0.14	60.04	4	4	2.5	126.67	1.08	0	1.08	54.51	4.07	0	4	0.86	0.98	2.52	54.68	-0.06	22.09	5
19	56.5	3.03	0.4	0.48	56.5	5.36	4	2.61	128.22	1.15	0	1.15	48.32	5.47	0	4	0.91	0.93	2.65	48.65	0.03	17.45	3
20	38.95	2.51	0.48	0.49	38.96	6.43	3	2.78	125.93	1.21	0	1.21	31.23	6.64	0	3	0.99	0.88	2.84	31.28	0.03	14.87	3
21	58.37	2.82	-0.16	0.12	58.37	4.83	4	2.57	127.77	1.27	0	1.27	44.87	4.94	0	4	0.91	0.84	2.63	45.59	-0.01	18.84	3
22	146.09	3.45	-1.57	0.21	146.07	2.36	5	2.08	131.48	1.34	0	1.34	108.14	2.38	0	5	0.72	0.84	2.13	115.38	-0.08	36.37	7
23	106.72	1.98	-6.66	-0.04	106.64	1.86	5	2.09	126.67	1.4	0	1.4	75.09	1.89	0	5	0.74	0.81	2.16	80.77	-0.34	40.84	7

Depth (ft)	CPT-3 qc (tsf)	In situ data fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	Basic output data ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	203.63	1.57	1.18	0.9	203.65	0.77	6	1.62	126.52	0.06	0	0.06	3216.1	0.77	0	6	0.36	2.78	1.33	534.11	1.34	113.13	7
2	101.92	1.78	1.87	1.05	101.94	1.74	5	2.08	125.75	0.13	0	0.13	806.68	1.74	0	6	0.53	3.09	1.77	297.38	1.06	52.23	7
3	72.37	1.67	1.05	1.02	72.38	2.31	5	2.28	124.47	0.19	0	0.19	383.41	2.31	0	6	0.61	2.87	1.97	196.04	0.4	39.34	7
4	34.57	1.46	1.15	1.03	34.58	4.23	4	2.69	121.69	0.25	0	0.25	137.77	4.26	0	9	0.76	3.02	2.37	97.83	0.33	22.16	5
5	17.02	0.73	1.33	1.12	17.04	4.29	3	2.92	114.89	0.31	0	0.31	54.56	4.37	0.01	4	0.85	2.88	2.6	45.5	0.31	20.65	3
6	27.26	1.04	0.87	1.24	27.27	3.83	4	2.74	118.65	0.37	0	0.37	73.49	3.88	0	4	0.81	2.36	2.48	60.1	0.17	23.11	5
7	37.18	1.98	0.03	1.26	37.18	5.34	3	2.74	124.1	0.43	0	0.43	85.84	5.4	0	9	0.83	2.12	2.53	73.75	0.01	17.89	3
8	133.88	2.72	1.45	1.19	133.89	2.03	5	2.05	129.52	0.49	0	0.49	270.75	2.04	0	6	0.61	1.59	1.92	200.36	0.21	44.03	7
9	279.45	5.43	1.83	0.71	279.47	1.94	6	1.84	136.39	0.56	0	0.56	497.21	1.95	0	6	0.55	1.41	1.76	372.68	0.24	48.1	7
10	322.16	9.09	2.1	0.5	322.18	2.82	8	1.94	137.28	0.63	0	0.63	510.7	2.83	0	8	0.59	1.36	1.88	413.78	0.24	34.2	7
11	593.88	9.29	5.57	0.55	593.95	1.56	6	1.59	137.28	0.7	0	0.7	849.53	1.57	0	6	0.47	1.22	1.55	682.73	0.57	60.79	7
12	84.9	0	3.89	0.05	84.95	0	0	0	87.36	0.74	0	0.74	113.48	0	0	0	1	1.43	4.06	113.48	0.38	176.4	0

Depth (ft)	CPT-4 qc (tsf)	In situ data fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	Basic output data ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	219.61	2.72	-0.4	1.49	219.61	1.24	6	1.75	130.73	0.07	0	0.07	3356.5	1.24	0	6	0.41	3.15	1.47	653.98	-0.44	75.56	7
2	116.65	3.34	-0.29	1.58	116.64	2.86	5	2.2	130.71	0.13	0	0.13	890.73	2.87	0	8	0.58	3.37	1.9	371.58	-0.16	33.6	7
3	40	2.4	-0.46	1.61	39.99	6.01	3	2.75	125.68	0.19	0	0.19	205.69	6.04	0	9	0.77	3.72	2.4	139.73	-0.17	16.39	3
4	69.13	1.78	-0.9	1.64	69.12	2.57	5	2.32	124.8	0.26	0	0.26	269.08	2.58	0	5	0.65	2.5	2.06	162.79	-0.25	35.29	7
5	28.3	0.42	-0.77	1.72	28.29	1.48	5	2.47	112.04	0.31	0	0.31	89.68	1.49	0	5	0.69	2.34	2.18	61.79	-0.18	44.25	7
6	29.14	0.52	-0.84	1.8	29.12	1.79	4	2.51	113.74	0.37	0	0.37	77.95	1.82	0	5	0.73	2.15	2.26	58.42	-0.16	38.86	7
7	45.22	1.25	-1.15	1.9	45.2	2.77	4	2.48	121.22	0.43	0	0.43	104.24	2.8	0	5	0.74	1.95	2.28	82.34	-0.19	30.73	5
8	59.63	2.72	-1.87	1.98	59.61	4.56	4	2.55	127.55	0.49	0	0.49	119.87	4.59	0	9	0.78	1.82	2.38	101.46	-0.27	20.79	3
9	52	3.24	-9.05	2.01	51.89	6.24	3	2.69	128.5	0.56	0	0.56	92.09	6.31	-0.01	9	0.85	1.72	2.55	83.44	-1.17	15.67	3
10	34.15	2.19	-1.64	2.07	34.13	6.43	3	2.82	124.63	0.62	0	0.62	54.06	6.54	0	3	0.9	1.62	2.69	51.38	-0.19	15.11	3
11	37.8	1.25	-1.64	2.11	37.78	3.32	4	2.59	120.78	0.68	0	0.68	54.55	3.38	0	4	0.83	1.44	2.49	50.59	-0.17	25.15	5
12	25.38	0.63	-1.39	1.96	25.36	2.47	4	2.64	114.74	0.74	0	0.74	33.38	2.54	0	4	0.86	1.36	2.55	31.71	-0.14	27.68	5
13	26.84	0.42	-1.54	1.76	26.82	1.56	5	2.5	111.91	0.79	0	0.79	32.8	1.6	0	5	0.82	1.26	2.44	31.11	-0.14	34.28	7
14	32.69	0.52	-1.35	1.9	32.67	1.6	5	2.44	114.02	0.85	0	0.85	37.41	1.64	0	5	0.8	1.19	2.39	35.83	-0.11	35.58	7
15	28.09	0.42	-1.71	1.96	28.07	1.49	5	2.48	112.02	0.91	0	0.91	29.96	1.54	0	5	0.83	1.14	2.45	29.17	-0.14	34.1	7
16	47.31	0.63	-1.69	2.05	47.28	1.33	5	2.26	116.26	0.96	0	0.96	48.02	1.35	0	5	0.75	1.07	2.25	46.93	-0.13	42.65	7
17	87.61	1.15	-1.54	2.13	87.6	1.31	5	2.05	122.19	1.03	0	1.03	84.39	1.33	0	5	0.68	1.02	2.05	83.56	-0.11	51.73	7
18	78.74	1.36	-1.63	2.15	78.72	1.72	5	2.16	123.16	1.09	0	1.09	71.4	1.75	0	5	0.73	0.98	2.18	71.93	-0.11	41.85	7
19	86.05	1.78	-1.48	2.21	86.03	2.06	5	2.19	125.34	1.15	0	1.15	73.81	2.09	0	5	0.75	0.94	2.22	75.37	-0.09	37.5	7
20	64.43	2.92	-3.5	2.13	64.39	4.54	4	2.52	128.28	1.21	0	1.21	52.03	4.63	0	4	0.89	0.89	2.57	52.85	-0.21	19.98	3
21	52.84	3.03	-7.14	2.23	52.75	5.74	3	2.66	128.05	1.28	0	1.28	40.27	5.88	-0.01	3	0.95	0.84	2.72	40.67	-0.4	16.38	3
22	41.88	4.59	-12.35	2.19	41.72	11.01	3	2.94	130.53	1.34	0	1.34	30.06	11.38	-0.02	3	1	0.79	3.02	30.06	-0.66	9.72	2
23	159.15	10.13	-11.28	2.09	159.01	6.37	9	2.4	137.28	1.41	0	1.41	111.62	6.43	-0.01	9	0.86	0.78	2.47	116.33	-0.58	15.45	3
24	686.19	13.58	-7.73	2.43	686.1	1.98	8	1.65	137.28	1.48	0	1.48	462.37	1.98	0	8	0.56	0.83	1.69	535.44	-0.38	48.19	7
25	317.04	9.92	-6.46	2.63	316.96	3.13	8	1.98	137.28	1.55	0	1.55	203.58	3.15	0	8	0.7	0.76	2.05	227.98	-0.3	30.24	5
26	383.98	8.98	-6.37	2.43	383.9	2.34	8	1.83	137.28	1.62	0	1.62	236.27	2.35	0	6	0.65	0.76	1.9	274.25	-0.28	39.8	7
27	470.03	0	-5.98	2.69	469.95	0	0	0	87.36	1.66	0	1.66	281.81	0	0	0	1	0.64	4.06	281.81	-0.26	416.87	0

	CPT-5	In situ data											Basic output data											
Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	137.01	1.25	0.92	-0.44	137.02	0.91	6	1.8	123.92	0.06	0	0.06	2208.9	0.91	0	6	0.41	3.18	1.46	411.72	1.07	94.41	7
2	134.29	1.04	1.45	-0.28	134.31	0.78	6	1.76	122.54	0.12	0	0.12	1088.2	0.78	0	6	0.42	2.47	1.48	313.2	0.85	103.02	7
3	41.35	0.84	0.97	-0.22	41.37	2.02	5	2.42	118.03	0.18	0	0.18	226.06	2.03	0	5	0.65	3.11	2.06	121.1	0.39	41.53	7
4	25.27	0.94	0.9	-0.37	25.28	3.72	4	2.75	117.7	0.24	0	0.24	103.88	3.75	0	4	0.78	3.15	2.4	74.54	0.27	24.17	5
5	35.92	1.04	0.97	-0.34	35.93	2.91	4	2.57	119.32	0.3	0	0.3	118.48	2.93	0	5	0.73	2.52	2.29	84.79	0.23	29.76	5
6	49.71	1.46	1.03	-0.4	49.72	2.94	4	2.47	122.58	0.36	0	0.36	136.31	2.96	0	5	0.72	2.16	2.24	100.9	0.2	30.07	5
7	28.93	1.36	0.68	-0.41	28.93	4.69	3	2.78	120.72	0.42	0	0.42	67.49	4.76	0	4	0.84	2.17	2.55	58.35	0.12	19.65	3
8	54.72	1.46	0.85	-0.34	54.73	2.67	5	2.41	122.81	0.48	0	0.48	112.14	2.7	0	5	0.73	1.76	2.24	90.49	0.13	32.02	5
9	31.22	1.88	0.9	-0.3	31.23	6.02	3	2.83	123.28	0.55	0	0.55	56.27	6.12	0	3	0.89	1.81	2.66	52.35	0.12	15.96	3
10	59.84	2.92	0.96	-0.08	59.85	4.89	4	2.57	128.1	0.61	0	0.61	97.19	4.94	0	9	0.81	1.56	2.45	87.6	0.11	19.43	3
11	161.86	5.43	1.29	-0.98	161.88	3.35	8	2.17	135.06	0.68	0	0.68	238.08	3.37	0	8	0.68	1.35	2.09	206.4	0.14	28.28	5
12	396.41	9.09	1.09	-0.2	396.42	2.29	8	1.82	137.28	0.75	0	0.75	530.56	2.3	0	8	0.56	1.22	1.78	455.24	0.11	41.71	7
13	241.85	10.23	3.86	0.26	241.9	4.23	8	2.15	137.28	0.81	0	0.81	296.09	4.24	0	8	0.7	1.2	2.12	273.37	0.34	23.03	5
14	769.52	11.38	7.08	0.95	769.61	1.48	6	1.52	137.28	0.88	0	0.88	870.67	1.48	0	6	0.46	1.09	1.5	790.26	0.58	64.53	7
15	283.94	11.59	2.74	1.34	283.97	4.08	8	2.11	137.28	0.95	0	0.95	297.42	4.1	0	8	0.69	1.08	2.09	287.86	0.21	23.85	5
16	793.12	6.37	3.77	1.42	793.17	0.8	7	1.27	137.28	1.02	0	1.02	776.4	0.8	0	7	0.38	1.01	1.27	759.14	0.27	113.03	7
17	86.67	0	-1.97	0.69	86.65	0	0	0	87.36	1.06	0	1.06	80.44	0	0	0	1	0.99	4.06	80.44	-0.13	129.2	0

	CPT-6	In situ data										Basic output data											
Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	99.83	1.15	-0.19	0.49	99.83	1.15	6	1.97	122.51	0.06	0	0.06	1627.6	1.15	0	6	0.46	3.66	1.58	345.28	-0.22	75.99	7
2	24.02	0.94	-0.76	0.49	24.01	3.91	3	2.78	117.57	0.12	0	0.12	198.87	3.93	0	8	0.73	4.95	2.31	111.7	-0.46	23.89	5
3	13.89	0.84	-1.42	0.7	13.87	6.02	3	3.09	115.37	0.18	0	0.18	77.08	6.1	-0.01	3	0.86	4.62	2.62	59.76	-0.58	16.05	3
4	17.02	0.84	-0.6	0.53	17.01	4.91	3	2.96	115.87	0.24	0	0.24	71.21	4.98	0	4	0.84	3.54	2.58	56.15	-0.18	18.92	3
5	16.81	3.24	-1.82	0.85	16.79	19.28	3	3.38	125.75	0.3	0	0.3	55.24	19.63	-0.01	3	1	3.54	3.05	55.24	-0.44	5.65	2
6	453.95	8.25	0.53	1.13	453.95	1.82	6	1.7	137.28	0.37	0	0.37	1235.2	1.82	0	8	0.48	1.66	1.6	711.07	0.1	52.89	7
7	544.48	9.71	5.57	1.16	544.55	1.78	8	1.66	137.28	0.44	0	0.44	1248.2	1.78	0	8	0.47	1.52	1.58	782.04	0.92	54.03	7
8	416.77	6.47	6.37	1.63	416.85	1.55	6	1.66	137.28	0.5	0	0.5	825.47	1.56	0	6	0.48	1.42	1.59	560.61	0.91	60.59	7
9	34.36	0	1.38	0.08	34.37	0	0	0	87.36	0.55	0	0.55	61.72	0	0	0	1	1.93	4.06	61.72	0.18	102.45	0

	CPT-7	In situ data										Basic output data												
Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	173.14	1.04	0.83	1.06	173.15	0.6	6	1.61	123.16	0.06	0	0.06	2809	0.6	0	7	0.35	2.68	1.3	438.22	0.97	134.04	7
2	34.04	0.42	0.99	0.87	34.06	1.23	5	2.36	112.49	0.12	0	0.12	287.85	1.23	0	6	0.59	3.64	1.92	116.86	0.6	59.33	7
3	16.08	1.04	0.8	0.91	16.09	6.49	3	3.06	117.36	0.18	0	0.18	90.21	6.56	0	9	0.85	4.6	2.61	69.12	0.33	15.11	3
4	33.63	1.88	1.07	1.01	33.64	5.59	3	2.78	123.46	0.24	0	0.24	140.22	5.63	0	9	0.79	3.27	2.45	103.15	0.32	17.39	3
5	20.36	1.15	1.06	1.08	20.38	5.64	3	2.94	118.64	0.3	0	0.3	67.48	5.72	0	4	0.86	2.98	2.62	56.6	0.26	16.91	3
6	17.65	0.63	0.77	1.11	17.66	3.55	3	2.86	113.85	0.35	0	0.35	48.81	3.62	0	4	0.85	2.52	2.57	41.22	0.16	23.36	5
7	28.4	1.15	0.66	1.25	28.41	4.04	4	2.74	119.45	0.41	0	0.41	67.58	4.1	0	4	0.82	2.17	2.51	57.35	0.11	22.06	5
8	36.97	2.4	-0.09	1.36	36.97	6.5	3	2.8	125.49	0.48	0	0.48	76.52	6.58	0	9	0.87	2	2.61	68.84	-0.01	15.07	3
9	39.79	2.72	0.35	1.37	39.79	6.82	3	2.79	126.56	0.54	0	0.54	72.66	6.92	0	9	0.88	1.81	2.64	67.04	0.05	14.43	3
10	33.1	1.67	0.49	1.44	33.11	5.05	3	2.76	122.56	0.6	0	0.6	54.04	5.14	0	4	0.88	1.64	2.62	50.4	0.06	18.36	3
11	21.09	0.42	0.58	1.6	21.1	1.98	4	2.65	111.32	0.66	0	0.66	31.11	2.04	0	4	0.84	1.49	2.53	28.87	0.06	30.14	5
12	20.47	0.31	0.21	1.61	20.47	1.53	4	2.6	109.14	0.71	0	0.71	27.76	1.59	0	5	0.84	1.39	2.5	26.01	0.02	32.37	7
13	30.7	0.63	-0.19	1.66	30.7	2.04	4	2.52	115.2	0.77	0	0.77	38.91	2.09	0	5	0.82	1.3	2.45	36.74	-0.02	31.81	5
14	38.12	0.94	0.39	1.87	38.12	2.47	4	2.5	118.7	0.83	0	0.83	45	2.52	0	5	0.82	1.22	2.45	43.09	0.03	29.73	5
15	56.6	1.98	0.06	2.19	56.6	3.51	4	2.48	125.13	0.89	0	0.89	62.51	3.56	0	4	0.82	1.15	2.45	60.65	0	24.7	5
16	220.97	4.18	0.32	1.63	220.97	1.89	6	1.89	133.9	0.96	0	0.96	229.6	1.9	0	6	0.61	1.06	1.87	220.88	0.02	47.18	7
17	46.89	4.49	0.56	0.87	46.89	9.58	3	2.86	130.65	1.02	0	1.02	44.81	9.79	0	3	0.99	1.03	2.86	44.8	0.04	10.78	3
18	136.9	3.97	0.82	1	136.91	2.9	5	2.16	132.35	1.09	0	1.09	124.65	2.92	0	5	0.73	0.98	2.17	125.65	0.05	31.03	5
19	393.69	5.85	0.66	0.61	393.7	1.49	6	1.66	137.28	1.16	0	1.16	338.89	1.49	0	6	0.54	0.95	1.67	353.25	0.04	60.92	7
20	224.21	11.07	0.75	1.02	224.21	4.94	9	2.23	137.28	1.23	0	1.23	181.74	4.96	0	9	0.77	0.89	2.26	188.07	0.04	19.74	3
21	312.76	9.19	-0.4	0.8	312.75	2.94	8	1.96	137.28	1.3	0	1.3	240.38	2.95	0	8	0.67	0.87	1.99	256.93	-0.02	32.24	7
22	171.37	7.83	-0.18	0.59	171.36	4.57	9	2.26	137.28	1.36	0	1.36	124.6	4.61	0	9	0.8	0.82	2.32	131.17	-0.01	20.94	3
23	329.05	10.13	0.04	1.02	329.05	3.08	8	1.97	137.28	1.43	0	1.43	228.65	3.09	0	8	0.69	0.81	2.02	251.45	0	30.85	5
24	769	0	-2.17	0.99	768.98	0	0	0	87.36	1.48	0	1.48	519.8	0	0	0	1	0.72	4.06	519.8	-0.11	756.86	0

	CPT-8	In situ data										Basic output data											
Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	50.75	0.94	0.21	0.02	50.75	1.85	5	2.33	119.4	0.06	0	0.06	848.63	1.85	0	6	0.56	4.94	1.85	236.87	0.25	48.49	7
2	23.81	1.25	-0.56	0.24	23.8	5.26	3	2.87	119.65	0.12	0	0.12	198.01	5.29	0	9	0.77	5.33	2.39	119.24	-0.34	18.44	3
3	34.04	1.36	-2.8	0.22	34.01	3.99	4	2.68	121.11	0.18	0	0.18	187.94	4.01	-0.01	9	0.73	3.66	2.3	117.12	-1.12	23.54	5
4	18.59	1.25	-1.72	0.23	18.57	6.75	3	3.03	119.05	0.24	0	0.24	76.5	6.84	-0.01	9	0.87	3.64	2.65	63.04	-0.52	14.58	3
5	35.61	1.15	-4	0.26	35.56	3.23	4	2.6	120	0.3	0	0.3	117.69	3.26	-0.01	5	0.75	2.56	2.32	85.45	-0.96	27.4	5
6	18.07	0.21	-0.83	0.24	18.06	1.16	4	2.58	105.87	0.35	0	0.35	50.21	1.18	0	5	0.74	2.25	2.29	37.69	-0.17	41.66	7
7	18.38	0.52	-0.63	0.37	18.37	2.84	4	2.79	112.62	0.41	0	0.41	43.93	2.91	0	4	0.83	2.21	2.54	37.55	-0.11	26.54	5
8	27.05	1.25	-1.26	0.37	27.03	4.64	3	2.8	119.96	0.47	0	0.47	56.67	4.72	0	4	0.86	2.01	2.59	50.51	-0.19	19.63	3
9	29.03	1.98	-1.45	0.39	29.01	6.84	3	2.89	123.5	0.53	0	0.53	53.69	6.97	0	3	0.91	1.87	2.72	50.47	-0.2	14.34	3
10	29.97	1.78	-4.08	0.33	29.92	5.93	3	2.84	122.76	0.59	0	0.59	49.55	6.05	-0.01	3	0.9	1.69	2.69	46.86	-0.5	16.08	3
11	27.78	0.84	-0.97	0.35	27.77	3.01	4	2.66	117.06	0.65	0	0.65	41.68	3.08	0	4	0.85	1.51	2.54	38.74	-0.11	25.74	5
12	17.23	0.63	-0.43	0.32	17.23	3.64	3	2.88	113.79	0.71	0	0.71	23.35	3.79	0	4	0.94	1.46	2.77	22.8	-0.04	20.96	3
13	30.81	0.52	-0.77	0.29	30.8	1.7	5	2.47	113.88	0.76	0	0.76	39.3	1.74	0	5	0.8	1.3	2.4	36.83	-0.07	34.94	7
14	39.37	0.63	-1.02	0.3	39.36	1.59	5	2.37	115.81	0.82	0	0.82	46.87	1.63	0	5	0.77	1.22	2.32	44.25	-0.09	38.22	7
15	20.05	0.63	0	0.3	20.05	3.13	4	2.78	114.16	0.88	0	0.88	21.8	3.27	0	4	0.94	1.19	2.75	21.56	0	22.47	5
16	25.9	0.84	0.06	0.34	25.9	3.23	4	2.71	116.89	0.94	0	0.94	26.62	3.35	0	4	0.92	1.12	2.69	26.36	0	22.98	5
17	25.17	0.84	-0.43	0.36	25.16	3.32	4	2.72	116.82	1	0	1	24.26	3.46	0	4	0.94	1.06	2.73	24.16	-0.03	22.25	5
18	25.38	0.73	0.1	0.29	25.38	2.88	4	2.68	115.87	1.05	0	1.05	23.08	3.01	0	4	0.93	1	2.71	23.07	0.01	23.73	5
19	43.44	1.04	-0.63	0.4	43.43	2.4	5	2.45	119.79	1.11	0	1.11	37.99	2.47	0	4	0.85	0.96	2.48	38.29	-0.04	29.36	5
20	30.81	1.04	-0.1	0.34	30.8	3.39	4	2.66	118.95	1.17	0	1.17	25.25	3.52	0	4	0.94	0.91	2.72	25.41	-0.01	22.19	5
21	17.65	0.84	-1.25	0.36	17.63	4.74	3	2.94	115.95	1.23	0	1.23	13.32	5.09	-0.01	3	1	0.86	3.04	13.32	-0.07	16.92	3
22	28.61	0.73	-1.34	0.41	28.6	2.56	4	2.61	116.16	1.29	0	1.29	21.17	2.68	0	4	0.94	0.83	2.7	21.43	-0.07	24.68	5
23	42.5	0.94	-6.4	0.33	42.42	2.22	5	2.44	118.96	1.35	0	1.35	30.45	2.29	-0.01	4	0.88	0.81	2.53	31.37	-0.34	29.18	5
24	30.08	1.04	-1.45	0.31	30.06	3.47	4	2.68	118.89	1.41	0	1.41	20.34	3.65	0	3	0.98	0.75	2.8	20.44	-0.07	21.06	3
25	42.5	0.63	-1.64	0.27	42.48	1.47	5	2.33	115.99	1.47	0	1.47	27.97	1.53	0	5	0.85	0.76	2.45	29.36	-0.08	34.27	7
26	10.55	0.31	-0.83	0.33	10.54	2.97	3	3	107.52	1.52	0	1.52	5.93	3.47	-0.01	3	1	0.7	3.22	5.93	-0.04	17.58	2
27	7.41	0.31	-1.06	0.34	7.4	4.23	3	3.21	106.66	1.57	0	1.57	3.7	5.38	-0.01	3	1	0.67	3.5	3.7	-0.05	15.24	2
28	17.44	0.42	-0.48	0.35	17.43	2.4	4	2.76	110.86	1.63	0	1.63	9.7	2.64	0	3	1	0.65	2.98	9.7	-0.02	20.6	2
29	27.57	0.63	0.19	0.37	27.57	2.27	4	2.59	114.94	1.69	0	1.69	15.35	2.42	0	4	0.99	0.63	2.79	15.4	0.01	23.68	4
30	32.79	1.15	0.78	0.41	32.8	3.5	4	2.65	119.8	1.75	0	1.75	17.78	3.7	0	3	1	0.61	2.85	17.78	0.03	20.46	3
31	43.76	1.78	0.77	0.46	43.76	4.06	4	2.6	123.69	1.81	0	1.81	23.2	4.23	0	3	1	0.59	2.8	23.2	0.03	19.74	3
32	59.73	3.24	1.02	0.46	59.74	5.42	4	2.6	128.84	1.87	0	1.87	30.9	5.59	0	3	1	0.57	2.79	30.9	0.04	16.84	3
33	48.87	4.18	1.54	0.5	48.89	8.54	3	2.81	130.22	1.94	0	1.94	24.23	8.9	0	3	1	0.55	3.01	24.23	0.06	11.99	3
34	49.08	1.67	1.56	0.47	49.1	3.4	4	2.51	123.52	2	0	2	23.56	3.55	0	4	0.99	0.53	2.74	23.7	0.06	21.87	3
35	52.63	1.98	1.45	0.4	52.65	3.77	4	2.52	124.95	2.06	0	2.06	24.53	3.92	0	4	1	0.51	2.76	24.55	0.05	20.78	3
36	188.07	4.07	2.41	0.53	188.1	2.17	6	1.98	133.32	2.13	0	2.13	87.37	2.19	0	5	0.76	0.59	2.13	103.03	0.08	38.23	7
37	182.75	7.31	3	0.01	182.78	4	8	2.2	137.28	2.2	0	2.2	82.19	4.05	0	4	0.86	0.53	2.37	91.24	0.1	23.04	5
38	183.27	10.34	3.77	-0.33	183.32	5.64	9	2.32	137.28	2.27	0	2.27	79.91	5.71	0	9	0.91	0.5	2.5	85.45	0.12	17.11	3
39	219.4	13.47	4.13	0.02	219.45	6.14	9	2.32	137.28	2.33	0	2.33	93.01	6.2	0	9	0.91	0.49	2.49	99.82	0.13	15.93	3
40	674.39	13.68	3.93	0.9	674.44	2.03	8	1.67	137.28	2.4	0	2.4	279.65	2.04	0	6	0.64	0.59	1.77	376.18	0.12	46.21	7
41	672.3	13.89	1.97	1.03	672.33	2.07	8	1.67	137.28	2.47	0	2.47	270.99	2.07	0	6	0.65	0.58	1.78	365.7	0.06	45.36	7
42	732.77	0	-7.26	0.75	732.68	0	0	0	87.36	2.52	0	2.52	290.26	0	0	0	1	0.42	4.06	290.26	-0.21	428.94	0

	CPT-9	In situ data											Basic output data											
Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	93.67	1.15	1.14	-0.99	93.69	1.23	6	2.01	122.36	0.06	0	0.06	1529.3	1.23	0	6	0.47	3.79	1.61	334.98	1.34	71.72	7
2	38.74	1.67	1.46	-0.8	38.76	4.31	4	2.66	122.95	0.12	0	0.12	314.81	4.32	0	9	0.71	4.59	2.23	167.77	0.85	22.35	5
3	14.83	1.15	0.68	-0.6	14.84	7.74	3	3.14	117.86	0.18	0	0.18	80.74	7.84	0	9	0.88	4.72	2.68	65.41	0.27	12.94	3
4	7	0.63	0	-0.51	7	8.96	3	3.43	111.6	0.24	0	0.24	28.48	9.27	0	3	0.99	4.42	2.98	28.24	0	11.53	3
5	7.94	0.42	0.58	-0.52	7.94	5.26	3	3.24	108.94	0.29	0	0.29	26.22	5.46	0.01	3	0.95	3.41	2.85	24.67	0.14	16.94	3
6	11.07	0.52	0	-0.61	11.07	4.72	3	3.1	111.38	0.35	0	0.35	30.85	4.87	0	3	0.92	2.8	2.78	28.35	0	18.43	3
7	37.28	0.94	0.68	-0.56	37.29	2.52	4	2.52	118.64	0.41	0	0.41	90.63	2.55	0	5	0.74	2.03	2.29	70.91	0.12	32.27	7
8	24.75	1.04	0.08	-0.45	24.75	4.22	3	2.8	118.41	0.47	0	0.47	52.11	4.3	0	4	0.86	2.02	2.59	46.36	0.01	20.92	3
9	30.18	0.63	0.31	-0.42	30.18	2.08	4	2.53	115.16	0.52	0	0.52	56.64	2.11	0	5	0.77	1.72	2.36	48.33	0.04	33.89	7
10	83.02	3.13	0.34	-0.49	83.02	3.77	4	2.39	129.41	0.59	0	0.59	140.11	3.8	0	8	0.74	1.55	2.27	120.56	0.04	24.72	5
11	492.9	0	1.95	-0.71	492.92	0	0	0	87.36	0.63	0	0.63	778.86	0	0	0	1	1.67	4.06	778.86	0.22	1126.94	0

CPT-10 In situ data **Basic output data**

Depth (ft)	qc (tsf)	fs (tsf)	u (psi)	Other	qt (tsf)	Rf(%)	SBT	Ic SBT	ã (pcf)	ó,v (tsf)	u0 (tsf)	ó',vo (tsf)	Qt1	Fr (%)	Bq	SBTn	n	Cn	Ic	Qtn	U2	I(B)	Mod. SBTn
1	117.06	1.25	-0.05	0.94	117.06	1.07	6	1.9	123.54	0.06	0	0.06	1892.9	1.07	0	6	0.44	3.48	1.53	384.78	-0.06	81.88	7
2	35.61	1.25	-0.14	1.07	35.61	3.52	4	2.63	120.64	0.12	0	0.12	290.47	3.53	0	8	0.69	4.45	2.19	149.28	-0.08	26.67	5
3	79.26	1.15	-0.33	1.09	79.26	1.45	5	2.11	121.95	0.18	0	0.18	432.14	1.45	0	6	0.55	2.63	1.82	196.48	-0.13	58.09	7
4	64.01	1.36	-0.68	1.11	64.01	2.12	5	2.29	122.65	0.24	0	0.24	260.94	2.13	0	5	0.63	2.51	2.02	151.25	-0.2	41.13	7
5	17.23	0.73	-0.29	1.2	17.23	4.24	3	2.92	114.92	0.3	0	0.3	56.07	4.32	0	4	0.85	2.9	2.59	46.43	-0.07	20.86	3
6	15.87	0.52	-0.64	1.19	15.87	3.29	3	2.88	112.26	0.36	0	0.36	43.31	3.37	0	4	0.85	2.51	2.58	36.85	-0.13	24.14	5
7	21.3	0.63	-0.55	1.26	21.3	2.94	4	2.75	114.31	0.42	0	0.42	50.29	3	0	4	0.82	2.16	2.5	42.62	-0.1	26.59	5
8	39.26	1.46	-0.37	1.34	39.26	3.72	4	2.61	122	0.48	0	0.48	81.47	3.77	0	4	0.8	1.89	2.43	69.24	-0.06	23.94	5
9	29.03	1.98	-1.41	1.48	29.01	6.84	3	2.89	123.5	0.54	0	0.54	52.94	6.97	0	3	0.91	1.85	2.72	49.89	-0.19	14.34	3
10	33.31	1.88	-2.44	1.52	33.28	5.65	3	2.79	123.44	0.6	0	0.6	54.51	5.75	-0.01	3	0.89	1.66	2.65	51.16	-0.29	16.79	3
11	39.37	1.04	-2.79	1.48	39.33	2.65	4	2.51	119.54	0.66	0	0.66	58.65	2.7	-0.01	5	0.8	1.46	2.4	53.26	-0.3	29.59	5
12	29.97	0.52	-1.45	1.56	29.95	1.74	5	2.49	113.81	0.72	0	0.72	40.81	1.79	0	5	0.8	1.36	2.4	37.71	-0.15	34.74	7
13	22.66	0.31	-0.78	1.58	22.65	1.38	5	2.54	109.39	0.77	0	0.77	28.38	1.43	0	5	0.82	1.3	2.46	26.85	-0.07	33.98	6
14	26.84	0.42	-0.79	1.64	26.83	1.56	5	2.5	111.91	0.83	0	0.83	31.44	1.61	0	5	0.82	1.22	2.45	30.1	-0.07	33.88	7
15	25.38	0.63	-0.36	1.6	25.37	2.47	4	2.64	114.74	0.88	0	0.88	27.69	2.56	0	4	0.89	1.17	2.61	27.13	-0.03	26.63	5
16	23.39	0.63	-0.78	1.7	23.38	2.68	4	2.69	114.54	0.94	0	0.94	23.83	2.79	0	4	0.91	1.11	2.68	23.6	-0.06	24.72	5
17	26.84	0.63	-0.48	1.6	26.83	2.34	4	2.61	114.87	1	0	1	25.86	2.43	0	4	0.89	1.05	2.61	25.7	-0.03	26.98	5
18	29.03	0.84	-0.77	1.59	29.02	2.88	4	2.64	117.17	1.06	0	1.06	26.44	2.99	0	4	0.91	1	2.66	26.44	-0.05	24.46	5
19	34.15	1.15	-0.68	1.76	34.14	3.36	4	2.63	119.9	1.12	0	1.12	29.55	3.48	0	4	0.92	0.95	2.66	29.68	-0.04	22.9	5
20	24.75	1.25	-0.46	1.9	24.74	5.06	3	2.85	119.75	1.18	0	1.18	20.02	5.32	0	3	1	0.9	2.91	20.02	-0.03	17.01	3
21	15.87	0.84	-0.83	2.09	15.86	5.27	3	3.01	115.7	1.24	0	1.24	11.84	5.71	0	3	1	0.86	3.11	11.84	-0.05	15.87	3
22	26.42	0.84	-0.24	2.17	26.42	3.16	4	2.69	116.94	1.29	0	1.29	19.42	3.33	0	4	0.97	0.82	2.79	19.52	-0.01	21.88	3
23	25.38	0.94	0.09	2.31	25.38	3.7	4	2.75	117.7	1.35	0	1.35	17.76	3.91	0	3	1	0.78	2.87	17.76	0	19.9	3
24	11.17	1.04	0.48	2.61	11.18	9.34	3	3.28	116.48	1.41	0	1.41	6.92	10.69	0	2	1	0.75	3.46	6.92	0.02	11.75	1
25	20.05	1.15	0.22	2.86	20.05	5.73	3	2.95	118.6	1.47	0	1.47	12.64	6.18	0	3	1	0.72	3.11	12.64	0.01	15.28	3
26	19.53	0.94	0.62	3.05	19.54	4.81	3	2.91	117.07	1.53	0	1.53	11.78	5.22	0	3	1	0.69	3.08	11.78	0.03	16.56	3
27	46.89	1.57	0.17	3.27	46.89	3.34	4	2.52	122.94	1.59	0	1.59	28.49	3.46	0	4	0.94	0.68	2.67	29.17	0.01	22.92	5
28	40.41	1.36	0.69	3.29	40.42	3.36	4	2.57	121.53	1.65	0	1.65	23.49	3.5	0	4	0.97	0.65	2.74	23.79	0.03	22.04	5
29	59.21	2.19	0.45	3.31	59.22	3.7	4	2.48	125.97	1.71	0	1.71	33.55	3.81	0	4	0.94	0.64	2.64	34.58	0.02	22.08	5
30	104.43	3.03	1.06	3.35	104.44	2.9	5	2.24	129.72	1.78	0	1.78	57.72	2.95	0	5	0.84	0.65	2.38	62.7	0.04	28.51	5
31	59.31	2.61	1.16	3.53	59.33	4.4	4	2.54	127.25	1.84	0	1.84	31.2	4.54	0	4	0.97	0.58	2.72	31.66	0.05	19.49	3
32	57.96	1.67	0.74	3.67	57.97	2.88	5	2.41	123.93	1.9	0	1.9	29.44	2.98	0	4	0.93	0.58	2.61	30.59	0.03	25.19	5
33	46.57	1.46	1.38	3.65	46.59	3.14	4	2.51	122.42	1.97	0	1.97	22.71	3.28	0	4	0.98	0.54	2.73	22.94	0.05	22.69	5
34	43.76	1.67	1.55	3.65	43.77	3.82	4	2.58	123.24	2.03	0	2.03	20.59	4	0	3	1	0.52	2.82	20.59	0.05	20.07	3
35	151.94	5.74	1.16	3.55	151.96	3.78	8	2.23	135.31	2.09	0	2.09	71.54	3.83	0	4	0.86	0.56	2.39	78.62	0.04	23.87	5
36	526.1	12.74	2.28	4.01	526.13	2.42	8	1.78	137.28	2.16	0	2.16	242.19	2.43	0	8	0.67	0.62	1.88	306.72	0.08	38.82	7
37	153.3	11.28	2.51	4.23	153.33	7.36	9	2.46	137.28	2.23	0	2.23	67.69	7.46	0	9	0.97	0.49	2.65	69.43	0.08	13.5	3
38	753.44	12.64	1.91	4.31	753.47	1.68	8	1.57	137.28	2.3	0	2.3	326.5	1.68	0	6	0.59	0.63	1.66	448.3	0.06	55.61	7
39	656.01	15.35	0.66	4.72	656.02	2.34	8	1.73	137.28	2.37	0	2.37	275.88	2.35	0	8	0.66	0.59	1.83	362.76	0.02	40.43	7
40	540.93	12.43	-1.64	5.06	540.91	2.3	8	1.75	137.28	2.44	0	2.44	220.87	2.31	0	6	0.68	0.57	1.88	288.28	-0.05	40.57	7
41	190.79	10.86	-1.23	5.44	190.77	5.69	9	2.32	137.28	2.51	0	2.51	75.11	5.77	0	9	0.93	0.45	2.53	79.66	-0.04	16.93	3
42	544.59	0	-1.54	5.52	544.57	0	0	0	87.36	2.55	0	2.55	212.52	0	0	0	1	0.41	4.06	212.52	-0.04	317.89	0

Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236\right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \leq 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: N_{SPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a}\right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c\_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c\_cutoff}$)

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Peak drained friction angle, φ (°) ::

$$\varphi = 17.60 + 11 \cdot \log(Q_{tn})$$

(applicable only to SBT_n: 5, 6, 7 and 8)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$

$a = 14$ for $Q_{tn} > 14$

$a = Q_{tn}$ for $Q_{tn} \leq 14$

$M_{CPT} = a \cdot (q_t - \sigma_v)$

If $I_c \leq 2.20$

$M_{CPT} = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho}\right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot +7 \cdot \log(F_r))}\right]^{1.25}$$ or user defined

$$OCR = k_{OCR} \cdot Q_{tn}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = (1 - \sin\varphi') \cdot OCR^{\sin\varphi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c\_cutoff}$)

:: Effective Stress Friction Angle, φ' (°) ::

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

References

- Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012
- Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)

Appendix B

Laboratory Testing Program

APPENDIX B: LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Test results are presented herein and on the Logs of Borings in Appendix A, *Field Exploration*. The following is a summary of the laboratory tests conducted for this project.

B.1 Moisture Content and Dry Density

Results of moisture content and dry density tests, performed on relatively undisturbed ring samples were used to aid in the classification of the soils and to provide quantitative measure of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, *Field Exploration*.

B.2 Grain-Size Analysis

To assist in classification of soils, mechanical grain-size analyses were performed on Two (2) selected samples. Testing was performed in general accordance with the ASTM Standard C136 test method. Grain-size curves are shown in Drawing No. B-1, *Grain Size Distribution Results*.

B.3 Percent Finer than Sieve No. 200

The percent finer than sieve No. 200 tests were performed on six (6) representative soil samples to aid in the classification of the on-site soils and to estimate other engineering parameters. Testing was performed in general accordance with the ASTM Standard D1140 test method. Test results are presented in the Logs of Borings in Appendix A, *Field Exploration*.

Table No. B-1, Percent Passing Sieve # 200 Results

Boring No.	Depth (feet)	Soil Classification	Percent Passing Sieve No. 200
BH-3	0-5	Silty Sand (SM)	43%
BH-3	15	Silty Sand (SM) with trace gravels	34%
BH-3	25	Silty Sand (SM) with trace gravels	45%
BH-3	35	Sandy Clay (CL)	55%
BH-4	5	Silty Sand (SM)	38%
BH-6	5	Silty Sand (SM) with trace silt	29 %

B.4 Maximum Dry Density Test

One (1) laboratory maximum dry density-moisture content relationship test was performed on one representative bulk sample. The test was conducted in accordance with ASTM Standard D1557 laboratory procedure. The test result is presented on Drawing No. B-2, *Moisture-Density Relationship Results*.

B.5 Direct Shear

Direct shear tests were performed on three (3) relatively undisturbed samples at soaked moisture conditions. For each test, three samples contained in brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The samples were then sheared at a constant strain rate of 0.01 inch/minute. Shear deformation was recorded until a maximum of about 0.50-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear strength parameters. For test data, including sample density and moisture content, see Drawing Nos. B-3 through B-5, *Direct Shear Test Results,* and in the following table:

Table No. B-2, Direct Shear Test Results

Boring No.	Depth (feet)	Soil Classification	Peak Strength Parameters	
			Friction Angle (degrees)	Cohesion (psf)
BH-1	10	Clayey Sand (SC)	34	110
BH-5	5	Sandy Silt (ML)	25	240
BH - 8	5	Clayey Silt (ML)	27	360

B.6 Consolidation Test

Consolidation tests were performed on two (2) selected samples. Data obtained from this test performed on a relatively undisturbed soil sample was used to evaluate the settlement characteristics of the foundation soils under load. Preparation for this test involved trimming the sample and placing the one-inch high brass ring into the test apparatus, which contained porous stones, both top and bottom, to accommodate drainage during testing. Normal axial loads were applied to one end of the sample through the porous stones, and the resulting deflections were recorded at various time periods. The load was increased after the sample reached a reasonable state of equilibrium. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. The sample was tested at field and submerged conditions. The test results, including sample density and moisture content, are presented in Drawing Nos. B-6 through B-7, *Consolidation Test Results*.

B.7 R-Value Test

One (1) representative bulk soil sample was tested for resistance value (R-value) in accordance with ASTM D2844 Standard. This test is designed to provide a relative measure of soil strength for use in pavement design. The test results are shown in the following table:

Table No. B-3, R-value Test Result

Boring No.	Depth (feet)	Soil Classification	Measured R-value
BH-5	1-5	Silty Sand (SM)	46

B.8 Soil Corrosivity

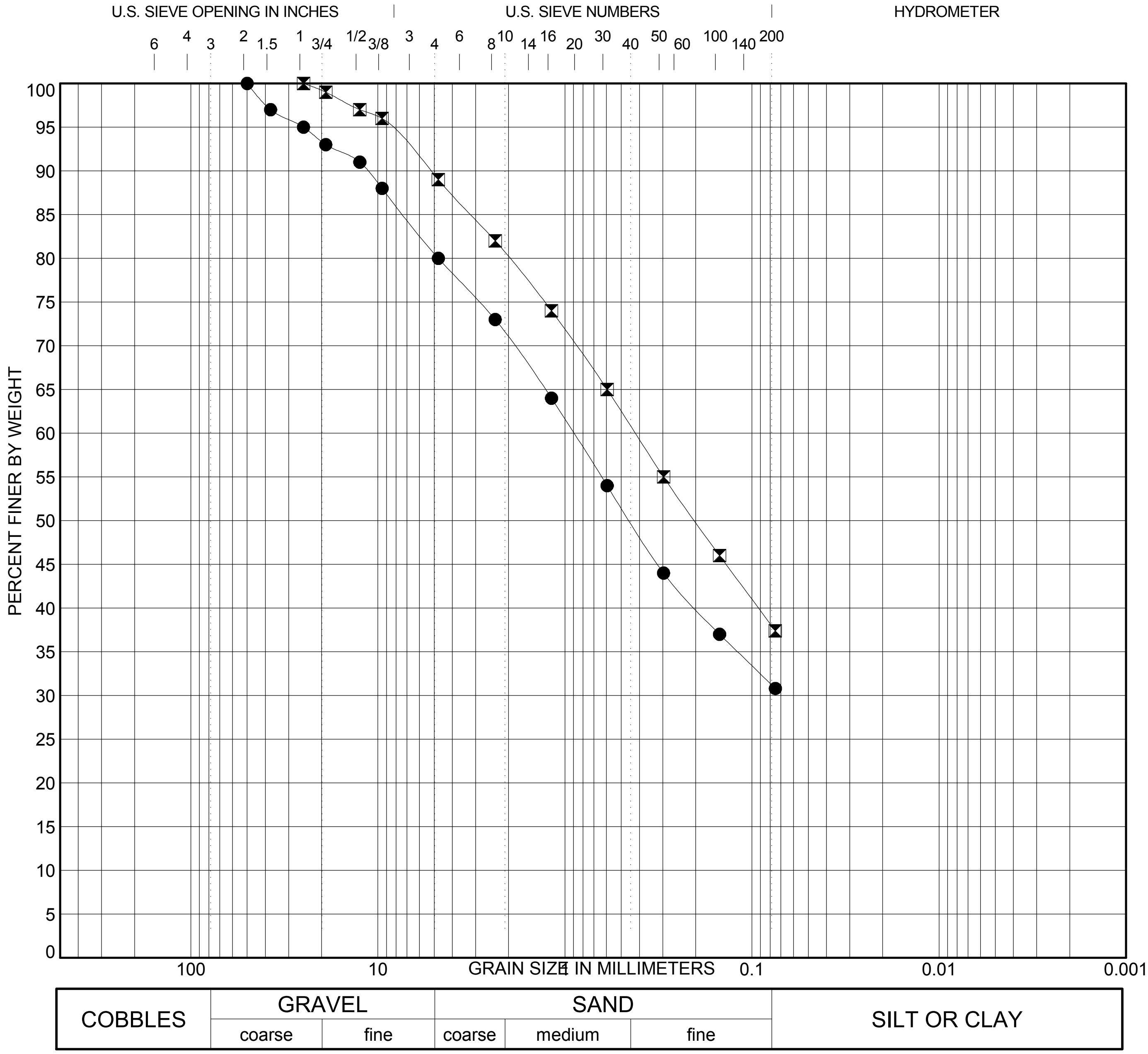
One (1) representative soil sample was tested to determine minimum electrical resistivity, pH, and chemical content, including chloride concentrations, and soluble sulfate. The purpose of these tests is to determine the corrosion potential of site soils when placed in contact with common construction materials. These tests were performed by EGL in Arcadia, California. The test results received from EGL are included in the following table:

Table No. B-4, Corrosivity Test Results

Boring No.	Sample Depth (feet)	pH (Caltrans 643)	Soluble Chlorides (Caltrans 422) ppm	Soluble Sulfate (Caltrans 417) (%)	Saturated Resistivity (Caltrans 532) Ohm-cm
BH-4	10	8.17	115	0.006	2,100

B.9 Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period of time.



	Boring No.	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	**BH-1**	**0-5**	**SANDY SILT (ML)**					
⧗	**BH-7**	**0-5**	**SILTY SAND (SM)**					

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH-1**	**0-5**	**50**	**0.897**			**20.0**	**49.2**	**30.8**	
⧗	**BH-7**	**0-5**	**25**	**0.42**			**11.0**	**51.6**	**37.4**	

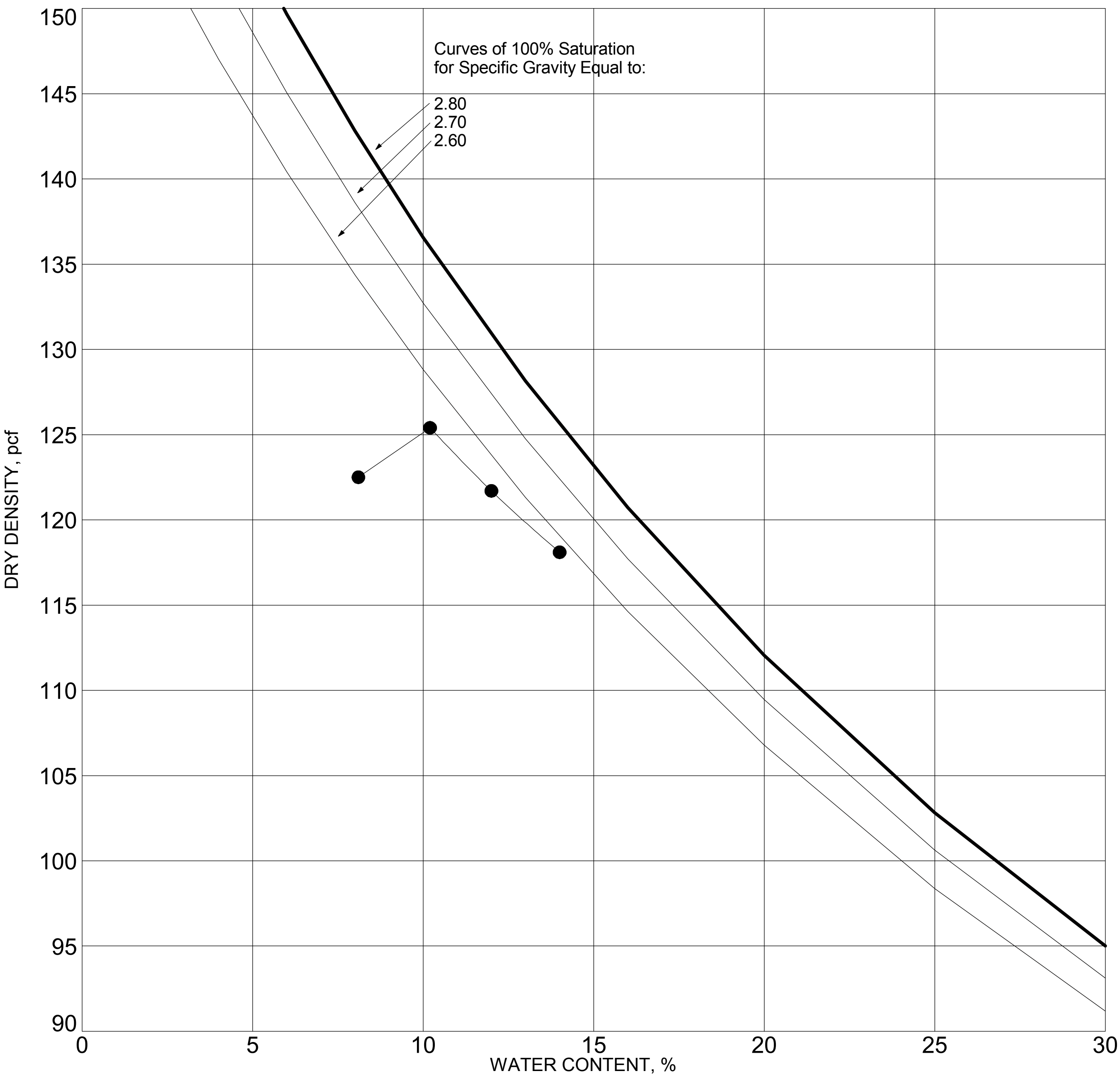
GRAIN SIZE DISTRIBUTION RESULTS

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No.
17-31-247-01

Figure No.
B-1



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	BH-3	0-5	SILTY SAND (SM)	D1557 Method B	10.2	125.4

NOTE:

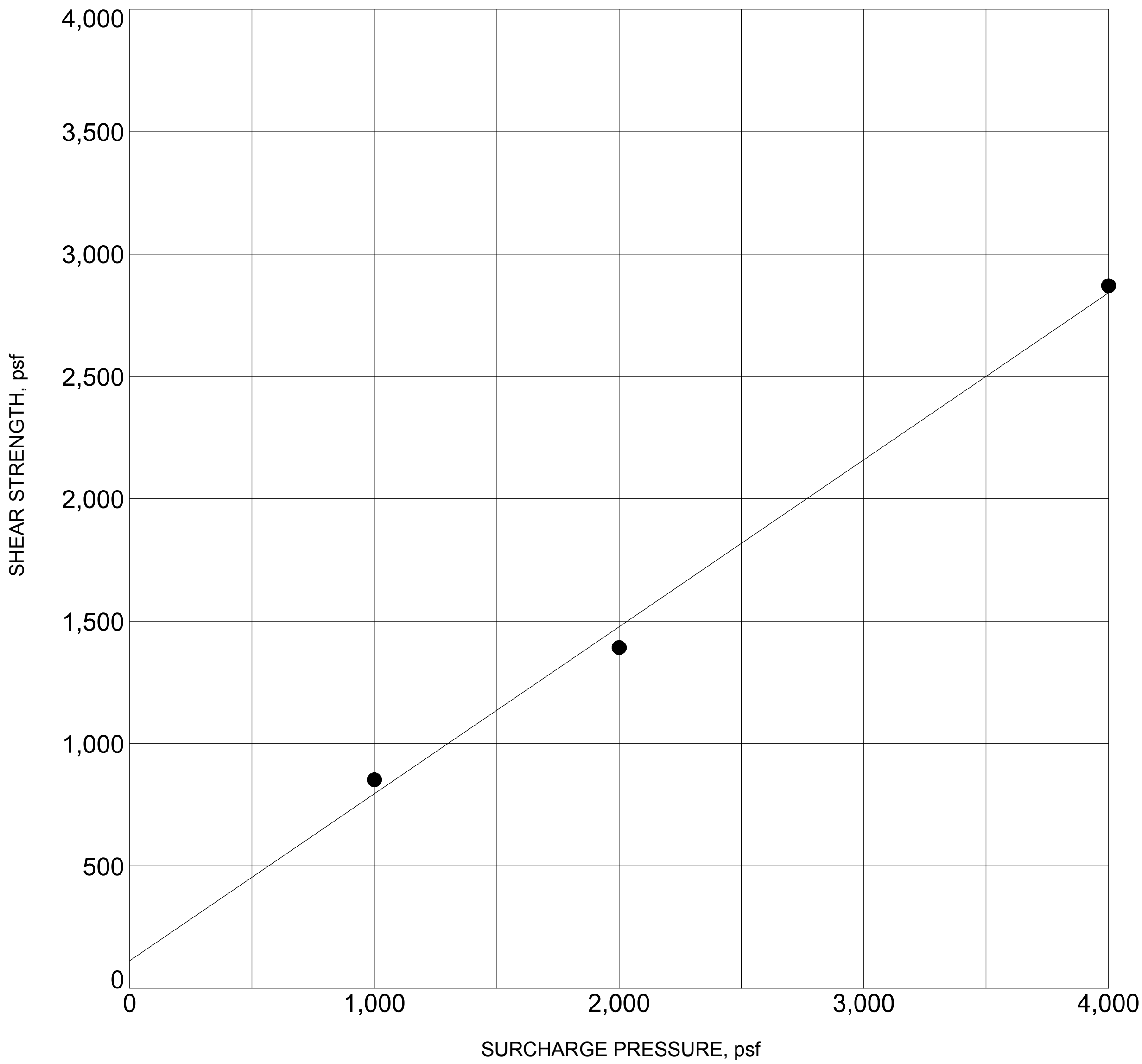
MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No.
17-31-247-01

Figure No.
B-2



BORING NO. :	**BH-1**	DEPTH (ft) :	**10**
DESCRIPTION :	**CLAYEY SAND (SC)**		
COHESION (psf) :	**110**	FRICTION ANGLE (degrees):	**34**
MOISTURE CONTENT (%) :	**9.0**	DRY DENSITY (pcf) :	**107.0**

NOTE: Ultimate Strength.

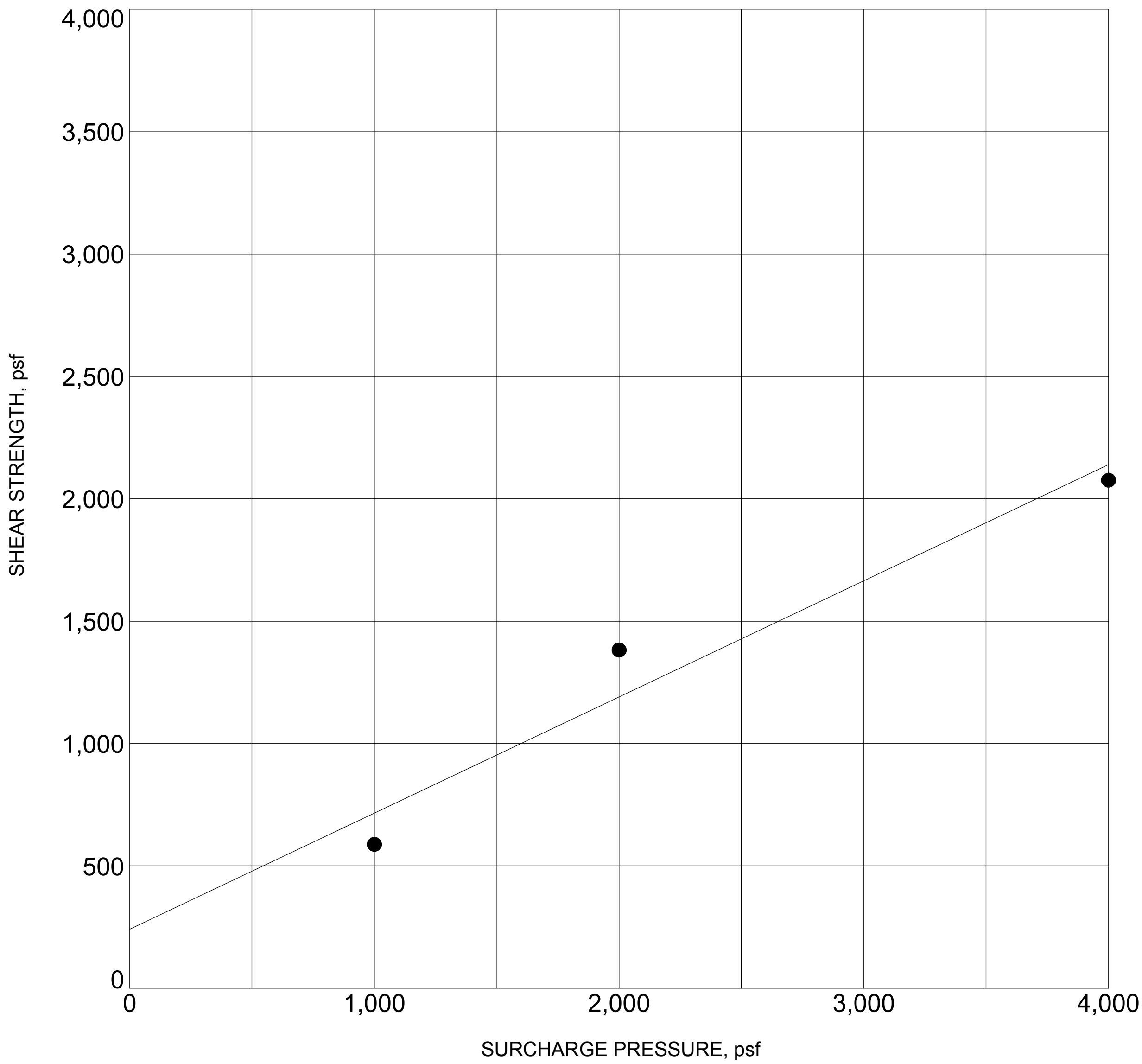
DIRECT SHEAR TEST RESULTS

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No.
17-31-247-01

Figure No.
B-3



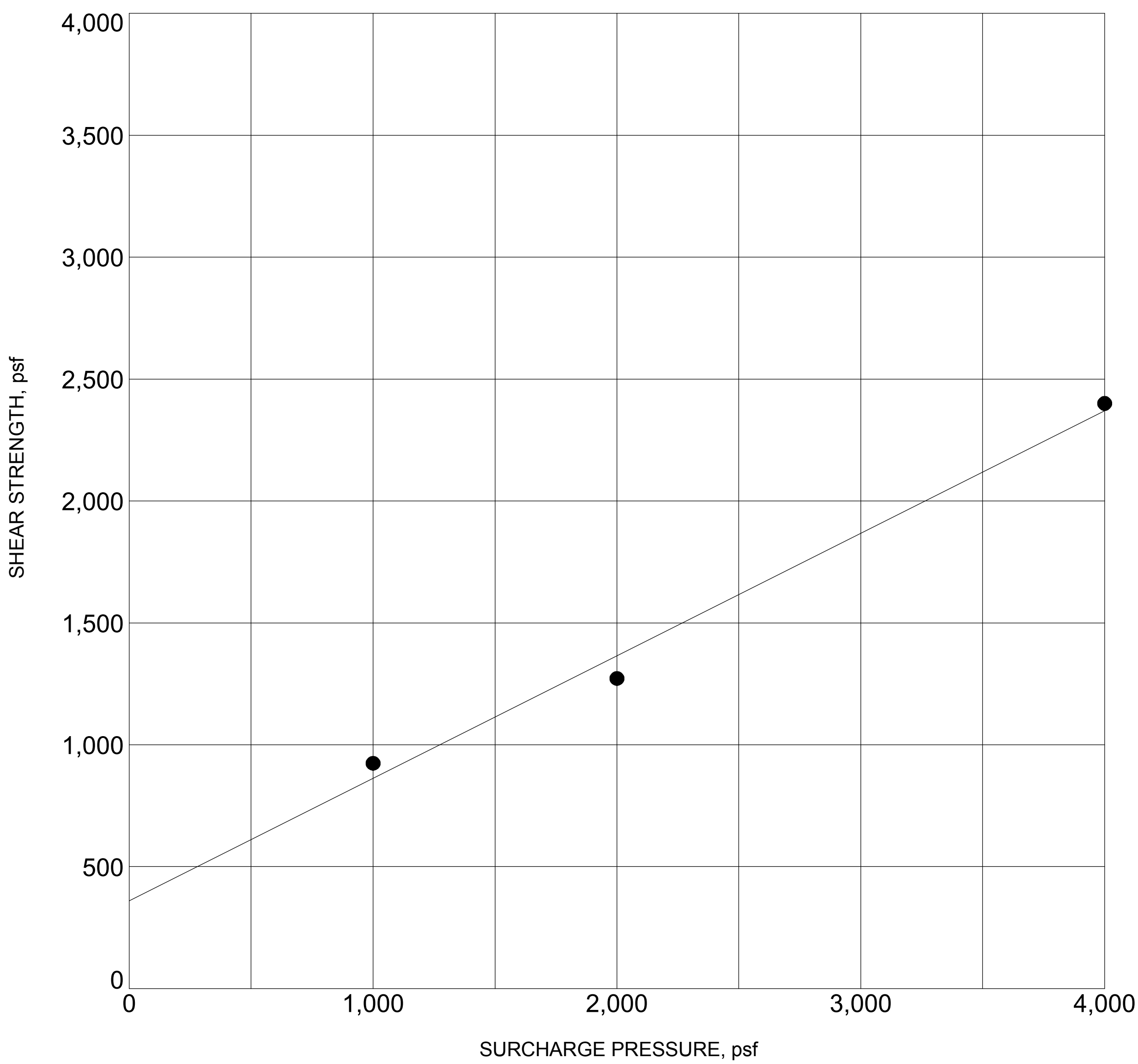
BORING NO. :	**BH-5**	DEPTH (ft) :	**5**
DESCRIPTION :	**SANDY SILT (ML)**		
COHESION (psf) :	**240**	FRICTION ANGLE (degrees):	**25**
MOISTURE CONTENT (%) :	**17.0**	DRY DENSITY (pcf) :	**110.0**

NOTE: Ultimate Strength.

DIRECT SHEAR TEST RESULTS

Converse Consultants

Project Name	Project No.	Figure No.
MT. SAN ANTONIO COLLEGE **PARKING LOT S** **WALNUT, CALIFORNIA**	**17-31-247-01**	**B-4**



BORING NO. :	**BH-8**	DEPTH (ft) :	**5**
DESCRIPTION :	**CLAYEY SILT (ML)**		
COHESION (psf) :	**360**	FRICTION ANGLE (degrees):	**27**
MOISTURE CONTENT (%) :	**9.5**	DRY DENSITY (pcf) :	**107.0**

NOTE: Ultimate Strength.

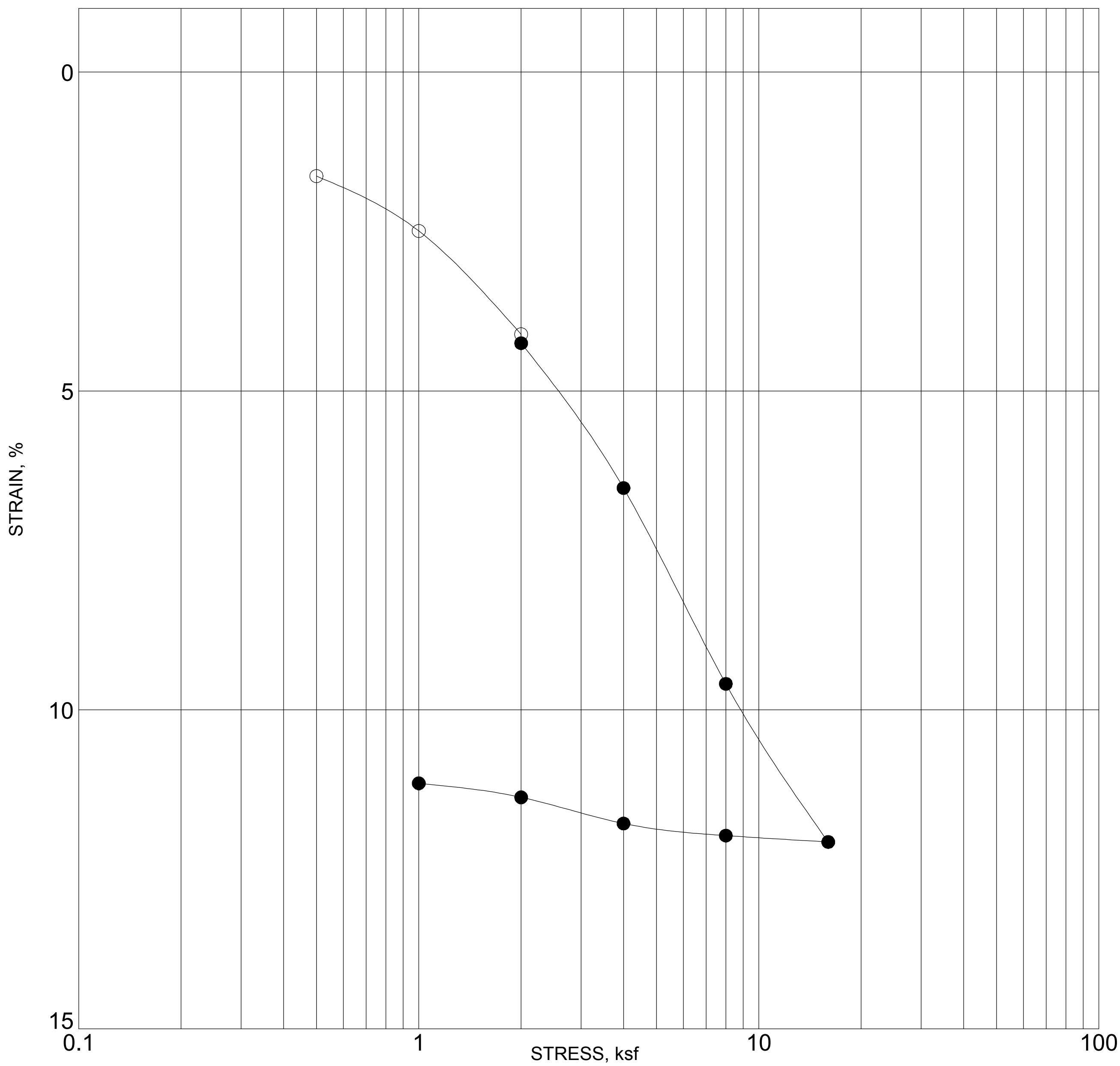
DIRECT SHEAR TEST RESULTS

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No.
17-31-247-01

Figure No.
B-5



BORING NO. :	BH-2	DEPTH (ft) :	5
DESCRIPTION :	**CLAYEY SAND (SC)**		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	**5**	**110**	**27**	**0.475**
FINAL				

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

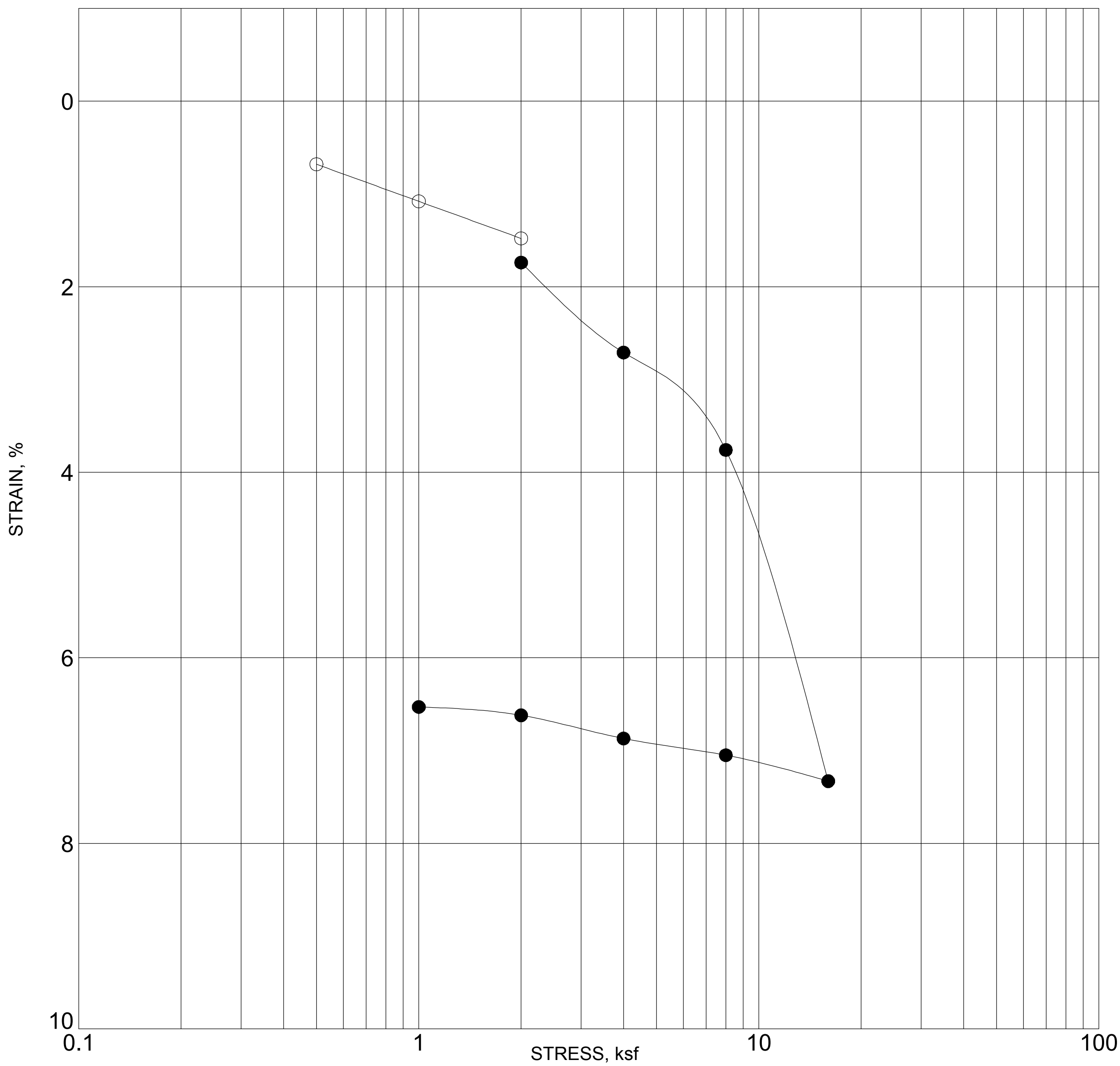
CONSOLIDATION TEST RESULTS

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No.
17-31-247-01

Figure No.
B-6



BORING NO. :	BH-6	DEPTH (ft) :	5
DESCRIPTION :	**BEDROCK-PUENTE FORMATION: SANDSTONE**		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	7	122	53	0.340
FINAL				

NOTE: SOLID CIRCLES INDICATE READINGS AFTER ADDITION OF WATER

CONSOLIDATION TEST RESULTS

Converse Consultants

Project Name
MT. SAN ANTONIO COLLEGE
PARKING LOT S
WALNUT, CALIFORNIA

Project No. **17-31-247-01**

Figure No. **B-7**

Appendix C

Liquefaction/Seismic Settlement Analysis

APPENDIX C: LIQUEFACTION/SEISMIC SETTLEMENT ANALYSIS

Liquefaction is defined as the phenomenon where a soil mass exhibits a substantial reduction in its shear strength. This strength reduction is due to the development of excess pore pressure in a soil mass caused by earthquake induced ground motions. Saturated soils behave temporarily as a viscous fluid (liquefaction) and, consequently, lose their capacity to support the structures founded on them. The potential for liquefaction decreases with increasing clay and gravel content, but increases as the ground acceleration and duration of shaking increase. Liquefaction potential has been found to be the greatest where the groundwater level and loose sands occur within 50 feet of the ground surface.

Our liquefaction analyses are based on the *Special Publication 117A: Guidelines for Evaluating and Mitigating Seismic Hazards in California* (9/2008), *Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California* (3/1999), and *2013 California Building Code*.

The subsurface data obtained from exploratory borings were used to evaluate the liquefaction/seismic settlement potential of the area. The Log of Borings is presented in Appendix A, *Field Exploration*. The liquefaction potential and seismic settlement analyses were performed utilizing data obtained from borings BH-3 and CPT-8 for the upper 50 feet of soil. The analyses were performed using *LiquefyPro,* Version 5.8d, 2009, by Civil Tech Software. The following seismic parameters are used for liquefaction potential analyses.

Table No. C-1, Seismic Parameters Used in Liquefaction Analysis

Groundwater Depth* (feet)	Earthquake Magnitude** (Mw)	Peak Ground Acceleration*** (g)
23	6.51	0.777

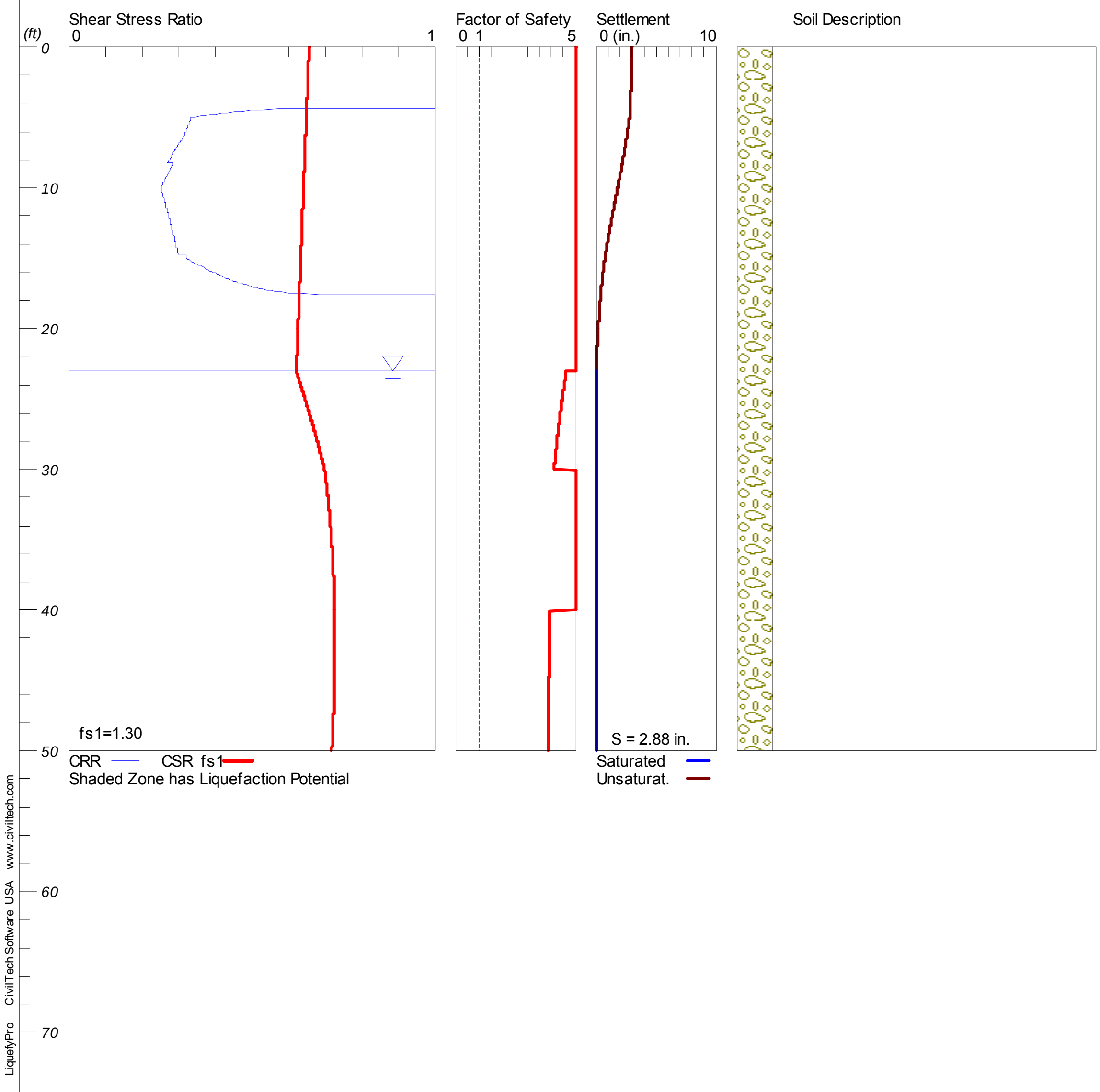
* Based on research of Los Angeles County Groundwater Wells No. 3145, No. 3155 and No. 3155A
** Based on the 2008 NSHMP PSHA Interactive Deaggregation web site for a return period of 2475 years
*******Based on S_{DS}/2.5 per CBC 2013

LIQUEFACTION ANALYSIS

Parking Lot S MT Sac

Hole No.=BH 3   Water Depth=23 ft

Magnitude=6.51
Acceleration=0.777g



CivilTech Corporation   **17-31-247-01**   **Plate C**

****

LIQUEFACTION ANALYSIS SUMMARY
Copyright by CivilTech Software
www.civiltechsoftware.com

****

Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 10/17/2017 11:58:05 AM

Input File Name: K:\Ram\17-31-247-00 MT SAC lot R&S\Parking Lot S\BH3 rev.liq
Title: Parking Lot S MT Sac
Subtitle: 17-31-247-01

Surface Elev.=
Hole No.=3
Depth of Hole= 50.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 23.40 ft
Max. Acceleration= 0.78 g
Earthquake Magnitude= 6.51

Input Data:

Surface Elev.=
Hole No.=3
Depth of Hole=50.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 23.40 ft
Max. Acceleration=0.78 g
Earthquake Magnitude=6.51
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Modify Stark/Olson
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.25
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*

* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	50.00	114.00	43.00
5.00	7.70	114.00	43.00
10.00	4.90	118.00	43.00
15.00	8.40	115.00	45.00
20.00	25.00	115.00	45.00
25.00	20.30	115.00	45.00
30.00	21.00	110.00	NoLiq
35.00	35.00	110.00	NoLiq
40.00	50.00	110.00	NoLiq
45.00	50.00	107.00	55.00
50.00	50.00	107.00	55.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=2.88 in.
Total Settlement of Saturated and Unsaturated Sands=2.88 in.
Differential Settlement=1.442 to 1.904 in.

Depth CRRm CSRfs F.S. S_sat. S_dry S_all

						BH3 rev.sum
ft				in.	in.	in.
0.00	2.87	0.66	5.00	0.00	2.88	2.88
0.05	2.87	0.66	5.00	0.00	2.88	2.88
0.10	2.87	0.66	5.00	0.00	2.88	2.88
0.15	2.87	0.66	5.00	0.00	2.88	2.88
0.20	2.87	0.66	5.00	0.00	2.88	2.88
0.25	2.87	0.66	5.00	0.00	2.88	2.88
0.30	2.87	0.66	5.00	0.00	2.88	2.88
0.35	2.87	0.66	5.00	0.00	2.88	2.88
0.40	2.87	0.66	5.00	0.00	2.88	2.88
0.45	2.87	0.66	5.00	0.00	2.88	2.88
0.50	2.87	0.66	5.00	0.00	2.88	2.88
0.55	2.87	0.66	5.00	0.00	2.88	2.88
0.60	2.87	0.66	5.00	0.00	2.88	2.88
0.65	2.87	0.66	5.00	0.00	2.88	2.88
0.70	2.87	0.66	5.00	0.00	2.88	2.88
0.75	2.87	0.66	5.00	0.00	2.88	2.88
0.80	2.87	0.66	5.00	0.00	2.88	2.88
0.85	2.87	0.66	5.00	0.00	2.88	2.88
0.90	2.87	0.66	5.00	0.00	2.88	2.88
0.95	2.87	0.66	5.00	0.00	2.88	2.88
1.00	2.87	0.66	5.00	0.00	2.88	2.88
1.05	2.87	0.65	5.00	0.00	2.88	2.88
1.10	2.87	0.65	5.00	0.00	2.88	2.88
1.15	2.87	0.65	5.00	0.00	2.88	2.88
1.20	2.87	0.65	5.00	0.00	2.88	2.88
1.25	2.87	0.65	5.00	0.00	2.88	2.88
1.30	2.87	0.65	5.00	0.00	2.88	2.88
1.35	2.87	0.65	5.00	0.00	2.88	2.88
1.40	2.87	0.65	5.00	0.00	2.88	2.88
1.45	2.87	0.65	5.00	0.00	2.88	2.88
1.50	2.87	0.65	5.00	0.00	2.88	2.88
1.55	2.87	0.65	5.00	0.00	2.88	2.88
1.60	2.87	0.65	5.00	0.00	2.88	2.88
1.65	2.87	0.65	5.00	0.00	2.88	2.88
1.70	2.87	0.65	5.00	0.00	2.88	2.88
1.75	2.87	0.65	5.00	0.00	2.88	2.88
1.80	2.87	0.65	5.00	0.00	2.88	2.88
1.85	2.87	0.65	5.00	0.00	2.88	2.88
1.90	2.87	0.65	5.00	0.00	2.88	2.88
1.95	2.87	0.65	5.00	0.00	2.88	2.88
2.00	2.87	0.65	5.00	0.00	2.88	2.88
2.05	2.87	0.65	5.00	0.00	2.88	2.88
2.10	2.87	0.65	5.00	0.00	2.88	2.88
2.15	2.87	0.65	5.00	0.00	2.88	2.88
2.20	2.87	0.65	5.00	0.00	2.88	2.88
2.25	2.87	0.65	5.00	0.00	2.88	2.88
2.30	2.87	0.65	5.00	0.00	2.88	2.88
2.35	2.87	0.65	5.00	0.00	2.88	2.88
2.40	2.87	0.65	5.00	0.00	2.88	2.88
2.45	2.87	0.65	5.00	0.00	2.88	2.88
2.50	2.87	0.65	5.00	0.00	2.88	2.88
2.55	2.87	0.65	5.00	0.00	2.88	2.88
2.60	2.87	0.65	5.00	0.00	2.88	2.88
2.65	2.87	0.65	5.00	0.00	2.88	2.88
2.70	2.87	0.65	5.00	0.00	2.88	2.88
2.75	2.87	0.65	5.00	0.00	2.88	2.88
2.80	2.87	0.65	5.00	0.00	2.88	2.88
2.85	2.87	0.65	5.00	0.00	2.88	2.88
2.90	2.87	0.65	5.00	0.00	2.88	2.88
2.95	2.87	0.65	5.00	0.00	2.88	2.88
3.00	2.87	0.65	5.00	0.00	2.88	2.88
3.05	2.87	0.65	5.00	0.00	2.88	2.88
3.10	2.87	0.65	5.00	0.00	2.88	2.88
3.15	2.87	0.65	5.00	0.00	2.88	2.88
3.20	2.87	0.65	5.00	0.00	2.88	2.88

3.25	2.87	0.65	5.00	0.00	2.88	2.88
3.30	2.87	0.65	5.00	0.00	2.88	2.88
3.35	2.87	0.65	5.00	0.00	2.88	2.88
3.40	2.87	0.65	5.00	0.00	2.88	2.88
3.45	2.87	0.65	5.00	0.00	2.88	2.88
3.50	2.87	0.65	5.00	0.00	2.88	2.88
3.55	2.87	0.65	5.00	0.00	2.87	2.87
3.60	2.87	0.65	5.00	0.00	2.87	2.87
3.65	2.87	0.65	5.00	0.00	2.87	2.87
3.70	2.87	0.65	5.00	0.00	2.87	2.87
3.75	2.87	0.65	5.00	0.00	2.87	2.87
3.80	2.87	0.65	5.00	0.00	2.86	2.86
3.85	2.87	0.65	5.00	0.00	2.86	2.86
3.90	2.87	0.65	5.00	0.00	2.85	2.85
3.95	2.87	0.65	5.00	0.00	2.85	2.85
4.00	2.87	0.65	5.00	0.00	2.85	2.85
4.05	2.87	0.65	5.00	0.00	2.84	2.84
4.10	2.87	0.65	5.00	0.00	2.84	2.84
4.15	2.87	0.65	5.00	0.00	2.83	2.83
4.20	2.87	0.65	5.00	0.00	2.83	2.83
4.25	2.87	0.65	5.00	0.00	2.83	2.83
4.30	2.87	0.65	5.00	0.00	2.82	2.82
4.35	2.87	0.65	5.00	0.00	2.82	2.82
4.40	0.57	0.65	5.00	0.00	2.82	2.82
4.45	0.53	0.65	5.00	0.00	2.82	2.82
4.50	0.50	0.65	5.00	0.00	2.82	2.82
4.55	0.47	0.65	5.00	0.00	2.81	2.81
4.60	0.45	0.65	5.00	0.00	2.81	2.81
4.65	0.43	0.65	5.00	0.00	2.81	2.81
4.70	0.42	0.65	5.00	0.00	2.81	2.81
4.75	0.40	0.65	5.00	0.00	2.80	2.80
4.80	0.39	0.65	5.00	0.00	2.80	2.80
4.85	0.37	0.65	5.00	0.00	2.79	2.79
4.90	0.36	0.65	5.00	0.00	2.79	2.79
4.95	0.35	0.65	5.00	0.00	2.78	2.78
5.00	0.33	0.65	5.00	0.00	2.77	2.77
5.05	0.33	0.65	5.00	0.00	2.76	2.76
5.10	0.33	0.65	5.00	0.00	2.75	2.75
5.15	0.33	0.65	5.00	0.00	2.75	2.75
5.20	0.33	0.65	5.00	0.00	2.74	2.74
5.25	0.33	0.65	5.00	0.00	2.73	2.73
5.30	0.33	0.65	5.00	0.00	2.72	2.72
5.35	0.33	0.65	5.00	0.00	2.71	2.71
5.40	0.33	0.65	5.00	0.00	2.70	2.70
5.45	0.33	0.65	5.00	0.00	2.69	2.69
5.50	0.33	0.65	5.00	0.00	2.69	2.69
5.55	0.33	0.65	5.00	0.00	2.68	2.68
5.60	0.32	0.65	5.00	0.00	2.67	2.67
5.65	0.32	0.65	5.00	0.00	2.66	2.66
5.70	0.32	0.65	5.00	0.00	2.65	2.65
5.75	0.32	0.65	5.00	0.00	2.64	2.64
5.80	0.32	0.65	5.00	0.00	2.63	2.63
5.85	0.32	0.65	5.00	0.00	2.63	2.63
5.90	0.32	0.65	5.00	0.00	2.62	2.62
5.95	0.32	0.65	5.00	0.00	2.61	2.61
6.00	0.32	0.65	5.00	0.00	2.60	2.60
6.05	0.32	0.65	5.00	0.00	2.59	2.59
6.10	0.32	0.65	5.00	0.00	2.58	2.58
6.15	0.32	0.65	5.00	0.00	2.57	2.57
6.20	0.32	0.65	5.00	0.00	2.56	2.56
6.25	0.32	0.65	5.00	0.00	2.55	2.55
6.30	0.31	0.65	5.00	0.00	2.55	2.55
6.35	0.31	0.65	5.00	0.00	2.54	2.54
6.40	0.31	0.65	5.00	0.00	2.53	2.53
6.45	0.31	0.65	5.00	0.00	2.52	2.52
6.50	0.31	0.65	5.00	0.00	2.51	2.51
6.55	0.31	0.65	5.00	0.00	2.50	2.50

6.60	0.31	0.65	5.00	0.00	2.49	2.49
6.65	0.31	0.65	5.00	0.00	2.48	2.48
6.70	0.30	0.65	5.00	0.00	2.47	2.47
6.75	0.30	0.65	5.00	0.00	2.46	2.46
6.80	0.30	0.65	5.00	0.00	2.45	2.45
6.85	0.30	0.65	5.00	0.00	2.44	2.44
6.90	0.30	0.65	5.00	0.00	2.43	2.43
6.95	0.30	0.65	5.00	0.00	2.42	2.42
7.00	0.30	0.65	5.00	0.00	2.41	2.41
7.05	0.30	0.65	5.00	0.00	2.41	2.41
7.10	0.29	0.65	5.00	0.00	2.40	2.40
7.15	0.29	0.65	5.00	0.00	2.39	2.39
7.20	0.29	0.65	5.00	0.00	2.38	2.38
7.25	0.29	0.65	5.00	0.00	2.37	2.37
7.30	0.29	0.65	5.00	0.00	2.36	2.36
7.35	0.29	0.65	5.00	0.00	2.35	2.35
7.40	0.29	0.65	5.00	0.00	2.34	2.34
7.45	0.29	0.65	5.00	0.00	2.33	2.33
7.50	0.29	0.65	5.00	0.00	2.32	2.32
7.55	0.28	0.65	5.00	0.00	2.31	2.31
7.60	0.28	0.64	5.00	0.00	2.30	2.30
7.65	0.28	0.64	5.00	0.00	2.28	2.28
7.70	0.28	0.64	5.00	0.00	2.27	2.27
7.75	0.28	0.64	5.00	0.00	2.26	2.26
7.80	0.28	0.64	5.00	0.00	2.25	2.25
7.85	0.28	0.64	5.00	0.00	2.24	2.24
7.90	0.28	0.64	5.00	0.00	2.23	2.23
7.95	0.28	0.64	5.00	0.00	2.22	2.22
8.00	0.27	0.64	5.00	0.00	2.21	2.21
8.05	0.27	0.64	5.00	0.00	2.20	2.20
8.10	0.27	0.64	5.00	0.00	2.19	2.19
8.15	0.27	0.64	5.00	0.00	2.18	2.18
8.20	0.27	0.64	5.00	0.00	2.17	2.17
8.25	0.29	0.64	5.00	0.00	2.16	2.16
8.30	0.29	0.64	5.00	0.00	2.15	2.15
8.35	0.28	0.64	5.00	0.00	2.14	2.14
8.40	0.28	0.64	5.00	0.00	2.13	2.13
8.45	0.28	0.64	5.00	0.00	2.12	2.12
8.50	0.28	0.64	5.00	0.00	2.11	2.11
8.55	0.28	0.64	5.00	0.00	2.10	2.10
8.60	0.28	0.64	5.00	0.00	2.08	2.08
8.65	0.28	0.64	5.00	0.00	2.07	2.07
8.70	0.28	0.64	5.00	0.00	2.06	2.06
8.75	0.28	0.64	5.00	0.00	2.05	2.05
8.80	0.27	0.64	5.00	0.00	2.04	2.04
8.85	0.27	0.64	5.00	0.00	2.03	2.03
8.90	0.27	0.64	5.00	0.00	2.02	2.02
8.95	0.27	0.64	5.00	0.00	2.01	2.01
9.00	0.27	0.64	5.00	0.00	2.00	2.00
9.05	0.27	0.64	5.00	0.00	1.99	1.99
9.10	0.27	0.64	5.00	0.00	1.98	1.98
9.15	0.27	0.64	5.00	0.00	1.97	1.97
9.20	0.27	0.64	5.00	0.00	1.95	1.95
9.25	0.27	0.64	5.00	0.00	1.94	1.94
9.30	0.26	0.64	5.00	0.00	1.93	1.93
9.35	0.26	0.64	5.00	0.00	1.92	1.92
9.40	0.26	0.64	5.00	0.00	1.91	1.91
9.45	0.26	0.64	5.00	0.00	1.90	1.90
9.50	0.26	0.64	5.00	0.00	1.89	1.89
9.55	0.26	0.64	5.00	0.00	1.88	1.88
9.60	0.26	0.64	5.00	0.00	1.86	1.86
9.65	0.26	0.64	5.00	0.00	1.85	1.85
9.70	0.26	0.64	5.00	0.00	1.84	1.84
9.75	0.26	0.64	5.00	0.00	1.83	1.83
9.80	0.25	0.64	5.00	0.00	1.82	1.82
9.85	0.25	0.64	5.00	0.00	1.80	1.80
9.90	0.25	0.64	5.00	0.00	1.79	1.79

9.95	0.25	0.64	5.00	0.00	1.78	1.78
10.00	0.25	0.64	5.00	0.00	1.77	1.77
10.05	0.25	0.64	5.00	0.00	1.76	1.76
10.10	0.25	0.64	5.00	0.00	1.74	1.74
10.15	0.25	0.64	5.00	0.00	1.73	1.73
10.20	0.25	0.64	5.00	0.00	1.72	1.72
10.25	0.25	0.64	5.00	0.00	1.71	1.71
10.30	0.25	0.64	5.00	0.00	1.70	1.70
10.35	0.25	0.64	5.00	0.00	1.69	1.69
10.40	0.26	0.64	5.00	0.00	1.67	1.67
10.45	0.26	0.64	5.00	0.00	1.66	1.66
10.50	0.26	0.64	5.00	0.00	1.65	1.65
10.55	0.26	0.64	5.00	0.00	1.64	1.64
10.60	0.26	0.64	5.00	0.00	1.63	1.63
10.65	0.26	0.64	5.00	0.00	1.61	1.61
10.70	0.26	0.64	5.00	0.00	1.60	1.60
10.75	0.26	0.64	5.00	0.00	1.59	1.59
10.80	0.26	0.64	5.00	0.00	1.58	1.58
10.85	0.26	0.64	5.00	0.00	1.57	1.57
10.90	0.26	0.64	5.00	0.00	1.56	1.56
10.95	0.26	0.64	5.00	0.00	1.55	1.55
11.00	0.26	0.64	5.00	0.00	1.53	1.53
11.05	0.26	0.64	5.00	0.00	1.52	1.52
11.10	0.26	0.64	5.00	0.00	1.51	1.51
11.15	0.26	0.64	5.00	0.00	1.50	1.50
11.20	0.26	0.64	5.00	0.00	1.49	1.49
11.25	0.26	0.64	5.00	0.00	1.48	1.48
11.30	0.27	0.64	5.00	0.00	1.47	1.47
11.35	0.27	0.64	5.00	0.00	1.45	1.45
11.40	0.27	0.64	5.00	0.00	1.44	1.44
11.45	0.27	0.64	5.00	0.00	1.43	1.43
11.50	0.27	0.64	5.00	0.00	1.42	1.42
11.55	0.27	0.64	5.00	0.00	1.41	1.41
11.60	0.27	0.64	5.00	0.00	1.40	1.40
11.65	0.27	0.64	5.00	0.00	1.39	1.39
11.70	0.27	0.64	5.00	0.00	1.38	1.38
11.75	0.27	0.64	5.00	0.00	1.37	1.37
11.80	0.27	0.64	5.00	0.00	1.36	1.36
11.85	0.27	0.64	5.00	0.00	1.34	1.34
11.90	0.27	0.64	5.00	0.00	1.33	1.33
11.95	0.27	0.64	5.00	0.00	1.32	1.32
12.00	0.27	0.64	5.00	0.00	1.31	1.31
12.05	0.27	0.64	5.00	0.00	1.30	1.30
12.10	0.27	0.64	5.00	0.00	1.29	1.29
12.15	0.27	0.64	5.00	0.00	1.28	1.28
12.20	0.27	0.64	5.00	0.00	1.27	1.27
12.25	0.28	0.64	5.00	0.00	1.26	1.26
12.30	0.28	0.64	5.00	0.00	1.25	1.25
12.35	0.28	0.64	5.00	0.00	1.24	1.24
12.40	0.28	0.64	5.00	0.00	1.23	1.23
12.45	0.28	0.64	5.00	0.00	1.22	1.22
12.50	0.28	0.64	5.00	0.00	1.20	1.20
12.55	0.28	0.64	5.00	0.00	1.19	1.19
12.60	0.28	0.64	5.00	0.00	1.18	1.18
12.65	0.28	0.64	5.00	0.00	1.17	1.17
12.70	0.28	0.64	5.00	0.00	1.16	1.16
12.75	0.28	0.64	5.00	0.00	1.15	1.15
12.80	0.28	0.64	5.00	0.00	1.14	1.14
12.85	0.28	0.64	5.00	0.00	1.13	1.13
12.90	0.28	0.64	5.00	0.00	1.12	1.12
12.95	0.28	0.64	5.00	0.00	1.11	1.11
13.00	0.28	0.64	5.00	0.00	1.10	1.10
13.05	0.28	0.64	5.00	0.00	1.09	1.09
13.10	0.28	0.64	5.00	0.00	1.08	1.08
13.15	0.28	0.64	5.00	0.00	1.07	1.07
13.20	0.28	0.64	5.00	0.00	1.06	1.06
13.25	0.29	0.64	5.00	0.00	1.05	1.05

13.30	0.29	0.64	5.00	0.00	1.04	1.04
13.35	0.29	0.64	5.00	0.00	1.03	1.03
13.40	0.29	0.64	5.00	0.00	1.02	1.02
13.45	0.29	0.64	5.00	0.00	1.01	1.01
13.50	0.29	0.64	5.00	0.00	1.00	1.00
13.55	0.29	0.64	5.00	0.00	0.99	0.99
13.60	0.29	0.64	5.00	0.00	0.98	0.98
13.65	0.29	0.64	5.00	0.00	0.97	0.97
13.70	0.29	0.64	5.00	0.00	0.96	0.96
13.75	0.29	0.64	5.00	0.00	0.95	0.95
13.80	0.29	0.64	5.00	0.00	0.94	0.94
13.85	0.29	0.64	5.00	0.00	0.93	0.93
13.90	0.29	0.64	5.00	0.00	0.92	0.92
13.95	0.29	0.64	5.00	0.00	0.91	0.91
14.00	0.29	0.64	5.00	0.00	0.90	0.90
14.05	0.29	0.64	5.00	0.00	0.89	0.89
14.10	0.29	0.63	5.00	0.00	0.88	0.88
14.15	0.29	0.63	5.00	0.00	0.87	0.87
14.20	0.29	0.63	5.00	0.00	0.86	0.86
14.25	0.29	0.63	5.00	0.00	0.85	0.85
14.30	0.30	0.63	5.00	0.00	0.84	0.84
14.35	0.30	0.63	5.00	0.00	0.83	0.83
14.40	0.30	0.63	5.00	0.00	0.82	0.82
14.45	0.30	0.63	5.00	0.00	0.81	0.81
14.50	0.30	0.63	5.00	0.00	0.80	0.80
14.55	0.30	0.63	5.00	0.00	0.79	0.79
14.60	0.30	0.63	5.00	0.00	0.78	0.78
14.65	0.30	0.63	5.00	0.00	0.77	0.77
14.70	0.30	0.63	5.00	0.00	0.76	0.76
14.75	0.30	0.63	5.00	0.00	0.75	0.75
14.80	0.32	0.63	5.00	0.00	0.74	0.74
14.85	0.32	0.63	5.00	0.00	0.73	0.73
14.90	0.32	0.63	5.00	0.00	0.72	0.72
14.95	0.32	0.63	5.00	0.00	0.72	0.72
15.00	0.32	0.63	5.00	0.00	0.71	0.71
15.05	0.32	0.63	5.00	0.00	0.70	0.70
15.10	0.33	0.63	5.00	0.00	0.69	0.69
15.15	0.33	0.63	5.00	0.00	0.68	0.68
15.20	0.33	0.63	5.00	0.00	0.67	0.67
15.25	0.34	0.63	5.00	0.00	0.66	0.66
15.30	0.34	0.63	5.00	0.00	0.65	0.65
15.35	0.34	0.63	5.00	0.00	0.65	0.65
15.40	0.35	0.63	5.00	0.00	0.64	0.64
15.45	0.35	0.63	5.00	0.00	0.63	0.63
15.50	0.36	0.63	5.00	0.00	0.62	0.62
15.55	0.36	0.63	5.00	0.00	0.61	0.61
15.60	0.36	0.63	5.00	0.00	0.61	0.61
15.65	0.37	0.63	5.00	0.00	0.60	0.60
15.70	0.37	0.63	5.00	0.00	0.59	0.59
15.75	0.37	0.63	5.00	0.00	0.58	0.58
15.80	0.38	0.63	5.00	0.00	0.58	0.58
15.85	0.38	0.63	5.00	0.00	0.57	0.57
15.90	0.39	0.63	5.00	0.00	0.56	0.56
15.95	0.39	0.63	5.00	0.00	0.56	0.56
16.00	0.39	0.63	5.00	0.00	0.55	0.55
16.05	0.40	0.63	5.00	0.00	0.54	0.54
16.10	0.40	0.63	5.00	0.00	0.53	0.53
16.15	0.41	0.63	5.00	0.00	0.53	0.53
16.20	0.41	0.63	5.00	0.00	0.52	0.52
16.25	0.42	0.63	5.00	0.00	0.51	0.51
16.30	0.42	0.63	5.00	0.00	0.51	0.51
16.35	0.43	0.63	5.00	0.00	0.50	0.50
16.40	0.43	0.63	5.00	0.00	0.49	0.49
16.45	0.43	0.63	5.00	0.00	0.49	0.49
16.50	0.44	0.63	5.00	0.00	0.48	0.48
16.55	0.45	0.63	5.00	0.00	0.47	0.47
16.60	0.45	0.63	5.00	0.00	0.47	0.47

16.65	0.46	0.63	5.00	0.00	0.46	0.46
16.70	0.46	0.63	5.00	0.00	0.46	0.46
16.75	0.47	0.63	5.00	0.00	0.45	0.45
16.80	0.47	0.63	5.00	0.00	0.44	0.44
16.85	0.48	0.63	5.00	0.00	0.44	0.44
16.90	0.48	0.63	5.00	0.00	0.43	0.43
16.95	0.49	0.63	5.00	0.00	0.43	0.43
17.00	0.50	0.63	5.00	0.00	0.42	0.42
17.05	0.51	0.63	5.00	0.00	0.41	0.41
17.10	0.51	0.63	5.00	0.00	0.41	0.41
17.15	0.52	0.63	5.00	0.00	0.40	0.40
17.20	0.53	0.63	5.00	0.00	0.40	0.40
17.25	0.54	0.63	5.00	0.00	0.39	0.39
17.30	0.55	0.63	5.00	0.00	0.39	0.39
17.35	0.56	0.63	5.00	0.00	0.38	0.38
17.40	0.58	0.63	5.00	0.00	0.37	0.37
17.45	0.60	0.63	5.00	0.00	0.37	0.37
17.50	0.63	0.63	5.00	0.00	0.36	0.36
17.55	0.69	0.63	5.00	0.00	0.36	0.36
17.60	2.87	0.63	5.00	0.00	0.35	0.35
17.65	2.87	0.63	5.00	0.00	0.35	0.35
17.70	2.87	0.63	5.00	0.00	0.34	0.34
17.75	2.87	0.63	5.00	0.00	0.34	0.34
17.80	2.87	0.63	5.00	0.00	0.33	0.33
17.85	2.87	0.63	5.00	0.00	0.33	0.33
17.90	2.87	0.63	5.00	0.00	0.32	0.32
17.95	2.87	0.63	5.00	0.00	0.32	0.32
18.00	2.87	0.63	5.00	0.00	0.31	0.31
18.05	2.87	0.63	5.00	0.00	0.31	0.31
18.10	2.87	0.63	5.00	0.00	0.30	0.30
18.15	2.87	0.63	5.00	0.00	0.30	0.30
18.20	2.87	0.63	5.00	0.00	0.29	0.29
18.25	2.87	0.63	5.00	0.00	0.29	0.29
18.30	2.87	0.63	5.00	0.00	0.28	0.28
18.35	2.87	0.63	5.00	0.00	0.28	0.28
18.40	2.87	0.63	5.00	0.00	0.27	0.27
18.45	2.87	0.63	5.00	0.00	0.27	0.27
18.50	2.87	0.63	5.00	0.00	0.27	0.27
18.55	2.87	0.63	5.00	0.00	0.26	0.26
18.60	2.87	0.63	5.00	0.00	0.26	0.26
18.65	2.87	0.63	5.00	0.00	0.25	0.25
18.70	2.87	0.63	5.00	0.00	0.25	0.25
18.75	2.87	0.63	5.00	0.00	0.24	0.24
18.80	2.87	0.63	5.00	0.00	0.24	0.24
18.85	2.87	0.63	5.00	0.00	0.24	0.24
18.90	2.87	0.63	5.00	0.00	0.23	0.23
18.95	2.87	0.63	5.00	0.00	0.23	0.23
19.00	2.87	0.63	5.00	0.00	0.22	0.22
19.05	2.87	0.63	5.00	0.00	0.22	0.22
19.10	2.87	0.63	5.00	0.00	0.21	0.21
19.15	2.87	0.63	5.00	0.00	0.21	0.21
19.20	2.87	0.63	5.00	0.00	0.21	0.21
19.25	2.87	0.63	5.00	0.00	0.20	0.20
19.30	2.87	0.63	5.00	0.00	0.20	0.20
19.35	2.87	0.63	5.00	0.00	0.19	0.19
19.40	2.87	0.63	5.00	0.00	0.19	0.19
19.45	2.87	0.63	5.00	0.00	0.19	0.19
19.50	2.87	0.63	5.00	0.00	0.18	0.18
19.55	2.87	0.63	5.00	0.00	0.18	0.18
19.60	2.87	0.63	5.00	0.00	0.18	0.18
19.65	2.87	0.63	5.00	0.00	0.17	0.17
19.70	2.87	0.63	5.00	0.00	0.17	0.17
19.75	2.87	0.63	5.00	0.00	0.17	0.17
19.80	2.87	0.63	5.00	0.00	0.16	0.16
19.85	2.87	0.63	5.00	0.00	0.16	0.16
19.90	2.87	0.63	5.00	0.00	0.15	0.15
19.95	2.87	0.63	5.00	0.00	0.15	0.15

20.00	2.87	0.63	5.00	0.00	0.15	0.15
20.05	2.87	0.63	5.00	0.00	0.14	0.14
20.10	2.87	0.63	5.00	0.00	0.14	0.14
20.15	2.87	0.63	5.00	0.00	0.14	0.14
20.20	2.87	0.63	5.00	0.00	0.13	0.13
20.25	2.87	0.63	5.00	0.00	0.13	0.13
20.30	2.87	0.63	5.00	0.00	0.13	0.13
20.35	2.87	0.63	5.00	0.00	0.12	0.12
20.40	2.87	0.63	5.00	0.00	0.12	0.12
20.45	2.87	0.63	5.00	0.00	0.12	0.12
20.50	2.87	0.63	5.00	0.00	0.11	0.11
20.55	2.87	0.63	5.00	0.00	0.11	0.11
20.60	2.87	0.63	5.00	0.00	0.11	0.11
20.65	2.87	0.62	5.00	0.00	0.10	0.10
20.70	2.87	0.62	5.00	0.00	0.10	0.10
20.75	2.87	0.62	5.00	0.00	0.10	0.10
20.80	2.87	0.62	5.00	0.00	0.09	0.09
20.85	2.87	0.62	5.00	0.00	0.09	0.09
20.90	2.87	0.62	5.00	0.00	0.08	0.08
20.95	2.87	0.62	5.00	0.00	0.08	0.08
21.00	2.87	0.62	5.00	0.00	0.08	0.08
21.05	2.87	0.62	5.00	0.00	0.07	0.07
21.10	2.87	0.62	5.00	0.00	0.07	0.07
21.15	2.87	0.62	5.00	0.00	0.07	0.07
21.20	2.87	0.62	5.00	0.00	0.06	0.06
21.25	2.87	0.62	5.00	0.00	0.06	0.06
21.30	2.87	0.62	5.00	0.00	0.06	0.06
21.35	2.87	0.62	5.00	0.00	0.06	0.06
21.40	2.87	0.62	5.00	0.00	0.06	0.06
21.45	2.87	0.62	5.00	0.00	0.06	0.06
21.50	2.87	0.62	5.00	0.00	0.05	0.05
21.55	2.87	0.62	5.00	0.00	0.05	0.05
21.60	2.87	0.62	5.00	0.00	0.05	0.05
21.65	2.87	0.62	5.00	0.00	0.05	0.05
21.70	2.87	0.62	5.00	0.00	0.05	0.05
21.75	2.87	0.62	5.00	0.00	0.05	0.05
21.80	2.87	0.62	5.00	0.00	0.04	0.04
21.85	2.87	0.62	5.00	0.00	0.04	0.04
21.90	2.87	0.62	5.00	0.00	0.04	0.04
21.95	2.87	0.62	5.00	0.00	0.04	0.04
22.00	2.87	0.62	5.00	0.00	0.04	0.04
22.05	2.87	0.62	5.00	0.00	0.04	0.04
22.10	2.87	0.62	5.00	0.00	0.04	0.04
22.15	2.87	0.62	5.00	0.00	0.03	0.03
22.20	2.87	0.62	5.00	0.00	0.03	0.03
22.25	2.87	0.62	5.00	0.00	0.03	0.03
22.30	2.87	0.62	5.00	0.00	0.03	0.03
22.35	2.87	0.62	5.00	0.00	0.03	0.03
22.40	2.87	0.62	5.00	0.00	0.02	0.02
22.45	2.87	0.62	5.00	0.00	0.02	0.02
22.50	2.87	0.62	5.00	0.00	0.02	0.02
22.55	2.87	0.62	5.00	0.00	0.02	0.02
22.60	2.87	0.62	5.00	0.00	0.02	0.02
22.65	2.87	0.62	5.00	0.00	0.02	0.02
22.70	2.87	0.62	5.00	0.00	0.01	0.01
22.75	2.87	0.62	5.00	0.00	0.01	0.01
22.80	2.87	0.62	5.00	0.00	0.01	0.01
22.85	2.87	0.62	5.00	0.00	0.01	0.01
22.90	2.87	0.62	5.00	0.00	0.01	0.01
22.95	2.87	0.62	5.00	0.00	0.00	0.00
23.00	2.87	0.62	5.00	0.00	0.00	0.00
23.05	2.87	0.62	4.62	0.00	0.00	0.00
23.10	2.87	0.62	4.62	0.00	0.00	0.00
23.15	2.87	0.62	4.61	0.00	0.00	0.00
23.20	2.87	0.62	4.61	0.00	0.00	0.00
23.25	2.87	0.62	4.60	0.00	0.00	0.00
23.30	2.87	0.62	4.60	0.00	0.00	0.00

23.35	2.87	0.63	4.59	0.00	0.00	0.00
23.40	2.87	0.63	4.59	0.00	0.00	0.00
23.45	2.87	0.63	4.59	0.00	0.00	0.00
23.50	2.87	0.63	4.58	0.00	0.00	0.00
23.55	2.87	0.63	4.58	0.00	0.00	0.00
23.60	2.87	0.63	4.57	0.00	0.00	0.00
23.65	2.87	0.63	4.57	0.00	0.00	0.00
23.70	2.87	0.63	4.56	0.00	0.00	0.00
23.75	2.87	0.63	4.56	0.00	0.00	0.00
23.80	2.87	0.63	4.55	0.00	0.00	0.00
23.85	2.87	0.63	4.55	0.00	0.00	0.00
23.90	2.87	0.63	4.54	0.00	0.00	0.00
23.95	2.87	0.63	4.54	0.00	0.00	0.00
24.00	2.87	0.63	4.54	0.00	0.00	0.00
24.05	2.87	0.63	4.53	0.00	0.00	0.00
24.10	2.87	0.63	4.53	0.00	0.00	0.00
24.15	2.87	0.64	4.52	0.00	0.00	0.00
24.20	2.87	0.64	4.52	0.00	0.00	0.00
24.25	2.87	0.64	4.51	0.00	0.00	0.00
24.30	2.87	0.64	4.51	0.00	0.00	0.00
24.35	2.87	0.64	4.50	0.00	0.00	0.00
24.40	2.87	0.64	4.50	0.00	0.00	0.00
24.45	2.87	0.64	4.50	0.00	0.00	0.00
24.50	2.87	0.64	4.49	0.00	0.00	0.00
24.55	2.87	0.64	4.49	0.00	0.00	0.00
24.60	2.87	0.64	4.48	0.00	0.00	0.00
24.65	2.87	0.64	4.48	0.00	0.00	0.00
24.70	2.87	0.64	4.47	0.00	0.00	0.00
24.75	2.87	0.64	4.47	0.00	0.00	0.00
24.80	2.87	0.64	4.47	0.00	0.00	0.00
24.85	2.87	0.64	4.46	0.00	0.00	0.00
24.90	2.87	0.64	4.46	0.00	0.00	0.00
24.95	2.87	0.64	4.45	0.00	0.00	0.00
25.00	2.87	0.65	4.45	0.00	0.00	0.00
25.05	2.87	0.65	4.45	0.00	0.00	0.00
25.10	2.87	0.65	4.44	0.00	0.00	0.00
25.15	2.87	0.65	4.44	0.00	0.00	0.00
25.20	2.87	0.65	4.43	0.00	0.00	0.00
25.25	2.87	0.65	4.43	0.00	0.00	0.00
25.30	2.87	0.65	4.43	0.00	0.00	0.00
25.35	2.87	0.65	4.42	0.00	0.00	0.00
25.40	2.87	0.65	4.42	0.00	0.00	0.00
25.45	2.87	0.65	4.41	0.00	0.00	0.00
25.50	2.87	0.65	4.41	0.00	0.00	0.00
25.55	2.87	0.65	4.41	0.00	0.00	0.00
25.60	2.87	0.65	4.40	0.00	0.00	0.00
25.65	2.87	0.65	4.40	0.00	0.00	0.00
25.70	2.87	0.65	4.39	0.00	0.00	0.00
25.75	2.87	0.65	4.39	0.00	0.00	0.00
25.80	2.87	0.65	4.39	0.00	0.00	0.00
25.85	2.87	0.66	4.38	0.00	0.00	0.00
25.90	2.87	0.66	4.38	0.00	0.00	0.00
25.95	2.87	0.66	4.38	0.00	0.00	0.00
26.00	2.87	0.66	4.37	0.00	0.00	0.00
26.05	2.87	0.66	4.37	0.00	0.00	0.00
26.10	2.87	0.66	4.36	0.00	0.00	0.00
26.15	2.87	0.66	4.36	0.00	0.00	0.00
26.20	2.87	0.66	4.36	0.00	0.00	0.00
26.25	2.87	0.66	4.35	0.00	0.00	0.00
26.30	2.87	0.66	4.35	0.00	0.00	0.00
26.35	2.87	0.66	4.35	0.00	0.00	0.00
26.40	2.87	0.66	4.34	0.00	0.00	0.00
26.45	2.87	0.66	4.34	0.00	0.00	0.00
26.50	2.87	0.66	4.33	0.00	0.00	0.00
26.55	2.87	0.66	4.33	0.00	0.00	0.00
26.60	2.87	0.66	4.33	0.00	0.00	0.00
26.65	2.87	0.66	4.32	0.00	0.00	0.00

26.70	2.87	0.66	4.32	0.00	0.00	0.00
26.75	2.87	0.67	4.32	0.00	0.00	0.00
26.80	2.87	0.67	4.31	0.00	0.00	0.00
26.85	2.87	0.67	4.31	0.00	0.00	0.00
26.90	2.87	0.67	4.31	0.00	0.00	0.00
26.95	2.87	0.67	4.30	0.00	0.00	0.00
27.00	2.87	0.67	4.30	0.00	0.00	0.00
27.05	2.87	0.67	4.30	0.00	0.00	0.00
27.10	2.87	0.67	4.29	0.00	0.00	0.00
27.15	2.87	0.67	4.29	0.00	0.00	0.00
27.20	2.87	0.67	4.29	0.00	0.00	0.00
27.25	2.87	0.67	4.28	0.00	0.00	0.00
27.30	2.87	0.67	4.28	0.00	0.00	0.00
27.35	2.87	0.67	4.28	0.00	0.00	0.00
27.40	2.87	0.67	4.27	0.00	0.00	0.00
27.45	2.87	0.67	4.27	0.00	0.00	0.00
27.50	2.87	0.67	4.26	0.00	0.00	0.00
27.55	2.87	0.67	4.26	0.00	0.00	0.00
27.60	2.87	0.67	4.26	0.00	0.00	0.00
27.65	2.87	0.68	4.25	0.00	0.00	0.00
27.70	2.87	0.68	4.25	0.00	0.00	0.00
27.75	2.87	0.68	4.25	0.00	0.00	0.00
27.80	2.87	0.68	4.25	0.00	0.00	0.00
27.85	2.87	0.68	4.24	0.00	0.00	0.00
27.90	2.87	0.68	4.24	0.00	0.00	0.00
27.95	2.87	0.68	4.24	0.00	0.00	0.00
28.00	2.87	0.68	4.23	0.00	0.00	0.00
28.05	2.87	0.68	4.23	0.00	0.00	0.00
28.10	2.87	0.68	4.23	0.00	0.00	0.00
28.15	2.87	0.68	4.22	0.00	0.00	0.00
28.20	2.87	0.68	4.22	0.00	0.00	0.00
28.25	2.87	0.68	4.22	0.00	0.00	0.00
28.30	2.87	0.68	4.21	0.00	0.00	0.00
28.35	2.87	0.68	4.21	0.00	0.00	0.00
28.40	2.87	0.68	4.21	0.00	0.00	0.00
28.45	2.87	0.68	4.20	0.00	0.00	0.00
28.50	2.87	0.68	4.20	0.00	0.00	0.00
28.55	2.87	0.68	4.20	0.00	0.00	0.00
28.60	2.87	0.68	4.19	0.00	0.00	0.00
28.65	2.87	0.69	4.19	0.00	0.00	0.00
28.70	2.87	0.69	4.19	0.00	0.00	0.00
28.75	2.87	0.69	4.19	0.00	0.00	0.00
28.80	2.87	0.69	4.18	0.00	0.00	0.00
28.85	2.87	0.69	4.18	0.00	0.00	0.00
28.90	2.87	0.69	4.18	0.00	0.00	0.00
28.95	2.87	0.69	4.17	0.00	0.00	0.00
29.00	2.87	0.69	4.17	0.00	0.00	0.00
29.05	2.87	0.69	4.17	0.00	0.00	0.00
29.10	2.87	0.69	4.16	0.00	0.00	0.00
29.15	2.87	0.69	4.16	0.00	0.00	0.00
29.20	2.87	0.69	4.16	0.00	0.00	0.00
29.25	2.87	0.69	4.16	0.00	0.00	0.00
29.30	2.87	0.69	4.15	0.00	0.00	0.00
29.35	2.87	0.69	4.15	0.00	0.00	0.00
29.40	2.87	0.69	4.15	0.00	0.00	0.00
29.45	2.87	0.69	4.14	0.00	0.00	0.00
29.50	2.87	0.69	4.14	0.00	0.00	0.00
29.55	2.87	0.69	4.14	0.00	0.00	0.00
29.60	2.87	0.69	4.13	0.00	0.00	0.00
29.65	2.87	0.70	4.13	0.00	0.00	0.00
29.70	2.87	0.70	4.13	0.00	0.00	0.00
29.75	2.87	0.70	4.13	0.00	0.00	0.00
29.80	2.87	0.70	4.12	0.00	0.00	0.00
29.85	2.87	0.70	4.12	0.00	0.00	0.00
29.90	2.87	0.70	4.12	0.00	0.00	0.00
29.95	2.87	0.70	4.11	0.00	0.00	0.00
30.00	2.87	0.70	4.11	0.00	0.00	0.00

30.05	2.00	0.70	5.00	0.00	0.00	0.00
30.10	2.00	0.70	5.00	0.00	0.00	0.00
30.15	2.00	0.70	5.00	0.00	0.00	0.00
30.20	2.00	0.70	5.00	0.00	0.00	0.00
30.25	2.00	0.70	5.00	0.00	0.00	0.00
30.30	2.00	0.70	5.00	0.00	0.00	0.00
30.35	2.00	0.70	5.00	0.00	0.00	0.00
30.40	2.00	0.70	5.00	0.00	0.00	0.00
30.45	2.00	0.70	5.00	0.00	0.00	0.00
30.50	2.00	0.70	5.00	0.00	0.00	0.00
30.55	2.00	0.70	5.00	0.00	0.00	0.00
30.60	2.00	0.70	5.00	0.00	0.00	0.00
30.65	2.00	0.70	5.00	0.00	0.00	0.00
30.70	2.00	0.70	5.00	0.00	0.00	0.00
30.75	2.00	0.70	5.00	0.00	0.00	0.00
30.80	2.00	0.70	5.00	0.00	0.00	0.00
30.85	2.00	0.70	5.00	0.00	0.00	0.00
30.90	2.00	0.70	5.00	0.00	0.00	0.00
30.95	2.00	0.70	5.00	0.00	0.00	0.00
31.00	2.00	0.70	5.00	0.00	0.00	0.00
31.05	2.00	0.70	5.00	0.00	0.00	0.00
31.10	2.00	0.70	5.00	0.00	0.00	0.00
31.15	2.00	0.70	5.00	0.00	0.00	0.00
31.20	2.00	0.70	5.00	0.00	0.00	0.00
31.25	2.00	0.70	5.00	0.00	0.00	0.00
31.30	2.00	0.70	5.00	0.00	0.00	0.00
31.35	2.00	0.70	5.00	0.00	0.00	0.00
31.40	2.00	0.71	5.00	0.00	0.00	0.00
31.45	2.00	0.71	5.00	0.00	0.00	0.00
31.50	2.00	0.71	5.00	0.00	0.00	0.00
31.55	2.00	0.71	5.00	0.00	0.00	0.00
31.60	2.00	0.71	5.00	0.00	0.00	0.00
31.65	2.00	0.71	5.00	0.00	0.00	0.00
31.70	2.00	0.71	5.00	0.00	0.00	0.00
31.75	2.00	0.71	5.00	0.00	0.00	0.00
31.80	2.00	0.71	5.00	0.00	0.00	0.00
31.85	2.00	0.71	5.00	0.00	0.00	0.00
31.90	2.00	0.71	5.00	0.00	0.00	0.00
31.95	2.00	0.71	5.00	0.00	0.00	0.00
32.00	2.00	0.71	5.00	0.00	0.00	0.00
32.05	2.00	0.71	5.00	0.00	0.00	0.00
32.10	2.00	0.71	5.00	0.00	0.00	0.00
32.15	2.00	0.71	5.00	0.00	0.00	0.00
32.20	2.00	0.71	5.00	0.00	0.00	0.00
32.25	2.00	0.71	5.00	0.00	0.00	0.00
32.30	2.00	0.71	5.00	0.00	0.00	0.00
32.35	2.00	0.71	5.00	0.00	0.00	0.00
32.40	2.00	0.71	5.00	0.00	0.00	0.00
32.45	2.00	0.71	5.00	0.00	0.00	0.00
32.50	2.00	0.71	5.00	0.00	0.00	0.00
32.55	2.00	0.71	5.00	0.00	0.00	0.00
32.60	2.00	0.71	5.00	0.00	0.00	0.00
32.65	2.00	0.71	5.00	0.00	0.00	0.00
32.70	2.00	0.71	5.00	0.00	0.00	0.00
32.75	2.00	0.71	5.00	0.00	0.00	0.00
32.80	2.00	0.71	5.00	0.00	0.00	0.00
32.85	2.00	0.71	5.00	0.00	0.00	0.00
32.90	2.00	0.71	5.00	0.00	0.00	0.00
32.95	2.00	0.71	5.00	0.00	0.00	0.00
33.00	2.00	0.71	5.00	0.00	0.00	0.00
33.05	2.00	0.71	5.00	0.00	0.00	0.00
33.10	2.00	0.71	5.00	0.00	0.00	0.00
33.15	2.00	0.71	5.00	0.00	0.00	0.00
33.20	2.00	0.71	5.00	0.00	0.00	0.00
33.25	2.00	0.71	5.00	0.00	0.00	0.00
33.30	2.00	0.71	5.00	0.00	0.00	0.00
33.35	2.00	0.71	5.00	0.00	0.00	0.00

33.40	2.00	0.71	5.00	0.00	0.00	0.00
33.45	2.00	0.71	5.00	0.00	0.00	0.00
33.50	2.00	0.71	5.00	0.00	0.00	0.00
33.55	2.00	0.71	5.00	0.00	0.00	0.00
33.60	2.00	0.71	5.00	0.00	0.00	0.00
33.65	2.00	0.71	5.00	0.00	0.00	0.00
33.70	2.00	0.71	5.00	0.00	0.00	0.00
33.75	2.00	0.71	5.00	0.00	0.00	0.00
33.80	2.00	0.71	5.00	0.00	0.00	0.00
33.85	2.00	0.71	5.00	0.00	0.00	0.00
33.90	2.00	0.71	5.00	0.00	0.00	0.00
33.95	2.00	0.71	5.00	0.00	0.00	0.00
34.00	2.00	0.71	5.00	0.00	0.00	0.00
34.05	2.00	0.72	5.00	0.00	0.00	0.00
34.10	2.00	0.72	5.00	0.00	0.00	0.00
34.15	2.00	0.72	5.00	0.00	0.00	0.00
34.20	2.00	0.72	5.00	0.00	0.00	0.00
34.25	2.00	0.72	5.00	0.00	0.00	0.00
34.30	2.00	0.72	5.00	0.00	0.00	0.00
34.35	2.00	0.72	5.00	0.00	0.00	0.00
34.40	2.00	0.72	5.00	0.00	0.00	0.00
34.45	2.00	0.72	5.00	0.00	0.00	0.00
34.50	2.00	0.72	5.00	0.00	0.00	0.00
34.55	2.00	0.72	5.00	0.00	0.00	0.00
34.60	2.00	0.72	5.00	0.00	0.00	0.00
34.65	2.00	0.72	5.00	0.00	0.00	0.00
34.70	2.00	0.72	5.00	0.00	0.00	0.00
34.75	2.00	0.72	5.00	0.00	0.00	0.00
34.80	2.00	0.72	5.00	0.00	0.00	0.00
34.85	2.00	0.72	5.00	0.00	0.00	0.00
34.90	2.00	0.72	5.00	0.00	0.00	0.00
34.95	2.00	0.72	5.00	0.00	0.00	0.00
35.00	2.00	0.72	5.00	0.00	0.00	0.00
35.05	2.00	0.72	5.00	0.00	0.00	0.00
35.10	2.00	0.72	5.00	0.00	0.00	0.00
35.15	2.00	0.72	5.00	0.00	0.00	0.00
35.20	2.00	0.72	5.00	0.00	0.00	0.00
35.25	2.00	0.72	5.00	0.00	0.00	0.00
35.30	2.00	0.72	5.00	0.00	0.00	0.00
35.35	2.00	0.72	5.00	0.00	0.00	0.00
35.40	2.00	0.72	5.00	0.00	0.00	0.00
35.45	2.00	0.72	5.00	0.00	0.00	0.00
35.50	2.00	0.72	5.00	0.00	0.00	0.00
35.55	2.00	0.72	5.00	0.00	0.00	0.00
35.60	2.00	0.72	5.00	0.00	0.00	0.00
35.65	2.00	0.72	5.00	0.00	0.00	0.00
35.70	2.00	0.72	5.00	0.00	0.00	0.00
35.75	2.00	0.72	5.00	0.00	0.00	0.00
35.80	2.00	0.72	5.00	0.00	0.00	0.00
35.85	2.00	0.72	5.00	0.00	0.00	0.00
35.90	2.00	0.72	5.00	0.00	0.00	0.00
35.95	2.00	0.72	5.00	0.00	0.00	0.00
36.00	2.00	0.72	5.00	0.00	0.00	0.00
36.05	2.00	0.72	5.00	0.00	0.00	0.00
36.10	2.00	0.72	5.00	0.00	0.00	0.00
36.15	2.00	0.72	5.00	0.00	0.00	0.00
36.20	2.00	0.72	5.00	0.00	0.00	0.00
36.25	2.00	0.72	5.00	0.00	0.00	0.00
36.30	2.00	0.72	5.00	0.00	0.00	0.00
36.35	2.00	0.72	5.00	0.00	0.00	0.00
36.40	2.00	0.72	5.00	0.00	0.00	0.00
36.45	2.00	0.72	5.00	0.00	0.00	0.00
36.50	2.00	0.72	5.00	0.00	0.00	0.00
36.55	2.00	0.72	5.00	0.00	0.00	0.00
36.60	2.00	0.72	5.00	0.00	0.00	0.00
36.65	2.00	0.72	5.00	0.00	0.00	0.00
36.70	2.00	0.72	5.00	0.00	0.00	0.00

36.75	2.00	0.72	5.00	0.00	0.00	0.00
36.80	2.00	0.72	5.00	0.00	0.00	0.00
36.85	2.00	0.72	5.00	0.00	0.00	0.00
36.90	2.00	0.72	5.00	0.00	0.00	0.00
36.95	2.00	0.72	5.00	0.00	0.00	0.00
37.00	2.00	0.72	5.00	0.00	0.00	0.00
37.05	2.00	0.72	5.00	0.00	0.00	0.00
37.10	2.00	0.72	5.00	0.00	0.00	0.00
37.15	2.00	0.72	5.00	0.00	0.00	0.00
37.20	2.00	0.72	5.00	0.00	0.00	0.00
37.25	2.00	0.72	5.00	0.00	0.00	0.00
37.30	2.00	0.72	5.00	0.00	0.00	0.00
37.35	2.00	0.72	5.00	0.00	0.00	0.00
37.40	2.00	0.72	5.00	0.00	0.00	0.00
37.45	2.00	0.72	5.00	0.00	0.00	0.00
37.50	2.00	0.72	5.00	0.00	0.00	0.00
37.55	2.00	0.72	5.00	0.00	0.00	0.00
37.60	2.00	0.72	5.00	0.00	0.00	0.00
37.65	2.00	0.72	5.00	0.00	0.00	0.00
37.70	2.00	0.72	5.00	0.00	0.00	0.00
37.75	2.00	0.72	5.00	0.00	0.00	0.00
37.80	2.00	0.72	5.00	0.00	0.00	0.00
37.85	2.00	0.72	5.00	0.00	0.00	0.00
37.90	2.00	0.72	5.00	0.00	0.00	0.00
37.95	2.00	0.72	5.00	0.00	0.00	0.00
38.00	2.00	0.72	5.00	0.00	0.00	0.00
38.05	2.00	0.72	5.00	0.00	0.00	0.00
38.10	2.00	0.72	5.00	0.00	0.00	0.00
38.15	2.00	0.72	5.00	0.00	0.00	0.00
38.20	2.00	0.72	5.00	0.00	0.00	0.00
38.25	2.00	0.72	5.00	0.00	0.00	0.00
38.30	2.00	0.72	5.00	0.00	0.00	0.00
38.35	2.00	0.72	5.00	0.00	0.00	0.00
38.40	2.00	0.72	5.00	0.00	0.00	0.00
38.45	2.00	0.72	5.00	0.00	0.00	0.00
38.50	2.00	0.72	5.00	0.00	0.00	0.00
38.55	2.00	0.72	5.00	0.00	0.00	0.00
38.60	2.00	0.72	5.00	0.00	0.00	0.00
38.65	2.00	0.72	5.00	0.00	0.00	0.00
38.70	2.00	0.72	5.00	0.00	0.00	0.00
38.75	2.00	0.72	5.00	0.00	0.00	0.00
38.80	2.00	0.72	5.00	0.00	0.00	0.00
38.85	2.00	0.73	5.00	0.00	0.00	0.00
38.90	2.00	0.73	5.00	0.00	0.00	0.00
38.95	2.00	0.73	5.00	0.00	0.00	0.00
39.00	2.00	0.73	5.00	0.00	0.00	0.00
39.05	2.00	0.73	5.00	0.00	0.00	0.00
39.10	2.00	0.73	5.00	0.00	0.00	0.00
39.15	2.00	0.73	5.00	0.00	0.00	0.00
39.20	2.00	0.73	5.00	0.00	0.00	0.00
39.25	2.00	0.73	5.00	0.00	0.00	0.00
39.30	2.00	0.73	5.00	0.00	0.00	0.00
39.35	2.00	0.73	5.00	0.00	0.00	0.00
39.40	2.00	0.73	5.00	0.00	0.00	0.00
39.45	2.00	0.73	5.00	0.00	0.00	0.00
39.50	2.00	0.73	5.00	0.00	0.00	0.00
39.55	2.00	0.73	5.00	0.00	0.00	0.00
39.60	2.00	0.73	5.00	0.00	0.00	0.00
39.65	2.00	0.73	5.00	0.00	0.00	0.00
39.70	2.00	0.73	5.00	0.00	0.00	0.00
39.75	2.00	0.73	5.00	0.00	0.00	0.00
39.80	2.00	0.73	5.00	0.00	0.00	0.00
39.85	2.00	0.73	5.00	0.00	0.00	0.00
39.90	2.00	0.73	5.00	0.00	0.00	0.00
39.95	2.00	0.73	5.00	0.00	0.00	0.00
40.00	2.00	0.73	5.00	0.00	0.00	0.00
40.05	2.85	0.73	3.93	0.00	0.00	0.00

40.10	2.85	0.73	3.93	0.00	0.00	0.00
40.15	2.85	0.73	3.93	0.00	0.00	0.00
40.20	2.85	0.73	3.93	0.00	0.00	0.00
40.25	2.85	0.73	3.93	0.00	0.00	0.00
40.30	2.85	0.73	3.93	0.00	0.00	0.00
40.35	2.85	0.73	3.93	0.00	0.00	0.00
40.40	2.85	0.73	3.93	0.00	0.00	0.00
40.45	2.85	0.73	3.93	0.00	0.00	0.00
40.50	2.85	0.73	3.93	0.00	0.00	0.00
40.55	2.85	0.73	3.92	0.00	0.00	0.00
40.60	2.85	0.73	3.92	0.00	0.00	0.00
40.65	2.85	0.73	3.92	0.00	0.00	0.00
40.70	2.85	0.73	3.92	0.00	0.00	0.00
40.75	2.85	0.73	3.92	0.00	0.00	0.00
40.80	2.85	0.73	3.92	0.00	0.00	0.00
40.85	2.85	0.73	3.92	0.00	0.00	0.00
40.90	2.85	0.73	3.92	0.00	0.00	0.00
40.95	2.85	0.73	3.92	0.00	0.00	0.00
41.00	2.85	0.73	3.92	0.00	0.00	0.00
41.05	2.85	0.73	3.92	0.00	0.00	0.00
41.10	2.85	0.73	3.92	0.00	0.00	0.00
41.15	2.85	0.73	3.92	0.00	0.00	0.00
41.20	2.85	0.73	3.92	0.00	0.00	0.00
41.25	2.85	0.73	3.92	0.00	0.00	0.00
41.30	2.85	0.73	3.92	0.00	0.00	0.00
41.35	2.85	0.73	3.92	0.00	0.00	0.00
41.40	2.85	0.73	3.92	0.00	0.00	0.00
41.45	2.85	0.73	3.92	0.00	0.00	0.00
41.50	2.84	0.73	3.91	0.00	0.00	0.00
41.55	2.84	0.73	3.91	0.00	0.00	0.00
41.60	2.84	0.73	3.91	0.00	0.00	0.00
41.65	2.84	0.73	3.91	0.00	0.00	0.00
41.70	2.84	0.73	3.91	0.00	0.00	0.00
41.75	2.84	0.73	3.91	0.00	0.00	0.00
41.80	2.84	0.73	3.91	0.00	0.00	0.00
41.85	2.84	0.73	3.91	0.00	0.00	0.00
41.90	2.84	0.73	3.91	0.00	0.00	0.00
41.95	2.84	0.73	3.91	0.00	0.00	0.00
42.00	2.84	0.73	3.91	0.00	0.00	0.00
42.05	2.84	0.73	3.91	0.00	0.00	0.00
42.10	2.84	0.73	3.91	0.00	0.00	0.00
42.15	2.84	0.73	3.91	0.00	0.00	0.00
42.20	2.84	0.73	3.91	0.00	0.00	0.00
42.25	2.84	0.73	3.91	0.00	0.00	0.00
42.30	2.84	0.73	3.91	0.00	0.00	0.00
42.35	2.84	0.73	3.91	0.00	0.00	0.00
42.40	2.84	0.73	3.91	0.00	0.00	0.00
42.45	2.84	0.73	3.91	0.00	0.00	0.00
42.50	2.84	0.73	3.91	0.00	0.00	0.00
42.55	2.84	0.73	3.91	0.00	0.00	0.00
42.60	2.84	0.73	3.90	0.00	0.00	0.00
42.65	2.84	0.73	3.90	0.00	0.00	0.00
42.70	2.84	0.73	3.90	0.00	0.00	0.00
42.75	2.84	0.73	3.90	0.00	0.00	0.00
42.80	2.84	0.73	3.90	0.00	0.00	0.00
42.85	2.84	0.73	3.90	0.00	0.00	0.00
42.90	2.84	0.73	3.90	0.00	0.00	0.00
42.95	2.84	0.73	3.90	0.00	0.00	0.00
43.00	2.84	0.73	3.90	0.00	0.00	0.00
43.05	2.84	0.73	3.90	0.00	0.00	0.00
43.10	2.83	0.73	3.90	0.00	0.00	0.00
43.15	2.83	0.73	3.90	0.00	0.00	0.00
43.20	2.83	0.73	3.90	0.00	0.00	0.00
43.25	2.83	0.73	3.90	0.00	0.00	0.00
43.30	2.83	0.73	3.90	0.00	0.00	0.00
43.35	2.83	0.73	3.90	0.00	0.00	0.00
43.40	2.83	0.73	3.90	0.00	0.00	0.00

43.45	2.83	0.73	3.90	0.00	0.00	0.00
43.50	2.83	0.73	3.90	0.00	0.00	0.00
43.55	2.83	0.73	3.90	0.00	0.00	0.00
43.60	2.83	0.73	3.90	0.00	0.00	0.00
43.65	2.83	0.73	3.90	0.00	0.00	0.00
43.70	2.83	0.73	3.90	0.00	0.00	0.00
43.75	2.83	0.73	3.90	0.00	0.00	0.00
43.80	2.83	0.73	3.90	0.00	0.00	0.00
43.85	2.83	0.73	3.90	0.00	0.00	0.00
43.90	2.83	0.73	3.90	0.00	0.00	0.00
43.95	2.83	0.73	3.90	0.00	0.00	0.00
44.00	2.83	0.73	3.90	0.00	0.00	0.00
44.05	2.83	0.73	3.89	0.00	0.00	0.00
44.10	2.83	0.73	3.89	0.00	0.00	0.00
44.15	2.83	0.73	3.89	0.00	0.00	0.00
44.20	2.83	0.73	3.89	0.00	0.00	0.00
44.25	2.83	0.73	3.89	0.00	0.00	0.00
44.30	2.83	0.73	3.89	0.00	0.00	0.00
44.35	2.83	0.73	3.89	0.00	0.00	0.00
44.40	2.83	0.73	3.89	0.00	0.00	0.00
44.45	2.83	0.73	3.89	0.00	0.00	0.00
44.50	2.83	0.73	3.89	0.00	0.00	0.00
44.55	2.83	0.73	3.89	0.00	0.00	0.00
44.60	2.83	0.73	3.89	0.00	0.00	0.00
44.65	2.83	0.73	3.89	0.00	0.00	0.00
44.70	2.83	0.73	3.89	0.00	0.00	0.00
44.75	2.82	0.73	3.89	0.00	0.00	0.00
44.80	2.82	0.73	3.89	0.00	0.00	0.00
44.85	2.82	0.73	3.89	0.00	0.00	0.00
44.90	2.82	0.73	3.89	0.00	0.00	0.00
44.95	2.82	0.73	3.89	0.00	0.00	0.00
45.00	2.82	0.73	3.89	0.00	0.00	0.00
45.05	2.82	0.73	3.89	0.00	0.00	0.00
45.10	2.82	0.73	3.89	0.00	0.00	0.00
45.15	2.82	0.73	3.89	0.00	0.00	0.00
45.20	2.82	0.73	3.89	0.00	0.00	0.00
45.25	2.82	0.73	3.89	0.00	0.00	0.00
45.30	2.82	0.73	3.89	0.00	0.00	0.00
45.35	2.82	0.73	3.89	0.00	0.00	0.00
45.40	2.82	0.73	3.89	0.00	0.00	0.00
45.45	2.82	0.73	3.89	0.00	0.00	0.00
45.50	2.82	0.73	3.89	0.00	0.00	0.00
45.55	2.82	0.73	3.89	0.00	0.00	0.00
45.60	2.82	0.73	3.89	0.00	0.00	0.00
45.65	2.82	0.73	3.89	0.00	0.00	0.00
45.70	2.82	0.73	3.89	0.00	0.00	0.00
45.75	2.82	0.73	3.89	0.00	0.00	0.00
45.80	2.82	0.73	3.89	0.00	0.00	0.00
45.85	2.82	0.73	3.89	0.00	0.00	0.00
45.90	2.82	0.72	3.89	0.00	0.00	0.00
45.95	2.82	0.72	3.89	0.00	0.00	0.00
46.00	2.82	0.72	3.89	0.00	0.00	0.00
46.05	2.82	0.72	3.89	0.00	0.00	0.00
46.10	2.82	0.72	3.89	0.00	0.00	0.00
46.15	2.82	0.72	3.89	0.00	0.00	0.00
46.20	2.82	0.72	3.89	0.00	0.00	0.00
46.25	2.82	0.72	3.89	0.00	0.00	0.00
46.30	2.82	0.72	3.89	0.00	0.00	0.00
46.35	2.82	0.72	3.89	0.00	0.00	0.00
46.40	2.81	0.72	3.89	0.00	0.00	0.00
46.45	2.81	0.72	3.89	0.00	0.00	0.00
46.50	2.81	0.72	3.89	0.00	0.00	0.00
46.55	2.81	0.72	3.89	0.00	0.00	0.00
46.60	2.81	0.72	3.89	0.00	0.00	0.00
46.65	2.81	0.72	3.89	0.00	0.00	0.00
46.70	2.81	0.72	3.89	0.00	0.00	0.00
46.75	2.81	0.72	3.89	0.00	0.00	0.00

46.80	2.81	0.72	3.88	0.00	0.00	0.00
46.85	2.81	0.72	3.88	0.00	0.00	0.00
46.90	2.81	0.72	3.88	0.00	0.00	0.00
46.95	2.81	0.72	3.88	0.00	0.00	0.00
47.00	2.81	0.72	3.88	0.00	0.00	0.00
47.05	2.81	0.72	3.88	0.00	0.00	0.00
47.10	2.81	0.72	3.88	0.00	0.00	0.00
47.15	2.81	0.72	3.88	0.00	0.00	0.00
47.20	2.81	0.72	3.88	0.00	0.00	0.00
47.25	2.81	0.72	3.88	0.00	0.00	0.00
47.30	2.81	0.72	3.88	0.00	0.00	0.00
47.35	2.81	0.72	3.88	0.00	0.00	0.00
47.40	2.81	0.72	3.88	0.00	0.00	0.00
47.45	2.81	0.72	3.88	0.00	0.00	0.00
47.50	2.81	0.72	3.88	0.00	0.00	0.00
47.55	2.81	0.72	3.88	0.00	0.00	0.00
47.60	2.81	0.72	3.88	0.00	0.00	0.00
47.65	2.81	0.72	3.88	0.00	0.00	0.00
47.70	2.81	0.72	3.88	0.00	0.00	0.00
47.75	2.81	0.72	3.88	0.00	0.00	0.00
47.80	2.81	0.72	3.88	0.00	0.00	0.00
47.85	2.81	0.72	3.88	0.00	0.00	0.00
47.90	2.81	0.72	3.88	0.00	0.00	0.00
47.95	2.81	0.72	3.88	0.00	0.00	0.00
48.00	2.81	0.72	3.88	0.00	0.00	0.00
48.05	2.81	0.72	3.88	0.00	0.00	0.00
48.10	2.80	0.72	3.88	0.00	0.00	0.00
48.15	2.80	0.72	3.88	0.00	0.00	0.00
48.20	2.80	0.72	3.88	0.00	0.00	0.00
48.25	2.80	0.72	3.88	0.00	0.00	0.00
48.30	2.80	0.72	3.88	0.00	0.00	0.00
48.35	2.80	0.72	3.88	0.00	0.00	0.00
48.40	2.80	0.72	3.88	0.00	0.00	0.00
48.45	2.80	0.72	3.88	0.00	0.00	0.00
48.50	2.80	0.72	3.88	0.00	0.00	0.00
48.55	2.80	0.72	3.88	0.00	0.00	0.00
48.60	2.80	0.72	3.88	0.00	0.00	0.00
48.65	2.80	0.72	3.88	0.00	0.00	0.00
48.70	2.80	0.72	3.88	0.00	0.00	0.00
48.75	2.80	0.72	3.88	0.00	0.00	0.00
48.80	2.80	0.72	3.89	0.00	0.00	0.00
48.85	2.80	0.72	3.89	0.00	0.00	0.00
48.90	2.80	0.72	3.89	0.00	0.00	0.00
48.95	2.80	0.72	3.89	0.00	0.00	0.00
49.00	2.80	0.72	3.89	0.00	0.00	0.00
49.05	2.80	0.72	3.89	0.00	0.00	0.00
49.10	2.80	0.72	3.89	0.00	0.00	0.00
49.15	2.80	0.72	3.89	0.00	0.00	0.00
49.20	2.80	0.72	3.89	0.00	0.00	0.00
49.25	2.80	0.72	3.89	0.00	0.00	0.00
49.30	2.80	0.72	3.89	0.00	0.00	0.00
49.35	2.80	0.72	3.89	0.00	0.00	0.00
49.40	2.80	0.72	3.89	0.00	0.00	0.00
49.45	2.80	0.72	3.89	0.00	0.00	0.00
49.50	2.80	0.72	3.89	0.00	0.00	0.00
49.55	2.80	0.72	3.89	0.00	0.00	0.00
49.60	2.80	0.72	3.89	0.00	0.00	0.00
49.65	2.80	0.72	3.89	0.00	0.00	0.00
49.70	2.80	0.72	3.89	0.00	0.00	0.00
49.75	2.80	0.72	3.89	0.00	0.00	0.00
49.80	2.79	0.72	3.89	0.00	0.00	0.00
49.85	2.79	0.72	3.89	0.00	0.00	0.00
49.90	2.79	0.72	3.89	0.00	0.00	0.00
49.95	2.79	0.72	3.89	0.00	0.00	0.00
50.00	2.79	0.72	3.89	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone

(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

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

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1 atm (atmosphere) = 1 tsf (ton/ft2)

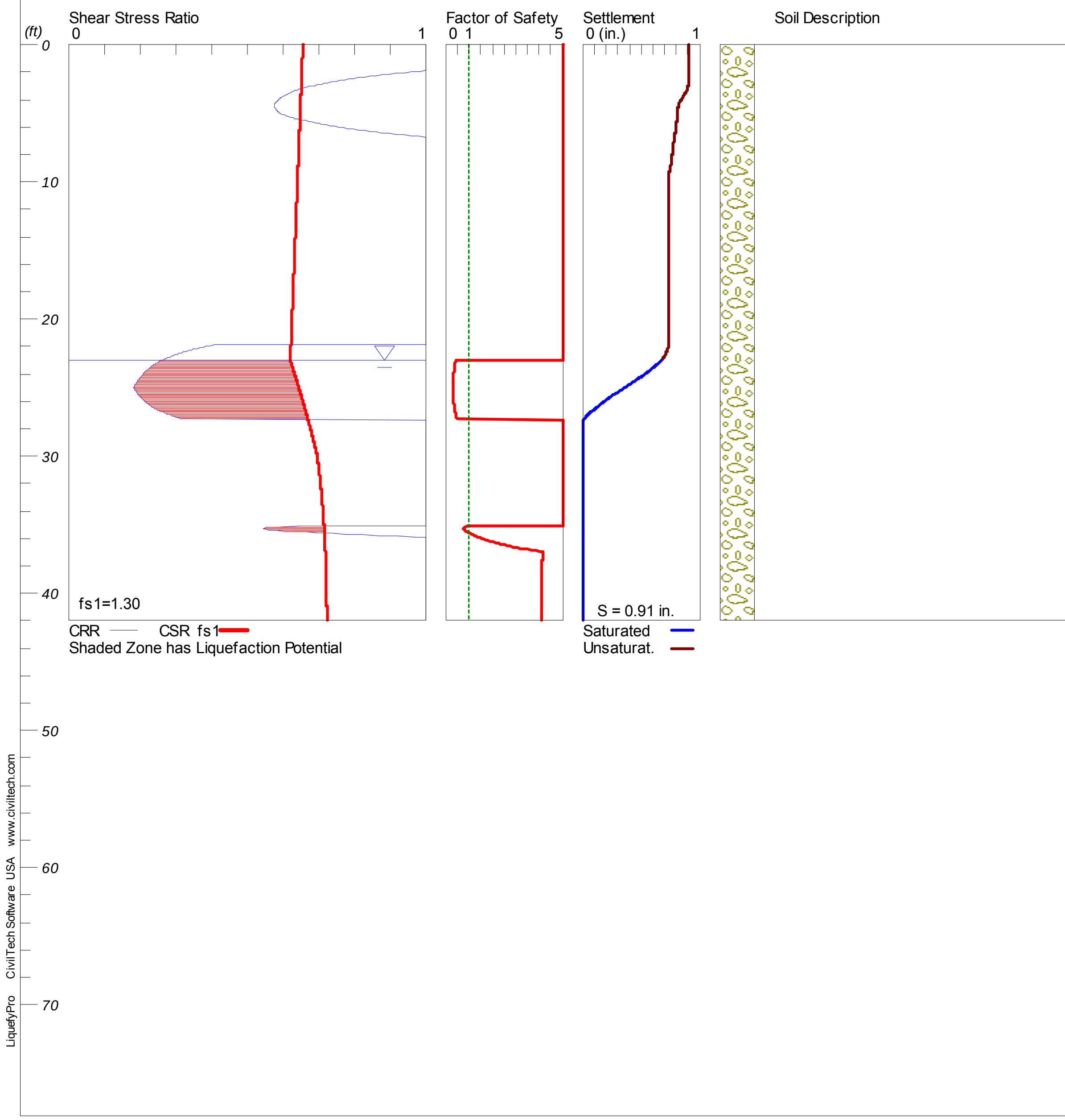
CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

LIQUEFACTION ANALYSIS

Parking Lot S MT Sac

Hole No.=CPT 8   Water Depth=23 ft

Magnitude=6.51
Acceleration=0.777g



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LIQUEFACTION ANALYSIS SUMMARY

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Font: Courier New, Regular, Size 8 is recommended for this report.
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Input File Name: K:\Ram\17-31-247-00 MT SAC lot R&S\Parking Lot S\UNTITLED CPT.liq
Title: Parking Lot S MT Sac
Subtitle: 17-31-247-01

Surface Elev.=
Hole No.=CPT 8
Depth of Hole= 42.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 23.00 ft
Max. Acceleration= 0.78 g
Earthquake Magnitude= 6.51

Input Data:

Surface Elev.=
Hole No.=CPT 8
Depth of Hole=42.00 ft
Water Table during Earthquake= 23.00 ft
Water Table during In-Situ Testing= 23.00 ft
Max. Acceleration=0.78 g
Earthquake Magnitude=6.51
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. CPT Calculation Method: Modify Robertson*
2. Settlement Analysis Method: Tokimatsu, M-correction
3. Fines Correction for Liquefaction: Stark/Olson et al.*
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
9. User request factor of safety (apply to CSR) ,   User= 1.3
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	qc atm	fs atm	Rf pcf	gamma %	Fines mm	D50
0.00	50.75	0.94	1.85	114.00	0.00	0.50
5.00	35.61	1.15	3.23	114.00	0.00	0.50
10.00	29.97	1.78	5.94	118.00	0.00	0.50
15.00	20.05	0.63	3.14	118.00	0.00	0.50
20.00	30.81	1.04	3.38	118.00	0.00	0.50
25.00	42.50	0.63	1.48	118.00	0.00	0.50
30.00	32.79	1.15	3.51	113.00	0.00	0.50
35.00	52.63	1.98	3.76	112.00	0.00	0.50
40.00	674.30	13.68	2.03	110.00	0.00	0.50
42.00	732.00	13.80	1.89	110.00	0.00	0.50

Modify Robertson method generates Fines from qc/fs. Inputted Fines are not relevant.

Output Results:

Settlement of Saturated Sands=0.67 in.
Settlement of Unsaturated Sands=0.24 in.
Total Settlement of Saturated and Unsaturated Sands=0.91 in.
Differential Settlement=0.454 to 0.600 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.66	5.00	0.67	0.24	0.91

0.05	2.99	0.66	5.00	0.67	0.24	0.91
0.10	2.99	0.66	5.00	0.67	0.24	0.91
0.15	2.99	0.66	5.00	0.67	0.24	0.91
0.20	2.99	0.66	5.00	0.67	0.24	0.91
0.25	2.99	0.66	5.00	0.67	0.24	0.91
0.30	2.99	0.66	5.00	0.67	0.24	0.91
0.35	2.99	0.66	5.00	0.67	0.24	0.91
0.40	2.99	0.66	5.00	0.67	0.24	0.91
0.45	2.99	0.66	5.00	0.67	0.24	0.91
0.50	2.99	0.66	5.00	0.67	0.24	0.91
0.55	2.99	0.66	5.00	0.67	0.24	0.91
0.60	2.99	0.66	5.00	0.67	0.24	0.91
0.65	2.99	0.66	5.00	0.67	0.24	0.91
0.70	2.99	0.66	5.00	0.67	0.24	0.91
0.75	2.92	0.66	5.00	0.67	0.24	0.91
0.80	2.69	0.66	5.00	0.67	0.24	0.91
0.85	2.50	0.66	5.00	0.67	0.24	0.91
0.90	2.33	0.66	5.00	0.67	0.24	0.91
0.95	2.19	0.66	5.00	0.67	0.24	0.91
1.00	2.06	0.66	5.00	0.67	0.24	0.91
1.05	1.94	0.65	5.00	0.67	0.24	0.91
1.10	1.84	0.65	5.00	0.67	0.24	0.91
1.15	1.75	0.65	5.00	0.67	0.24	0.91
1.20	1.66	0.65	5.00	0.67	0.24	0.91
1.25	1.59	0.65	5.00	0.67	0.24	0.91
1.30	1.52	0.65	5.00	0.67	0.24	0.91
1.35	1.46	0.65	5.00	0.67	0.24	0.91
1.40	1.40	0.65	5.00	0.67	0.24	0.91
1.45	1.35	0.65	5.00	0.67	0.24	0.91
1.50	1.30	0.65	5.00	0.67	0.24	0.91
1.55	1.25	0.65	5.00	0.67	0.24	0.91
1.60	1.21	0.65	5.00	0.67	0.24	0.91
1.65	1.17	0.65	5.00	0.67	0.24	0.91
1.70	1.14	0.65	5.00	0.67	0.24	0.91
1.75	1.10	0.65	5.00	0.67	0.24	0.91
1.80	1.07	0.65	5.00	0.67	0.24	0.91
1.85	1.04	0.65	5.00	0.67	0.24	0.91
1.90	1.01	0.65	5.00	0.67	0.24	0.91
1.95	0.99	0.65	5.00	0.67	0.24	0.91
2.00	0.96	0.65	5.00	0.67	0.24	0.91
2.05	0.94	0.65	5.00	0.67	0.23	0.91
2.10	0.92	0.65	5.00	0.67	0.23	0.91
2.15	0.90	0.65	5.00	0.67	0.23	0.91
2.20	0.88	0.65	5.00	0.67	0.23	0.91
2.25	0.86	0.65	5.00	0.67	0.23	0.91
2.30	0.84	0.65	5.00	0.67	0.23	0.91
2.35	0.83	0.65	5.00	0.67	0.23	0.91
2.40	0.81	0.65	5.00	0.67	0.23	0.91
2.45	0.80	0.65	5.00	0.67	0.23	0.91
2.50	0.79	0.65	5.00	0.67	0.23	0.90
2.55	0.77	0.65	5.00	0.67	0.23	0.90
2.60	0.76	0.65	5.00	0.67	0.23	0.90
2.65	0.75	0.65	5.00	0.67	0.23	0.90
2.70	0.74	0.65	5.00	0.67	0.23	0.90
2.75	0.73	0.65	5.00	0.67	0.23	0.90
2.80	0.72	0.65	5.00	0.67	0.23	0.90
2.85	0.71	0.65	5.00	0.67	0.23	0.90
2.90	0.70	0.65	5.00	0.67	0.23	0.90
2.95	0.69	0.65	5.00	0.67	0.23	0.90
3.00	0.68	0.65	5.00	0.67	0.23	0.90
3.05	0.67	0.65	5.00	0.67	0.23	0.90
3.10	0.67	0.65	5.00	0.67	0.23	0.90
3.15	0.66	0.65	5.00	0.67	0.23	0.90
3.20	0.65	0.65	5.00	0.67	0.22	0.90
3.25	0.65	0.65	5.00	0.67	0.22	0.89
3.30	0.64	0.65	5.00	0.67	0.22	0.89
3.35	0.63	0.65	5.00	0.67	0.22	0.89

3.40	0.63	0.65	5.00	0.67	0.22	0.89
3.45	0.62	0.65	5.00	0.67	0.21	0.88
3.50	0.62	0.65	5.00	0.67	0.21	0.88
3.55	0.62	0.65	5.00	0.67	0.20	0.88
3.60	0.61	0.65	5.00	0.67	0.20	0.87
3.65	0.61	0.65	5.00	0.67	0.20	0.87
3.70	0.60	0.65	5.00	0.67	0.19	0.86
3.75	0.60	0.65	5.00	0.67	0.19	0.86
3.80	0.60	0.65	5.00	0.67	0.18	0.86
3.85	0.59	0.65	5.00	0.67	0.18	0.85
3.90	0.59	0.65	5.00	0.67	0.18	0.85
3.95	0.59	0.65	5.00	0.67	0.17	0.84
4.00	0.59	0.65	5.00	0.67	0.17	0.84
4.05	0.59	0.65	5.00	0.67	0.17	0.84
4.10	0.58	0.65	5.00	0.67	0.16	0.83
4.15	0.58	0.65	5.00	0.67	0.16	0.83
4.20	0.58	0.65	5.00	0.67	0.15	0.82
4.25	0.58	0.65	5.00	0.67	0.15	0.82
4.30	0.58	0.65	5.00	0.67	0.15	0.82
4.35	0.58	0.65	5.00	0.67	0.15	0.82
4.40	0.58	0.65	5.00	0.67	0.14	0.82
4.45	0.58	0.65	5.00	0.67	0.14	0.82
4.50	0.58	0.65	5.00	0.67	0.14	0.82
4.55	0.58	0.65	5.00	0.67	0.14	0.81
4.60	0.58	0.65	5.00	0.67	0.14	0.81
4.65	0.58	0.65	5.00	0.67	0.14	0.81
4.70	0.58	0.65	5.00	0.67	0.14	0.81
4.75	0.58	0.65	5.00	0.67	0.14	0.81
4.80	0.58	0.65	5.00	0.67	0.14	0.81
4.85	0.59	0.65	5.00	0.67	0.14	0.81
4.90	0.59	0.65	5.00	0.67	0.14	0.81
4.95	0.59	0.65	5.00	0.67	0.14	0.81
5.00	0.59	0.65	5.00	0.67	0.14	0.81
5.05	0.60	0.65	5.00	0.67	0.14	0.81
5.10	0.60	0.65	5.00	0.67	0.14	0.81
5.15	0.61	0.65	5.00	0.67	0.14	0.81
5.20	0.61	0.65	5.00	0.67	0.14	0.81
5.25	0.62	0.65	5.00	0.67	0.14	0.81
5.30	0.63	0.65	5.00	0.67	0.14	0.81
5.35	0.63	0.65	5.00	0.67	0.13	0.81
5.40	0.64	0.65	5.00	0.67	0.13	0.81
5.45	0.65	0.65	5.00	0.67	0.13	0.80
5.50	0.66	0.65	5.00	0.67	0.13	0.80
5.55	0.66	0.65	5.00	0.67	0.13	0.80
5.60	0.67	0.65	5.00	0.67	0.13	0.80
5.65	0.68	0.65	5.00	0.67	0.13	0.80
5.70	0.69	0.65	5.00	0.67	0.13	0.80
5.75	0.70	0.65	5.00	0.67	0.13	0.80
5.80	0.71	0.65	5.00	0.67	0.13	0.80
5.85	0.72	0.65	5.00	0.67	0.13	0.80
5.90	0.73	0.65	5.00	0.67	0.13	0.80
5.95	0.74	0.65	5.00	0.67	0.13	0.80
6.00	0.76	0.65	5.00	0.67	0.13	0.80
6.05	0.77	0.65	5.00	0.67	0.12	0.80
6.10	0.78	0.65	5.00	0.67	0.12	0.80
6.15	0.80	0.65	5.00	0.67	0.12	0.79
6.20	0.81	0.65	5.00	0.67	0.12	0.79
6.25	0.83	0.65	5.00	0.67	0.12	0.79
6.30	0.84	0.65	5.00	0.67	0.12	0.79
6.35	0.86	0.65	5.00	0.67	0.12	0.79
6.40	0.88	0.65	5.00	0.67	0.12	0.79
6.45	0.90	0.65	5.00	0.67	0.12	0.79
6.50	0.92	0.65	5.00	0.67	0.12	0.79
6.55	0.94	0.65	5.00	0.67	0.12	0.79
6.60	0.96	0.65	5.00	0.67	0.12	0.79
6.65	0.98	0.65	5.00	0.67	0.11	0.79
6.70	1.01	0.65	5.00	0.67	0.11	0.79

6.75	1.03	0.65	5.00	0.67	0.11	0.78
6.80	1.06	0.65	5.00	0.67	0.11	0.78
6.85	1.09	0.65	5.00	0.67	0.11	0.78
6.90	1.12	0.65	5.00	0.67	0.11	0.78
6.95	1.15	0.65	5.00	0.67	0.11	0.78
7.00	1.19	0.65	5.00	0.67	0.11	0.78
7.05	1.22	0.65	5.00	0.67	0.11	0.78
7.10	1.26	0.65	5.00	0.67	0.11	0.78
7.15	1.30	0.65	5.00	0.67	0.11	0.78
7.20	1.34	0.65	5.00	0.67	0.11	0.78
7.25	1.39	0.65	5.00	0.67	0.10	0.78
7.30	1.44	0.65	5.00	0.67	0.10	0.78
7.35	1.49	0.65	5.00	0.67	0.10	0.77
7.40	1.55	0.65	5.00	0.67	0.10	0.77
7.45	1.61	0.65	5.00	0.67	0.10	0.77
7.50	1.67	0.65	5.00	0.67	0.10	0.77
7.55	1.74	0.65	5.00	0.67	0.10	0.77
7.60	1.81	0.64	5.00	0.67	0.10	0.77
7.65	1.89	0.64	5.00	0.67	0.10	0.77
7.70	1.98	0.64	5.00	0.67	0.10	0.77
7.75	2.07	0.64	5.00	0.67	0.10	0.77
7.80	2.17	0.64	5.00	0.67	0.10	0.77
7.85	2.17	0.64	5.00	0.67	0.10	0.77
7.90	2.14	0.64	5.00	0.67	0.10	0.77
7.95	1.79	0.64	5.00	0.67	0.10	0.77
8.00	1.85	0.64	5.00	0.67	0.09	0.77
8.05	1.92	0.64	5.00	0.67	0.09	0.76
8.10	2.00	0.64	5.00	0.67	0.09	0.76
8.15	2.08	0.64	5.00	0.67	0.09	0.76
8.20	2.16	0.64	5.00	0.67	0.09	0.76
8.25	2.25	0.64	5.00	0.67	0.09	0.76
8.30	2.35	0.64	5.00	0.67	0.09	0.76
8.35	2.46	0.64	5.00	0.67	0.09	0.76
8.40	2.58	0.64	5.00	0.67	0.09	0.76
8.45	2.71	0.64	5.00	0.67	0.09	0.76
8.50	2.84	0.64	5.00	0.67	0.09	0.76
8.55	2.77	0.64	5.00	0.67	0.09	0.76
8.60	2.72	0.64	5.00	0.67	0.08	0.76
8.65	2.68	0.64	5.00	0.67	0.08	0.76
8.70	2.63	0.64	5.00	0.67	0.08	0.75
8.75	2.59	0.64	5.00	0.67	0.08	0.75
8.80	2.55	0.64	5.00	0.67	0.08	0.75
8.85	2.50	0.64	5.00	0.67	0.08	0.75
8.90	2.46	0.64	5.00	0.67	0.08	0.75
8.95	2.42	0.64	5.00	0.67	0.08	0.75
9.00	2.38	0.64	5.00	0.67	0.08	0.75
9.05	2.34	0.64	5.00	0.67	0.08	0.75
9.10	2.30	0.64	5.00	0.67	0.08	0.75
9.15	2.27	0.64	5.00	0.67	0.07	0.75
9.20	2.23	0.64	5.00	0.67	0.07	0.74
9.25	2.19	0.64	5.00	0.67	0.07	0.74
9.30	2.16	0.64	5.00	0.67	0.07	0.74
9.35	2.13	0.64	5.00	0.67	0.07	0.74
9.40	2.00	0.64	5.00	0.67	0.07	0.74
9.45	2.00	0.64	5.00	0.67	0.07	0.74
9.50	2.00	0.64	5.00	0.67	0.07	0.74
9.55	2.00	0.64	5.00	0.67	0.07	0.74
9.60	2.00	0.64	5.00	0.67	0.07	0.74
9.65	2.00	0.64	5.00	0.67	0.07	0.74
9.70	2.00	0.64	5.00	0.67	0.07	0.74
9.75	2.00	0.64	5.00	0.67	0.07	0.74
9.80	2.00	0.64	5.00	0.67	0.07	0.74
9.85	2.00	0.64	5.00	0.67	0.07	0.74
9.90	2.00	0.64	5.00	0.67	0.07	0.74
9.95	2.00	0.64	5.00	0.67	0.07	0.74
10.00	2.00	0.64	5.00	0.67	0.07	0.74
10.05	2.00	0.64	5.00	0.67	0.07	0.74

10.10	2.00	0.64	5.00	0.67	0.07	0.74
10.15	2.00	0.64	5.00	0.67	0.07	0.74
10.20	2.00	0.64	5.00	0.67	0.07	0.74
10.25	2.00	0.64	5.00	0.67	0.07	0.74
10.30	2.00	0.64	5.00	0.67	0.07	0.74
10.35	2.00	0.64	5.00	0.67	0.07	0.74
10.40	2.00	0.64	5.00	0.67	0.07	0.74
10.45	2.00	0.64	5.00	0.67	0.07	0.74
10.50	2.00	0.64	5.00	0.67	0.07	0.74
10.55	2.00	0.64	5.00	0.67	0.07	0.74
10.60	2.00	0.64	5.00	0.67	0.07	0.74
10.65	2.00	0.64	5.00	0.67	0.07	0.74
10.70	2.00	0.64	5.00	0.67	0.07	0.74
10.75	2.00	0.64	5.00	0.67	0.07	0.74
10.80	2.00	0.64	5.00	0.67	0.07	0.74
10.85	2.00	0.64	5.00	0.67	0.07	0.74
10.90	2.00	0.64	5.00	0.67	0.07	0.74
10.95	2.00	0.64	5.00	0.67	0.07	0.74
11.00	2.00	0.64	5.00	0.67	0.07	0.74
11.05	2.00	0.64	5.00	0.67	0.07	0.74
11.10	2.00	0.64	5.00	0.67	0.07	0.74
11.15	2.00	0.64	5.00	0.67	0.07	0.74
11.20	2.00	0.64	5.00	0.67	0.07	0.74
11.25	2.00	0.64	5.00	0.67	0.07	0.74
11.30	2.00	0.64	5.00	0.67	0.07	0.74
11.35	2.00	0.64	5.00	0.67	0.07	0.74
11.40	2.00	0.64	5.00	0.67	0.07	0.74
11.45	2.00	0.64	5.00	0.67	0.07	0.74
11.50	2.00	0.64	5.00	0.67	0.07	0.74
11.55	2.00	0.64	5.00	0.67	0.07	0.74
11.60	2.00	0.64	5.00	0.67	0.07	0.74
11.65	2.00	0.64	5.00	0.67	0.07	0.74
11.70	2.00	0.64	5.00	0.67	0.07	0.74
11.75	2.00	0.64	5.00	0.67	0.07	0.74
11.80	2.00	0.64	5.00	0.67	0.07	0.74
11.85	2.00	0.64	5.00	0.67	0.07	0.74
11.90	2.00	0.64	5.00	0.67	0.07	0.74
11.95	2.00	0.64	5.00	0.67	0.07	0.74
12.00	2.00	0.64	5.00	0.67	0.07	0.74
12.05	2.00	0.64	5.00	0.67	0.07	0.74
12.10	2.00	0.64	5.00	0.67	0.07	0.74
12.15	2.00	0.64	5.00	0.67	0.07	0.74
12.20	2.00	0.64	5.00	0.67	0.07	0.74
12.25	2.00	0.64	5.00	0.67	0.07	0.74
12.30	2.00	0.64	5.00	0.67	0.07	0.74
12.35	2.00	0.64	5.00	0.67	0.07	0.74
12.40	2.00	0.64	5.00	0.67	0.07	0.74
12.45	2.00	0.64	5.00	0.67	0.07	0.74
12.50	2.00	0.64	5.00	0.67	0.07	0.74
12.55	2.00	0.64	5.00	0.67	0.07	0.74
12.60	2.00	0.64	5.00	0.67	0.07	0.74
12.65	2.00	0.64	5.00	0.67	0.07	0.74
12.70	2.00	0.64	5.00	0.67	0.07	0.74
12.75	2.00	0.64	5.00	0.67	0.07	0.74
12.80	2.00	0.64	5.00	0.67	0.07	0.74
12.85	2.00	0.64	5.00	0.67	0.07	0.74
12.90	2.00	0.64	5.00	0.67	0.07	0.74
12.95	2.00	0.64	5.00	0.67	0.07	0.74
13.00	2.00	0.64	5.00	0.67	0.07	0.74
13.05	2.00	0.64	5.00	0.67	0.07	0.74
13.10	2.00	0.64	5.00	0.67	0.07	0.74
13.15	2.00	0.64	5.00	0.67	0.07	0.74
13.20	2.00	0.64	5.00	0.67	0.07	0.74
13.25	2.00	0.64	5.00	0.67	0.07	0.74
13.30	2.00	0.64	5.00	0.67	0.07	0.74
13.35	2.00	0.64	5.00	0.67	0.07	0.74
13.40	2.00	0.64	5.00	0.67	0.07	0.74

13.45	2.00	0.64	5.00	0.67	0.07	0.74
13.50	2.00	0.64	5.00	0.67	0.07	0.74
13.55	2.00	0.64	5.00	0.67	0.07	0.74
13.60	2.00	0.64	5.00	0.67	0.07	0.74
13.65	2.00	0.64	5.00	0.67	0.07	0.74
13.70	2.00	0.64	5.00	0.67	0.07	0.74
13.75	2.00	0.64	5.00	0.67	0.07	0.74
13.80	2.00	0.64	5.00	0.67	0.07	0.74
13.85	2.00	0.64	5.00	0.67	0.07	0.74
13.90	2.00	0.64	5.00	0.67	0.07	0.74
13.95	2.00	0.64	5.00	0.67	0.07	0.74
14.00	2.00	0.64	5.00	0.67	0.07	0.74
14.05	2.00	0.64	5.00	0.67	0.07	0.74
14.10	2.00	0.63	5.00	0.67	0.07	0.74
14.15	2.00	0.63	5.00	0.67	0.07	0.74
14.20	2.00	0.63	5.00	0.67	0.07	0.74
14.25	2.00	0.63	5.00	0.67	0.07	0.74
14.30	2.00	0.63	5.00	0.67	0.07	0.74
14.35	2.00	0.63	5.00	0.67	0.07	0.74
14.40	2.00	0.63	5.00	0.67	0.07	0.74
14.45	2.00	0.63	5.00	0.67	0.07	0.74
14.50	2.00	0.63	5.00	0.67	0.07	0.74
14.55	2.00	0.63	5.00	0.67	0.07	0.74
14.60	2.00	0.63	5.00	0.67	0.07	0.74
14.65	2.00	0.63	5.00	0.67	0.07	0.74
14.70	2.00	0.63	5.00	0.67	0.07	0.74
14.75	2.00	0.63	5.00	0.67	0.07	0.74
14.80	2.00	0.63	5.00	0.67	0.07	0.74
14.85	2.00	0.63	5.00	0.67	0.07	0.74
14.90	2.00	0.63	5.00	0.67	0.07	0.74
14.95	2.00	0.63	5.00	0.67	0.07	0.74
15.00	2.00	0.63	5.00	0.67	0.07	0.74
15.05	2.00	0.63	5.00	0.67	0.07	0.74
15.10	2.00	0.63	5.00	0.67	0.07	0.74
15.15	2.00	0.63	5.00	0.67	0.07	0.74
15.20	2.00	0.63	5.00	0.67	0.07	0.74
15.25	2.00	0.63	5.00	0.67	0.07	0.74
15.30	2.00	0.63	5.00	0.67	0.07	0.74
15.35	2.00	0.63	5.00	0.67	0.07	0.74
15.40	2.00	0.63	5.00	0.67	0.07	0.74
15.45	2.00	0.63	5.00	0.67	0.07	0.74
15.50	2.00	0.63	5.00	0.67	0.07	0.74
15.55	2.00	0.63	5.00	0.67	0.07	0.74
15.60	2.00	0.63	5.00	0.67	0.07	0.74
15.65	2.00	0.63	5.00	0.67	0.07	0.74
15.70	2.00	0.63	5.00	0.67	0.07	0.74
15.75	2.00	0.63	5.00	0.67	0.07	0.74
15.80	2.00	0.63	5.00	0.67	0.07	0.74
15.85	2.00	0.63	5.00	0.67	0.07	0.74
15.90	2.00	0.63	5.00	0.67	0.07	0.74
15.95	2.00	0.63	5.00	0.67	0.07	0.74
16.00	2.00	0.63	5.00	0.67	0.07	0.74
16.05	2.00	0.63	5.00	0.67	0.07	0.74
16.10	2.00	0.63	5.00	0.67	0.07	0.74
16.15	2.00	0.63	5.00	0.67	0.07	0.74
16.20	2.00	0.63	5.00	0.67	0.07	0.74
16.25	2.00	0.63	5.00	0.67	0.07	0.74
16.30	2.00	0.63	5.00	0.67	0.07	0.74
16.35	2.00	0.63	5.00	0.67	0.07	0.74
16.40	2.00	0.63	5.00	0.67	0.07	0.74
16.45	2.00	0.63	5.00	0.67	0.07	0.74
16.50	2.00	0.63	5.00	0.67	0.07	0.74
16.55	2.00	0.63	5.00	0.67	0.07	0.74
16.60	2.00	0.63	5.00	0.67	0.07	0.74
16.65	2.00	0.63	5.00	0.67	0.07	0.74
16.70	2.00	0.63	5.00	0.67	0.07	0.74
16.75	2.00	0.63	5.00	0.67	0.07	0.74

16.80	2.00	0.63	5.00	0.67	0.07	0.74
16.85	2.00	0.63	5.00	0.67	0.07	0.74
16.90	2.00	0.63	5.00	0.67	0.07	0.74
16.95	2.00	0.63	5.00	0.67	0.07	0.74
17.00	2.00	0.63	5.00	0.67	0.07	0.74
17.05	2.00	0.63	5.00	0.67	0.07	0.74
17.10	2.00	0.63	5.00	0.67	0.07	0.74
17.15	2.00	0.63	5.00	0.67	0.07	0.74
17.20	2.00	0.63	5.00	0.67	0.07	0.74
17.25	2.00	0.63	5.00	0.67	0.07	0.74
17.30	2.00	0.63	5.00	0.67	0.07	0.74
17.35	2.00	0.63	5.00	0.67	0.07	0.74
17.40	2.00	0.63	5.00	0.67	0.07	0.74
17.45	2.00	0.63	5.00	0.67	0.07	0.74
17.50	2.00	0.63	5.00	0.67	0.07	0.74
17.55	2.00	0.63	5.00	0.67	0.07	0.74
17.60	2.00	0.63	5.00	0.67	0.07	0.74
17.65	2.00	0.63	5.00	0.67	0.07	0.74
17.70	2.00	0.63	5.00	0.67	0.07	0.74
17.75	2.00	0.63	5.00	0.67	0.07	0.74
17.80	2.00	0.63	5.00	0.67	0.07	0.74
17.85	2.00	0.63	5.00	0.67	0.07	0.74
17.90	2.00	0.63	5.00	0.67	0.07	0.74
17.95	2.00	0.63	5.00	0.67	0.07	0.74
18.00	2.00	0.63	5.00	0.67	0.07	0.74
18.05	2.00	0.63	5.00	0.67	0.07	0.74
18.10	2.00	0.63	5.00	0.67	0.07	0.74
18.15	2.00	0.63	5.00	0.67	0.07	0.74
18.20	2.00	0.63	5.00	0.67	0.07	0.74
18.25	2.00	0.63	5.00	0.67	0.07	0.74
18.30	2.00	0.63	5.00	0.67	0.07	0.74
18.35	2.00	0.63	5.00	0.67	0.07	0.74
18.40	2.00	0.63	5.00	0.67	0.07	0.74
18.45	2.00	0.63	5.00	0.67	0.07	0.74
18.50	2.00	0.63	5.00	0.67	0.07	0.74
18.55	2.00	0.63	5.00	0.67	0.07	0.74
18.60	2.00	0.63	5.00	0.67	0.07	0.74
18.65	2.00	0.63	5.00	0.67	0.07	0.74
18.70	2.00	0.63	5.00	0.67	0.07	0.74
18.75	2.00	0.63	5.00	0.67	0.07	0.74
18.80	2.00	0.63	5.00	0.67	0.07	0.74
18.85	2.00	0.63	5.00	0.67	0.07	0.74
18.90	2.00	0.63	5.00	0.67	0.07	0.74
18.95	2.00	0.63	5.00	0.67	0.07	0.74
19.00	2.00	0.63	5.00	0.67	0.07	0.74
19.05	2.00	0.63	5.00	0.67	0.07	0.74
19.10	2.00	0.63	5.00	0.67	0.07	0.74
19.15	2.00	0.63	5.00	0.67	0.07	0.74
19.20	2.00	0.63	5.00	0.67	0.07	0.74
19.25	2.00	0.63	5.00	0.67	0.07	0.74
19.30	2.00	0.63	5.00	0.67	0.07	0.74
19.35	2.00	0.63	5.00	0.67	0.07	0.74
19.40	2.00	0.63	5.00	0.67	0.07	0.74
19.45	2.00	0.63	5.00	0.67	0.07	0.74
19.50	2.00	0.63	5.00	0.67	0.07	0.74
19.55	2.00	0.63	5.00	0.67	0.07	0.74
19.60	2.00	0.63	5.00	0.67	0.07	0.74
19.65	2.00	0.63	5.00	0.67	0.07	0.74
19.70	2.00	0.63	5.00	0.67	0.07	0.74
19.75	2.00	0.63	5.00	0.67	0.07	0.74
19.80	2.00	0.63	5.00	0.67	0.07	0.74
19.85	2.00	0.63	5.00	0.67	0.07	0.74
19.90	2.00	0.63	5.00	0.67	0.07	0.74
19.95	2.00	0.63	5.00	0.67	0.07	0.74
20.00	2.00	0.63	5.00	0.67	0.07	0.74
20.05	2.00	0.63	5.00	0.67	0.07	0.74
20.10	2.00	0.63	5.00	0.67	0.07	0.74

20.15	2.00	0.63	5.00	0.67	0.07	0.74
20.20	2.00	0.63	5.00	0.67	0.07	0.74
20.25	2.00	0.63	5.00	0.67	0.07	0.74
20.30	2.00	0.63	5.00	0.67	0.07	0.74
20.35	2.00	0.63	5.00	0.67	0.07	0.74
20.40	2.00	0.63	5.00	0.67	0.07	0.74
20.45	2.00	0.63	5.00	0.67	0.07	0.74
20.50	2.00	0.63	5.00	0.67	0.07	0.74
20.55	2.00	0.63	5.00	0.67	0.07	0.74
20.60	2.00	0.63	5.00	0.67	0.07	0.74
20.65	2.00	0.62	5.00	0.67	0.07	0.74
20.70	2.00	0.62	5.00	0.67	0.07	0.74
20.75	2.00	0.62	5.00	0.67	0.07	0.74
20.80	2.00	0.62	5.00	0.67	0.07	0.74
20.85	2.00	0.62	5.00	0.67	0.07	0.74
20.90	2.00	0.62	5.00	0.67	0.07	0.74
20.95	2.00	0.62	5.00	0.67	0.07	0.74
21.00	2.00	0.62	5.00	0.67	0.07	0.74
21.05	2.00	0.62	5.00	0.67	0.07	0.74
21.10	2.00	0.62	5.00	0.67	0.07	0.74
21.15	2.00	0.62	5.00	0.67	0.07	0.74
21.20	2.00	0.62	5.00	0.67	0.07	0.74
21.25	2.00	0.62	5.00	0.67	0.07	0.74
21.30	2.00	0.62	5.00	0.67	0.07	0.74
21.35	2.00	0.62	5.00	0.67	0.07	0.74
21.40	2.00	0.62	5.00	0.67	0.07	0.74
21.45	2.00	0.62	5.00	0.67	0.07	0.74
21.50	2.00	0.62	5.00	0.67	0.07	0.74
21.55	2.00	0.62	5.00	0.67	0.07	0.74
21.60	2.00	0.62	5.00	0.67	0.07	0.74
21.65	2.00	0.62	5.00	0.67	0.07	0.74
21.70	2.00	0.62	5.00	0.67	0.07	0.74
21.75	2.00	0.62	5.00	0.67	0.07	0.74
21.80	2.00	0.62	5.00	0.67	0.07	0.74
21.85	2.00	0.62	5.00	0.67	0.07	0.74
21.90	0.41	0.62	5.00	0.67	0.07	0.74
21.95	0.40	0.62	5.00	0.67	0.06	0.74
22.00	0.39	0.62	5.00	0.67	0.06	0.73
22.05	0.38	0.62	5.00	0.67	0.06	0.73
22.10	0.37	0.62	5.00	0.67	0.06	0.73
22.15	0.36	0.62	5.00	0.67	0.06	0.73
22.20	0.35	0.62	5.00	0.67	0.06	0.73
22.25	0.34	0.62	5.00	0.67	0.05	0.72
22.30	0.34	0.62	5.00	0.67	0.05	0.72
22.35	0.33	0.62	5.00	0.67	0.05	0.72
22.40	0.32	0.62	5.00	0.67	0.05	0.72
22.45	0.32	0.62	5.00	0.67	0.04	0.71
22.50	0.31	0.62	5.00	0.67	0.04	0.71
22.55	0.30	0.62	5.00	0.67	0.04	0.71
22.60	0.30	0.62	5.00	0.67	0.03	0.71
22.65	0.29	0.62	5.00	0.67	0.03	0.70
22.70	0.29	0.62	5.00	0.67	0.03	0.70
22.75	0.28	0.62	5.00	0.67	0.02	0.70
22.80	0.28	0.62	5.00	0.67	0.02	0.69
22.85	0.27	0.62	5.00	0.67	0.02	0.69
22.90	0.27	0.62	5.00	0.67	0.01	0.68
22.95	0.27	0.62	5.00	0.67	0.01	0.68
23.00	0.26	0.62	5.00	0.67	0.00	0.68
23.05	0.26	0.62	0.41*	0.67	0.00	0.67
23.10	0.25	0.62	0.41*	0.66	0.00	0.66
23.15	0.25	0.62	0.40*	0.66	0.00	0.66
23.20	0.25	0.62	0.40*	0.65	0.00	0.65
23.25	0.24	0.62	0.39*	0.64	0.00	0.64
23.30	0.24	0.62	0.39*	0.64	0.00	0.64
23.35	0.24	0.63	0.38*	0.63	0.00	0.63
23.40	0.24	0.63	0.38*	0.62	0.00	0.62
23.45	0.23	0.63	0.37*	0.62	0.00	0.62

23.50	0.23	0.63	0.37*	0.61	0.00	0.61
23.55	0.23	0.63	0.36*	0.60	0.00	0.60
23.60	0.23	0.63	0.36*	0.59	0.00	0.59
23.65	0.22	0.63	0.35*	0.59	0.00	0.59
23.70	0.22	0.63	0.35*	0.58	0.00	0.58
23.75	0.22	0.63	0.35*	0.57	0.00	0.57
23.80	0.22	0.63	0.34*	0.56	0.00	0.56
23.85	0.21	0.63	0.34*	0.56	0.00	0.56
23.90	0.21	0.63	0.34*	0.55	0.00	0.55
23.95	0.21	0.63	0.33*	0.54	0.00	0.54
24.00	0.21	0.63	0.33*	0.53	0.00	0.53
24.05	0.21	0.63	0.33*	0.52	0.00	0.52
24.10	0.20	0.63	0.32*	0.52	0.00	0.52
24.15	0.20	0.64	0.32*	0.51	0.00	0.51
24.20	0.20	0.64	0.32*	0.50	0.00	0.50
24.25	0.20	0.64	0.31*	0.49	0.00	0.49
24.30	0.20	0.64	0.31*	0.48	0.00	0.48
24.35	0.20	0.64	0.31*	0.47	0.00	0.47
24.40	0.20	0.64	0.31*	0.46	0.00	0.46
24.45	0.19	0.64	0.30*	0.46	0.00	0.46
24.50	0.19	0.64	0.30*	0.45	0.00	0.45
24.55	0.19	0.64	0.30*	0.44	0.00	0.44
24.60	0.19	0.64	0.30*	0.43	0.00	0.43
24.65	0.19	0.64	0.30*	0.42	0.00	0.42
24.70	0.19	0.64	0.29*	0.41	0.00	0.41
24.75	0.19	0.64	0.29*	0.40	0.00	0.40
24.80	0.19	0.64	0.29*	0.39	0.00	0.39
24.85	0.18	0.64	0.29*	0.38	0.00	0.38
24.90	0.18	0.64	0.29*	0.38	0.00	0.38
24.95	0.18	0.64	0.28*	0.37	0.00	0.37
25.00	0.18	0.65	0.28*	0.36	0.00	0.36
25.05	0.18	0.65	0.28*	0.35	0.00	0.35
25.10	0.18	0.65	0.28*	0.34	0.00	0.34
25.15	0.19	0.65	0.29*	0.33	0.00	0.33
25.20	0.19	0.65	0.29*	0.32	0.00	0.32
25.25	0.19	0.65	0.29*	0.31	0.00	0.31
25.30	0.19	0.65	0.29*	0.30	0.00	0.30
25.35	0.19	0.65	0.29*	0.29	0.00	0.29
25.40	0.19	0.65	0.30*	0.28	0.00	0.28
25.45	0.19	0.65	0.30*	0.28	0.00	0.28
25.50	0.19	0.65	0.30*	0.27	0.00	0.27
25.55	0.20	0.65	0.30*	0.26	0.00	0.26
25.60	0.20	0.65	0.30*	0.25	0.00	0.25
25.65	0.20	0.65	0.31*	0.24	0.00	0.24
25.70	0.20	0.65	0.31*	0.23	0.00	0.23
25.75	0.20	0.65	0.31*	0.22	0.00	0.22
25.80	0.21	0.65	0.31*	0.22	0.00	0.22
25.85	0.21	0.65	0.32*	0.21	0.00	0.21
25.90	0.21	0.66	0.32*	0.20	0.00	0.20
25.95	0.21	0.66	0.32*	0.19	0.00	0.19
26.00	0.21	0.66	0.33*	0.18	0.00	0.18
26.05	0.22	0.66	0.33*	0.17	0.00	0.17
26.10	0.22	0.66	0.33*	0.17	0.00	0.17
26.15	0.22	0.66	0.33*	0.16	0.00	0.16
26.20	0.22	0.66	0.34*	0.15	0.00	0.15
26.25	0.23	0.66	0.34*	0.14	0.00	0.14
26.30	0.23	0.66	0.35*	0.14	0.00	0.14
26.35	0.23	0.66	0.35*	0.13	0.00	0.13
26.40	0.23	0.66	0.35*	0.12	0.00	0.12
26.45	0.24	0.66	0.36*	0.11	0.00	0.11
26.50	0.24	0.66	0.36*	0.11	0.00	0.11
26.55	0.24	0.66	0.37*	0.10	0.00	0.10
26.60	0.25	0.66	0.37*	0.09	0.00	0.09
26.65	0.25	0.66	0.38*	0.09	0.00	0.09
26.70	0.26	0.66	0.38*	0.08	0.00	0.08
26.75	0.26	0.66	0.39*	0.07	0.00	0.07
26.80	0.26	0.67	0.40*	0.07	0.00	0.07

26.85	0.27	0.67	0.40*	0.06	0.00	0.06
26.90	0.27	0.67	0.41*	0.05	0.00	0.05
26.95	0.28	0.67	0.42*	0.05	0.00	0.05
27.00	0.28	0.67	0.42*	0.04	0.00	0.04
27.05	0.29	0.67	0.43*	0.03	0.00	0.03
27.10	0.29	0.67	0.44*	0.03	0.00	0.03
27.15	0.30	0.67	0.45*	0.02	0.00	0.02
27.20	0.31	0.67	0.46*	0.02	0.00	0.02
27.25	0.31	0.67	0.47*	0.01	0.00	0.01
27.30	0.32	0.67	0.48*	0.01	0.00	0.01
27.35	2.00	0.67	5.00	0.01	0.00	0.01
27.40	2.00	0.67	5.00	0.01	0.00	0.01
27.45	2.00	0.67	5.00	0.01	0.00	0.01
27.50	2.00	0.67	5.00	0.01	0.00	0.01
27.55	2.00	0.67	5.00	0.01	0.00	0.01
27.60	2.00	0.67	5.00	0.01	0.00	0.01
27.65	2.00	0.67	5.00	0.01	0.00	0.01
27.70	2.00	0.67	5.00	0.01	0.00	0.01
27.75	2.00	0.68	5.00	0.01	0.00	0.01
27.80	2.00	0.68	5.00	0.01	0.00	0.01
27.85	2.00	0.68	5.00	0.01	0.00	0.01
27.90	2.00	0.68	5.00	0.01	0.00	0.01
27.95	2.00	0.68	5.00	0.01	0.00	0.01
28.00	2.00	0.68	5.00	0.01	0.00	0.01
28.05	2.00	0.68	5.00	0.01	0.00	0.01
28.10	2.00	0.68	5.00	0.01	0.00	0.01
28.15	2.00	0.68	5.00	0.01	0.00	0.01
28.20	2.00	0.68	5.00	0.01	0.00	0.01
28.25	2.00	0.68	5.00	0.01	0.00	0.01
28.30	2.00	0.68	5.00	0.01	0.00	0.01
28.35	2.00	0.68	5.00	0.01	0.00	0.01
28.40	2.00	0.68	5.00	0.01	0.00	0.01
28.45	2.00	0.68	5.00	0.01	0.00	0.01
28.50	2.00	0.68	5.00	0.01	0.00	0.01
28.55	2.00	0.68	5.00	0.01	0.00	0.01
28.60	2.00	0.68	5.00	0.01	0.00	0.01
28.65	2.00	0.68	5.00	0.01	0.00	0.01
28.70	2.00	0.68	5.00	0.01	0.00	0.01
28.75	2.00	0.69	5.00	0.01	0.00	0.01
28.80	2.00	0.69	5.00	0.01	0.00	0.01
28.85	2.00	0.69	5.00	0.01	0.00	0.01
28.90	2.00	0.69	5.00	0.01	0.00	0.01
28.95	2.00	0.69	5.00	0.01	0.00	0.01
29.00	2.00	0.69	5.00	0.01	0.00	0.01
29.05	2.00	0.69	5.00	0.01	0.00	0.01
29.10	2.00	0.69	5.00	0.01	0.00	0.01
29.15	2.00	0.69	5.00	0.01	0.00	0.01
29.20	2.00	0.69	5.00	0.01	0.00	0.01
29.25	2.00	0.69	5.00	0.01	0.00	0.01
29.30	2.00	0.69	5.00	0.01	0.00	0.01
29.35	2.00	0.69	5.00	0.01	0.00	0.01
29.40	2.00	0.69	5.00	0.01	0.00	0.01
29.45	2.00	0.69	5.00	0.01	0.00	0.01
29.50	2.00	0.69	5.00	0.01	0.00	0.01
29.55	2.00	0.69	5.00	0.01	0.00	0.01
29.60	2.00	0.69	5.00	0.01	0.00	0.01
29.65	2.00	0.69	5.00	0.01	0.00	0.01
29.70	2.00	0.69	5.00	0.01	0.00	0.01
29.75	2.00	0.69	5.00	0.01	0.00	0.01
29.80	2.00	0.70	5.00	0.01	0.00	0.01
29.85	2.00	0.70	5.00	0.01	0.00	0.01
29.90	2.00	0.70	5.00	0.01	0.00	0.01
29.95	2.00	0.70	5.00	0.01	0.00	0.01
30.00	2.00	0.70	5.00	0.01	0.00	0.01
30.05	2.00	0.70	5.00	0.01	0.00	0.01
30.10	2.00	0.70	5.00	0.01	0.00	0.01
30.15	2.00	0.70	5.00	0.01	0.00	0.01

30.20	2.00	0.70	5.00	0.01	0.00	0.01
30.25	2.00	0.70	5.00	0.01	0.00	0.01
30.30	2.00	0.70	5.00	0.01	0.00	0.01
30.35	2.00	0.70	5.00	0.01	0.00	0.01
30.40	2.00	0.70	5.00	0.01	0.00	0.01
30.45	2.00	0.70	5.00	0.01	0.00	0.01
30.50	2.00	0.70	5.00	0.01	0.00	0.01
30.55	2.00	0.70	5.00	0.01	0.00	0.01
30.60	2.00	0.70	5.00	0.01	0.00	0.01
30.65	2.00	0.70	5.00	0.01	0.00	0.01
30.70	2.00	0.70	5.00	0.01	0.00	0.01
30.75	2.00	0.70	5.00	0.01	0.00	0.01
30.80	2.00	0.70	5.00	0.01	0.00	0.01
30.85	2.00	0.70	5.00	0.01	0.00	0.01
30.90	2.00	0.70	5.00	0.01	0.00	0.01
30.95	2.00	0.70	5.00	0.01	0.00	0.01
31.00	2.00	0.70	5.00	0.01	0.00	0.01
31.05	2.00	0.70	5.00	0.01	0.00	0.01
31.10	2.00	0.70	5.00	0.01	0.00	0.01
31.15	2.00	0.70	5.00	0.01	0.00	0.01
31.20	2.00	0.70	5.00	0.01	0.00	0.01
31.25	2.00	0.70	5.00	0.01	0.00	0.01
31.30	2.00	0.70	5.00	0.01	0.00	0.01
31.35	2.00	0.70	5.00	0.01	0.00	0.01
31.40	2.00	0.70	5.00	0.01	0.00	0.01
31.45	2.00	0.70	5.00	0.01	0.00	0.01
31.50	2.00	0.70	5.00	0.01	0.00	0.01
31.55	2.00	0.70	5.00	0.01	0.00	0.01
31.60	2.00	0.70	5.00	0.01	0.00	0.01
31.65	2.00	0.70	5.00	0.01	0.00	0.01
31.70	2.00	0.70	5.00	0.01	0.00	0.01
31.75	2.00	0.70	5.00	0.01	0.00	0.01
31.80	2.00	0.70	5.00	0.01	0.00	0.01
31.85	2.00	0.71	5.00	0.01	0.00	0.01
31.90	2.00	0.71	5.00	0.01	0.00	0.01
31.95	2.00	0.71	5.00	0.01	0.00	0.01
32.00	2.00	0.71	5.00	0.01	0.00	0.01
32.05	2.00	0.71	5.00	0.01	0.00	0.01
32.10	2.00	0.71	5.00	0.01	0.00	0.01
32.15	2.00	0.71	5.00	0.01	0.00	0.01
32.20	2.00	0.71	5.00	0.01	0.00	0.01
32.25	2.00	0.71	5.00	0.01	0.00	0.01
32.30	2.00	0.71	5.00	0.01	0.00	0.01
32.35	2.00	0.71	5.00	0.01	0.00	0.01
32.40	2.00	0.71	5.00	0.01	0.00	0.01
32.45	2.00	0.71	5.00	0.01	0.00	0.01
32.50	2.00	0.71	5.00	0.01	0.00	0.01
32.55	2.00	0.71	5.00	0.01	0.00	0.01
32.60	2.00	0.71	5.00	0.01	0.00	0.01
32.65	2.00	0.71	5.00	0.01	0.00	0.01
32.70	2.00	0.71	5.00	0.01	0.00	0.01
32.75	2.00	0.71	5.00	0.01	0.00	0.01
32.80	2.00	0.71	5.00	0.01	0.00	0.01
32.85	2.00	0.71	5.00	0.01	0.00	0.01
32.90	2.00	0.71	5.00	0.01	0.00	0.01
32.95	2.00	0.71	5.00	0.01	0.00	0.01
33.00	2.00	0.71	5.00	0.01	0.00	0.01
33.05	2.00	0.71	5.00	0.01	0.00	0.01
33.10	2.00	0.71	5.00	0.01	0.00	0.01
33.15	2.00	0.71	5.00	0.01	0.00	0.01
33.20	2.00	0.71	5.00	0.01	0.00	0.01
33.25	2.00	0.71	5.00	0.01	0.00	0.01
33.30	2.00	0.71	5.00	0.01	0.00	0.01
33.35	2.00	0.71	5.00	0.01	0.00	0.01
33.40	2.00	0.71	5.00	0.01	0.00	0.01
33.45	2.00	0.71	5.00	0.01	0.00	0.01
33.50	2.00	0.71	5.00	0.01	0.00	0.01

33.55	2.00	0.71	5.00	0.01	0.00	0.01
33.60	2.00	0.71	5.00	0.01	0.00	0.01
33.65	2.00	0.71	5.00	0.01	0.00	0.01
33.70	2.00	0.71	5.00	0.01	0.00	0.01
33.75	2.00	0.71	5.00	0.01	0.00	0.01
33.80	2.00	0.71	5.00	0.01	0.00	0.01
33.85	2.00	0.71	5.00	0.01	0.00	0.01
33.90	2.00	0.71	5.00	0.01	0.00	0.01
33.95	2.00	0.71	5.00	0.01	0.00	0.01
34.00	2.00	0.71	5.00	0.01	0.00	0.01
34.05	2.00	0.71	5.00	0.01	0.00	0.01
34.10	2.00	0.71	5.00	0.01	0.00	0.01
34.15	2.00	0.71	5.00	0.01	0.00	0.01
34.20	2.00	0.71	5.00	0.01	0.00	0.01
34.25	2.00	0.71	5.00	0.01	0.00	0.01
34.30	2.00	0.71	5.00	0.01	0.00	0.01
34.35	2.00	0.71	5.00	0.01	0.00	0.01
34.40	2.00	0.71	5.00	0.01	0.00	0.01
34.45	2.00	0.71	5.00	0.01	0.00	0.01
34.50	2.00	0.71	5.00	0.01	0.00	0.01
34.55	2.00	0.71	5.00	0.01	0.00	0.01
34.60	2.00	0.71	5.00	0.01	0.00	0.01
34.65	2.00	0.71	5.00	0.01	0.00	0.01
34.70	2.00	0.71	5.00	0.01	0.00	0.01
34.75	2.00	0.71	5.00	0.01	0.00	0.01
34.80	2.00	0.71	5.00	0.01	0.00	0.01
34.85	2.00	0.71	5.00	0.01	0.00	0.01
34.90	2.00	0.71	5.00	0.01	0.00	0.01
34.95	2.00	0.72	5.00	0.01	0.00	0.01
35.00	2.00	0.72	5.00	0.01	0.00	0.01
35.05	2.00	0.72	5.00	0.01	0.00	0.01
35.10	0.65	0.72	0.91*	0.01	0.00	0.01
35.15	0.58	0.72	0.81*	0.01	0.00	0.01
35.20	0.55	0.72	0.77*	0.01	0.00	0.01
35.25	0.55	0.72	0.76*	0.01	0.00	0.01
35.30	0.55	0.72	0.77*	0.00	0.00	0.00
35.35	0.56	0.72	0.79*	0.00	0.00	0.00
35.40	0.58	0.72	0.81*	0.00	0.00	0.00
35.45	0.60	0.72	0.84*	0.00	0.00	0.00
35.50	0.63	0.72	0.88*	0.00	0.00	0.00
35.55	0.66	0.72	0.93*	0.00	0.00	0.00
35.60	0.70	0.72	0.97*	0.00	0.00	0.00
35.65	0.74	0.72	1.03	0.00	0.00	0.00
35.70	0.78	0.72	1.09	0.00	0.00	0.00
35.75	0.82	0.72	1.15	0.00	0.00	0.00
35.80	0.87	0.72	1.21	0.00	0.00	0.00
35.85	0.92	0.72	1.29	0.00	0.00	0.00
35.90	0.98	0.72	1.36	0.00	0.00	0.00
35.95	1.03	0.72	1.44	0.00	0.00	0.00
36.00	1.09	0.72	1.52	0.00	0.00	0.00
36.05	1.16	0.72	1.61	0.00	0.00	0.00
36.10	1.22	0.72	1.71	0.00	0.00	0.00
36.15	1.29	0.72	1.80	0.00	0.00	0.00
36.20	1.37	0.72	1.90	0.00	0.00	0.00
36.25	1.44	0.72	2.01	0.00	0.00	0.00
36.30	1.52	0.72	2.12	0.00	0.00	0.00
36.35	1.61	0.72	2.24	0.00	0.00	0.00
36.40	1.69	0.72	2.36	0.00	0.00	0.00
36.45	1.78	0.72	2.48	0.00	0.00	0.00
36.50	1.88	0.72	2.62	0.00	0.00	0.00
36.55	1.98	0.72	2.75	0.00	0.00	0.00
36.60	2.08	0.72	2.89	0.00	0.00	0.00
36.65	2.18	0.72	3.04	0.00	0.00	0.00
36.70	2.29	0.72	3.19	0.00	0.00	0.00
36.75	2.41	0.72	3.35	0.00	0.00	0.00
36.80	2.52	0.72	3.51	0.00	0.00	0.00
36.85	2.64	0.72	3.68	0.00	0.00	0.00

36.90	2.77	0.72	3.85	0.00	0.00	0.00
36.95	2.90	0.72	4.03	0.00	0.00	0.00
37.00	2.98	0.72	4.15	0.00	0.00	0.00
37.05	2.98	0.72	4.15	0.00	0.00	0.00
37.10	2.98	0.72	4.15	0.00	0.00	0.00
37.15	2.98	0.72	4.14	0.00	0.00	0.00
37.20	2.98	0.72	4.14	0.00	0.00	0.00
37.25	2.98	0.72	4.14	0.00	0.00	0.00
37.30	2.98	0.72	4.14	0.00	0.00	0.00
37.35	2.98	0.72	4.14	0.00	0.00	0.00
37.40	2.98	0.72	4.14	0.00	0.00	0.00
37.45	2.98	0.72	4.14	0.00	0.00	0.00
37.50	2.98	0.72	4.14	0.00	0.00	0.00
37.55	2.98	0.72	4.14	0.00	0.00	0.00
37.60	2.98	0.72	4.14	0.00	0.00	0.00
37.65	2.98	0.72	4.14	0.00	0.00	0.00
37.70	2.98	0.72	4.13	0.00	0.00	0.00
37.75	2.98	0.72	4.13	0.00	0.00	0.00
37.80	2.98	0.72	4.13	0.00	0.00	0.00
37.85	2.98	0.72	4.13	0.00	0.00	0.00
37.90	2.98	0.72	4.13	0.00	0.00	0.00
37.95	2.98	0.72	4.13	0.00	0.00	0.00
38.00	2.98	0.72	4.13	0.00	0.00	0.00
38.05	2.98	0.72	4.13	0.00	0.00	0.00
38.10	2.98	0.72	4.13	0.00	0.00	0.00
38.15	2.98	0.72	4.13	0.00	0.00	0.00
38.20	2.97	0.72	4.13	0.00	0.00	0.00
38.25	2.97	0.72	4.12	0.00	0.00	0.00
38.30	2.97	0.72	4.12	0.00	0.00	0.00
38.35	2.97	0.72	4.12	0.00	0.00	0.00
38.40	2.97	0.72	4.12	0.00	0.00	0.00
38.45	2.97	0.72	4.12	0.00	0.00	0.00
38.50	2.97	0.72	4.12	0.00	0.00	0.00
38.55	2.97	0.72	4.12	0.00	0.00	0.00
38.60	2.97	0.72	4.12	0.00	0.00	0.00
38.65	2.97	0.72	4.12	0.00	0.00	0.00
38.70	2.97	0.72	4.12	0.00	0.00	0.00
38.75	2.97	0.72	4.12	0.00	0.00	0.00
38.80	2.97	0.72	4.12	0.00	0.00	0.00
38.85	2.97	0.72	4.12	0.00	0.00	0.00
38.90	2.97	0.72	4.11	0.00	0.00	0.00
38.95	2.97	0.72	4.11	0.00	0.00	0.00
39.00	2.97	0.72	4.11	0.00	0.00	0.00
39.05	2.97	0.72	4.11	0.00	0.00	0.00
39.10	2.97	0.72	4.11	0.00	0.00	0.00
39.15	2.97	0.72	4.11	0.00	0.00	0.00
39.20	2.97	0.72	4.11	0.00	0.00	0.00
39.25	2.97	0.72	4.11	0.00	0.00	0.00
39.30	2.97	0.72	4.11	0.00	0.00	0.00
39.35	2.97	0.72	4.11	0.00	0.00	0.00
39.40	2.97	0.72	4.11	0.00	0.00	0.00
39.45	2.97	0.72	4.11	0.00	0.00	0.00
39.50	2.97	0.72	4.11	0.00	0.00	0.00
39.55	2.97	0.72	4.10	0.00	0.00	0.00
39.60	2.97	0.72	4.10	0.00	0.00	0.00
39.65	2.96	0.72	4.10	0.00	0.00	0.00
39.70	2.96	0.72	4.10	0.00	0.00	0.00
39.75	2.96	0.72	4.10	0.00	0.00	0.00
39.80	2.96	0.72	4.10	0.00	0.00	0.00
39.85	2.96	0.72	4.10	0.00	0.00	0.00
39.90	2.96	0.72	4.10	0.00	0.00	0.00
39.95	2.96	0.72	4.10	0.00	0.00	0.00
40.00	2.96	0.72	4.10	0.00	0.00	0.00
40.05	2.96	0.72	4.10	0.00	0.00	0.00
40.10	2.96	0.72	4.10	0.00	0.00	0.00
40.15	2.96	0.72	4.10	0.00	0.00	0.00
40.20	2.96	0.72	4.10	0.00	0.00	0.00

40.25	2.96	0.72	4.10	0.00	0.00	0.00
40.30	2.96	0.72	4.10	0.00	0.00	0.00
40.35	2.96	0.72	4.09	0.00	0.00	0.00
40.40	2.96	0.72	4.09	0.00	0.00	0.00
40.45	2.96	0.72	4.09	0.00	0.00	0.00
40.50	2.96	0.72	4.09	0.00	0.00	0.00
40.55	2.96	0.72	4.09	0.00	0.00	0.00
40.60	2.96	0.72	4.09	0.00	0.00	0.00
40.65	2.96	0.72	4.09	0.00	0.00	0.00
40.70	2.96	0.72	4.09	0.00	0.00	0.00
40.75	2.96	0.72	4.09	0.00	0.00	0.00
40.80	2.96	0.72	4.09	0.00	0.00	0.00
40.85	2.96	0.72	4.09	0.00	0.00	0.00
40.90	2.96	0.72	4.09	0.00	0.00	0.00
40.95	2.96	0.72	4.09	0.00	0.00	0.00
41.00	2.96	0.72	4.09	0.00	0.00	0.00
41.05	2.96	0.72	4.09	0.00	0.00	0.00
41.10	2.95	0.72	4.09	0.00	0.00	0.00
41.15	2.95	0.72	4.09	0.00	0.00	0.00
41.20	2.95	0.72	4.08	0.00	0.00	0.00
41.25	2.95	0.72	4.08	0.00	0.00	0.00
41.30	2.95	0.72	4.08	0.00	0.00	0.00
41.35	2.95	0.72	4.08	0.00	0.00	0.00
41.40	2.95	0.72	4.08	0.00	0.00	0.00
41.45	2.95	0.72	4.08	0.00	0.00	0.00
41.50	2.95	0.72	4.08	0.00	0.00	0.00
41.55	2.95	0.72	4.08	0.00	0.00	0.00
41.60	2.95	0.72	4.08	0.00	0.00	0.00
41.65	2.95	0.72	4.08	0.00	0.00	0.00
41.70	2.95	0.72	4.08	0.00	0.00	0.00
41.75	2.95	0.72	4.08	0.00	0.00	0.00
41.80	2.95	0.72	4.08	0.00	0.00	0.00
41.85	2.95	0.72	4.08	0.00	0.00	0.00
41.90	2.95	0.72	4.08	0.00	0.00	0.00
41.95	2.95	0.72	4.08	0.00	0.00	0.00
42.00	2.95	0.72	4.08	0.00	0.00	0.00

* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

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

1 atm (atmosphere) = 1 tsf (ton/ft2)

CRRm	Cyclic resistance ratio from soils
CSRsf	Cyclic stress ratio induced by a given earthquake (with user request factor of safety)
F.S.	Factor of Safety against liquefaction, F.S.=CRRm/CSRsf
S_sat	Settlement from saturated sands
S_dry	Settlement from Unsaturated Sands
S_all	Total Settlement from Saturated and Unsaturated Sands
NoLiq	No-Liquefy Soils

Appendix D

Earthwork Specifications

APPENDIX D: EARTHWORK SPECIFICATIONS

D.1 Scope of Work

The work includes all labor, supplies and construction equipment required to construct the building pads in a good, workmanlike manner, as shown on the drawings and herein specified. The major items of work covered in this section include the following:

- Site Inspection
- Authority of Geotechnical Engineer
- Site Clearing
- Excavations
- Preparation of Fill Areas
- Placement and Compaction of Fill
- Observation and Testing

D.2 Site Inspection

- The Contractor shall carefully examine the site and make all inspections necessary, in order to determine the full extent of the work required to make the completed work conform to the drawings and specifications. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

- This *Geoseismic/Geotechnical Study Report* by Converse Consultants may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information shall not relieve the Contractor from performing such independent investigation and evaluation to satisfy himself as to the nature of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

D.3 Authority of the Geotechnical Engineer

- The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.

- As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material; and (c) have the authority to approve or reject soils proposed for use in building areas.

- The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

D.4 Site Clearing

- Clearing and grubbing shall consist of the removal from building areas to be graded of all existing structures, pavements, utilities, trees and vegetation.

- Organic and inorganic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

D.5 Excavations

- Based on observations made during our field explorations, the surficial soils can be excavated with conventional earthwork equipment.

D.6 Preparation of Fill Areas

- All organic material, organic soils, incompetent alluvium, undocumented fill soils and debris should be removed from the proposed building areas.

- In order to provide a relative uniform bearing material below shallow foundations, over-excavation and re-compaction of below the foundations and slab-on-grade are recommended. We recommend a minimum 5 feet of onsite soils below the bottom of foundations should be removed, moisture-conditioned if necessary, and replaced as compacted fill. At least the six (6) inches of soil at bottom of over-excavation, cut and transition areas should be scarified and compacted. All undocumented fill should be removed and replaced with compacted fill. The excavation to remove unsuitable soils should be extended to five (5) feet beyond the building limits and appendages where space is available. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. The actual depth of removal should be determined based on observations made during grading. After the required removals have been made, the exposed native earth materials shall be excavated to provide a zone of structural fill for the support of footings, slabs-on-grade, and exterior flatwork. The fill thickness under structures should not vary.

- The subgrade in all areas to receive fill shall be scarified to a minimum depth of six (6) inches, the soil moisture adjusted within three (3) percent of the optimum moisture for granular soils and at above approximately three (3) percent of the optimum moisture for fine-grained soils. and then compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Scarification may be terminated on moderately hard to hard, cemented earth materials with the approval of the Geotechnical Engineer.

- Compacted fill may be placed on native soils that have been properly scarified and recompacted as discussed above.

- All areas to receive compacted fill will be observed and approved by the Geotechnical Engineer before the placement of fill.

D.7 Placement and Compaction of Fill

- Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and driveways will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.

- Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer shall be placed in layers on approved earth materials. Soils used as compacted structural fill shall have the following characteristics:

  - All fill soil particles shall not exceed three (3) inches in nominal size, and shall be free of organic matter and miscellaneous inorganic debris and inert rubble.

  - Imported fill materials shall have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 percent of the laboratory maximum dry density (ASTM Standard D1557) at about three (3) percent above optimum moisture for fine grained soils, and within three (3) percent of optimum for granular soils.

- Fill soils shall be evenly spread in maximum 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

- All fill placed at the site shall be compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. The on-site soils shall be moisture conditioned within three (3) percent of the optimum moisture for granular soils and at above approximately three (3) percent of the optimum moisture for fine-grained soils. At least the upper 12 inches of subgrade soils underneath the concrete apron, pavement and parking areas should be compacted to a minimum of 95 percent relative compaction.

- Fill exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be benched into competent materials. The height and width of the benches shall be at least two (2) feet.

- Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 compaction method.

- Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.

- It shall be the Grading Contractor's obligation to take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. It shall be the contractor's responsibility to maintain slopes in their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the Civil Engineer.

D.8 Trench Backfill

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

- Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement.

- Trench backfill shall be compacted to a minimum relative compaction of 90 percent as per ASTM Standard D1557 test method.

- Rocks larger than one (1) inch should not be placed within 12 inches of the top of the pipeline or within the upper 12 inches of pavement or structure subgrade. No more than 30 percent of the backfill volume shall be larger than 3/4-inch in largest dimension diameter, and rocks shall be well mixed with finer soil.

- The pipe design engineer should select bedding material for the pipe. Bedding materials generally should have a Sand Equivalent (SE) greater than or equal to 30, as determined by the ASTM Standard D2419 test method.

- Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The backfill materials shall be brought to within three (3) percent of optimum moisture content for granular soils and fine-grained soils, then placed in horizontal layers. The thickness of uncompacted layers should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.

- The contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work.

- The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent.

- Observation and field tests should be performed by Converse during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compactive effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.

- It should be the responsibility of the Contractor to maintain safe conditions during cut and/or fill operations.

- Trench backfill shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

D.9 Observation and Testing

- During the progress of grading, the Geotechnical Engineer will provide observation of the fill placement operations.

- Field density tests will be made during grading to provide an opinion on the degree of compaction being obtained by the contractor. Where compaction of less than specified herein is indicated, additional compactive effort with adjustment of the moisture content shall be made as necessary, until the required degree of compaction is obtained.

- A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill placed.

Storm Water Low Impact Development (LID) Report

Athletic Complex East Storm Water Improvements

PREPARED FOR

Mount San Antonio College
1100 North Grand Avenue
Walnut, CA 91789
(909) 274-7500

MT. SAC
Mt. San Antonio College

August 30, 2018
Psomas Project No.: 1HMC015300

Balancing the Natural and Built Environment

PSOMAS

TABLE OF CONTENTS

1 OWNER'S CERTIFICATION 3

2 INTRODUCTION 4

2.1 Project Summary 4

2.2 Purpose and Scope 4

3 EXISTING AND PROPOSED DRAINAGE CONDITIONS 5

3.1 Existing Conditions 5

3.2 Proposed Conditions 5

4 HYDROLOGIC CALCULATIONS 7

4.1 Proposed Condition Results 7

5 SITE CHARACTERIZATION 8

5.1 Site Designation 8

5.2 Feasibility of Infiltration 8

5.3 Feasibility of Storm Water Runoff Harvesting 8

5.4 Feasibility of Green Roof Design 9

6 SOURCE CONTROL MEASURES 10

7 STORM WATER QUALITY CONTROL MEASURES 11

8 MAINTENANCE 12

8.1 Maintenance Requirements 12

REFERENCES 13

APPENDICIES 14

Appendix A: Vicinity Map 15

Appendix B: LA County Soil Runoff Curve& Isohyet Hydrology Map 16

Appendix C: LID Site Plan Exhibit 17

Appendix D: Proposed Hydrologic Exhibit 18

Appendix E: Hydrology Calculations 19

Appendix F: Master Covenant and Agreement 20

Appendix G: Geotechnical Reports 21

Appendix H: LID Treatment Stormwater Quality Control Sizing Calculation and Information 22

Appendix I: Source Control Measure Fact Sheets 23

Appendix J: Storm Water Outreach Material 24

1 OWNER'S CERTIFICATION

This project-specific Storm Water Low Impact Development (LID) Report has been prepared for Mt. San Antonio College by Psomas for the project known as the Athletics Complex Storm Water Improvements at 1100 N. Grand Ave., Walnut, CA 91789.

This LID Report is intended to comply with the requirements of the City of Walnut and County of Los Angeles which includes the requirement for the preparation and implementation of a project-specific LID Report.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation of this LID Report and will ensure that this LID Report is amended as appropriate to reflect up-to-date conditions on the site. This LID Report 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 LID Report. At least one copy of this LID Report will be maintained at the project site or project office in perpetuity.

The undersigned is authorized to certify and to approve implementation of this LID Report. The undersigned is aware that implementation of this LID Report may be enforceable under County of Los Angeles Water Quality Ordinance.

If the undersigned transfers its interest in the subject property/project, its successor in interest the undersigned shall notify the successor in interest of its responsibility to implement this LID Report.

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

______________________________	______________________________
Owner's Signature	Date
Mikaela Klein	Senior Facilities Planner
Owner's Printed Name	Owner's Title/Position

Mt. San Antonio College
1100 North Grand Avenue
Walnut, CA 91789
Telephone: 909-274-7500

2 INTRODUCTION

2.1 Project Summary

The Athletic Complex East (ACE) at Mount San Antonio College (Mt. SAC), located in the eastern area of the campus near the intersection of Bonita Avenue and Temple Avenue, is a project consisting of several proposed structures, a track and field, practice fields, walkways, and a parking structure. The Athletic Complex East area has been identified in the Vicinity Map in Appendix A. The proposed storm water quality LID improvements will be incorporated into the site drainage and utility infrastructure to comprehensively provide treatment for the entire complex.

This project is a Designated Project, as defined in the County of Los Angeles LID Manual, because the development is larger than one acre of disturbed area and more than 10,000 square feet of impervious surface area are being added to the site. This project classifies as a Redevelopment Project given that more than 50 percent of the impervious surface of the previously developed site is proposed to be altered and the previous development project was not subject to storm water quality control measures. As such, the entire development site must meet the requirements of the County of Los Angeles LID Manual, regardless of the existing hydrologic conditions.

2.2 Purpose and Scope

The project falls under the jurisdiction of the City of Walnut and the County of Los Angeles. The purpose of this Low Impact Development (LID) report is:

- To meet City of Walnut requirements in allowing final design and construction to proceed in a timely manner;
- To provide project compliance with Order Number R4-2012-0175, MS4 Discharges within the Coastal Watersheds of Los Angeles County and County of Los Angeles LID requirements;
- Lessen the adverse impacts of storm water runoff from development and urban runoff on natural drainage systems, receiving waters, and other water bodies;
- Minimize pollutant loadings from impervious surfaces by incorporating properly-designed, technically-appropriate Best Management Practices (BMPs) and other Low Impact Development (LID) strategies; and
- Minimize erosion and other hydrologic impacts on natural drainage systems.

3 EXISTING AND PROPOSED DRAINAGE CONDITIONS

3.1 Existing Conditions

The ACE project site at Mt. SAC consists of an old athletic complex and impervious parking lots. There are no known sources of contamination at the site.

Existing topography directs site drainage currently towards the southwest. The elevations of the existing site range from 770 to 714 feet above mean sea level (msl). Surface drainage at the site currently flows southwest and is collected in various storm drain inlets. Storm water is conveyed through a combination of surface flow and underground drainage systems.

The site ultimately discharges to the San Jose Creek Reach 2, which is listed for water quality impairment on the most recent 303(d)-list for:

- Coliforms

Existing site topography, drainage patterns, and storm water conveyances are shown in the Existing Drainage Map in Appendix D.

3.2 Proposed Conditions

The ACE project at Mt. SAC is approximately 32.5 acres of new athletics facilities, fields, and a parking structure (Structure R). The total area is divided into five drainage sub-areas, generally draining from east to west and ultimately west through the existing storm water utility system. Drainage includes surface runoff, building roof drains, and field underdrain systems.

There are two backbone storm drain lines that collect and convey runoff from four of the five drainage sub-areas to an existing 81-inch regional storm drain line that runs along the west boundary of the project site adjacent to Bonita Avenue. Two diversion structures are proposed, one for each backbone storm drain line, to divert the Storm Water Quality Design Volume (SWQDv) to a proposed underground ADS StormTech Infiltration Chamber system. The fifth drainage sub-area contains bioswales that treat the SWQDv and then discharge directly to the regional storm drain main line. A description of each sub-area is presented below.

Sub-area A is approximately 11.13 acres that includes field buildings, complex entrance road, small parking lot, and other landscaped slopes. Storm water runoff from this subarea will be collected through surface inlets and conveyed through the proposed underground storm drain system. The SWQDv for this subarea is diverted by a manhole diversion structure to the ADS StormTech Infiltration Chamber system.

Sub-area B consists of 16.04 acres that includes a new stadium with track and field, bleachers and field house, practice fields, and a portion of the cross-country path. Storm water runoff from this subarea will be collected through surface inlets and conveyed through the proposed underground storm drain system. The SWQDv for this subarea is diverted by a manhole diversion structure to the ADS StormTech Infiltration Chamber system.

Sub-area C consists of a portion of the proposed parking structure, Structure R. Storm water from the parking structure drains to bioswales within the Structure R area for treatment. The discharge from the bioswales connects to the existing 81-inch storm drain line adjacent to Bonita

Avenue. Portions of Structure R which do not drain to the bioswales are considered separate subareas and are discussed in the following paragraphs.

Sub-area E consists of a portion of the Structure R which is not tributary to the proposed bioswales. Drainage for this area is collected through roof drains and area drains within the parking structure and conveyed to the same backbone storm drain line as sub-area A for diversion of the SWQDv to the ADS StormTech Infiltration Chamber unit.

Sub-area F consists of the remainder portion of the Structure R which is not tributary to the proposed bioswales. Drainage is collected through roof drains and area drains within the parking structure and conveyed to the same to the same backbone storm drain line as sub-area B for diversion to the ADS StormTech Infiltration Chamber unit.

Proposed drainage areas and the LID treatment layout are presented in the LID Site Plan Exhibit in Appendix C. Proposed site topography, drainage patterns, and storm water conveyances are shown in the Proposed Drainage Map in Appendix D.

(Note: Sub-area D is not analyzed as part of the Athletic Complex LID report. This is an off-site area that is not tributary to the proposed ACE storm drain system. Future development of this area will provide LID compliant measures within the sub-area.)

4 HYDROLOGIC CALCULATIONS

The project site is located in the San Dimas Quadrant of Hydrologic Map Figure LACDPW1-H1.22 (see Appendix B). The 85th Percentile (24-hour) rainfall isohyet nearest to the project is 1.0 inches. The soil type is classified as No.002 per LA County Department of Public Works Hydrology Manual (2006).

The design storm, from which the SWQDv is calculated, is defined as the greater of:

- The 0.75-inch, 24-hour rain event; or
- The 85th percentile, 24-hour rain event as determined from the Los Angeles County 85th percentile precipitation isoheytal map.

Based on our analysis, the run-off generated by the 85th percentile storm event is larger than the 0.75-inch storm event. Therefore, the 85th percentile storm event is the design storm and was used to calculate the SWQDv for the project site. The existing project site consists of approximately 50% impervious ground surface cover. The proposed project will have a surface imperviousness of approximately 85% for a net increase of 35% imperviousness; however, the project is a Designated Redevelopment Project so the entire proposed project redevelopment SWQDv must be addressed.

The Los Angeles County approved hydrology program HydroCalc 1.0.2 was used to calculate the SWQDv and peak flows for the site per LID guidelines.

4.1 Proposed Condition Results

Refer to Appendix D for a map of proposed drainage sub-areas. Appendix E includes output results from the HydroCalc software. Table 1 summarizes the SWQDv for the proposed condition.

Table 1: Proposed Hydrologic Summary; 85th Percentile Storm Event

Sub-Area	Area	85th Percentile Storm Event				
		Impervious	Time of Concentration	Q	SWQDv	SWQDv*
	(acres)	(%)	(min)	(cfs)	(ft^3)	(ft^3)
A	11.13	0.76	28	2.30	28,692	N/A
B	16.04	0.85	26	3.64	45,336	
C	2.55	0.85	24	0.603	7,214	10,821
E	1.93	1.00	22	0.518	6,267	N/A
F	0.80	1.00	15	0.256	2,592	
TOTAL	**32.45**			**7.317**	**93,708**	

*Treatment flow is increased 1.5 times for biofiltration design per Los Angeles County LID guidelines.

5 SITE CHARACTERIZATION

The project site is tributary to San Jose Creek Reach 2. San Jose Creek Reach 2 is listed on the 2016 California Integrated Report (Clean Water Act Section 303(d) list) as impaired due to the prevalence of the pollutants shown in Table 3. According to the *Water Quality Control Plan for the Los Angeles Region*, San Jose Creek watershed is not designated beneficial uses for rare, threaten, or endangered species (RARE).

Table 2: 2016 California Integrated Report (Clean Air Act Section 303(d) list)

Receiving Waters	303(d) List Impairments	Proximity to RARE Uses
San Jose Creek Reach 2	Coliforms	Not Applicable

5.1 Site Designation

This project is a Designated Project as defined in the County of Los Angeles LID Manual, per the following:

- Proposed development is larger than one acre of disturbed area; and
- More than 10,000 square feet of impervious surface area are being added to the site as part of the proposed design.

The proposed design gives this project classification as a Redevelopment Project because more than 50 percent of the impervious surface of the previously developed site is proposed to be altered and the previous development project was not subject to storm water quality control measures. As such, the entire development site must meet the requirements of the County of Los Angeles LID Manual, regardless of existing hydrologic conditions.

5.2 Feasibility of Infiltration

Infiltration has been selected as the most feasible method for handling storm water generated by the design storm. Percolation testing was performed at the project site, and the full report is provided in Appendix G. The exploratory boring located nearest the proposed ADS StormTech Chamber Isolation unit has an average percolation rate of 1.81 in/hr. The exploratory boring located nearest the proposed Structure R bioswales has an average percolation rate of 0.54 in/hr.

5.3 Feasibility of Storm Water Runoff Harvesting

Storm water runoff harvesting is not feasible for the ACE project site due to storage restraints. Harvesting rain water requires large areas and/or tanks to hold the water until use, and such large storage areas are not available for incorporation into the proposed design. Additionally, infrequent rain events would not provide enough rain water to be used at the frequency needed for irrigation.

5.4 Feasibility of Green Roof Design

Green roofs are not feasible as part of the proposed ACE site design because the proposed building types are not suitable for maintaining or planting green roofs.

6 SOURCE CONTROL MEASURES

Source control measures are designed to prevent pollutants from contacting storm water runoff or prevent discharge of contaminated storm water runoff to the storm drain system and/or receiving waters. This section includes structural-type source control measures that were considered for implementation in conjunction with appropriate non-structural source control measures, such as good housekeeping and employee training. Combined, source control measures of structural-type and non-structural-type optimize pollution prevention.

Table 3 below identifies the source control measures to be implemented for this project.

Table 3: Source Control Measures Selection Matrix (*Ref. LID Manual*)

Project Type	**Source Control Measures**										
	Storm Drain Message and Signage (S-1)	Outdoor Material Storage Area (S-2)	Outdoor Trash Storage/ Waste Handling Area (s-3)	Outdoor Loading/ Unloading Dock Area (S-4)	Outdoor Vehicle/ Equipment Repair/ Maintenance Area (S-5)	Outdoor Vehicle/ Equipment/ Accessory Wash Area (S-6)	Fuel & Maintenance Area (s-7)	Landscape Irrigation Practices (S-8)	Building Materials (S-9)	Animal Care and Handling Facilities (S-10)	Outdoor Horticulture Areas (S-11)
Designated Projects – Redevelopment											
Development ≥ 1 acre and ≥ 10,000 ft^2 new impervious area	**X**	**X**	**X**					**X**	**X**		

Source control measures shall be implemented to the maximum extent practicable to mitigate pollutant mobilization from the project site in storm water and non-storm water runoff.

Education and outreach are key components to any successful storm water program. Public education and involvement are effective means to spread the message on preventing storm water pollution. Refer to Appendix J for Storm Water Outreach Material for Los Angeles County.

7 STORM WATER QUALITY CONTROL MEASURES

Storm water quality control measures are required to supplement site design principles and source control measures to achieve reduced volume of stormwater runoff and potential pollution loads to the maximum extent practicable. Stormwater quality control measures are designed to handle the frequent, smaller storm rain events, or the initial volume of stormwater of runoff from larger storm events (first flush). The first flush of larger storm rain events is the initial period of the storm where stormwater runoff typically carries the highest concentration and variety of pollutants. Designated Projects are required to retain the SWQDv onsite using retention-based stormwater quality control measures.

Infiltration was selected for the site as the primary means to handle the SWQDv from the proposed drainage subareas based. See Appendix G for supporting Geotechnical Reports and analysis.

The layout of the LID treatment items is shown on the site plan in Appendix C.

- Sub-area A, sub-area B, sub-area E, and sub-area F – ADS StormTech Chamber Isolation System, manufactured by ADS – Qty 1, 194' x 124' footprint (volume-based)
- The storm water quality design volume (SWQDv) diverted to the ADS StormTech Chamber Isolation Unit is equal to 82,887 ft^3, per Table 2.
- Per the manufacturer drawings, the ADS StormTech Chamber Isolation unit has been sized to treat 82,920 ft^3, exceeding the SWQDv.

Refer to Appendix H for ADS StormTech Chamber Isolation unit specifications, sizing information, and installation and maintenance procedures.

Biofiltration was used for areas where the site characteristics allowed for the construction of bioswales.

- Sub-area C – vegetated bioswales – Qty 2
- The design LID flow for each bioswale is as follows: 0.79 cfs to the northern bioswale and 0.61 cfs to the southern bioswale.
- Given the provided 1.5' depths in each bioswale, the required lengths are 128 feet and 98 feet for the northern and southern bioswales, respectively.
- The provided bioswale lengths in the LID design are as follows:
    - North L_1 = 134 ft (flow-based), South L_2 = 142 ft (flow-based)
    - Each bioswale exceeds the required lengths necessary to treat LID flows.

The Los Angeles County LID Manual guidelines requires biofiltration treatment flows to include a 1.5x factor for sizing purposes. The flow (Q) calculated in Section 3.4 includes the 1.5x factor and the bioswales were designed accordingly. Refer to Appendix H for bioswale sizing calculations.

8 MAINTENANCE

The owner is responsible for the implementation of this LID report for the onsite areas, including the long-term inspection and maintenance of all source control measures and all storm water quality control measures.

8.1 Maintenance Requirements

Maintenance and cleaning of the ADS StormTech Chamber Isolation unit shall be in accordance with the manufacturer's recommendations. At a minimum, the control measures shall be inspected and maintained once prior to the rainy season, once during the rainy season, and once after the rainy season (generally accepted as October 1st through April 30th). All control measures shall be inspected and maintained according to the executed maintenance agreement in Appendix F.

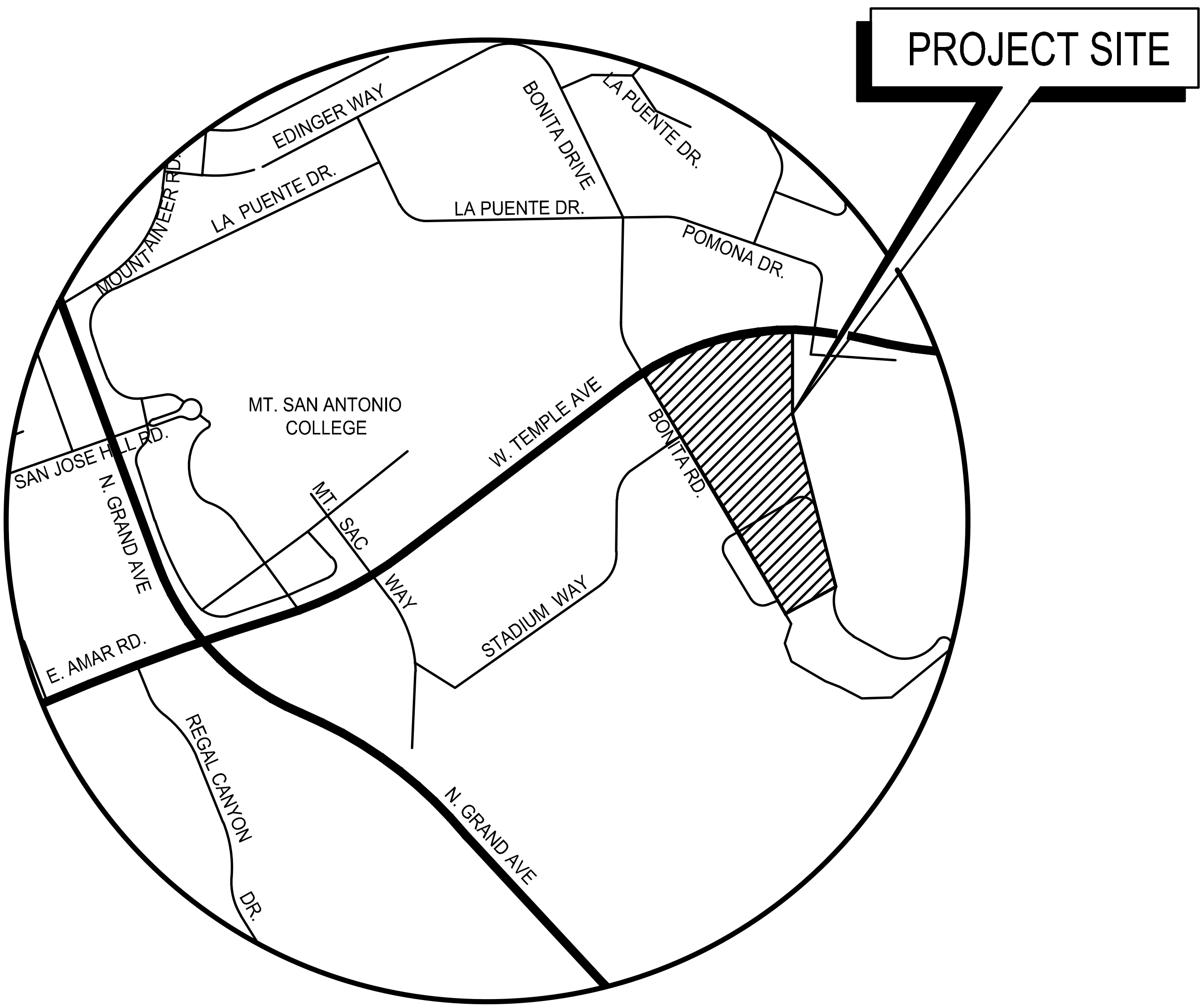
REFERENCES

Los Angeles Department of Public Works, *Low Impact Development, Standard Manual*, (February 2014)

Los Angeles County Department of Public Works, *LACDPW Hydrology Manual and Appendices* (LACDPW 1991, 1992, 1993, 2002, 2006).

APPENDICIES

Appendix A: Vicinity Map



Appendix A - Vicinity Map
N.T.S.

PSOMAS

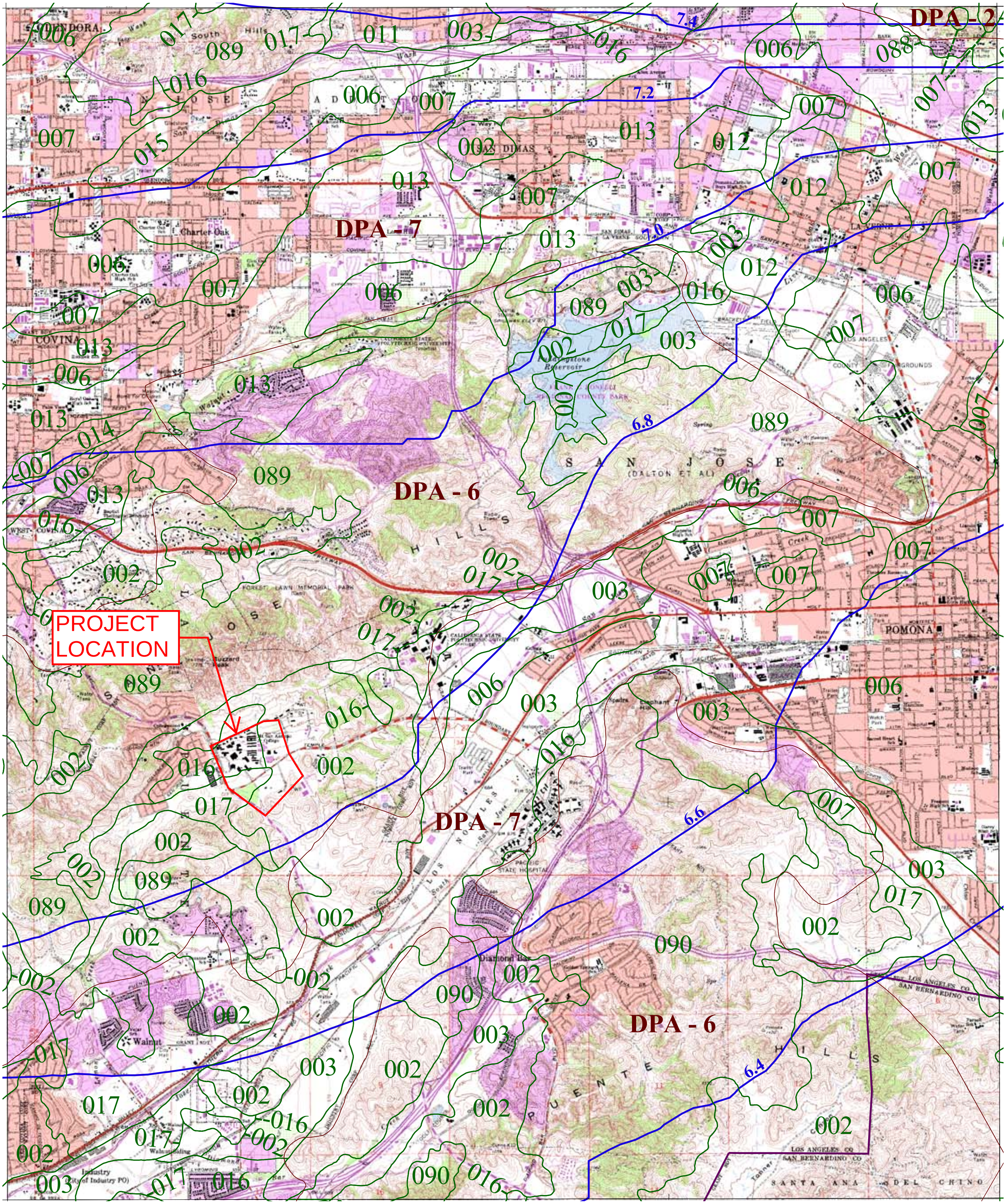
DATE: 08-30-18 REVISED ON:
JOB No:1HMC015300

SHEET 1 OF 1

Mount San Antonio College

Plotted:

Appendix B: LA County Soil Runoff Curve& Isohyet Hydrology Map



25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

SAN DIMAS
50-YEAR 24-HOUR ISOHYET

1-H1.22

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

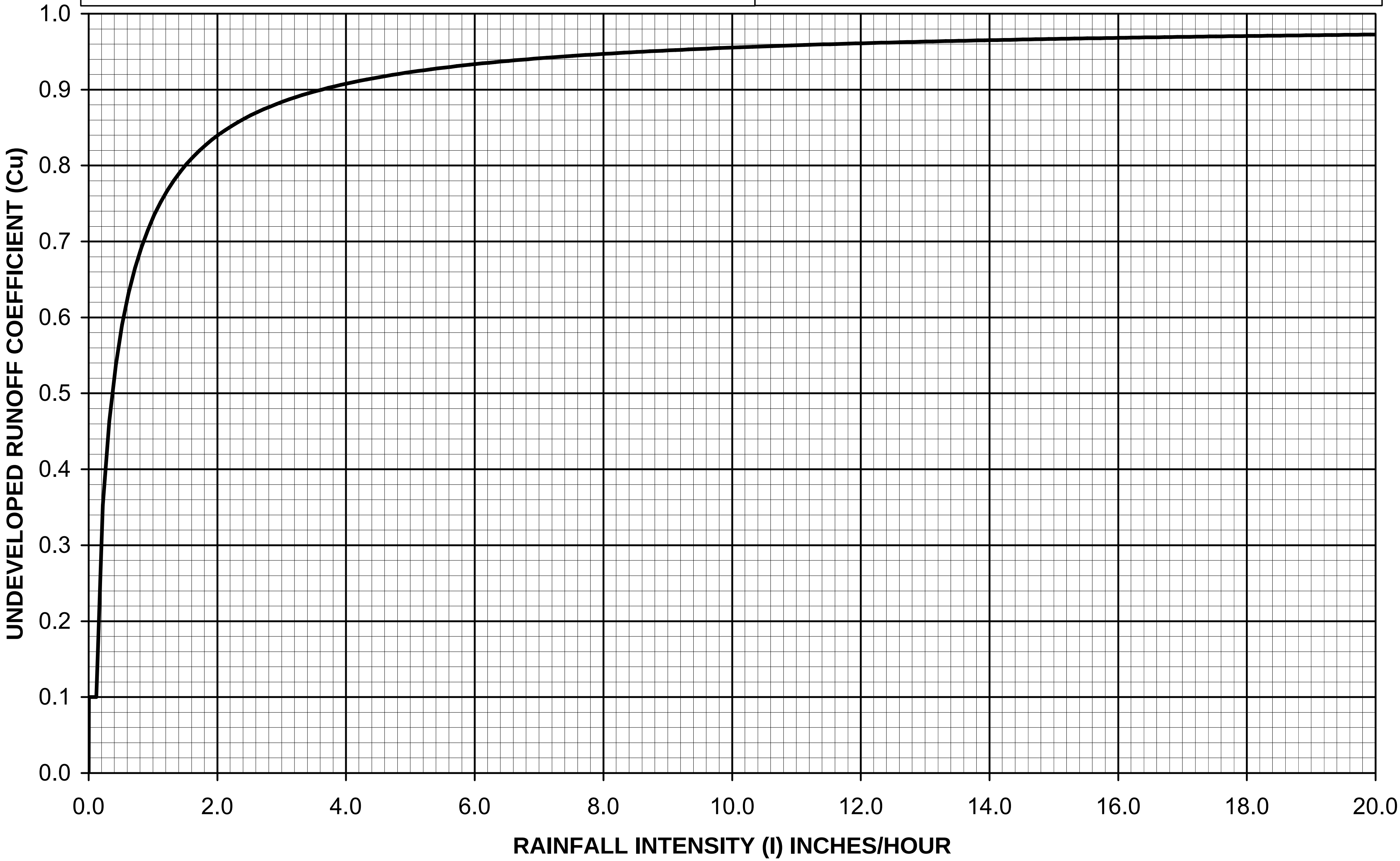
Where: C_D = Developed Runoff Coefficient

IMP = Proportion Impervious

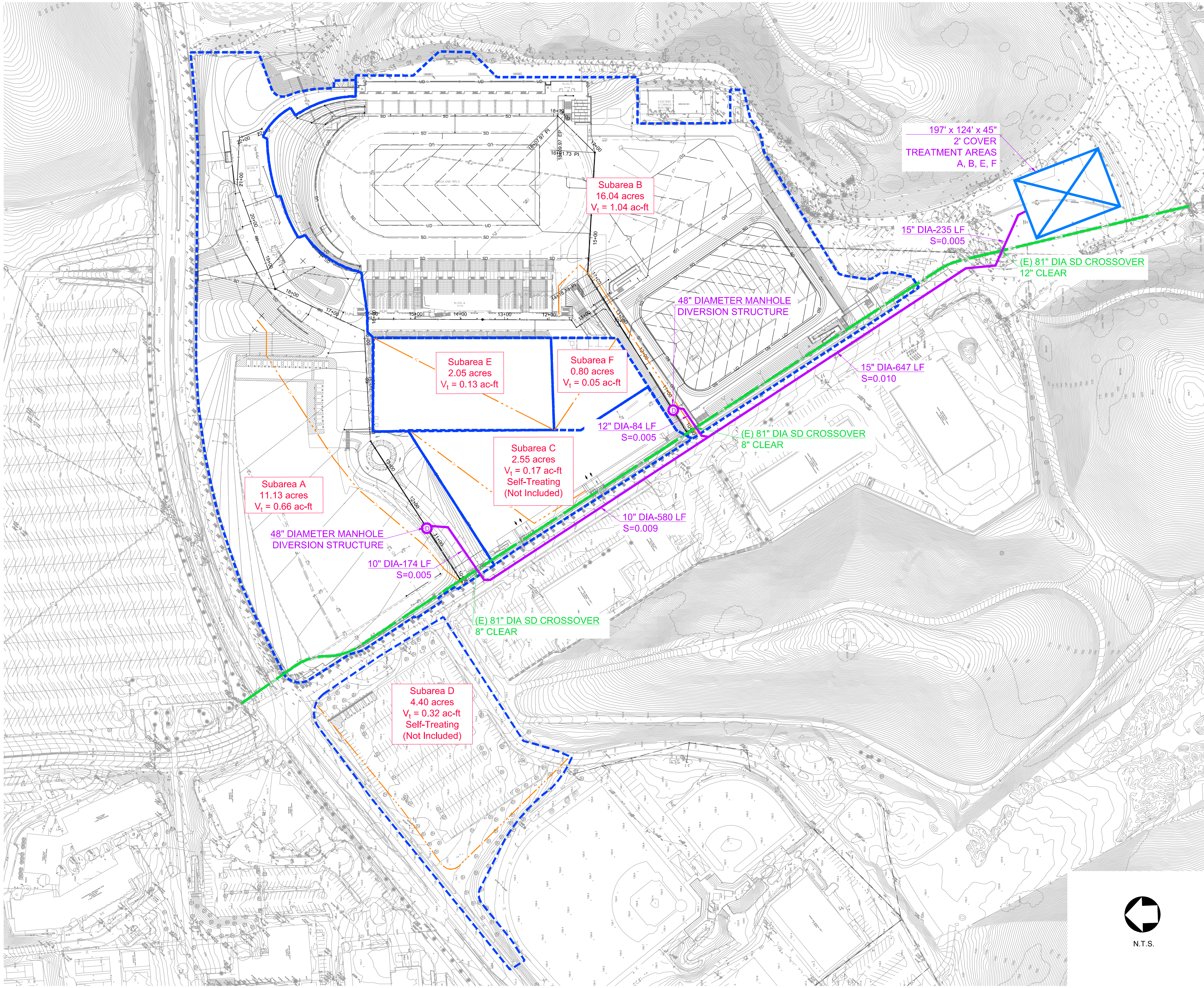
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 002



Appendix C: LID Site Plan Exhibit



HMC Architects

PSOMAS

NOTES

- DIVERSION STRUCTURE
- EXISTING 81" STORM DRAIN
- ADS STORMTECH CHAMBER ISOLATION ROW TREATMENT SYSTEM
- ACE STORM DRAIN

FILE NO.

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT

ACS ______ FLS ______ SSS ______
DATE ______

MT SAN ANTONIO COLLEGE

1100 North Grand Avenue
Walnut, CA 91789
(909) 274-7500

No.	Description	Date

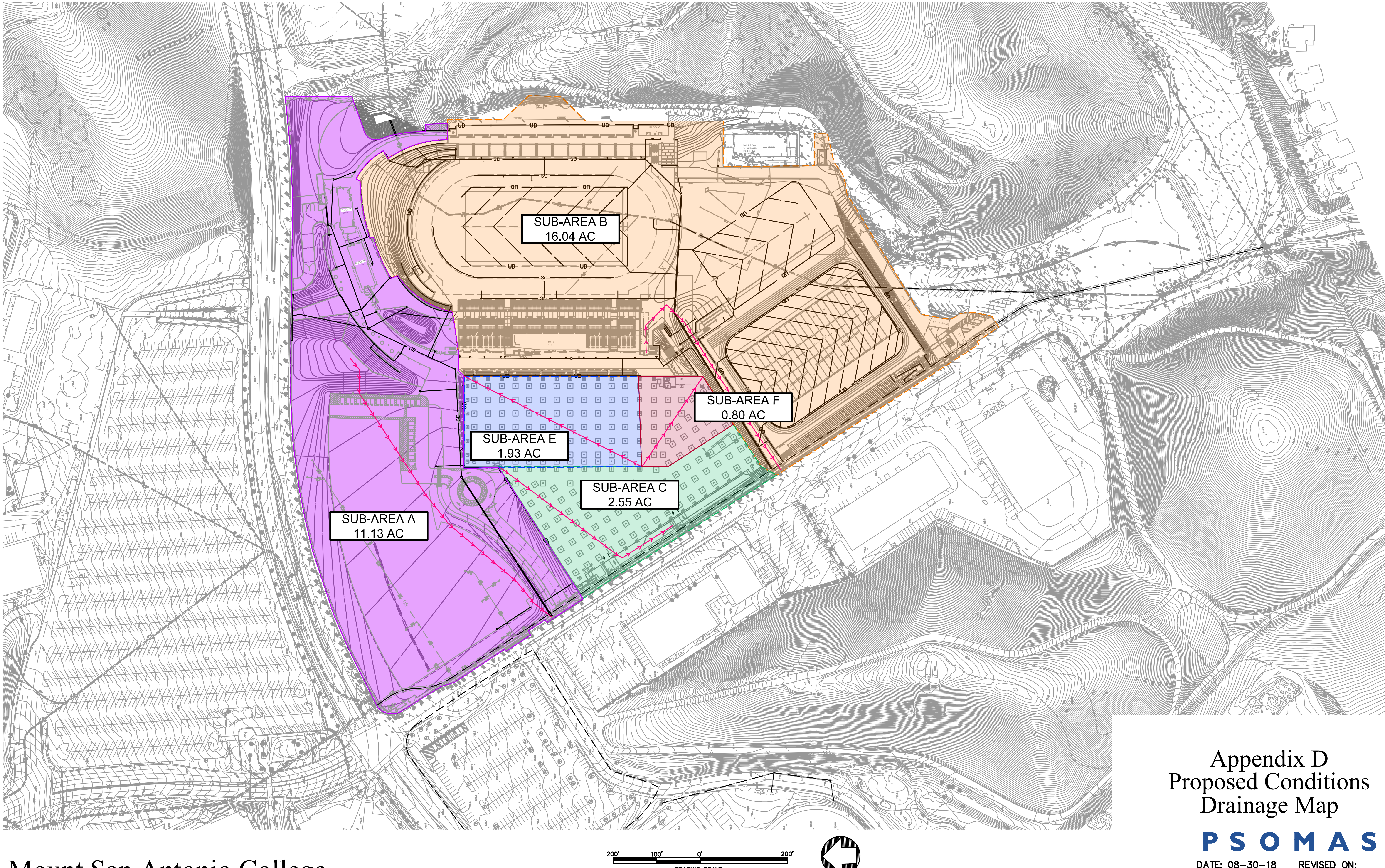
Mt. SAC Storm Water Improvements
LID Site Plan Exhibit

Designed:	MM	Project No.	1HMC01.300
Drawn:	EH	Scale:	AS SHOWN
QAQC	AW	Drawing No.	C-EXH-1
Date:	08.30.2018		

PLEASE RECYCLE

W:\Mt_SAC\1HMC015300\ENGR\EXHIB\Appendix C_LID Site Plan.dwg Tue, 28 Aug 2018 - 1:56pm Plotted by: emma.harrison

Appendix D: Proposed Hydrologic Exhibit



Appendix D
Proposed Conditions Drainage Map

PSOMAS

DATE: 08-30-18 REVISED ON:
JOB No:1HMC015300

SHEET 1 OF 1

Mount San Antonio College

Appendix E: Hydrology Calculations

Peak Flow Hydrologic Analysis

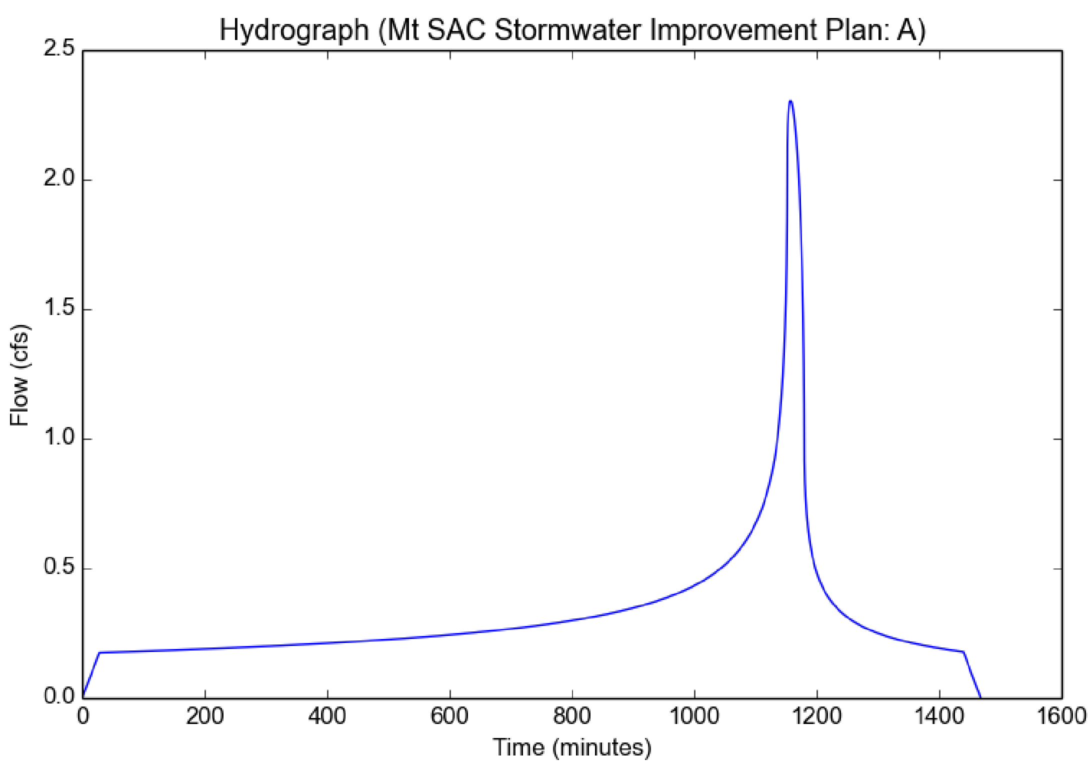
File location: W:/Mt_SAC/1HMC015300/ENGR/CALCS/HydroCalc/Mt SAC Stormwater Improvement Plan - A.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt SAC Stormwater Improvement Plan
Subarea ID	A
Area (ac)	11.13
Flow Path Length (ft)	771.0
Flow Path Slope (vft/hft)	0.032
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.76
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.2655
Undeveloped Runoff Coefficient (Cu)	0.3991
Developed Runoff Coefficient (Cd)	0.7798
Time of Concentration (min)	28.0
Clear Peak Flow Rate (cfs)	2.3042
Burned Peak Flow Rate (cfs)	2.3042
24-Hr Clear Runoff Volume (ac-ft)	0.6587
24-Hr Clear Runoff Volume (cu-ft)	28691.6134



Peak Flow Hydrologic Analysis

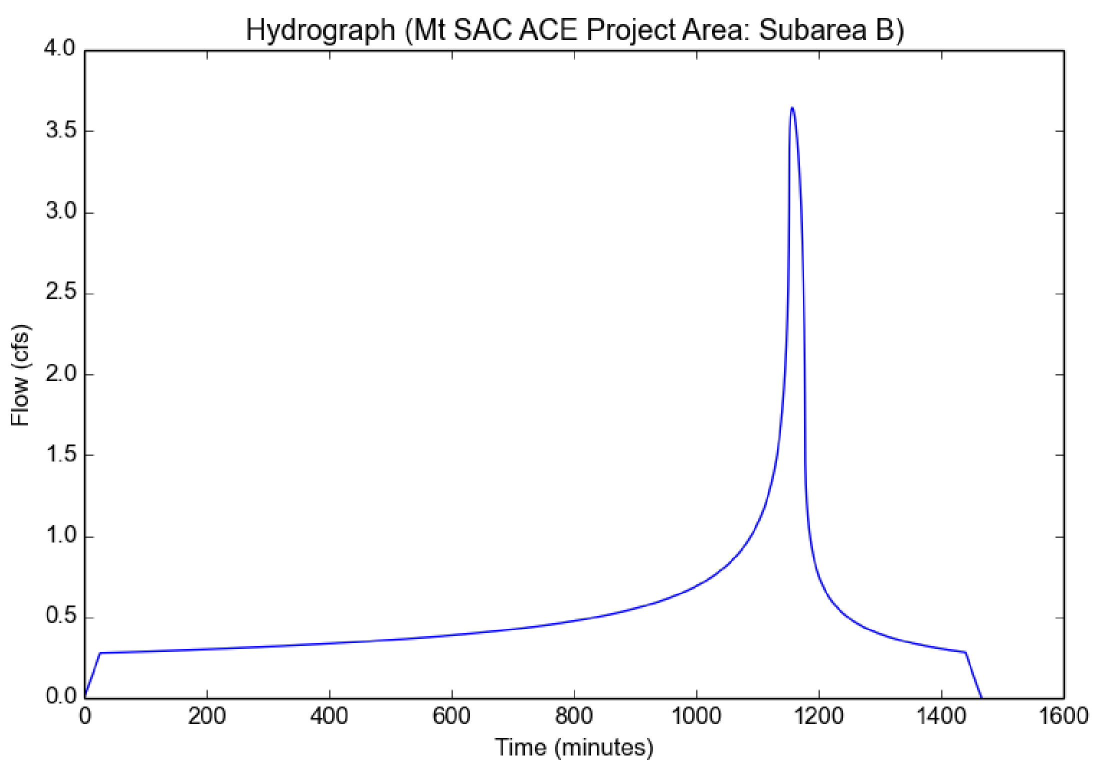
File location: W:/Mt_SAC/1HMC015001/ENGR/CALCS/2018-0405_ACE LID/2018-0406/Mt SAC ACE Project Area - Subarea B (south).pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt SAC ACE Project Area
Subarea ID	Subarea B
Area (ac)	16.04
Flow Path Length (ft)	594.0
Flow Path Slope (vft/hft)	0.013
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.85
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.2749
Undeveloped Runoff Coefficient (Cu)	0.4078
Developed Runoff Coefficient (Cd)	0.8262
Time of Concentration (min)	26.0
Clear Peak Flow Rate (cfs)	3.643
Burned Peak Flow Rate (cfs)	3.643
24-Hr Clear Runoff Volume (ac-ft)	1.0408
24-Hr Clear Runoff Volume (cu-ft)	45335.5939



Peak Flow Hydrologic Analysis

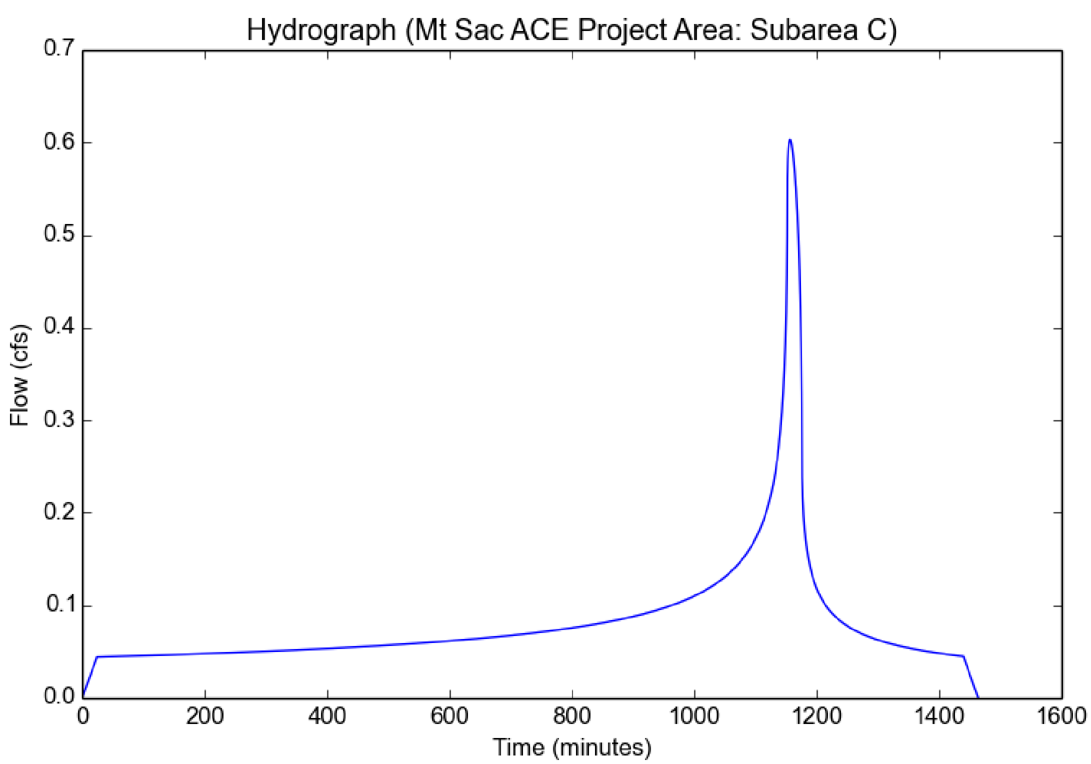
File location: W:/Mt_SAC/1HMC015300/ENGR/CALCS/HydroCalc/Mt Sac ACE Project Area - Subarea C.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt Sac ACE Project Area
Subarea ID	Subarea C
Area (ac)	2.552
Flow Path Length (ft)	484.458
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	0.85
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.2854
Undeveloped Runoff Coefficient (Cu)	0.4176
Developed Runoff Coefficient (Cd)	0.8276
Time of Concentration (min)	24.0
Clear Peak Flow Rate (cfs)	0.6029
Burned Peak Flow Rate (cfs)	0.6029
24-Hr Clear Runoff Volume (ac-ft)	0.1656
24-Hr Clear Runoff Volume (cu-ft)	7213.5746



Peak Flow Hydrologic Analysis

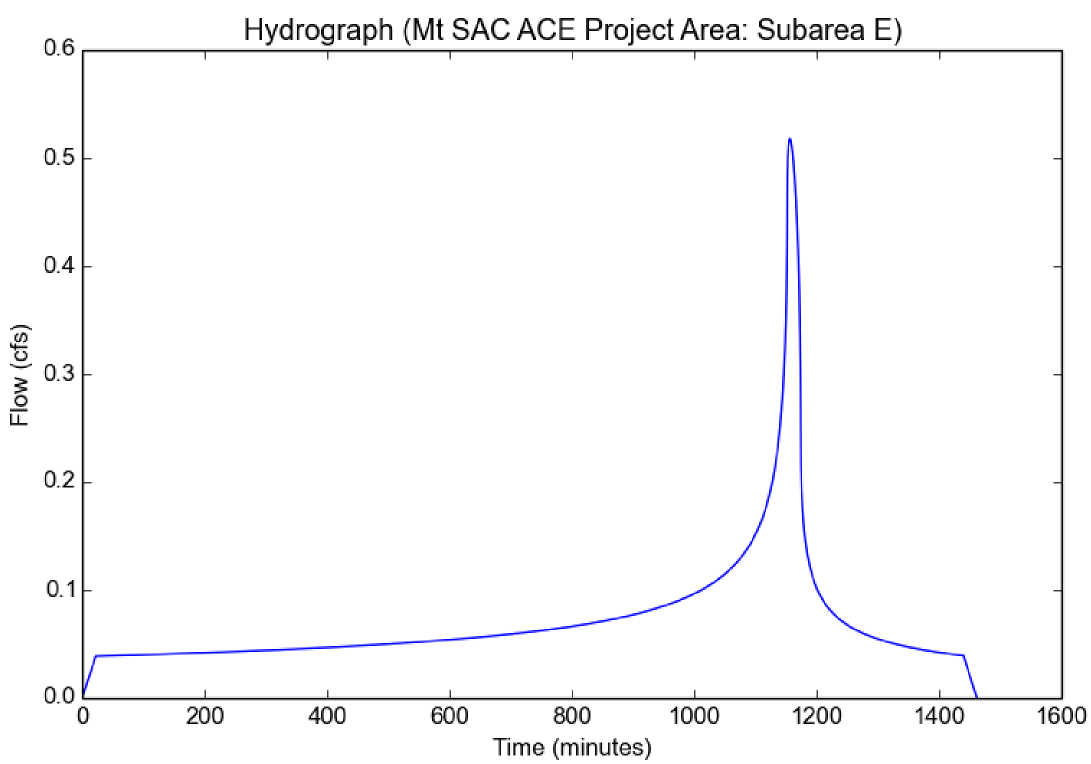
File location: W:/Mt_SAC/1HMC015300/ENGR/CALCS/Hydrology/HydroCalc/Mt Sac ACE Project Area - Subarea E.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt SAC ACE Project Area
Subarea ID	Subarea E
Area (ac)	1.934
Flow Path Length (ft)	456.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.2974
Undeveloped Runoff Coefficient (Cu)	0.4286
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	22.0
Clear Peak Flow Rate (cfs)	0.5176
Burned Peak Flow Rate (cfs)	0.5176
24-Hr Clear Runoff Volume (ac-ft)	0.1439
24-Hr Clear Runoff Volume (cu-ft)	6266.1985



Peak Flow Hydrologic Analysis

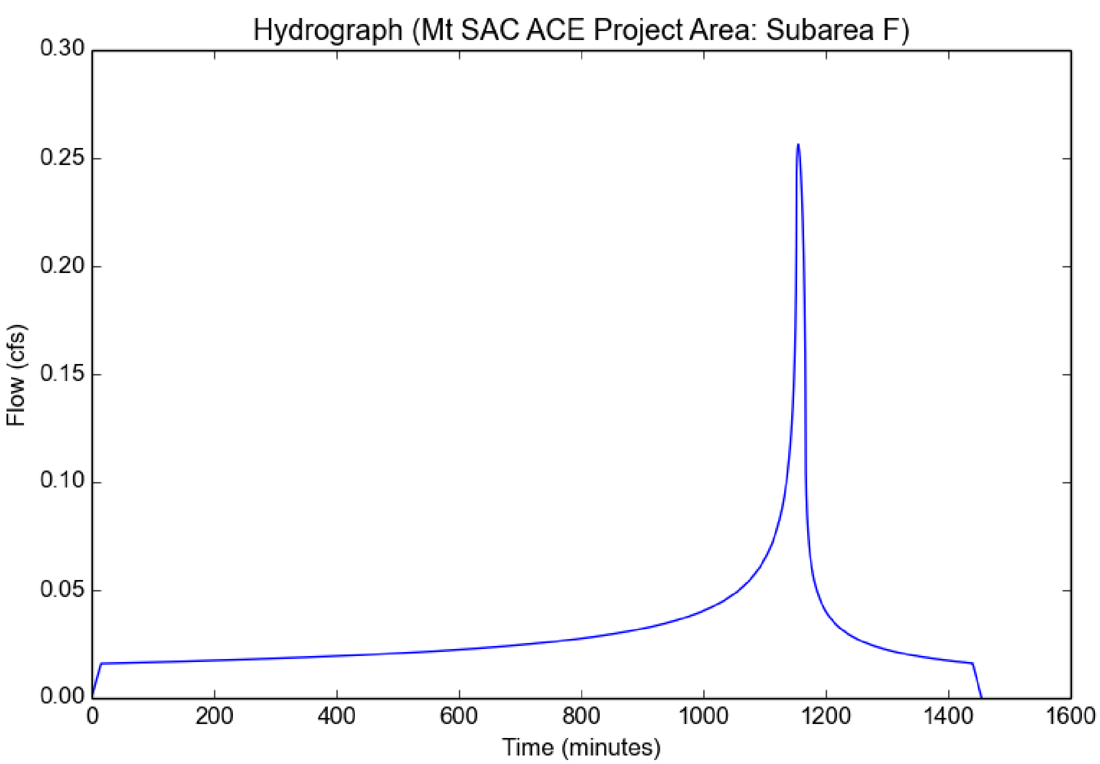
File location: W:/Mt_SAC/1HMC015300/ENGR/CALCS/Hydrology/HydroCalc/Mt Sac ACE Project Area - Subarea F.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt SAC ACE Project Area
Subarea ID	Subarea F
Area (ac)	0.8
Flow Path Length (ft)	250.0
Flow Path Slope (vft/hft)	0.01
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.356
Undeveloped Runoff Coefficient (Cu)	0.4829
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	15.0
Clear Peak Flow Rate (cfs)	0.2563
Burned Peak Flow Rate (cfs)	0.2563
24-Hr Clear Runoff Volume (ac-ft)	0.0595
24-Hr Clear Runoff Volume (cu-ft)	2592.0074



Peak Flow Hydrologic Analysis

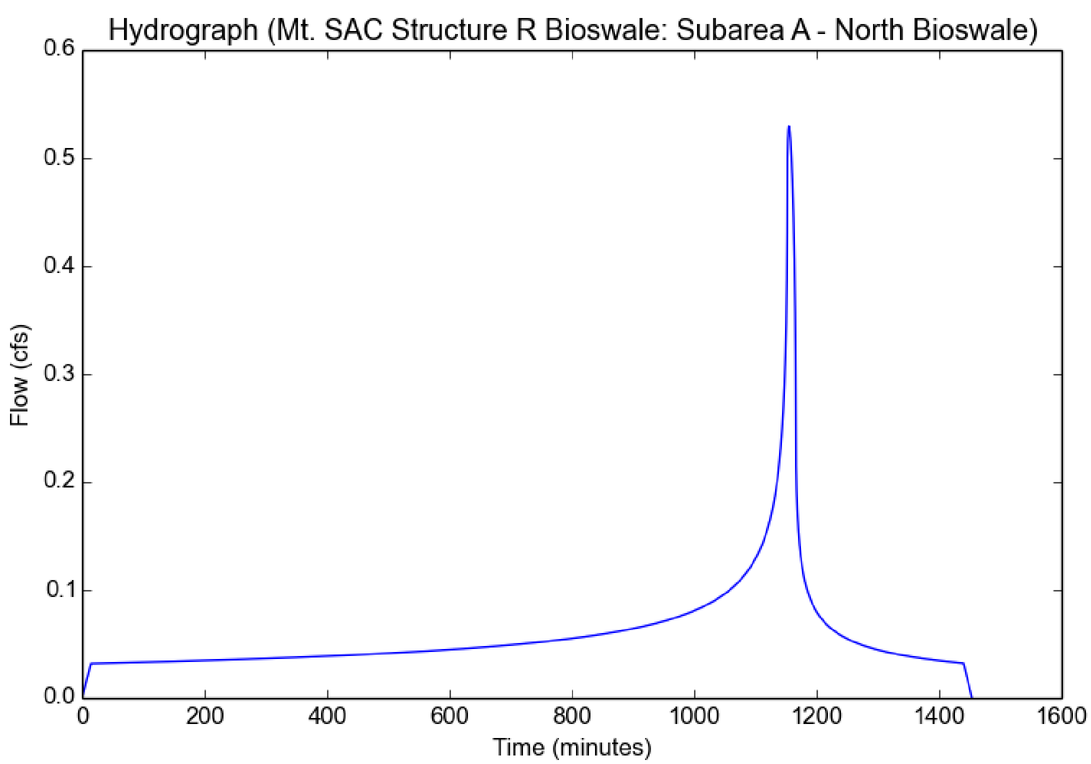
File location: W:/Mt_SAC/1HMC015200/ENGR/CALCS/Structure R LID/Mt. SAC Structure R Bioswale - Subarea A - North Bioswale.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt. SAC Structure R Bioswale
Subarea ID	Subarea A - North Bioswale
Area (ac)	1.6
Flow Path Length (ft)	347.0
Flow Path Slope (vft/hft)	0.043
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.3677
Undeveloped Runoff Coefficient (Cu)	0.4938
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	14.0
Clear Peak Flow Rate (cfs)	0.5295
Burned Peak Flow Rate (cfs)	0.5295
24-Hr Clear Runoff Volume (ac-ft)	0.119
24-Hr Clear Runoff Volume (cu-ft)	5184.0128



Peak Flow Hydrologic Analysis

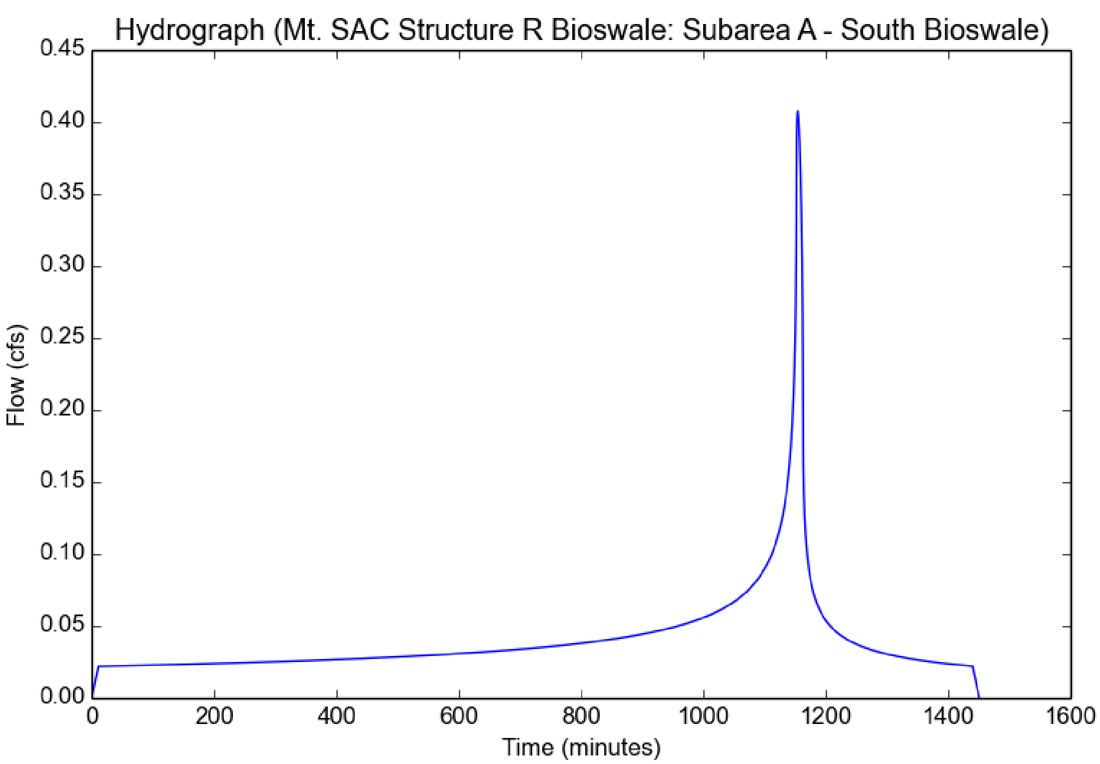
File location: W:/Mt_SAC/1HMC015200/ENGR/CALCS/Structure R LID/Mt. SAC Structure R Bioswale - Subarea A - South Bioswale.pdf
Version: HydroCalc 1.0.2

Input Parameters

Project Name	Mt. SAC Structure R Bioswale
Subarea ID	Subarea A - South Bioswale
Area (ac)	1.1
Flow Path Length (ft)	261.0
Flow Path Slope (vft/hft)	0.057
85th Percentile Rainfall Depth (in)	1.0
Percent Impervious	1.0
Soil Type	2
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	1.0
Peak Intensity (in/hr)	0.4119
Undeveloped Runoff Coefficient (Cu)	0.5286
Developed Runoff Coefficient (Cd)	0.9
Time of Concentration (min)	11.0
Clear Peak Flow Rate (cfs)	0.4078
Burned Peak Flow Rate (cfs)	0.4078
24-Hr Clear Runoff Volume (ac-ft)	0.0818
24-Hr Clear Runoff Volume (cu-ft)	3564.0054



Appendix F: Master Covenant and Agreement

RECORDING REQUESTED BY
AND MAIL TO:

COUNTY OF LOS ANGELES
DEPARTMENT OF PUBLIC WORKS
BUILDING AND SAFETY DIVISION
900 S. FREMONT AVENUE, 3RD FLOOR
ALHAMBRA, CA 91803-1331

Space above this line is for Recorder's use

COVENANT AND AGREEMENT REGARDING THE MAINTENANCE OF LOW IMPACT DEVELOPMENT (LID) & NATIONAL POLLUTANTS DISCHARGE ELIMINATION SYSTEM (NPDES) BMPs

The undersigned, ____ ("Owner"), hereby certifies that it owns the real property described as follows ("Subject Property"), located in the County of Los Angeles, State of California:

LEGAL DESCRIPTION

ASSESSOR'S ID #___________________TRACT NO.___________________LOT NO.__________________________

ADDRESS: ____

____

Owner is aware of the requirements of the County of Los Angeles' Green Building Standards Code, Title 31, Section 4.106.4 (LID), and National Pollutant Discharge Elimination System (NPDES) permit. The following post-construction BMP features have been installed on the Subject Property:

- □ Porous pavement
- □ Cistern/rain barrel
- □ Infiltration trench/pit
- □ Bioretention or biofiltration
- □ Rain garden/planter box
- □ Disconnect impervious surfaces
- □ Dry Well
- □ Storage containers
- □ Landscaping and landscape irrigation
- □ Green roof
- □ Other ____

____

The location, including GPS x-y coordinates, and type of each post-construction BMP feature installed on the Subject Property is identified on the site diagram attached hereto as Exhibit 1.

Owner hereby covenants and agrees to maintain the above-described post-construction BMP features in a good and operable condition at all times, and in accordance with the LID/NPDES Maintenance Guidelines, attached hereto as Exhibit 2.

Owner further covenants and agrees that the above-described post-construction BMP features shall not be removed from the Subject Property unless and until they have been replaced with other post-construction BMP features in accordance with County of Los Angeles' Green Building Standards Code, Title 31 and NPDES permit.

Owner further covenants and agrees that if Owner hereafter sells the Subject Property, Owner shall provide printed educational materials to the buyer regarding the post-construction BMP features that are located on the Subject Property, including the type(s) and location(s) of all such features, and instructions for properly maintaining all such features.

Owner makes this Covenant and Agreement on behalf of itself and its successors and assigns. This Covenant and Agreement shall run with the Subject Property and shall be binding upon owner, future owners, and their heirs, successors and assignees, and shall continue in effect until the release of this Covenant and Agreement by the County of Los Angeles, in its sole discretion.

Owner(s):

By:__________________________________ Date:__________________________________

By:__________________________________ Date:__________________________________

(PLEASE ATTACH NOTARY)

REFERENCE

PLAN CHECK NO.: ____________________________________ DISTRICT OFFICE NO.:_______________________

ATTACHMENTS

RECORDING REQUEST BY AND MAIL TO:

County of Los Angeles
Department of Public Works

Building and Safety – Drainage and Grading Section
Land Development – Drainage and Grading Section

P.O. Box 1460
Alhambra, California 91802-1460

Space above this line is for Recorder's use

COVENANT FOR MAINTENANCE OF WATER QUALITY (WQ) DEVICES

I (we) ______________________________________, hereby certify that I (we) am (are) the legal owner(s) of Tract # _____, and as such owners for the mutual benefit of future purchasers, their heirs, successors, and assigns, do hereby fix the following protective conditions to which their property, or portions thereof, shall be held, sold and/or conveyed.

That owner(s) shall maintain the WQ system shown on attached Exhibit A map and on Grading Plan GPC # ____________, on file in the office of the Director of Public Works, in a good and functional condition at least once a year and retain proof of the inspection. The owner(s) shall perform this responsibility, unless the County discharges this obligation through a subsequently recorded written instrument.

The undersigned also covenants and agrees for himself, his heirs, successors, and assigns, to indemnify, defend, and save harmless the County, its agents, officers and employees from and against any and all liability, expenses, including defense costs and legal fees, and claims for damages of any nature whatsoever, including, but not limited to, bodily injury, death, personal injury, or property damage arising from or connected with the construction or maintenance of said work.

Owner(s):

By: ____ Date: ______________________

By: ____ Date: ______________________

Appendix G: Geotechnical Reports

Geotechnical Study Report for Proposed Lot R Tennis and Parking Structure Project, prepared by Converse Consultants, dated December 1, 2017.	Provided on enclosed CD.
Geoseismic/Geotechnical Study Report for Proposed Building 12 Renovation Project, prepared by Converse Consultants, dated September 19, 2011.	
Geotechnical Study Report for Proposed Athletic Complex East, prepared by Converse Consultants, dated November 25, 2014, and revised on January 23, 2015, and updated March 14, 2016.	
Geotechnical Study Report for Proposed Athletic Complex East (Telecommunications Building D), prepared by Converse Consultants, dated July 31, 2015.	

Summary of Percolation Test Results, prepared by Converse Consultants, dated May 17, 2018.

May 17, 2018

Mr. Gary Gidcumb
Mt. San Antonio College
Facilities Planning & Management
1100 North Grand Avenue, Building 23
Walnut, California 91789

Subject: **SUMMARY OF PERCOLATION TEST RESULTS**
Percolation Tests within Mt San Antonio College
Mt. San Antonio College
Walnut, Los Angeles County, California
Converse Project No. 14-31-124-04

Dear Mr. Gidcumb:

Converse Consultants (Converse) has prepared this letter to summarize the results of the percolation tests performed to assist in the dry well design as per our proposal dated April 30th, 2018. Converse conducted five percolation tests on May 4th, 2018 at the Athletic Complex East area within Mt San Antonio College. The testing was performed in general accordance with Los Angeles County Low Impact Development, Best Management Practices Guidelines.

The percolation tests were conducted at the Athletic Complex East area within Mt San Antonio College as shown on Figure No. 1, *Site and Percolation Location Map*. Five (5) exploratory borings (PT-1 through PT-5) were drilled within the project site on May 4th, using a truck-mounted drill rig equipped with 8-inch diameter hollow-stem augers. Boring was terminated to a depth of 15 to 27 feet due to shallow ground water and the percolation test was performed to meet the County of Los Angeles requirement. Detailed descriptions of the field exploration and sampling program are presented in Appendix A, *Field Exploration*. For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*.

Upon completion of drilling, a 2-inch-thick gravel layer was placed at the bottom of the hole and a 2-inch diameter perforated pipe was installed above the gravel to the ground surface. The boring annulus around the pipe was filled with gravel. The purpose of the pipe and gravel was to reduce the potential for erosion and caving due to the addition of water to the holes.

The test holes were presoaked by filling with water. Based on the percolation of water during presoaking at percolation tests, the site soils meet the conditions for clay soils (*Administrative Manual, Los Angeles County 2017*) for four bore holes (PT-1 through PT-

4) and meet the conditions for sandy soils for one bore hole (PT-5). The corresponding clay soil and sandy soil test procedures were used.

For clayey soil, the water level and total depth of test hole were measured from the top of the pipe every 30 minutes for 90 minutes. For sandy soil, the water level and total depth of test hole were measured from the top of the pipe every 10 minutes for 30 minutes. After each measurement, the water level was adjusted to a depth greater than 5 times the hole radius. There were at least three (3) sets of measurements taken for each test and each set consisted of at least three (3) measurements.

The percolation test hole data is presented in the table below.

Percolation Test	Location	Test Hole Diameter (inches)	Total Depth of Test Hole (feet)	Perforated Pipe Inside Diameter (inches)	Porosity of Gravel (n)
PT-1	South side of ACE area	8	17	1.92	0.48
PT-2	Within ACE subarea B	8	27	1.92	0.48
PT-3	Within ACE subarea C along the service road	8	25	1.92	0.48
PT-4	Within ACE subarea A	8	20	1.92	0.48
PT-5	Next to ACE subarea D along the service road	8	21	1.92	0.48

Percolation rates describe the movement of water horizontally and downward into the soil from a boring. Infiltration rates describe the downward movement of water through a horizontal surface. Percolation rates are related to infiltration rates but are generally higher and may require conversion before use in design. It is our understanding that infiltration rates are not needed for the design of the drywell and have not been provided in this letter. If an infiltration rate is needed, the percolation test data can be used to estimate infiltration rates using the Porchet Inverse Borehole Method, in accordance with the Los Angeles County guidelines. The results of the percolation test and requirements are presented in Appendix C, *Percolation Testing*. The well designer should determine whether additional design-related safety factors are appropriate and whether infiltration rates or percolation rates are appropriate for use in the well design. Details of the dry well can be seen in Figure No. 2, *Standard Drywell Detail*.

The field data of the most conservative test interval and percolation rates are presented in the following table.

Percolation Test	Location	Test Depth (feet bgs)	Time Interval (min)	Average Change in Water Height In 30 Mins (feet)	Average Percolation Rate (in/hour)	Lowest Percolation Rate (in/hour)
PT-1*	South side of ACE area	17	30	2.84	1.81	0.98
PT-2*	Within ACE subarea B	27	30	3.29	1.20	0.72
PT-3*	Within ACE subarea C along the service road	25	30	1.51	0.54	0.18
PT-4*	Within ACE subarea A	20	30	0.96	0.41	0.26
PT-5*	Next to ACE subarea D along the service road	21	10	1.46	0.57	0.3

*Percolation rate was obtained from an 8-inch diameter bore hole to a depth which shows in the next column (Test Depth). The percolation rate may change with different well dimensions. The adjustment to the provided percolation rate to a well with different dimensions should be determined by the well designer.

We appreciate the opportunity to be of continued service to Mt San Antonio College. If you have any questions or require additional information, please contact the undersigned at (626) 930-1275.

CONVERSE CONSULTANTS

Sivathasan

Siva K. Sivathasan, PhD, PE, GE, DGE, QSD, F. ASCE
Senior Vice President / Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
KATHIRAVETPILLAI SIVATHASAN
No. 2708
Exp. 6-30-18
GEOTECHNICAL
STATE OF CALIFORNIA

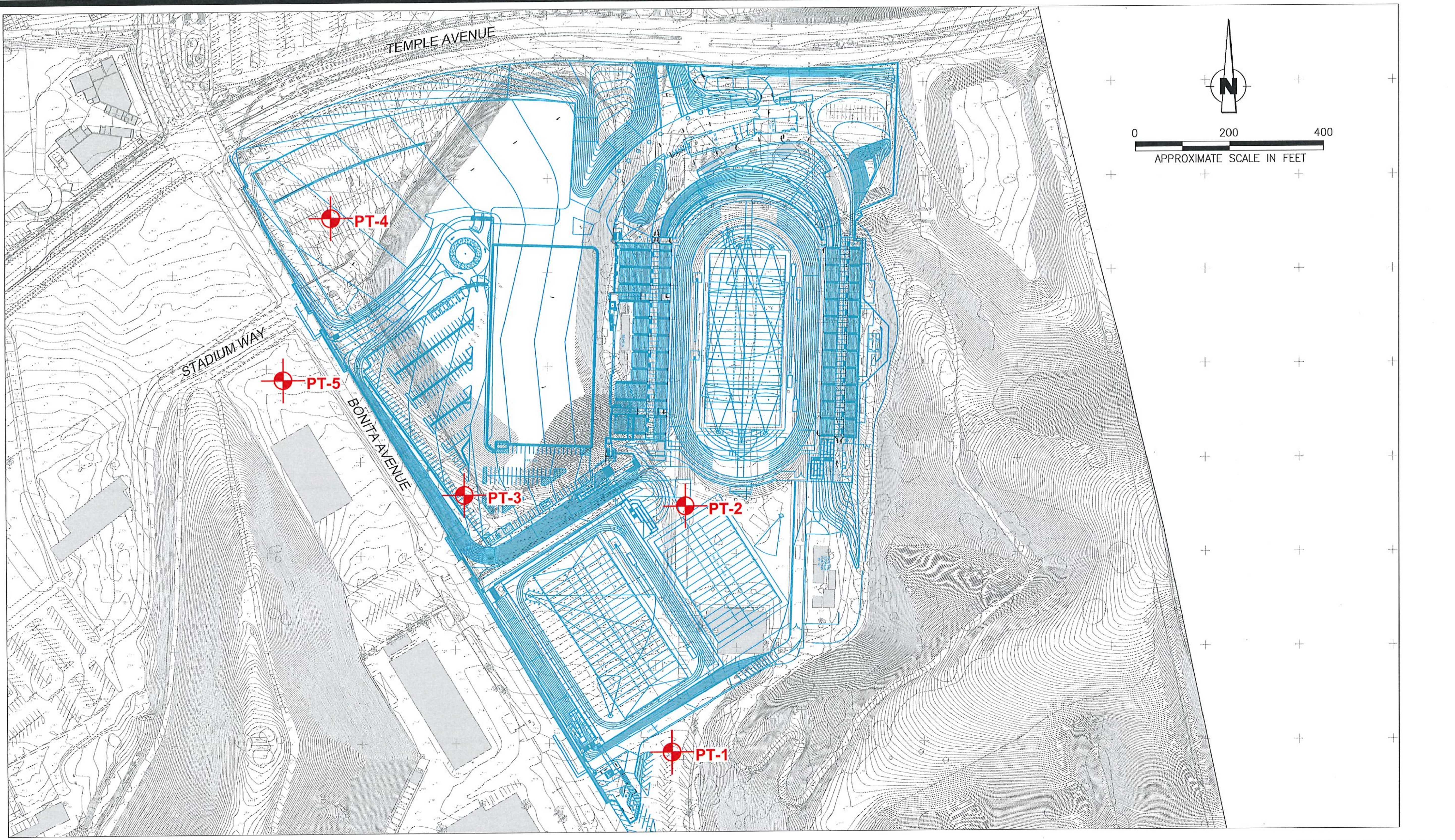
Dist: 2/Addressee
Encl: Figures
Appendix A
Appendix B
Appendix C

REFERENCES

COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS, *Low Impact Development, Standard Manual*, February 2014.

COUNTY OF LOS ANGELES, *Administrative Manual - Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration*, 2017.

Figures



EXPLANATION

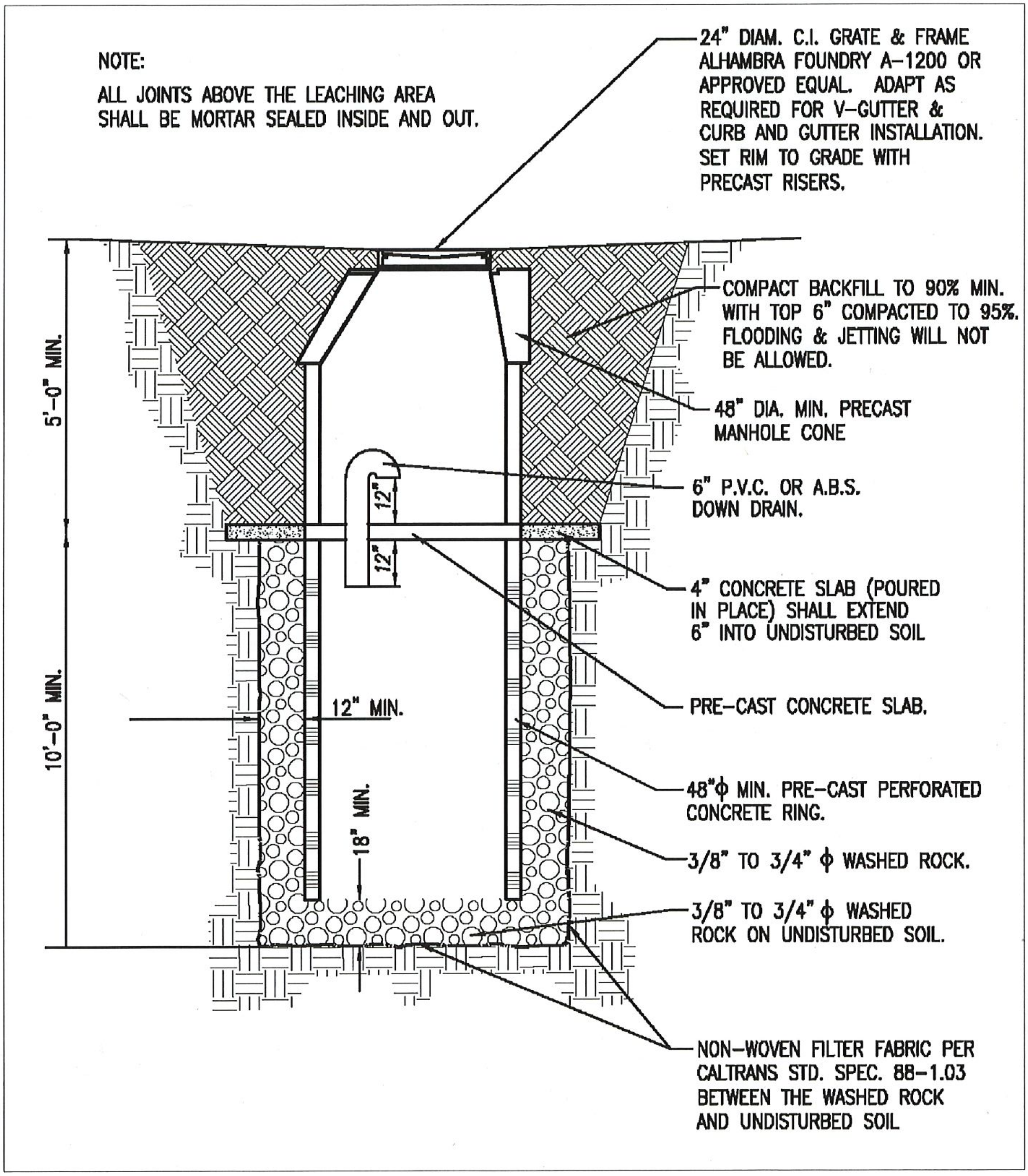
APPROXIMATE LOCATION OF PERCOLATION TESTING

SITE PLAN AND APPROXIMATE BORING LOCATIONS MAP

Converse Consultants

PROPOSED LOT M IMPROVEMENT
MT. SAN ANTONIO COLLEGE
WALNUT, CALIFORNIA

Project No.	Drawing No.
14-31-124-04	1



STANDARD DRYWELL DETAIL

Converse Consultants

PROPOSED LOT M IMPROVEMENT
MT. SAN ANTONIO COLLEGE
WALNUT, CALIFORNIA

Project No.	Drawing No.
14-31-124-04	2

Appendix A

Field Exploration

APPENDIX A: FIELD EXPLORATION

Field exploration included a site reconnaissance and subsurface exploration program. During the site reconnaissance, the surface conditions were noted, and the approximate location of the boring was determined. The exploratory boring was approximately located using existing boundary and other features as a guide and should be considered accurate only to the degree implied by the method used. The various field study methods performed are discussed below.

Five (5) exploratory borings (PT-1 through PT-5) were drilled within the project site on May 4th, 2017. The borings were advanced using a truck-mounted 8-inch-diameter hollow stem auger drill rig to a maximum depth of 27 feet below the existing ground surface (bgs). The boring was visually logged by a Converse engineer in accordance with the Unified Soil Classification System and sampled at regular intervals and at changes in subsurface soils. The field descriptions have been modified where appropriate to reflect laboratory test results.

California Modified Sampler (ring samples) of the subsurface materials were obtained at frequent intervals in the exploratory boring using a drive sampler (2.4-inches inside diameter and 3.0-inches outside diameter) lined with sample rings. The steel ring sampler was driven into the bottom of the borehole with successive drops of a 140-pound driving weight falling 30 inches, using an automatic hammer. Samples were retained in brass rings (2.4-inches inside diameter and 1.0-inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the Converse laboratory. Blow counts for each sample interval are presented on the logs of borings. Bulk samples of typical soil types were also obtained. The boring location is shown on Figure No. 1, *Site Location map*.

It should be noted that the exact depths at which material changes occur cannot always be established accurately. Changes in material conditions that occur between driven samples are indicated in the logs at the top of the next drive sample. A key to soil symbols and terms is presented as Drawing No. A-1, *Soil Classification Chart*. The log of the exploratory borings is presented in Drawing Nos. A-2 through A-6, *Log of Borings*.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

STANDARD PENETRATION TEST
Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method

DRIVE SAMPLE 2.42" I.D. sampler.

DRIVE SAMPLE No recovery

BULK SAMPLE

GRAB SAMPLE

GROUNDWATER WHILE DRILLING

GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS

TEST TYPE		STRENGTH	
(Results shown in Appendix B)		Pocket Penetrometer	p
		Direct Shear	ds
		Direct Shear (single point)	ds*
CLASSIFICATION		Unconfined Compression	uc
		Triaxial Compression	tx
Plasticity	pi	Vane Shear	vs
Grain Size Analysis	ma		
Passing No. 200 Sieve	wa	Consolidation	c
Sand Equivalent	se	Collapse Test	col
Expansion Index	ei	Resistance (R) Value	r
Compaction Curve	max	Chemical Analysis	ca
Hydrometer	h	Electrical Resistivity	er

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

Project Name	Project No.	Figure No.
PROPOSED LOT M IMPROVEMENT MT. SAN ANTONIO COLLEGE WALNUT, CALIFORNIA	14-31-124-04	A-1

Log of Boring No. PT-1

Dates Drilled: 5/4/2018 Logged by: RAM Checked By: SKS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 715 Depth to Water (ft): 19

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
0		**FILL (Af):** **SANDY CLAY (CL):** with gravels, dark brown to black.		X				
5		**ALLUVIUM (Qal):** **SILTY SAND (SM):** with gravel, few clay, brown.	X		7/7/7	7	107	wa (fc=30%)
10		**CLAY (CL):** with gravel, dark brown.	X		3/6/9			
15			X		8/9/17	16	103	
19			X		2/4/4			
20		End of boring at 20 feet. Groundwater encountered at 19 feet. Percolation test was performed. Borehole was backfilled with soil cuttings and tamped on 5-4-18.						

Converse Consultants

Project Name
PROPOSED LOT M IMPROVEMENT
MT. SAN ANTONIO COLLEGE
WALNUT, CALIFORNIA

Project No. 14-31-124-04

Figure No. A-2

Log of Boring No. PT-2

Dates Drilled: 5/4/2018 Logged by: RAM Checked By: SKS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 731 Depth to Water (ft): 29

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
0		**FILL (Af):** **SILTY SAND (SM):** brown.		X				
5			X		13/27/33	10	112	
8		**ALLUVIUM (Qal):** **CLAY (CL):** with gravels, brown to black.						
10			X		13/17/18	17	96	
15			X		13/19/21	16	98	wa (fc=70%)
20		-light brown	X		4/7/11			
25			X		10/20/26	23	101	wa (fc=84%)
28			X		4/6/9			
30		End of boring at 30 feet. Groundwater encountered at 29 feet. Percolation test was performed. Borehole was backfilled with soil cuttings and tamped on 5-4-18.						

Converse Consultants

Project Name
PROPOSED LOT M IMPROVEMENT
MT. SAN ANTONIO COLLEGE
WALNUT, CALIFORNIA

Project No. 14-31-124-04

Figure No. A-3

Log of Boring No. PT-3

Dates Drilled: 5/4/2018 | Logged by: RAM | Checked By: SKS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 730 | Depth to Water (ft): 25

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
0–5		**FILL (Af):** **SILTY SAND (SM):** with gravels, brown.		X				
5		**ALLUVIUM (Qal):** **CLAY (CL):** with gravel, brown.	X		7/11/16	32	86	
10		brown to black	X		8/11/21	25	94	wa (fc=89%)
15								
20		-moist, black	X		7/9/13	30	90	wa (fc=93%)
25			X		4/5/7	37	86	

End of boring at 26.5 feet.
Groundwater encountered at 25 feet.
Percolation test was performed.
Borehole was backfilled with soil cuttings and tamped on 5-4-18.

Converse Consultants

Project Name
PROPOSED LOT M IMPROVEMENT
MT. SAN ANTONIO COLLEGE
WALNUT, CALIFORNIA

Project No. 14-31-124-04

Figure No. A-4

Log of Boring No. PT-4

Dates Drilled: 5/4/2018 | Logged by: RAM | Checked By: SKS

Equipment: 8" HOLLOW STEM AUGER | Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 728 | Depth to Water (ft): 23

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		4" ASPHALT OVER 6" BASE						
		FILL (Af): **SILTY SAND (SM):** with gravels, brown.		X				
5			X		11/13/14	11	107	wa (fc=27%)
		ALLUVIUM (Qal): **CLAY (CL):** with gravels.						
10								
15		**SAND SILT (ML):** with gravels, few clay, reddish brown.	X		6/9/10	17	103	wa (fc=76%)
20								
		End of boring at 23 feet. Groundwater encountered at 23 feet. Percolation test was performed. Borehole was backfilled with soil cuttings and tamped and patched with cold asphalt on 5-4-18.						

Log of Boring No. PT-5

Dates Drilled: 5/4/2018 Logged by: RAM Checked By: SKS

Equipment: 8" HOLLOW STEM AUGER Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): 726 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES: DRIVE	SAMPLES: BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		4" ASPHALT OVER 2" BASE						
		FILL (Af): **SILTY SAND (SM):** with gravel, reddish brown.		X				
5		**ALLUVIUM (Qal):** **SILTY SAND (SM):** with gravel, reddish brown.	X		6/13/15	15	108	
10		**SANDY SILT (ML):** with gravel, brown.	X		7/11/13	27	93	wa (fc=55%)
15		**SILTY SAND (SM):** with graels, brown.						
20		**SANDY CLAY (CL):** reddish brown.	X		11/18/7	27	93	
		End of boring at 21.5 feet. Groundwater not encountered Percolation test was performed. Borehole was backfilled with soil cuttings and tamped and patched with cold asphalt on 5-4-18.						

Converse Consultants

Project Name
PROPOSED LOT M IMPROVEMENT
MT. SAN ANTONIO COLLEGE
WALNUT, CALIFORNIA

Project No. 14-31-124-04

Figure No. A-6

Appendix B

Laboratory Testing Program

APPENDIX B: LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. Test results are presented herein and on the Logs of Borings in Appendix A, *Field Exploration*. The following is a summary of the laboratory tests conducted for this project.

Moisture Content and Dry Density

Results of moisture content and dry density tests performed on relatively undisturbed ring samples were used to aid in the classification of the soils and to provide quantitative measure of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, *Field Exploration*.

Percent Finer than Sieve No. 200

The percent finer than sieve No. 200 tests were performed on eight (8) representative soil samples to aid in the classification of the on-site soils and to estimate other engineering parameters. Testing was performed in general accordance with the ASTM Standard D1140 test method. Test results are presented in the Logs of Borings in Appendix A, *Field Exploration*.

Table No. B-1, Percent Passing Sieve No. 200 Results

Boring No.	Depth (feet)	Soil Classification	Percent Passing Sieve No. 200
PT-1	5	Silty Sand (SM)	30%
PT -2	15	Clay (CL)	70%
PT -2	25	Clay (CL)	84%
PT -3	10	Clay (CL)	89%
PT -3	20	Clay (CL)	93%
PT -4	5	Silty Sand (SM)	27%
PT -4	15	Sandy Silt (ML)	76%
PT -5	10	Sandy Silt (ML)	55%

Appendix C

Percolation Testing

APPENDIX C: PERCOLATION TESTING

Percolation testing was performed utilizing exploratory borings PT-1 to PT-5 on May 4th, 2018. The continuous pre-soak falling-head test method for water percolation testing was utilized to evaluate soil infiltration rates of the native soils encountered between depths of 0 to 27 feet below the ground surface at the respective boring locations in accordance with Los Angeles County (2017), Administrative Manual--Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration. The test location was prepared by placing a perforated 2-inch diameter PVC pipe surrounded by pea gravel after drilling and sampling. Water was filled to the ground surface to pre-soak prior to testing.

The borings were cased using a two-inch diameter perforated casing. Water was added to the bore hole until the water level was as near the ground surface as could be achieved and allowed to pre-soak for at least 4 hours if the water did not drain entirely within 30 minutes after filling the boring two (2) consecutive times. After pre-soak, water was added to the bore hole until the water level was as near the ground surface as could be achieved. The water level was measured to the nearest 1/8-inch. There were at least three (3) sets of measurements taken for each test and each set consisted of at least three (3) measurements. The results of the percolation tests are tabulated in the tables below:

Table No. C-1, Soil Boring Percolation Test Results

Boring No.	Depth of Test (feet)	Top Soil Types (USCS)	Average Percolation Rate (inches/hour)	Lowest Percolation Rate (inches/hour)
PT-1*	17	Silty Sand (SM) / Sandy Clay (CL)	1.81	0.98
PT-2*	27	Silty Sand (SM) / Clay (CL)	1.20	0.72
PT-3*	25	Silty Sand (SM) / Clay (CL)	0.54	0.18
PT-4*	20	Silty Sand (SM) / Clay (CL) / Sandy Silt (ML)	0.41	0.26
PT-5*	21	Silty Sand (SM) / Sandy Silt (ML) / Sandy Clay (CL)	0.57	0.3

*Percolation rate was obtained from an 8-inch diameter bore hole to a depth which shows in the next column (Depth of Test). The percolation rate may change with different well dimensions. The adjustment to the provided percolation rate to a well with different dimensions should be determined by the well designer.

In accordance with County of Los Angeles requirements, the minimum percolation rate for design of infiltration systems for storm water management is 0.3 inches per hour. It should be noted that per Los Angeles County Low Impact Development, Best Management Practices Guidelines, any planned infiltration systems should be at least 10 feet above historically highest groundwater levels. The historic ground water level at the project site is 25 feet below ground level according to the seismic hazard zone report for the San Dimas Quadrangle by the Department of Conservation. The project Civil Engineer shall review the percolation rates presented for design of the proposed infiltration system. Additional details about drywell design and requirements can be found in the Low Impact Development Manual, County of Los Angeles Department of Public Works, latest edition. The infiltration system should be properly maintained periodically to minimize sedimentation in the infiltration system.

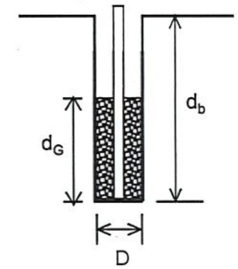
Table No. C-2, Infiltration Facility Setback Requirements per Los Angeles County

Setback from	Distance
Property lines and public right of way	5 feet
Any foundation	15 feet or within 1:1 plane drawn up from the bottom of foundation, whichever greater
Face of any slope	H/2, 5 feet minimum (H is height of slope)
Water wells used for drinking water	100 feet
Historically highest groundwater levels	10 feet above

Percolation Testing

Job Name: ACE, Mt San Antonio College
Job No.: 14-31-124-04
Location: South Side of ACE area
Test Date: May 4, 2018

Test Boring No **PT-1**
Depth of Boring (d_b): 17.0 feet
Diameter of Boring (D): 0.67 feet
Test Performer: CQ



Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
Initial Time	Final Time	Time Interval	Initial depth to water	Final depth to water	Initial Height of water column	Final Height of water column	Drop in Height	Average height of water column	Pre-adjusted Percolation Rate	Reduction Factor	Adjusted Percolation Rate
T_i	T_f	ΔT	d_1	d_2	d_i	d_f	$\Delta d = d_i - d_f$	L_{ave}	$k_i = \Delta d / \Delta T$	R_f	$k = k_i / R_f$
		(hr)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(inch/hr)		(inch/hr)
Percolation Test											
11:00:00 AM	11:30:00 AM	0.50	0.00	3.08	17.00	13.92	3.08	15.46	73.92	47.1	1.57
11:30:00 AM	12:00:00 PM	0.50	3.08	6.33	13.92	10.67	3.25	12.30	78.00	37.7	2.07
12:00:00 PM	12:30:00 PM	0.50	6.33	9.25	10.67	7.75	2.92	9.21	70.08	28.5	2.46
12:30:00 PM	1:00:00 PM	0.50	0.00	2.08	17.00	14.92	2.08	15.96	49.92	48.6	1.03
1:00:00 PM	1:30:00 PM	0.50	2.08	6.00	14.92	11.00	3.92	12.96	94.08	39.7	2.37
1:30:00 PM	2:00:00 PM	0.50	6.00	8.60	11.00	8.40	2.60	9.70	62.40	30.0	2.08
2:00:00 PM	2:30:00 PM	0.50	0.00	2.00	17.00	15.00	2.00	16.00	48.00	48.8	0.98
2:30:00 PM	3:00:00 PM	0.50	2.00	6.42	15.00	10.58	4.42	12.79	106.08	39.2	2.71
3:00:00 PM	3:30:00 PM	0.50	6.42	7.75	10.58	9.25	1.33	9.92	31.92	30.6	1.04

Note: Reduction Factor, $R_f = (2*d_i - \Delta d)/D + 1$

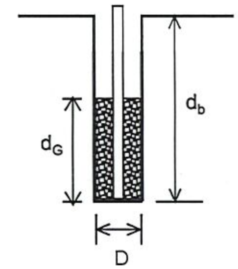
Lowest Perlcolaton Rate = **0.98** **inch/hr**
Average Percolation Rate = **1.81** **inch/hr**

Reference: Los Angeles County (2017). Administrative Manual - Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration , 6/30/17.

Percolation Testing

Job Name: ACE, Mt San Antonio College
Job No.: 14-31-124-04
Location: ACE Subarea B
Test Date: May 4, 2018

Test Boring No **PT-2**
Depth of Boring (d_b): 27.0 feet
Diameter of Boring (D): 0.67 feet
Test Performer: CQ



Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
Initial Time	Final Time	Time Interval	Initial depth to water	Final depth to water	Initial Height of water column	Final Height of water column	Drop in Height	Average height of water column	Pre-adjusted Percolation Rate	Reduction Factor	Adjusted Percolation Rate
T_i	T_f	ΔT	d_1	d_2	d_i	d_f	$\Delta d = d_i - d_f$	L_{ave}	$k_i = \Delta d / \Delta T$	R_f	$k = k_i / R_f$
		(hr)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(inch/hr)		(inch/hr)
Percolation Test											
11:00:00 AM	11:30:00 AM	0.50	0.00	3.67	27.00	23.33	3.67	25.17	88.08	76.1	1.16
11:30:00 AM	12:00:00 PM	0.50	3.67	8.34	23.33	18.66	4.67	21.00	112.08	63.7	1.76
12:00:00 PM	12:30:00 PM	0.50	8.34	10.67	18.66	16.33	2.33	17.50	55.92	53.2	1.05
12:30:00 PM	1:00:00 PM	0.50	0.00	4.00	27.00	23.00	4.00	25.00	96.00	75.6	1.27
1:00:00 PM	1:30:00 PM	0.50	4.00	7.50	23.00	19.50	3.50	21.25	84.00	64.4	1.30
1:30:00 PM	2:00:00 PM	0.50	7.50	9.40	19.50	17.60	1.90	18.55	45.60	56.4	0.81
2:00:00 PM	2:30:00 PM	0.50	0.00	3.25	27.00	23.75	3.25	25.38	78.00	76.7	1.02
2:30:00 PM	3:00:00 PM	0.50	3.25	7.92	23.75	19.08	4.67	21.42	112.08	64.9	1.73
3:00:00 PM	3:30:00 PM	0.50	7.92	9.58	19.08	17.42	1.66	18.25	39.84	55.5	0.72

Note: Reduction Factor, $R_f = (2*d_i - \Delta d)/D + 1$

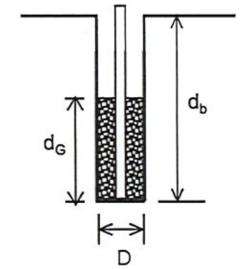
Lowest Perlcolaton Rate = 0.72 inch/hr
Average Percolation Rate = 1.20 inch/hr

Reference: Los Angeles County (2017). Administrative Manual - Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration , 6/30/17.

Percolation Testing

Job Name: ACE, Mt San Antonio College
Job No.: 14-31-124-04
Location: ACE Subarea C along the service road
Test Date: May 4, 2018

Test Boring No **PT-3**
Depth of Boring (d_b): 25.0 feet
Diameter of Boring (D): 0.67 feet
Test Performer: JC



Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
Initial Time	Final Time	Time Interval	Initial depth to water	Final depth to water	Initial Height of water column	Final Height of water column	Drop in Height	Average height of water column	Pre-adjusted Percolation Rate	Reduction Factor	Adjusted Percolation Rate
T_i	T_f	ΔT	d_1	d_2	d_i	d_f	$\Delta d = d_i - d_f$	L_{ave}	$k_i = \Delta d / \Delta T$	R_f	$k = k_i / R_f$
		(hr)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(inch/hr)		(inch/hr)
Percolation Test											
12:30:00 PM	1:00:00 PM	0.50	0.00	2.70	25.00	22.30	2.70	23.65	64.80	71.6	0.91
1:00:00 PM	1:30:00 PM	0.50	2.70	4.30	22.30	20.70	1.60	21.50	38.40	65.2	0.59
1:30:00 PM	2:00:00 PM	0.50	4.30	6.97	20.70	18.03	2.67	19.37	64.08	58.8	1.09
2:00:00 PM	2:30:00 PM	0.50	0.00	1.97	25.00	23.03	1.97	24.02	47.28	72.7	0.65
2:30:00 PM	3:00:00 PM	0.50	1.97	2.90	23.03	22.10	0.93	22.57	22.32	68.4	0.33
3:00:00 PM	3:30:00 PM	0.50	2.90	3.43	22.10	21.57	0.53	21.84	12.72	66.2	0.19
3:30:00 PM	4:00:00 PM	0.50	0.00	1.90	25.00	23.10	1.90	24.05	45.60	72.8	0.63
4:00:00 PM	4:30:00 PM	0.50	1.90	2.70	23.10	22.30	0.80	22.70	19.20	68.8	0.28
4:30:00 PM	5:00:00 PM	0.50	2.70	3.20	22.30	21.80	0.50	22.05	12.00	66.8	0.18

Note: Reduction Factor, $R_f = (2{*}d_i - \Delta d)/D + 1$

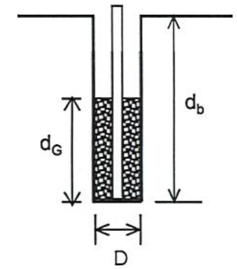
Lowest Perlcolaton Rate = 0.18 inch/hr
Average Percolation Rate = 0.54 inch/hr

Reference: Los Angeles County (2017). Administrative Manual - Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration , 6/30/17.

Percolation Testing

Job Name: ACE, Mt San Antonio College
Job No.: 14-31-124-04
Location: within ACE Subarea A
Test Date: May 4, 2018

Test Boring No **PT-4**
Depth of Boring (d_b): 20.0 feet
Diameter of Boring (D): 0.67 feet
Test Performer: JC



Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
Initial Time	Final Time	Time Interval	Initial depth to water	Final depth to water	Initial Height of water column	Final Height of water column	Drop in Height	Average height of water column	Pre-adjusted Percolation Rate	Reduction Factor	Adjusted Percolation Rate
T_i	T_f	ΔT	d_1	d_2	d_i	d_f	$\Delta d = d_i - d_f$	L_{ave}	$k_i = \Delta d / \Delta T$	R_f	$k = k_i / R_f$
		(hr)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(inch/hr)		(inch/hr)
Percolation Test											
2:00:00 PM	2:30:00 PM	0.50	0.00	1.10	20.00	18.90	1.10	19.45	26.40	59.1	0.45
2:30:00 PM	3:00:00 PM	0.50	1.10	2.00	18.90	18.00	0.90	18.45	21.60	56.1	0.39
3:00:00 PM	3:30:00 PM	0.50	2.00	2.60	18.00	17.40	0.60	17.70	14.40	53.8	0.27
3:30:00 PM	4:00:00 PM	0.50	0.00	1.30	20.00	18.70	1.30	19.35	31.20	58.8	0.53
4:00:00 PM	4:30:00 PM	0.50	1.30	2.10	18.70	17.90	0.80	18.30	19.20	55.6	0.35
4:30:00 PM	5:00:00 PM	0.50	2.10	2.96	17.90	17.04	0.86	17.47	20.64	53.1	0.39
5:00:00 PM	5:30:00 PM	0.50	0.00	1.37	20.00	18.63	1.37	19.32	32.88	58.7	0.56
5:30:00 PM	6:00:00 PM	0.50	1.37	1.98	18.63	18.02	0.61	18.33	14.64	55.7	0.26
6:00:00 PM	6:30:00 PM	0.50	1.98	3.13	18.02	16.87	1.15	17.45	27.60	53.1	0.52

Note: Reduction Factor, $R_f = (2*d_i - \Delta d)/D + 1$

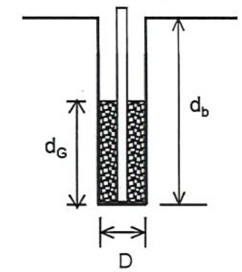
Lowest Perlcolaton Rate = 0.26 inch/hr
Average Percolation Rate = 0.41 inch/hr

Reference: Los Angeles County (2017). Administrative Manual - Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration , 6/30/17.

Percolation Testing

Job Name: ACE, Mt San Antonio College
Job No.: 14-31-124-04
Location: Next to ACE subarea D along the service road
Test Date: May 4, 2018

Test Boring No **PT-5**
Depth of Boring (d_b): 21.0 feet
Diameter of Boring (D): 0.67 feet
Test Performer: PA



Time of Testing			Water Level Measurement		Water Level Calculations				Percolation Rate Calculations		
Initial Time	Final Time	Time Interval	Initial depth to water	Final depth to water	Initial Height of water column	Final Height of water column	Drop in Height	Average height of water column	Pre-adjusted Percolation Rate	Reduction Factor	Adjusted Percolation Rate
T_i	T_f	ΔT	d_1	d_2	d_i	d_f	$\Delta d = d_i - d_f$	L_{ave}	$k_i = \Delta d / \Delta T$	R_f	$k = k_i / R_f$
		(hr)	(feet)	(feet)	(feet)	(feet)	(feet)	(feet)	(inch/hr)		(inch/hr)
Percolation Test											
5:00:00 PM	5:10:00 PM	0.17	0.00	0.75	21.00	20.25	0.75	20.63	54.00	62.6	0.86
5:10:00 PM	5:20:00 PM	0.17	0.75	1.30	20.25	19.70	0.55	19.98	39.60	60.6	0.65
5:20:00 PM	5:30:00 PM	0.17	1.30	1.72	19.70	19.28	0.42	19.49	30.24	59.2	0.51
5:30:00 PM	5:40:00 PM	0.17	0.00	0.68	21.00	20.32	0.68	20.66	48.96	62.7	0.78
5:40:00 PM	5:50:00 PM	0.17	0.68	1.16	20.32	19.84	0.48	20.08	34.56	60.9	0.57
5:50:00 PM	6:00:00 PM	0.17	1.15	1.40	19.85	19.60	0.25	19.73	18.00	59.9	0.30
6:00:00 PM	6:10:00 PM	0.17	0.00	0.60	21.00	20.40	0.60	20.70	43.20	62.8	0.69
6:10:00 PM	6:20:00 PM	0.17	0.60	0.95	20.40	20.05	0.35	20.23	25.20	61.4	0.41
6:20:00 PM	6:30:00 PM	0.17	0.95	1.25	20.05	19.75	0.30	19.90	21.60	60.4	0.36

Note: Reduction Factor, $R_f = (2*d_i - \Delta d)/D + 1$

Lowest Perlcolaton Rate = 0.30 inch/hr
Average Percolation Rate = 0.57 inch/hr

Reference: Los Angeles County (2017). Administrative Manual - Guidelines for Design, Investigation, and Reporting Low Impact Development Storm Water Infiltration , 6/30/17.

Appendix H: LID Treatment Stormwater Quality Control Sizing Calculation and Information

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	TERENCE ZHAO 626-425-2874 TERENCE.ZHAO@ADS-PIPE.COM
ADS SALES REP:	ARNE ERIKSEN (951)-796-2048 ARNE.ERIKSEN@ADS-PIPE.COM
PROJECT NO:	S096323

ADVANCED DRAINAGE SYSTEMS, INC.

MT SAC ATHLETIC COMPLEX

WALNUT, CA

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE MADE FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
5. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS.
   STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

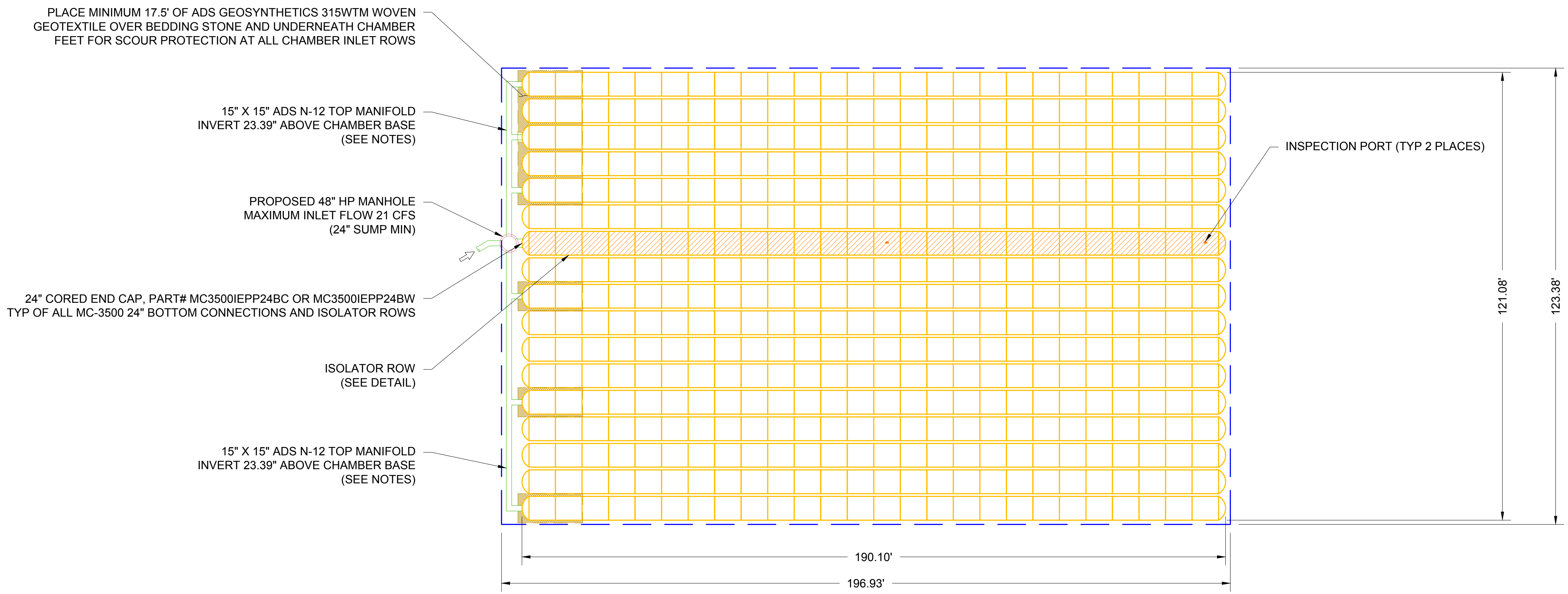
442	STORMTECH MC-3500 CHAMBERS
34	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	% STONE VOID
82,920	**INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED)**
24,298	SYSTEM AREA (ft²)
641	SYSTEM PERIMETER (ft)

PROPOSED ELEVATIONS

715.08	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED)
709.58	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC)
709.08	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC)
709.08	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT)
709.08	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT)
708.08	TOP OF STONE
707.08	TOP OF MC-3500 CHAMBER
705.28	15" TOP MANIFOLD INVERT
703.50	24" ISOLATOR ROW CONNECTION INVERT
703.33	BOTTOM OF MC-3500 CHAMBER
702.58	BOTTOM OF STONE

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- THE SITE DESIGN ENGINEER MUST REVIEW THE PROXIMITY OF THE CHAMBERS TO THE SLOPE AND CONSIDER EFFECTS OF POSSIBLE SATURATED SOILS ON THE SLOPE'S INTEGRITY.



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WALNUT, CA

DATE: 8-13-18 DRAWN: HB
PROJECT #: S096323 CHECKED: JPR

DATE	DRWN	CHKD	DESCRIPTION
8/22/18	NBR	DAF	LARGER VOLUME

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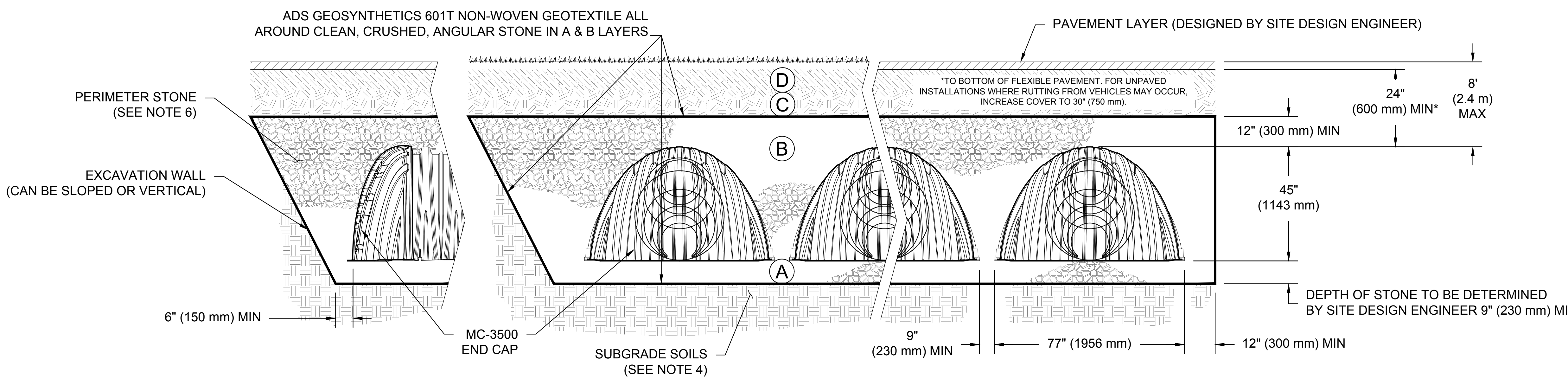
0 30' 60'

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

1. MC-3500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
5. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.

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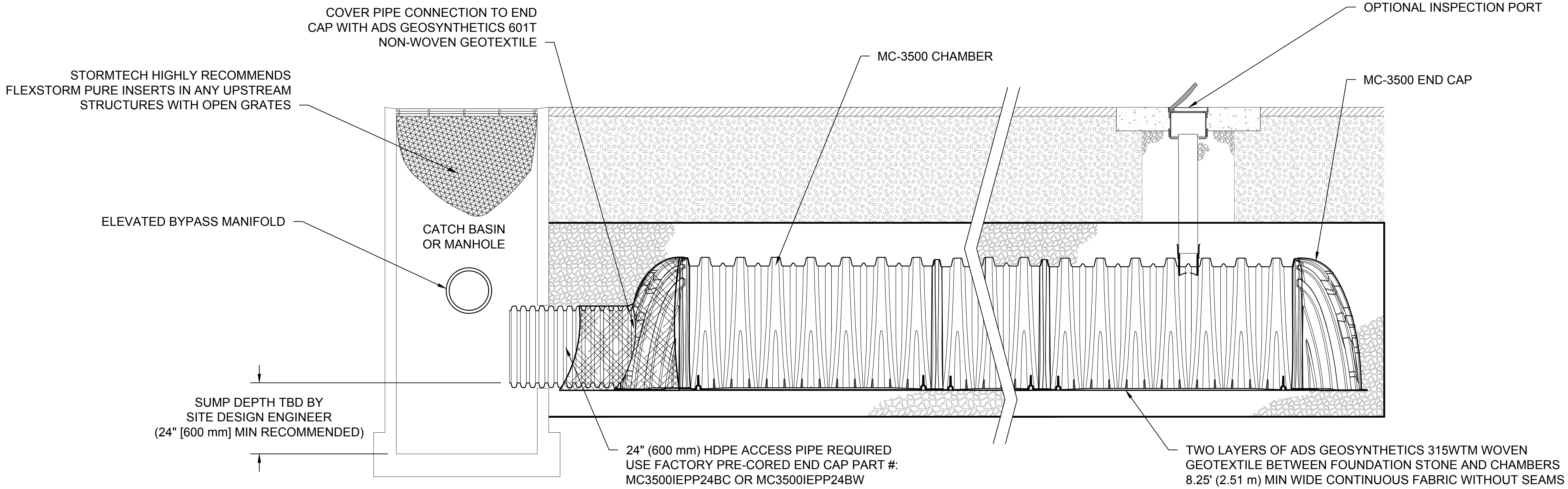


MC-3500 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

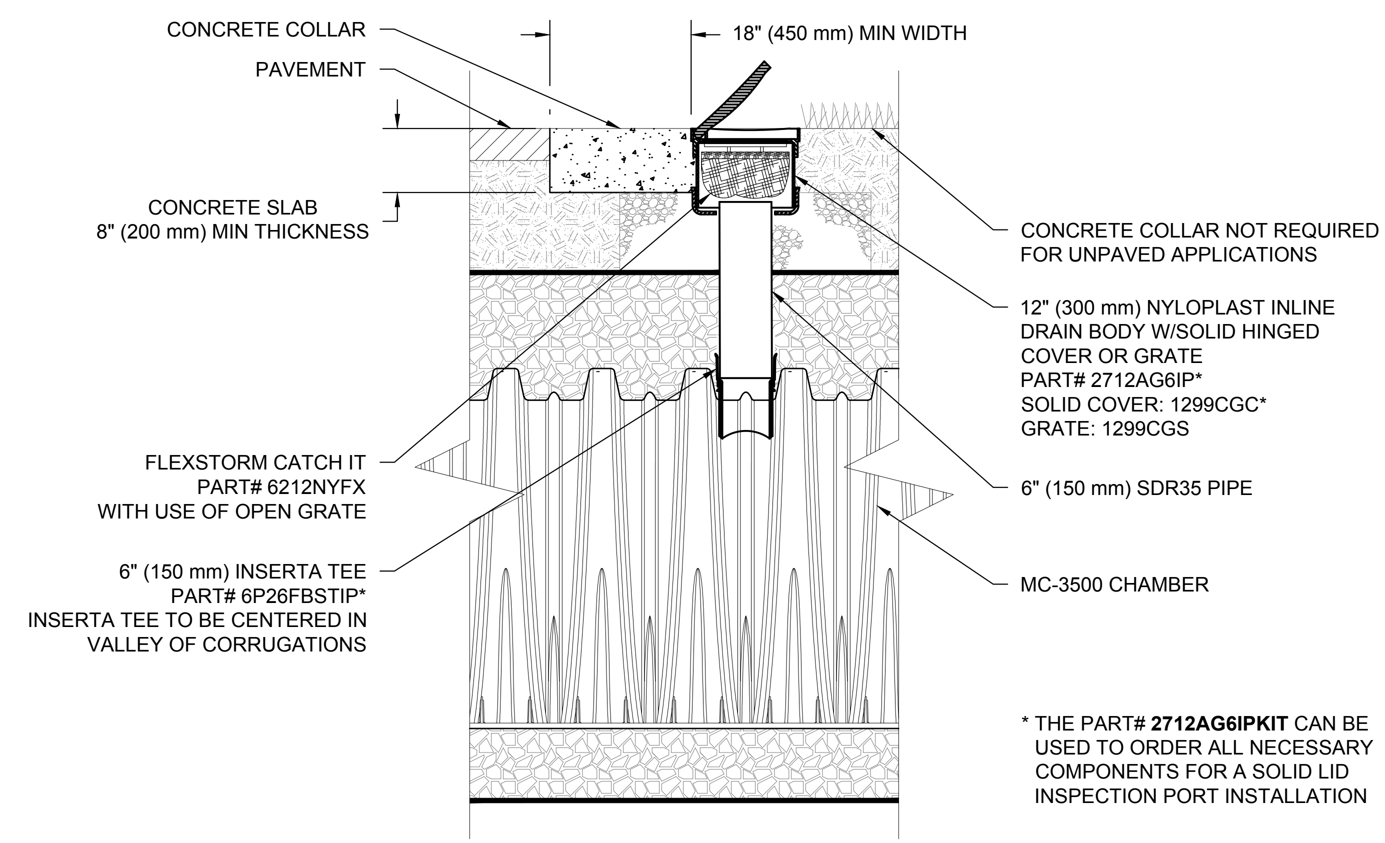
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

MC-3500 6" INSPECTION PORT DETAIL

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SHEET 4 OF 6

MC-3500 TECHNICAL SPECIFICATION

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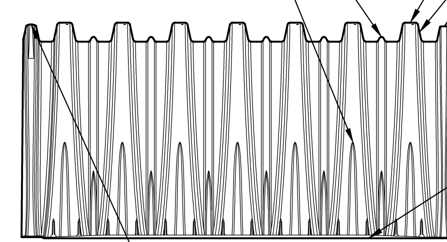
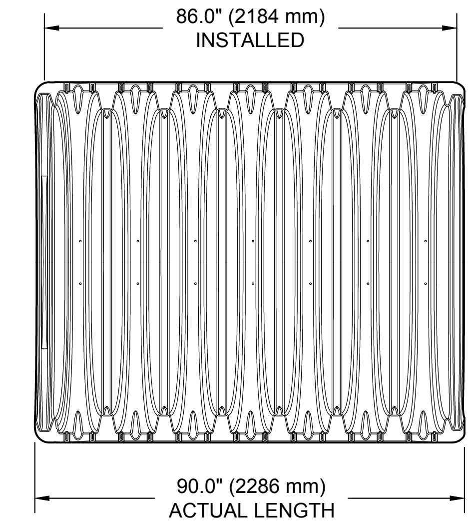
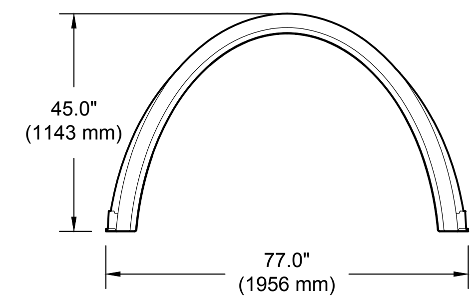
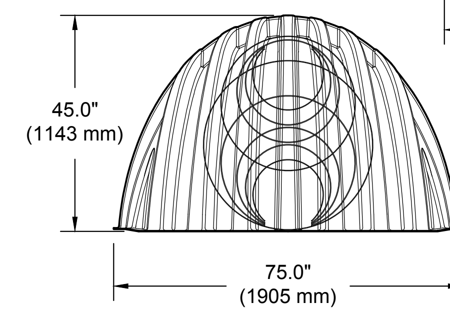
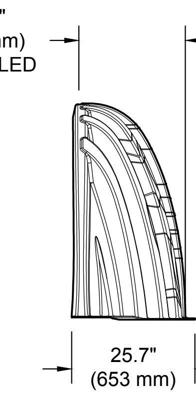










NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	178.9 CUBIC FEET	(5.06 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

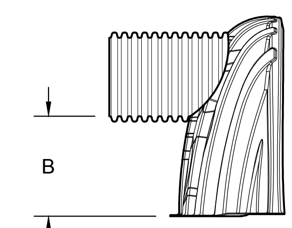
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	46.0 CUBIC FEET	(1.30 m³)
WEIGHT	49 lbs.	(22.2 kg)

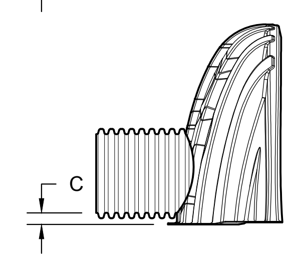
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL

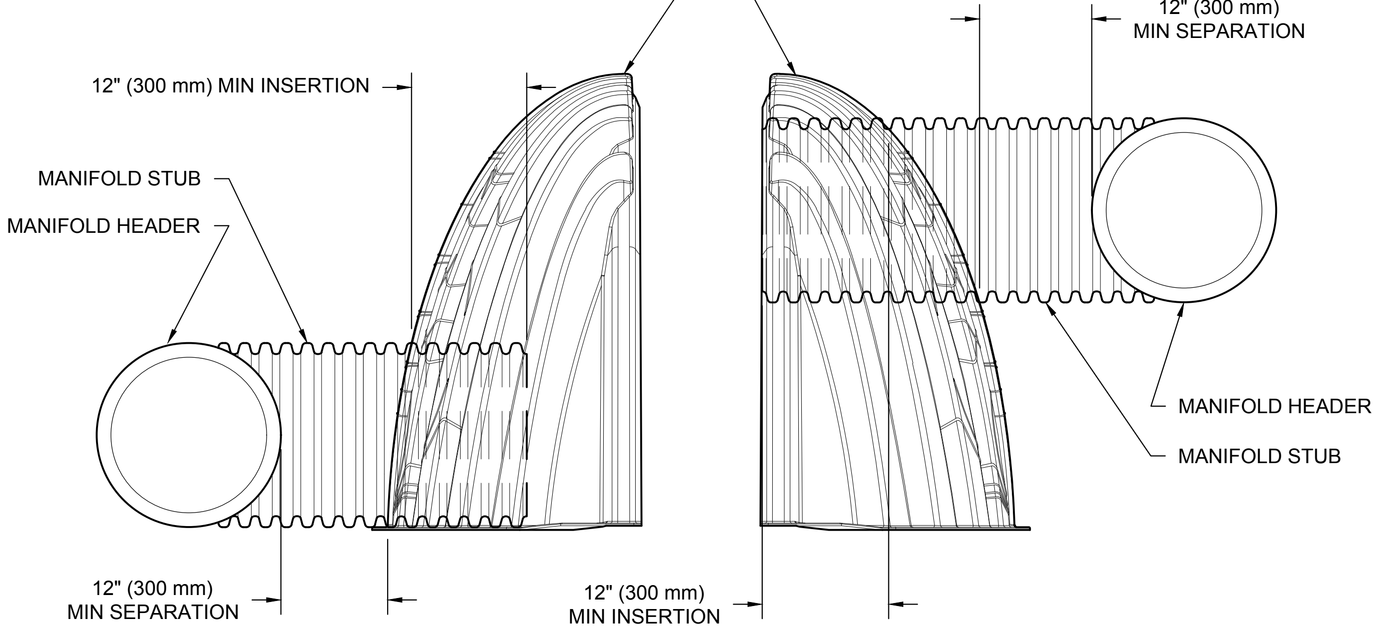




CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

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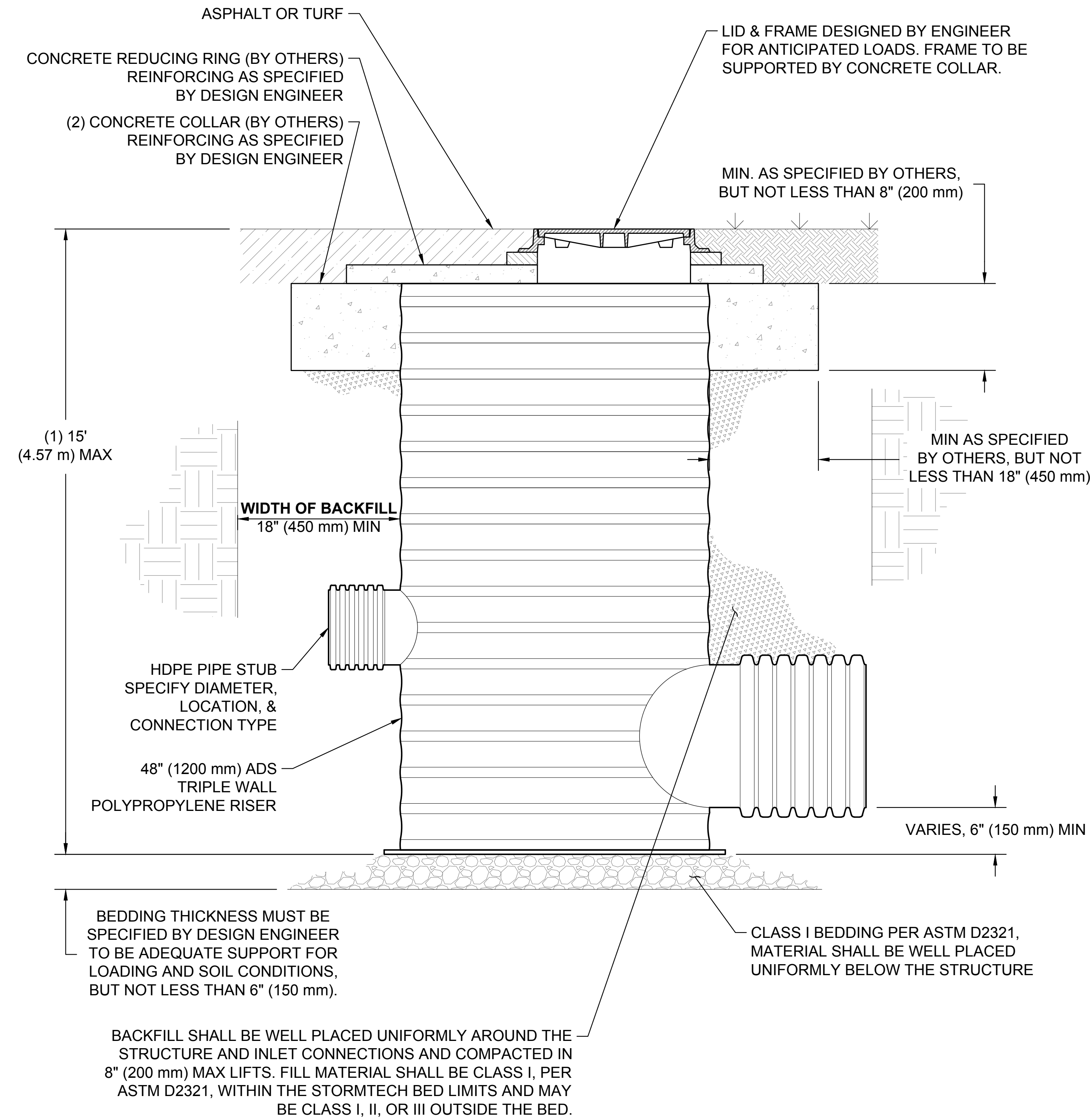
HP MANHOLE INSTALLATION FOR STORMTECH SYSTEMS

NTS

NOTES:
1. FOR BURIAL DEPTHS GREATER THAN 15' (4.57 m), OR WHERE GROUND WATER WILL BE ENCOUNTERED, CONTACT ADS ENGINEERING SERVICES.
2. AVOID CONSTRUCTION LOADING ON STRUCTURE PRIOR TO CONCRETE COLLAR INSTALLATION.



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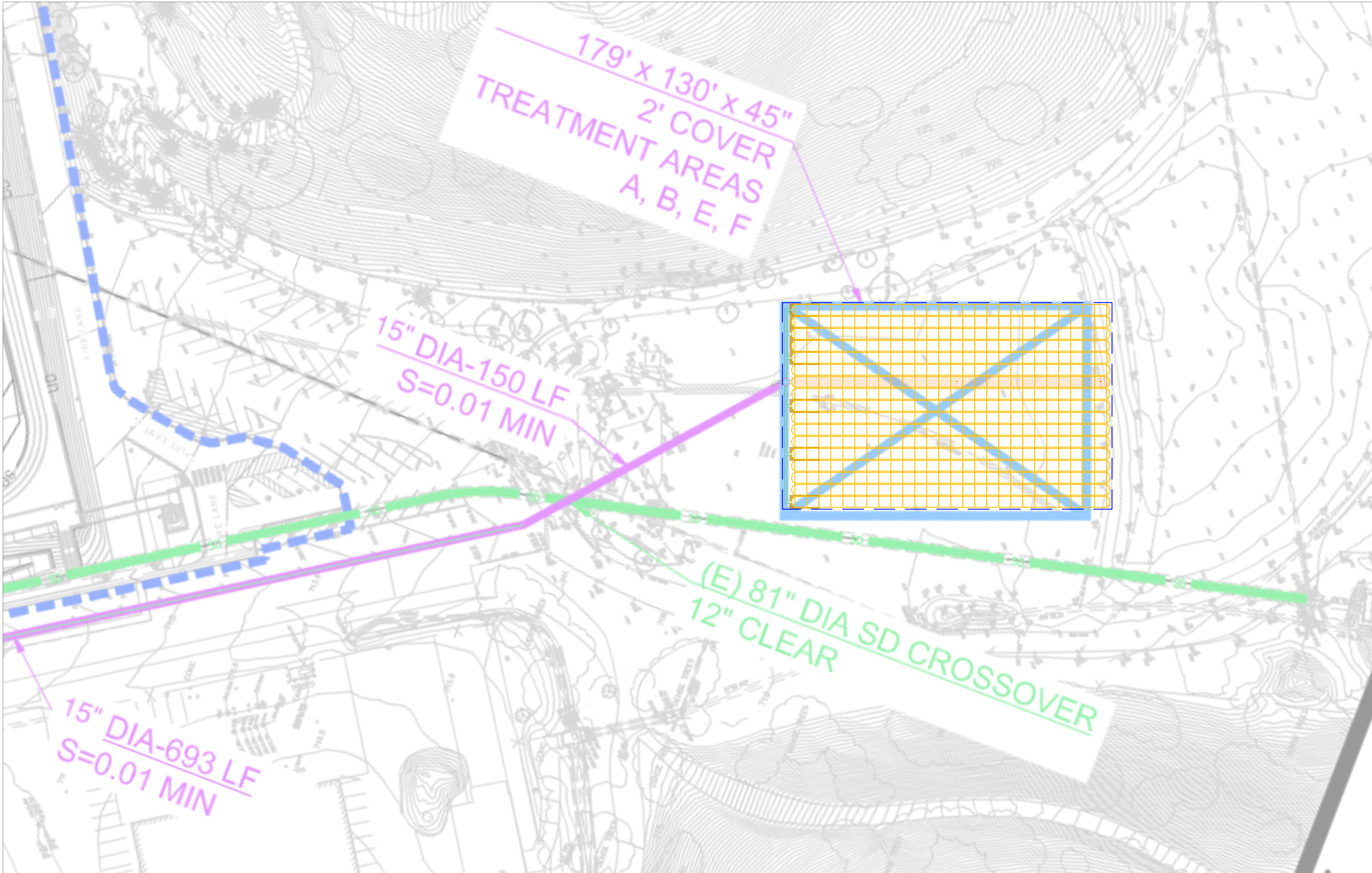
179' x 130' x 45"
2' COVER
TREATMENT AREAS
A, B, E, F
15" DIA-150 LF
S=0.01 MIN
(E) 81" DIA SD CROSSOVER
12" CLEAR
15" DIA-693 LF
S=0.01 MIN

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Isolator® Row O&M Manual

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160LP, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160LP, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

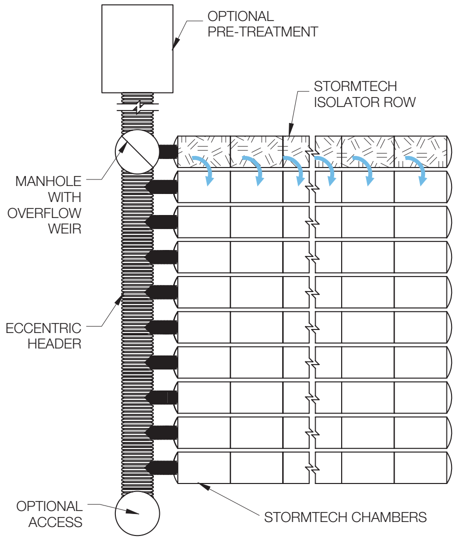
The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

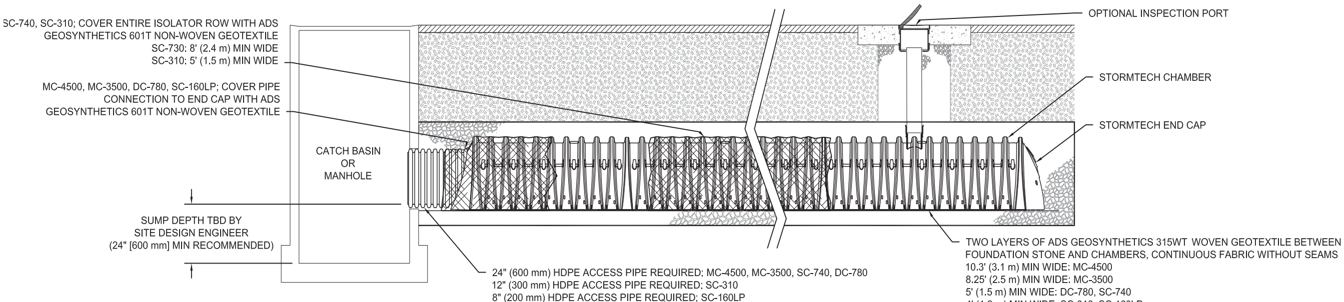
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



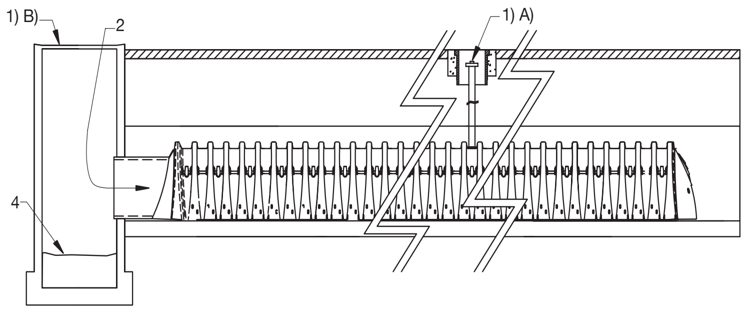
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings: Fixed point to chamber bottom (1)	Stadia Rod Readings: Fixed point to top of sediment (2)	Sediment Depth (1)–(2)	Observations/Actions	Inspector
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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Tech Sheet

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ASTM & AASHTO Standards for Buried Thermoplastic Structures

Tech Sheet # 6
November 2012

Design Requirements for Thermoplastic Structures:

1. **The structural design must evaluate short term live loads, intermediate term loads and long term soil loads.**
2. **The materials used in production must provide necessary short, intermediate and long term properties.**
3. **The structural design must be completed by experts in the field of soil-structure interaction.**
4. **The product must be designed and manufactured to meet meaningful standards.**
5. **The structural design of the subsurface stormwater system must be up to the standards that a professional engineer expects.**

General:
This summarizes key components of structural design and national standards for subsurface thermoplastic structures. Although the focus of this guidance is on chamber systems, the principles apply to the wider category of buried products of various structural shapes and material properties.

Structural Design of a Subsurface Thermoplastic System:
The objective of *structural* design is to ensure a proper safety factor over the intended ***service life*** of the buried system. Typically the intended service life of a subsurface storm drainage system ranges from 20 to 100 years. Since the polypropylene and polyethylene, thermoplastic materials now used for subsurface structures are very stable in the stormwater environment; the limiting criterion for service life is generally long-term structural stability.

The primary benefit of subsurface systems is to facilitate additional paved surfaces for the purpose of parking or traffic flow. For such applications, where public safety is of paramount importance, “structural survival”, i.e. lack of failure, is not sufficient. For a design to be safe, structural ***safety factors*** must be demonstrated for the entire service life of the project to account for uncertainties in loading, installation, and material performance. AASHTO design procedures mandate load factors of 1.75 for live loads to account for impact effects and the presence of multiple or overweight loads and 1.95 for earth loads on buried culverts.

There are two components to ensuring long term performance of any structural product: 1) the product must be designed, tested and manufactured to meet meaningful ***product standards*** and 2) the system must be designed to meet meaningful ***design standards***. ASTM and AASHTO, the most respected, dependable standards available, have developed standards for buried structures.

Short Term Properties, Intermediate Term Properties, Long Term Properties, Strain and Deflection:
Buried thermoplastic products must be designed for three conditions: 1) short duration live loads under shallow cover, 2) minimum 1-week sustained loads and 3) permanent earth loads. ***Load duration*** is a key criterion for the design of thermoplastic structures since the “apparent strength” and stiffness decrease with increasing load duration. For live load design, the thermoplastic product must be able to withstand the dynamic load from moving vehicles. *Live load design is based on short duration loads and short term material properties.* Intermediate load design requires the thermoplastic product to withstand 1-week sustained loads from parked oversized loads. *Intermediate load design is based on 1-week duration loads and 1-week material properties.*

1 AASHTO is the American Association of State Highway and Transportation Officials
2 ASTM / ASTM International is the American Society of Testing Materials

Earth (dead) loads are permanent in duration and magnitude. For dead load design, the thermoplastic product must be able to withstand the continuous dead load and remain stable after 75 years or more under sustained load. For thermoplastic systems using structural aggregate (stone) support, the performance of the structure is a function of the ability of the thermoplastic structure to a shed significant portion of the load to the surrounding stone (arching). *Earth load design is based on permanent loads and long term material properties.* The material properties that govern long-term design are tensile creep rupture and creep modulus.

Strain limits are the maximum strains that can occur before the structure fails. Long, slender shapes are inherently unstable and fail at lower loads by buckling. Wide, flat shapes may also buckle under continuous load. Design for long-term service life must be based on long duration loads, long term creep modulus and strain limits. ***Without proper soil support, thermoplastic structures may reach a strain limit and fail.***

Deflection is generally not a failure limit or a service limit for soil supported chamber systems. When deflection is not limited by soil support, excessive deflection of thermoplastic structures has been found to cause pavement distress. ***Without proper soil support, deflection is a service limit for thermoplastic structures.***

Specifying industry standards, not just products, establishes objective, meaningful performance criteria and a defensible basis of design.

AASHTO Standards:
The AASHTO LRFD Bridge Design Specification is the primary source of design standards for soil-structure interaction under traffic loads. Section 3 of this specification provides for calculation of loads and Section 12.12 provides for structural design of buried thermoplastic structures.
The AASHTO standard:
- **Assures design safety factors for live loads and long-term loads**
- **Provides the design method for soil-structure interaction**
- **Assures a long-term service life by designing for creep and strain limits**
- **Provides consulting engineers with a defensible basis of design**

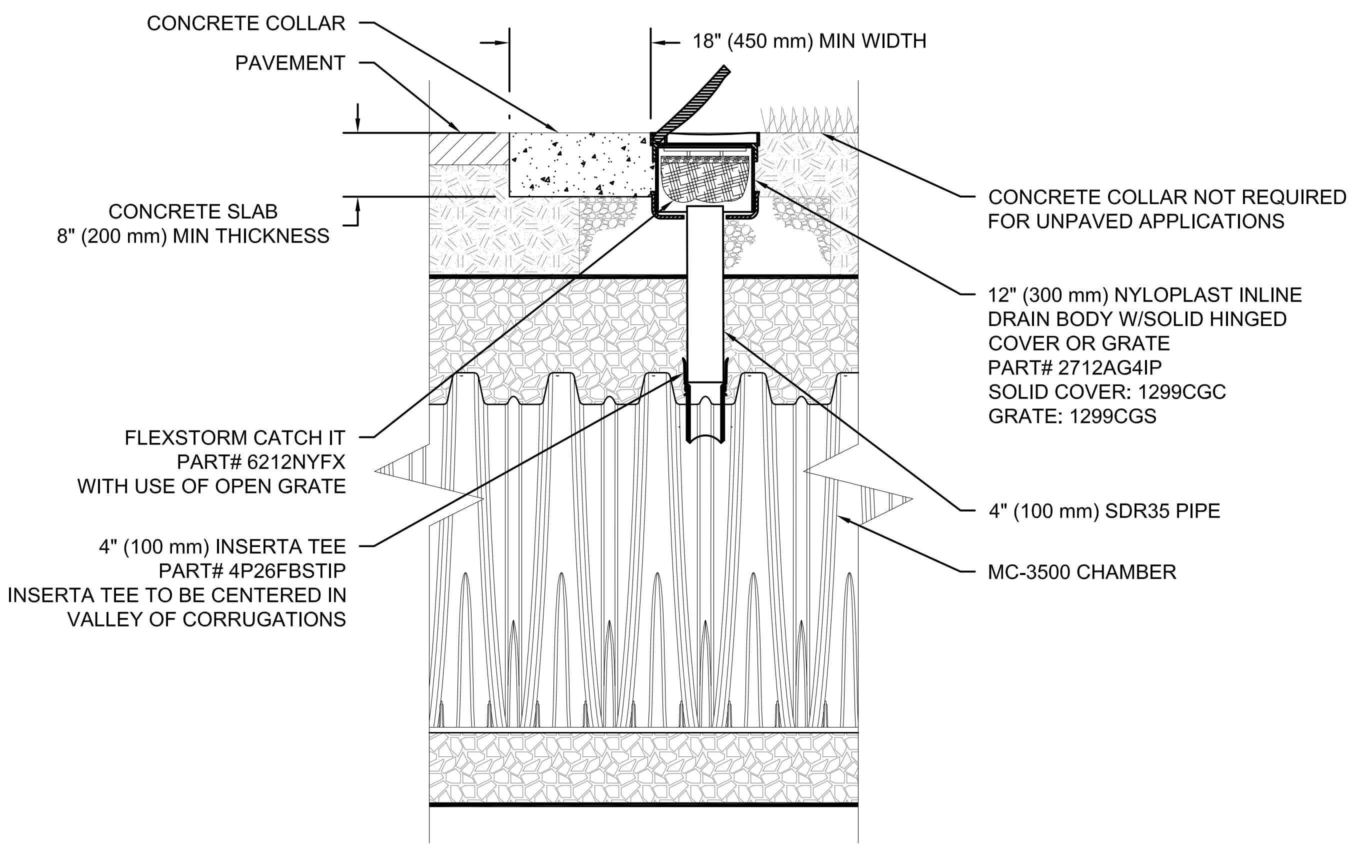
ASTM Standards:
ASTM is an internationally recognized source for a variety of standards including; testing methods, standard practices and product specifications. ASTM has developed two product standards for Stormwater chambers, designations ASTM F2418 (polypropylene chambers) and ASTM F2922 (polyethylene chambers).
The ASTM F 2418 and F2922 Standards:
- **Assure consistent product quality in a non-proprietary specification**
- **Establish physical and mechanical requirements for the finished product**
- **Establish long and short-term material properties for design**
- **Require AASHTO safety factors and full scale validation testing**

ASTM has developed a design standard for Stormwater chambers, designation: ASTM F 2787, entitled “Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers”.
The ASTM F 2787 Standard:
- **Applies the AASHTO Section 12.12 thermoplastic pipe design criteria and applies it directly to chambers**
- **Includes an additional design load for a minimum 1-week sustained vehicle load to account for parked vehicles**
- **Provides design criteria that can be applied to different thermoplastic resins.**

Product Design:
Stone support is a key component of the soil-structure interaction system. Stone columns between thermoplastic components provide the load paths from the load above to the foundation below. For stone-structure designs, the stone reduces the load that the thermoplastic components must carry and limits the deflection and strain of the thermoplastic components. Designs of subsurface thermoplastic structures that purport to require no structural stone or are not designed in accordance with AASHTO requirements may result in excessive deflections or complete failure.

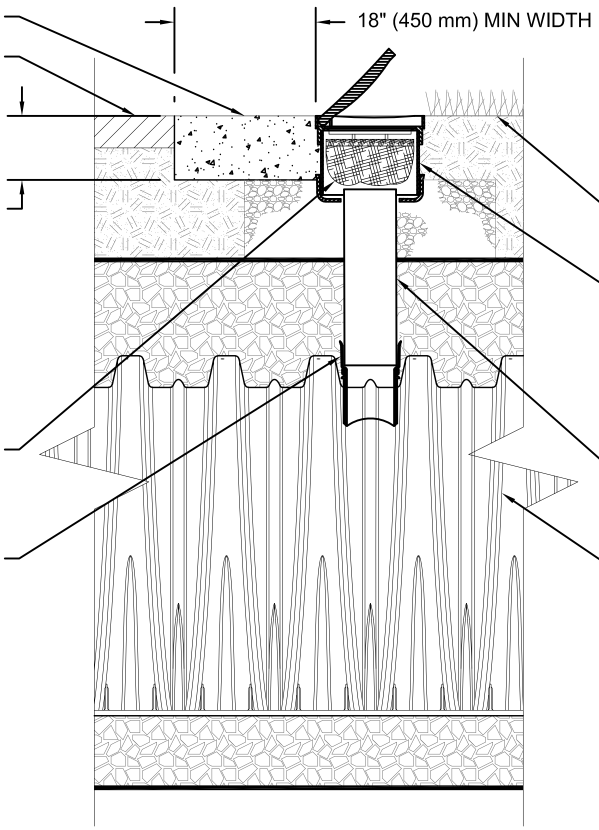
StormTech chambers are designed and rigorously tested in accordance with national standards to provide the most reliable subsurface system available.

ADS “Terms and Conditions of Sale” are available on the ADS website, www.ads-pipe.com
 ST TS6 11/12



MC-3500 4" INSPECTION PORT DETAIL

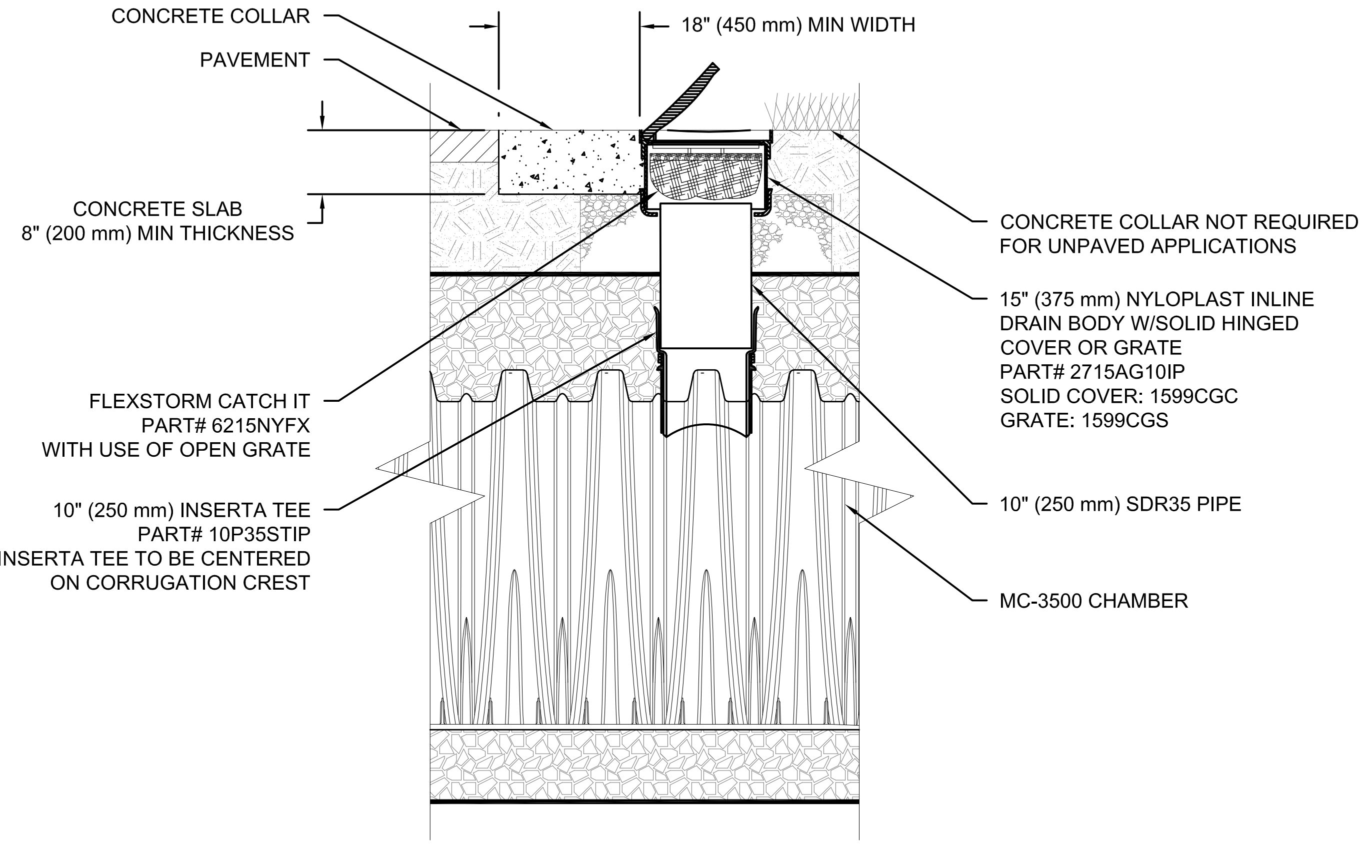
NTS



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

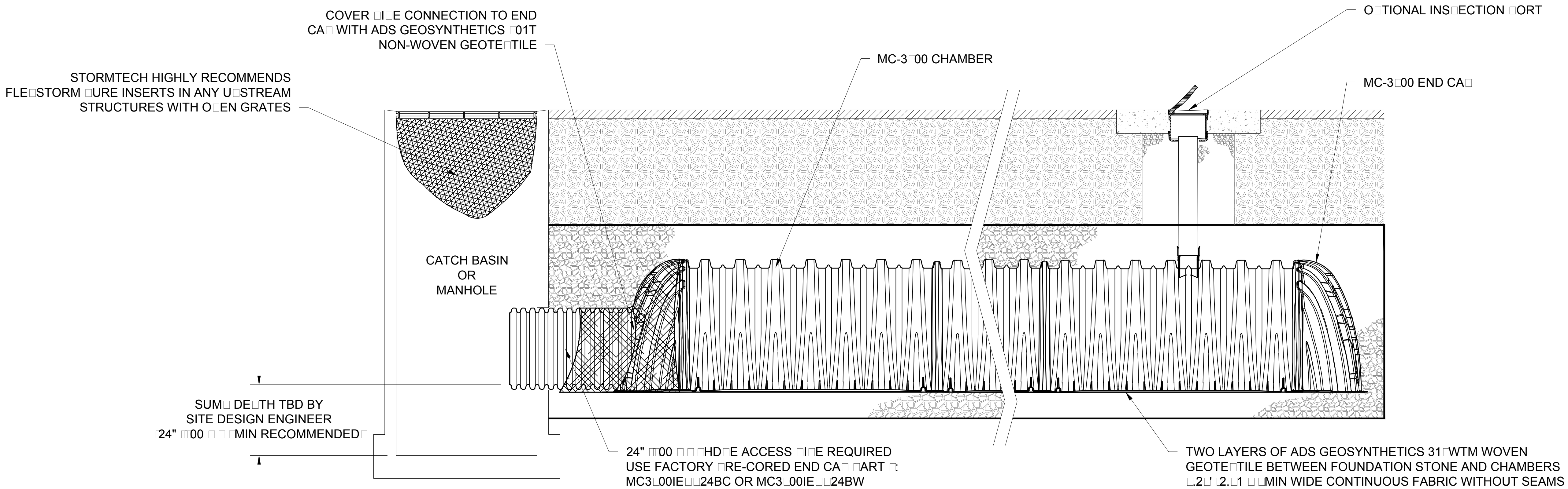
MC-3500 6" INSPECTION PORT DETAIL

NTS



MC-3500 10" INSPECTION PORT DETAIL

NTS



MC-3500 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STE□ 1□ INS□ECT ISOLATOR ROW FOR SEDIMENT

- A. INS□ECTION □ORTS □IF □RESENT□
  - A.1. REMOVE□O□EN LID ON NYLO□LAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLE□STORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DE□TH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INS□ECTION OF SEDIMENT LEVELS □O□TIONAL□
  - A.□. IF SEDIMENT IS AT, OR ABOVE, 3" □□0 □ □ □ □ROCEED TO STE□ 2. IF NOT, □ROCEED TO STE□ 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT U□STREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INS□ECT DOWN THE ISOLATOR ROW THROUGH OUTLET □I□E
    - □□ MIRRORS ON □OLES OR CAMERAS MAY BE USED TO AVOID A CONFINED S□ACE ENTRY
    - □□□ FOLLOW OSHA REGULATIONS FOR CONFINED S□ACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" □□0 □ □ □ □ROCEED TO STE□ 2. IF NOT, □ROCEED TO STE□ 3.

STE□ 2□ CLEAN OUT ISOLATOR ROW USING THE □ETVAC □ROCESS

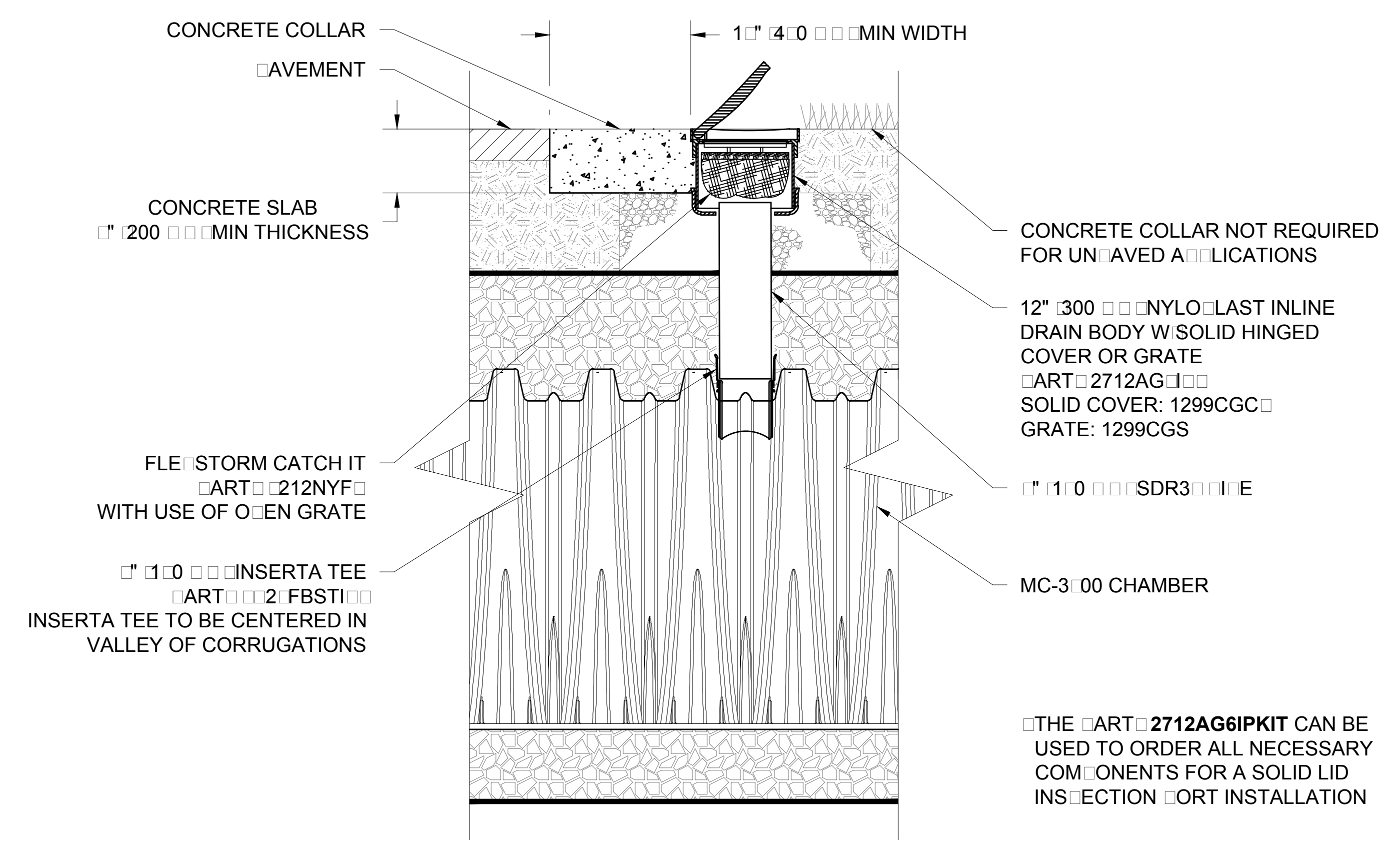
- A. A FI□ED CULVERT CLEANING NOZZLE WITH REAR FACING S□READ OF 4□" □1.1 □ □OR MORE IS □REFERRED
- B. A□□LY MULTI□LE □ASSES OF □ETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUM□ AS REQUIRED

STE□ 3□ RE□LACE ALL COVERS, GRATES, FILTERS, AND LIDS□RECORD OBSERVATIONS AND ACTIONS.

STE□ 4□ INS□ECT AND CLEAN BASINS AND MANHOLES U□STREAM OF THE STORMTECH SYSTEM.

NOTES

1. INS□ECT EVERY □MONTHS DURING THE FIRST YEAR OF O□ERATION. AD□UST THE INS□ECTION INTERVAL BASED ON □REVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT □ETTING AND VACTORING ANNUALLY OR WHEN INS□ECTION SHOWS THAT MAINTENANCE IS NECESSARY.



MC-3500 6" INSPECTION PORT DETAIL

NTS

ISOLATOR ROW DETAILS

MC-3□00

DATE: 03□0□17 DRAWN: □LM

□RO□ECT □: CHECKED:

REV	DWN	CKD	DESCRIPTION
09□13□17	□LM		U□DATE END CA□ □ART NUMBERS

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STORMTECH MC-3500 CHAMBER

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

STORMTECH MC-3500 CHAMBER
(not to scale)

Nominal Chamber Specifications

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

Chamber Storage
109.9 ft^3 (3.11 m^3)

Min. Installed Storage*
178.9 ft^3 (5.06 m^3)

Weight
134 lbs (60.8 kg)

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

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

STORMTECH MC-3500 END CAP
(not to scale)

Nominal End Cap Specifications

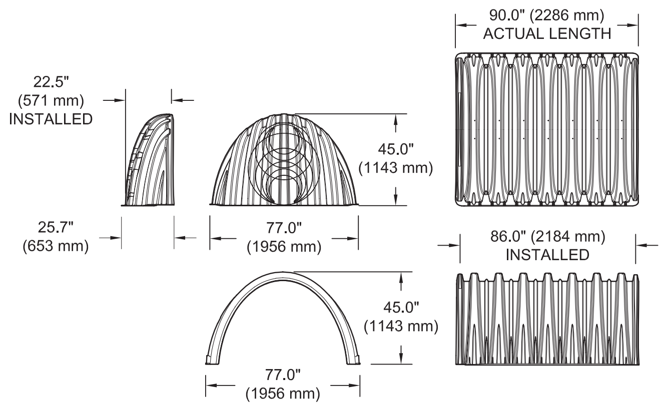
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1,803 mm x 1,145 mm

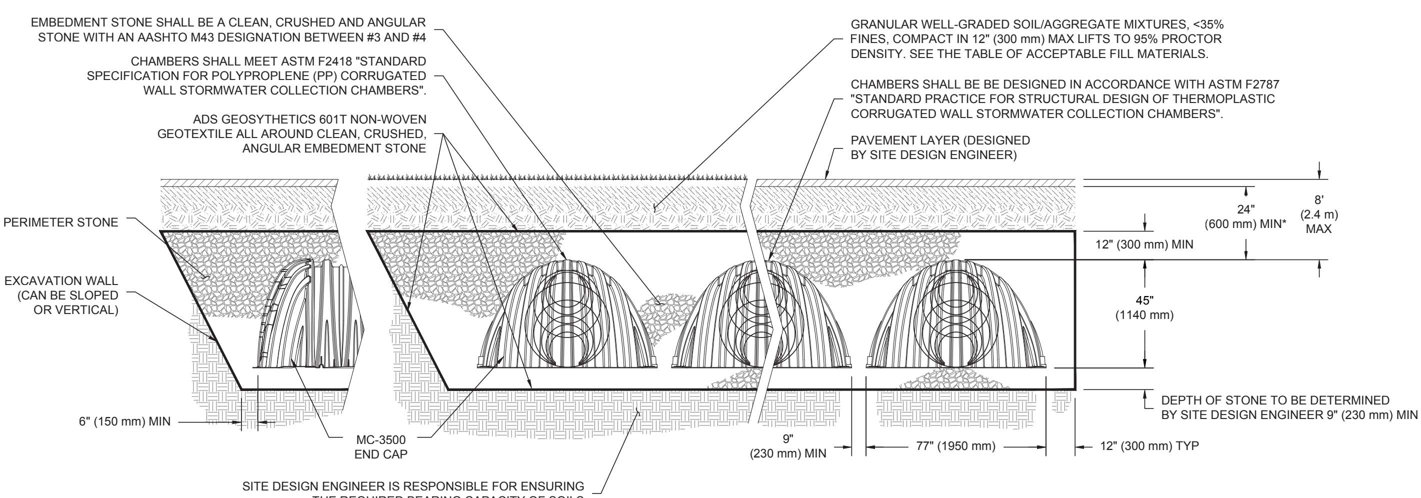
End Cap Storage
14.9 ft^3 (1.30 m^3)

Min. Installed Storage*
46.0 ft^3 (1.30 m^3)

Weight
49 lbs (22.2 kg)

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





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

MC-3500 CHAMBER SPECIFICATION

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (.42)	46.0 (1.33)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

Note: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500 Chamber	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
MC-3500 End Cap	4.1 (2.9)	4.3 (3.0)	4.5 (3.2)	4.5 (3.2)
METRIC KILOGRAMS (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-3500 Chamber	8,220 (4.9)	8,831 (5.3)	9,443 (5.6)	10,054 (6.0)
MC-3500 End Cap	3,699 (2.2)	3,900 (2.3)	4,100 (2.5)	4,301 (2.6)

Note: Assumes 12" (300 mm) of stone above and 9" (230 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (375mm)	18" (450 mm)
MC-3500 Chamber	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
MC-3500 End Cap	4.1 (3.1)	4.2 (3.2)	4.4. (3.3)	4.5 (3.5)

Note: Assumes 9" (230 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

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

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

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StormTech Construction Guide

REQUIRED MATERIALS AND EQUIPMENT LIST

- Acceptable fill materials per Table 1
- Woven and non-woven geotextiles
- StormTech solid end caps, pre-cored and pre-fabricated end caps
- StormTech chambers, manifolds and fittings

NOTE: MC-3500 chamber pallets are 77" x 90" (2.0 m x 2.3 m) and weigh about 2010 lbs. (912 kg) and MC-4500 pallets are 100" x 52" (2.5 m x 1.3 m) and weigh about 840 lbs. (381 kg). Unloading chambers requires 72" (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

IMPORTANT NOTES:

A. This installation guide provides the minimum requirements for proper installation of chambers. Nonadherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

C. Care should be taken in the handling of chambers and end caps. End caps must be stored standing upright. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans.

Place non-woven geotextile over prepared soils and up excavation walls.

Place clean, crushed, angular stone foundation 9" (230 mm) min. Install underdrains if required. Compact to achieve a flat surface.

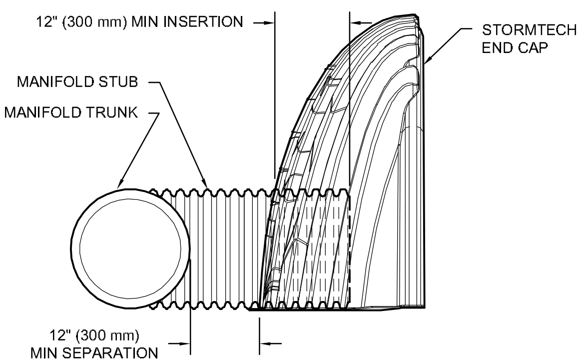
Manifold, Scour Fabric and Chamber Assembly

Install manifolds and lay out woven scour geotextile at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® Row(s) in two layers.

Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled "Lower Joint – Overlap Here" and "Build this direction – Upper Joint" Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 9" (300 mm) spacing between rows. For the Isolator Row place two continuous layers of ADS Woven fabric between the foundation stone and the isolator row chambers, making sure the fabric lays flat and extends the entire width of the chamber feet.

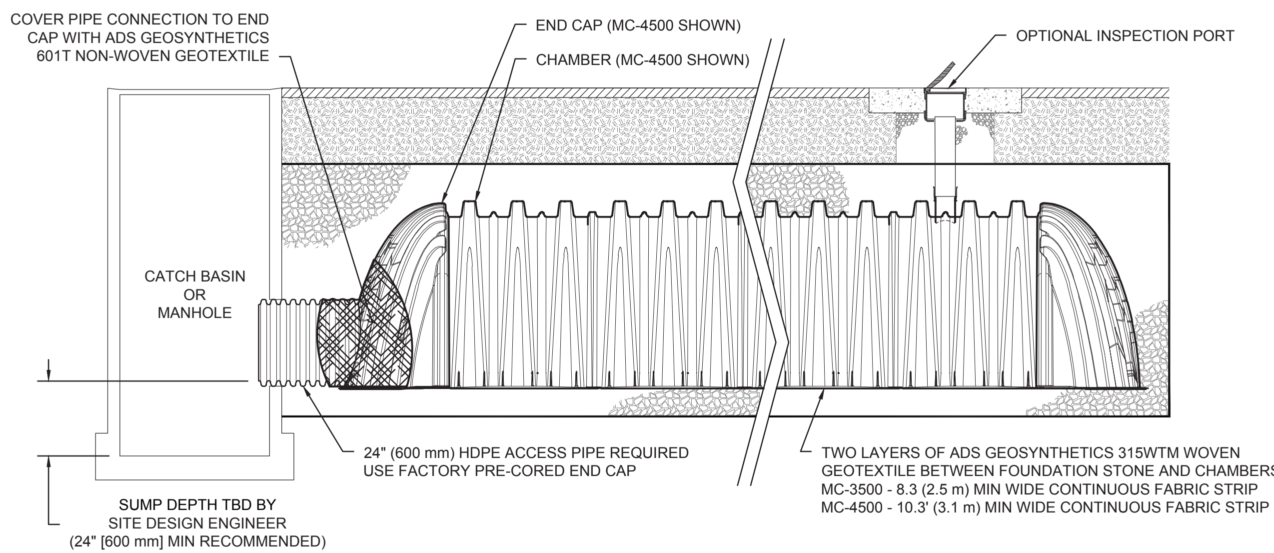
Manifold Insertion



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

Insert inlet and outlet manifolds a minimum 12" (300 mm) into chamber end caps. Manifold header should be a minimum 12" (300 mm) from base of end cap.

StormTech Isolator Row Detail

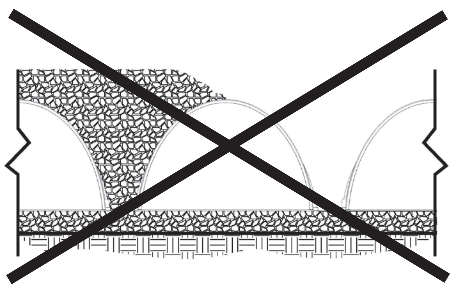


Initial Anchoring of Chambers – Embedment Stone

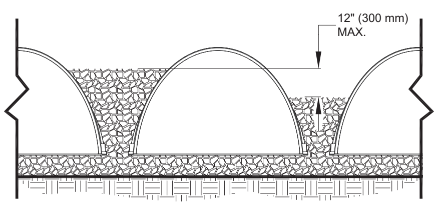
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

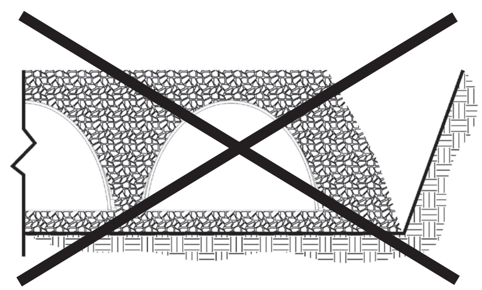


UNEVEN BACKFILL

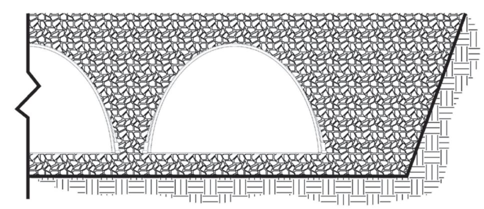


EVEN BACKFILL

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



PERIMETER NOT BACKFILLED



PERIMETER FULLY BACKFILLED

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill of Chambers – Embedment Stone and Cover Stone

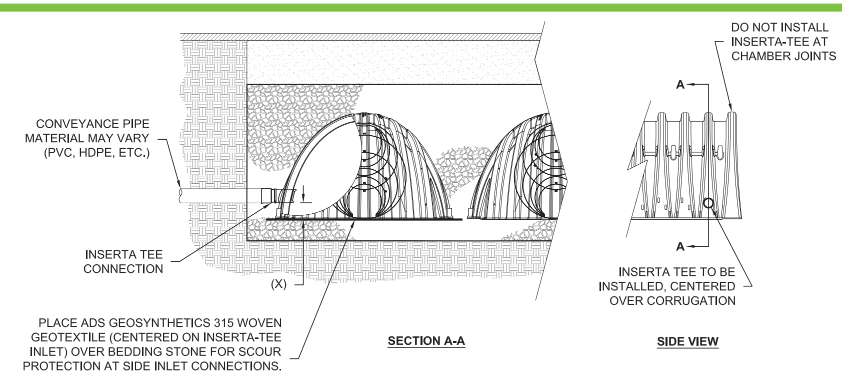
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12" (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are with a stone conveyor outside of the bed or build as you go with an excavator inside the bed reaching along the rows. Backfilling while assembling chambers rows as shown in the picture will help to ensure that equipment reach is not exceeded.

Only after chambers have been backfilled to top of chamber and with a minimum 12" (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends the contractor inspect chamber rows before placing final backfill. Any chambers damaged by construction equipment shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) in. where edges meet. Compact at 24" (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



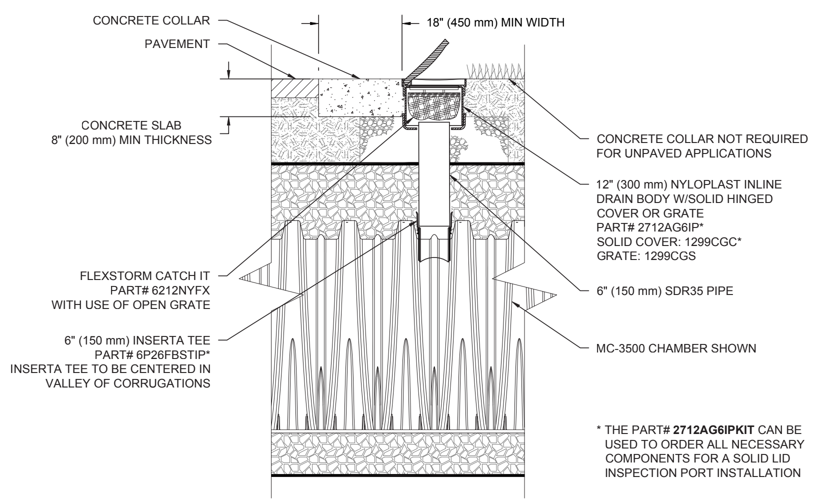
CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
MC-3500	12" (300 mm)	6" (150 mm)
MC-4500	12" (300 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
Ⓓ **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
Ⓒ **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 24" (600 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M145 A-1, A-2-4, A-3 or AASHTO M431 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 24" (600 mm) of material over the chambers is reached. Compact additional layers in 12" (300 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials.
Ⓑ **Embedment Stone:** Fill the surrounding surrounding chambers from the foundation stone ('A' layer) to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4	No compaction required.
Ⓐ **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor.[2,3]

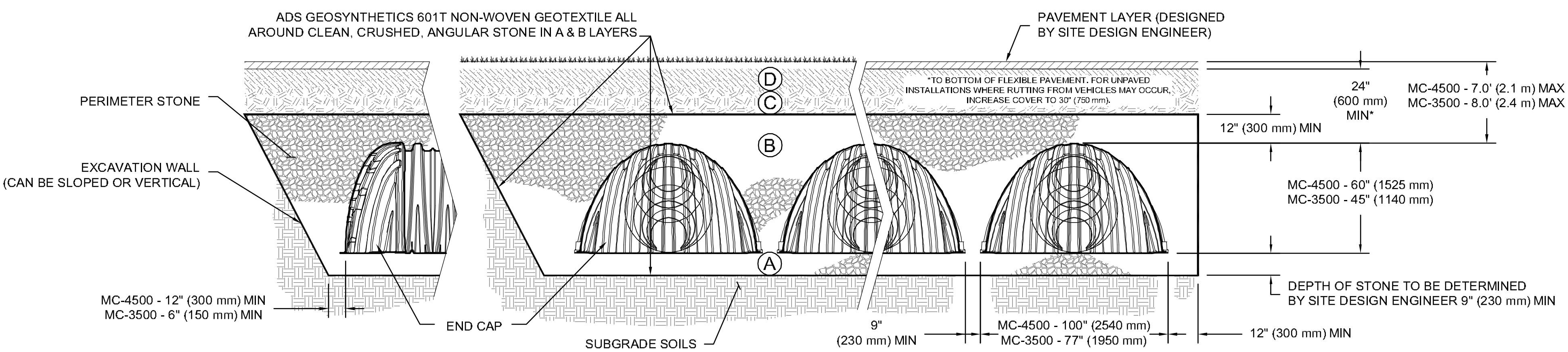
Figure 1- Inspection Port Detail



PLEASE NOTE:

1. ***The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".***
2. ***StormTech compaction requirements are met for 'A' location materials when placed and compacted in 9" (230 mm) (max) lifts using two full coverages with a vibratory compactor.***
3. ***Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.***

Figure 2 - Fill Material Locations



NOTES:

1. ***36" (900 mm) of stabilized cover materials over the chambers is required for full dump truck travel and dumping.***
2. ***During paving operations, dump truck axle loads on 24" (600mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 24" (600 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.***
3. ***Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.***
4. ***Mini-excavators (<8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.***
5. ***StormTech does not require compaction of initial fill at 18" (450 mm) of cover. However, requirements by others for 6" (150 mm) lifts may necessitate the use of small compactors at 18" (450 mm) of cover.***
6. ***Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.***
7. ***Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.***

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. [mm]	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs [kN]	Max Wheel Load for Loaders lbs [kN]	Track Width in. [mm]	Max Ground Pressure psf [kPa]	Max Drum Weight or Dynamic Force lbs [kN]
Ⓓ Final Fill Material	36" [900] Compacted	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	3420 [164] 2350 [113] 1850 [89] 1510 [72] 1310 [63]	38,000 [169]
Ⓒ Initial Fill Material	24" [600] Compacted	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2480 [119] 1770 [85] 1430 [68] 1210 [58] 1070 [51]	20,000 [89]
	24" [600] Loose/Dumped	24,000 [107]	12,000 [53]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2245 [107] 1625 [78] 1325 [63] 1135 [54] 1010 [48]	16,000 [71]
	18" [450]	24,000 [107]	12,000 [53]	12" [305] 18" [457] 24" [610] 30" [762]	2010 [96] 1480 [71] 1220 [58] 1060 [51]	5,000 [22] (static loads only)[5]
Ⓑ Embedment Stone	12" [300]	NOT ALLOWED	NOT ALLOWED	12" [305] 18" [457] 24" [610] 30" [762]	1100 [53] 715 [34] 660 [32] 580 [28]	NOT ALLOWED
	6" [150]	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 24" (600 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 12" (300 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 24" (600 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 12" (300 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

Mt SAC Parking Structure R LID Calculations for Stormwater Quality Design Volume

Subarea ID	Area (sq ft)	Area (ac)	Flow Path Length (ft)	Flow Path EL 1[1] (ft)	Flow Path EL 2[1] (ft)	Flow Path Slope[1] (ft/ft)	Soil Type[2]	Percent Impervious[3]	Design Storm F	Design Storm Depth[4] (in)	Tc[5] (min)	Peak Flow Rate[5] (cfs)	Bioswale Bottom Width (ft)	Manning's Roughness Coefficient, n	Bioswale slope (ft/ft)	Design Flow Rate = Peak*1.5 (cfs)	Design Flow Depth, d (ft)	Chosen Bioswale Depth, d (ft)	Design Flow Velocity, v (ft/s)	Design Length, L (ft)	Flow-Based Bioswale Length[6], Assumed 4-ft Bottom Width (ft)	Bioswale Length Provided (ft)	Stormwater Quality Design Volume (SWQDv)[5] (cu ft)
North	69,350	1.6	347	743	728	0.043	2	1.00	85th %	1.0	14	0.5295	3	0.25	0.005	0.7943	0.84	1.50	0.21	127.08	128	134	5,184
South	46,653	1.1	261	743	728	0.057	2	1.00	85th %	1.0	11	0.4078	3	0.25	0.005	0.6117	0.72	1.50	0.16	97.87	98	142	3,564
																						TOTAL	**8,748**

[1] Calculated using flow path length and elevations on existing topo

[2] Soil type determined using LA County Hydrology GIS

[3] Estimate based on proposed surfacing in Structure R Paving & Grading Plan

[4] 85th percentile storm depth taken from LA County Hydrology GIS

[5] Calculated using LA County HydroCalc program

[6] Calculated with conservative assumption of 1.5 * Peak Flow Rate

Appendix I: Source Control Measure Fact Sheets

S-1: Storm Drain Message and Signage

Purpose

Waste material dumped into storm drain inlets can adversely impact surface and ground waters. In fact, any material discharged into the storm drain system has the potential to significantly impact downstream receiving waters. Storm drain messages have become a popular method of alerting and reminding the public about the effects of and the prohibitions against waste disposal into the storm drain system. The signs are typically stenciled or affixed near the storm drain inlet or catch basin. The message simply informs the public that dumping of wastes into storm drain inlets is prohibited and/or that the drain ultimately discharges into receiving waters.

General Guidance

- The signs must be placed so they are easily visible to the public.
- Be aware that signs placed on sidewalk will be worn by foot traffic.

Design Specifications

- Signs with language and/or graphical icons that prohibit illegal dumping, must be posted at designated public access points along channels and streams within the project area. Consult with Los Angeles County Department of Public Works (LACDPW) staff to determine specific signage requirements for channels and streams.
- Storm drain message markers, placards, concrete stamps, or stenciled language/icons (e.g., “No Dumping – Drains to the Ocean”) are required at all storm drain inlets and catch basins within the project area to discourage illegal or inadvertent dumping. Signs should be placed in clear sight facing anyone approaching the storm drain inlet or catch basin from either side (see Figure D-1 and Figure D-2). LACDPW staff should be contacted to determine specific requirements for types of signs and methods of application. A stencil can be purchased for a nominal fee from LACDPW Building and Safety Office by calling (626) 458-3171. All storm drain inlet and catch basin locations must be identified on the project site map.

Maintenance Requirements

Legibility and visibility of markers and signs should be maintained (e.g., signs should be repainted or replaced as necessary). If required by LACDPW, the owner/operator or homeowner’s association shall enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards and signs.

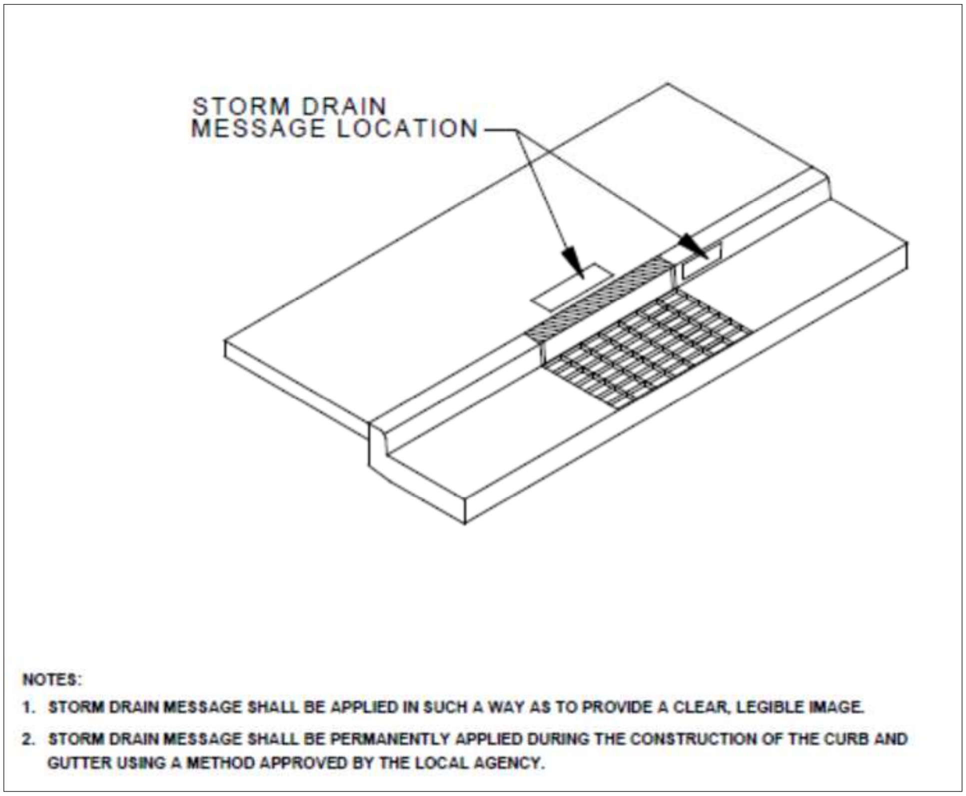


Figure D-1. Storm Drain Message Location – Curb Type Inlet

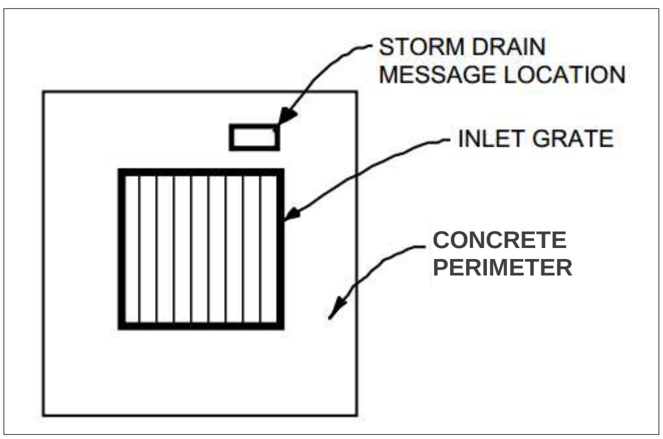


Figure D-2. Storm Drain Message Location – Catch Basin/Area Type Inlet

S-2: Outdoor Material Storage Area

Purpose

The County defines outdoor material storage areas as areas or facilities whose sole purpose is the storage of materials. Materials, including raw materials, by-products, finished products, and waste products, stored outdoors can become sources of pollutants in stormwater runoff if not handled or stored properly. The type of pollutants associated with the materials will vary depending on the type of commercial or industrial activity present.

Materials may be stored in a variety of ways, including bulk piles, containers, shelving, stacking, and tanks. Contamination of stormwater runoff may be prevented by eliminating the possibility of stormwater runoff contact with the material storage areas either through diversion, cover, or capture of the stormwater runoff. Design considerations may also include minimizing the storage area. The source control measures presented in this fact sheet must meet local permitting requirements.

Some materials, such as those containing heavy metals or toxic compounds, are of more concern than other materials. Toxic and hazardous materials must be prevented from coming in contact with stormwater runoff. Non-toxic or non-hazardous materials, such as debris and sediment, can also have significant impacts on receiving waters. Contact between non-toxic or non-hazardous materials and stormwater runoff should be limited, and such materials prevented from being discharged with stormwater runoff.

Materials are classified into three categories based on the potential risk of pollutant release associated with stormwater runoff contact – high risk, medium risk, and low risk. General types of materials under each category are presented in Table D-1. The categorization of the potential pollutant risk is used to determine the design specifications, which are presented in Table D-2, for design features at the project site.

Table D-1. Classification of Materials for Potential Pollutant Risk

High Risk Materials	Medium Risk Materials	Low Risk Materials
• Recycled materials with discharge potential • Corrosives • Food items • Chalk/gypsum products • Scrap or salvage goods • Feedstock/grain • Fertilizers • Pesticides • Compost • Asphalt • Lime/lye/soda ash • Animal/human wastes • Rubber and plastic pellets or other small pieces • Uncured concrete/cement • Lead and copper, and any metals with oil/grease coating	• Clean recycled materials without discharge potential • Metal (excluding lead and copper, and any metals with oil/grease coating) • Sawdust/bark chips • Sand/soil • Unwashed gravel/rock	• Washed gravel/rock • Finished lumber (non-pressure treated) • Rubber or plastic products (excluding small pieces) • Clean, precast concrete products • Glass products (new) • Inert products • Gaseous products • Products in containers that prevent contact with stormwater (fertilizers and pesticides excluded)

Design Specifications

Design specifications for material storage areas are regulated by local building and fire codes, ordinances, and zoning requirements. Source control measures presented in this fact sheet are intended to enhance and be consistent with local code and ordinance requirements while addressing stormwater runoff concerns. The design specifications, presented in Table D-2, must be incorporated into the design of outdoor material storage areas when stored materials could contribute pollutants to the storm drain system. The level of controls required varies relative to the risk category of the material stored.

As general guidance, downspouts and roofs should be directed away from outdoor materials storage areas, and such storage areas should slope towards a dead-end sump to collect stormwater runoff, non-stormwater runoff, and spills. Stormwater runoff, non-stormwater runoff, and spills must be disposed of in accordance with local, state, and federal laws. Locations of design features, including the features presented in Table D-2, must be included on site maps or plans. Additionally, site maps or plans must show all storage areas for chemicals and/or waste materials, with a tank/drum schedule indicating tank capacities, materials of construction, and contents.

Table D-2. Design Specifications for Outdoor Material Storage Areas

Design Feature	Design Specifications
Surfacing	• High-Risk Materials: o Construct/pave outdoor material storage areas with Portland cement concrete or an equivalent impervious surface. Ensure that the surfacing material is chemically-resistant to the materials being stored. • Medium-Risk Materials: o Construct/pave outdoor material storage areas with Portland cement concrete. • Low-Risk Materials: o There are no requirements for surfacing.

Enclosures and Covers	• High-Risk Materials:
	o Place materials in an enclosure such as a shed, cabinet, or other structure that prevents contact with stormwater runoff; or
	o Cover entire storage area with a permanent canopy, roof, or awning to prevent precipitation from making direct contact with and collecting within the storage area. Direct stormwater runoff from the cover away from the storage area to a stormwater runoff disposal point that meets all applicable code, ordinance, and LID Standards Manual requirements. For cover structures that do not include sidewalls, include a roof overhang that extends beyond the grade break.
	  o Covers 10 feet high or less should extend a minimum of 3 feet beyond the perimeter of the hydraulically-isolated storage area.
	  o Covers higher than 10 feet should extend a minimum of either 20 percent of the cover's height or 5 feet beyond the perimeter of the hydraulically-isolated storage area, whichever is greater.
	  o LACDPW may grant waivers for covers on a case-by-case basis.
	• Medium-Risk Materials:
	o At a minimum, completely cover material with temporary plastic sheeting during storm events.
	• Low-Risk Materials:
	o There are no requirements for enclosures or covers.

Table D-2. Design Specifications for Outdoor Material Storage Areas (continued)

Hydraulic Isolation and Drainage	• High-Risk Materials: o Hydraulically-isolate storage area with grading, berms, drains, dikes, or curbs to prevent stormwater run-on from surrounding areas or roof drains. o Direct stormwater runoff from surrounding areas away from the hydraulically-isolated storage area to a stormwater runoff disposal point that meets all applicable LID Standards Manual requirements. o Drainage facilities are not required for the hydraulically-isolated storage area. However, if drainage facilities are provided, drainage from the hydraulically-isolated storage area must be directed to a stormwater runoff disposal point as determined by LACDPW. • Medium-Risk Materials: o Drainage from storage area may be allowed, on a case-by-case basis with approval from LACDPW, to a treatment control measure or standard storm drain(s). o For erodible material, provide grading and a structural containment barrier on at least three sides of each stockpile to prevent stormwater run-on from surrounding areas and migration of material due to wind erosion. • Low-Risk Materials: o Provide appropriate drainage from the storage area to minimize contact with materials.
Spill Containment	• All Materials: o Implement spill containment measures where materials are stored in tanks, drums, or similar containers and that may potentially enter the storm drain system, sanitary sewer system, or contaminate the soil. Spill containment must be designed for the volume of the largest tank/drum or 10 percent of the tank/drum total (whichever is greater). o Separate spill containment systems for all tanks containing incompatible materials such as acids, bases, reactive or flammable materials. o Clean, repair, and seal (using epoxy or equivalent sealant compatible with the stored materials) the interior wall and floors within all spill containment areas. Identify the areas to be sealed on the site maps. o Bond the contact joint for spill containment walls or dikes constructed on existing concrete, masonry or asphalt to the existing surface. Identify the areas to be bonded on the site maps. o Cover the spill containment areas with a roof or awning to minimize collection of stormwater runoff within. o Store materials collected in spill containment areas until its quality and an appropriate approved disposal method have been determined.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and regulations, and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor material storage areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Any enclosures and secondary/spill containment areas should be checked periodically to ensure spills are contained efficiently. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-3: Outdoor Trash Storage and Waste Handling Area

Purpose

Stormwater runoff from areas where trash is stored or handled can be polluted. Loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or receiving waters. Waste handling operations (i.e., dumpsters, litter control, waste piles) may be sources of stormwater pollution.

Design Specifications

Wastes from commercial and industrial sites are typically hauled away for disposal by either public or commercial carriers that may have design or access requirements for waste storage areas. Design specifications for waste handling areas are regulated by local building and fire codes and by current County ordinances and zoning requirements. The design specifications, listed below in Table D-3, are recommendations and are not intended to conflict with requirements established by the waste hauler. The design specifications are intended to enhance local codes and ordinances while addressing stormwater runoff concerns. The waste hauler should be contacted prior to the design of trash storage and collection areas to determine established and accepted guidelines for designing trash collection areas. All hazardous waste must be handled in accordance with the legal requirements established in Title 22 of the California Code of Regulations. Conflicts or issues should be discussed with LACDPW staff.

Table D-3. Design Specifications for Outdoor Trash Storage and Waste Handling Area

Design Feature	Design Specifications
Surfacing	• Construct/pave outdoor trash storage and waste handling area with Portland cement concrete or an equivalent impervious surface.
Screens/Covers	• Install a screen or wall around trash storage area to prevent off-site transport of loose trash. • Use lined bins or dumpsters to reduce leaking of liquid wastes. • Use waterproof lids on bins/dumpsters or provide a roof to cover storage area enclosure (LACDPW discretion) to prevent precipitation from entering containers.
Grading/Drainage	• Berm and/or grade waste handling area to prevent stormwater run-on. • Locate waste handling area at least 35 feet from storm drains. • Divert drainage from adjoining roofs and pavement away from adjacent trash storage areas.
Signs	• Post signs on all dumpsters and/or inside enclosures prohibiting disposal of liquids and hazardous materials in accordance with any waste disposal ordinance.

Accumulated Water

Stormwater runoff, non-stormwater runoff, and spills will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and regulations, and cannot be discharged directly to the storm drain or sanitary sewer system without appropriate permitting. Contact LACDPW (1-888-CLEAN-LA) for information regarding discharge of contaminated accumulated water.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., screens, covers, signs) must be maintained by the owner/operator as required by local codes and ordinances. Outdoor trash storage and waste handling areas must be checked periodically to ensure containment of accumulated water and prevention of stormwater run-on. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

S-8: Landscape Irrigation Practices

Purpose

Irrigation runoff provides a pathway for pollutants (i.e., nutrients, bacteria, organics, sediment) to enter the storm drain system. By effectively irrigating, less runoff is produced resulting in less potential for pollutants to enter the storm drain system.

General Guidance

- Do not allow irrigation runoff from the landscaped area to drain directly to storm drain system.
- Minimize use of fertilizer, pesticides, and herbicides on landscaped areas.
- Plan sites with sufficient landscaped area and dispersal capacity (e.g., ability to receive irrigation water without generating runoff).
- Consult a landscape professional regarding appropriate plants, fertilizer, mulching applications, and irrigation requirements (if any) to ensure healthy vegetation growth.

Design Specifications

- Choose plants that minimize the need for fertilizer and pesticides.
- Group plants with similar water requirements and water accordingly.
- Use mulch to minimize evaporation and erosion.
- Include a vegetative boundary around project site to act as a filter.
- Design the irrigation system to only water areas that need it.
- Install an approved subsurface drip, pop-up, or other irrigation system.[1] The irrigation system should employ effective energy dissipation and uniform flow spreading methods to prevent erosion and facilitate efficient dispersion.
- Install rain sensors to shut off the irrigation system during and after storm events.
- Include pressure sensors to shut off flow-through system in case of sudden pressure drop. A sudden pressure drop may indicate a broken irrigation head or water line.
- If the hydraulic conductivity in the soil is not sufficient for the necessary water application rate, implement soil amendments to avoid potential geotechnical hazards (i.e., liquefaction, landslide, collapsible soils, and expansive soils).

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[1] If alternative distribution systems (e.g., spray irrigation) are approved, the County will establish guidelines to implement these new systems.

- For sites located on or within 50 feet of a steep slope (15% or greater), do not irrigate landscape within three days of a storm event to avoid potential geotechnical instability.[2]
- Implement Integrated Pest Management practices.

For additional guidelines and requirements, refer to the Los Angeles County Department of Health Services.

Maintenance Requirements

Maintain irrigation areas to remove trash and debris and loose vegetation. Rehabilitate areas of bare soil. If a rain or pressure sensor is installed, it should be checked periodically to ensure proper function. Inspect and maintain irrigation equipment and components to ensure proper functionality. Clean equipment as necessary to prevent algae growth and vector breeding. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

[2] As determined by the City of Los Angeles, Building and Safety Division

S-9: Building Materials Selection

Purpose

Building materials can potentially contribute pollutants of concern to stormwater runoff through leaching. For example, metal buildings, roofing, and fencing materials may be significant sources of metals in stormwater runoff, especially due to acidic precipitation. The use of alternative building materials can reduce pollutant sources in stormwater runoff by eliminating compounds that can leach into stormwater runoff. Alternative building materials may also reduce the need to perform maintenance activities (i.e., painting) that involve pollutants of concern, and may reduce the volume of stormwater runoff. Alternative materials are available to replace lumber and paving.

Design Specifications

Lumber

Decks and other house components constructed using pressure-treated wood that is typically treated using arsenate, copper, and chromium compounds are hazardous to the environment. Pressure-treated wood may be replaced with cement-fiber or vinyl.

Roofs, Fencing, and Metals

Minimizing the use of copper and galvanized (zinc-coated) metals on buildings and fencing can reduce leaching of these pollutants into stormwater runoff. The following building materials are conventionally made of galvanized metals:

- Metal roofs;
- Chain-link fencing and siding; and
- Metal downspouts, vents, flashing, and trim on roofs.

Architectural use of copper for roofs and gutters should be avoided. As an alternative to copper and galvanized materials, coated metal products are available for both roofing and gutter application. Vinyl-coated fencing is an alternative to traditional galvanized chain-link fences. These products eliminate contact of bare metal with precipitation or stormwater runoff, and reduce the potential for stormwater runoff contamination. Roofing materials are also made of recycled rubber and plastic.

Green roofs may be an option. Green roofs use vegetation such as grasses and other plants as an exterior surface. The plants reduce the velocity of stormwater runoff and absorb water to reduce the volume of stormwater runoff. One potential problem with using green roofs in the Los Angeles County area is the long, hot and dry summers, which may kill the plants if they are not watered. See the Green Roof Fact Sheet (RET-7) in Appendix E.

Pesticides

The use of pesticides around foundations can be reduced through the use of alternative barriers. Sand barriers can be applied around foundations to deter termites, as they cannot tunnel through sand. Metal shields also block termites from tunneling. Additionally, diatomaceous earth can be used to repel or kill a wide variety of other pests.

Maintenance Requirements

The integrity of structural elements that are subject to damage (e.g., signs) must be maintained by the owner/operator as required by local codes and ordinances. Maintenance agreements between LACDPW and the owner/operator may be required. Failure to properly maintain building and property may subject the property owner to citation.

Appendix J: Storm Water Outreach Material

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids, recyclable products, or household hazardous wastes into the street or gutter. Take them to your local auto repair station, recycling center or a household hazardous waste roundup.

1(888)CLEAN LA
www.888CleanLA.com

...they're not recycling centers.

PROJECT POLLUTION PREVENTION

Recycling Tips:

You can help keep your community clean, protect our area waterways and make the beaches safe for ocean swimmers by putting recyclable materials where they belong — at a recycling center or household hazardous waste roundup. Never throw or pour anything into the streets or gutters…

- When changing vehicle fluids – transmission, hydraulic and motor oil, brake and radiator fluid – drain them into a drip pan to avoid spills. Do not combine these fluids. Do not dispose of them in the street, gutter or in the garbage. It is illegal.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visit www.888CleanLA.com for the location of a center that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Other materials that should be taken to a household hazardous waste Roundup are: paint and paint-related materials, household cleaners, batteries, pesticides and fertilizers, pool chemicals, and aerosol products.
- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

Printed on recycled paper

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- Aluminum, glass, plastic and newspapers should be placed in your curbside recycling bin or taken to a local recycling center.

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PROJECT POLLUTION PREVENTION

Are You a Litter Bug and Don't Know It?

Take our quiz!

Have you ever...

- Dropped a cigarette butt or trash on the ground?
- Failed to pick up after your dog while out on a walk?
- Overwatered your lawn after applying fertilizers/pesticides?
- Disposed of used motor oil in the street, gutter or garbage?

If you answered **yes** to any of these actions, then **YOU ARE A LITTER BUG!**

Each of these behaviors contribute to stormwater pollution, which contaminates our ocean and waterways, kills marine life and causes beach closures.

You can become part of the solution!
To find out how, flip this card over.

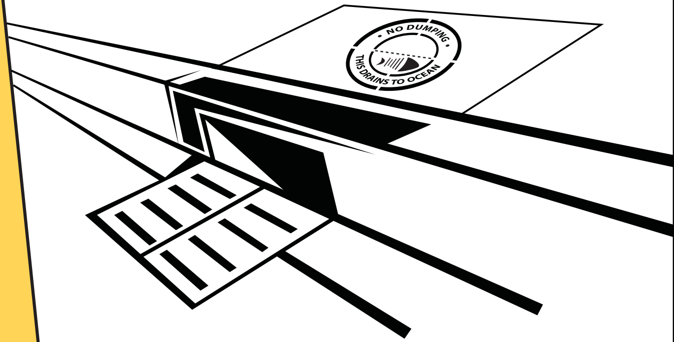
For more information, call or visit:

1 (888) CLEAN LA
www.888CleanLA.com

PROJECT Pollution PREVENTION

Follow these simple steps to prevent stormwater pollution:

- Put your garbage where it belongs — in the trash can.
- Pick up after your dog when out on a walk.
- Reduce pesticide and fertilizer use; don't overwater after application or apply if rain is forecast.
- Dispose of used motor oil at an oil recycling center or at a free Household Hazardous Waste/E-Waste collection event.



A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Don't Paint the Town Red!

Storm drains are for rain…
they're not for paint disposal.

More than **197,000** times each month, L.A. County residents wash their dirty paint brushes under an outdoor faucet.

This dirty rinse water flows into the street, down the storm drain and straight to the ocean — **untreated**.

Remember to clean water-based paint brushes in the sink, rinse oil-based paint brushes with paint thinner, and take old paint and paint-related products to a Household Hazardous Waste/E-Waste collection event.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Paint Clean-Up:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps when working with paint and paint-related products…

- Never dispose of paint or paint-related products in the gutters or storm drains. This is called illegal dumping. Take them to a Household Hazardous Waste/E-Waste collection event. Call 1 (888) CLEAN LA or visit www.888CleanLA.com to locate an event near you.

- Buy only what you need. Reuse leftover paint for touch-ups or donate it to a local graffiti abatement program. Recycle or use excess paint.

- Clean water-based paint brushes in the sink.

- Oil-based paints should be cleaned with paint thinner. Filter and reuse paint thinner. Set the used thinner aside in a closed jar to settle-out paint particles.

- Store paints and paint-related products in rigid, durable and watertight containers with tight-fitting covers.

PROJECT POLLUTION PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 50% of the automotive oil sold to do-it-yourself oil changers is not recycled. There are more than 600 State-certified used oil collection centers within Los Angeles County.

Never dispose of automotive fluids in the street or gutter. Take them to your local auto parts store, gas station or repair shop, or a household hazardous waste Roundup for recycling.

1(888)CLEAN LA
www.888CleanLA.com

...not automotive fluids.

PROJECT Pollution PREVENTION

Car Care Tips:

You can keep your car running smoothly and efficiently, and at the same time help prevent stormwater pollution by taking these easy steps…

- When changing vehicle fluids — motor oil, transmission, brake and radiator fluids — drain them into separate drip pans to avoid spills. Do not combine these fluids. Do not dispose of these fluids in the street, gutter or garbage. It is illegal.
- If a spill occurs, use kitty litter, sawdust or cornmeal for cleanup. Do not hose or rinse with water.
- Recycle all used vehicle fluids. Call 1(888)CLEAN LA or visitwww.888CleanLA.com for the location of an auto parts store or gas station that recycles these fluids, or for the location of a local household hazardous waste Roundup.
- Regularly check and maintain your car to keep it running safely and efficiently. Water runoff from streets, parking lots and driveways picks up oil and grease drippings, asbestos from brake linings, zinc from tires and organic compounds and metals from spilled fuels and carries them to the ocean.

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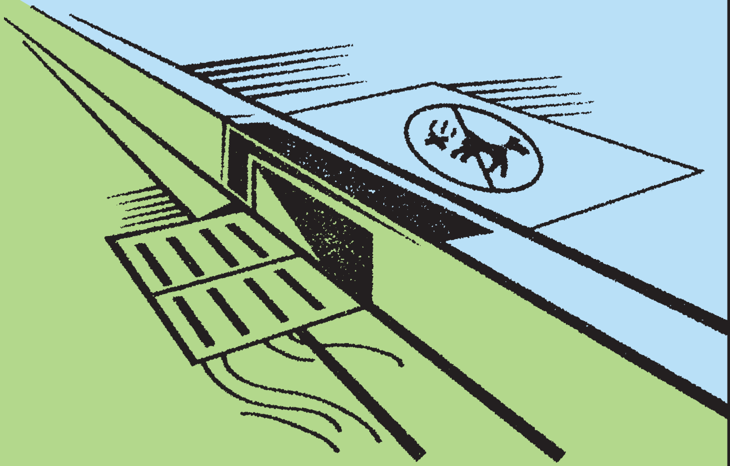
Pick Up After Your Pooch!



Storm drains are for rain…
they're not pooper scoopers.

L.A. County residents walk a dog without picking up the droppings more than **62,000** times per month.

Disease-causing dog waste washes from the ground and streets into storm drains and flows straight to the ocean — untreated.

Remember to bring a bag and clean up after your dog.

1 (888) CLEAN LA
www.888CleanLA.com

Tips for Dog Owners:

Dog owners can help solve the stormwater pollution problem by taking these easy steps…

- Clean up after your dog every single time.
- Take advantage of the complimentary waste bags offered in dispensers at local parks.
- Ensure you always have extra bags in your car so you are prepared when you travel with your dog.
- Carry extra bags when walking your dog and make them available to other pet owners who are without.
- Teach children how to properly clean up after a pet. Encourage them to throw the used bags in the nearest trash receptacle if they are away from home.
- Put a friendly message on the bulletin board at the local dog park to remind pet owners to clean up after their dogs.
- Tell friends and neighbors about the ill effects of animal waste on the environment. Encourage them to clean up after their pets as well.

PROJECT POLLUTION PREVENTION

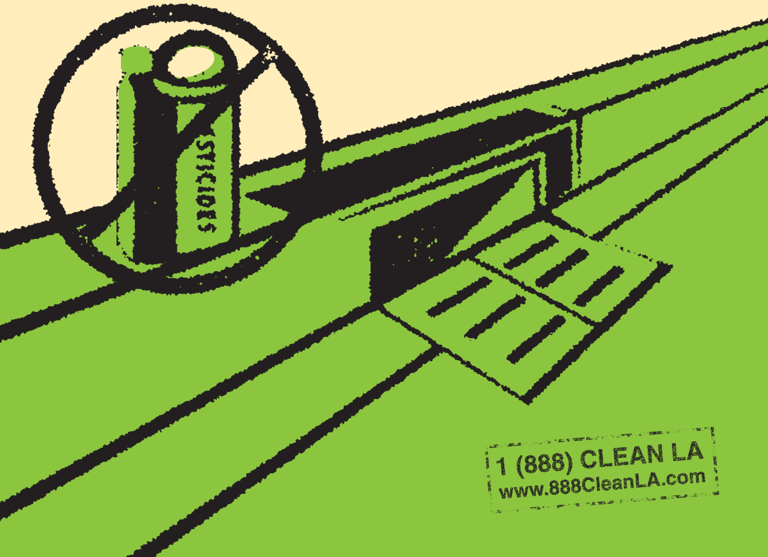
A Yard is a Terrible Thing to Waste!

Storm drains are for rain…**not yard waste.**

Residential yard waste represents about **13 percent** of the total waste generated in L.A. County.

Pesticides, fertilizer and yard waste such as leaves and mowed grass wash from the ground and streets into storm drains and flow straight to the ocean — **untreated.**

Remember to use pesticides and fertilizer wisely and pick-up yard waste.



Tips For Yard Care:

L.A. County residents can help solve the stormwater pollution problem by taking these easy steps…

- Do not over-fertilize and do not use fertilizer or pesticides near ditches, gutters or storm drains.
- Do not use fertilizer or pesticides before a rain.
- Follow the directions on the label carefully.
- Use pesticides sparingly — more is not better. "Spot" apply, rather than "blanket" apply.
- When watering your lawn, use the least amount of water possible so it doesn't run into the street carrying pesticides and other chemicals with it.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides or fertilizer, make sure they are in a sealed, water-proof container in a covered area to prevent runoff.
- Do not blow, sweep, hose or rake leaves or other yard trimmings into the street, gutter or storm drain.

PROJECT POLLUTION PREVENTION

A message from the County of Los Angeles Department of Public Works.
Printed on recycled paper.

Storm Drains are for Rain...

More than 200,000 times each month, lawns and gardens throughout LA County are sprayed with pesticides. Overwatering or rain causes pesticides on leaves and grass to flow into the storm drain and to the ocean — untreated.

Please use pesticides wisely, not before a rain, and water carefully.

...not pesticides.

1(888)CLEAN LA
www.888CleanLA.com

PROJECT Pollution PREVENTION

Pesticide Tips:

You can keep your lawn and garden green and at the same time solve the pollution problem by taking these easy steps...

- Never dispose of lawn or garden chemicals in storm drains. This is called illegal dumping. Take them to a household hazardous waste roundup. Call 1(888)CLEAN LA or visit www.888CleanLA.com to locate a roundup or collection facility near you.
- More is not better. Use pesticides sparingly. “Spot” apply, rather than “blanket” apply.
- Read labels! Use only as directed.
- Use non-toxic products for your garden and lawn whenever possible.
- If you must store pesticides, make sure they are in a sealed, water-proof container that cannot leak.
- When watering your lawn, use the least amount of water possible so it doesn’t run into the street and carry pesticide chemicals with it. Don’t use pesticides before a rain storm. You will not only lose the pesticide, but also will be harming the environment.

PROJECT Pollution PREVENTION

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PROJECT Pollution PREVENTION

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Storm Drains are for Rain...

Stormdrains take runoff directly to creeks and the ocean without treatment. Pool chemicals can harm our natural creeks and waterways. Anything going into our stormdrains that isn't rainwater contributes to stormwater pollution, which contaminates our creeks and ocean, kills marine life and causes beach closures.

...not pool chemicals

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Swimming Pool Tips

Follow these simple steps to prevent stormwater pollution...

- Make sure all chemicals are dissipated before draining a pool or spa
- Do not drain pools within 5 days of adding chemicals
- Never backwash a filter into the street or stormdrain
- Cleanup chemical spills with absorbent, don't wash it down the drain
- Dispose of leftover chemicals and paints through a licensed hazardous waste disposal provider

PROJECT Pollution PREVENTION