

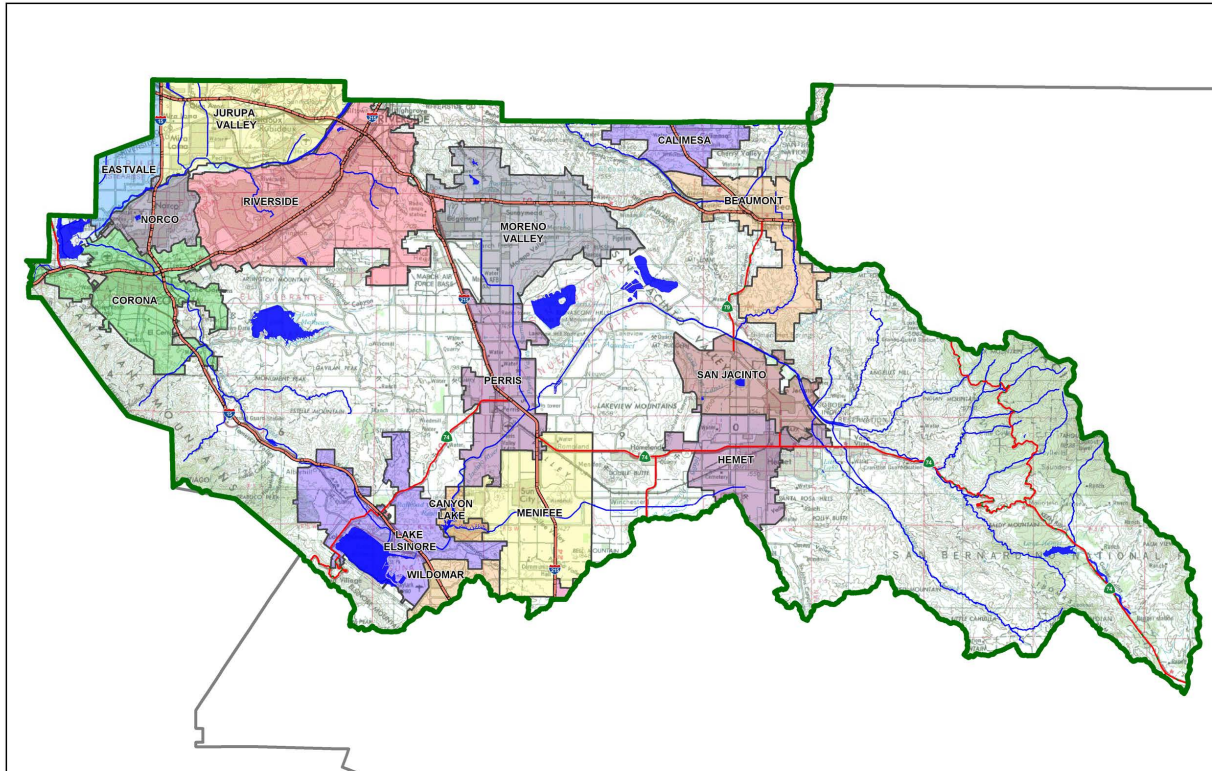
Project Specific Water Quality Management Plan

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

Project Title: Barker Industrial

Development No: N/A

Design Review/Case No: PPT190008



- Preliminary
- Final

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

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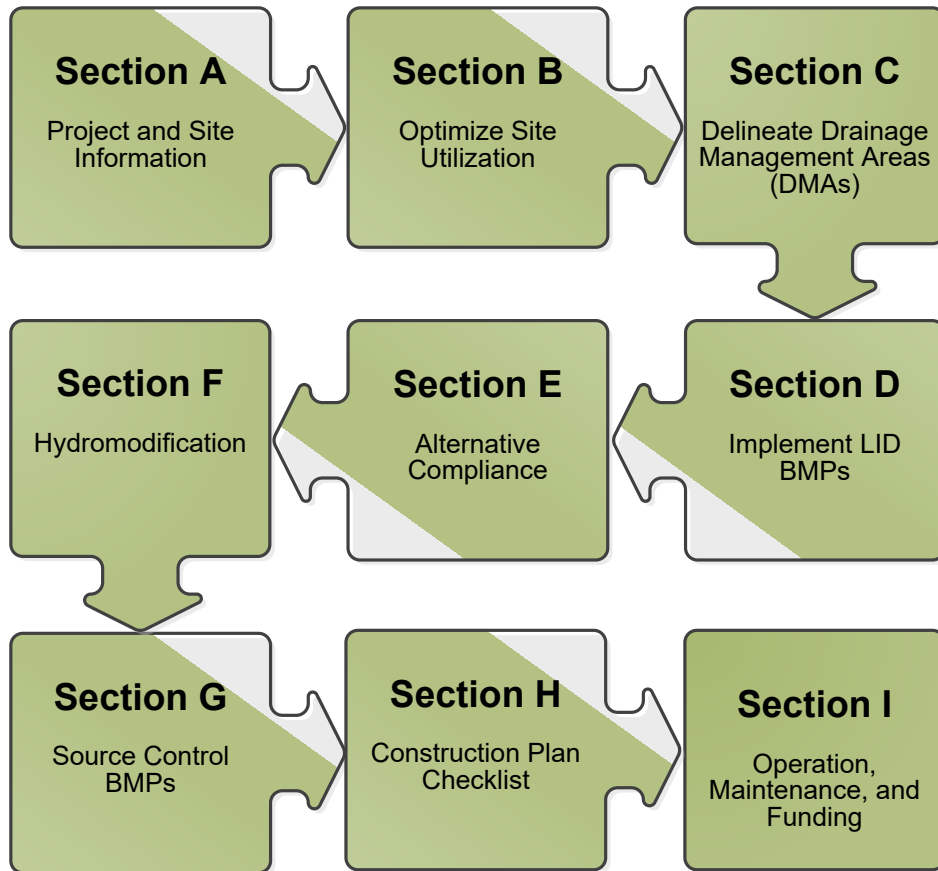
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A Brief Introduction

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



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Orbis Real Estate Partners by Tory R. Walker Engineering for the Barker Industrial project.

This WQMP is intended to comply with the requirements of County of Riverside for Ordinance No. 745 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under County of Riverside Water Quality Ordinance (Municipal Code Chapter 13.12).

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

Owner's Signature

Date

Owner's Printed Name

Owner's Title/Position

PREPARER'S CERTIFICATION

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

Preparer's Signature

Date

Preparer's Printed Name

Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Industrial
Planning Area:	Mead Valley Area Plan (MVAP)
Community Name:	N/A
Development Name:	Barker Industrial
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°49'29.82 N & 117°15'03.52" W	
Project Watershed and Sub-Watershed: Santa Ana Watershed, San	
Gross Acres: 30.19	
APN(s): 317-240-001	
Map Book and Page No.: Thomas Guide, Page 289	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Industrial
Proposed or Potential SIC Code(s)	4214
Area of Impervious Project Footprint (SF)	1,297,341
Total Area of <u>proposed</u> Impervious Surfaces within the Project Footprint (SF)/or Replacement	1,166,052
Does the project consist of offsite road improvements?	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
Does the project propose to construct unpaved roads?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
Is the project part of a larger common plan of development (phased project)?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
EXISTING SITE CHARACTERISTICS	
Total area of <u>existing</u> Impervious Surfaces within the Project limits Footprint (SF)	0
Is the project located within any MSHCP Criteria Cell?	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
If so, identify the Cell number:	2432
Are there any natural hydrologic features on the project site?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
Is a Geotechnical Report attached?	<input checked="" type="checkbox"/> Y <input type="checkbox"/> N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	N/A
What is the Water Quality Design Storm Depth for the project?	0.59 inches

Orbis Real Estate Partners is proposing to develop an industrial tilt up warehouse building on the project site, with associated office, parking stalls, and landscaping. The approximately 30-acre site consists of vacant/undeveloped land located in Riverside County, California. The site is located west of Harvill Avenue, directly east of Patterson Avenue, north of Placentia Avenue, and south of a Walnut Avenue. The site design proposes to maintain the existing drainage conditions, enhance vegetation, and disperse rooftop runoff to surrounding landscape areas, where feasible. To site will fully retain the water quality design storm via three underground infiltration vaults and a single surface infiltration basin.

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Perris Valley Channel	N/A	AGR, GWR, REC1, REC2, WARM, WILD	N/A
San Jacinto River, Reach 3	N/A	AGR, GWR, REC1, REC2, WARM, WILD	N/A
Canyon Lake (Railroad Canyon Reservoir)	Nutrients	MUN, AGR, GWR, REC1, REC2, WARM, WILD	N/A
San Jacinto River, Reach 1	N/A	MUN, AGR, GWR, REC1, REC2, WARM, WILD	N/A
Lake Elsinore	DDT (Dichlorodiphenyl trichloroethane), Nutrients, Organic Enrichment/Low Dissolved Oxygen, PCBs (Polychlorinated biphenyls), Toxicity	REC1, REC2, WARM, WILD	N/A

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

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	<input type="checkbox"/> Y	<input checked="" type="checkbox"/> N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	<input type="checkbox"/> Y	<input checked="" type="checkbox"/> N
US Army Corps of Engineers, CWA Section 404 Permit	<input type="checkbox"/> Y	<input checked="" type="checkbox"/> N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	<input type="checkbox"/> Y	<input checked="" type="checkbox"/> N
Statewide Construction General Permit Coverage	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N
Statewide Industrial General Permit Coverage	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N
Other <i>(please list in the space below as required)</i>		
County of Riverside Building Permit	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N
County of Riverside Grading Permit		

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

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

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

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

Site Optimization

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

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

Yes, existing drainage patterns have been identified, and the overall drainage pattern will be preserved. The existing site drains from the southwest to the northeast via overland flow and shallow concentrated flow, where runoff then becomes collected offsite in an existing detention pond within the adjacent property. The proposed development drains in the same orientation, but will be intercepted and directly routed to Line H-11 after being detained onsite for the 2-year, 5-year, and 10-year storms at the 1-hour, 3-hour, 6-hour, and 24-hour durations.

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

Yes, however, the site is composed of cleared land that has been previously disked or otherwise physically altered to an extent that native understory vegetation is no longer supported. The proposed landscape plan proposes native, drought-tolerant vegetation.

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

Yes, natural infiltration capacity has been identified as fair and will be preserved via self-retaining landscaped features and full infiltration-type BMPs. The native infiltration rates range between 0.16 to 3.49 inches per hour at depths ranging from three to ten feet below the existing ground surface per percolation testing conducted by a geotechnical professional.

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

Yes, proposed impervious area has been limited to provide for essential proposed industrial functions and safety (i.e., building footprint, parking, sidewalk, ADA compliance, etc.). Paved pedestrian access, parking and drive aisles are limited to the minimum widths necessary to support the proposed vehicular traffic.

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

Yes, runoff will be dispersed where feasible throughout the site. Isolated pedestrian walkways are dispersed to adjacent landscaped areas. However, all rooftop runoff will be directly connected to proposed impervious areas due to the infeasibility of maintaining sizable and uncompacted landscaping within the proposed loading dock areas along the east and west faces of the proposed warehouse, and all paved parking areas and drive aisles are directly connected to their downstream BMP. However, runoff from these areas are fully retained via infiltration BMPs sized to retain runoff generated by the water quality design storm.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s) ¹²	Area (Sq. Ft.)	DMA Type
DMA A/1	Mixed	9,610	Type A
DMA A/2	Mixed	31,529	Type A
DMA D/1	Mixed	562,726	Type D
DMA D/2	Mixed	507,634	Type D
DMA D/3	Mixed	81,313	Type D
DMA D/4	Mixed	104,529	Type D

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

²If multi-surface provide back-up

**Mixed surface types include roof areas, paved parking, LID BMPs, and self-retaining landscaped islands. Therefore, the associated BMPs have been conservatively over-sized by assuming these self-retaining areas produce runoff. Refer to Appendix 6 for precise DMA land cover quantities.*

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA A/1	9,610	Landscaping	Drip
DMA A/2	31,529	Landscaping	Drip

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

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

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

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

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

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

DMA Name or ID	BMP Name or ID
DMA D/1	BMP D/1
DMA D/2	BMP D/2
DMA D/3	BMP D/3
DMA D/4	BMP D/4

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

If yes has been checked, Infiltration BMPs shall not be used for the site; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream ‘Highest and Best Use’ feature.

Geotechnical Report

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

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

Infiltration Feasibility

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

Table D.1 Infiltration Feasibility

Does the project site...	YES	NO
...have any DMAs with a seasonal high groundwater mark shallower than 10 feet? If Yes, list affected DMAs:		✓
...have any DMAs located within 100 feet of a water supply well? If Yes, list affected DMAs:		✓
...have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact? If Yes, list affected DMAs:		✓
...have measured in-situ infiltration rates of less than 1.6 inches / hour? If Yes, list affected DMAs: D/2, D/3, and D/4; however, the average site-wide in-situ rates are barely less than 1.6 in/hr and infiltration for the site has been deemed feasible by a geotechnical professional. Therefore, the facilities have been sized with a factory of safety to draw down in 72 hours.	✓	
...have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface? If Yes, list affected DMAs:		✓
...geotechnical report identify other site-specific factors that would preclude effective and safe infiltration? Describe here:		✓

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

D.2 Harvest and Use Assessment

Please check what applies:

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

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: N/A

Type of Landscaping (Conservation Design or Active Turf): N/A

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

Total Area of Impervious Surfaces: N/A

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

Enter your EIATIA factor: N/A

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

Minimum required irrigated area: N/A

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

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

Toilet Use Feasibility

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

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

Projected Number of Daily Toilet Users: N/A

Project Type: N/A

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

Total Area of Impervious Surfaces: N/A

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

Enter your TUTIA factor: N/A

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

Minimum number of toilet users: N/A

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

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

Other Non-Potable Use Feasibility

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

N/A

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

Average Daily Demand: N/A

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

Total Area of Impervious Surfaces: N/A

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4: N/A

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: N/A

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

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

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment per Section 3.4.2 of the WQMP Guidance Document.

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

- LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).
- A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

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

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
D/1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D/2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D/3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D/4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

N/A

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First, calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second, design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	BMP D/1 Infiltration (Underground)		
						Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
	[A]		[B]	[C]	[A] x [C]			
D/1 ROOF	343,790	Roofs	1	0.89	306,661	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/1 IMP	182,722	Concrete or Asphalt	1	0.89	162,988			
D/1 LSCAPE	36,214	Ornamental Landscaping	0.1	0.11	4,000			
	562,726				473,649	0.59	23,288	24,301

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

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

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	BMP D/2 Infiltration (Underground)		
						Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
	[A]		[B]	[C]	[A] x [C]			
D/2 ROOF	334,509	Roofs	1	0.89	298,382	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/2 IMP	171,183	Concrete or Asphalt	1	0.89	152,695			
D/2 LSCAPE	1,942	Ornamental Landscaping	0.1	0.11	215			
	507,634				451,292	0.59	22,189	23,175

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	BMP D/3		
						<i>Infiltration (Underground)</i>		
	[A]		[B]	[C]	[A] x [C]			
D/3 ROOF	144	Roofs	1	0.89	128	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/3 IMP	70,198	Concrete or Asphalt	1	0.89	62,617			
D/3 LSCAPE	10,971	Ornamental Landscaping	0.1	0.11	1,212			
	81,313				63,957	0.59	3,145	3,321

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	BMP D/4		
						<i>Infiltration Basin</i>		
	[A]		[B]	[C]	[A] x [C]			
D/4 IMP	63,506	Concrete or Asphalt	1	0.89	56,647	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/4 LSCAPE	41,023	Ornamental Landscaping	0.1	0.11	4,531			
	104,529				61,179	0.59	3,008	14,262

Section E: Alternative Compliance (LID Waiver Program)

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

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

- Or -

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

List DMAs here.

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

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

P = Potential

N = Not Potential

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

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

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

⁽⁴⁾ *Specifically petroleum hydrocarbons*

⁽⁵⁾ *Specifically solvents*

⁽⁶⁾ *Bacterial indicators are routinely detected in pavement runoff*

E.2 Stormwater Credits

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

Table E.2 Water Quality Credits

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

¹Cannot Exceed 50%

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

E.3 Sizing Criteria

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

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I _f	DMA Runoff Factor	DMA Area x Runoff Factor	Enter BMP Name / Identifier Here			
	[A]		[B]	[C]	[A] x [C]				
N/A						Design Storm Depth (in)	Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)	Total Storm Water Credit % Reduction	Proposed Volume or Flow on Plans (cubic feet or cfs)
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{[G]}$	$[F] \times (1-[H])$	[I]

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

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] is from the Total Credit Percentage as Calculated from Table E.2 above

[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

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

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

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

Table E.4 Treatment Control BMP Selection

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

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

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

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

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

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

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

Does the project qualify for this HCOC Exemption? Y N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration¹ of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

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

Does the project qualify for this HCOC Exemption? Y N

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

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	Post-condition	% Difference
Time of Concentration	N/A	N/A	N/A
Volume (Cubic Feet)	N/A	N/A	N/A

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

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

Does the project qualify for this HCOC Exemption? Y N

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

The site is located within the HCOC exemption area as presented in the HCOC Map, part of the WAP document, approved April 20, 2017. Therefore, HCOC mitigation is not required.

However, due to prevailing runoff increase requirements set forth by Riverside County Flood Control & Water Conservation District, the proposed BMPs have been designed with flow controls to mimic pre-development conditions for the 2-year, 24-hour, 6-hour, 3-hour, and 1-hour storm durations. Therefore, de facto HCOC mitigation has been provided. Please refer to the site-specific drainage study for hydrograph information.

F.2 HCOC Mitigation

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

- a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.
- b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.
- c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

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

Section G: Source Control BMPs

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

1. **Identify Pollutant Sources:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.
2. **Note Locations on Project-Specific WQMP Exhibit:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.
3. **Prepare a Table and Narrative:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.
4. **Identify Operational Source Control BMPs:** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlets	<p>Mark all inlets with the words “Only Rain Down the Storm Drain” or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.</p>	<ol style="list-style-type: none"> 1. Maintain and periodically repaint or replace inlet markings. 2. Provide stormwater pollution prevention information to new site owners, lessees, or operators. 3. See applicable operational BMPs in Fact Sheet SC-44, “Drainage System Maintenance,” in the CASQA Stormwater Quality Handbook. 4. Include the following in lease agreements: “Tenant shall now allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drain.”
Landscape/outdoor pesticide use	<ol style="list-style-type: none"> 1. Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. 2. Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. 3. Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. 4. Consider using pest-resistant plants, especially adjacent to hardscape. 5. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions. 	<ol style="list-style-type: none"> 1. Maintain landscaping using minimum or no pesticides. 2. Prevent erosion of slopes by planting fast-growing, dense ground covering plants. 3. Plant native vegetation to reduce the amount of water, fertilizers, and pesticides applied to the landscape. 4. Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers. 5. Do not rake or blow leaves, clippings, or pruning waste into the street, gutter, or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city’s program. 6. Provide IPM information to new owners, lessees and operators.

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Refuse areas	<ol style="list-style-type: none"> 1. Site design features dumpster enclosures. 2. Signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar. 	<ol style="list-style-type: none"> 1. Periodic inspections for leaky, overfilled, uncovered, or other problematic conditions will occur. Corrective action will be made upon detection, as circumstances permit. 2. Dumping of liquid or hazardous wastes will be prohibited. 3. Spill control materials will be available on-site.
Industrial processes	All process activities to be performed indoors. No processes to drain to exterior or to storm drain system.	<ol style="list-style-type: none"> 1. CASQA Stormwater Quality Handbook for Industrial & Commercial Facilities Best Management Practices will be referenced, as appropriate. 2. RC Flood's Industrial & Commercial Facilities BMP fact sheet will be referenced, as appropriate.
Loading Docks	N/A	Move loaded and unloaded items indoors as soon as possible.
Miscellaneous Drain or Wash Water or Other Sources <ul style="list-style-type: none"> • Roofing, gutters, and trim 	Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	N/A
Plazas, Sidewalks, and Parking Lots	N/A	Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.

Section H: Construction Plan Checklist

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

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
BMP D/1	Infiltration Vault (underground) 72x 6-ft Oldcastle Precast StormCapture Modules	Sheet 2	33.825567° -117.252266°
BMP D/2	Infiltration Vault (underground) 108x 6-ft Oldcastle Precast StormCapture Modules	Sheet 4	33.825429° -117.249842°
BMP D/3	Infiltration Vault (underground) 13x 4-ft Oldcastle Precast StormCapture Modules	Sheet 3	33.826304° -117.250805°
BMP D/4	Infiltration Basin, 2:1 side slopes w/ 2.5 ft maximum ponded depth	Sheet 5	33.824020° -117.249253°

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

Section I: Operation, Maintenance and Funding

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

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

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

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

Maintenance Mechanism: Property Owner

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

Y N

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

Appendix 1: Maps and Site Plans

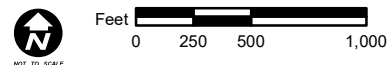
Location Map, WQMP Site Plan and Receiving Waters Map



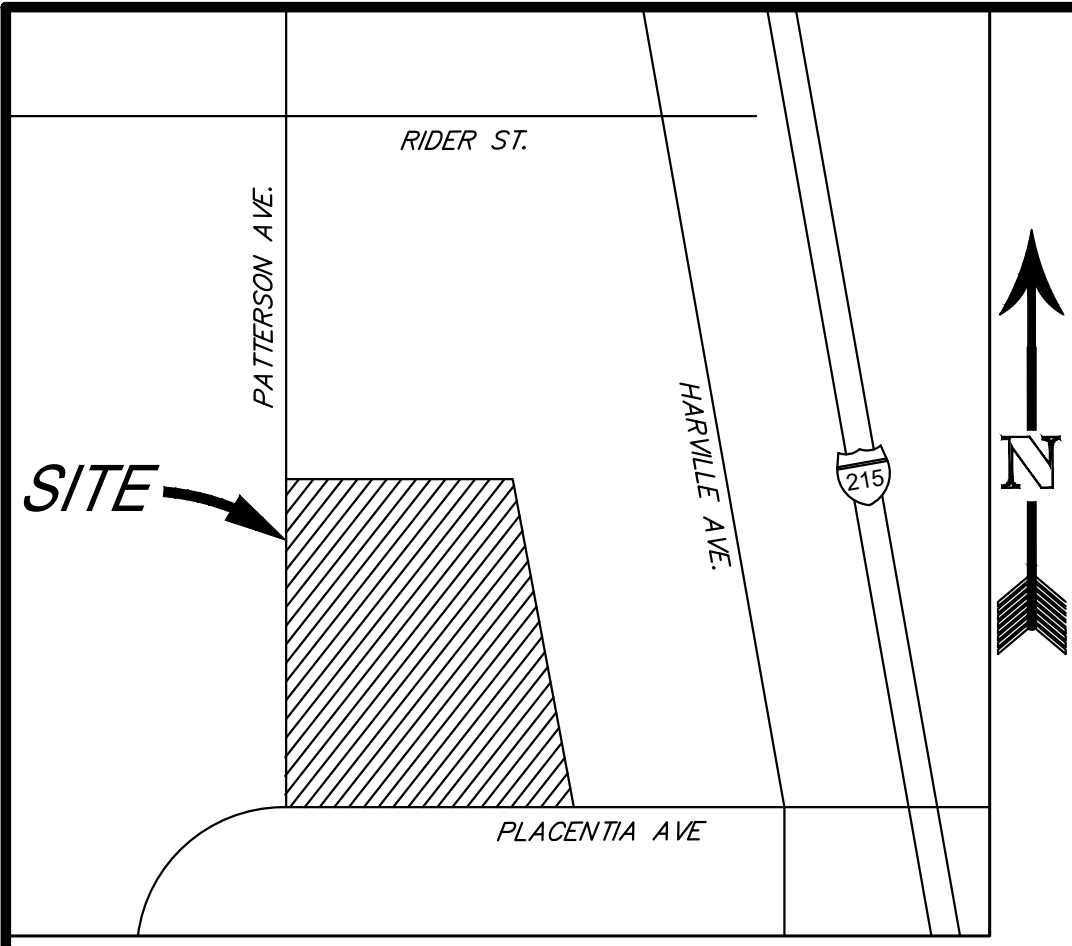
Legend

 Project Site

Barker Industrial: Location Map
Placentia & Patterson Avenue
Perris, CA 92570



POST-CONSTRUCTION BMP SITE PLAN BARKER INDUSTRIAL CASE NUMBER PPT190008



VICINITY MAP
NOT TO SCALE

OWNER/APPLICANT
ORBIS REAL ESTATE PARTNERS
280 NEWPORT DRIVE, SUITE 240
NEWPORT BEACH, CA 92660
VOICE: (949) 330-7564

ENGINEER
TORY R. WALKER ENGINEERING, INC.
122 CIVIC CENTER DRIVE, STE. 206
VISTA, CA 92084
VOICE: (760) 414-9212
FAX: (760) 414-9277

LEGEND

- DRAINAGE MANAGEMENT AREA (DMA)
- SELF-TREATING DMA
- BMP FOOTPRINT
- PROPOSED STORM DRAIN
- CURB AND GUTTER
- RIBBON DRAIN
- EXISTING CONTOUR LINE
- SLOPE
- STORM DRAIN CATCH BASIN
- ROOF DOWNSPOUT
- DISCHARGE POINT (POINT OF COMPLIANCE, POC)
- ▨ LANDSCAPE/PERVIOUS AREA
- ▨ SELF-RETAINING LANDSCAPED AREA
- ▨ CONCRETE/IMPERVIOUS AREA
- ▨ ROOFS/IMPERVIOUS AREA

NOTES

- NO OFFSITE RUN-ON HAS BEEN DETECTED FOR THE PROPOSED CONDITION

PERMANENT SOURCE CONTROL BMPs

- MARK ALL INLETS WITH THE WORDS "ONLY RAIN DOWN THE STORM DRAIN" OR SIMILAR
- ENCLOSED REFUSE AREA WITH SIGNS POSTED NEARBY STATING "DO NOT DUMP HAZARDOUS MATERIALS HERE" OR SIMILAR
- LANDSCAPING DESIGNED TO MINIMIZE IRRIGATION AND RUNOFF, TO PROMOTE SURFACE INFILTRATION WHERE APPROPRIATE, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORMWATER POLLUTION.

OPERATIONAL SOURCE CONTROL BMPs

- MAINTAIN LANDSCAPING USING MINIMUM OR NO PESTICIDES
- PREVENT EROSION OF SLOPES BY PLANTING FAST-GROWING, DENSE GROUND COVERING PLANTS
- PLANT NATIVE VEGETATION TO REDUCE THE AMOUNT OF WATER, FERTILIZERS, AND PESTICIDES APPLIED TO THE LANDSCAPE
- DO NOT OVERWATER
- USE IRRIGATION PRACTICES SUCH AS DRIP IRRIGATION, SOAKER HOSES OR MICRO-SPRAY SYSTEMS
- PERIODICALLY INSPECT AND FIX LEAKS AND MISDIRECTED SPRINKLERS
- DO NOT RAKE OR BLOW LEAVES, CLIPPINGS, OR PRUNING WASTE INTO THE STREET, GUTTER OR STORM DRAIN
- DISPOSE OF GREEN WASTE BY COMPOSTING, HAULING IT TO A PERMITTED LANDFILL, OR RECYCLING IT THROUGH YOUR CITY'S PROGRAM
- PROVIDE IPM INFORMATION TO NEW OWNERS, LESSEES AND OPERATORS
- PERIODIC INSPECTIONS FOR LEAKY, OVERFILLED, UNCOVERED, OR OTHER PROBLEMATIC CONDITIONS WILL OCCUR
- CORRECTIVE ACTION WILL BE MADE UPON DETECTION, AS CIRCUMSTANCES PERMIT
- DUMPING OF LIQUID OR HAZARDOUS WASTES WILL BE PROHIBITED
- SPILL CONTROL MATERIALS WILL BE AVAILABLE ON-SITE
- MOVE LOADED AND UNLOADED ITEMS INDOORS AS SOON AS POSSIBLE
- SWEEP PLAZAS, SIDEWALKS, AND PARKING LOTS REGULARLY TO PREVENT ACCUMULATION OF LITTER AND DEBRIS
- COLLECT DEBRIS FROM PRESSURE WASHING TO PREVENT ENTRY INTO THE STORM DRAIN SYSTEM
- COLLECT WASHWATER CONTAINING ANY CLEANING AGENT OR DEGREASER AND DISCHARGE TO THE SANITARY SEWER (NOT TO THE STORM DRAIN)

LID CONSTRAINTS

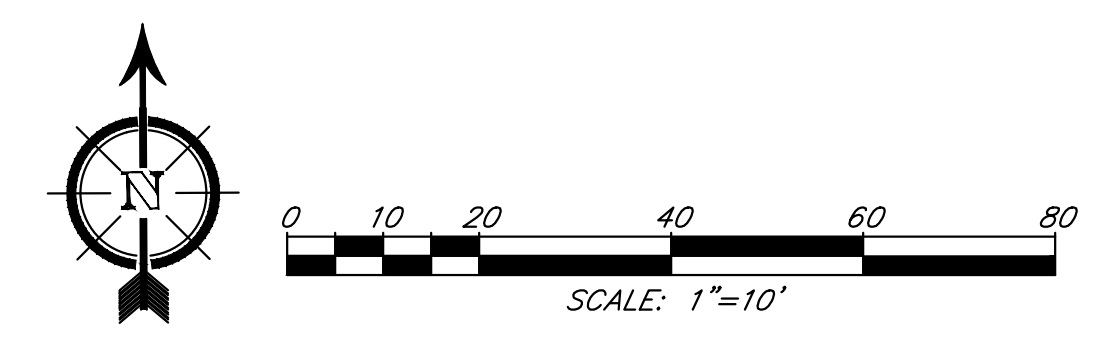
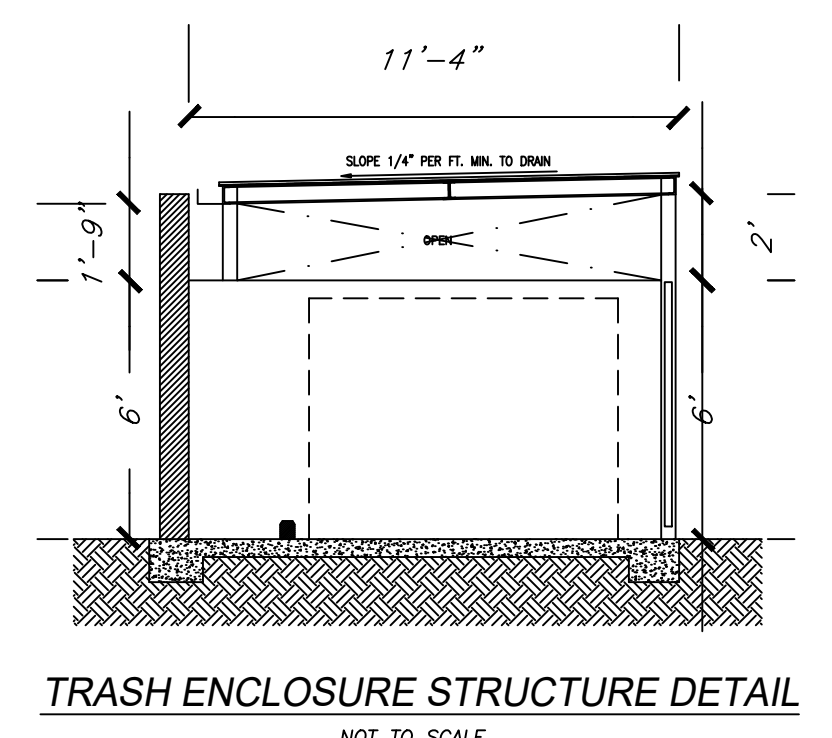
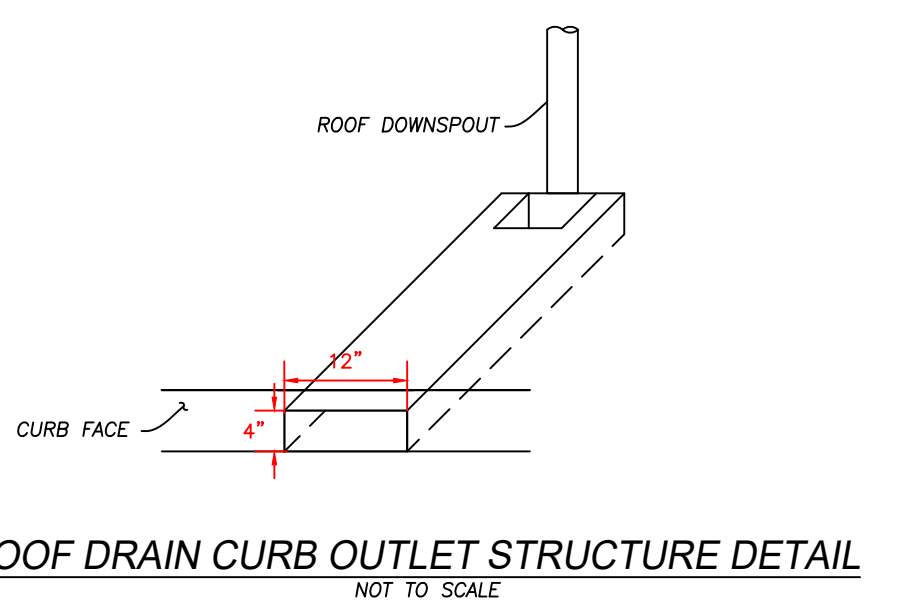
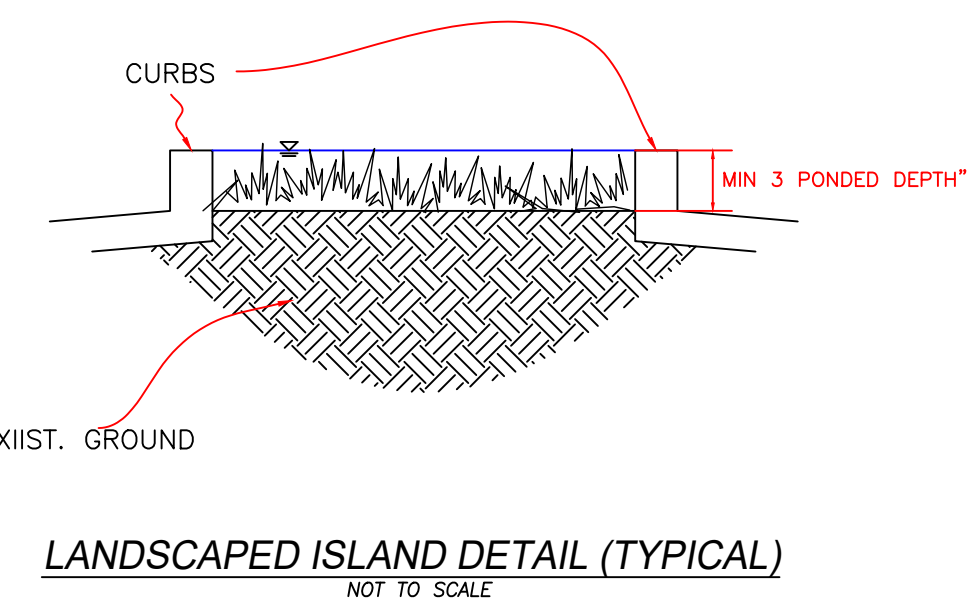
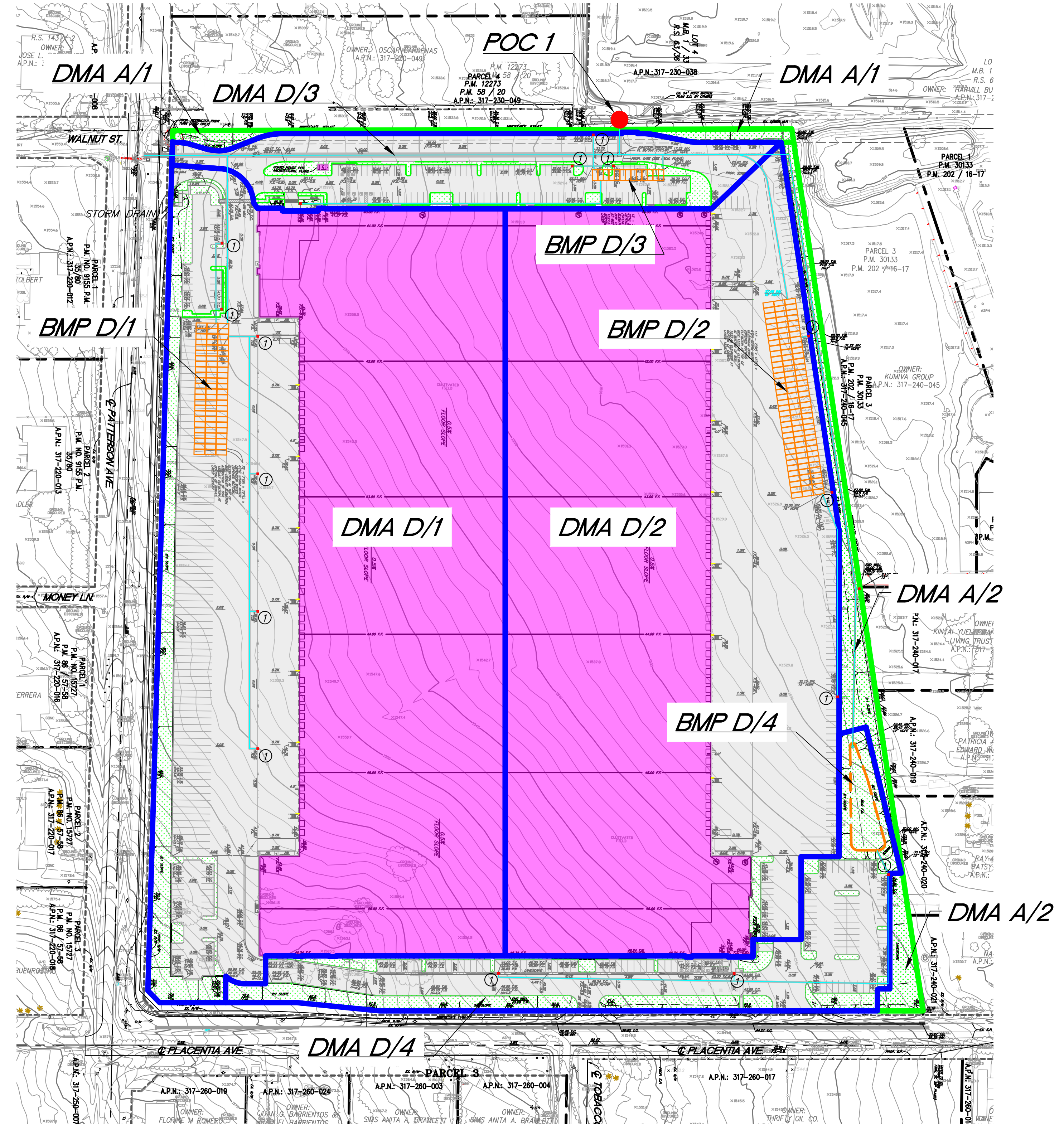
- INSUFFICIENT DEMAND FOR HARVEST AND USE

LID OPPORTUNITIES

- EXISTING PERVIOUS AREA THROUGHOUT SITE
- LANDSCAPED AREAS DESIGNED TO BE SELF-RETAINING

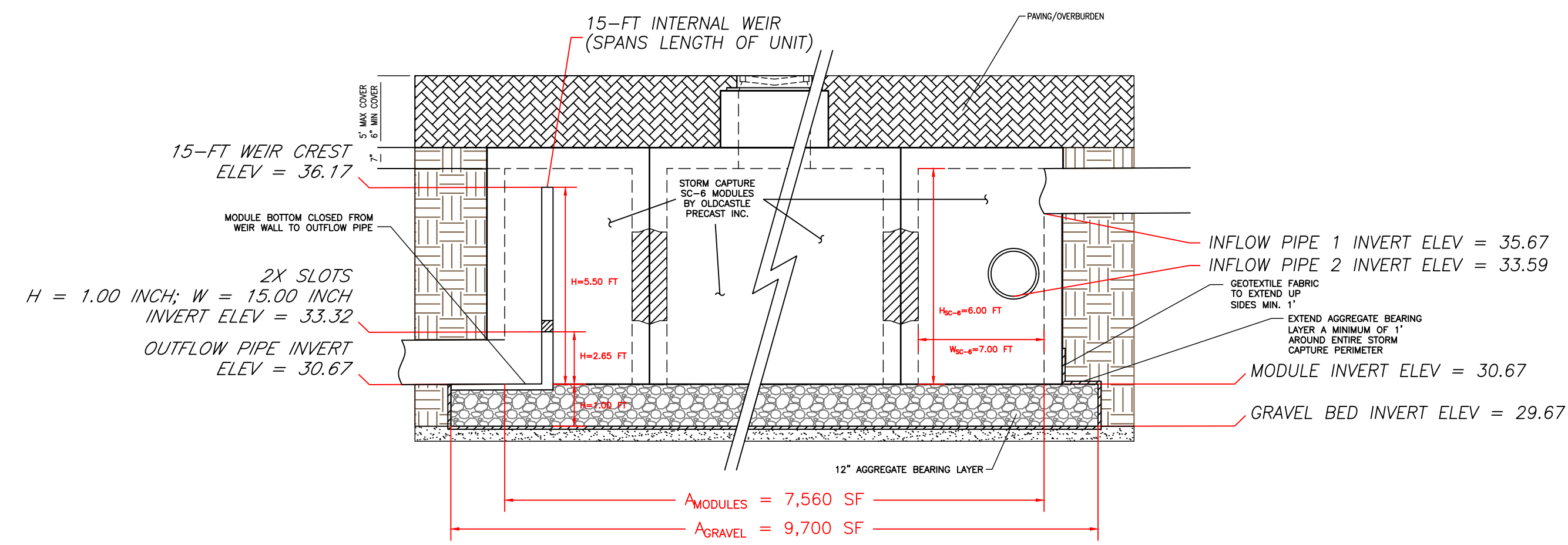
LID BMP DCV SUMMARY

DMA ID	BMP ID	DCV (cf)	V _{BMP} (cf)
D/1	D/1	23,288	23,914
D/2	D/2	22,189	22,281
D/3	D/3	3,145	3,321
D/4	D/4	3,008	14,262



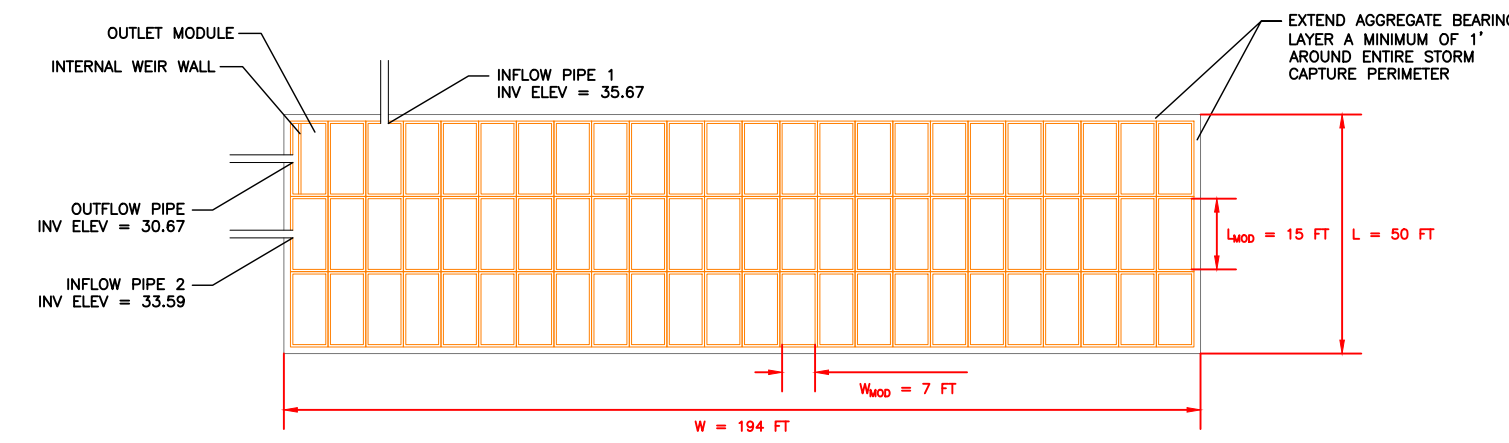
POST-CONSTRUCTION BMP SECTION DETAIL BARKER INDUSTRIAL CASE NUMBER PPT190008

BMP D/1



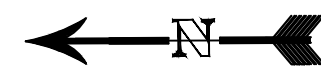
BMP D/1 TYPICAL SYSTEM CROSS SECTION

NOT TO SCALE

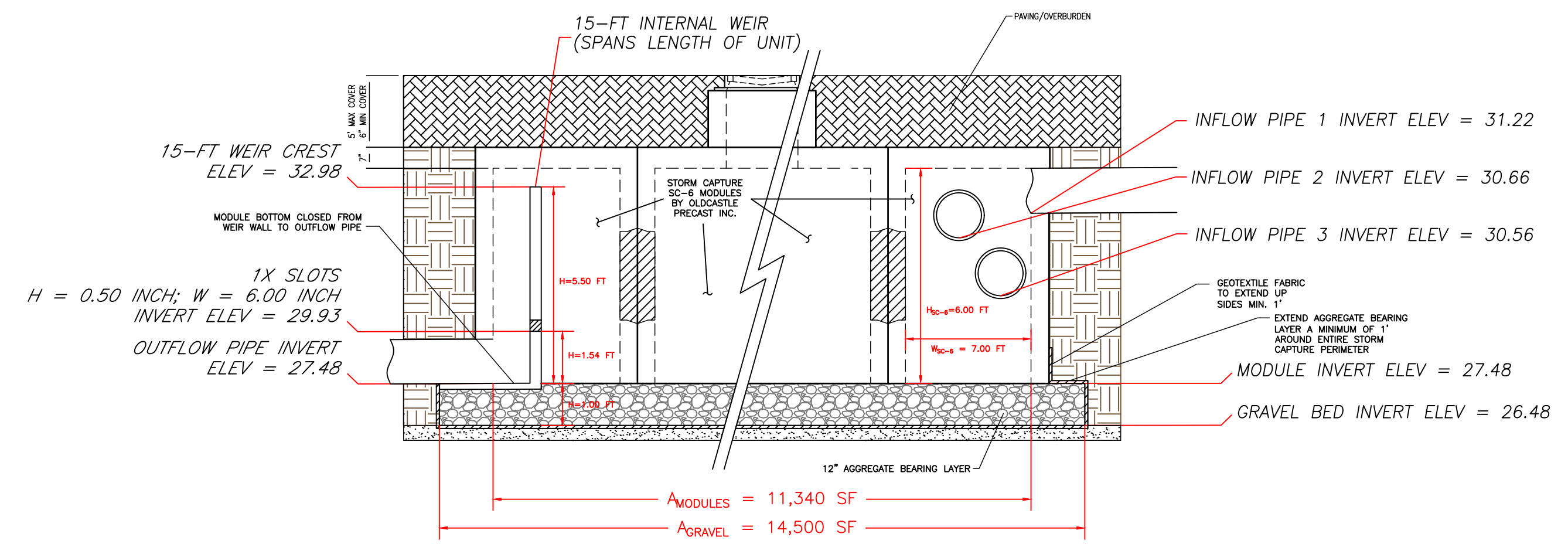


BMP D/1 SYSTEM PLAN VIEW

NOT TO SCALE

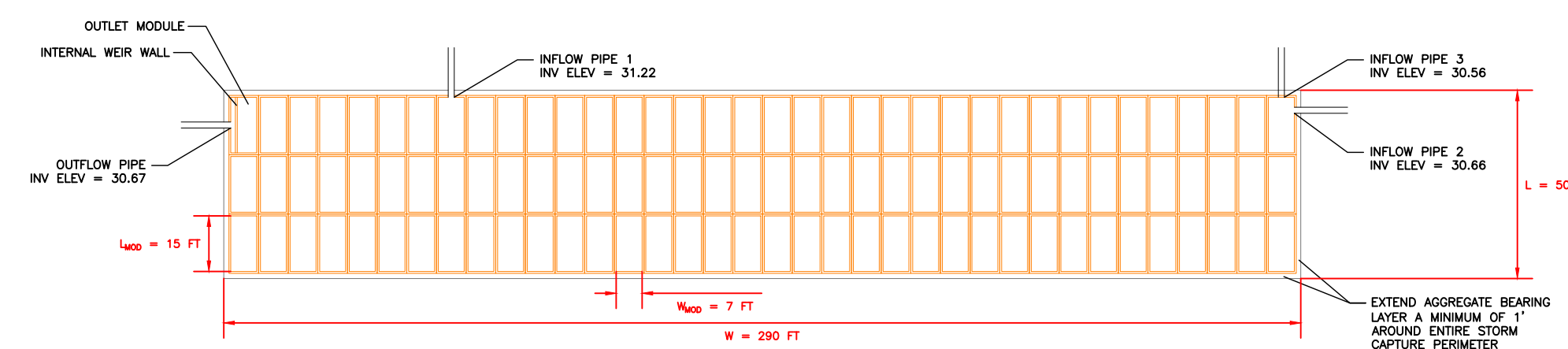


BMP D/2



BMP D/2 TYPICAL SYSTEM CROSS SECTION

NOT TO SCALE

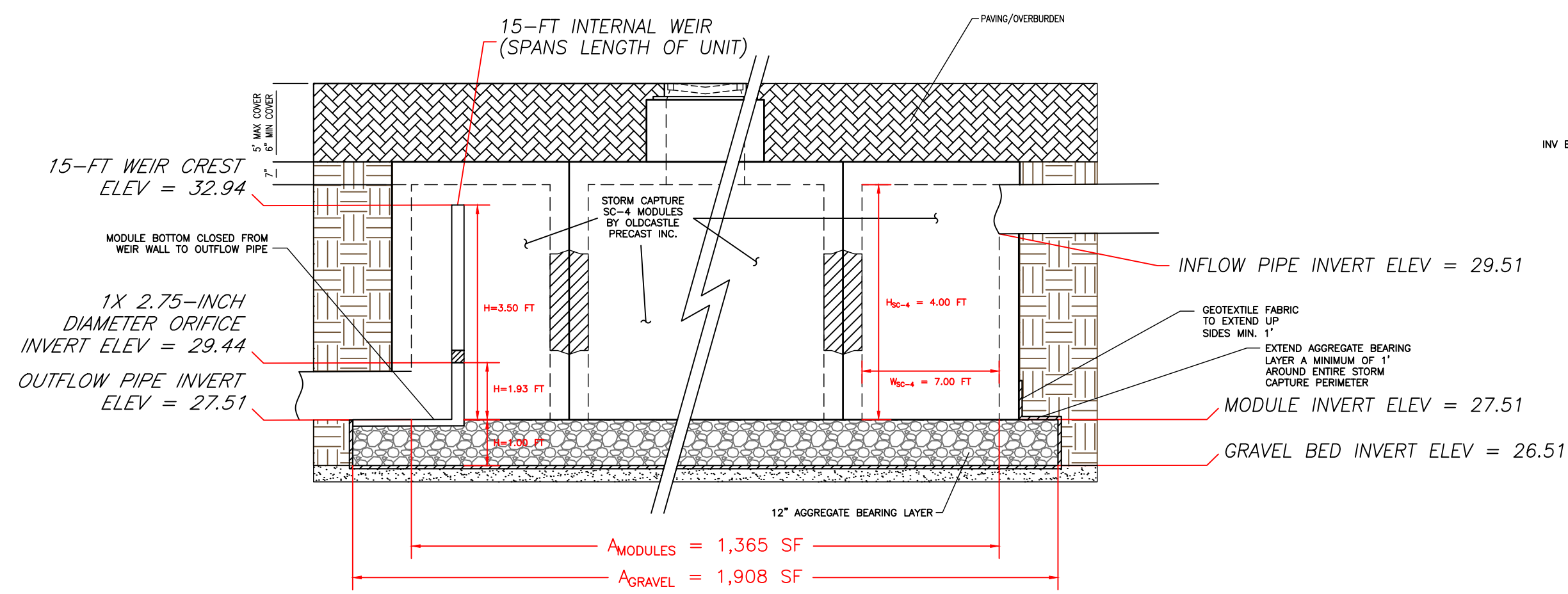


BMP D/2 SYSTEM PLAN VIEW

NOT TO SCALE

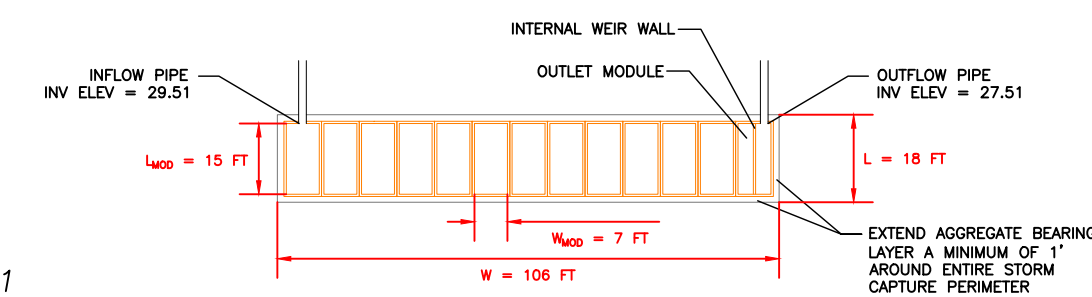


BMP D/3



BMP D/3 TYPICAL SYSTEM CROSS SECTION

NOT TO SCALE

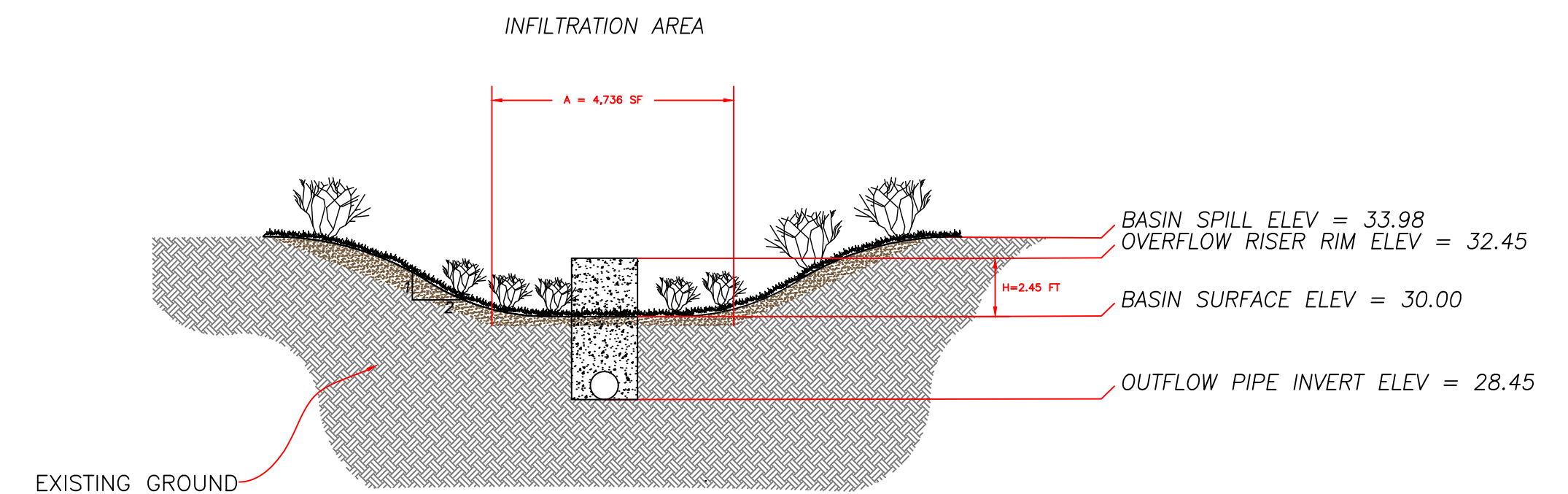


BMP D/3 SYSTEM PLAN VIEW

NOT TO SCALE



BMP D/4



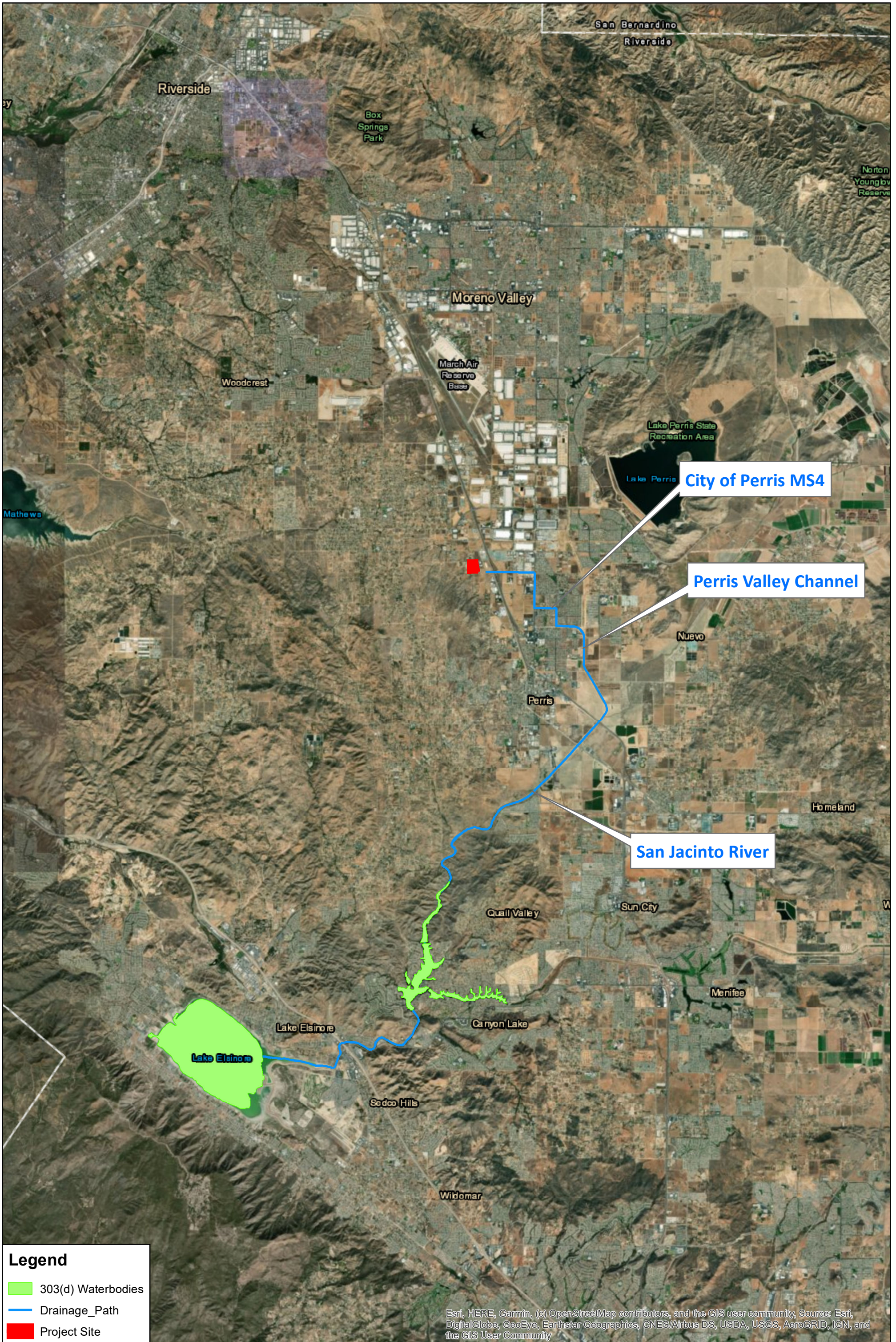
BMP D/4 BASIN CROSS SECTION

NOT TO SCALE

COUNTY OF RIVERSIDE

POST-CONSTRUCTION BMP SECTION DETAIL
BARKER INDUSTRIAL

2
OF
2
SHEETS

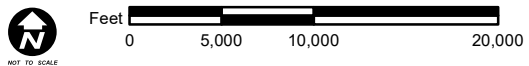


Legend

- 303(d) Waterbodies
- Drainage_Path
- Project Site

Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Barker Industrial: Receiving Waters Map
Placentia & Patterson Avenue
Perris, CA 92570



Data Sources:
 Esri World Imagery: October 2018
 Drainage Path: USGS NHD
 303(d): State Water Resources Control Board

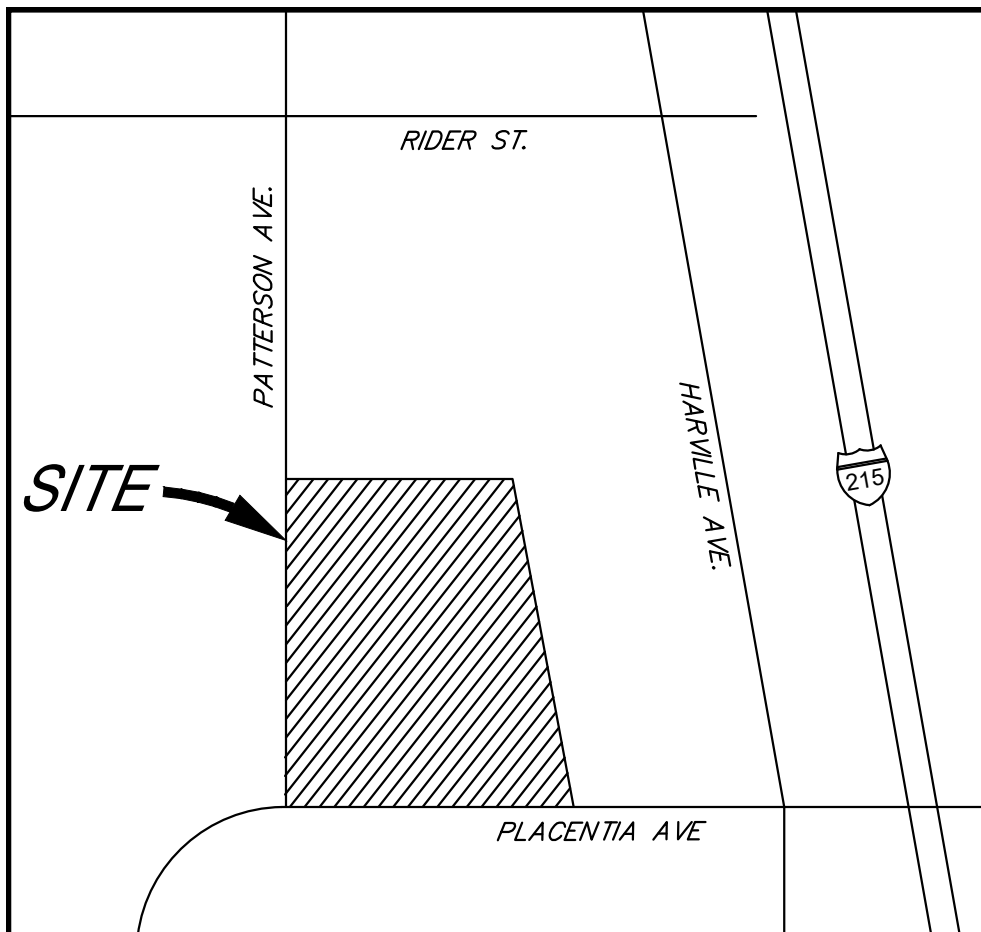


Appendix 2: Construction Plans

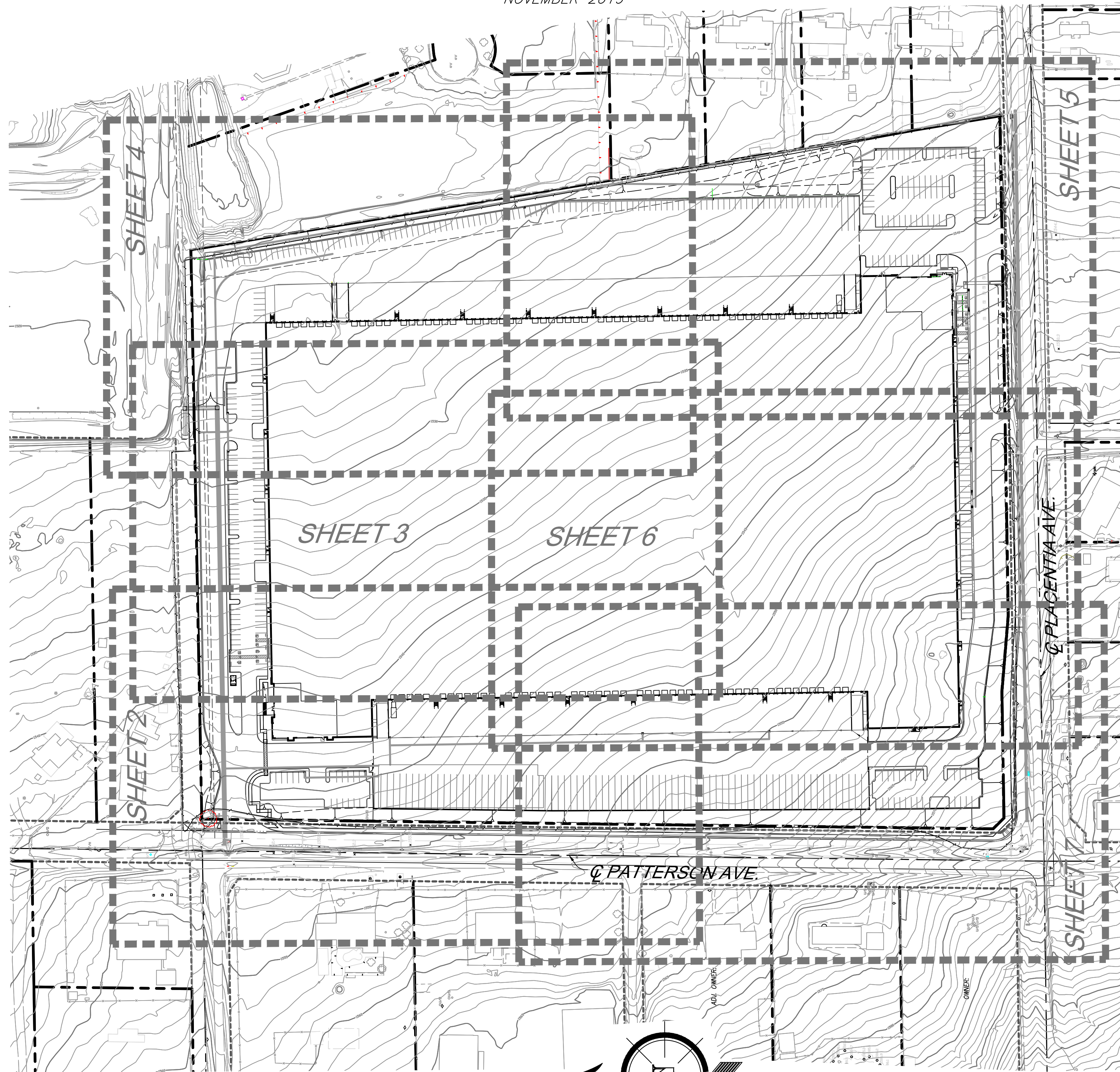
Grading and Drainage Plans

BARKER INDUSTRIAL PRELIMINARY GRADING PLAN - PPT190008

COUNTY OF RIVERSIDE, CA.
NOVEMBER 2019



VICINITY MAP
NOT TO SCALE

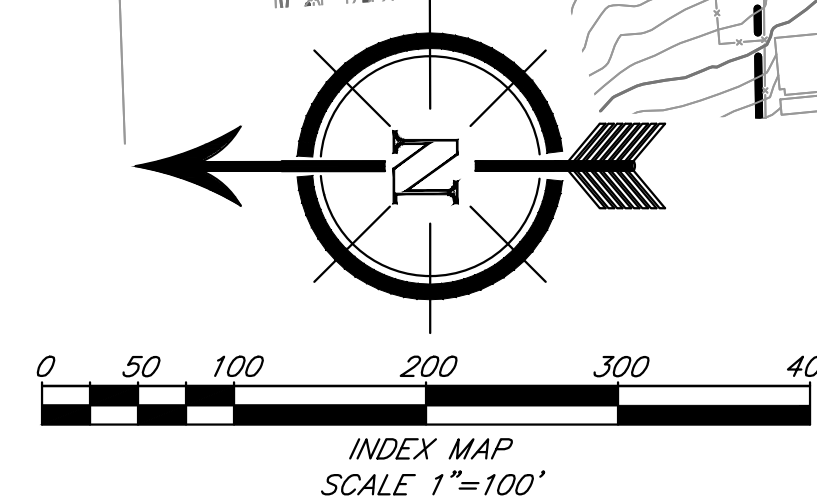
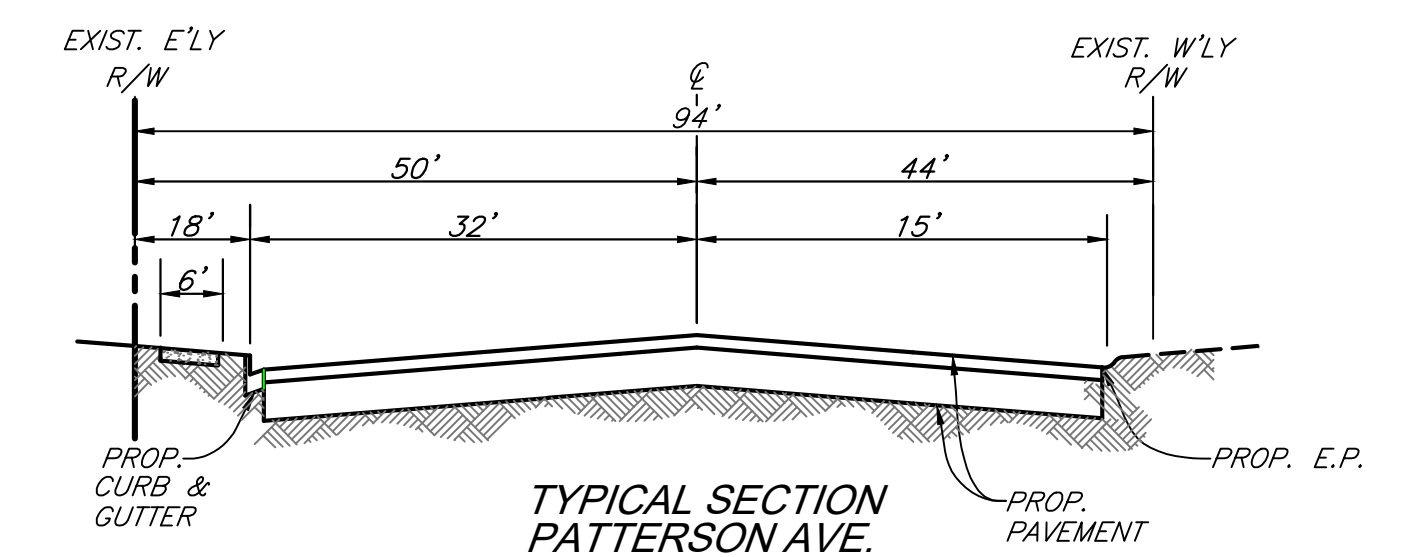
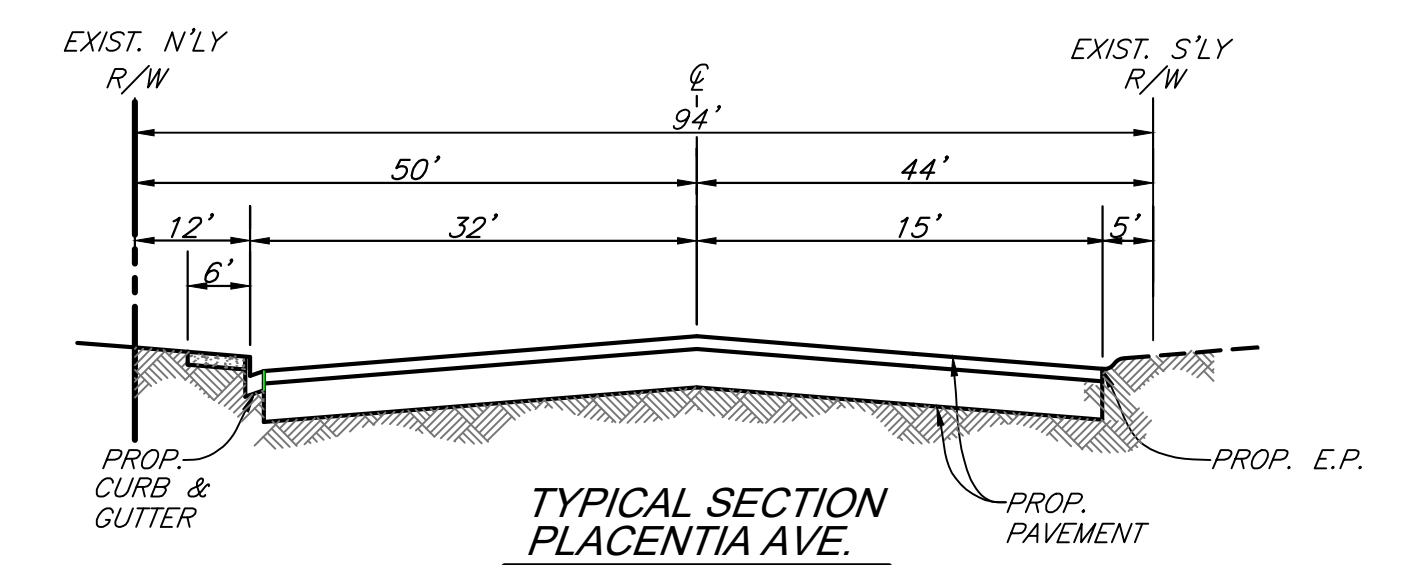


CONSTRUCTION NOTES

- 1 CONSTRUCT P.C.C./A.C. DRIVE ISLE, PARKING AREAS, AND TRUCK COURT
- 2 CONSTRUCT 6" CURB ONLY (ONSITE)
- 3 CONSTRUCT 6" CURB AND GUTTER (ONSITE)
- 4 CONSTRUCT P.C.C. SIDEWALK (FINISHED SURFACE MATERIALS PER ARCH. PLANS)
- 5 CONSTRUCT A.D.A. COMPLIANT HANDICAP RAMP
- 6 CONSTRUCT 3' WIDE CONC. RIBBON GUTTER
- 7 CONSTRUCT COMMERCIAL DRIVEWAY APPROACH
- 8 CONSTRUCT TOW DITCH @ BOTTOM OF SLOPE BEHIND RET. WALL
- 9 CONSTRUCT 8" CURB & GUTTER PER COUNTY STANDARDS
- 10 CONSTRUCT XX" A.C. OVER XX A.B. STREET SECTION PER COUNTY STANDARDS
- 11 RELOCATE/ REMOVE EX. POLE
- 12 CONSTRUCT SIDE INLET CATCH BASIN PER COUNTY STANDARDS
- 13 CONSTRUCT CURB OPENING FOR DRAINAGE CONVEYANCE
- 14 CONSTRUCT 54" RCP MASTER PLANNED STORM DRAIN PER RCFC STANDARDS
- 15 CONSTRUCT 24" RCP MASTER PLANNED STORM DRAIN PER RCFC STANDARDS
- 16 CONSTRUCT 30" RCP MASTER PLANNED STORM DRAIN PER RCFC STANDARDS
- 17 CONSTRUCT 6" PVC DRAIN PIPE (ONSITE)
- 18 CONSTRUCT 12" PVC DRAIN PIPE (ONSITE)
- 19 CONSTRUCT 18" RCP DRAIN PIPE (ONSITE)
- 20 CONSTRUCT 24" RCP DRAIN PIPE (ONSITE)
- 21 CONSTRUCT 20" RCP DRAIN PIPE (ONSITE)
- 22 JOIN EX. PIPE
- 23 CONSTRUCT BULK HEAD
- 24 CONSTRUCT 24" CATCH BASIN (BROOKS 2424CB OR APPROVED EQUAL)
- 25 CONSTRUCT RETAINING WALL
- 26 CONSTRUCT 2' WIDE X 12" DEEP "V" DITCH

EXISTING EASEMENT INFORMATION

- 1 WALNUT STREET VACATION PER RESOLUTION NO. 2005 198, INST.# 2005-0457957
- 2 RIGHTS OF THE PUBLIC IN AND TO THAT PORTION OF THE LAND LYING WITHIN THE NORTHERN 20' OF SAID LAND



OWNER/APPLICANT

ORBIS REAL ESTATE PARTNERS
280 NEWPORT DRIVE STE 240
NEWPORT BEACH, CA 92660
VOICE: (949) 330-7564
EMAIL: RPOLVERINI@ORBISREP.COM

WATER QUALITY NOTE

WATER QUALITY DESIGN STORM TO BE TREATED BY INFILTRATION BASIN LOCATED AT NORTH END OF SITE (SHOWN HEREON), AND 100 YEAR STORM FLOW TO BE MITIGATED OR CONVEYED TO MASTER PLAN STORM DRAIN

ENGINEER

SDH & ASSOCIATES, INC
5225 CANYON CREST DRIVE 71439
RIVERSIDE, CA 92507
VOICE: (951) 683-3691
FAX: (951) 788-2314
EMAIL: STEFFEN@SDHINC.NET

PROJECT DATA

SITE AREA: 1,315,102 S.F. (30.19 AC.)
NET AREA: 1,294,065 S.F. (29.71 AC.)
BUILDING AREA:
OFFICE: 10,000 S.F.
WAREHOUSE: 684,640 S.F.
TOTAL: 694,640 S.F.

ARCHITECT

HPA ARCHITECTS
18831 BARDEEN AVE, STE. 100
IRVINE, CA 92612
VOICE: (949) 863-1770

PARKING INFO

REQUIRED PARKING: 40 STALLS
OFFICE AREA: 343 STALLS
WAREHOUSE AREA: 383 STALLS
TOTAL STALLS: 468 STALLS
PROVIDED PARKING: 468 STALLS

ASSESSOR'S PARCEL NO.

317-240-001

SITE AREA

30.19 AC.

ZONING & LAND USE

EXISTING ZONING: I-P, M-SC
EXISTING LAND USE: VACANT
PROPOSED ZONING: I-P, M-SC
PROPOSED LAND USE: INDUSTRIAL

SURROUNDING ZONING & LAND USE

NORTH: I-P, M-SC, VACANT/ RESIDENTIAL
EAST: I-P, M-SC, INDUSTRIAL/ RESIDENTIAL
SOUTH: I-P, M-SC, VACANT/ RESIDENTIAL
WEST: I-P, M-SC, RESIDENTIAL

WASTE AND DISPOSAL

E.M.W.D.

LEGAL DESCRIPTION

(PER NORTH AMERICAN TITLE COMPANY TITLE REPORT NO. 91402-1541640-17 DATED NOVEMBER 28, 2017.)

THE REAL PROPERTY IN THE UNINCORPORATED AREA OF THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

LOTS 11 AND 14 OF CHANDLER'S SUBDIVISION, AS SHOWN BY MAP ENTITLED "REVISED MAP OF CHANDLER'S SUBDIVISION OF THE NORTHEAST 1/4 OF SECTION 13, IN TOWNSHIP 4 SOUTH, RANGE 4 WEST, SAN BERNARDINO BASE AND MERIDIAN", ON FILE IN BOOK 1 PAGE 33 OF MAPS, RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

THE LAND SHOWN IN THIS SURVEY IS THE SAME AS THAT DESCRIBED PER NORTH AMERICAN TITLE COMPANY TITLE REPORT NO. 91402-1541640-17 DATED NOVEMBER 28, 2017.

FEMA NOTE

ZONE "X" DENOTES AREAS OUTSIDE THE 1-PERCENT ANNUAL CHANCE FLOOD PLAIN, AREAS OF 1% ANNUAL CHANCE SHEET FLOW FLOODING WHERE AVERAGE DEPTHS ARE LESS THAN 1 FOOT, AREAS OF 1% ANNUAL CHANCE STREAM FLOODING WHERE THE CONTRIBUTING DRAINAGE AREA IS LESS THAN 1 SQUARE MILE, OR AREAS PROTECTED FROM THE 1% ANNUAL CHANCE FLOOD BY LEVEES.

NOTE:
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MARK	BY	DATE	REVISIONS	APPR.	DATE

SEAL-ENGINEER
REGISTERED PROFESSIONAL ENGINEER
ROBERT C. VAN ZANTEN
No. 62325
Exp. 9-30-19
CIVIL
STATE OF CALIFORNIA

ENGINEERING COMPANY
SDH ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
14060 Meridian Parkway, 102
Riverside, California 92518
TEL: (951) 683-3691 FAX (951) 788-2314

PREPARED BY:
ROBERT VAN ZANTEN
R.C.E. NO. 62325
DATE 9-30-19

BENCHMARK:
ELEVATIONS SHOWN HEREON ARE BASED UPON THE N.G.S. BENCHMARK 035442, DESIGNATION "435". THE BENCHMARK IS LOCATED 1300' WEST OF THE AT&P RAILROAD ALONG RIDER STREET, ON TOP OF THE NORTH CURB FACE OF RIDER STREET, 20' NORTH OF RIDER STREET, 4' SOUTH OF GTE TELEPHONE BOX (DAMAGED). A STANDARD 3 1/4" ALUMINUM DISK SET FLUSH IN TOP OF CURB. ELEVATION 1515.12 FEET (DAND 88).

SCALE:
H: 1"=100' V:

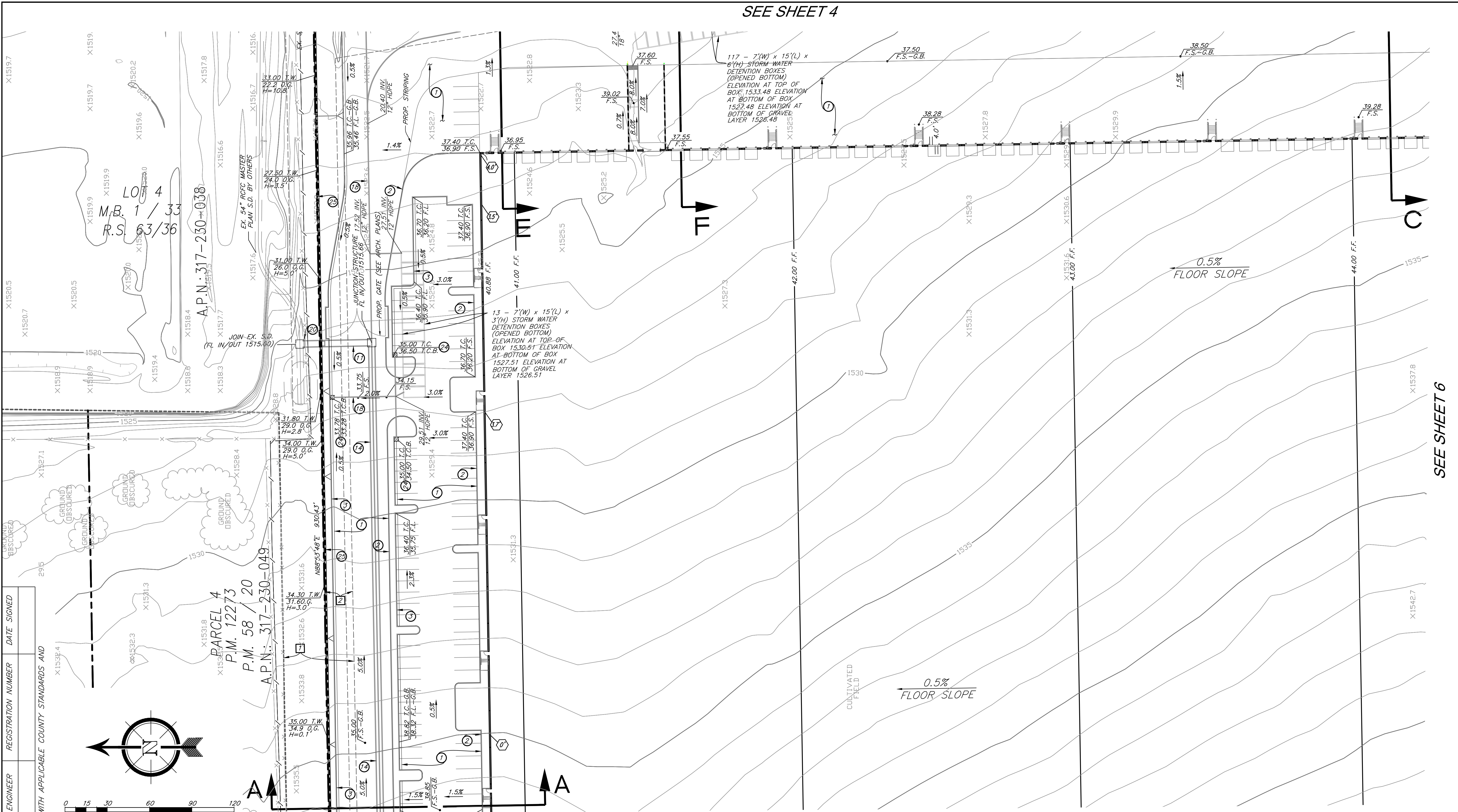
BARKER INDUSTRIAL
PRELIMINARY GRADING PLAN
TITLE SHEET

FOR: W.O. COUNTY FILE NO.

SHEET NO.
1
1 OF 8 SHTS

DATE SIGNED
REGISTRATION NUMBER
REGISTERED PROFESSIONAL ENGINEER
PLAN CHECK OVERSIGHT ENGINEER
APPROVED AS TO CONFORMANCE WITH APPLICABLE COUNTY STANDARDS AND PRACTICES.

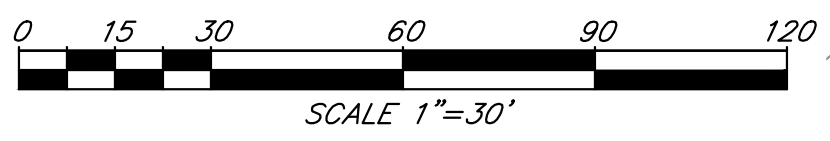
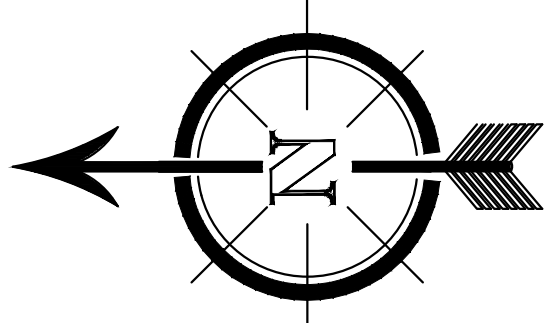
SEE SHEET 4



SEE SHEET 6

SEE SHEET 2

REC'D PLAN CHECK OVERSIGHT ENGINEER DATE SIGNED
 REGISTRATION NUMBER
 APPROVED AS TO CONFORMANCE WITH APPLICABLE COUNTY STANDARDS AND PRACTICES.



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 TWO WORKING DAYS BEFORE YOU DIG
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 A PUBLIC SERVICE BY UNDERGROUND SERVICE ALERT

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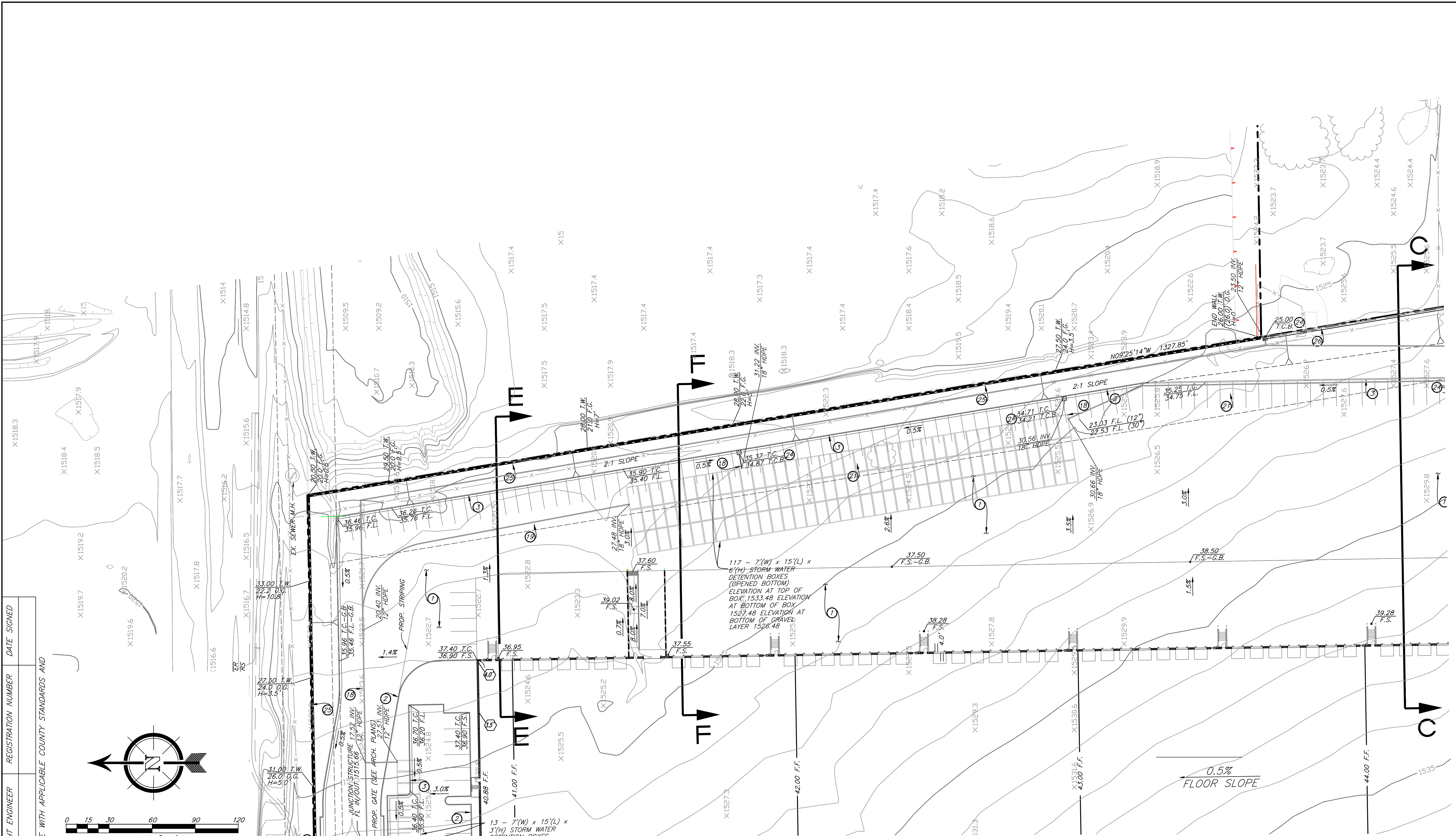
MARK	BY	DATE	REVISIONS	APPR.	DATE

SEAL-ENGINEER
 REGISTERED PROFESSIONAL ENGINEER
 ROBERT VAN ZANTEN
 No. 62325
 Exp. 9-30-19
 CIVIL
 STATE OF CALIFORNIA

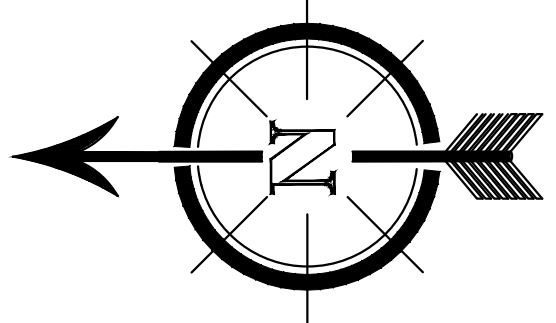
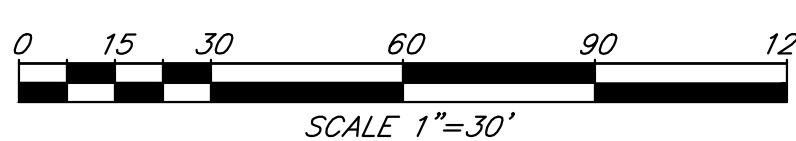
ENGINEERING COMPANY
SDH ASSOCIATES INCORPORATED
 SDH AND ASSOCIATES INC.
 14060 Meridian Parkway 102
 Riverside, California 92518
 TEL: (951) 683-3691 FAX (951) 788-2314
 PREPARED BY: ROBERT VAN ZANTEN
 R.C.E. NO. 62325
 DATE 9-30-19

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 SCALE: H: 1"=30' V: 1"=10'

BARKER INDUSTRIAL PRELIMINARY GRADING PLAN
 SHEET NO. 3
 3 OF 8 SHTS
 FOR: W.O. COUNTY FILE NO.



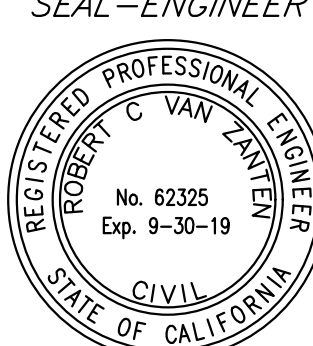
SEE SHEET 5


REC'D	PLAN CHECK OVERSIGHT ENGINEER	REGISTRATION NUMBER	DATE SIGNED
APPROVED AS TO CONFORMANCE WITH APPLICABLE COUNTY STANDARDS AND PRACTICES:			
 			

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MARK	BY	DATE	REVISIONS	APPR.	DATE
	ENGINEER				COUNTY

SEAL-ENGINEER


ENGINEERING COMPANY

 SDH AND ASSOCIATES INC.
 14080 Meridian Parkway 102
 Riverside, California 92518
 TEL: (951) 683-3691 FAX (951) 788-2314
 PREPARED BY: ROBERT VAN ZANTEN
 R.C.E. NO. 62325
 DATE 9-30-19

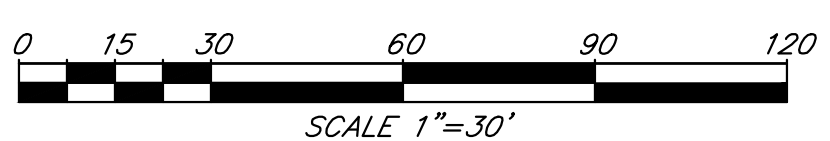
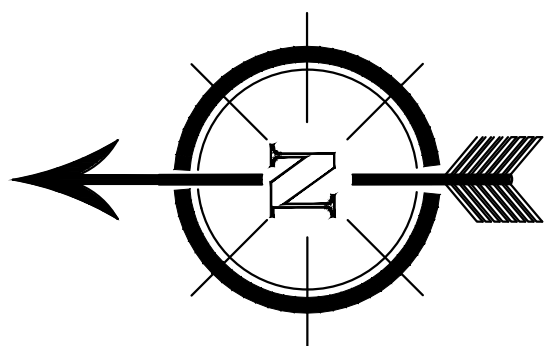
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 SCALE: H: 1"=30' V:

BARKER INDUSTRIAL
PRELIMINARY GRADING PLAN
 FOR: W.O. COUNTY FILE NO.

SHEET NO. **4**
 4 OF 8 SHTS

REC'D PLAN CHECK OVERSIGHT ENGINEER REGISTRATION NUMBER DATE SIGNED

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SEAL-ENGINEER
 REGISTERED PROFESSIONAL ENGINEER
 ROBERT VAN ZANTEN
 No. 62325
 Exp. 9-30-19
 CIVIL
 STATE OF CALIFORNIA

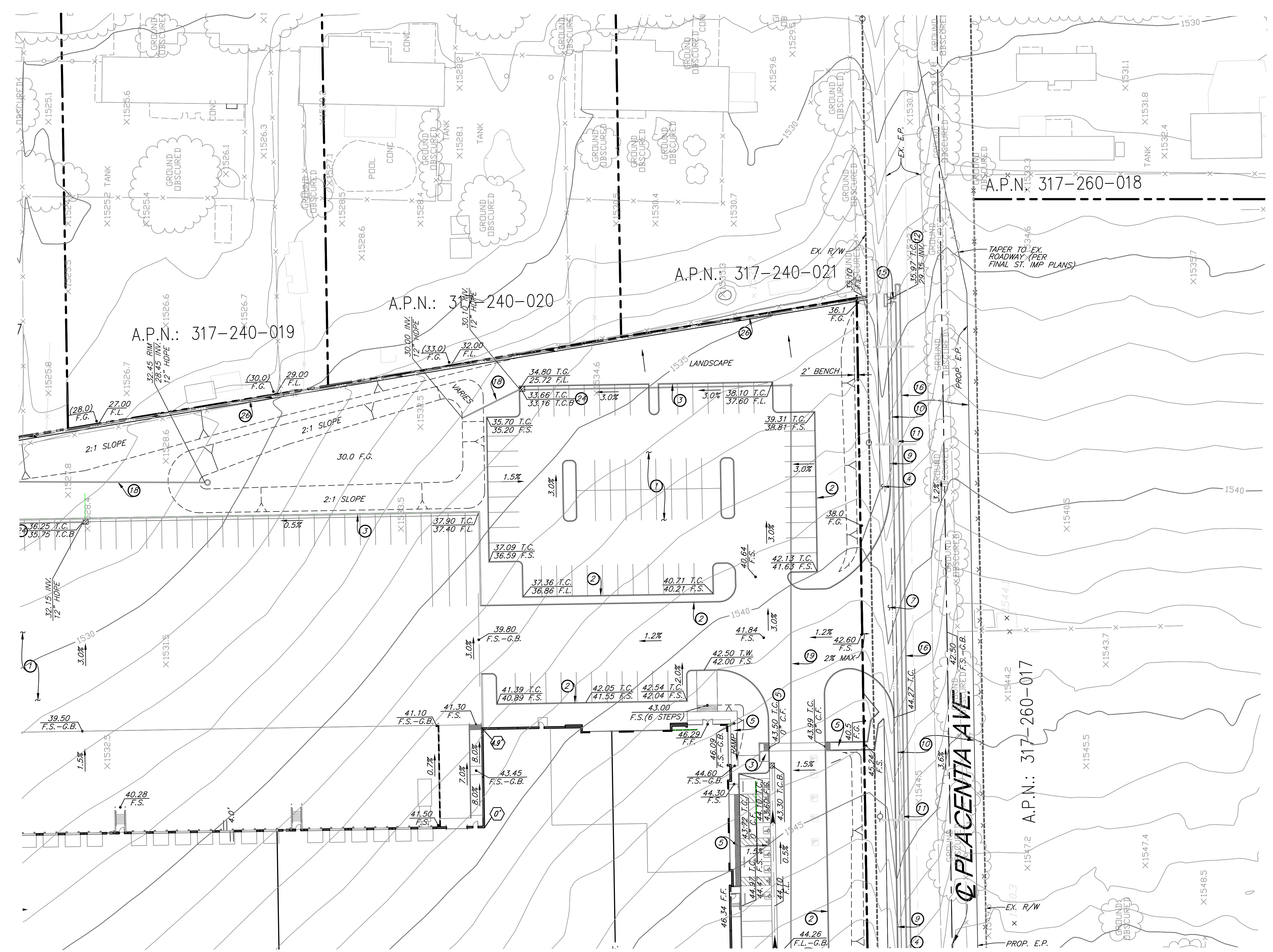
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SDH ASSOCIATES INCORPORATED
 SDH AND ASSOCIATES INC.
 14080 Meridian Parkway 102
 Riverside, California 92518
 TEL: (951) 683-3691 FAX: (951) 788-2314
 PREPARED BY: ROBERT VAN ZANTEN
 R.C.E. NO. 62325
 DATE 9-30-19

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 SCALE: H: 1"=30' V:

BARKER INDUSTRIAL PRELIMINARY GRADING PLAN
 FOR: W.O. COUNTY FILE NO.

SHEET NO. **5**
 OF 8 SHTS

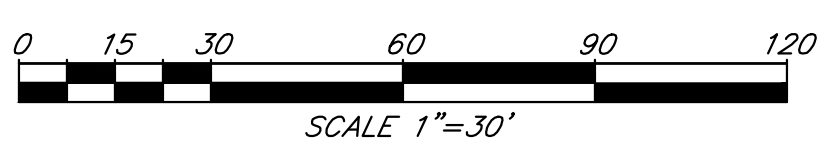
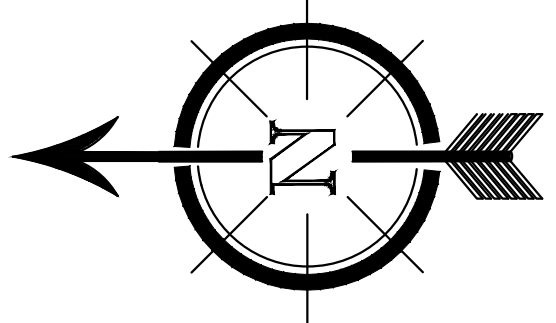
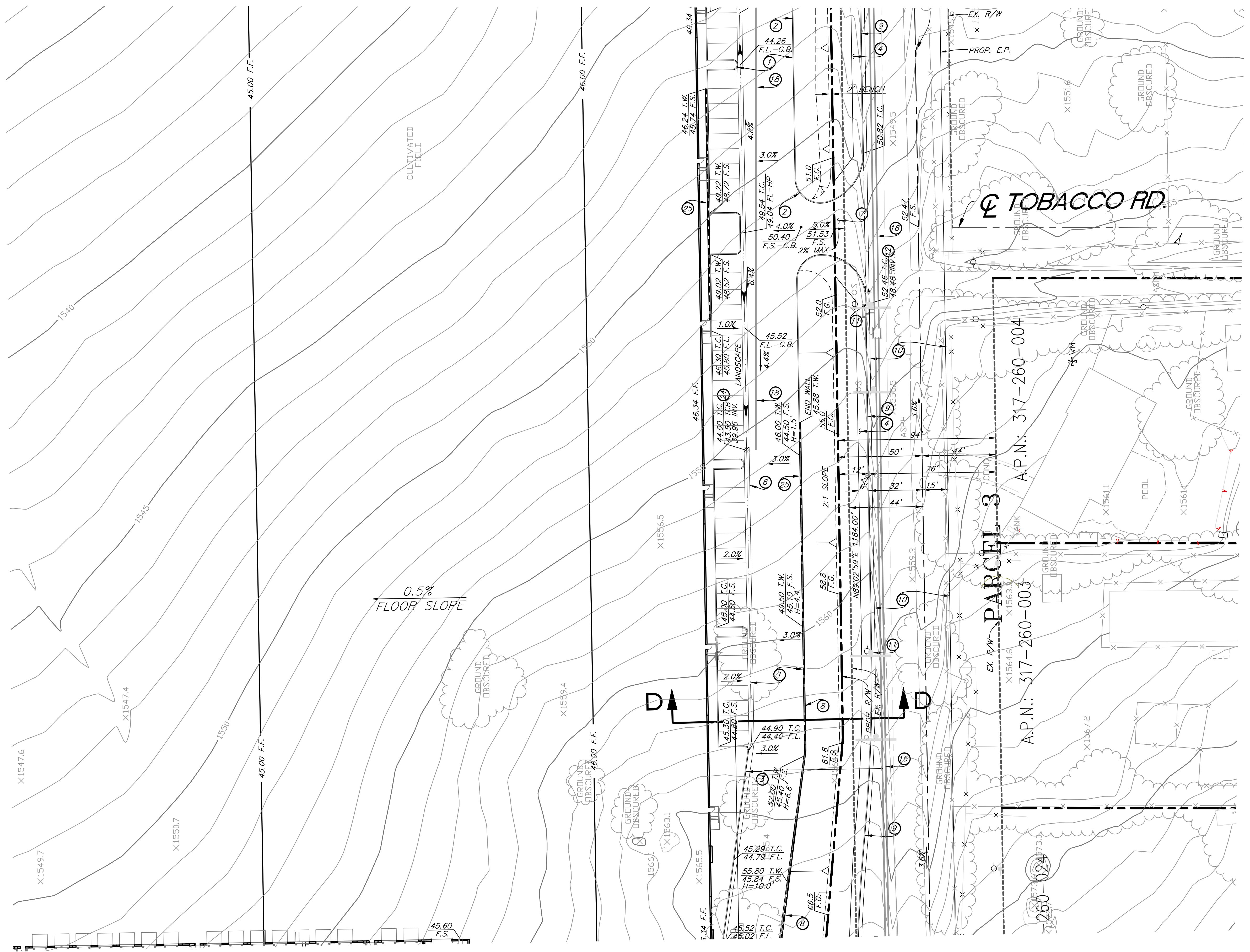
SEE SHEET 4



SEE SHEET 6

SEE SHEET 5

SEE SHEET 3



REG/CD	PLAN CHECK OVERSIGHT ENGINEER	REGISTRATION NUMBER	DATE SIGNED
--------	-------------------------------	---------------------	-------------

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MARK	BY	DATE	REVISIONS	APPR.	DATE

SEAL-ENGINEER

REGISTERED PROFESSIONAL ENGINEER

ROBERT C. VAN ZANTEN

No. 62325

Exp. 9-30-19

CIVIL

STATE OF CALIFORNIA

ENGINEERING COMPANY

SDH ASSOCIATES

SDH AND ASSOCIATES INC.

14060 Meridian Parkway 102

Riverside, California 92518

TEL: (951) 683-3691 FAX (951) 788-2314

PREPARED BY: **ROBERT VAN ZANTEN** R.C.E. NO. **62325**
 DATE **9-30-19**

BENCHMARK:
 ELEVATIONS SHOWN HEREON ARE BASED UPON THE N.G.S. BENCHMARK 01542, DESIGNATION "435". THE BENCHMARK IS LOCATED 1300' WEST OF THE AT&P RAILROAD ALONG ROYER STREET, ON TOP OF THE NORTH CURB FACE OF ROYER STREET, 20' NORTH OF ROYER STREET 4' SOUTH OF G.T.E. TELEPHONE BOX (DAMAGED). A STANDARD 3 1/4" ALUMINUM DISK SET FLUSH IN TOP OF CURB. ELEVATION 1515.12 FEET (DAND 88).

SCALE: H: 1"=30' V:

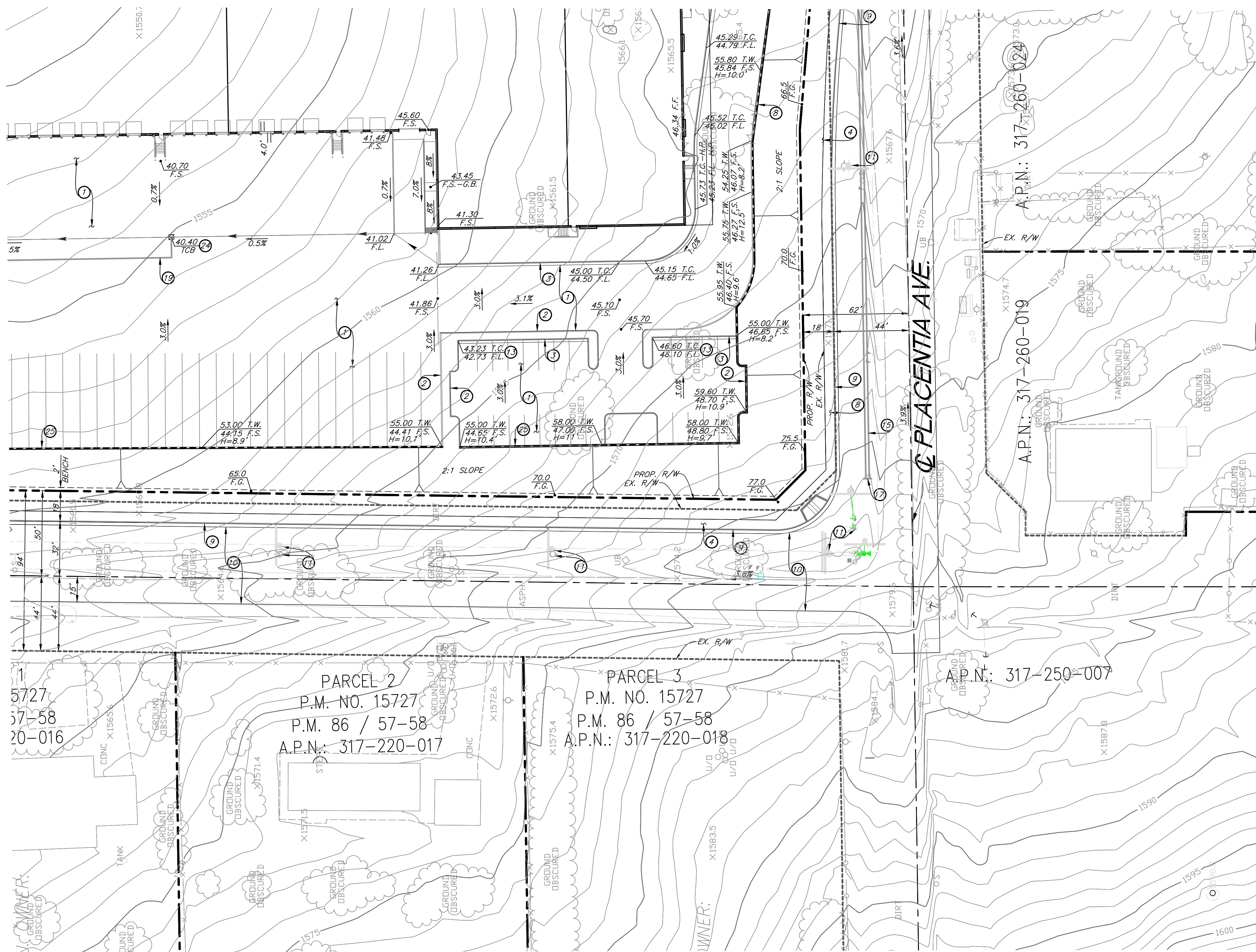
BARKER INDUSTRIAL
 PRELIMINARY GRADING PLAN

FOR: W.O. COUNTY FILE NO.

SHEET NO. **6**
 6 OF 8 SHTS

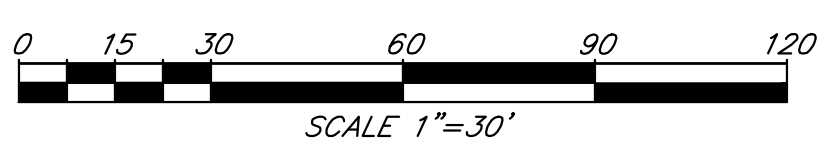
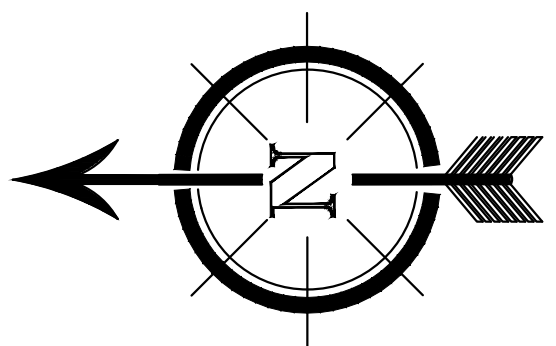
SEE SHEET 6

SEE SHEET 2



REG CD PLAN CHECK OVERSIGHT ENGINEER REGISTRATION NUMBER DATE SIGNED

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DIG ALERT
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MARK	BY	DATE	REVISIONS	APPR.	DATE

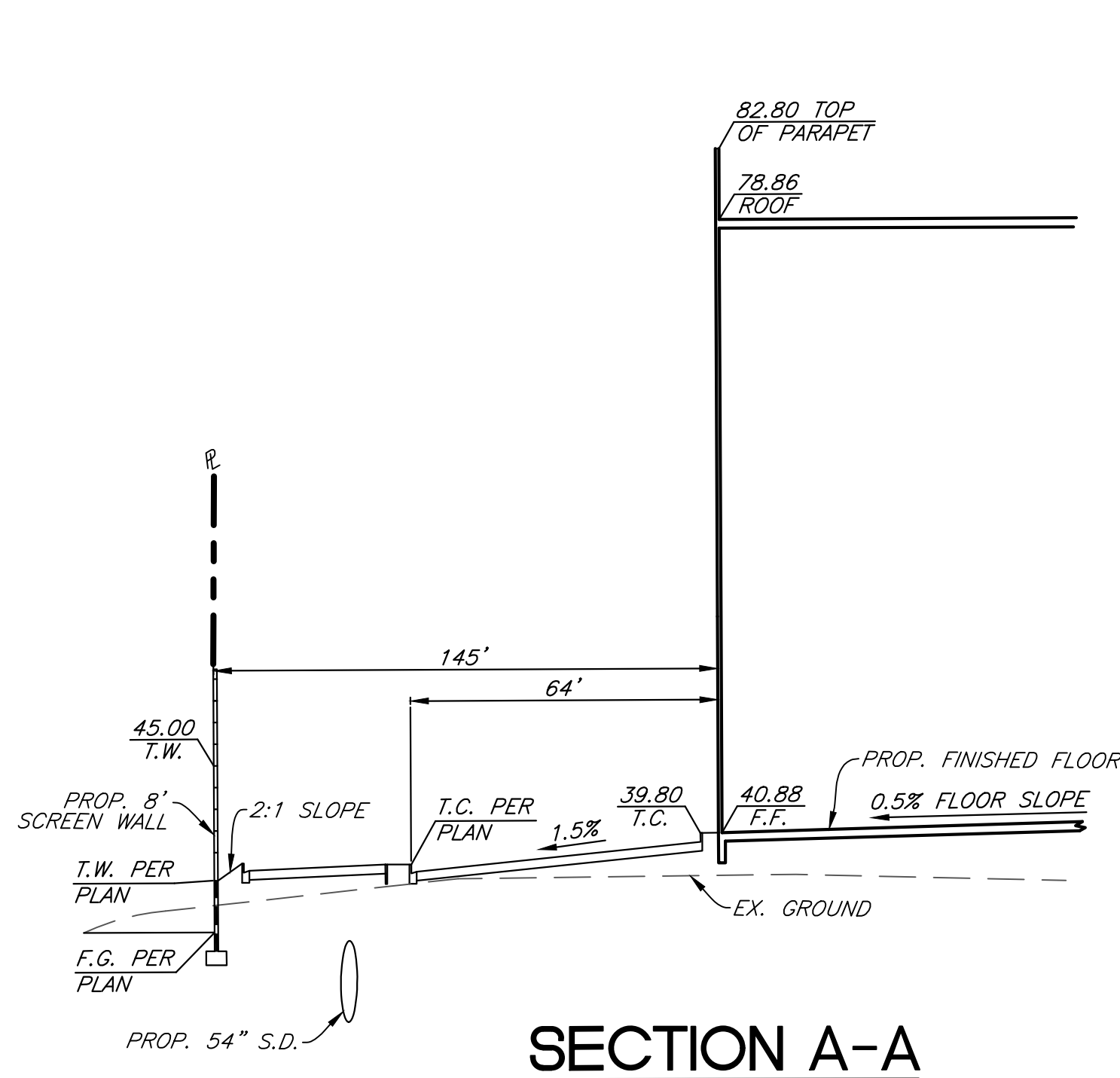
SEAL-ENGINEER
 REGISTERED PROFESSIONAL ENGINEER
 ROBERT VAN ZANTEN
 No. 62325
 Exp. 9-30-19
 CIVIL
 STATE OF CALIFORNIA

ENGINEERING COMPANY
SDH ASSOCIATES INCORPORATED
 SDH AND ASSOCIATES INC.
 14060 Meridian Parkway 102
 Riverside, California 92518
 TEL: (951) 683-3691 FAX (951) 788-2314
 PREPARED BY: ROBERT VAN ZANTEN
 R.C.E. NO. 62325
 DATE 9-30-19

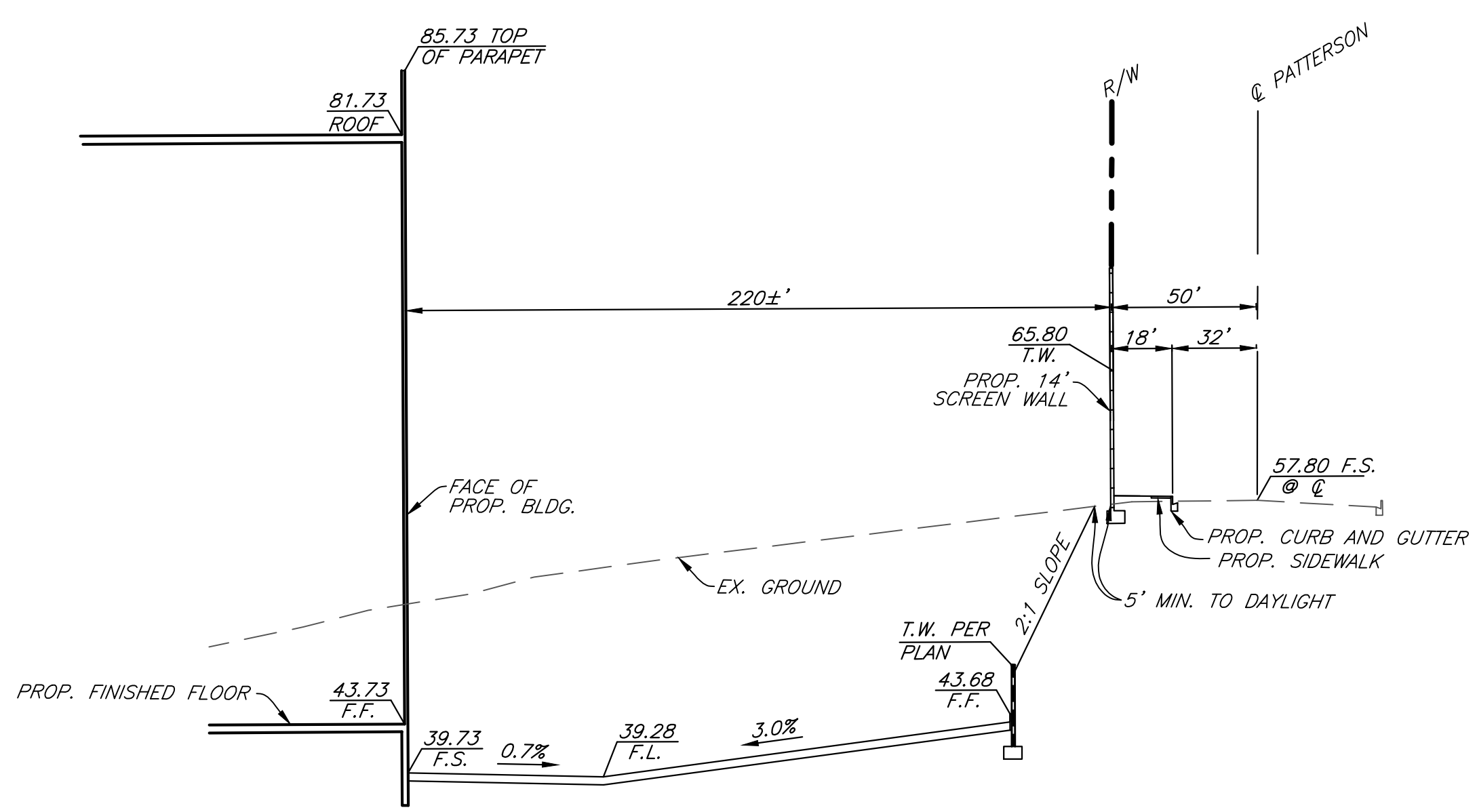
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 ELEVATIONS SHOWN HEREON ARE BASED UPON THE N.G.S. BENCHMARK DMS442, DESIGNATION "435". THE BENCHMARK IS LOCATED 1300' WEST OF THE AT&P RAILROAD ALONG RIDER STREET, ON TOP OF THE NORTH CURB FACE OF RIDER STREET, ON NORTH OF RIDER STREET, 4' SOUTH OF GTE TELEPHONE BOX (DAMAGED), A STANDARD 3 1/4" ALUMINUM DISK SET FLUSH IN TOP OF CURB, ELEVATION 1515.12 FEET (DWD 88).
 SCALE: H: 1"=30' V:

BARKER INDUSTRIAL PRELIMINARY GRADING PLAN
 FOR: W.O. COUNTY FILE NO.

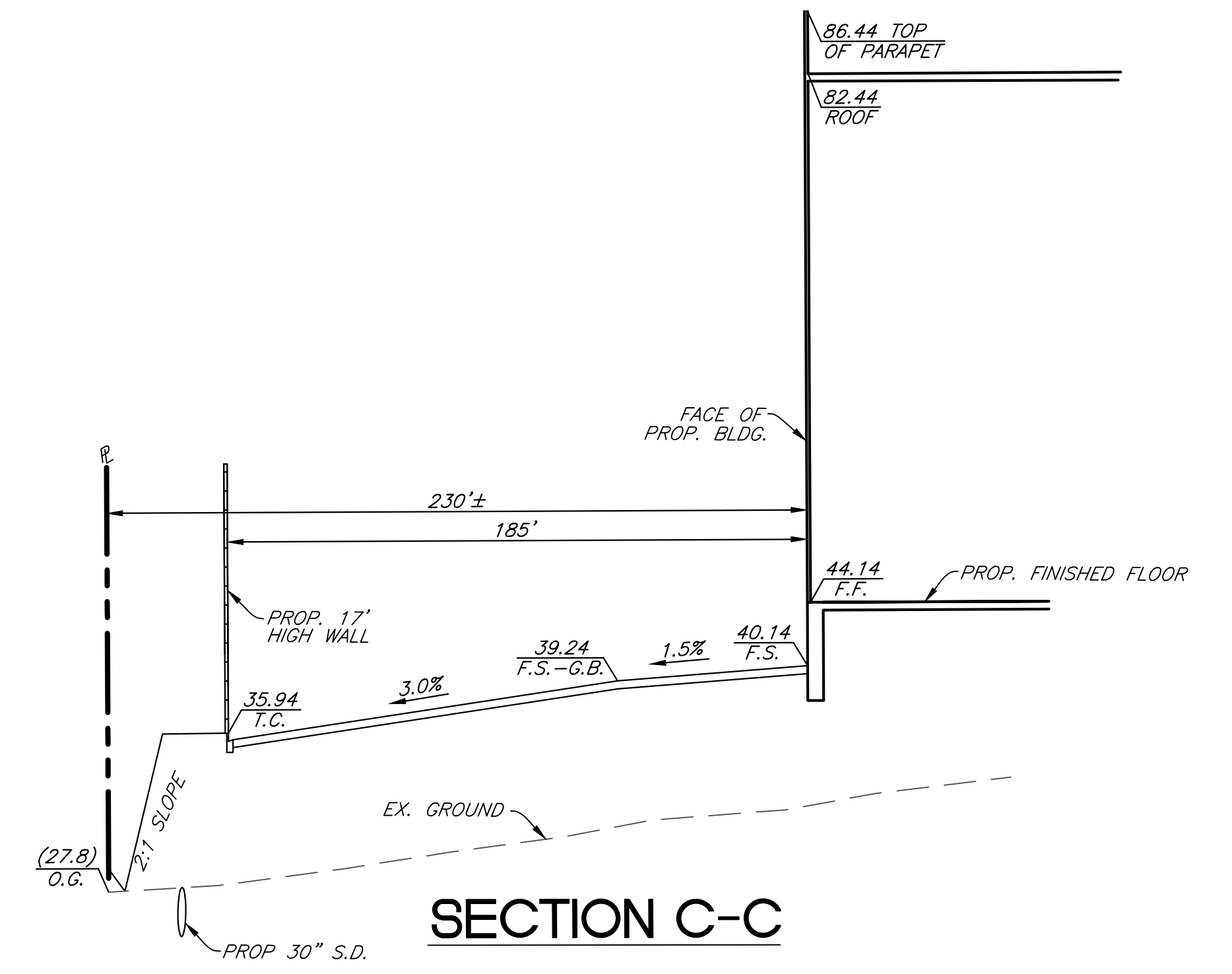
SHEET NO. **7**
 OF 8 SHTS



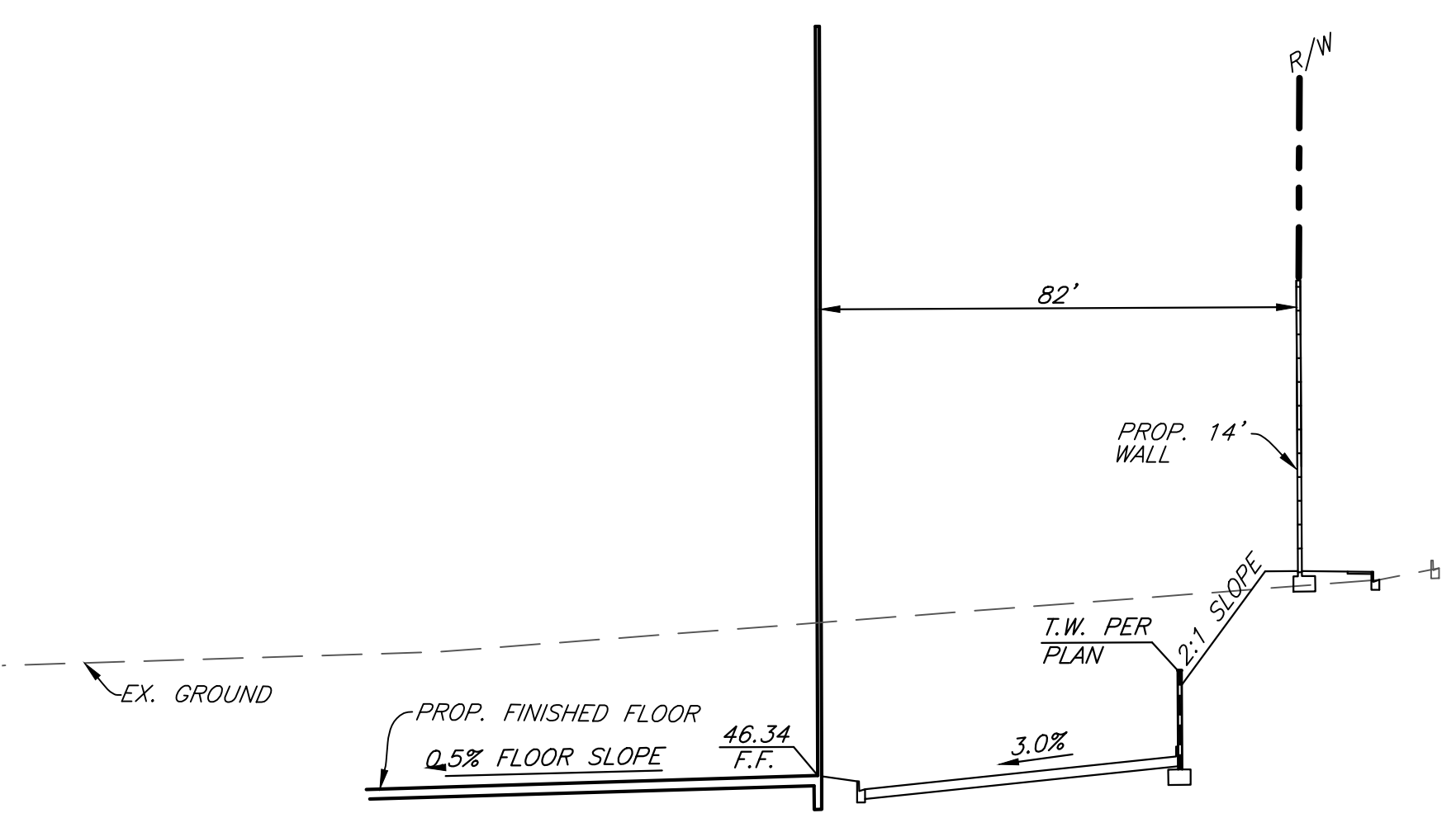
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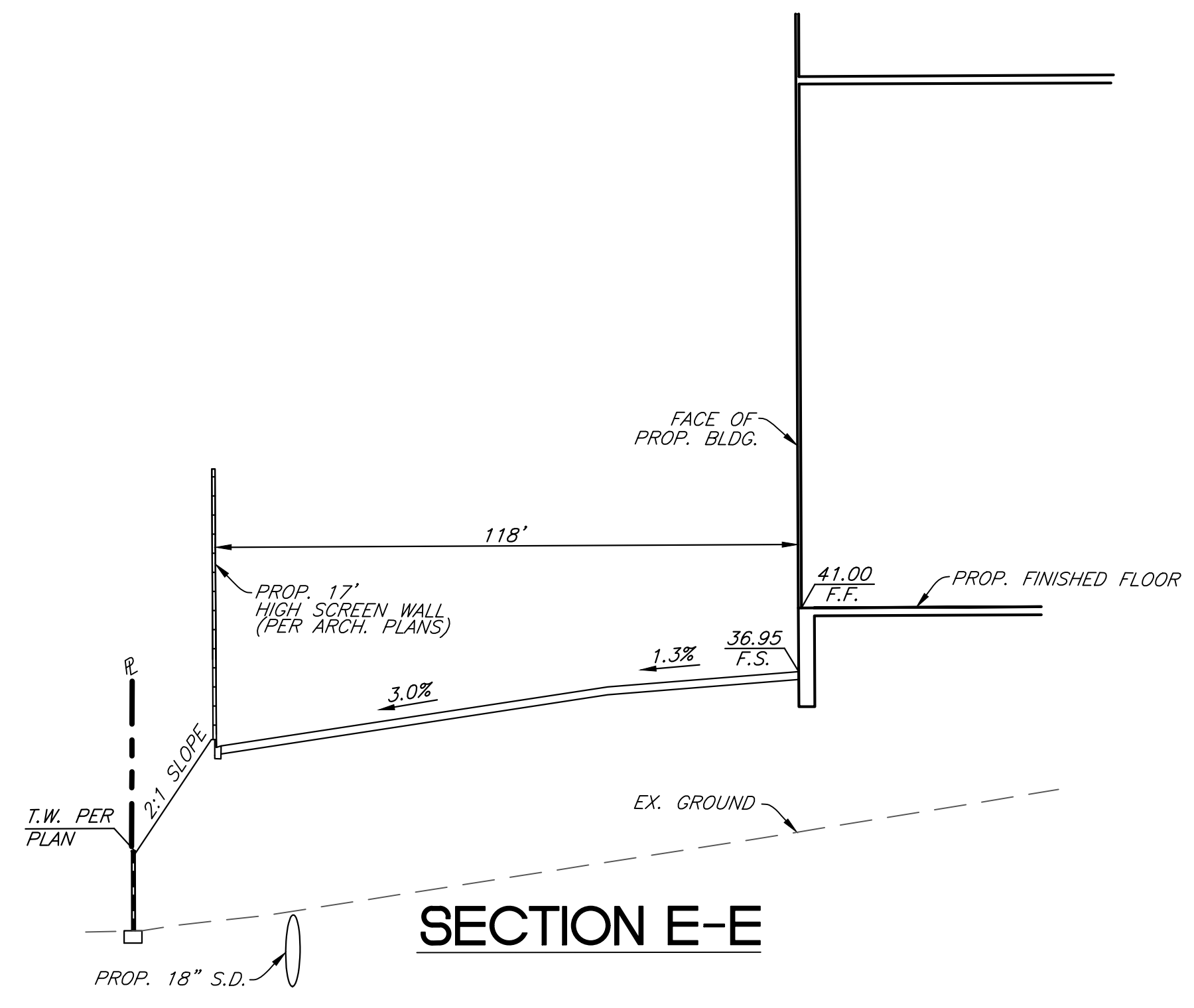
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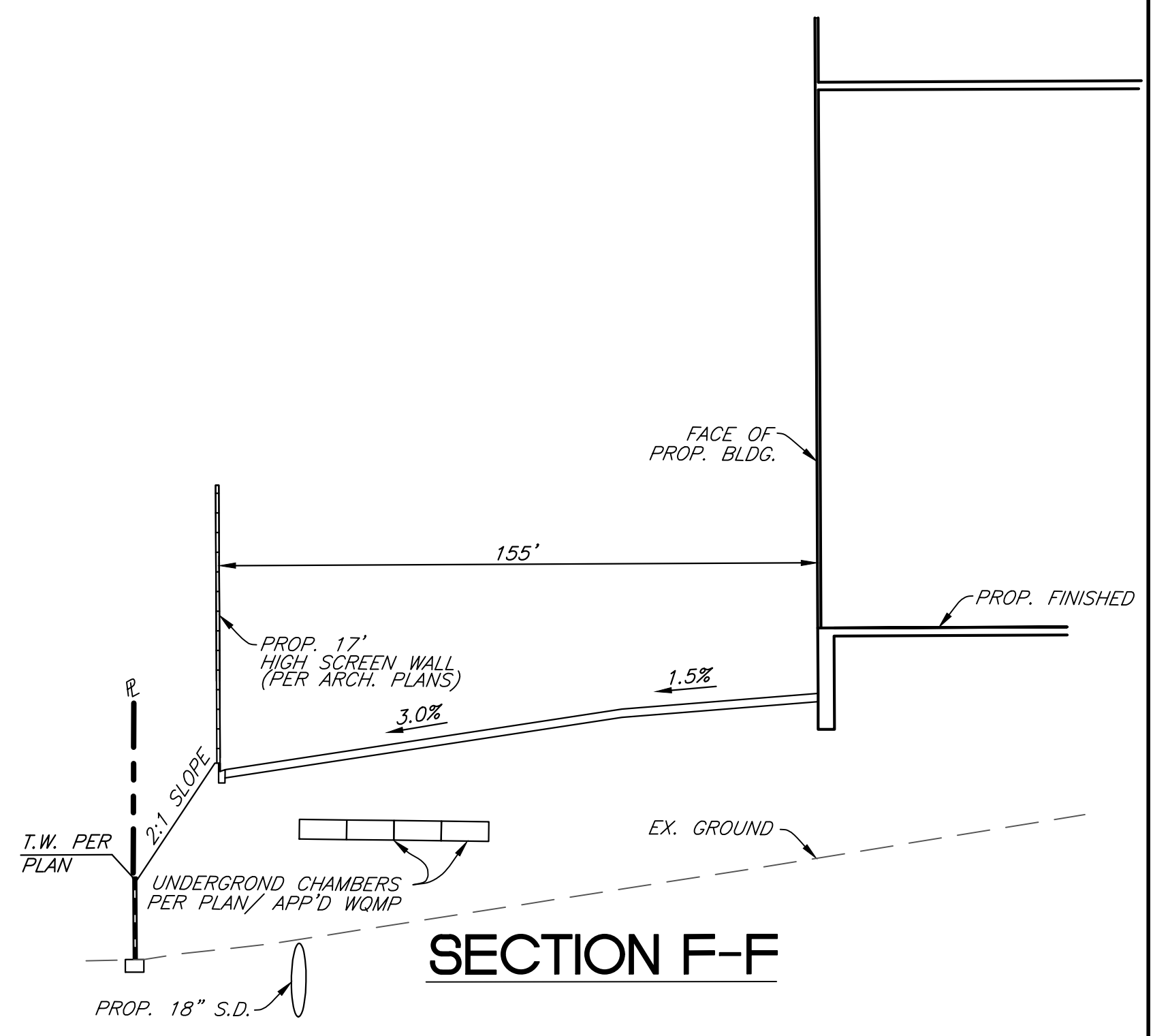
SECTION C-C



SECTION D-D



SECTION E-E



SECTION F-F

REG'D PLAN CHECK OVERSIGHT ENGINEER
 REGISTRATION NUMBER
 DATE SIGNED
 APPROVED AS TO CONFORMANCE WITH APPLICABLE COUNTY STANDARDS AND PRACTICES.

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The private engineer signing these plans is responsible for assuring the accuracy and acceptability of the design hereon. In the event of discrepancies arising after county approval or during construction, the private engineer shall be responsible for determining an acceptable solution and revising the plans for approval by the county.

MARK	BY	DATE	REVISIONS	APPR.	DATE

SEAL-ENGINEER

REGISTERED PROFESSIONAL ENGINEER

ROBERT C. VAN ZANTEN

No. 62325

Exp. 9-30-19

CIVIL

STATE OF CALIFORNIA

ENGINEERING COMPANY

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PREPARED BY: ROBERT VAN ZANTEN

R.C.E. NO. 62325

DATE 9-30-19

BENCHMARK:

ELEVATIONS SHOWN HEREON ARE BASED UPON THE N.G.S. BENCHMARK 035442, DESIGNATION: "435". THE BENCHMARK IS LOCATED 1300' WEST OF THE AT&P RAILROAD ALONG RIDER STREET, ON TOP OF THE NORTH CURB FACE OF RIDER STREET, 20' NORTH OF RIDER STREET, 4' SOUTH OF GTE TELEPHONE BOX (DAMAGED), A STANDARD 3 1/4" ALUMINUM DISK SET FLUSH IN TOP OF CURB. ELEVATION 1515.12 FEET (NAD 83).

BARKER INDUSTRIAL

SECTIONS AND DETAILS

FOR: _____ W.O. _____ COUNTY FILE NO. _____

SHEET NO. **8**

B OF 8 SHTS

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

**GEOTECHNICAL INVESTIGATION
AND PERCOLATION TEST RESULTS**

**BARKER LOGISTICS
WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF
PATTERSON AND
PLACENTIA AVENUES
MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA**



GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

**ORBIS REAL ESTATE PARTNERS
NEWPORT BEACH, CALIFORNIA**

**JANUARY 4, 2019
PROJECT NO. T2843-22-01**



Project No. T2843-22-01
January 4, 2019

Orbis Real Estate Partners
280 Newport Center Drive, Suite 240
Newport Beach, California 92660

Attention: Mr. Raymond Polverini

Subject: GEOTECHNICAL INVESTIGATION
AND PERCOLATION TEST RESULTS
BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON AND PLACENTIA AVENUES
MEAD VALLEY AREA, RIVERSIDE COUNTY CALIFORNIA

Dear Mr. Polverini:

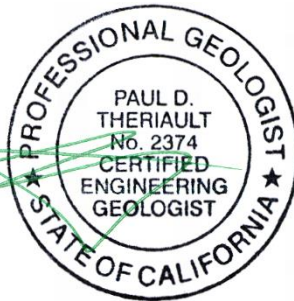
In accordance with your authorization of Proposal No. IE-2235, Geocon West Inc. (Geocon) herein submits the results of our geotechnical investigation and percolation test results for the subject site. The accompanying report presents the results of our study and conclusions and recommendations pertaining to the geotechnical aspects of the proposed warehouse project. The site is considered suitable for development provided the recommendations of this report are followed.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

Paul D. Theriault
CEG 2374



Chet E. Robinson
GE 2890



PDT:CER:LAB:hd

(e-mail) Addressee

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APPENDIX A

FIELD INVESTIGATION

- Figures A-1 through A-12, Logs of Borings
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LABORATORY TESTING

- Figure B-1, Laboratory Test Results
- Figures B-2 and B-3, Grain Size Distribution
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APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

GEOTECHNICAL INVESTIGATION AND PERCOLATION TEST RESULTS

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical investigation and percolation tests for the planned warehouse development located northeast of the intersection of Patterson and Placentia Avenues in the Mead Valley area of Riverside County, California (see *Vicinity Map*, Figure 1). The purposes of the geotechnical investigation and percolation testing are to evaluate the surface and subsurface soil conditions and general site geology, and to identify geotechnical constraints that may affect development of the property including faulting, liquefaction and seismic shaking based on the 2016 CBC seismic design criteria. In addition, we provided recommendations for remedial grading, shallow foundations, concrete slab-on-grade, concrete flatwork, preliminary pavement, lateral loading and retaining walls. This investigation also included a review of readily available published and unpublished geologic literature (see *List of References*).

The scope of this investigation included performing a site reconnaissance, field exploration, engineering analyses, and preparing this report. We performed our field investigation on November 26 and 27, 2018 by drilling twelve small-diameter borings to a maximum depth of approximately 46 feet below the existing ground surface. Five of the borings were used to perform percolation testing. The *Geologic Map*, Figures 2 and 3, presents the approximate locations of the borings. *Appendix A* provides a detailed discussion of the field investigation including logs of the borings and percolation test results. Details of the laboratory tests and a summary of the test results are presented in *Appendix B* and on the boring logs in *Appendix A*.

Recommendations presented herein are based on analyses of data obtained from our site investigation and our understanding of proposed site development. References reviewed to prepare this report are provided in the *List of References*. If project details vary significantly from those described herein, Geocon should be contacted to evaluate the necessity for review and possible revision of this report.

2. SITE AND PROJECT DESCRIPTION

The subject site is located at the northeast corner of Patterson and Placentia Avenues, in the Mead Valley area of Riverside County, California. The site is bounded on the west and south by Patterson and Placentia Avenues, respectively, and on the east and north by existing residential and commercial properties. The site is currently vacant and appears to be periodically disked for weed abatement. There are some trees in the south. Access to the property is from Placentia and Patterson Avenues. The existing grades range from approximate elevation 1,577 feet above Mean Sea Level (MSL) in the southwest corner to 1,521 feet above MSL in the northeast corner. The site is at latitude 33.82497 and longitude -117.25094.

Based on the *Conceptual Site Plan* prepared by HPA Architecture, we understand that the proposed construction consists of a 669,630 square foot warehouse, with associated parking and infrastructure. Based on the *Preliminary Grading Plan* prepared by SDH and Associates, cuts and fills of approximately 16 and 15 feet, respectively are planned to achieve proposed finished grades. A cut slope with varying heights of approximately 5 to 24 feet and inclined at 2:1 (horizontal:vertical) is planned along Patterson Avenue.

We expect that the construction will include a concrete cast-in-place or tilt-up building supported on spread footing foundations and with a concrete slab-on-grade floor. We expect column loads will be up to 100 kips and wall loads will be up to 10 kips per linear foot. Preliminary geotechnical recommendations for design of the structure are based on these assumptions and provided herein.

The site descriptions and proposed development are based on a site reconnaissance, review of published geologic literature, our field investigation, a review of the preliminary grading plans, and discussions with you. If development plans differ from those described herein, Geocon should be contacted for review of the plans and possible revisions to this report.

3. GEOLOGIC SETTING

The site is located within in the Perris block of the northern Peninsular Ranges Geomorphic Province (Province), defined as a relatively stable area between the Elsinore and San Jacinto fault zones. In the vicinity of the site, the geomorphology is massive granitic bedrock and older alluvial fan deposits. The Peninsular Ranges are bounded by the Transverse Ranges (San Gabriel and San Bernardino Mountains) to the north and the Colorado Desert Geomorphic Province to the east. The Peninsular Ranges Geomorphic Province extends westward into the Pacific Ocean and southward to the tip of Baja California. Overall, the Province is characterized by Cretaceous-age granitic rock and a lesser amount of Mesozoic-age metamorphic rock overlain by terrestrial and marine sediments. Faulting within the Province is typically northwest trending and includes the San Andreas, San Jacinto, Elsinore, and Newport-Inglewood faults.

The San Jacinto and Elsinore fault zones are located approximately 10.2 and 12.4 miles to the northeast and southwest, respectively. Geologic units within the site consist of very old alluvial fan deposits overlying granitic bedrock of the Val Verde Tonalite.

4. SOIL AND GEOLOGIC CONDITIONS

We observed very old alluvial fan deposits with a thin mantle of overlying topsoil and Val Verde Tonalite at depth during our field investigation. The occurrence, distribution and description of the geologic units encountered are shown on the *Geologic Map*, Figures 2 and 3 and the boring logs in *Appendix A*. The surficial soils and geologic units are described herein in order of increasing age.

4.1 Topsoil (No Map Symbol)

Topsoil was observed in the top ½ to 2½ feet all the borings during our geotechnical investigation. As observed, the topsoil, the consists of loose, dry, silty sand. Topsoil is predominately older alluvium that has been tilled.

4.2 Very Old Alluvial Fan Deposits (Qvof)

Very old alluvium was observed underlying the topsoil through the site. As observed, the older alluvium consists predominately of dry to moist, medium dense to very dense silty sand. Lesser amounts of clayey sand and sandy silt was also encountered.

4.3 Val Verde Tonalite (Kvt)

Val Verde Tonalite was encountered underlying the older alluvium in boring B-7. This granitic bedrock is weathered, strong, coarse-grained, grayish brown, and micaceous. The tonalite excavated as gravelly sand. Drilling within the bedrock was difficult.

5. GROUNDWATER

We did not encounter groundwater or seepage during the site investigation. According to the California Department of Water Resources, several wells in the area indicated a depth to groundwater of between 75 and 80 feet below the existing ground surface. It is not uncommon for seepage conditions to develop where none previously existed. Groundwater and seepage are dependent on seasonal precipitation, irrigation, land use, among other factors, and varies as a result. Proper surface drainage will be important to future performance of the project.

6. GEOLOGIC HAZARDS

6.1 Faulting

The numerous faults in southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (Bryant and Hart, 2007). By definition, an active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a currently established State of California Alquist-Priolo Earthquake Fault Zone or a Riverside County Fault Hazard Zone for surface fault rupture hazards. No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site.

According to the *Fault Activity Map of California* (2010), 25 known active faults are located within a search radius of 50 miles from the property. The nearest known active fault is the Glen Ivy segment of the Elsinore fault, located approximately 11 miles west of the site, and is the dominant source of potential ground motion. Earthquakes that might occur on these fault zones or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. Table 6.1.1 lists the estimated maximum earthquake magnitude for the most dominant faults in relationship to the site location.

**TABLE 6.1.1
KNOWN ACTIVE FAULTS WITHIN 50 MILES OF THE SITE**

Fault Name	Maximum Earthquake Magnitude (Mw)	Distance from Site (miles)	Direction from Site
Elsinore Fault (Glen Ivy)	6.8	11	W
San Jacinto (Casa Loma)	6.9	12	E
Elsinore (Wildomar)	6.8	13	S
San Jacinto (Claremont)	6.7	13	E
San Andreas (San Bernardino)	7.5	16	N
Chino	6.7	20	NW
San Geronio Pass	n/a	23	ENE
San Jacinto (Glen Helen)	6.7	24	N
San Jacinto (Clark)	7.2	24	SE
Whittier	6.8	25	NW
Cucamonga	6.9	28	NNW
Pinto Mountain	7.2	36	NE
San Andreas Fault (North Branch)	7.4	37	ENE
San Andreas Fault (South Branch)	7.5	37	E
Morongo Valley	7.2	41	NE
North Frontal Thrust	7.2	42	NNE
Newport-Inglewood-Rose Canyon	7.1	43	SW
Helendale	7.3	46	NNE
Burnt Mountain	6.5	48	ENE

Historic earthquakes in southern California of magnitude 6.0 and greater, their magnitude, distance, and direction from the site are listed in Table 6.1.2.

**TABLE 6.1.2
HISTORIC EARTHQUAKE EVENTS WITH RESPECT TO THE SITE**

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto	December 25, 1899	6.7	15	ESE
San Jacinto	April 21, 1918	6.8	15	ESE
Loma Linda Area	July 22, 1923	6.3	12	N
Long Beach	March 10, 1933	6.4	44	WSW
Buck Ridge	March 25, 1937	6.0	64	ESE
Imperial Valley	May 18, 1940	6.9	57	ENE
Desert Hot Springs	December 4, 1948	6.0	50	E
Arroyo Salada	March 19, 1954	6.4	77	ESE
Borrego Mountain	April 8, 1968	6.5	83	ESE
San Fernando	February 9, 1971	6.6	83	WNW
Joshua Tree	April 22, 1992	6.1	59	E
Landers	June 28, 1992	7.3	57	ENE
Big Bear	June 28, 1992	6.4	37	NE
Northridge	January 17, 1994	6.7	85	WNW
Hector Mine	October 16, 1999	7.1	82	NE

6.2 Ground Rupture

Ground surface rupture occurs when movement along a fault is sufficient to cause a gap or rupture where the upper edge of the fault zone intersects the earth surface. The potential for ground rupture is considered to be very low due to the absence of active or potentially active faults at the subject site.

6.3 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless or silt/clay with low plasticity, groundwater is encountered within 50 feet of the surface, and soil has a relative density less than about 70 percent. If the four previous criteria are met, a seismic event could result in a rapid pore water pressure increase from the earthquake-generated ground accelerations. Due to the lack of a permanent, near-surface groundwater table and the dense to very dense nature of the old alluvial fan deposits, liquefaction potential for the site is negligible and not a design consideration.

6.4 Expansive Soil

The older alluvium generally consists of silty or clayey sands with lesser amounts of sandy silts and sandy clays. Laboratory testing results indicate samples of the near surface soils exhibits a “very low” expansion potential (expansion index [EI] of 20 or less) with test results showing expansion indices of 3 and 15.

6.5 Hydrocompression

Hydrocompression is the tendency of unsaturated soil structure to collapse upon wetting resulting in the overall settlement of the affected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and recompacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydrocompression of the soil exists.

Soils obtained during our investigation were tested for hydrocompression and exhibited a collapse potential of 1.2 to 1.7 percent when loaded to the expected post-grading pressures. The test results indicate that the soils are classified as having a “slight” (0.1 to 2.0 percent) degree of specimen collapse in accordance with ASTM D5333.

6.6 Seiches and Tsunamis

Seiches are caused by the movement of an inland body of water due to the movement from seismic forces. The site is located approximately 3.8 miles southwest of Lake Perris. In the unlikely event of a seiche, water is anticipated to be confined to the young alluvial valley channel east of Interstate 215.

A tsunami is a series of long-period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The site is located approximately 36 miles from the Pacific Ocean at an elevation greater than 1,500 feet MSL. Therefore, the risk of tsunamis affecting the site is negligible and not a design consideration.

6.7 Inundation

According to the State of California, Department of Water Resources, Inundation Map for Perris Dam, dated April 29, 1975, the site is not within an inundation zone due to dam failure. Therefore, inundation due to dam failure is not a design consideration.

6.8 Landslides

Landslides are not mapped on or near the site. Due to the relatively level topography at the site, we opine that landslides are not present at the property or at a location that could impact the subject site.

6.9 Rock Fall Hazards

Rock falls are not a design consideration due to the lack of natural bedrock slopes above and adjacent to the site.

6.10 Slope Stability

Based on the preliminary site plans, cut and fill slopes will be 30 feet or less at inclinations no steeper than 2:1 (h:v). In general, permanent, cut slopes and graded fill slopes constructed with on-site soils inclined no steeper than 2:1 (h:v) with vertical heights of 30 feet or less will possess Factors of Safety of 1.5 or greater under static loading, 1.1 or greater under pseudo-static loading, and 1.5 or greater for surficial stability (see Figures 3 to 5). Fill keys should be constructed in accordance with the standard grading specifications in *Appendix C*. Grading of fill slopes should be designed in accordance with the requirements of Riverside County and the 2016 California Building Code (CBC).

7. SITE INFILTRATION

Percolation testing was performed in accordance with the procedures in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A*. The percolation test locations are depicted on the *Geologic Map* (see Figures 2 and 3).

A 3-inch diameter perforated PVC pipe in silt filter sock was placed in each percolation test hole and approximately 2 inches of gravel was placed at the bottom of the PVC pipe. The test locations were pre-saturated prior to testing. Percolation testing was begun within 24 hours after the holes were presaturated. Percolation data sheets are presented in *Appendix A* of this report. Calculations to convert the percolation test rate to infiltration test rates are presented in Table 7.0 below. Note that the Handbook requires a factor of safety of 3 be applied to the values below based on the test method used.

**TABLE 7.0
INFILTRATION TEST RATES FOR PERCOLATION AREAS**

Parameter	P-1	P-2	P-3	P-4	P-5
Depth (inches)	37.2	81.6	104.4	115.2	117.6
Test Type	Normal	Normal	Normal	Normal	Normal
Change in head over time: ΔH (inches)	1.2	4.8	4.8	0.6	9.6
Average head: H_{avg} (inches)	11.4	9.6	9.6	12.9	9.0
Time Interval (minutes): Δt (minutes)	30	30	30	30	30
Radius of test hole: r (inches)	4	4	4	4	4
Tested Infiltration Rate: I_t (inches/hour)	0.36	1.66	1.66	0.16	3.49

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

- 8.1.1 From a geotechnical engineering standpoint, the site is suitable for construction of the proposed warehouse development provided the recommendations presented herein are implemented in design and construction of the project.
- 8.1.2 Potential geologic hazards at the site include seismic shaking and hydrocompression.
- 8.1.3 The site is located approximately 11 miles from the nearest active fault. Based on our background research and previous investigation, it is our opinion active, potentially active, or inactive faults do not extend across the site. Risks associated with seismic activity consist of the potential for moderate to strong seismic shaking.
- 8.1.4 Our field investigation indicates the site is blanketed by topsoil and underlain by very old alluvium and granitic bedrock. The topsoil and upper portion of the very old alluvium are not considered suitable for the support of compacted fill and settlement-sensitive structures. Remedial grading of the surficial soil will be required as discussed herein. The existing site soils are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed.
- 8.1.5 Moisture contents in the borings varied significantly between the silty sands and clayey sands and were well below optimum moisture content. Significant moisture conditioning of the soils should be expected during construction. Special handling of the soil should be anticipated, particularly if grading occurs during the rainy season.
- 8.1.6 Although the majority of on-site soils consist of silty and clayey sands, some granular material, having little to no cohesion and subject to caving in unshored excavations, should be expected at the site. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with OSHA rules and regulations to maintain the stability of adjacent existing improvements.
- 8.1.7 The laboratory tests indicate that the site soils are non-expansive and have a “very low” expansion potential. If medium to highly expansive soils are encountered at the site, they should be exported from the site or selectively graded and placed in the deeper fill areas to allow for the placement of low expansion material at the finish pad grade.
- 8.1.8 Based on the grading plan, cuts and fills ranging up to 16 feet and 15 feet, respectively are planned to achieve planned finish grades.

- 8.1.9 Consolidation testing of samples of the subsurface soils indicates that there is a potential for hydrocompression of the soils beneath the site. Remedial grading will address the collapse potential of the near-surface soils; however, precautionary measures will be needed to mitigate the potential for hydrocollapse of deeper soils. Proper site drainage should be maintained. Landscape planters that saturate the subsurface or stormwater infiltration structures should not be used within 20 feet of the proposed buildings or other on grade improvements. Localized surface settlement should be expected in the vicinity of the stormwater infiltration structures or other areas where water is allowed to infiltrate to the subsurface.
- 8.1.10 Although not encountered in our exploration, cobbles or corestones within the granitic bedrock may be encountered during site grading and may present difficulty for site excavations. The contractor should be prepared to perform site excavations in these conditions.
- 8.1.11 We did not encounter groundwater during our investigation and do not expect groundwater would impact site improvements. However, wet conditions and seepage could affect proposed construction if grading and improvement operations occur during or shortly after a rain event.
- 8.1.12 Proper drainage should be maintained in order to preserve the design properties of the fill in the sheet-graded pad and slope areas.
- 8.1.13 The planned structures can be supported on a shallow foundation system with a slab-on-grade floor system.
- 8.1.14 Changes in the design, location or elevation of improvements, as outlined in this report, should be reviewed by this office. Once final grading plans become available, they should be reviewed by this office to evaluate the necessity for review and possible revision of this report.
- 8.1.15 Recommended grading specifications are provided in *Appendix C*.

8.2 Excavation and Soil Characteristics

8.2.1 Excavation of the very old alluvium should be possible with moderate to heavy effort using conventional heavy-duty equipment. Some difficulty in excavation may be encountered within moderately cemented zones. Excavations extending into the granitic bedrock will require heavy ripping and rock breaking tools.

8.2.2 The soil encountered in the field investigation is considered to be “non-expansive” (expansion index [EI] of less than 20) as defined by 2016 California Building Code (CBC) Section 1803.5.3. Table 8.2.2 presents soil classifications based on the expansion index. Based on the laboratory test results, we expect a majority of the soil encountered will possess a “very low” to “low” expansion potential (EI between 0 and 50). Medium to highly expansive soils may be encountered at the site and should not be placed within 4 feet of the proposed foundations, flatwork or paving improvements. Additional testing for expansion potential should be performed during grading and once final grades are achieved.

**TABLE 8.2.2
EXPANSION CLASSIFICATION BASED ON EXPANSION INDEX**

Expansion Index (EI)	ASTM D 4829 Expansion Classification	2016 CBC Expansion Classification
0 – 20	Very Low	Non-Expansive
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.3 We performed laboratory tests on samples of the site materials to evaluate the percentage of water-soluble sulfate content. *Appendix B* presents results of the laboratory water-soluble sulfate content tests. The test results indicate the on-site materials at the location tested possess a sulfate content of 0.009 percent (90 parts per million [ppm]) equating to an exposure class of “S0” as defined by 2016 CBC Section 1904.3 and ACI 318. Table 8.2.3 presents a summary of concrete requirements set forth by 2016 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

**TABLE 8.2.3
REQUIREMENTS FOR CONCRETE EXPOSED TO
SULFATE-CONTAINING SOLUTIONS**

Exposure Class	Water-Soluble Sulfate (SO₄) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight¹	Minimum Compressive Strength (psi)
S0	SO₄<0.10	No Type Restriction	n/a	2,500
S1	0.10≤SO ₄ <0.20	II	0.50	4,000
S2	0.20≤SO ₄ ≤2.00	V	0.45	4,500
S3	SO ₄ >2.00	V+Pozzolan or Slag	0.45	4,500

¹ Maximum water to cement ratio limits do not apply to lightweight concrete

8.2.4 Laboratory testing indicates the site soils have a minimum electrical resistivity of 1,900 ohm-cm, possess 75 ppm chloride, 90 ppm sulfate, and a pH of 8.0. As shown in Table 8.2.4 below, the site would not be classified as “corrosive” to buried improvements, in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2018).

**TABLE 8.2.4
CALTRANS CORROSION GUIDELINES**

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,100	500 or greater	1,500 or greater	5.5 or less

8.2.5 Geocon does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer may be performed if improvements that could be susceptible to corrosion are planned.

8.3 Seismic Design Criteria

8.3.1 We used the computer program *U.S. Seismic Design Maps*, provided by the California Office of Statewide Health Planning and Development (OSHPD) to evaluate the seismic design criteria. Table 8.3.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements as currently proposed should be designed using a Site Class C in accordance with ASCE 7-10 Section 20.3.1. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10 using blow count data presented on the boring logs in *Appendix A*. The values presented in Table 8.3.1 are for the risk-targeted maximum considered earthquake (MCE_R).

**TABLE 8.3.1
2016 CBC SEISMIC DESIGN PARAMETERS**

Parameter	Value	2016 CBC Reference
Site Class	C	Section 1613.3.2
MCE _R Ground Motion Spectral Response Acceleration – Class B (short), S _S	1.50g	Figure 1613.3.1(1)
MCE _R Ground Motion Spectral Response Acceleration – Class B (1 sec), S ₁	0.60g	Figure 1613.3.1(2)
Site Coefficient, F _A	1.00	Table 1613.3.3(1)
Site Coefficient, F _V	1.30	Table 1613.3.3(2)
Site Class Modified MCE _R Spectral Response Acceleration (short), S _{MS}	1.50g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE _R Spectral Response Acceleration (1 sec), S _{M1}	0.78g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S _{DS}	1.00g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S _{D1}	0.52g	Section 1613.3.4 (Eqn 16-40)

8.3.2 Table 8.3.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

**TABLE 8.3.2
2016 CBC SITE ACCELERATION PARAMETERS**

Parameter	Value	ASCE 7-10 Reference
Site Class	C	Section 1613.3.2
Mapped MCE _G Peak Ground Acceleration, PGA	0.50g	Figures 2 through 42-7
Site Coefficient, F _{PGA}	1.00	Table 11.8-1
Site Class Modified MCE _G Peak Ground Acceleration, PGA _M	0.50g	Section 11.8.3 (Eqn 11.8-1)

8.3.3 Conformance to the criteria in Tables 8.3.1 and 8.3.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.4 Temporary Excavations

- 8.4.1 The recommendations included herein are provided for temporary excavations. It is the responsibility of the contractor to provide a safe excavation during the construction of the proposed project.
- 8.4.2 Excavations on the order of 5 to 15 feet in vertical height are expected during grading operations and utility installation. The contractor's competent person should evaluate the necessity for lay back of vertical cut areas. Vertical excavations up to 5 feet may be attempted where loose soils or caving sands are not present, and where not surcharged by existing structures or vehicle/construction equipment loads.
- 8.4.3 Vertical excavations greater than 5 feet will require sloping measures in order to provide a stable excavation. We expect that sufficient space is available to complete the majority of the required earthwork for this project using sloping measures. If necessary, compound excavation, slot-cutting, and or shoring recommendations will be provided in an addendum.
- 8.4.4 Where sufficient space is available, temporary unsurcharged embankments may be sloped back at a uniform 1.5:1 (h:v) slope gradient or flatter. A uniform slope does not have a vertical portion.
- 8.4.5 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's personnel should inspect the soil exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur. Excavations should be stabilized within 30 days of initial excavation.

8.5 Grading

- 8.5.1 Grading should be performed in accordance with the recommendations provided in this report, the *Recommended Grading Specifications* contained in *Appendix C* and Riverside County Standards.
- 8.5.2 Prior to commencing grading, a pre-construction conference should be held at the site with the owner/developer, city inspector, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling requirements can be discussed at that time.

- 8.5.3 Site preparation should begin with the removal of previous structures and infrastructure, deleterious material, debris, buried trash, and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.
- 8.5.4 Topsoil and the upper portion of the very old alluvium in the building areas should be removed to expose competent older alluvium. Based on our findings, we expect the existing soils within approximately 5 feet of the existing ground surface will require remedial excavation and proper compaction. Areas of loose, dry, or compressible soils will require additional excavation and processing prior to fill placement. Removals should extend at least 3 feet below the bottom of the planned foundations, and the excavations should be extended laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Where the lateral over-excavation is not possible, structural setbacks or deepened footings may be required.
- 8.5.5 Removals in pavement and walkway areas should extend at least 2 feet beneath the pavement or flatwork subgrade elevation.
- 8.5.6 The actual depth of removal should be evaluated by the engineering geologist during grading operations. Deeper excavations may be required if dry, loose, soft, or porous materials are present at the base of the removals. The bottom of the excavations should be scarified to a depth of at least 1 foot, moisture conditioned as necessary, and properly compacted.
- 8.5.7 The site should then be brought to final subgrade elevations with fill compacted in layers. In general, soil native to the site is suitable for use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be about 6 to 8 inches in loose thickness and no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 90 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content, as determined in accordance with ASTM D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill. The upper 12 inches of subgrade soil underlying pavement should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content shortly before paving operations.

- 8.5.8 Import fill soil (if necessary) should consist of granular materials with a “very low” expansion potential (EI of less than 20), free of deleterious material and rock fragments larger than 6 inches and should be compacted as recommended herein. Geocon should be notified of the import soil source and should perform laboratory testing of import soil prior to its arrival at the site to determine its suitability as fill material.
- 8.5.9 Foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing fill, steel, gravel or concrete.

8.6 Utility Trench Backfill

- 8.6.1 Utility trenches should be properly backfilled in accordance with the requirements of Riverside County and the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook). The pipes should be bedded with well graded crushed rock or clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). We recommend that jetting only be performed if trench wall soils have an SE of 15 or greater. The use of well graded crushed rock is only acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. Backfill of utility trenches should not contain rocks greater than 3 inches in diameter. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized and additional stabilization should be considered at these transitions.
- 8.6.2 Trench excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing bedding materials, fill, gravel, or concrete.

8.7 Earthwork Grading Factors

- 8.7.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates very approximate. As an example, the contractor can compact the fill to a dry density of 90 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Based on our experience and the densities measured during our investigation, the shrinkage of onsite topsoil is expected to be on the order of 15 to 20 percent. Shrinkage of older alluvium soil is

expected to be on the order of 0 to 10 percent when compacted to at least 90 percent of the laboratory maximum dry density. This estimate is for preliminary quantity estimates only. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations

8.8 Foundation and Concrete Slab-On-Grade Recommendations

- 8.8.1 The foundation recommendations presented herein are for the proposed buildings subsequent to the recommended grading assuming that the buildings are founded in soils with a low expansion potential. If soils with a medium or high expansion potential are placed within 4 feet of finish grade, then Geocon should be contacted for additional recommendations. The proposed structure can be supported on a shallow foundation system bearing in newly placed compacted fill.
- 8.8.2 Foundations for the structure should consist of either continuous strip footings and/or isolated spread footings. Continuous footings should be at least 18 inches wide and extend at least 18 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should also extend at least 18 inches below lowest adjacent pad grade. A wall/column footing dimension detail depicting footing embedment is provided on Figure 7.
- 8.8.3 From a geotechnical engineering standpoint, concrete slabs-on-grade for the structure should be at least 4 inches thick and be reinforced with at least No. 3 steel reinforcing bars placed 24 inches on center in both directions. The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slab for supporting equipment and storage loads. A thicker concrete slab may be required for heavier loading conditions. To reduce the effects of differential settlement on the foundation system, thickened slabs and/or an increase in steel reinforcement can provide a benefit to reduce concrete cracking.
- 8.8.4 Steel reinforcement for continuous footings should consist of at least two No. 4 steel reinforcing bars placed horizontally in the footings, one near the top and one near the bottom. Steel reinforcement for the spread footings should be designed by the project structural engineer.
- 8.8.5 The recommendations presented herein are based on soil characteristics only (EI of 50 or less) and are not intended to replace steel reinforcement required for structural considerations.

- 8.8.6 Foundations may be designed for an allowable soil bearing pressure of 4,000 pounds per square foot (psf) (dead plus live load). The value presented herein is for dead plus live loads and may be increased by one-third when considering transient loads due to wind or seismic forces.
- 8.8.7 The maximum expected static settlement for the planned structures supported on conventional foundation systems with the above allowable bearing pressure and deriving support in engineered fill is estimated to be 1 inch and to occur below the heaviest loaded structural element. Differential settlement is estimated to be on the order of ½ inch over a horizontal distance of 40 feet. Once the design and foundation loading configuration proceeds to a more finalized plan, the estimated settlements within this report should be reviewed and revised, if necessary
- 8.8.8 Once the design and foundation loading configuration proceeds to a more finalized plan, the estimated settlements within this report should be reviewed and revised, if necessary.
- 8.8.9 Slabs-on-grade that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder placed directly beneath the slab. The vapor retarder and acceptable permeance should be specified by the project architect or developer based on the type of floor covering that will be installed. The vapor retarder design should be consistent with the guidelines presented in Section 9.3 of the American Concrete Institute's (ACI) Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials (ACI 302.2R-06) and should be installed in general conformance with ASTM E1643 (latest edition) and the manufacturer's recommendations. A minimum thickness of 15 mils extruded polyolefin plastic is recommended; vapor retarders which contain recycled content or woven materials are not recommended. The vapor retarder should have a permeance of less than 0.01 perms demonstrated by testing before and after mandatory conditioning. The vapor retarder should be installed in direct contact with the concrete slab with proper perimeter seal. If the California Green Building Code requirements apply to this project, the vapor retarder should be underlain by 4 inches of clean aggregate. It is important that the vapor retarder be puncture resistant since it will be in direct contact with angular gravel. As an alternative to the clean aggregate suggested in the Green Building Code, the concrete slab-on-grade may be underlain by a vapor retarder over 4 inches of clean sand (sand equivalent greater than 30), since the sand will serve as a capillary break and will minimize the potential for punctures and damage to the vapor barrier.

- 8.8.10 The bedding sand thickness should be evaluated by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 4 inches. Placement of 3 inches and 4 inches of sand is common practice in southern California for 5-inch and 4-inch thick slabs, respectively. The foundation engineer should provide appropriate concrete mix design criteria and curing measures that may be utilized to assure proper curing of the slab to reduce the potential for rapid moisture loss and subsequent cracking and/or slab curl.
- 8.8.11 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisturized to maintain a moist condition as would be expected in any such concrete placement.
- 8.8.12 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil, or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.
- 8.8.13 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

8.9 Concrete Flatwork

- 8.9.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein. Slab panels should be a minimum of 4 inches thick and, when in excess of 8 feet square, should be reinforced with No. 3 reinforcing bars spaced 24 inches on center in each direction to reduce the potential for wide cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be checked prior to placing concrete.

- 8.9.2 Even with the incorporation of the recommendations within this report, the exterior concrete flatwork has a likelihood of experiencing some movement due to swelling or settlement; therefore, the steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork. Additionally, flatwork should be structurally connected to the curbs, where possible, to reduce the potential for offsets between the curbs and the flatwork.
- 8.9.3 Where exterior flatwork abuts structures at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stemwall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.
- 8.9.4 The recommendations presented herein are intended to reduce the potential for cracking as a result of differential movement. However, even with the incorporation of the recommendations presented herein, concrete will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.10 Conventional Retaining Walls

- 8.10.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 10 feet. In the event that walls higher than 10 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.
- 8.10.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2:1 (horizontal to vertical), an active soil pressure of 60 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 50 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

- 8.10.3 Unrestrained walls are those that are allowed to rotate more than $0.001H$ (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, walls with a level backfill surface should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 55 pcf.
- 8.10.4 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, proposed retaining walls in excess of 6 feet in height should be designed with seismic lateral pressure (Section 1803.5.12 of the 2016 CBC).
- 8.10.5 A seismic load of 10 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2016 CBC. The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. This seismic load should be applied in addition to the active earth pressure. The earth pressure is based on half of two-thirds of PGA_M calculated from ASCE 7-10 Section 11.8.3.
- 8.10.6 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.
- 8.10.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. A typical drain detail for each option is shown on Figure 8. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 20 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

8.10.8 Wall foundations should be designed in accordance with the above foundation recommendations.

8.11 Lateral Loading

8.11.1 To resist lateral loads, a passive pressure exerted by an equivalent fluid density of 350 pounds per cubic foot (pcf) should be used for the design of footings or shear keys. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

8.11.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.40 should be used for design. The friction coefficient may be reduced depending on the vapor barrier or waterproofing material used for construction in accordance with the manufacturer's recommendations.

8.11.3 The passive and frictional resistant loads can be combined for design purposes. The lateral passive pressures may be increased by one-third when considering transient loads due to wind or seismic forces.

8.12 Preliminary Pavement Recommendations

8.12.1 We calculated the flexible pavement sections in general conformance with the *Caltrans Method of Flexible Pavement Design* (Highway Design Manual, Section 608.4) and County of Riverside specifications using a range of Traffic Indices. The project civil engineer and owner should evaluate the final Traffic Index for the pavements and review the pavement designations to determine appropriate locations for pavement thickness. Based on the laboratory testing of the onsite soils, we have used a preliminary R-value of 50 (the maximum allowable by Caltrans Design Manual) for the subgrade soils for the purposes of this analysis. The final pavement sections should be based on the R-value of the subgrade soil encountered at final subgrade elevation. Table 8.12.1 presents the preliminary flexible pavement sections.

**TABLE 8.12.1
PRELIMINARY FLEXIBLE PAVEMENT SECTION**

Location	Assumed Traffic Index	Subgrade R-Value	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Driveways for automobiles and light-duty vehicles	5.5	50	3.0	4.0
Medium truck traffic areas	6.0	50	3.5	4.0
Driveways for heavy truck and fire truck traffic	7.0	50	4.0	5.0
Collector Roadways	8.0	50	5.0	6.0

- 8.12.2 Prior to placing base materials, the upper 12 inches of the subgrade soil should be scarified, moisture conditioned as necessary, and recompactd to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content as determined by ASTM D 1557. Similarly, the base material should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. Asphalt concrete should be compacted to a density of at least 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.
- 8.12.3 Base materials should conform to Section 26-1.028 of the *Standard Specifications for The State of California Department of Transportation (Caltrans)*. The asphalt concrete should conform to Section 203-6 of the *Standard Specifications for Public Works Construction (Greenbook)*.
- 8.12.4 A rigid Portland cement concrete (PCC) pavement section should be placed in heavy truck areas, driveway aprons, and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R *Guide for Design and Construction of Concrete Parking Lots* using the parameters presented in Table 8.12.4.

**TABLE 8.12.4
RIGID PAVEMENT DESIGN PARAMETERS**

Design Parameter	Design Value
Modulus of subgrade reaction, k	200 pci
Modulus of rupture for concrete, M_R	500 psi
Traffic Category, TC	C and D
Average daily truck traffic, ADTT	100 and 700

8.12.5 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 8.12.5.

**TABLE 8.12.5
RIGID PAVEMENT RECOMMENDATIONS**

Location	Portland Cement Concrete (inches)
Automobile Parking Stalls (TC=C)	6.5
Heavy Truck and Fire Lane Areas (TC=D)	7.5

8.12.6 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch).

8.12.7 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., 6-inch and 7.5-inch-thick slabs would have an 8- and 9.5-inch-thick edge, respectively). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

8.12.8 In order to control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab in accordance with the referenced ACI report.

8.12.9 The performance of pavements is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement surfaces will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

8.13 Temporary Excavations

- 8.13.1 Excavations on the order of 5 to 15 feet below the existing ground surface are expected for construction of the proposed utility improvements; and we expect that the proposed utilities will be installed with conventional cut-and-cover methods.
- 8.13.2 The excavations will expose previously placed fill and older alluvial soils which are suitable for vertical excavations up to 5 feet where loose soils or caving sands are not present and where not surcharged by adjacent traffic or structures.
- 8.13.3 Vertical excavations greater than 5 feet will require sloping measures in order to provide a stable excavation. Where sufficient space is available, temporary unsurcharged embankments should be designed by the contractor's competent person in accordance with OSHA regulations.
- 8.13.4 Where there is insufficient space for sloped excavations, shoring or trench shields should be used to support excavations. Shoring may also be necessary where sloped excavation could remove vertical or lateral support of existing improvements, including existing utilities and adjacent structures. Recommendations for temporary shoring can be provided in an addendum if needed.
- 8.13.5 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's competent person should inspect the soils exposed in the cut slopes during excavation in accordance with OSHA regulations so that modifications of the slopes can be made if variations in the soil conditions occur.

8.14 Site Drainage and Moisture Protection

- 8.14.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

- 8.14.2 In the case of basement walls or building walls retaining landscaping areas, a water-proofing system should be used on the wall and joints, and a Miradrain drainage panel (or similar) should be placed over the waterproofing. The project architect or civil engineer should provide detailed specifications on the plans for all waterproofing and drainage.
- 8.14.3 Landscape planters that saturate the subsurface should not be used within 20 feet of the proposed structure or other settlement sensitive on grade improvements. Localized surface settlement should be anticipated in areas where water is allowed to infiltrate into the subsurface.
- 8.14.4 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.
- 8.14.5 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. Area drains to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes can be used. In addition, where landscaping is planned adjacent to the pavement, construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material should be considered.
- 8.14.6 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Down-gradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.15 Grading and Foundation Plan Review

- 8.15.1 Geocon should review the project grading and foundation plans prior to final design submittal to verify that the plans have been prepared in substantial conformance with the recommendations of this report and to provide additional analyses or recommendations, if necessary.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

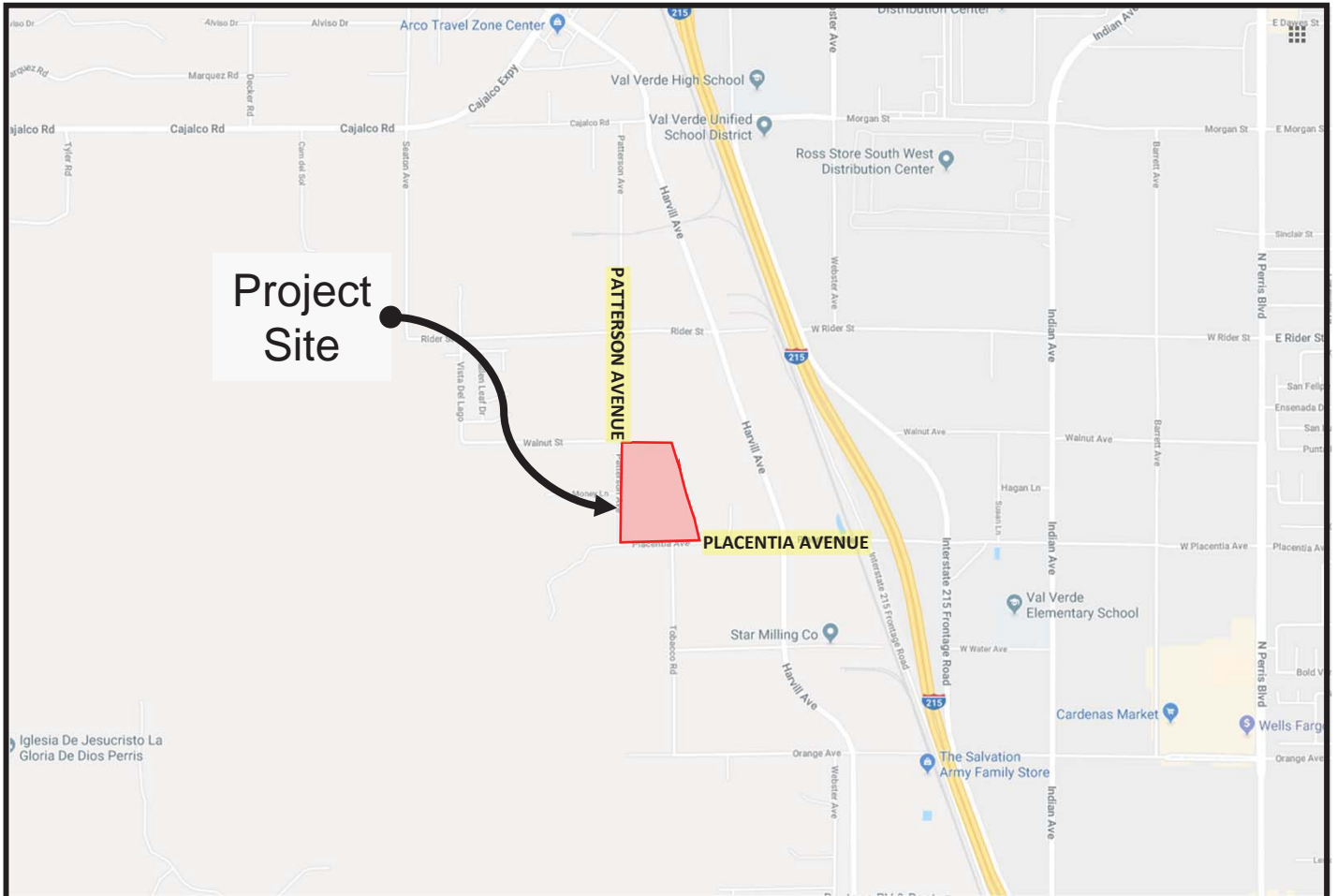
1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.
2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon.
3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.
4. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

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1000 ft

SOURCE: Google Maps, 2018

VICINITY MAP

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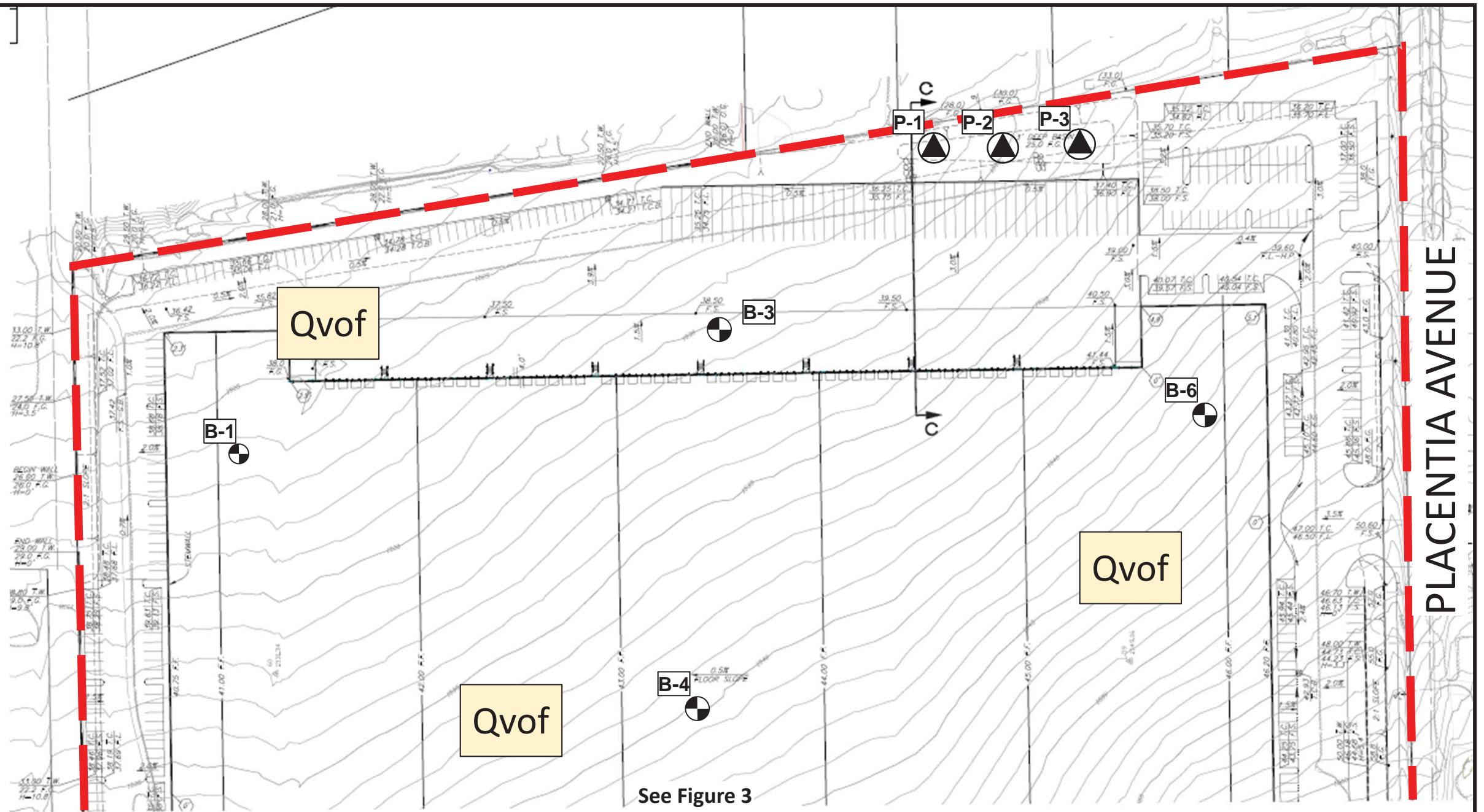
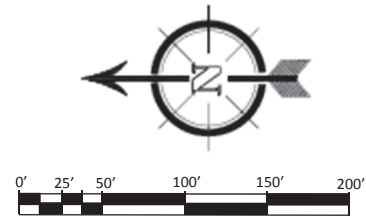


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BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

JANUARY, 2019	PROJECT NO. T2843-22-01	FIG. 1
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See Figure 3

GEOCON LEGEND

Locations are approximate

Qvof .. VERY OLD ALLUVIAL FAN DEPOSITS

..... LIMITS OF THIS REPORT

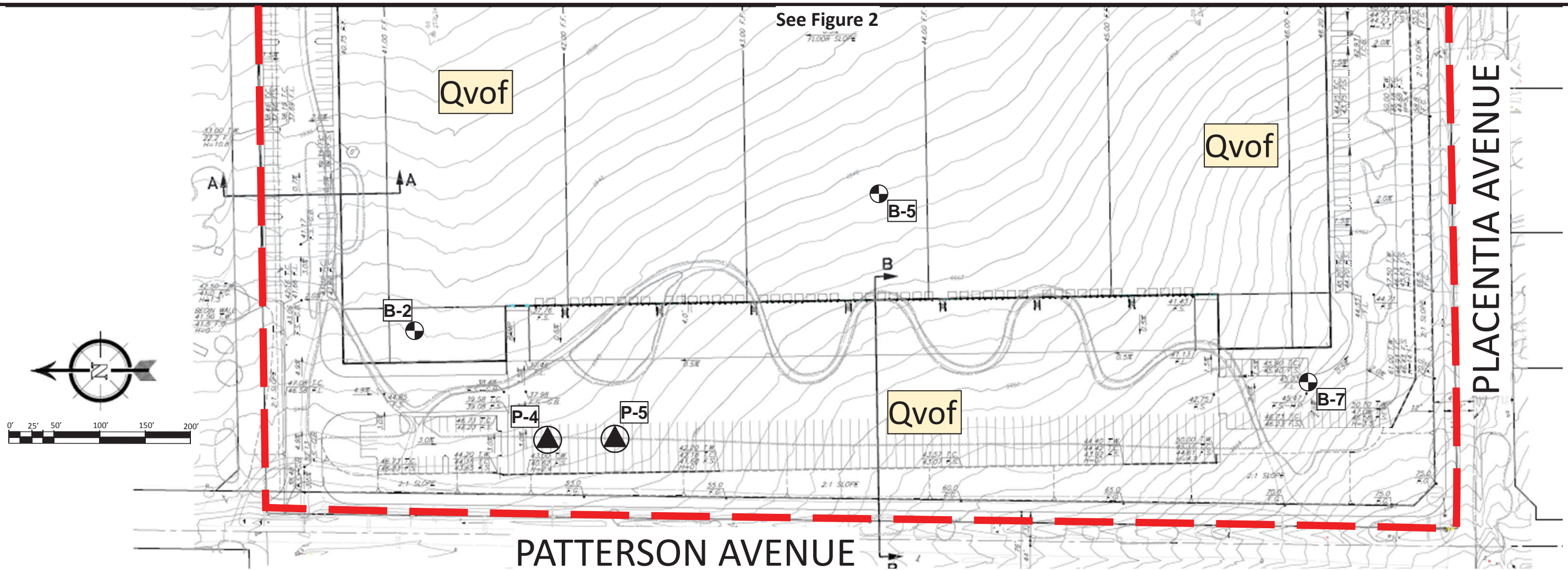
B-7 BORING LOCATION

P-5 PERCOLATION TEST LOCATION

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GEOLOGIC MAP
BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA



GEOCON LEGEND

Locations are approximate

Qvof .. VERY OLD ALLUVIAL FAN DEPOSITS

B-7 BORING LOCATION

P-5 PERCOLATION TEST LOCATION

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GEOLOGIC MAP
BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

ASSUMED CONDITIONS:

SLOPE HEIGHT H = 30 feet
 SLOPE INCLINATION 2.0 : 1.0 (Horizontal : Vertical)
 TOTAL UNIT WEIGHT OF SOIL γ_t = 130 pounds per cubic foot
 ANGLE OF INTERNAL FRICTION ϕ = 33 degrees
 APPARENT COHESION C = 200 pounds per square foot
 NO SEEPAGE FORCES

ANALYSIS:

$$\lambda_{cf} = \frac{\gamma H \tan \phi}{C} \text{ EQUATION (3-3), REFERENCE 1}$$

$$FS = \frac{N_{cf} C}{\gamma H} \text{ EQUATION (3-2), REFERENCE 1}$$

λ_{cf} = 12.7 CALCULATED USING EQ. (3-3)

N_{cf} = 40 DETERMINED USING FIGURE 10, REFERENCE 2

FS = 2.0 FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES:

- 1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics Series No. 46,1954
- 2.....Janbu, N., Discussion of J.M. Bell Dimensionless Parameters for Homogeneous Earth Slpes, Journal of Soil Mechanicx and Foundation Design, No. SM6, November 1967

 	
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CER	

SLOPE STABILITY ANALYSIS		
BARKER LOGISTICS WAREHOUSE DEVELOPMENT NORTHEAST CORENER OF PATTERSON AND PLACENTIA AVENUES MEAD VALLEY AREA		
JANUARY, 2019	PROJECT NO. T2843-22-01	FIG. 4

ASSUMED CONDITIONS:

SLOPE HEIGHT H = 30 feet
 SLOPE INCLINATION 2.0 : 1.0 (Horizontal : Vertical)
 TOTAL UNIT WEIGHT OF SOIL γ_t = 130 pounds per cubic foot
 ANGLE OF INTERNAL FRICTION ϕ = 33 degrees
 APPARENT COHESION C = 200 pounds per square foot
 PSEUDOSTATIC COEFFICIENT k_h = 0.15
 PSEUDOSTATIC INCLINATION 1.4 : 1.0 (Horizontal : Vertical)
 PSEUDOSTATIC UNIT WEIGHT γ_{ps} = 131 pounds per cubic foot

NO SEEPAGE FORCES

ANALYSIS:

$$\lambda_{cf} = \frac{\gamma H \tan \phi}{C} \text{ EQUATION (3-3), REFERENCE 1}$$

$$FS = \frac{N_{cf} C}{\gamma H} \text{ EQUATION (3-2), REFERENCE 1}$$

λ_{cf} = 12.8 CALCULATED USING EQ. (3-3)

N_{cf} = 31 DETERMINED USING FIGURE 10, REFERENCE 2

FS = 1.6 FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES:

- 1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics Series No. 46,1954
- 2.....Janbu, N., Discussion of J.M. Bell Dimensionless Parameters for Homogeneous Earth Slpes, Journal of Soil Mechanicx and Foundation Design, No. SM6, November 1967

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SLOPE STABILITY ANALYSIS - WITH SEISMIC

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 NORTHEAST CORNER OF PATTERSON
 AND PLACENTIA AVENUES
 MEAD VALLEY AREA

JANUARY, 2019

PROJECT NO. T2843-22-01

FIG. 5

ASSUMED CONDITIONS:

SLOPE HEIGHT	H = Infinte
SLOPE INCLINATION	2.0 : 1.0 (Horizontal : Vertical)
SLOPE ANGLE	i = 26.6 °
DEPTH OF SATURATION	Z = 4 feet
UNIT WEIGHT OF WATER	γ_w = 62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t = 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ = 33 degrees
APPARENT COHESION	C = 200 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE.
SEEPAGE FORCES PARALLEL TO SLOPE FACE.

ANALYSIS:

$$FS = \frac{C + (\gamma_t - \gamma_w)Z \cdot \cos^2 i \cdot \tan \phi}{\gamma_t \cdot Z \cdot \sin i \cdot \cos i} = 1.6$$

REFERENCES:

- 1.....Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62.
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SURFICIAL SLOPE STABILITY

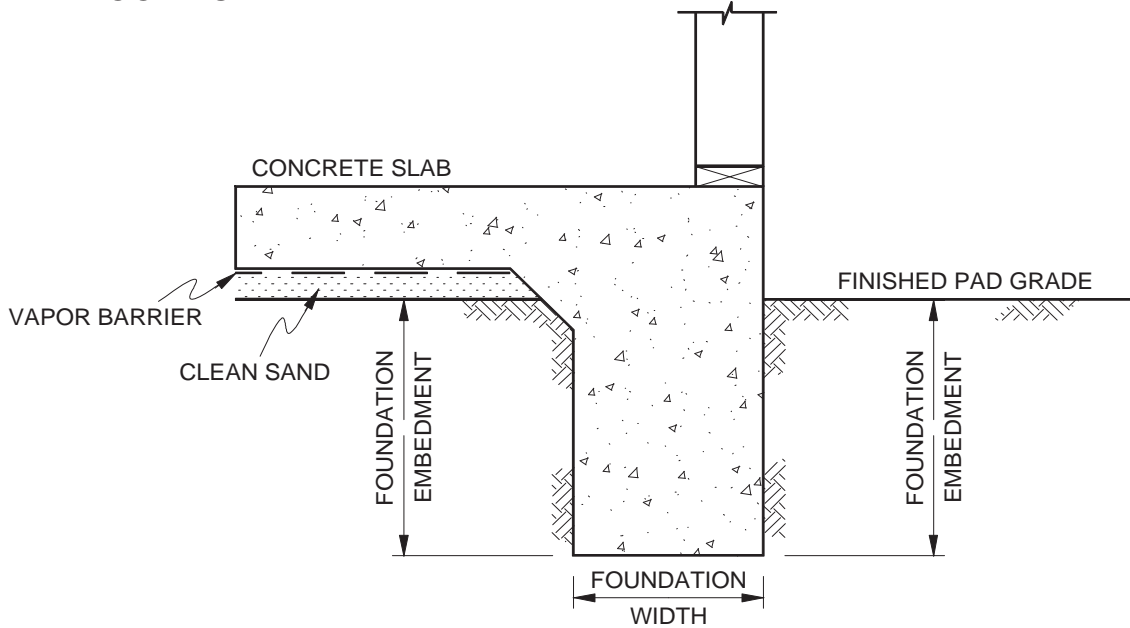
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MEAD VALLEY AREA

JANUARY, 2019

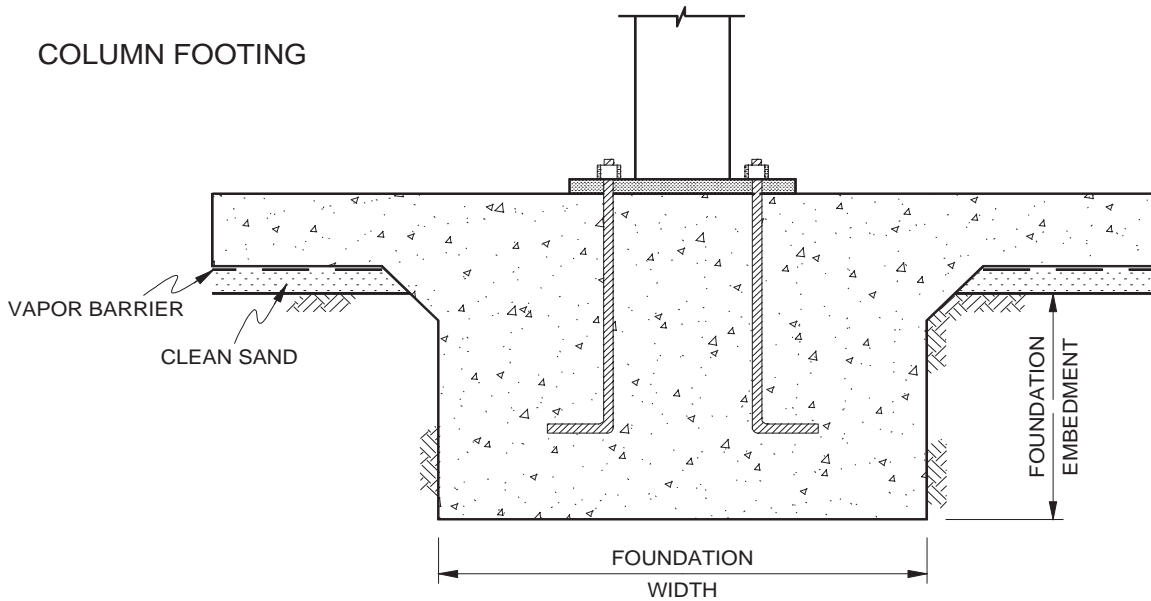
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FIG. 6

WALL FOOTING



COLUMN FOOTING



NOTE: SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

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WALL / COLUMN FOOTING DETAIL

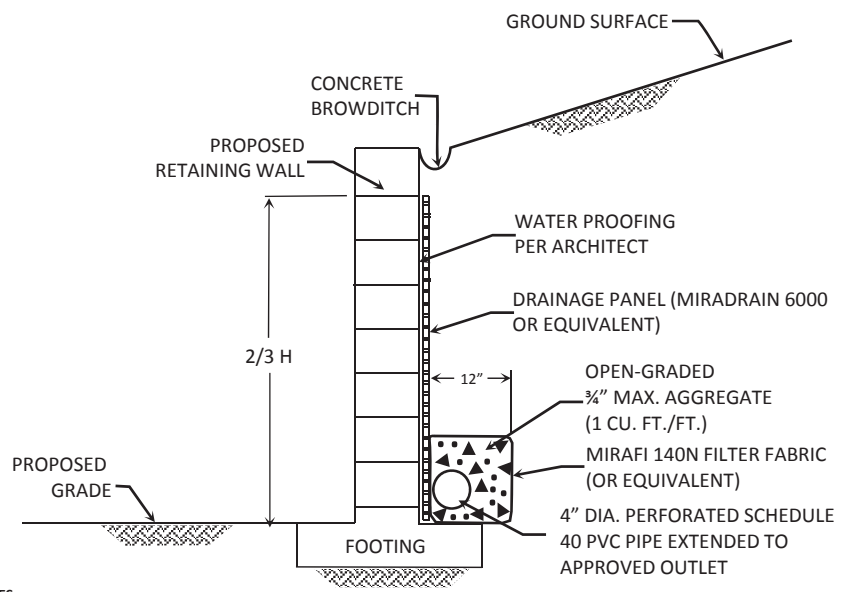
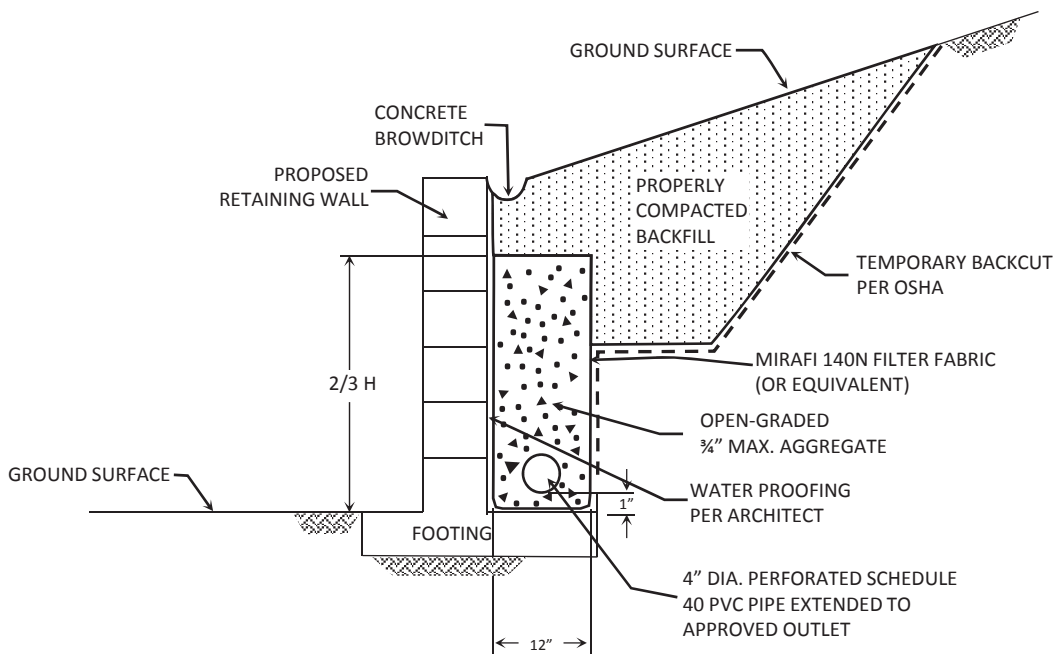
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MEAD VALLEY AREA
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JANUARY, 2019

PROJECT NO. T2843-22-01

FIG. 7



NOTES:

DRAIN SHOULD BE UNFORMLY SLOPED TO GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

CONCRETE BROW DITCH RECOMMENDED FOR SLOPE HEIGHTS GREATER THAN 6 FEET

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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BARKER LOGISTICS WAREHOUSE DEVELOPMENT
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MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

APPENDIX



APPENDIX A

FIELD INVESTIGATION

Field work for our investigation included a subsurface exploration, soil sampling, and percolation testing. The *Geologic Map*, Figures 2 and 3 presents the locations of the exploratory borings. Boring logs and an explanation of the geologic units encountered are presented in figures following the text in this appendix. We located the borings in the field using existing reference points. Therefore, actual boring locations may deviate slightly. We performed a field investigation on November 26, 2018 which consisted of drilling 12 exploratory borings to a maximum depth of approximately 46 feet below existing grade with a CME 75 drill rig equipped with 8-inch-diameter hollow-stem auger.

We collected bulk and relatively undisturbed samples from the borings by driving a 3-inch O. D., California Modified Sampler into the “undisturbed” soil mass with blows from a 140-pound hammer falling 30 inches on an auto hammer. The California Modified Sampler was equipped with 1-inch high by 2³/₈-inch inside diameter brass sampler rings to facilitate removal and testing. Relatively undisturbed samples and bulk samples of disturbed soils were transported to our laboratory for testing. The type of sample is noted on the exploratory boring logs.

The samplers were driven 18 inches into the bottom of the excavations. Blow counts are recorded for every 6 inches the sampler is driven. The penetration resistances shown on the boring logs are shown in terms of blows per foot. The values indicated on the boring logs are the sum of the last 12 inches of the sampler if driven 18 inches. If the sampler was not driven for 18 inches, an approximate value is calculated in term of blows per foot or the final 6-inch interval is reported. These values are not to be taken as N-values, adjustments have not been applied. We estimated elevations shown on the boring logs from a topographic map.

We visually examined the soil conditions encountered within the borings, classified, and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-12. The logs depict the general soil and geologic conditions encountered and the depth at which we obtained the samples.

Percolation testing was performed on November 27, 2018 in accordance with *Riverside County Flood Control and Water Conservation District, LID BMP Manual, Appendix A*. The percolation tests were run in accordance with *Section 2.3., Shallow Percolation Test*. The percolation test data is presented on Figures A-13 and A-17.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1527</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0	B-1@0-5'			SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand; rootlets				
2	B-1@2.5'			SM	OLDER ALLUVIUM (Qoal) Silty SAND, very dense, damp, dark brown; fine sand; trace clay; calcium carbonate stringers; pinhole porosity -Becomes yellowish brown; trace mottling	50/5"	115.5	4.0	
4	B-1@5'					50/4"	123.1	5.9	
6	B-1@7.5'					88/11"	132.7	5.0	
8	B-1@10'			SC	Clayey SAND, very dense, damp, medium brown; fine sand; trace medium sand; calcium carbonate stringers; pinhole porosity	81/11"			
10	B-1@15'			SP	Poorly-graded SAND with silt, dense, damp, yellowish brown; fine to medium sand; some coarse sand	60	123.7	4.4	
12	B-1@20'				-Becomes grayish brown; fine to coarse sand	62			
14	B-1@25'			ML	Sandy SILT, hard, damp, strong brown; trace mica	86/11"			
16	B-1@30'			SM	Silty SAND, very dense, damp, light olive brown; fine sand; pinhole porosity	50/4"			
18									
20									
22									
24									
26									
28									
30									
32									
34									

Figure A-1,
Log of Boring B-1, Page 1 of 2

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.


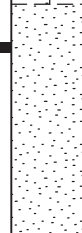


DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1527</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u>		BY: <u>ATS</u>		
MATERIAL DESCRIPTION									
36	B-1@35'						50/5"		
38									
40	B-1@40'			SP	Poorly-graded SAND, very dense, moist, olive brown; fine sand -Some medium sand		50/3"		
42									
44									
46	B-1@45'				-No recovery		50/2"		
					Total depth 46 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018				

Figure A-1,
Log of Boring B-1, Page 2 of 2

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-2		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1541</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand; rootlets				
2	B-2@2.5'			SM	OLDER ALLUVIUM (Q_{oal}) Silty SAND, very dense, dry, light olive brown; fine sand		50/4"		
4					-Becomes dense; damp		70	125.5	3.6
6	B-2@5'				-Becomes medium dense; increase in silt; pinhole porosity		38	135.1	2.8
8	B-2@7.5'								
10	B-2@10'			ML	Sandy SILT, very stiff, damp, strong brown; trace mica; pinhole porosity		77	130.9	5.4
12									
14									
16	B-2@15'			SM	Silty SAND, very dense, damp, light reddish brown; fine sand; some medium sand; pinhole porosity; micaceous		50/6"		
18									
20	B-2@20'			ML	sandy SILT, very stiff, damp, olive brown; pinhole porosity		67	121.4	7.8
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018				

Figure A-2,
Log of Boring B-2, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	<input type="checkbox"/> ... SAMPLING UNSUCCESSFUL	<input type="checkbox"/> ... STANDARD PENETRATION TEST	<input checked="" type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED)
	<input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE	<input checked="" type="checkbox"/> ... CHUNK SAMPLE	<input checked="" type="checkbox"/> ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-3		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1531</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u>		BY: <u>ATS</u>		
MATERIAL DESCRIPTION									
0				SM	TOPSOIL				
2	B-3@2.5'			SM	Silty SAND, loose, dry, light olive brown; fine sand; pinhole porosity; rootlets				
4					OLDER ALLUVIUM (Qoal)				
6	B-3@5'			SC	Silty SAND, very dense, damp, light olive brown; fine sand	50/6"	117.6	4.5	
8					Clayey SAND, very dense, damp, light reddish brown, fine sand; pinhole porosity; rootlets	50/5"			
10	B-3@7.5'			SM	Silty SAND, very dense, damp, light olive brown; fine to medium sand; some coarse sand; trace mica	82	124.4	3.8	
12					Clayey SAND, very dense, damp, strong brown; fine sand; some medium sand; trace calcium carbonate	91/10"			
14	B-3@10'			SC					
16	B-3@15'			ML	Sandy SILT, very stiff, damp, light olive brown; calcium carbonate stringers	64	128.1	6.4	
					Total depth 16.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018				

Figure A-3,
Log of Boring B-3, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ



SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-4		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1538</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand; root hairs				
2	B-4@2.5'			SC	OLDER ALLUVIUM (Q_{oal}) Clayey SAND, very dense, damp, medium brown; fine sand; calcium carbonate stringers; pinhole porosity	84			
4	B-4@5'					50/6"	126.9	4.4	
6									
8	B-4@7.5'			SM	Silty SAND, dense, dry, light olive brown; fine sand; micaceous; pinhole porosity	64			
10	B-4@10'			SC	Clayey SAND, very dense, moist, reddish brown and gray; fine sand; some medium and coarse sand; pinhole porosity; trace manganese staining	83	137.8	7.5	
12									
14									
16	B-4@15'			SM	Silty SAND, dense, moist, strong brown; fine sand; some medium and coarse sand; micaceous; pinhole porosity	59			
18									
20	B-4@20'					44	131.4	9.0	
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018				

Figure A-4,
Log of Boring B-4, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-5		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1545</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand				
2	B-5@2-7'			SM	OLDER ALLUVIUM (Qoal) Silty SAND, medium dense, damp, light reddish brown; fine to medium sand	34	121.3	3.7	
4	B-5@2.5'				-Trace pinhole porosity				
6	B-5@5'				-Becomes very dense, light yellowish brown; fine sand; some medium and coarse sand; some pinhole porosity; trace oxidation	50/6"			
8	B-5@7.5'			SC	Clayey SAND; very dense, moist, dark brown; fine to medium sand; trace oxidation; mottling; calcium carbonate stringers; pinhole porosity	90	129.7	10.3	
10	B-5@10'			SM	Silty SAND, dense, damp, medium brown; fine to medium sand; some coarse sand; calcium carbonate stringers; trace mica	59			
12									
14									
16	B-5@15'			ML	Sandy SILT, very stiff, damp, light olive brown; micaceous; mottling	56	125.9	4.4	
18									
20	B-5@20'					85			
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018				

Figure A-5,
Log of Boring B-5, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-6		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1544</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand				
2	B-6@2.5'			SC	OLDER ALLUVIUM (Qoal) Clayey SAND, very dense, dry, light olive brown; fine sand; root hairs	56			
4									
6	B-6@5'			SM	Silty SAND, very dense, moist, light brown; calcium carbonate stringers	85/11"	111.4	8.0	
8	B-6@7.5'				-Becomes medium brown	70			
10	B-6@10'			SC	Clayey SAND, dense, moist, strong brown; fine sand; trace mottling; calcium carbonate stringers	66	131.6	9.1	
12									
14									
16	B-6@15'					50/6"			
18									
20	B-6@20'			SP	Poorly-graded SAND with silt, dense, moist, light yellowish brown; fine sand; some medium sand	68	125.3	6.6	
					Total depth 21.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018				

Figure A-6,
Log of Boring B-6, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS		
	... SAMPLING UNSUCCESSFUL	
	... DISTURBED OR BAG SAMPLE	
		
		... DRIVE SAMPLE (UNDISTURBED)
		... CHUNK SAMPLE
		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-7 ELEV. (MSL.) <u>1564</u> DATE COMPLETED <u>11/26/2018</u> EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
MATERIAL DESCRIPTION								
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand			
2				SM	OLDER ALLUVIUM (Qoal) Silty SAND, medium dense, dry, olive brown			
6	B-7@5-10'							
10	B-7@10-15'							
16	B-7@15'					37	121.6	3.7
16	B-7@15-20'							
20	B-7@20'				VAL VERDE TONALITE (Kvt) Weathered, strong, grayish brown, GRANITIC BEDROCK; coarse-grained; micaceous; excavates as a gravelly sand	50/3"		
26	B-7@25'					50/3"		
30	B-7@30'					50/3"		
Total depth 31.5 feet Groundwater not encountered Penetration resistance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 11/26/2018								

Figure A-7,
Log of Boring B-7, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	<input type="checkbox"/> ... SAMPLING UNSUCCESSFUL	<input type="checkbox"/> ... STANDARD PENETRATION TEST	<input checked="" type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED)
	<input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE	<input checked="" type="checkbox"/> ... CHUNK SAMPLE	<input checked="" type="checkbox"/> ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)		
					ELEV. (MSL.) <u>1528</u>	DATE COMPLETED <u>11/26/2018</u>					
					EQUIPMENT <u>HOLLOW STEM AUGER</u>	BY: <u>ATS</u>					
					MATERIAL DESCRIPTION						
0				SM	TOPSOIL						
				SM	Silty SAND, loose, dry, light olive brown; fine sand						
2	P-1@2-3'				OLDER ALLUVIUM (Qoal)						
					Silty SAND, medium dense, dry, light olive brown; fine sand						
					Total depth 3 feet Groundwater not encountered Set as Percolation Test P-1 Backfilled with cuttings 11/27/2018						

Figure A-8,
Log of Boring P-1, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS					
	... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-2		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1530</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand				
2				SM	OLER ALLUVIUM (Qoal) Silty SAND, medium dense, dry, light olive brown; fine sand				
4									
6									
8	P-2@7-8								
					Total depth 8 feet Groundwater not encountered Set as Percolation Test P-2 Backfilled with cuttings 11/27/2018				

Figure A-9,
Log of Boring P-2, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	<input type="checkbox"/> ... SAMPLING UNSUCCESSFUL	<input type="checkbox"/> ... STANDARD PENETRATION TEST	<input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED)
	<input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE	<input checked="" type="checkbox"/> ... CHUNK SAMPLE	<input checked="" type="checkbox"/> ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-3		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1533</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL				
2				SM	Silty SAND, loose, dry, light olive brown; fine sand				
4					OLDER ALLUVIUM (Qoal)				
6					Silty SAND, medium dense, dry, light olive brown; fine sand				
8	P-3@7-8				-Trace clay				
					Total depth 8 feet Groundwater not encountered Set as Percolation Test P-3 Backfilled with cuttings 11/27/2018				

Figure A-10,
Log of Boring P-3, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	<input type="checkbox"/> ... SAMPLING UNSUCCESSFUL	<input type="checkbox"/> ... STANDARD PENETRATION TEST	<input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED)
	<input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE	<input checked="" type="checkbox"/> ... CHUNK SAMPLE	<input type="checkbox"/> ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-4		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1547</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL				
2				SM	Silty SAND, loose, dry, light olive brown; fine sand				
4					OLDER ALLUVIUM (Qoal)				
6					Silty SAND, medium dense, dry, light olive brown; fine sand				
8					-Becomes reddish brown				
10	P-4@9-10				-Trace clay; micaceous				
					Total depth 10 feet Groundwater not encountered Set as Percolation Test P-4 Backfilled with cuttings 11/27/2018				

Figure A-11,
Log of Boring P-4, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	<input type="checkbox"/>	... SAMPLING UNSUCCESSFUL	<input type="checkbox"/>	... STANDARD PENETRATION TEST	<input type="checkbox"/>	... DRIVE SAMPLE (UNDISTURBED)
	<input checked="" type="checkbox"/>	... DISTURBED OR BAG SAMPLE	<input type="checkbox"/>	... CHUNK SAMPLE	<input type="checkbox"/>	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-5		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>1548</u>	DATE COMPLETED <u>11/26/2018</u>			
					EQUIPMENT <u>HOLLOW STEM AUGER</u> BY: <u>ATS</u>				
					MATERIAL DESCRIPTION				
0				SM	TOPSOIL Silty SAND, loose, dry, light olive brown; fine sand				
2				SM	OLDER ALLUVIUM (Qoal) Silty SAND, medium dense, dry, light olive brown; fine sand -Becomes light reddish brown				
4									
6									
8					-Trace clay; some medium and coarse sand; micaceous				
10	P-5@9-10								
					Total depth 10 feet Groundwater not encountered Set as Percolation Test P-5 Backfilled with cuttings 11/27/2018				

Figure A-12,
Log of Boring P-5, Page 1 of 1

T2843-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	<input type="checkbox"/> ... SAMPLING UNSUCCESSFUL	<input type="checkbox"/> ... STANDARD PENETRATION TEST	<input type="checkbox"/> ... DRIVE SAMPLE (UNDISTURBED)
	<input checked="" type="checkbox"/> ... DISTURBED OR BAG SAMPLE	<input checked="" type="checkbox"/> ... CHUNK SAMPLE	<input type="checkbox"/> ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PERCOLATION TEST REPORT							
Project Name:		Barker Logistics			Project No.:		T2843-22-01
Test Hole No.:		P-1			Date Excavated:		11/26/2018
Length of Test Pipe:		39.6 inches			Soil Classification:		SM
Height of Pipe above Ground:		2.4 inches			Presoak Date:		11/26/2018
Depth of Test Hole:		37.2 inches			Perc Test Date:		11/27/2018
Check for Sandy Soil Criteria Tested by:		PDT			Percolation Tested by:		PDT
Water level measured from bottom of hole							
Sandy Soil Criteria Test							
Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:01 AM	25	25	19.2	18.0	1.2	20.8
	9:26 AM						
2	9:26 AM	25	50	18.0	16.8	1.2	20.8
	9:51 AM						
Soil Criteria: Normal							
Percolation Test							
Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:51 AM	30	30	16.8	16.2	0.6	50.0
	10:21 AM						
2	10:21 AM	30	60	16.2	15.6	0.6	50.0
	10:51 AM						
3	10:51 AM	30	90	15.6	15.0	0.6	50.0
	11:21 AM						
4	11:21 AM	30	120	15.0	14.4	0.6	50.0
	11:51 AM						
5	11:51 AM	30	150	14.4	13.8	0.6	50.0
	12:21 PM						
6	12:21 PM	30	180	13.8	13.2	0.6	50.0
	12:51 PM						
7	12:51 PM	30	210	13.2	12.0	1.2	25.0
	1:21 PM						
8	1:21 PM	30	240	12.0	10.8	1.2	25.0
	1:51 PM						
9	1:51 PM	30	270	12.0	10.8	1.2	25.0
	2:21 PM						
10	2:21 PM	30	300	13.2	12.0	1.2	25.0
	2:51 PM						
11	2:51 PM	30	330	13.2	12.0	1.2	25.0
	3:21 PM						
12	3:21 PM	30	360	12.0	10.8	1.2	25.0
	3:51 PM						
Infiltration Rate (in/hr):			0.36				
Radius of test hole (in):			4	Figure A-13			
Average Head (in):			11.4				

PERCOLATION TEST REPORT							
Project Name:		Barker Logistics			Project No.:		T2843-22-01
Test Hole No.:		P-2			Date Excavated:		11/26/2018
Length of Test Pipe:		81.6 inches			Soil Classification:		SM
Height of Pipe above Ground:		0.0 inches			Presoak Date:		11/26/2018
Depth of Test Hole:		81.6 inches			Perc Test Date:		11/27/2018
Check for Sandy Soil Criteria Tested by:		PDT			Percolation Tested by:		PDT
Water level measured from bottom of hole							
Sandy Soil Criteria Test							
Trial No.	Time	Time Interval	Total Elapsed Time	Initial Water Level	Final Water Level	Δ in Water Level	Percolation Rate
		(min)	(min)	(in)	(in)	(inches)	(min/inch)
1	8:57 AM 9:22 AM	25	25	10.8	4.8	6.0	4.2
2	9:22 AM 9:47 AM	25	50	12.0	4.8	7.2	3.5
Soil Criteria: Normal							
Percolation Test							
Reading No.	Time	Time Interval	Total Elapsed Time	Initial Water Head	Final Water Head	Δ in Water Level	Percolation Rate
		(min)	(min)	(in)	(in)	(inches)	(min/inch)
1	9:47 AM 10:17 AM	30	30	12.0	8.4	3.6	8.3
2	10:17 AM 10:47 AM	30	60	12.0	8.4	3.6	8.3
3	10:47 AM 11:17 AM	30	90	12.0	9.0	3.0	10.0
4	11:17 AM 11:47 AM	30	120	12.6	9.6	3.0	10.0
5	11:47 AM 12:17 PM	30	150	12.0	9.0	3.0	10.0
6	12:17 PM 12:47 PM	30	180	12.0	8.4	3.6	8.3
7	12:47 PM 1:17 PM	30	210	12.0	7.2	4.8	6.3
8	1:17 PM 1:47 PM	30	240	12.0	7.2	4.8	6.3
9	1:47 PM 2:17 PM	30	270	12.0	7.8	4.2	7.1
10	2:17 PM 2:47 PM	30	300	12.0	8.4	3.6	8.3
11	2:47 PM 3:17 PM	30	330	12.0	9.6	2.4	12.5
12	3:17 PM 3:47 PM	30	360	12.0	7.2	4.8	6.3
Infiltration Rate (in/hr):			1.66				
Radius of test hole (in):			4				
Average Head (in):			9.6				
							Figure A-14

PERCOLATION TEST REPORT

Project Name:	Barker Logistics	Project No.:	T2843-22-01
Test Hole No.:	P-3	Date Excavated:	11/26/2018
Length of Test Pipe:	122.4 inches	Soil Classification:	SM
Height of Pipe above Ground:	18.0 inches	Presoak Date:	11/26/2018
Depth of Test Hole:	104.4 inches	Perc Test Date:	11/27/2018
Check for Sandy Soil Criteria Tested by:	PDT	Percolation Tested by:	PDT

Water level measured from bottom of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:55 AM	25	25	30.0	15.6	14.4	1.7
	9:20 AM						
2	9:20 AM	25	50	30.0	20.4	9.6	2.6
	9:45 AM						

Soil Criteria: Normal

Percolation Test

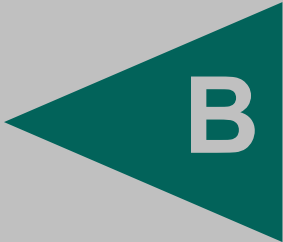
Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:45 AM	30	30	20.4	6.0	14.4	2.1
	10:15 AM						
2	10:15 AM	30	60	13.2	11.4	1.8	16.7
	10:45 AM						
3	10:45 AM	30	90	15.0	6.6	8.4	3.6
	11:15 AM						
4	11:15 AM	30	120	15.6	13.2	2.4	12.5
	11:45 AM						
5	11:45 AM	30	150	13.2	6.6	6.6	4.5
	12:15 PM						
6	12:15 PM	30	180	14.4	12.0	2.4	12.5
	12:45 PM						
7	12:45 PM	30	210	14.4	7.2	7.2	4.2
	1:15 PM						
8	1:15 PM	30	240	12.0	4.8	7.2	4.2
	1:45 PM						
9	1:45 PM	30	270	12.0	7.2	4.8	6.3
	2:15 PM						
10	2:15 PM	30	300	12.0	7.8	4.2	7.1
	2:45 PM						
11	2:45 PM	30	330	12.0	7.2	4.8	6.3
	3:15 PM						
12	3:15 PM	30	360	12.0	7.2	4.8	6.3
	3:45 PM						

Infiltration Rate (in/hr):	1.66	
Radius of test hole (in):	4	Figure A-15
Average Head (in):	9.6	

PERCOLATION TEST REPORT								
Project Name:		Barker Logistics			Project No.:		T2843-22-01	
Test Hole No.:		P-4			Date Excavated:		11/26/2018	
Length of Test Pipe:		120.0 inches			Soil Classification:		SM	
Height of Pipe above Ground:		4.8 inches			Presoak Date:		11/26/2018	
Depth of Test Hole:		115.2 inches			Perc Test Date:		11/27/2018	
Check for Sandy Soil Criteria Tested by:				PDT		Percolation Tested by:		PDT
Water level measured from bottom of hole								
Sandy Soil Criteria Test								
Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)	
1	9:09 AM	25	25	27.6	25.2	2.4	10.4	
	9:34 AM							
2	9:34 AM	25	50	25.2	24.6	0.6	41.7	
	9:59 AM							
Soil Criteria: Normal								
Percolation Test								
Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)	
1	9:59 AM	30	30	24.6	22.8	1.8	16.7	
	10:29 AM							
2	10:29 AM	30	60	22.8	20.4	2.4	12.5	
	10:59 AM							
3	10:59 AM	30	90	20.4	19.8	0.6	50.0	
	11:29 AM							
4	11:29 AM	30	120	19.8	18.6	1.2	25.0	
	11:59 AM							
5	11:59 AM	30	150	18.6	18.0	0.6	50.0	
	12:29 PM							
6	12:29 PM	30	180	18.0	15.6	2.4	12.5	
	12:59 PM							
7	12:59 PM	30	210	15.6	15.0	0.6	50.0	
	1:29 PM							
8	1:29 PM	30	240	15.0	14.4	0.6	50.0	
	1:59 PM							
9	1:59 PM	30	270	14.4	13.2	1.2	25.0	
	2:29 PM							
10	2:29 PM	30	300	13.2	13.2	0.0	0.0	
	2:59 PM							
11	2:59 PM	30	330	13.2	13.2	0.0	0.0	
	3:29 PM							
12	3:29 PM	30	360	13.2	12.6	0.6	50.0	
	3:59 PM							
Infiltration Rate (in/hr):			0.16					
Radius of test hole (in):			4	Figure A-16				
Average Head (in):			12.9					

PERCOLATION TEST REPORT							
Project Name:		Barker Logistics			Project No.:		T2843-22-0
Test Hole No.:		P-5			Date Excavated:		11/26/2018
Length of Test Pipe:		122.4 inches			Soil Classification:		SM
Height of Pipe above Ground:		4.8 inches			Presoak Date:		11/26/2018
Depth of Test Hole:		117.6 inches			Perc Test Date:		11/27/2018
Check for Sandy Soil Criteria Tested by:				PDT		Percolation Tested by: CER	
Water level measured from bottom of hole							
Sandy Soil Criteria Test							
Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	D in Water (inches)	Percolation Rate (min/inch)
1	9:12 AM	25	25	16.8	6	10.8	2.31
	9:37 AM						
2	9:37 AM	25	50	13.2	3.6	9.6	2.60
	10:02 AM						
				Soil Criteria: Normal			
Percolation Test							
Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Head (in)	Final Water Head (in)	D in Water Level (inches)	Percolation Rate (min/inch)
1	10:02 AM	30	30	15	4.8	10.2	2.94
	10:32 AM						
2	10:32 AM	30	30	15	4.8	10.2	2.94
	11:02 AM						
3	11:02 AM	30	30	12	4.2	7.8	3.85
	11:32 AM						
4	11:32 AM	30	30	20.4	10.8	9.6	3.13
	12:02 PM						
5	12:02 PM	30	30	13.2	4.8	8.4	3.57
	12:32 PM						
6	12:32 PM	30	30	15	6	9	3.33
	1:02 PM						
7	1:02 PM	30	30	13.2	7.2	6	5.00
	1:32 PM						
8	1:32 PM	30	30	19.2	7.2	12	2.50
	2:02 PM						
9	2:02 PM	30	30	19.2	7.2	12	2.50
	2:32 PM						
10	2:32 PM	30	30	12	6.6	5.4	5.56
	3:02 PM						
11	3:02 PM	30	30	12	3.6	8.4	3.57
	3:32 PM						
12	3:32 PM	30	30	13.8	4.2	9.6	3.13
	4:02 PM						
Infiltration Rate (in/hr):			3.49				
Radius of test hole (in):			4	Figure A-17			
Average Head (in):			9				

APPENDIX



B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with current, generally accepted test methods of ASTM International (ASTM) or other suggested procedures. We analyzed selected soil samples for in-situ density and moisture content, maximum dry density and optimum moisture content, expansion index, corrosivity, grain size distribution, consolidation characteristics, R-values, and direct shear strength. The results of the laboratory tests are presented on Figures B-1 through B-7. The in-place dry density and moisture content of the samples tested are presented on the boring logs in *Appendix A*.

**SUMMARY OF LABORATORY MAXIMUM DRY DENSITY
AND OPTIMUM MOISTURE CONTENT TEST RESULTS
ASTM D1557**

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% of dry wt.)
B-1 @ 0-5'	Silty SAND (SM), dark brown	133.9	7.2
B-7 @ 10-15'	Silty SAND (SM), olive brown	133.3	8.5

**SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D4829**

Sample No.	Moisture Content		After Test Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B-5 @ 2-7'	8.0	15.2	118.2	15
B-7 @ 5-10'	8.0	13.7	118.4	3

SUMMARY OF CORROSIIVITY TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm-centimeter)
B-5 @ 2-7'	75	0.009	8.0	1,900

Chloride content determined by California Test 429.
Water-soluble sulfate determined by California Test 417.
Resistivity and pH determined by Caltrans Test 643.

**SUMMARY OF LABORATORY R-VALUE TEST RESULTS
ASTM D2844**

Sample No.	R-Value
B-7 @ 15-20'	65

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PHONE 951-304-2300 FAX 951-304-2392

PDT

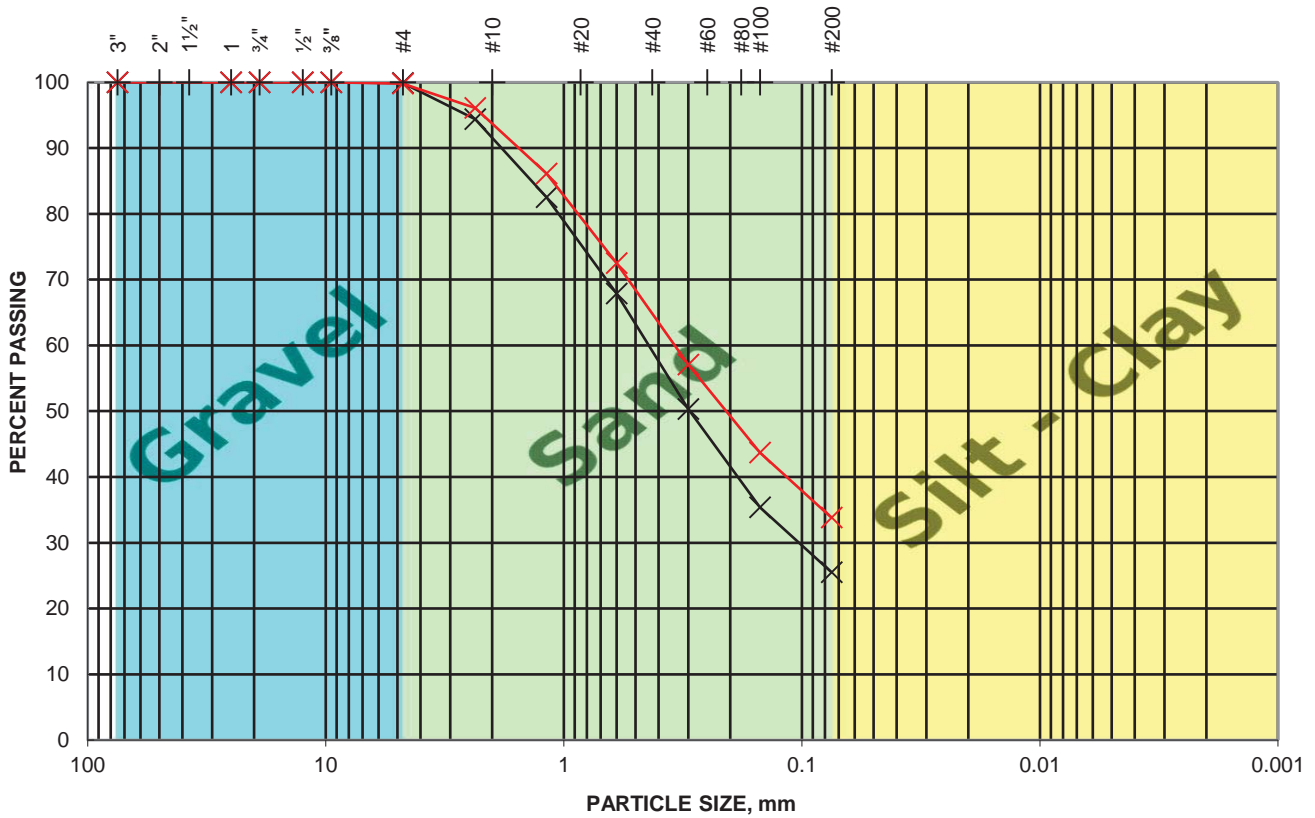
LABORATORY TEST RESULTS

BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA

JANUARY, 2019

PROJECT NO. T2843-22-01

FIG B-1



SAMPLE ID	SAMPLE DESCRIPTION
B-6 @ 5'	SM - Silty Sand
P-1 @ 2'/P-2 @ 7'	SM - Silty Sand

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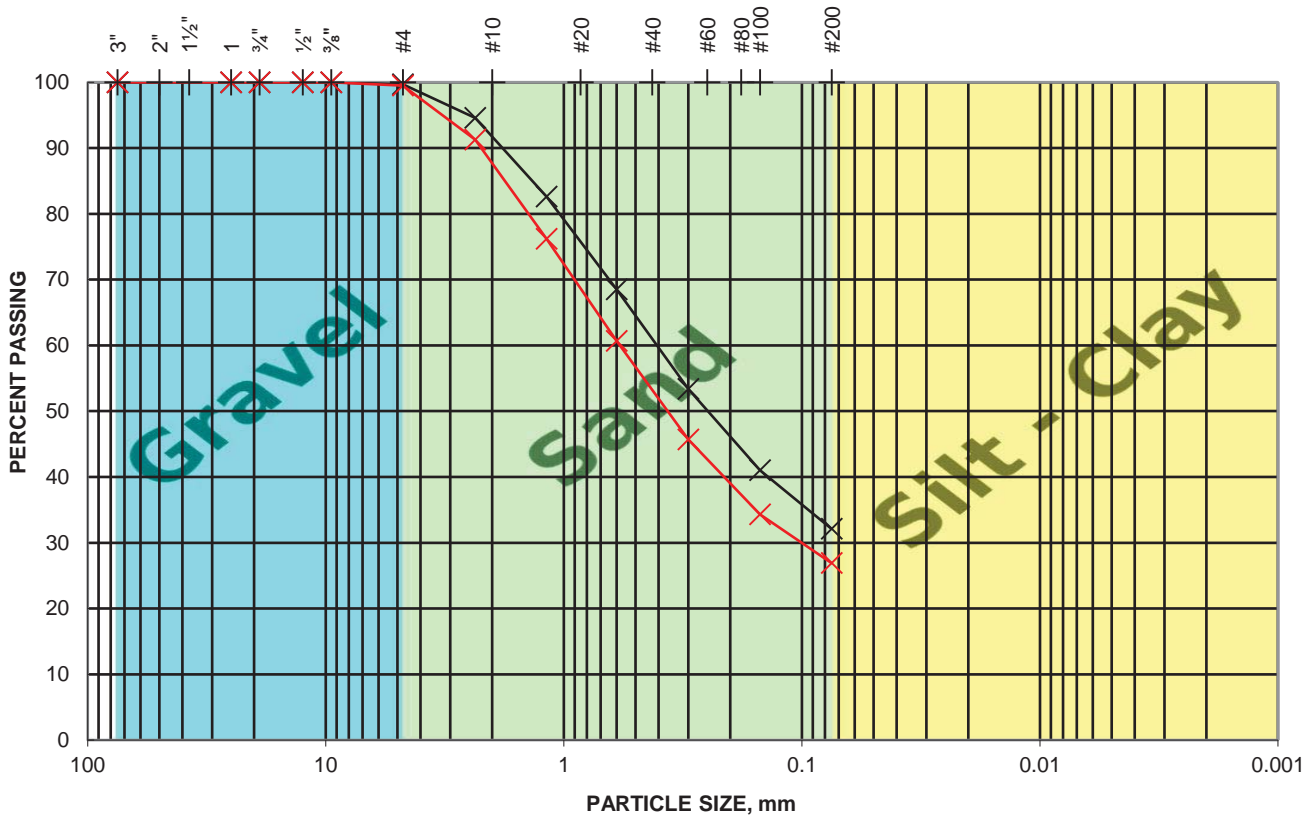
GRAIN SIZE DISTRIBUTION

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NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA

JANUARY, 2019

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FIG B-2



SAMPLE ID	SAMPLE DESCRIPTION
P-3 @ 7'	SM - Silty Sand
P-4 @ 9'/P-5 @ 9'	SM - Silty Sand

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GRAIN SIZE DISTRIBUTION

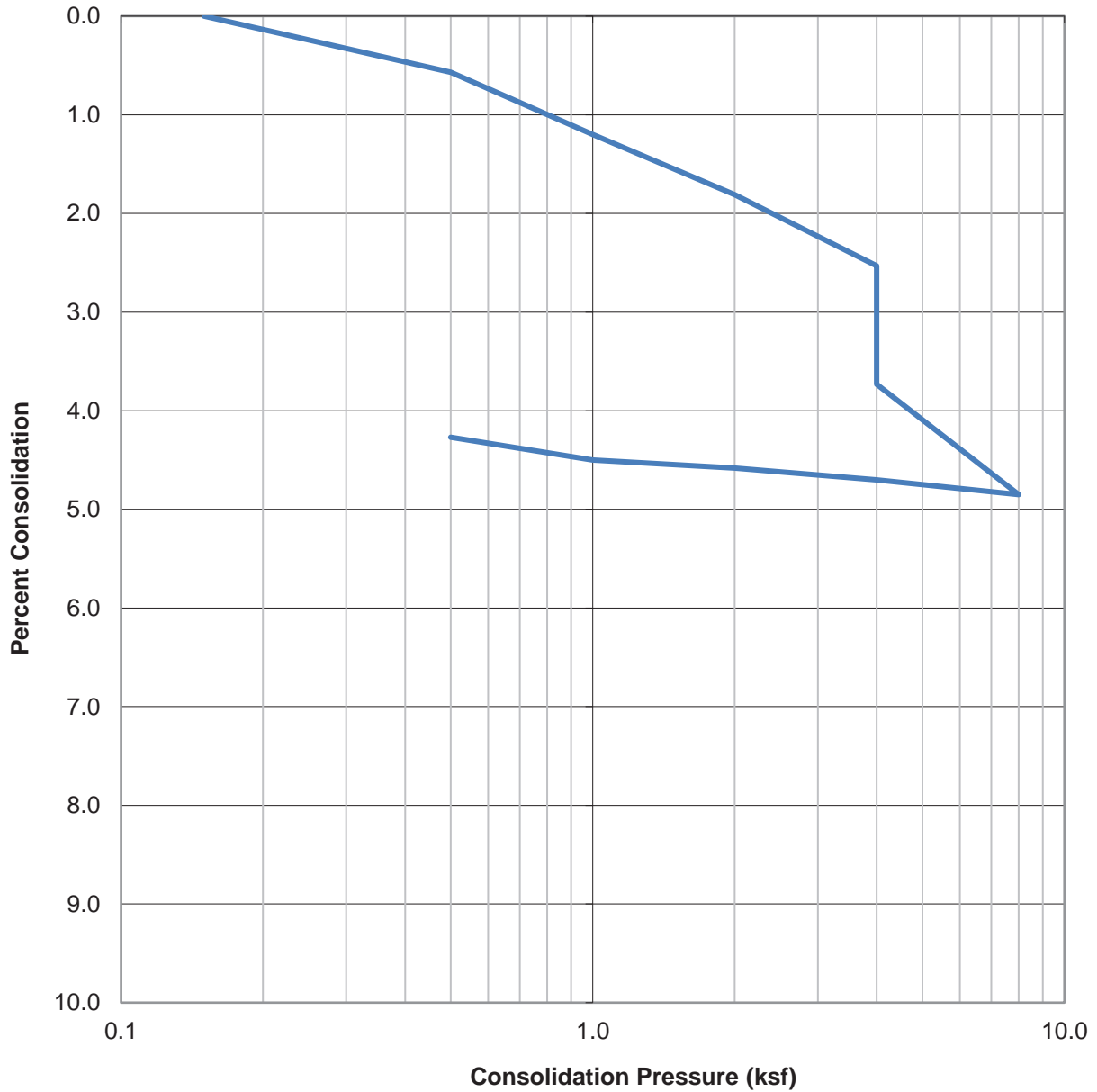
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MEAD VALLEY AREA

JANUARY, 2019

PROJECT NO. T2843-22-01

FIG B-3

WATER ADDED AT 4 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B-2 @ 7.5'	SM	135.1	2.8	12.6

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CONSOLIDATION TEST RESULTS

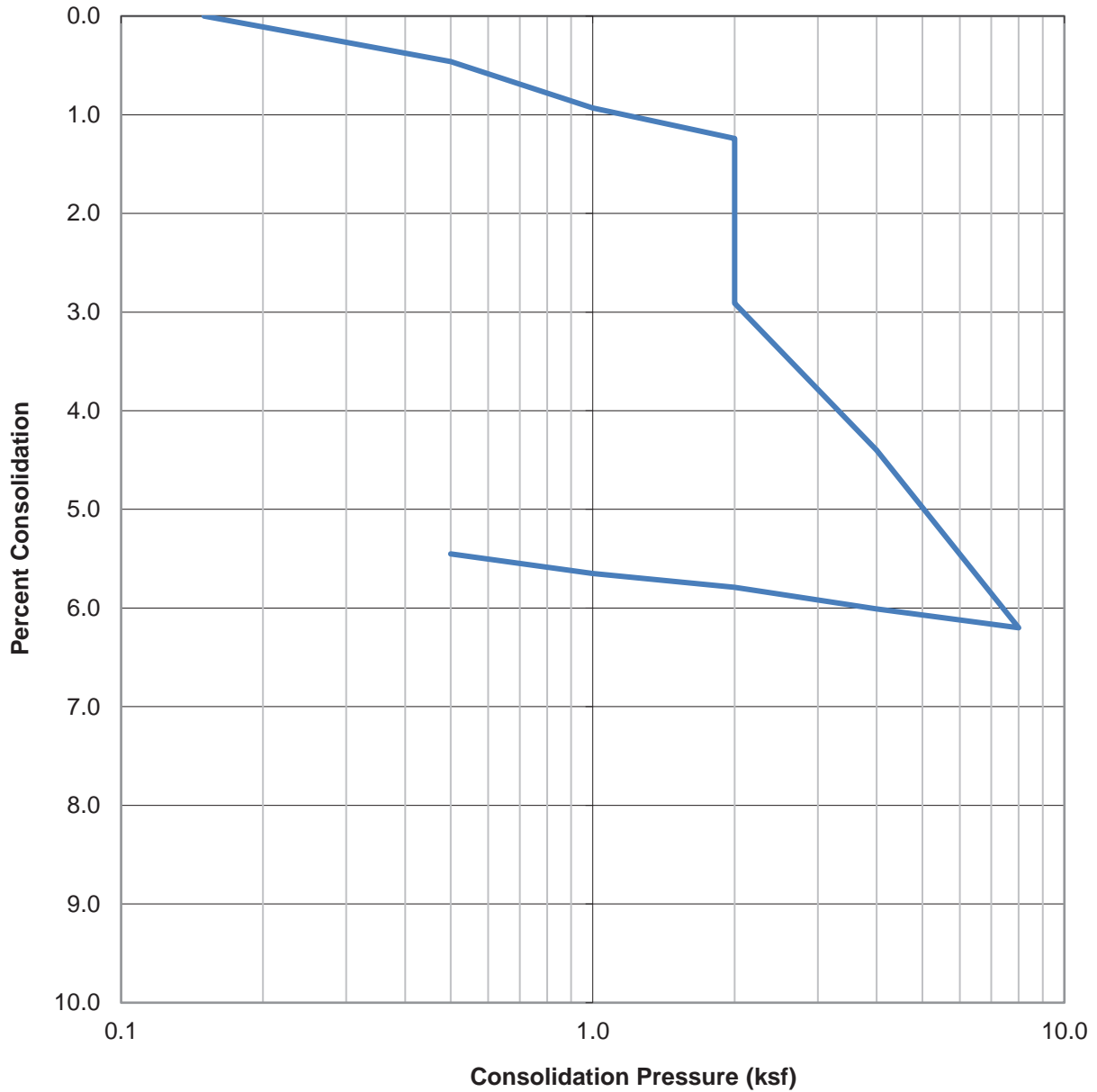
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NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA

JANUARY, 2019

PROJECT NO. T2843-22-01

FIG B-4

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B-5 @ 2.5'	SM	121.3	3.7	14.1

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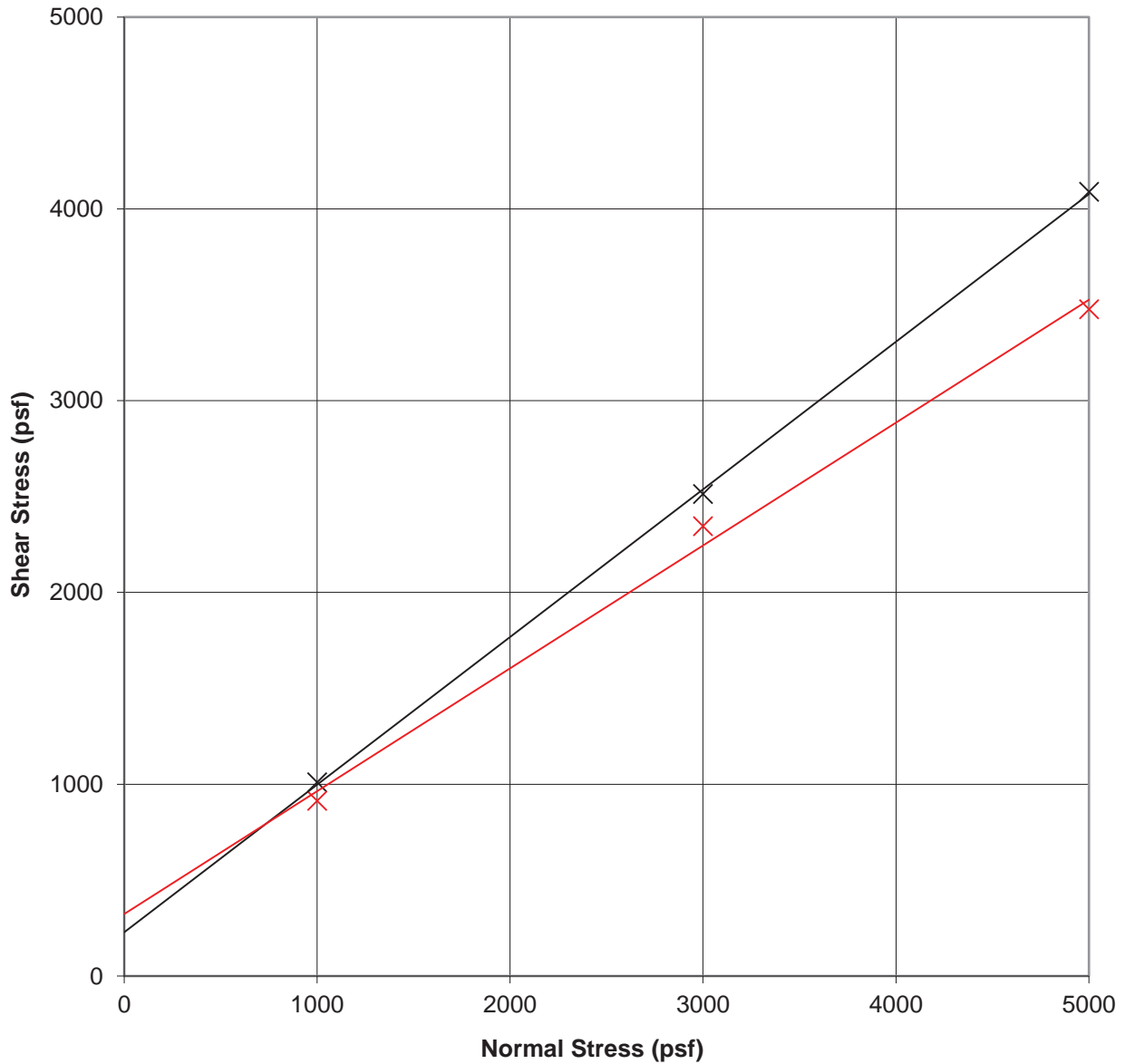
CONSOLIDATION TEST RESULTS

BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY AREA

JANUARY, 2019

PROJECT NO. T2843-22-01

FIG B-5



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
B-2 @ 7.5'	SM	135.1	2.8	16.0	230	38
*B-7 @ 10-15'	SM	120.0	8.5	13.4	320	33

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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DIRECT SHEAR TEST RESULTS

BARKER LOGISTICS WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF PATTERSON
AND PLACENTIA AVENUES
MEAD VALLEY,

JANUARY, 2019

PROJECT NO. T2843-22-01

FIG B-6

APPENDIX



C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

**BARKER LOGISTICS
WAREHOUSE DEVELOPMENT
NORTHEAST CORNER OF
PATTERSON AND
PLACENTIA AVENUES
MEAD VALLEY AREA
RIVERSIDE COUNTY, CALIFORNIA**

PROJECT NO. T2843-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

- 1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.
- 1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.
- 1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

- 2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.
- 2.2 **Contractor** shall refer to the Contractor performing the site grading work.
- 2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.
- 2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

- 2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.
- 2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.
- 2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

- 3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.
- 3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than $\frac{3}{4}$ inch in size.
- 3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.
- 3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than $\frac{3}{4}$ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.
- 3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.
- 3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9

and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

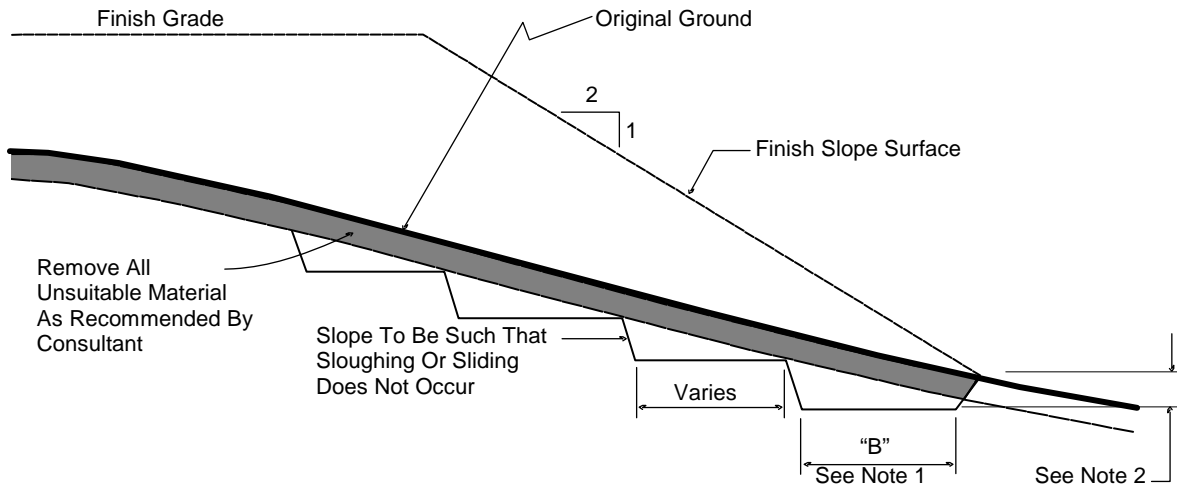
- 3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.
- 3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.
- 3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

- 4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.
- 4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

- 4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.
- 4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

- DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.
- (2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

- 4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

- 5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.
- 5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

- 6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:
- 6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.
- 6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.
- 6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.
- 6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.
- 6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

- 6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.
 - 6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.
 - 6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.
- 6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:
- 6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.
 - 6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.
 - 6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.
 - 6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

- 6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.
- 6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.
- 6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:
- 6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.
- 6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.
- 6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection

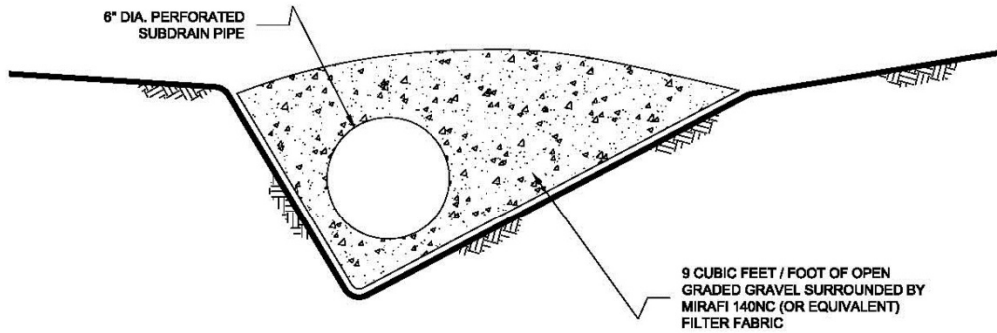
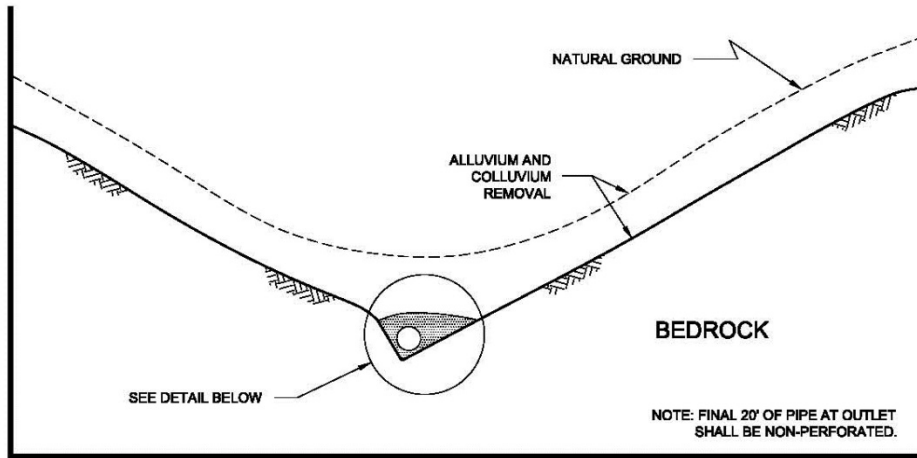
variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

- 6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.
- 6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.
- 6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.
- 6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

- 7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL



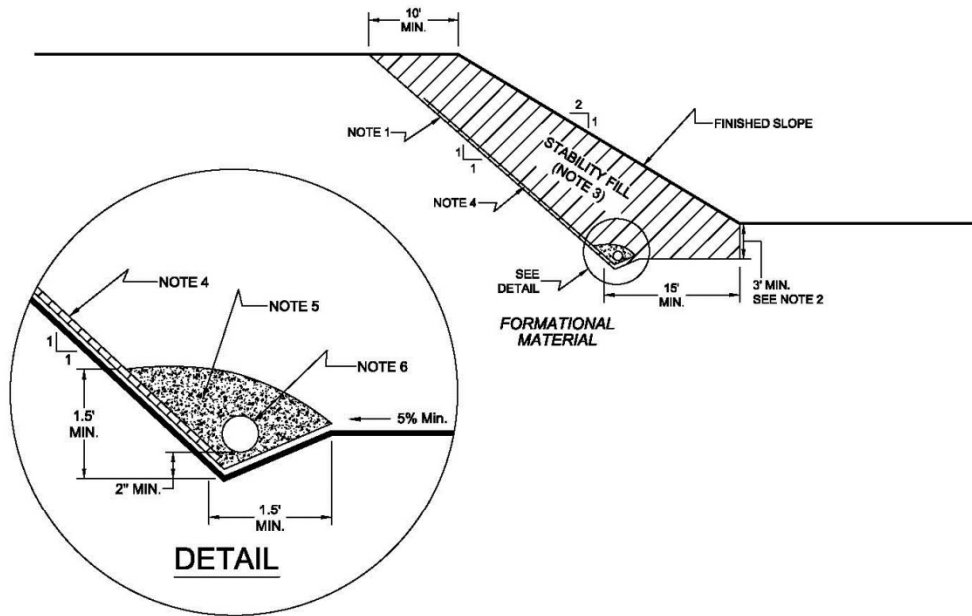
NOTES:

- 1.....8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.
- 2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or larger) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

- 1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).
- 2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.
- 3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.
- 4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.
- 5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).
- 6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

NO SCALE

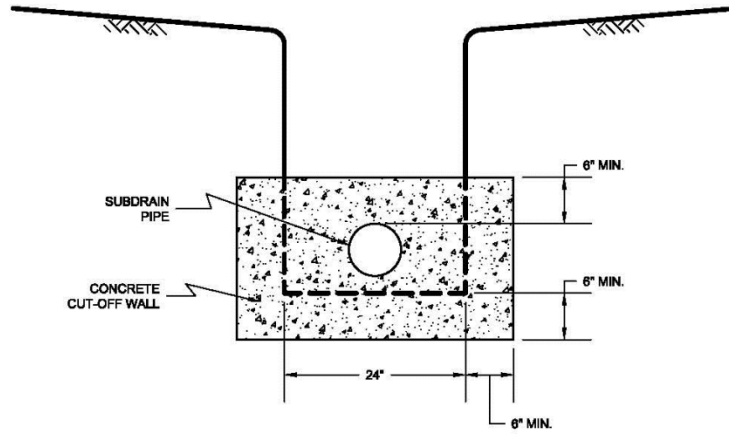
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock fill* or *soil-rock fill* areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock fill* drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

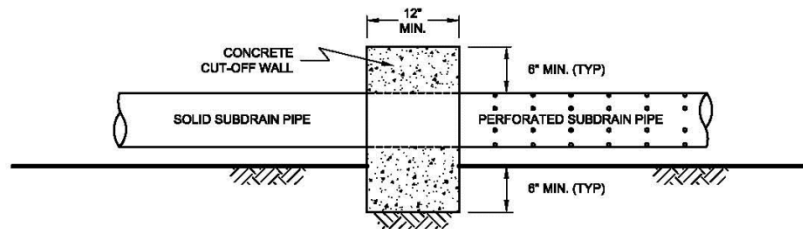
TYPICAL CUT OFF WALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW

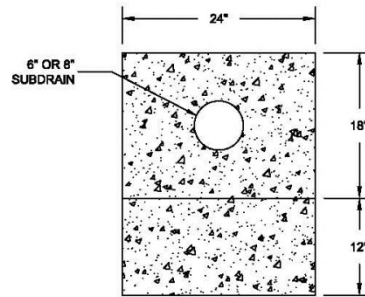


NO SCALE

7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

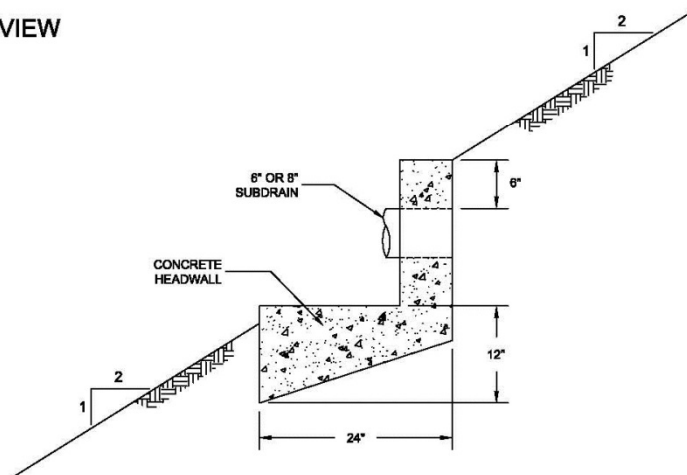
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE
OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

- 7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

- 8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.
- 8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.
- 8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.
- 8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.
- 8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.
- 8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

- 8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

- 8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)*.
- 8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.
- 8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

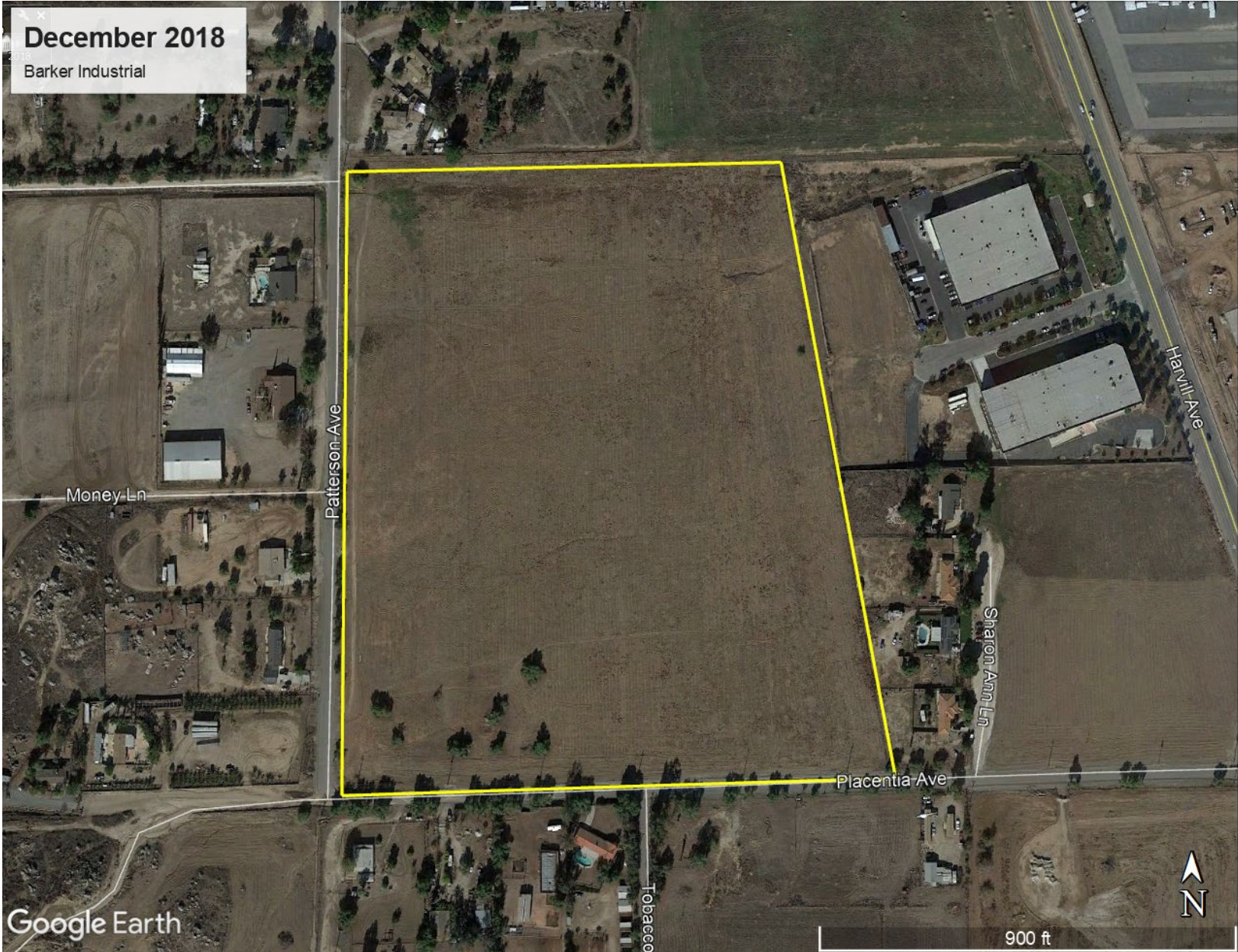
- 9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.
- 9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

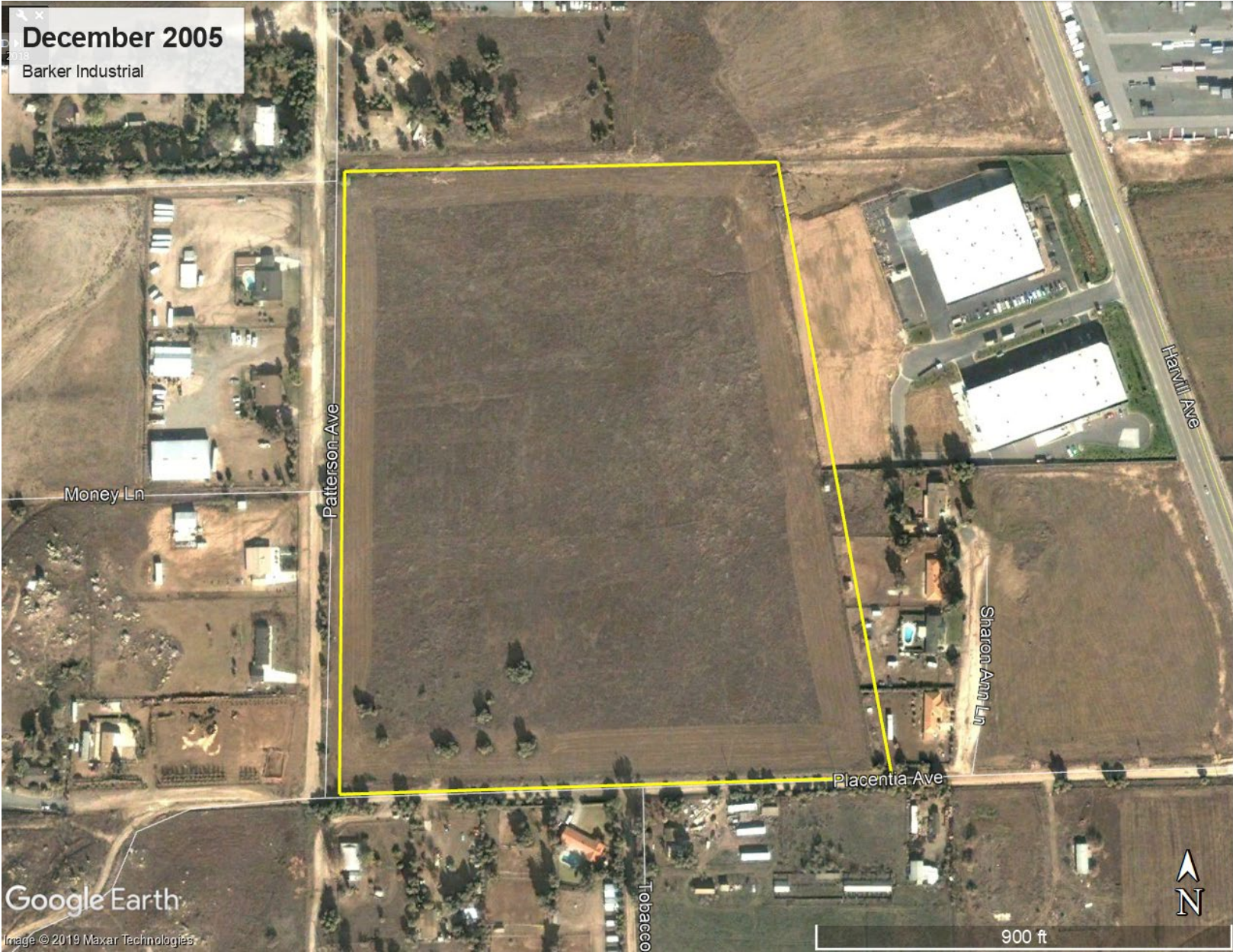
10. CERTIFICATIONS AND FINAL REPORTS

- 10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.
- 10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

Appendix 4: Historical Site Conditions

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





Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

NOT APPLICABLE

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend:

Required Entries

Calculated Cells

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

Company Name **TRWE**

Date **12/23/2019**

Designed by **AJS**

Case No **PPT 190008**

Company Project Number/Name

Barker Industrial

BMP Identification

BMP NAME / ID **BMP D/1**

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

$D_{85} =$ **0.59** inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/1 ROOF	343790	Roofs	1	0.89	306660.7			
D/1 IMP	182722	Concrete or Asphalt	1	0.89	162988			
D/1 LSCAPE	36214	Ornamental Landscaping	0.1	0.11	4000.1			
	562726				473648.8	0.59	23287.7	23914

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)		BMP ID	Legend:	Required Entries
Company Name: TRWE		D/1		Calculated Cells
Designed by: AJS			County/City Case No.:	Date: ##### PPT 190008
Design Volume				
a) Tributary area (BMP subarea)			$A_T =$	12.9184 acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook			$V_{BMP} =$	23,288 ft ³
Maximum Depth				
a) Infiltration rate			$I =$	1.825 in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)			$FS =$	3
c) Calculate D_1		$D_1 = \frac{I \text{ (in/hr)} \times 72 \text{ hrs}}{12 \text{ (in/ft)} \times FS}$	$D_1 =$	3.7 ft
d) Enter the depth of freeboard (at least 1 ft)				1 ft
e) Enter depth to historic high ground water (measured from top of basin)				75 ft
f) Enter depth to top of bedrock or impermeable layer (measured from top of basin)				20 ft
g) D_2 is the smaller of:				
Depth to groundwater - (10 ft + freeboard) and			$D_2 =$	14.0 ft
Depth to impermeable layer - (5 ft + freeboard)				
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet			$D_{MAX} =$	3.7 ft
Basin Geometry				
a) Basin side slopes (no steeper than 4:1)			$z =$	N/A :1
b) Proposed basin depth (excluding freeboard)			$d_B =$	3.7 ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)			$A_S =$	6380 ft ²
d) Proposed Design Surface Area			$A_D =$	9,700 ft ²
Forebay				
a) Forebay volume (minimum 0.5% V_{BMP})			Volume =	116 ft ³
b) Forebay depth (height of berm/splashwall. 1 foot min.)			Depth =	ft
c) Forebay surface area (minimum)			Area =	ft ²
d) Full height notch-type weir			Width (W) =	in
Notes: Underground infiltration system composed of 72 Oldcastle 6-ft StormCapture units; 3 rows @ 24 units/row				

Stage-Area-Storage for BMP D/1

Depth (ft)	Area (ft ²)	Volume (ft ³)
0.00	9,700	0
0.08	9,700	323
0.17	9,700	647
0.25	9,700	970
0.33	9,700	1,293
0.42	9,700	1,617
0.50	9,700	1,940
0.58	9,700	2,263
0.67	9,700	2,587
0.75	9,700	2,910
0.83	9,700	3,233
0.92	9,700	3,557
1.00	9,700	3,880
1.08	7,560	4,597
1.17	7,560	5,227
1.25	7,560	5,857
1.33	7,560	6,487
1.42	7,560	7,117
1.50	7,560	7,747
1.58	7,560	8,377
1.67	7,560	9,007
1.75	7,560	9,637
1.83	7,560	10,267
1.92	7,560	10,897
2.00	7,560	11,527
2.08	7,560	12,157
2.17	7,560	12,787
2.25	7,560	13,417
2.33	7,560	14,047
2.42	7,560	14,677
2.50	7,560	15,307
2.58	7,560	15,937
2.67	7,560	16,567
2.75	7,560	17,197
2.83	7,560	17,827
2.92	7,560	18,457
3.00	7,560	19,087
3.08	7,560	19,717
3.17	7,560	20,347
3.25	7,560	20,977
3.33	7,560	21,607
3.42	7,560	22,237
3.50	7,560	22,867

Depth (ft)	Area (ft ²)	Volume (ft ³)
3.58	7,560	23,497
3.67	7,560	24,127
3.75	7,560	24,757
3.83	7,560	25,387
3.92	7,560	26,017
4.00	7,560	26,647
4.08	7,560	27,277
4.17	7,560	27,907
4.25	7,560	28,537
4.33	7,560	29,167
4.42	7,560	29,797
4.50	7,560	30,427
4.58	7,560	31,057
4.67	7,560	31,687
4.75	7,560	32,317
4.83	7,560	32,947
4.92	7,560	33,577
5.00	7,560	34,207
5.08	7,560	34,837
5.17	7,560	35,467
5.25	7,560	36,097
5.33	7,560	36,727
5.42	7,560	37,357
5.50	7,560	37,987
5.58	7,560	38,617
5.67	7,560	39,247
5.75	7,560	39,877
5.83	7,560	40,507
5.92	7,560	41,137
6.00	7,560	41,767
6.08	7,560	42,397
6.17	7,560	43,027
6.25	7,560	43,657
6.33	7,560	44,287
6.42	7,560	44,917
6.50	7,560	45,547
6.58	7,560	46,177
6.67	7,560	46,807
6.75	7,560	47,437
6.83	7,560	48,067
6.92	7,560	48,697
7.00	7,560	49,327

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend:

Required Entries

Calculated Cells

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

Company Name **TRWE**

Date **12/23/2019**

Designed by **AJS**

Case No **PPT 190008**

Company Project Number/Name

Barker Industrial

BMP Identification

BMP NAME / ID **BMP D/2**

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

$D_{85} =$ **0.59** inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/2 ROOF	334509	Roofs	1	0.89	298382			
D/2 IMP	171183	Concrete or Asphalt	1	0.89	152695.2			
D/2 LSCAPE	1942	Ornamental Landscaping	0.1	0.11	214.5			
507634		Total			451291.7	0.59	22188.5	22281

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)		BMP ID D/2	Legend:	Required Entries Calculated Cells
Company Name:	TRWE			Date: #####
Designed by:	AJS		County/City Case No.:	PPT 190008
Design Volume				
a) Tributary area (BMP subarea)			$A_T =$	11.6537 acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook			$V_{BMP} =$	22,189 ft ³
Maximum Depth				
a) Infiltration rate			$I =$	1.22667 in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)			$FS =$	3
c) Calculate D_1	$D_1 = \frac{I \text{ (in/hr)} \times 72 \text{ hrs}}{12 \text{ (in/ft)} \times FS}$		$D_1 =$	2.5 ft
d) Enter the depth of freeboard (at least 1 ft)				1 ft
e) Enter depth to historic high ground water (measured from top of basin)				75 ft
f) Enter depth to top of bedrock or impermeable layer (measured from top of basin)				20 ft
g) D_2 is the smaller of:				
Depth to groundwater - (10 ft + freeboard) and			$D_2 =$	14.0 ft
Depth to impermeable layer - (5 ft + freeboard)				
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet			$D_{MAX} =$	2.5 ft
Basin Geometry				
a) Basin side slopes (no steeper than 4:1)			$z =$	N/A :1
b) Proposed basin depth (excluding freeboard)			$d_B =$	2.5 ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)			$A_S =$	9044 ft ²
d) Proposed Design Surface Area			$A_D =$	14500 ft ²
Forebay				
a) Forebay volume (minimum 0.5% V_{BMP})			Volume =	111 ft ³
b) Forebay depth (height of berm/splashwall. 1 foot min.)			Depth =	ft
c) Forebay surface area (minimum)			Area =	ft ²
d) Full height notch-type weir			Width (W) =	in
Notes: Underground infiltration system composed of 108 Oldcastle 6-ft StormCapture units; 3 rows @ 36 units/row				

Stage-Area-Storage for BMP D/2

Depth (ft)	Area (ft ²)	Volume (ft ³)
0.00	14,500	0
0.08	14,500	483
0.17	14,500	967
0.25	14,500	1,450
0.33	14,500	1,933
0.42	14,500	2,417
0.50	14,500	2,900
0.58	14,500	3,383
0.67	14,500	3,867
0.75	14,500	4,350
0.83	14,500	4,833
0.92	14,500	5,317
1.00	14,500	5,800
1.08	11,340	6,874
1.17	11,340	7,819
1.25	11,340	8,764
1.33	11,340	9,709
1.42	11,340	10,654
1.50	11,340	11,599
1.58	11,340	12,544
1.67	11,340	13,489
1.75	11,340	14,434
1.83	11,340	15,379
1.92	11,340	16,324
2.00	11,340	17,269
2.08	11,340	18,214
2.17	11,340	19,159
2.25	11,340	20,104
2.33	11,340	21,049
2.42	11,340	21,994
2.50	11,340	22,939
2.58	11,340	23,884
2.67	11,340	24,829
2.75	11,340	25,774
2.83	11,340	26,719
2.92	11,340	27,664
3.00	11,340	28,609
3.08	11,340	29,554
3.17	11,340	30,499
3.25	11,340	31,444
3.33	11,340	32,389
3.42	11,340	33,334
3.50	11,340	34,279

Depth (ft)	Area (ft ²)	Volume (ft ³)
3.58	11,340	35,224
3.67	11,340	36,169
3.75	11,340	37,114
3.83	11,340	38,059
3.92	11,340	39,004
4.00	11,340	39,949
4.08	11,340	40,894
4.17	11,340	41,839
4.25	11,340	42,784
4.33	11,340	43,729
4.42	11,340	44,674
4.50	11,340	45,619
4.58	11,340	46,564
4.67	11,340	47,509
4.75	11,340	48,454
4.83	11,340	49,399
4.92	11,340	50,344
5.00	11,340	51,289
5.08	11,340	52,234
5.17	11,340	53,179
5.25	11,340	54,124
5.33	11,340	55,069
5.42	11,340	56,014
5.50	11,340	56,959
5.58	11,340	57,904
5.67	11,340	58,849
5.75	11,340	59,794
5.83	11,340	60,739
5.92	11,340	61,684
6.00	11,340	62,629
6.08	11,340	63,574
6.17	11,340	64,519
6.25	11,340	65,464
6.33	11,340	66,409
6.42	11,340	67,354
6.50	11,340	68,299
6.58	11,340	69,244
6.67	11,340	70,189
6.75	11,340	71,134
6.83	11,340	72,079
6.92	11,340	73,024
7.00	11,340	73,969

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend:

Required Entries

Calculated Cells

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

Company Name **TRWE**

Date **12/23/2019**

Designed by **AJS**

Case No **PPT 190008**

Company Project Number/Name

Barker Industrial

BMP Identification

BMP NAME / ID **BMP D/3**

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

$D_{85} =$ **0.59** inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/3 ROOF	144	Roofs	1	0.89	128.4			
D/3IMP	70198	Concrete or Asphalt	1	0.89	62616.6			
D/3 LSCAPE	10971	Ornamental Landscaping	0.1	0.11	1211.8			
81313		Total			63956.8	0.59	3144.5	3,321

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)		BMP ID	Legend:	Required Entries
Company Name: TRWE		D/3		Calculated Cells
Designed by: AJS			County/City Case No.:	Date: ##### PPT 190008
Design Volume				
a) Tributary area (BMP subarea)			$A_T =$	1.86669 acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook			$V_{BMP} =$	3,145 ft ³
Maximum Depth				
a) Infiltration rate			$I =$	1.466 in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)			$FS =$	3
c) Calculate D_1		$D_1 = \frac{I \text{ (in/hr)} \times 72 \text{ hrs}}{12 \text{ (in/ft)} \times FS}$	$D_1 =$	2.9 ft
d) Enter the depth of freeboard (at least 1 ft)				1 ft
e) Enter depth to historic high ground water (measured from top of basin)				75 ft
f) Enter depth to top of bedrock or impermeable layer (measured from top of basin)				20 ft
g) D_2 is the smaller of:				
Depth to groundwater - (10 ft + freeboard) and			$D_2 =$	14.0 ft
Depth to impermeable layer - (5 ft + freeboard)				
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet			$D_{MAX} =$	2.9 ft
Basin Geometry				
a) Basin side slopes (no steeper than 4:1)			$z =$	N/A :1
b) Proposed basin depth (excluding freeboard)			$d_B =$	2.9 ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)			$A_S =$	1072 ft ²
d) Proposed Design Surface Area			$A_D =$	1908 ft ²
Forebay				
a) Forebay volume (minimum 0.5% V_{BMP})			Volume =	16 ft ³
b) Forebay depth (height of berm/splashwall. 1 foot min.)			Depth =	ft
c) Forebay surface area (minimum)			Area =	ft ²
d) Full height notch-type weir			Width (W) =	in
Notes: Underground infiltration system composed of 13 Oldcastle 4-ft StormCapture units; single row				

Stage-Area-Storage for BMP D/3

Depth (ft)	Area (ft ²)	Volume (ft ³)
0.00	1,908	0
0.08	1,908	64
0.17	1,908	127
0.25	1,908	191
0.33	1,908	254
0.42	1,908	318
0.50	1,908	382
0.58	1,908	445
0.67	1,908	509
0.75	1,908	572
0.83	1,908	636
0.92	1,908	700
1.00	1,908	763
1.08	1,365	899
1.17	1,365	1,013
1.25	1,365	1,126
1.33	1,365	1,240
1.42	1,365	1,354
1.50	1,365	1,468
1.58	1,365	1,581
1.67	1,365	1,695
1.75	1,365	1,809
1.83	1,365	1,923
1.92	1,365	2,036
2.00	1,365	2,150
2.08	1,365	2,264
2.17	1,365	2,378
2.25	1,365	2,491
2.33	1,365	2,605
2.42	1,365	2,719
2.50	1,365	2,833
2.58	1,365	2,946
2.67	1,365	3,060
2.75	1,365	3,174
2.83	1,365	3,288
2.92	1,365	3,401
3.00	1,365	3,515
3.08	1,365	3,629
3.17	1,365	3,743
3.25	1,365	3,856
3.33	1,365	3,970
3.42	1,365	4,084
3.50	1,365	4,198

Depth (ft)	Area (ft ²)	Volume (ft ³)
3.58	1,365	4,311
3.67	1,365	4,425
3.75	1,365	4,539
3.83	1,365	4,653
3.92	1,365	4,766
4.00	1,365	4,880
4.08	1,365	4,994
4.17	1,365	5,108
4.25	1,365	5,221
4.33	1,365	5,335
4.42	1,365	5,449
4.50	1,365	5,563
4.58	1,365	5,676
4.67	1,365	5,790
4.75	1,365	5,904
4.83	1,365	6,018
4.92	1,365	6,131
5.00	1,365	6,245

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend:

Required Entries

Calculated Cells

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

Company Name **TRWE**

Date **12/23/2019**

Designed by **AJS**

Case No **PPT 190008**

Company Project Number/Name

Barker Industrial

BMP Identification

BMP NAME / ID **BMP D/4**

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

$D_{85} =$ **0.59** inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/4 IMP	63506	Concrete or Asphalt	1	0.89	56647.4			
D/4 LSCAPE	41023	Ornamental Landscaping	0.1	0.11	4531.3			
	104529				61178.7	0.59	3008	14,262

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)		BMP ID D/4	Legend:	Required Entries Calculated Cells
Company Name:	TRWE			Date: #####
Designed by:	AJS			County/City Case No.: PPT 190008
Design Volume				
a) Tributary area (BMP subarea)			$A_T =$	2.39966 acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook			$V_{BMP} =$	3,008 ft ³
Maximum Depth				
a) Infiltration rate			$I =$	1.22667 in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)			$FS =$	3
c) Calculate D_1	$D_1 = \frac{I \text{ (in/hr)} \times 72 \text{ hrs}}{12 \text{ (in/ft)} \times FS}$		$D_1 =$	2.5 ft
d) Enter the depth of freeboard (at least 1 ft)				1 ft
e) Enter depth to historic high ground water (measured from top of basin)				75 ft
f) Enter depth to top of bedrock or impermeable layer (measured from top of basin)				20 ft
g) D_2 is the smaller of:				
Depth to groundwater - (10 ft + freeboard) and			$D_2 =$	14.0 ft
Depth to impermeable layer - (5 ft + freeboard)				
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet			$D_{MAX} =$	2.5 ft
Basin Geometry				
a) Basin side slopes (no steeper than 4:1)			$z =$	N/A :1
b) Proposed basin depth (excluding freeboard)			$d_B =$	2.5 ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)			$A_S =$	1226 ft ²
d) Proposed Design Surface Area			$A_D =$	4,736 ft ²
Forebay				
a) Forebay volume (minimum 0.5% V_{BMP})			Volume =	15 ft ³
b) Forebay depth (height of berm/splashwall. 1 foot min.)			Depth =	ft
c) Forebay surface area (minimum)			Area =	ft ²
d) Full height notch-type weir			Width (W) =	in
Notes:				

Stage-Area-Storage for BMP D/4

Depth (ft)	Area (ft ²)	Volume (ft ³)
0.00	4,736	0
0.08	4,801	397
0.17	4,865	800
0.25	4,930	1,208
0.33	4,995	1,622
0.42	5,059	2,041
0.50	5,124	2,465
0.58	5,188	2,895
0.67	5,253	3,330
0.75	5,317	3,770
0.83	5,382	4,216
0.92	5,447	4,667
1.00	5,511	5,124
1.08	5,576	5,586
1.17	5,640	6,053
1.25	5,705	6,526
1.33	5,769	7,004
1.42	5,834	7,487
1.50	5,899	7,976
1.58	5,963	8,470
1.67	6,028	8,970
1.75	6,092	9,475
1.83	6,157	9,985
1.92	6,222	10,501
2.00	6,286	11,022
2.08	6,351	11,549
2.17	6,415	12,081
2.25	6,480	12,618
2.33	6,544	13,161
2.42	6,609	13,709
2.50	6,674	14,262
2.58	6,738	14,821
2.67	6,803	15,385
2.75	6,867	15,955
2.83	6,932	16,530
2.92	6,996	17,110
3.00	7,061	17,696
3.08	7,126	18,287
3.17	7,190	18,883
3.25	7,255	19,485
3.33	7,319	20,092
3.42	7,384	20,705
3.50	7,448	21,323

Depth (ft)	Area (ft ²)	Volume (ft ³)
3.58	7,513	21,947
3.67	7,578	22,575
3.75	7,642	23,209
3.83	7,707	23,849
3.92	7,771	24,494
4.00	7,836	25,144

GENERAL NOTES:

THE STORM CAPTURE™ SYSTEM BY OLDCASTLE PRECAST IS PART OF THE STORMWATER MANAGEMENT SYSTEM FOR THE RESPECTIVE SITE, AS PREPARED BY THE PROJECT DESIGN ENGINEER. IT IS THE RESPONSIBILITY OF THE DESIGN ENGINEER TO DETERMINE DESIGN FLOW RATES, PRE-TREATMENT AND POST-TREATMENT REQUIREMENTS, STORAGE VOLUME, AND ENSURE THE FINAL DESIGN MEETS ALL CONVEYANCE AND STORAGE REQUIREMENTS. SYSTEM DESIGN AND TYPE, SOIL ANALYSIS, LOADING REQUIREMENTS, COVER HEIGHT AND MODULE SIZE DETERMINE THE FOUNDATION TYPE AND REQUIREMENTS AS STATED HEREIN. ANY VARIATIONS FOUND DURING CONSTRUCTION FROM THE SITE AND SYSTEM ANALYSIS MUST BE REPORTED TO THE PROJECT DESIGN ENGINEER. THE PROJECT DESIGN ENGINEER IS RESPONSIBLE FOR OBTAINING A GEOTECHNICAL ENGINEERING REPORT VERIFYING THE BEARING CAPACITY STATED IN DESIGN NOTES.

DESIGN NOTES:

1. DESIGN LOADINGS:
 - A. AASHTO HS20-44 W/ IMPACT.
 - B. DEPTH OF COVER = 6" - 5'-0".
 - C. ASSUMED WATER TABLE = BELOW BOTTOM.
 - D. EQUIVALENT FLUID PRESSURE = 45 PCF.
 - E. LATERAL LIVE LOAD SURCHARGE = 80 PSF.
 - F. NO LATERAL SURCHARGE FROM ADJACENT STRUCTURES.
2. CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6,000 PSI.
3. STEEL REINFORCEMENT: REBAR, ASTM A-615, GRADE 60.
4. CEMENT: ASTM C-150 SPECIFICATION.
5. STORM CAPTURE MODULE TYPE = INFILTRATION.
6. DEPTH OF AGGREGATE BEARING LAYER TO BE DETERMINED IN ACCORDANCE WITH OLDCASTLE TECH NOTE SC-01.
7. ALLOWABLE SOIL BEARING PRESSURE ADDRESSED IN OLDCASTLE TECH NOTE SC-01.
8. REFERENCE STANDARDS:
 - A. ASTM C 890
 - B. ASTM C 891
 - C. ASTM C 913
9. LESS THAN 6" OR GREATER THAN 5' OF COVER REQUIRES CUSTOM STRUCTURAL DESIGN AND MAY REQUIRE THICKER AGGREGATE BEARING LAYER.

INSTALLATION NOTES:

THE STORM CAPTURE™ MODULE SYSTEM IS TO BE INSTALLED IN ACCORDANCE WITH ASTM C891, INSTALLATION OF UNDERGROUND PRECAST UTILITY STRUCTURES. PROJECT PLAN AND SPECIFICATIONS MUST BE FOLLOWED ALONG WITH ANY APPLICABLE REGULATIONS.

1. PLAN LINE, GRADE AND ELEVATIONS MUST BE FOLLOWED.
2. A. WHERE SPECIFIED, AN 8 OZ. NON-WOVEN GEOTEXTILE FABRIC MUST BE USED AS A SEPARATION LAYER AROUND THE STORM CAPTURE SYSTEM.
3. PENETRATIONS IN THE GEOTEXTILE MAY ONLY BE MADE WITH SMOOTH WALL PIPES. MAKE PENETRATIONS FOR ALL OUTLETS BEFORE MAKING PENETRATIONS FOR ANY INLETS.
4. THE AGGREGATE BEARING LAYER SHOULD CONSIST OF CLEAN, DURABLE CRUSHED AGGREGATE COMPACTED AS DIRECTED BY THE ENGINEER. OLDCASTLE RECOMMENDS MATERIALS SUCH AS NO. 56 OR NO. 57 STONE PER ASTM C33.
5. DESIGNATED EMBEDDED LIFTERS MUST BE USED. USE PROPER RIGGING TO ASSURE ALL LIFTERS ARE EQUALLY ENGAGED WITH A MINIMUM 60 DEGREE ANGLE ON SLINGS AS NOTED AND IN ACCORDANCE WITH OLDCASTLE LIFTING PROCEDURES.
6. MODULES MUST BE PLACED AS CLOSE TOGETHER AS POSSIBLE, AND GAPS SHALL NOT BE GREATER THAN 3/4". ALL EXTERIOR SYSTEM JOINTS SHALL BE COVERED WITH A MIN. 8" JOINT WRAP ON SIDES AND TOP (CS-212 CONSEAL OR EQUIVALENT). INSTALL ONE ROW CS-102 CONSEAL (OR EQUIVALENT) BETWEEN PRECAST PIECES.
7. AUTHORIZATION SHOULD BE GIVEN BY THE PROJECT ENGINEER OR DESIGNATED PERSON PRIOR TO PLACEMENT ON BACKFILL FOR THE SYSTEM. CARE SHOULD BE TAKEN DURING PLACEMENT OF BACKFILL NOT TO DISPLACE MODULES OR JOINT WRAP. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR AS SPECIFIED, AND SHOULD NOT BE COMPACTED WITHIN 6" OF MODULE.
8. CONSTRUCTION EQUIPMENT EXCEEDING DESIGN LOADING SHALL NOT BE ALLOWED ON STRUCTURE.

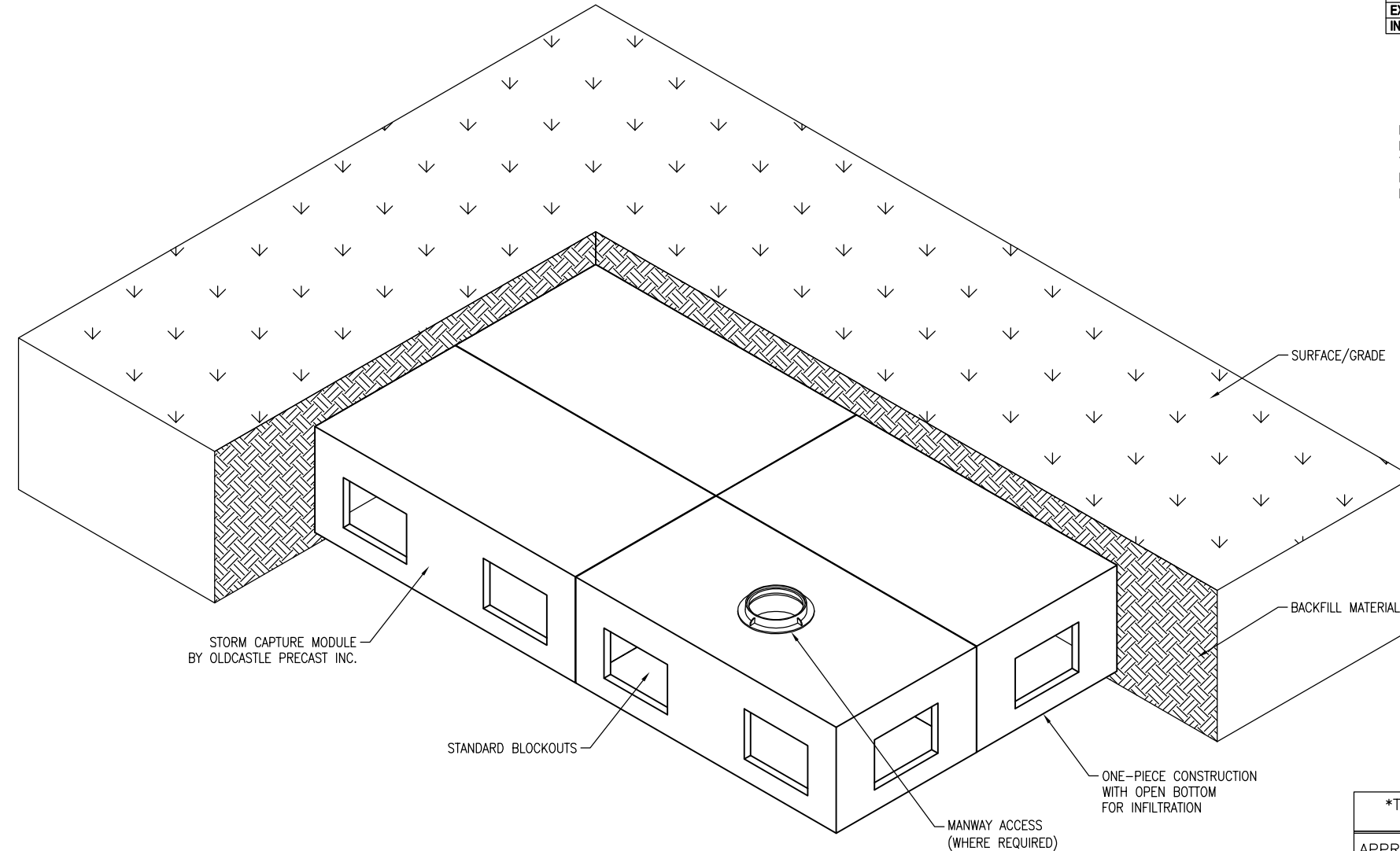
SPLASH PADS, INLETS AND RISERS:

PLACE SPLASH PADS AS DESIGNATED TO PREVENT SCOUR FROM INLETS AND INLET PIPES. ALL PIPE INLETS SHALL EXTEND INSIDE MODULE A MINIMUM OF 4". PLACE A NON-SHRINK, NON-METALIC GROUT, MIN. 3,000 PSI IN ANNULAR SPACE TO ELIMINATE ALL VOIDS.

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NOTE: THIS VIEW IS FOR ILLUSTRATION PURPOSES ONLY TO SHOW FEATURES OF THE SYSTEM. ACTUAL LAYOUT VARIES BY PROJECT, SEE SITE PLAN LAYOUT. ALL PERIMETER WALLS ARE SOLID.



INFILTRATION MODULE ISO VIEW

N.T.S.

THIS MUST BE FILLED OUT BEFORE MANUFACTURING BEGINS

APPROVED W/ NO EXCEPTIONS TAKEN:

APPROVED AS NOTED:

REVISE AND RESUBMIT:

**- PRELIMINARY -
NOT FOR CONSTRUCTION**

SIGNATURE _____ DATE _____



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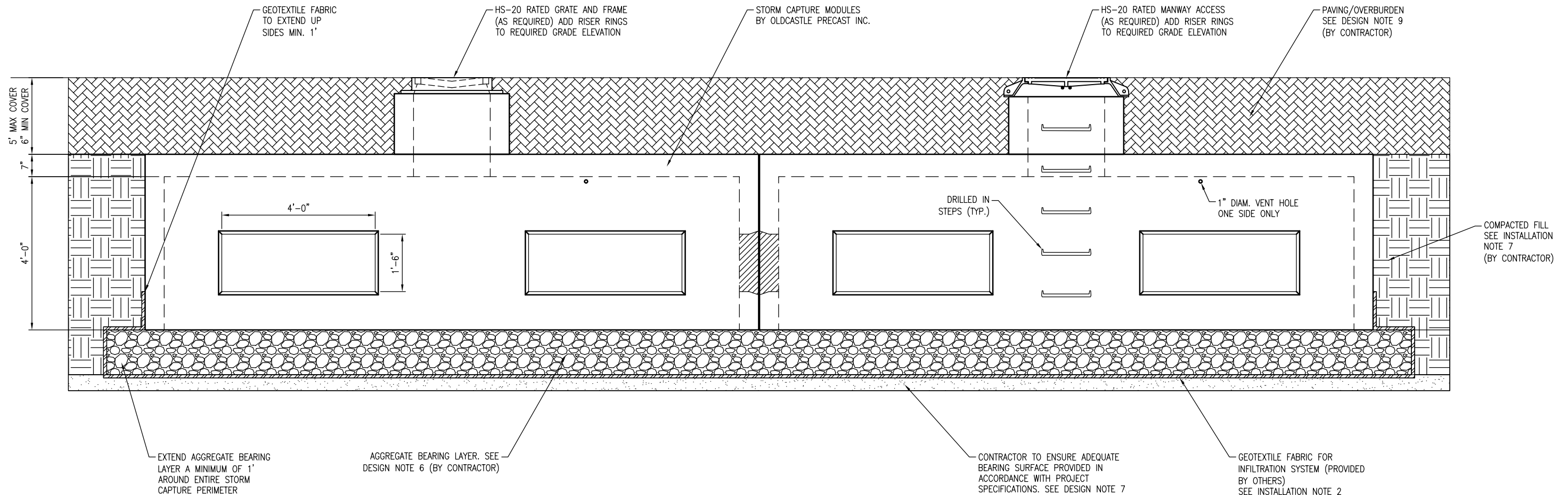
STORMCAPTURE
NOTES & GENERAL ISO

CUSTOMER _____

DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER SC - 4 ft top-only				REVISION REV DATE	SHEET 1 OF 4

REVISIONS

REVISION	DATE	SHEETS	DESCRIPTION OF REVISION



TYPICAL ELEVATION
SCALE: 3/8" = 1'-0"

NOTE:
FOR INFILTRATION - EXFILTRATION
SYSTEMS, THE AGGREGATE SUBGRADE
MUST BE WASHED AND CLEAN.

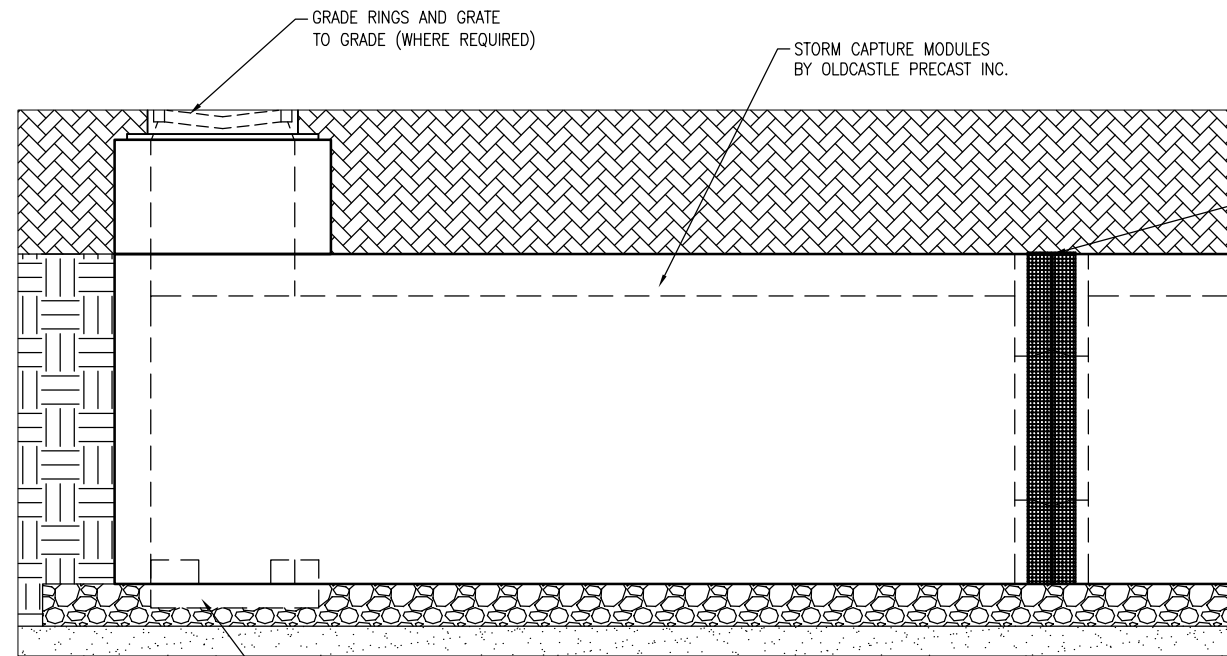
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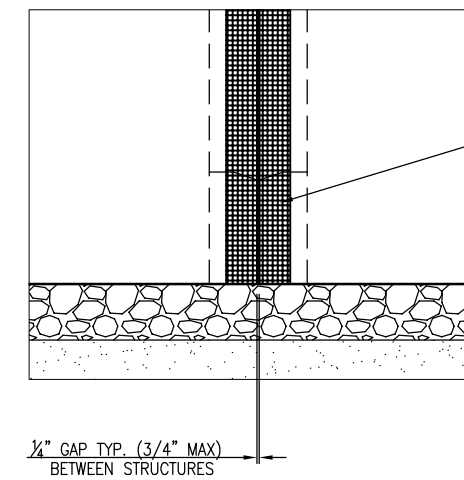
STORMCAPTURE
TYPICAL ELEVATION

CUSTOMER					
DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER				REVISION	SHEET
SC - 4 ft top-only				REV DATE	2 OF 4

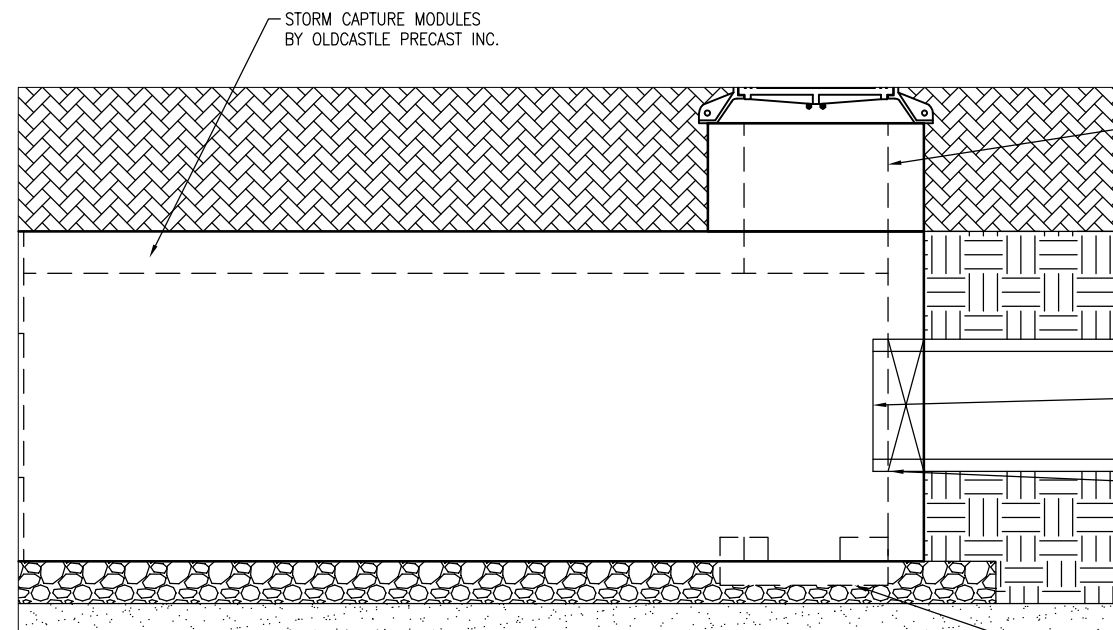


GRATE INLET DETAIL
SCALE: 3/8" = 1'-0"

NOTE: WEIR PLATES, IF REQUIRED, MAY BE INSTALLED WITH RED-HEAD ANCHORS (BY OTHERS). ELEVATIONS TO BE DETERMINED BY PROJECT DESIGN ENGINEER



MODULE JOINT DETAIL
SCALE: 1/2" = 1'-0"



MANWAY ACCESS DETAIL
SCALE: 3/8" = 1'-0"

- PRELIMINARY -
NOT FOR CONSTRUCTION

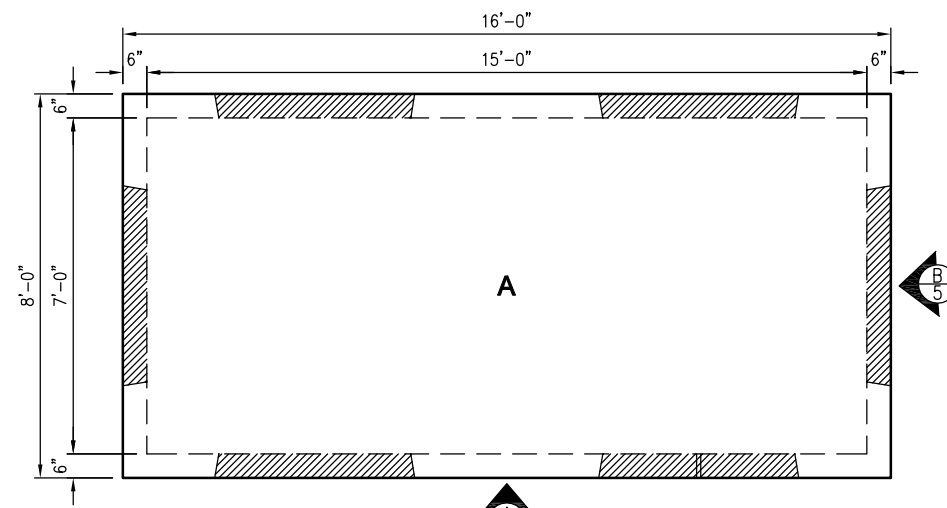


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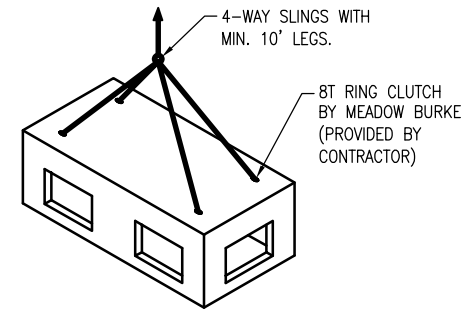
STORMCAPTURE
EXTERIOR DETAILS

CUSTOMER

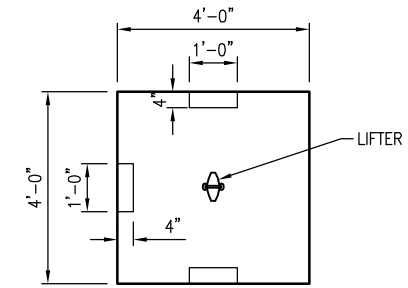
DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER				REVISION	SHEET
SC - 4 ft top-only				REV DATE	3 OF 4



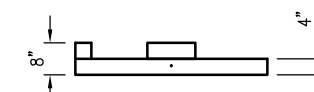
STORM CAPTURE PLAN VIEW
SCALE: 1/4" = 1'-0"



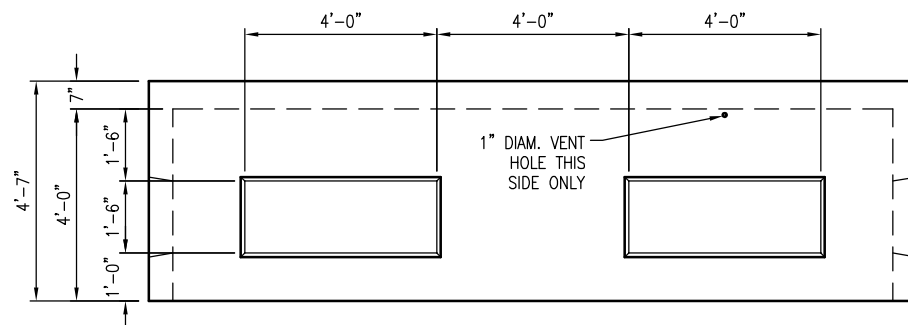
MODULE LIFTING DETAIL
N.T.S.



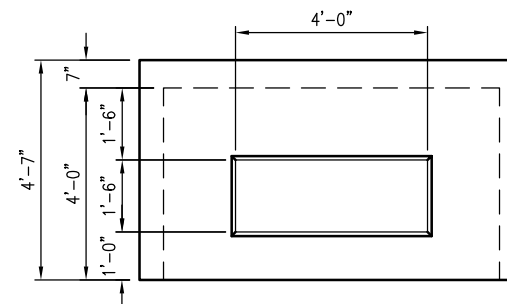
SPLASH PAD - PLAN
SCALE: 1/4" = 1'-0"



SPLASH PAD - PROFILE
SCALE: 1/4" = 1'-0"



VIEW A
SCALE: 1/4" = 1'-0"



VIEW B
SCALE: 1/4" = 1'-0"

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STORMCAPTURE
INTERIOR DETAILS

CUSTOMER					
DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER SC - 4 ft top-only				REVISION REV DATE	SHEET 4 OF 4

GENERAL NOTES:

THE STORM CAPTURE™ SYSTEM BY OLDCASTLE PRECAST IS PART OF THE STORMWATER MANAGEMENT SYSTEM FOR THE RESPECTIVE SITE, AS PREPARED BY THE PROJECT DESIGN ENGINEER. IT IS THE RESPONSIBILITY OF THE DESIGN ENGINEER TO DETERMINE DESIGN FLOW RATES, PRE-TREATMENT AND POST-TREATMENT REQUIREMENTS, STORAGE VOLUME, AND ENSURE THE FINAL DESIGN MEETS ALL CONVEYANCE AND STORAGE REQUIREMENTS. SYSTEM DESIGN AND TYPE, SOIL ANALYSIS, LOADING REQUIREMENTS, COVER HEIGHT AND MODULE SIZE DETERMINE THE FOUNDATION TYPE AND REQUIREMENTS AS STATED HEREIN. ANY VARIATIONS FOUND DURING CONSTRUCTION FROM THE SITE AND SYSTEM ANALYSIS MUST BE REPORTED TO THE PROJECT DESIGN ENGINEER. THE PROJECT DESIGN ENGINEER IS RESPONSIBLE FOR OBTAINING A GEOTECHNICAL ENGINEERING REPORT VERIFYING THE BEARING CAPACITY STATED IN DESIGN NOTES.

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DESIGN NOTES:

- DESIGN LOADINGS:
 - AASHTO HS20-44 W/ IMPACT.
 - DEPTH OF COVER = 6" - 5'-0".
 - ASSUMED WATER TABLE = BELOW BOTTOM.
 - EQUIVALENT FLUID PRESSURE = 45 PCF.
 - LATERAL LIVE LOAD SURCHARGE = 80 PSF.
 - NO LATERAL SURCHARGE FROM ADJACENT STRUCTURES.
- CONCRETE 28 DAY COMPRESSIVE STRENGTH SHALL BE 6,000 PSI.
- STEEL REINFORCEMENT: REBAR, ASTM A-615, GRADE 60.
- CEMENT: ASTM C-150 SPECIFICATION.
- STORM CAPTURE MODULE TYPE = INFILTRATION.
- DEPTH OF AGGREGATE BEARING LAYER TO BE DETERMINED IN ACCORDANCE WITH OLDCASTLE TECH NOTE SC-01.
- ALLOWABLE SOIL BEARING PRESSURE ADDRESSED IN OLDCASTLE TECH NOTE SC-01.
- REFERENCE STANDARDS:
 - ASTM C 890
 - ASTM C 891
 - ASTM C 913
- LESS THAN 6" OR GREATER THAN 5' OF COVER REQUIRES CUSTOM STRUCTURAL DESIGN AND MAY REQUIRE THICKER AGGREGATE BEARING LAYER.

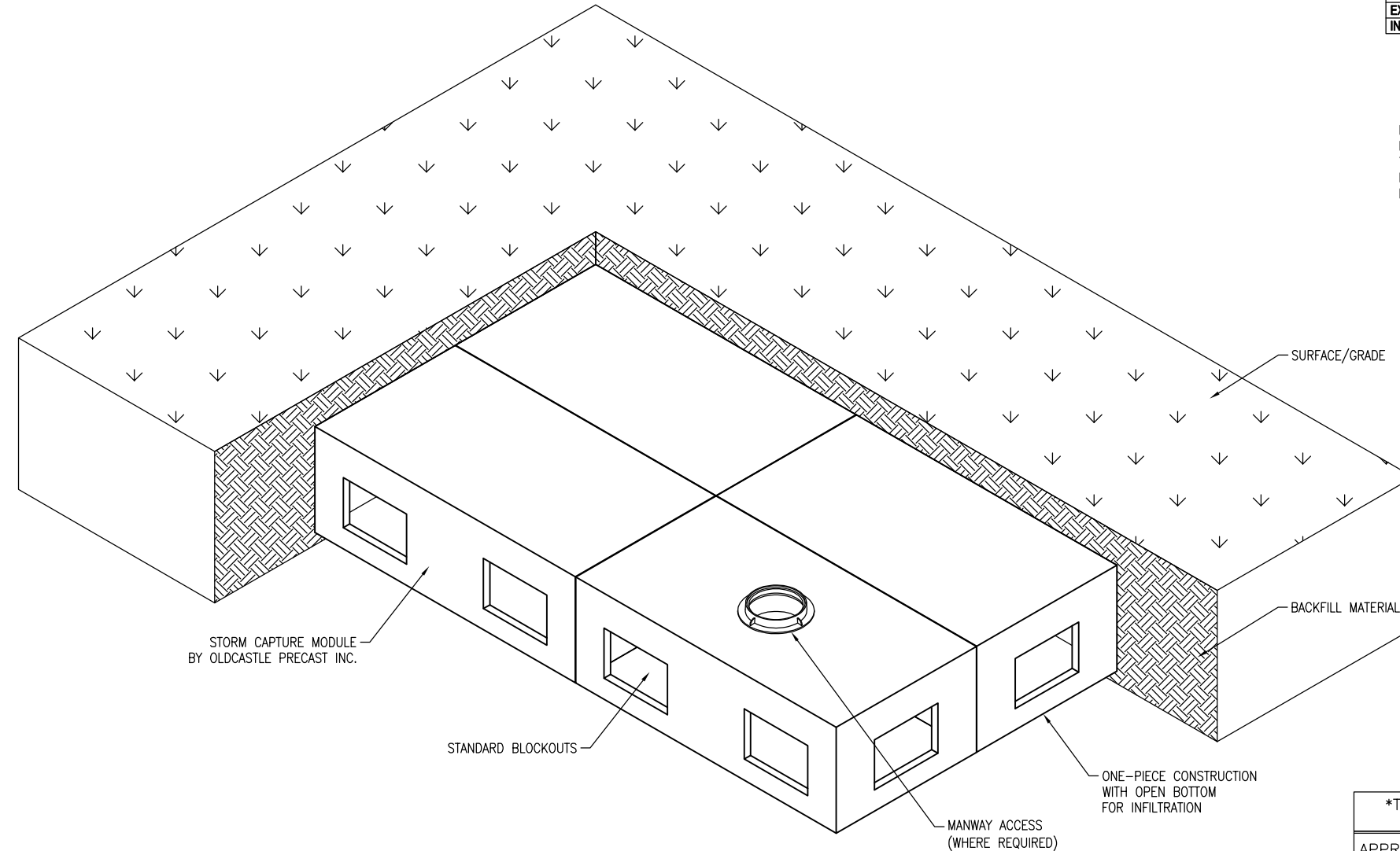
INSTALLATION NOTES:

THE STORM CAPTURE™ MODULE SYSTEM IS TO BE INSTALLED IN ACCORDANCE WITH ASTM C891, INSTALLATION OF UNDERGROUND PRECAST UTILITY STRUCTURES. PROJECT PLAN AND SPECIFICATIONS MUST BE FOLLOWED ALONG WITH ANY APPLICABLE REGULATIONS.

- PLAN LINE, GRADE AND ELEVATIONS MUST BE FOLLOWED.
- WHERE SPECIFIED, AN 8 OZ. NON-WOVEN GEOTEXTILE FABRIC MUST BE USED AS A SEPARATION LAYER AROUND THE STORM CAPTURE SYSTEM.
- PENETRATIONS IN THE GEOTEXTILE MAY ONLY BE MADE WITH SMOOTH WALL PIPES. MAKE PENETRATIONS FOR ALL OUTLETS BEFORE MAKING PENETRATIONS FOR ANY INLETS.
- THE AGGREGATE BEARING LAYER SHOULD CONSIST OF CLEAN, DURABLE CRUSHED AGGREGATE COMPACTED AS DIRECTED BY THE ENGINEER. OLDCASTLE RECOMMENDS MATERIALS SUCH AS NO. 56 OR NO. 57 STONE PER ASTM C33.
- DESIGNATED EMBEDDED LIFTERS MUST BE USED. USE PROPER RIGGING TO ASSURE ALL LIFTERS ARE EQUALLY ENGAGED WITH A MINIMUM 60 DEGREE ANGLE ON SLINGS AS NOTED AND IN ACCORDANCE WITH OLDCASTLE LIFTING PROCEDURES.
- MODULES MUST BE PLACED AS CLOSE TOGETHER AS POSSIBLE, AND GAPS SHALL NOT BE GREATER THAN 3/4". ALL EXTERIOR SYSTEM JOINTS SHALL BE COVERED WITH A MIN. 8" JOINT WRAP ON SIDES AND TOP (CS-212 CONSEAL OR EQUIVALENT). INSTALL ONE ROW CS-102 CONSEAL (OR EQUIVALENT) BETWEEN PRECAST PIECES.
- AUTHORIZATION SHOULD BE GIVEN BY THE PROJECT ENGINEER OR DESIGNATED PERSON PRIOR TO PLACEMENT ON BACKFILL FOR THE SYSTEM. CARE SHOULD BE TAKEN DURING PLACEMENT OF BACKFILL NOT TO DISPLACE MODULES OR JOINT WRAP. BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY OR AS SPECIFIED, AND SHOULD NOT BE COMPACTED WITHIN 6" OF MODULE.
- CONSTRUCTION EQUIPMENT EXCEEDING DESIGN LOADING SHALL NOT BE ALLOWED ON STRUCTURE.

SPLASH PADS, INLETS AND RISERS:

PLACE SPLASH PADS AS DESIGNATED TO PREVENT SCOUR FROM INLETS AND INLET PIPES. ALL PIPE INLETS SHALL EXTEND INSIDE MODULE A MINIMUM OF 4". PLACE A NON-SHRINK, NON-METALIC GROUT, MIN. 3,000 PSI IN ANNULAR SPACE TO ELIMINATE ALL VOIDS.



INFILTRATION MODULE ISO VIEW

N.T.S.

NOTE: THIS VIEW IS FOR ILLUSTRATION PURPOSES ONLY TO SHOW FEATURES OF THE SYSTEM. ACTUAL LAYOUT VARIES BY PROJECT, SEE SITE PLAN LAYOUT. ALL PERIMETER WALLS ARE SOLID.

REVISIONS			
REVISION	DATE	SHEETS	DESCRIPTION OF REVISION

THIS MUST BE FILLED OUT BEFORE MANUFACTURING BEGINS

APPROVED W/ NO EXCEPTIONS TAKEN:

APPROVED AS NOTED:

REVISE AND RESUBMIT:

**- PRELIMINARY -
NOT FOR CONSTRUCTION**

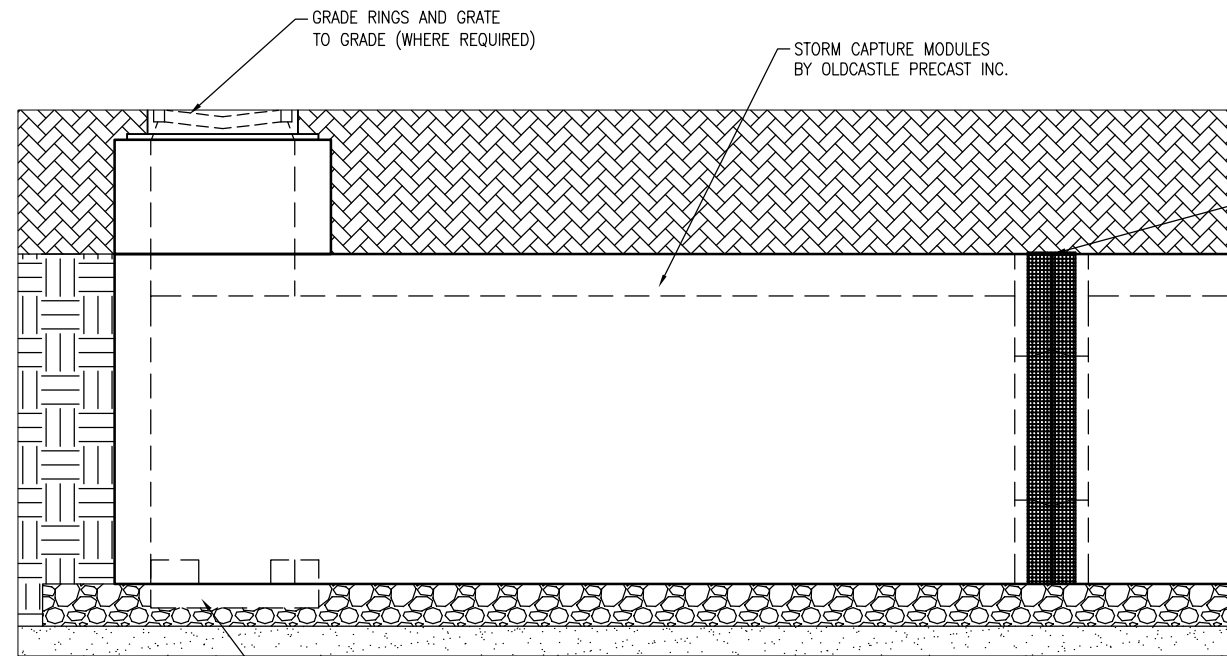
SIGNATURE _____ DATE _____



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STORMCAPTURE
NOTES & GENERAL ISO

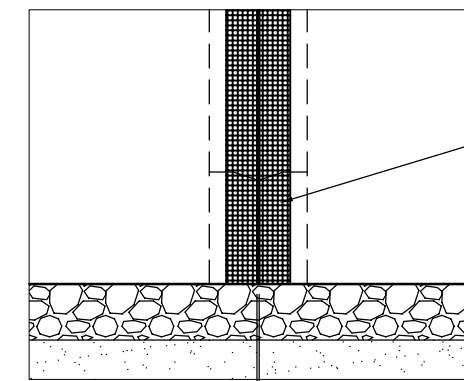
CUSTOMER					
DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER SC - 6 ft top-only				REVISION REV DATE	SHEET 1 OF 4



SPLASH PADS REQUIRED AT ALL PIPE AND GRATE INLETS. INVERT FLUSH WITH BOTTOM. SEE SPLASH PAD DETAIL ON NEXT PAGE

GRATE INLET DETAIL
SCALE: 3/8" = 1'-0"

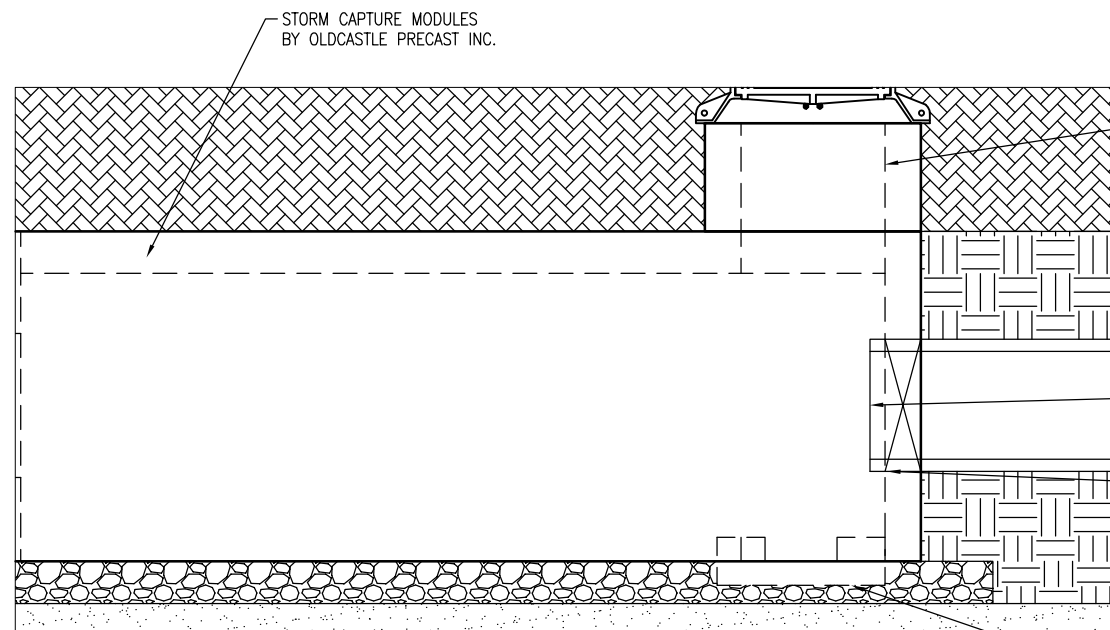
NOTE: WEIR PLATES, IF REQUIRED, MAY BE INSTALLED WITH RED-HEAD ANCHORS (BY OTHERS). ELEVATIONS TO BE DETERMINED BY PROJECT DESIGN ENGINEER



8" MIN. WIDE STRIP OF SELF-ADHESIVE OVER ENTIRE JOINT. PROVIDE MIN. 1' OVERLAP WHEN CONNECTING STRIPS. JOINT WRAP SUPPLIED BY OLDCASTLE AND INSTALLED BY OTHERS. SEE INSTALLATION NOTE 6.

1/4" GAP TYP. (3/4" MAX) BETWEEN STRUCTURES

MODULE JOINT DETAIL
SCALE: 1/2" = 1'-0"



MIN. 30" MANWAY ACCESS PROVIDED FOR EACH MAINTENANCE MODULE

PIPE ENTRANCE AS REQUIRED

VOID SPACE TO BE GROUT FILLED BY CONTRACTOR IN-FIELD

MANWAY ACCESS DETAIL
SCALE: 3/8" = 1'-0"

SPLASH PADS REQUIRED AT ALL PIPE AND GRATE INLETS. INVERT FLUSH WITH BOTTOM. SEE SPLASH PAD DETAIL ON NEXT PAGE

- PRELIMINARY -
NOT FOR CONSTRUCTION

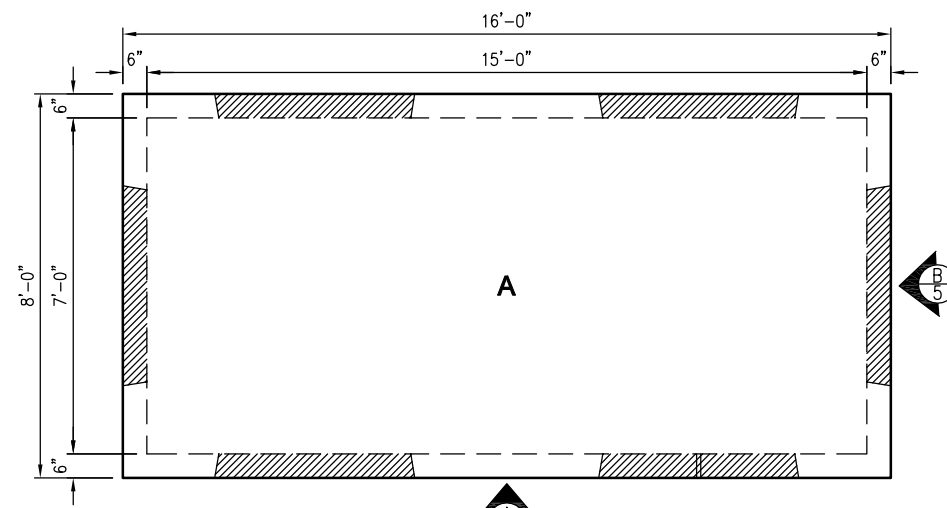


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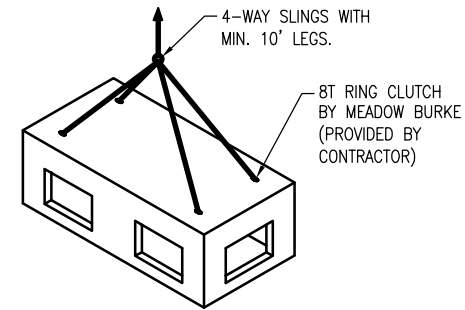
STORMCAPTURE
EXTERIOR DETAILS

CUSTOMER

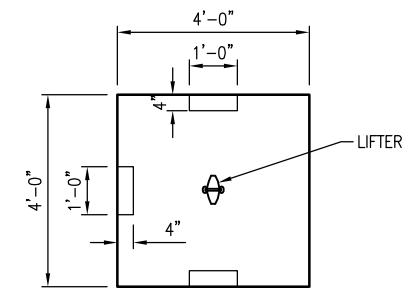
DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER				REVISION	SHEET
SC - 6 ft top-only				REV DATE	3 OF 4



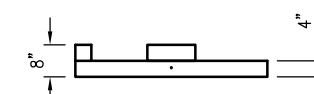
STORM CAPTURE PLAN VIEW
SCALE: 1/4" = 1'-0"



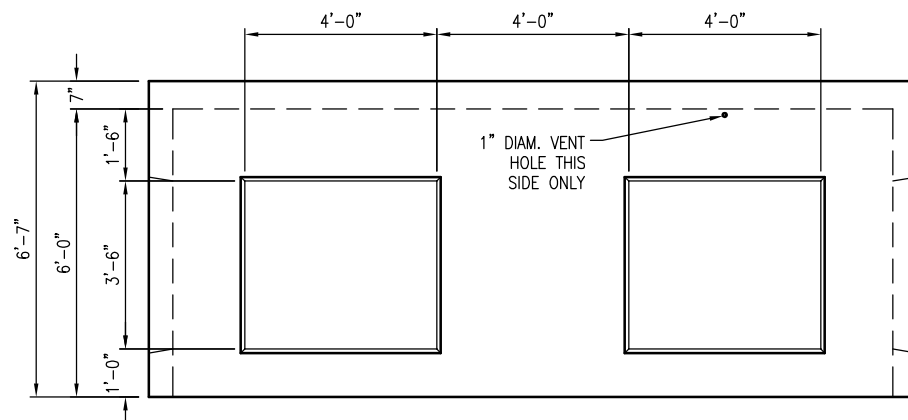
MODULE LIFTING DETAIL
N.T.S.



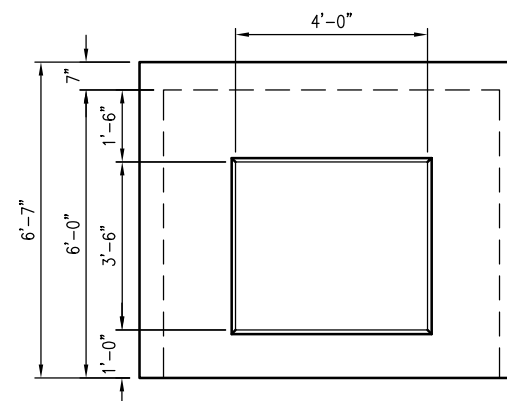
SPLASH PAD - PLAN
SCALE: 1/4" = 1'-0"



SPLASH PAD - PROFILE
SCALE: 1/4" = 1'-0"



VIEW A
SCALE: 1/4" = 1'-0"



VIEW B
SCALE: 1/4" = 1'-0"

- PRELIMINARY -
NOT FOR CONSTRUCTION



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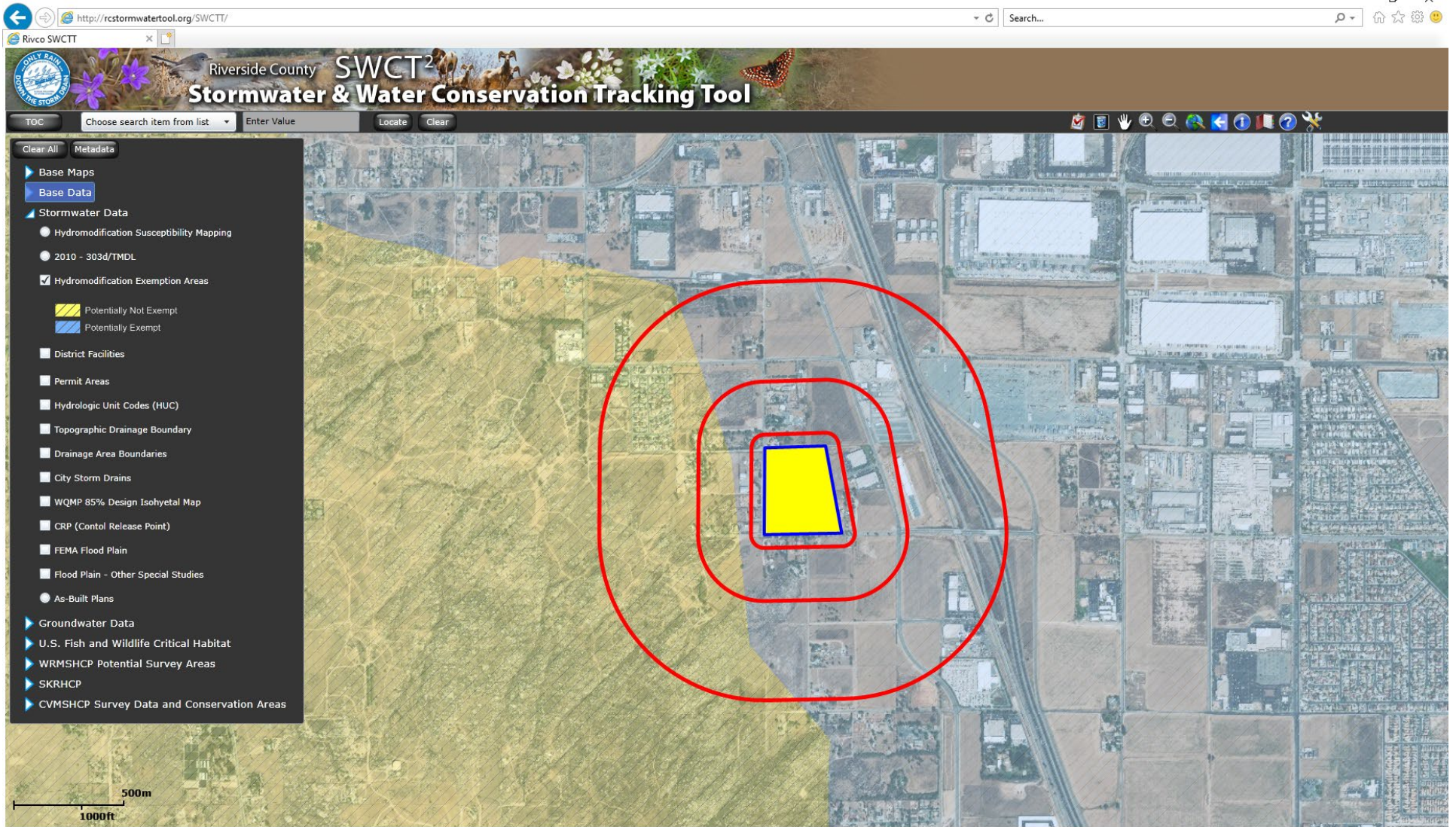
STORMCAPTURE
INTERIOR DETAILS

CUSTOMER

DATE	SALES STS	DRAWN STS	ENGINEER JH	CHECKED	SALES ORDER
DRAWING NUMBER				REVISION	SHEET
SC - 6 ft top-only				REV DATE	4 OF 4

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern



Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<p><input type="checkbox"/> I. Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)</p>	<p><input type="checkbox"/> Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.</p> <p><input type="checkbox"/> Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.</p> <p><input type="checkbox"/> Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.</p>	<p>Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.</p> <p>Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:</p> <ul style="list-style-type: none"> ▪ Hazardous Waste Generation ▪ Hazardous Materials Release Response and Inventory ▪ California Accidental Release (CalARP) ▪ Aboveground Storage Tank ▪ Uniform Fire Code Article 80 Section 103(b) & (c) 1991 ▪ Underground Storage Tank <p>www.cchealth.org/groups/hazmat/</p>	<p><input type="checkbox"/> See the Fact Sheets SC-31, “Outdoor Liquid Container Storage” and SC-33, “Outdoor Storage of Raw Materials ” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com</p>

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
<input checked="" type="checkbox"/> M. Loading Docks	<ul style="list-style-type: none"> <input type="checkbox"/> Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer. <input type="checkbox"/> Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation. <input type="checkbox"/> Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer. 		<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Move loaded and unloaded items indoors as soon as possible. <input checked="" type="checkbox"/> See Fact Sheet SC-30, “Outdoor Loading and Unloading,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

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

Appendix 9: O&M

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

TO BE PROVIDED AT FINAL ENGINEERING

Appendix 10: Educational Materials

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

TO BE PROVIDED AT FINAL ENGINEERING