

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements.

7.0 GENERAL COMMENTS

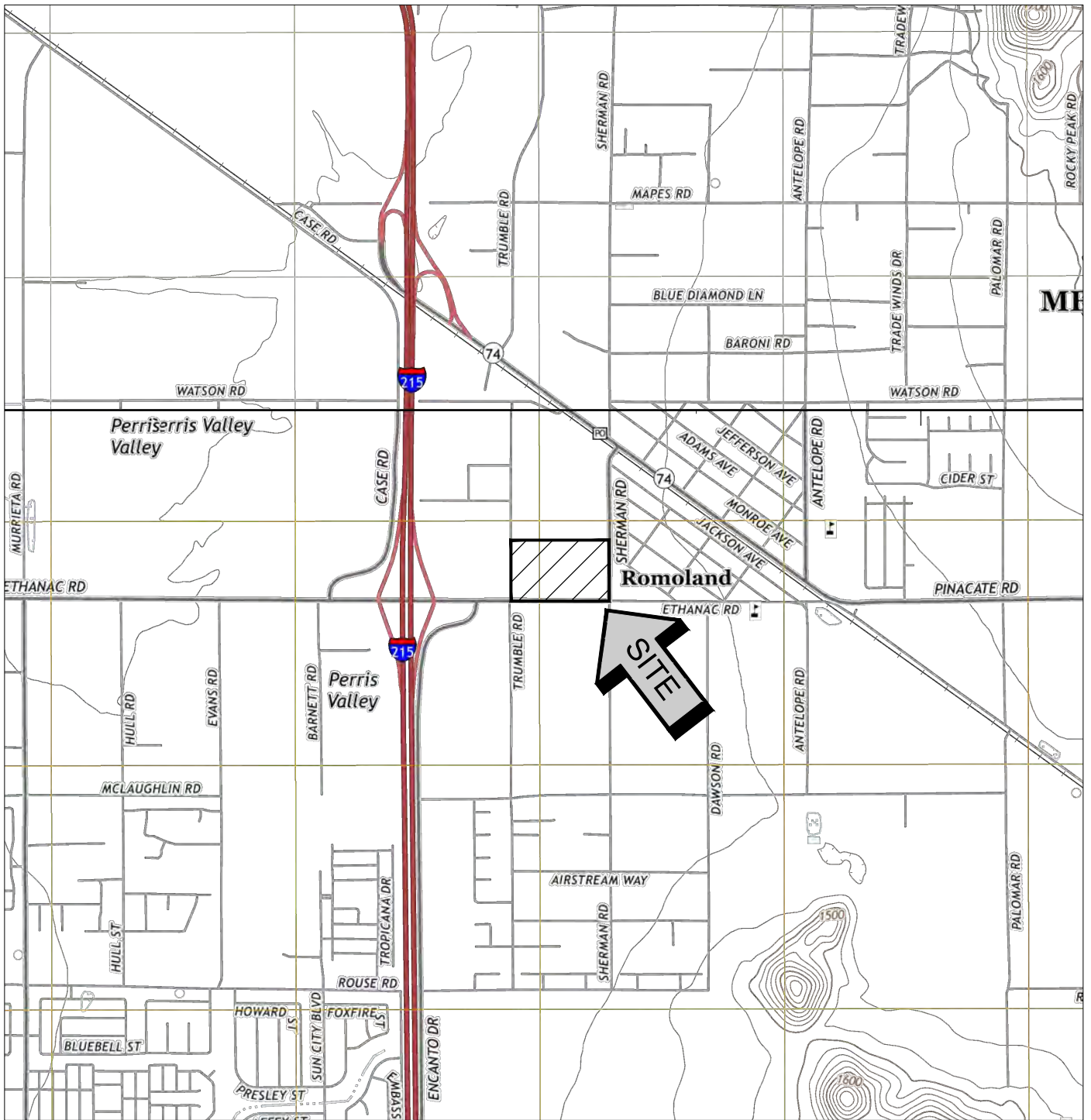
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

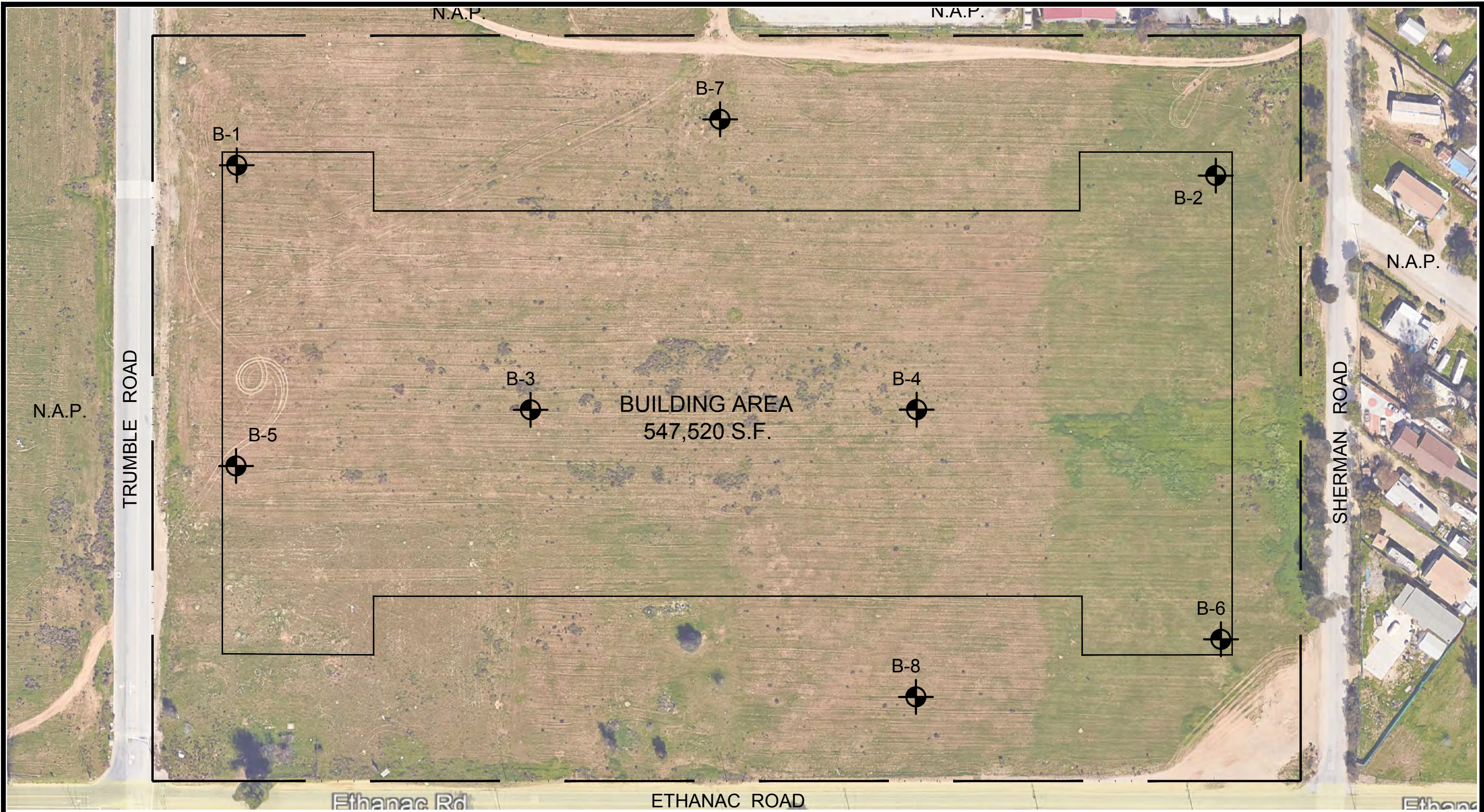
APPENDIX A



SOURCE: USGS TOPOGRAPHIC MAP OF THE ROMOLAND & PERRIS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.



SITE LOCATION MAP	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000'	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: MD	
CHKD: DN	
SCG PROJECT 22G107-1	
PLATE 1	



N.A.P.

N.A.P.

N.A.P.

N.A.P.

TRUMBLE ROAD

SHERMAN ROAD

Ethanac Rd

ETHANAC ROAD

Ethanac

BUILDING AREA
547,520 S.F.

B-1

B-7

B-2

B-3

B-4

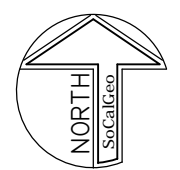
B-5

B-6

B-8

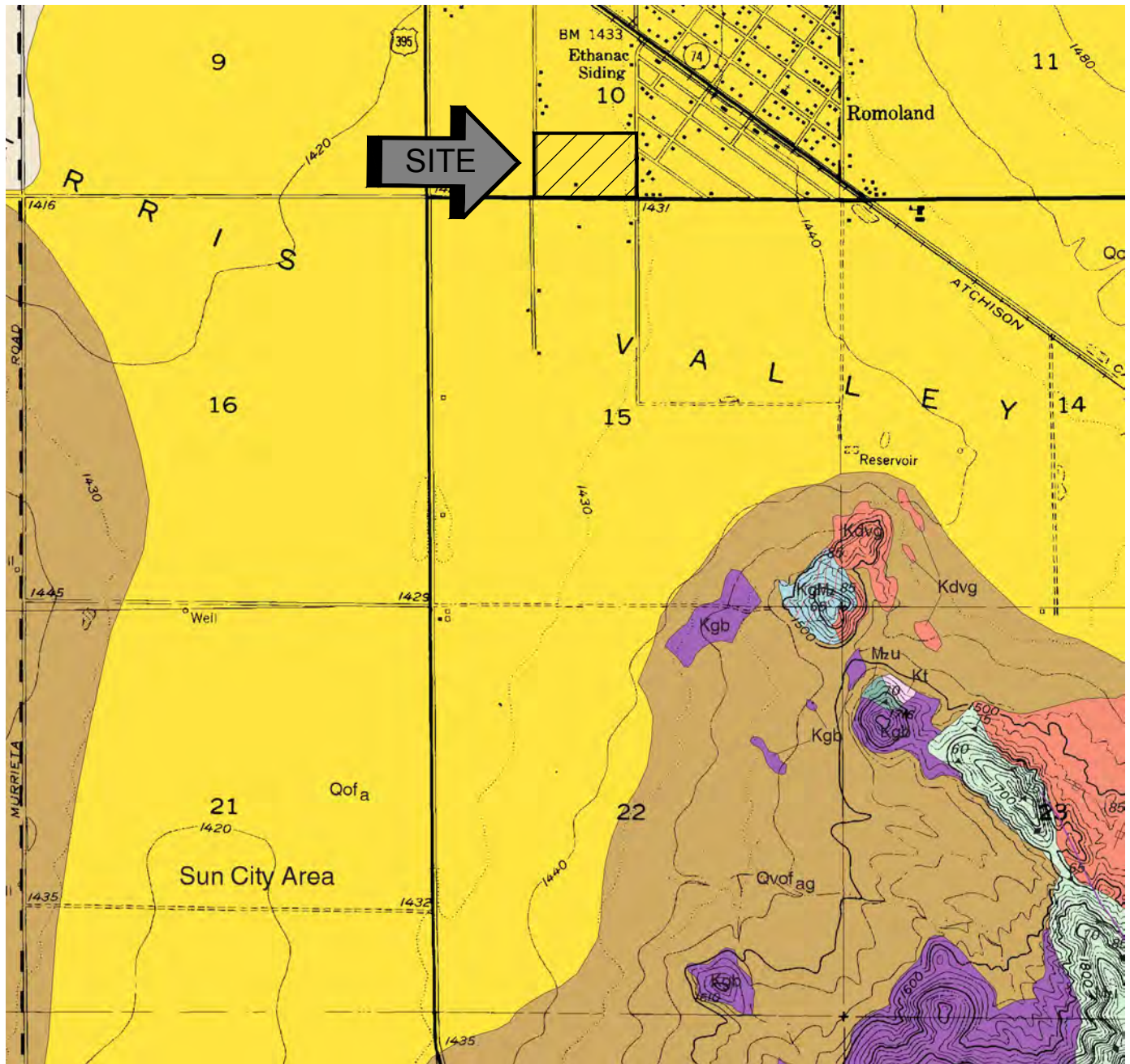
GEOTECHNICAL LEGEND

 APPROXIMATE BORING LOCATION



NOTE: CONCEPTUAL SITE PLAN (SCHEME 7) PREPARED BY HERDMAN ARCHITECTURE + DESIGN.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH (2018)

BORING LOCATION PLAN	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 100'	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: OS	
CHKD: RGT	
SCG PROJECT 22G107-1	
PLATE 2	



DESCRIPTION OF MAP UNITS

- Qof** Old alluvial fan deposits (late to middle Pleistocene)—Reddish brown, gravel and sand alluvial fan deposits; indurated, commonly slightly dissected. In places includes thin alluvial fan deposits of Holocene age

- Kdvg** Granodiorite to tonalite—Relatively uniform, massive hornblende biotite granodiorite grading into tonalite. Principal rock type of Domenigoni Valley pluton. Contains some mafic rich rocks in southern part of pluton. Common accessory minerals are zircon, sphene, apatite, and magnetite-ilmenite.


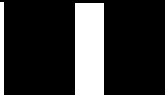



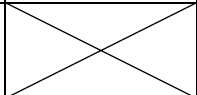
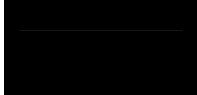



SOURCE: "GEOLOGIC MAP OF THE ROMOLAND 7.5' QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA" BY D. M. MORTON.

GEOLOGIC MAP	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000' DRAWN: JAH CHKD: DN SCG PROJECT 22G107-1 PLATE 3	 SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 11 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
				OLDER ALLUVIUM: Red Brown fine to coarse Sandy Clay, trace Silt, hard-moist							
	47	4.5			123	10					
	50/5"				116	11					
5											
	77/11"	4.5		Red Brown fine Sandy Clay, trace Silt, hard-damp to moist	124	8					
	82	4.5			125	9					
10	80/10"			@ 8½ feet, trace medium to coarse Sand	116	8					
15		59		GRANODIORITE TO TONALITE (Kdvg): Light Gray Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, dense to very dense-moist		10					
20		53				7					
25		46				8					
				Boring Terminated at 25'							

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 5 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
				OLDER ALLUVIUM	Light Brown fine to coarse Sandy Clay, trace Silt, hard-damp		8				
5		82/11"					8				
					Light Brown to Brown fine Sandy Clay, very stiff to hard-moist to very moist		11				
10		80/11"	3.5				23				
					Light Brown Clayey fine to coarse Sand to fine to coarse Sandy Clay, trace Silt, medium dense to very stiff-damp to moist to very moist		6				
15		24	2.5				15				
					Light Brown to Brown fine to coarse Sand, trace Silt, medium dense-damp		6				
20		16									
					Boring Terminated at 20'						

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 7 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
				[Hatched Pattern]	OLDER ALLUVIUM: Dark Brown fine to coarse Sandy Clay, trace Silt, hard-damp to moist		8				
5		70/9"	4.5				6				
		50/4"									
		42	4.5				11				
10		43			Brown Clayey fine to coarse Sand, dense-damp		5				
		40					6				
15											
Boring Terminated at 20'											

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: MSL												
					OLDER ALLUVIUM: Dark Red Brown fine to medium Sandy Clay, trace Silt, very stiff to hard-moist to very moist	126	9					
						120	15					
5		72/10"	4.5			131	10					
					GRANODIORITE TO TONALITE (Kdvg): Light Gray Brown Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, medium dense to dense-moist	122	9					
10						121	8					
15			26				7					
Boring Terminated at 15'												

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
					<u>OLDER ALLUVIUM</u> : Red Brown fine to medium Sandy Clay, trace Silt, hard-moist		10				
5		42	4.5								
		73	3.0				10				
		31			<u>GRANODIORITE TO TONALITE (Kdvg)</u> : Light Gray Brown Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, medium dense to dense-moist		9				
10		39					9				
15		18					12				
20		41					8				
					Boring Terminated at 15'						

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1 DRILLING DATE: 1/21/22 WATER DEPTH: Dry
 PROJECT: Proposed Warehouse DRILLING METHOD: Hollow Stem Auger CAVE DEPTH: 6 feet
 LOCATION: Perris, California LOGGED BY: Oscar Sandoval READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS	
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
SURFACE ELEVATION: MSL												
					OLDER ALLUVIUM: Dark Red Brown fine to medium Sandy Clay, trace Silt, hard-moist							
	70/11"		4.5			114	14					El = 62 @ 0 to 5'
	77/11"		4.5			113	13					
5		58	4.5			123	10					
		64	4.5			130	10					
10		45	4.5			128	11					
					GRANODIORITE TO TONALITE (Kdvg): Light Gray Brown Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, very dense-moist							
15		82/11"					10					
20		55					10					
25		55					9					
					Boring Terminated at 25'							

TBL_22G107-1.GPJ_SOCALGEO.GDT 2/23/22



JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 4 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
5	X	80	4.5		<p><u>OLDER ALLUVIUM</u>: Light Brown fine Sandy Clay, trace medium Sand, trace Silt, hard-damp to moist</p> <p>@ 8½ feet, stiff to very stiff</p>		10				
	X	60					7				
	X	80	4.5				9				
	X	50/5"	2.0				9				
10					Boring Terminated at 10'						

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22



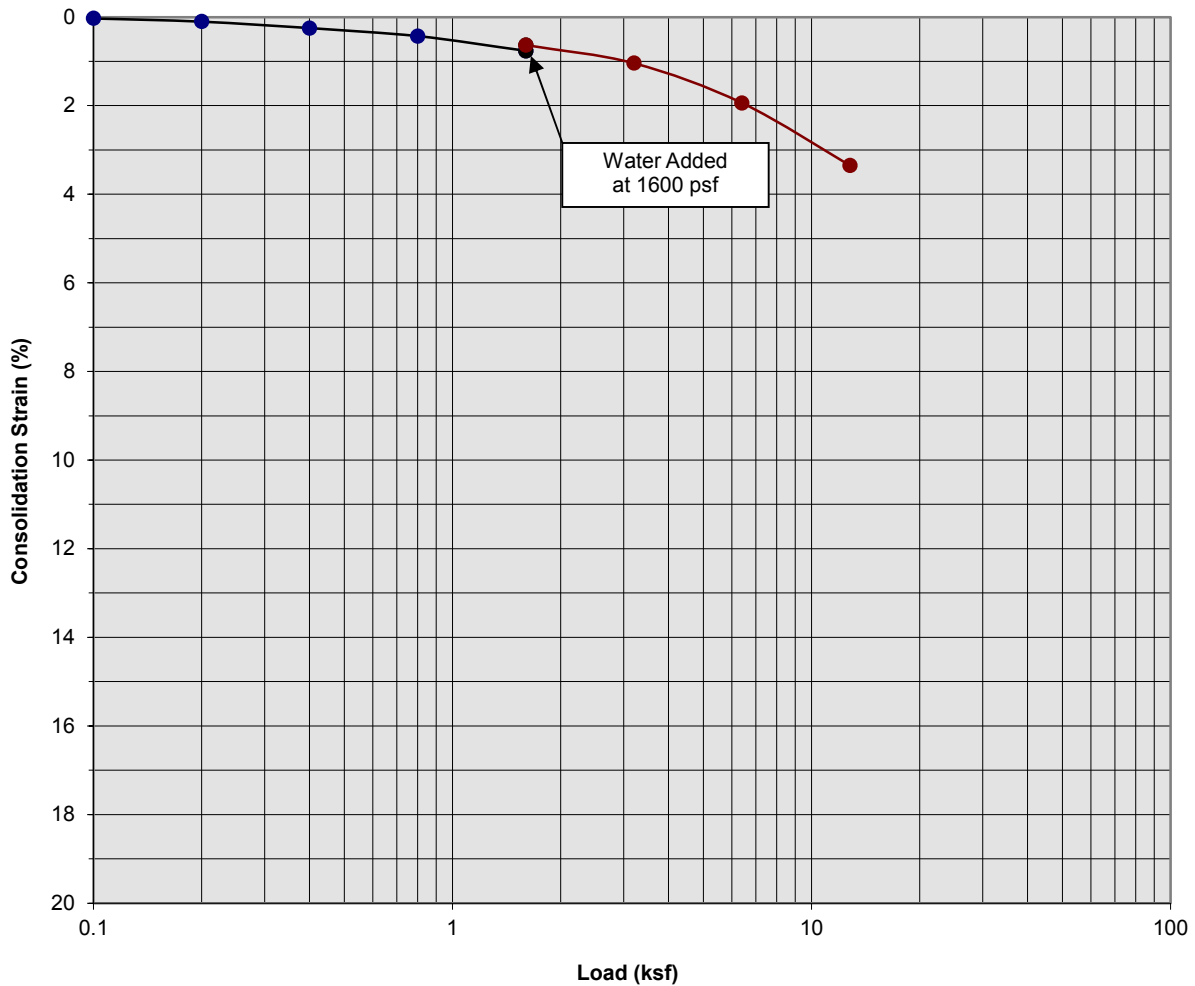
JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 8 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS	
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)		
SURFACE ELEVATION: MSL													
5		85	4.5		OLDER ALLUVIUM: Dark Brown fine to medium Sandy Clay, trace Silt, trace coarse Sand, hard-moist								
		65/11"					10						
		50/5"	4.5				9						
		87/10"					9						
10						12							
Boring Terminated at 10'													

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

A P P E N D I X C

Consolidation/Collapse Test Results



Classification: Dark Red Brown fine to medium Sandy Clay, trace Silt

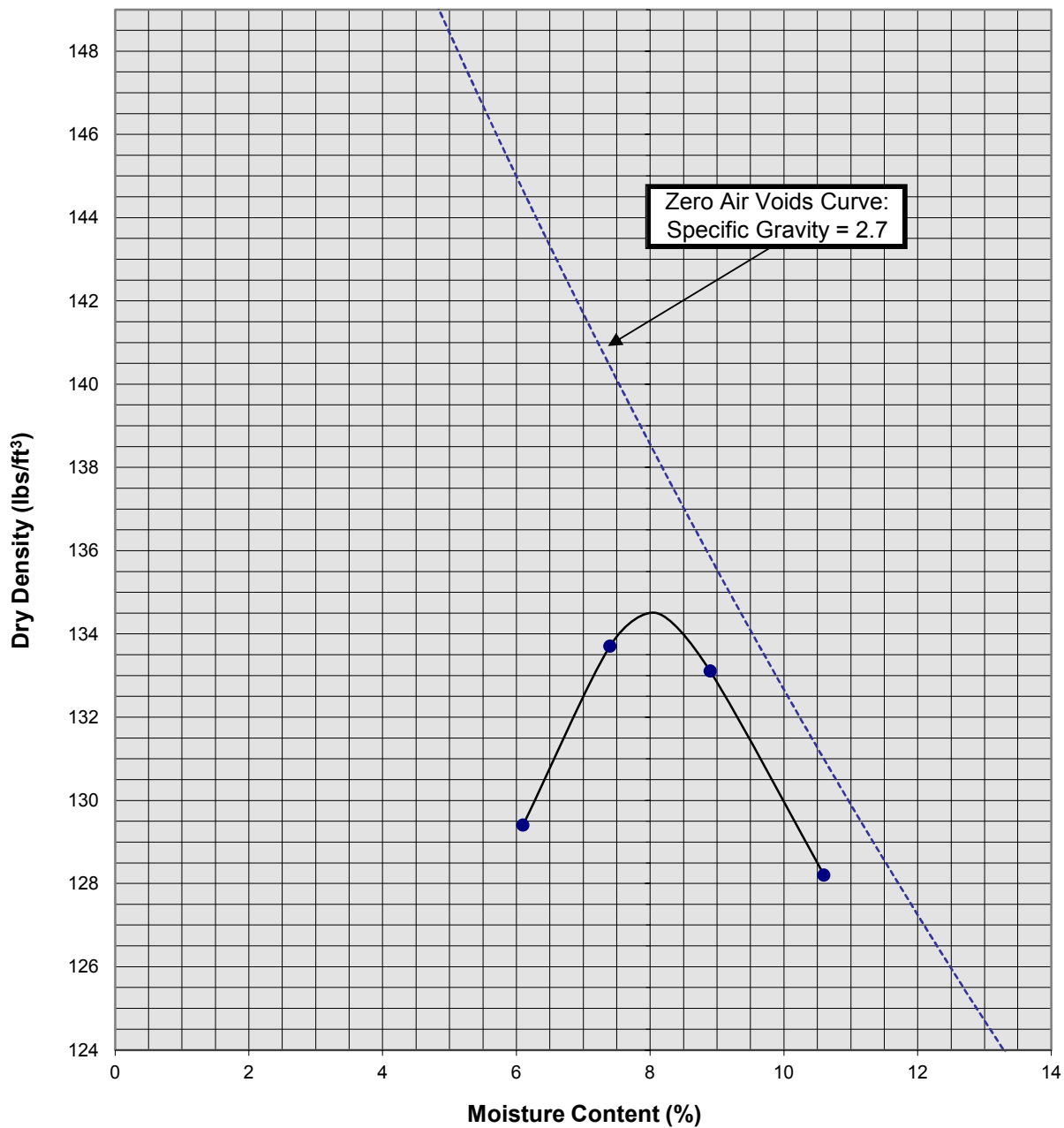
Boring Number:	B-4	Initial Moisture Content (%)	15
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	3 to 4	Initial Dry Density (pcf)	119.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.13

Proposed Warehouse
 Perris, California
 Project No. 22G107-1
PLATE C- 1



**SOUTHERN
 CALIFORNIA
 GEOTECHNICAL**
A California Corporation

Moisture/Density Relationship ASTM D-1557



Soil ID Number		B-1 @ 0 to 5'
Optimum Moisture (%)		8
Maximum Dry Density (pcf)		134.5
Soil Classification	Red Brown fine to coarse Sandy Clay, trace Silt	

Proposed Warehouse
Perris, CA
Project No. 22G107-1
PLATE C-2



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.
- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.
- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.
- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.
- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.
- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.
- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.
- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.
- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.
- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.
- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted
- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated," and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.
- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.
- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.
- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:
 - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.
 - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.
- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.
- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.
- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.
- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.
- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.
- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.
- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.
- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.
- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.
- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.
- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.
- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core
- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.
- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.
- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).
- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.
- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

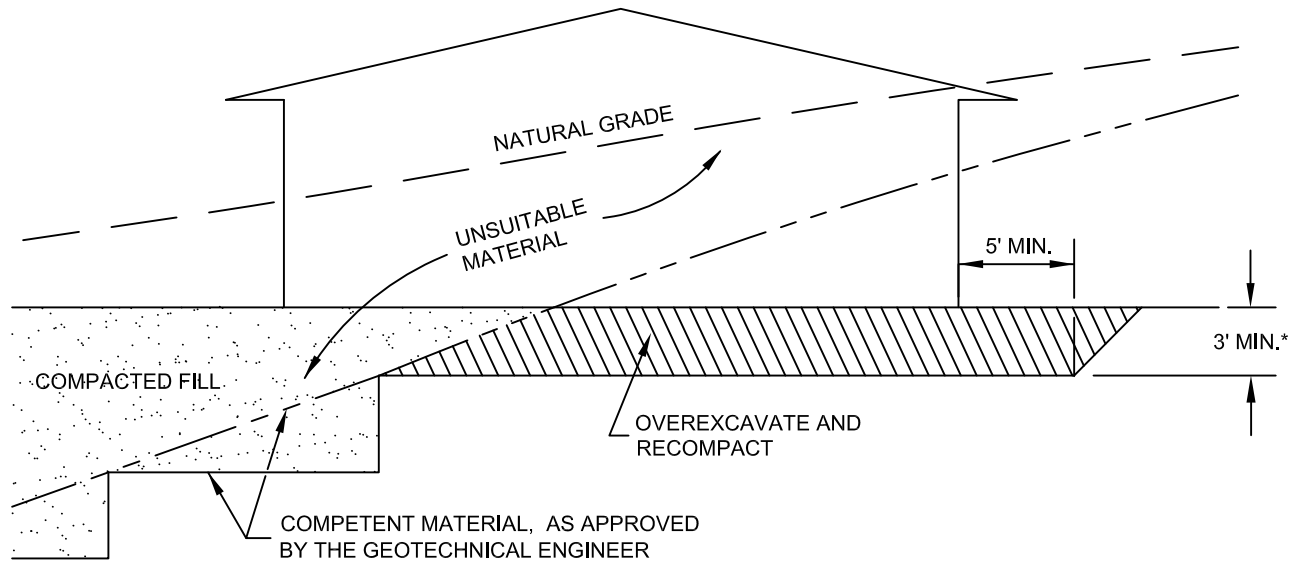
- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.
- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.
- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

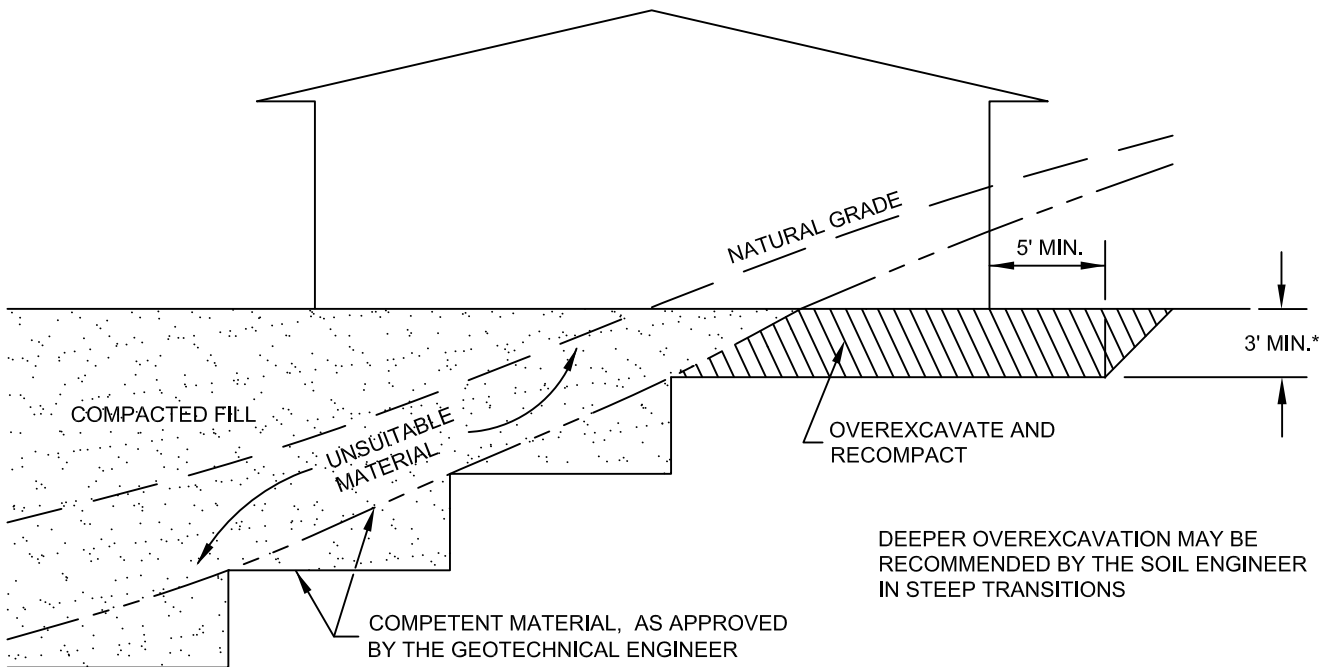
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.
- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean $\frac{3}{4}$ -inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT

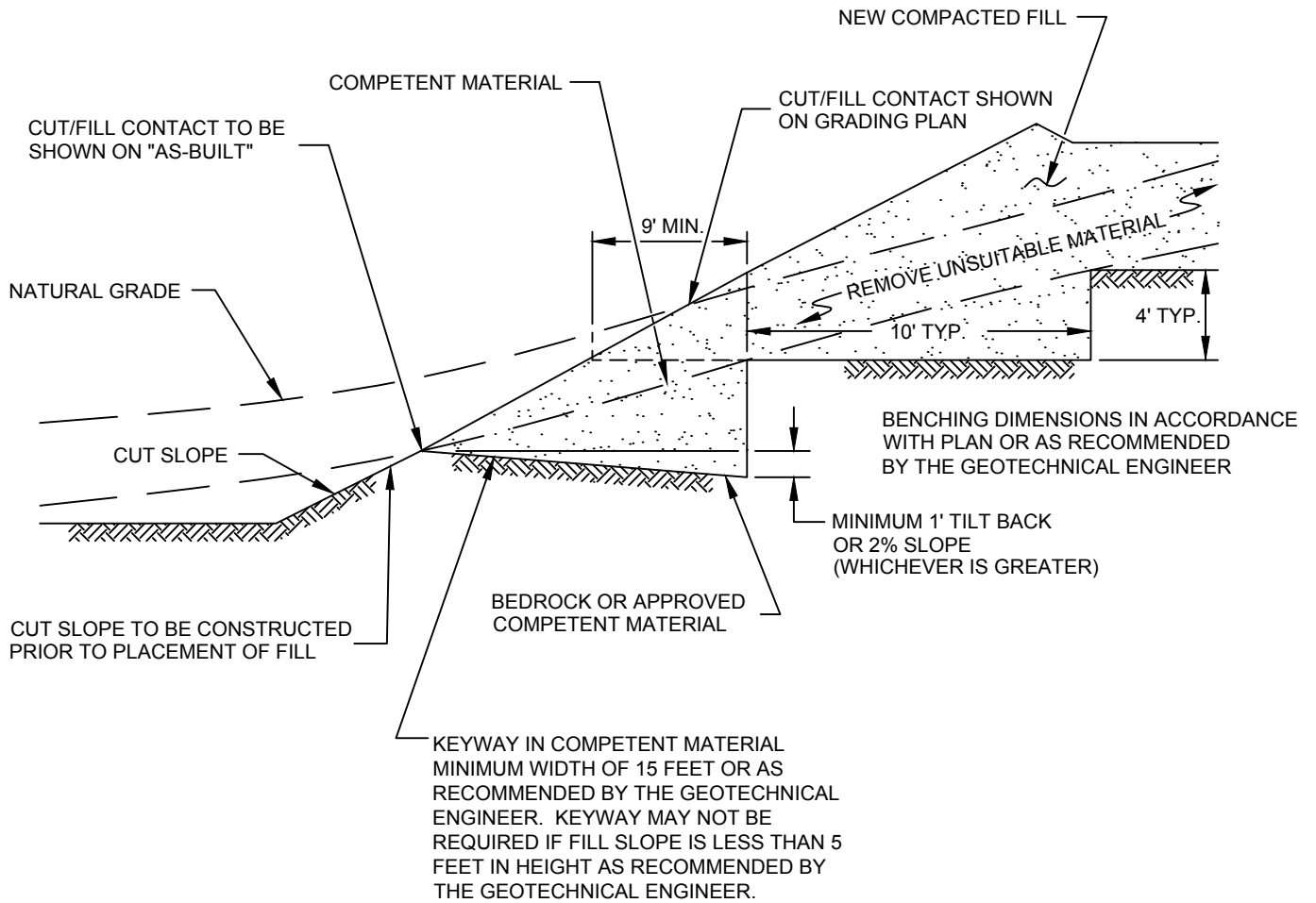



CUT/FILL LOT (TRANSITION)

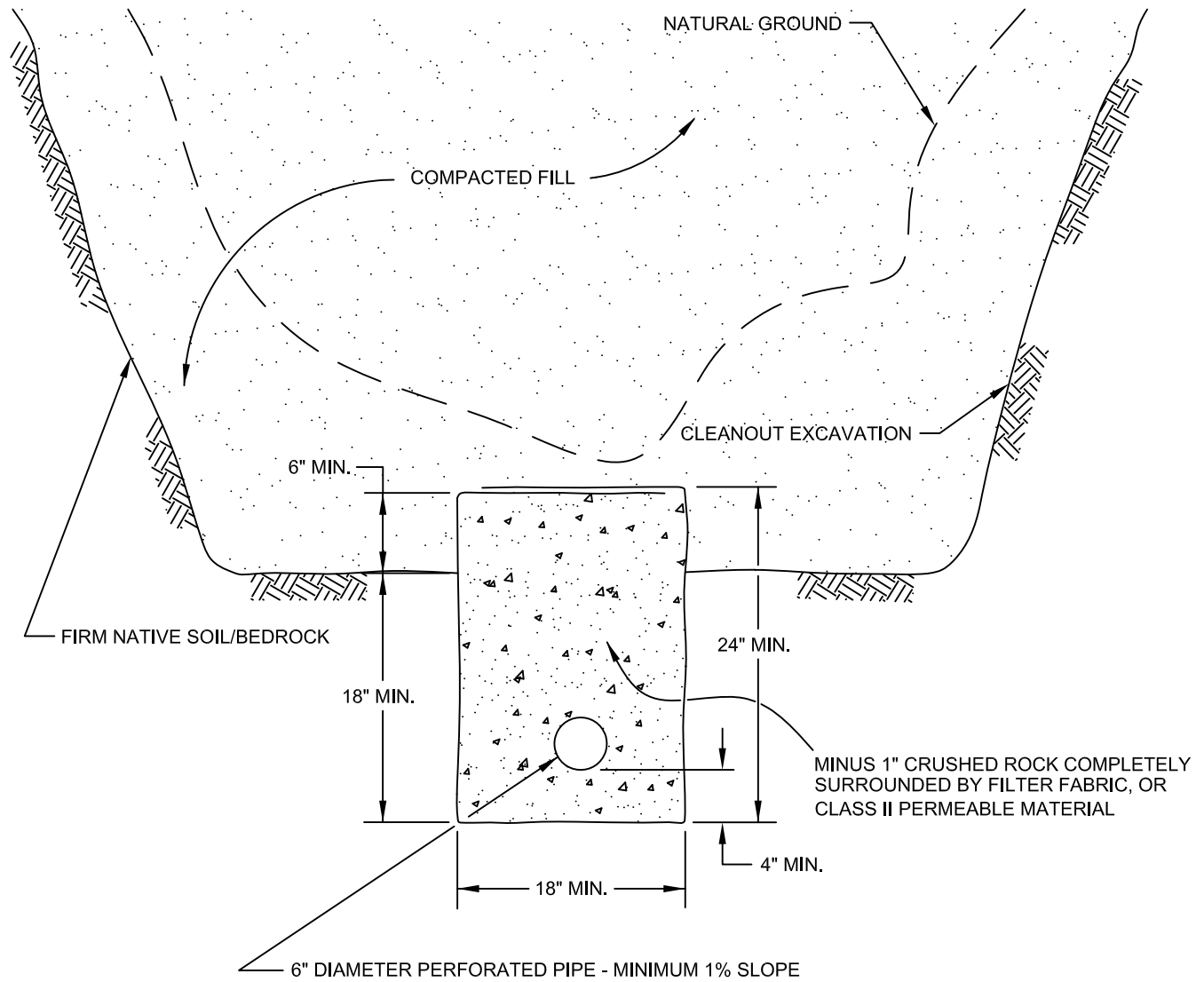


*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION.
ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-1	




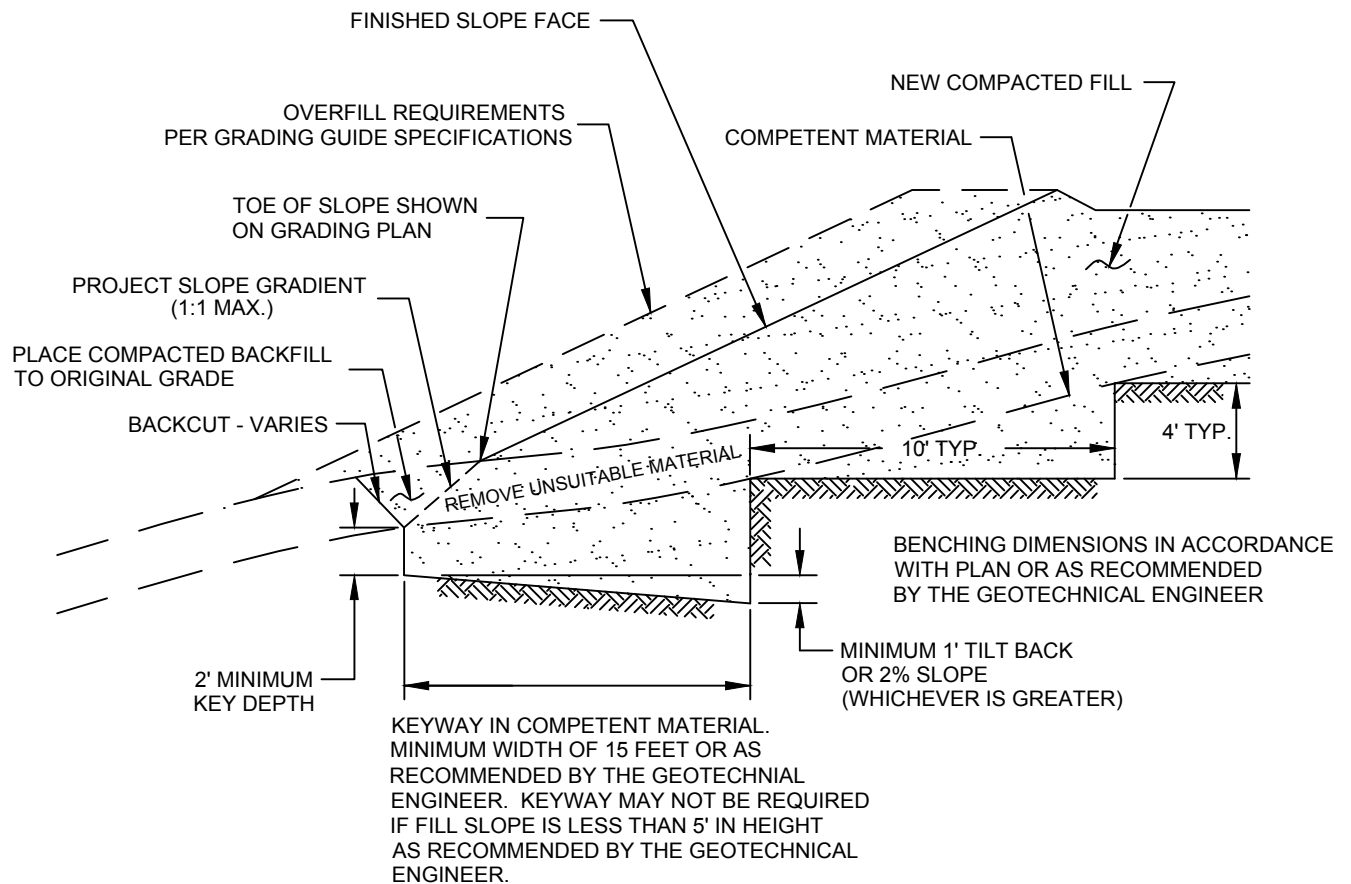
FILL ABOVE CUT SLOPE DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-2	




PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

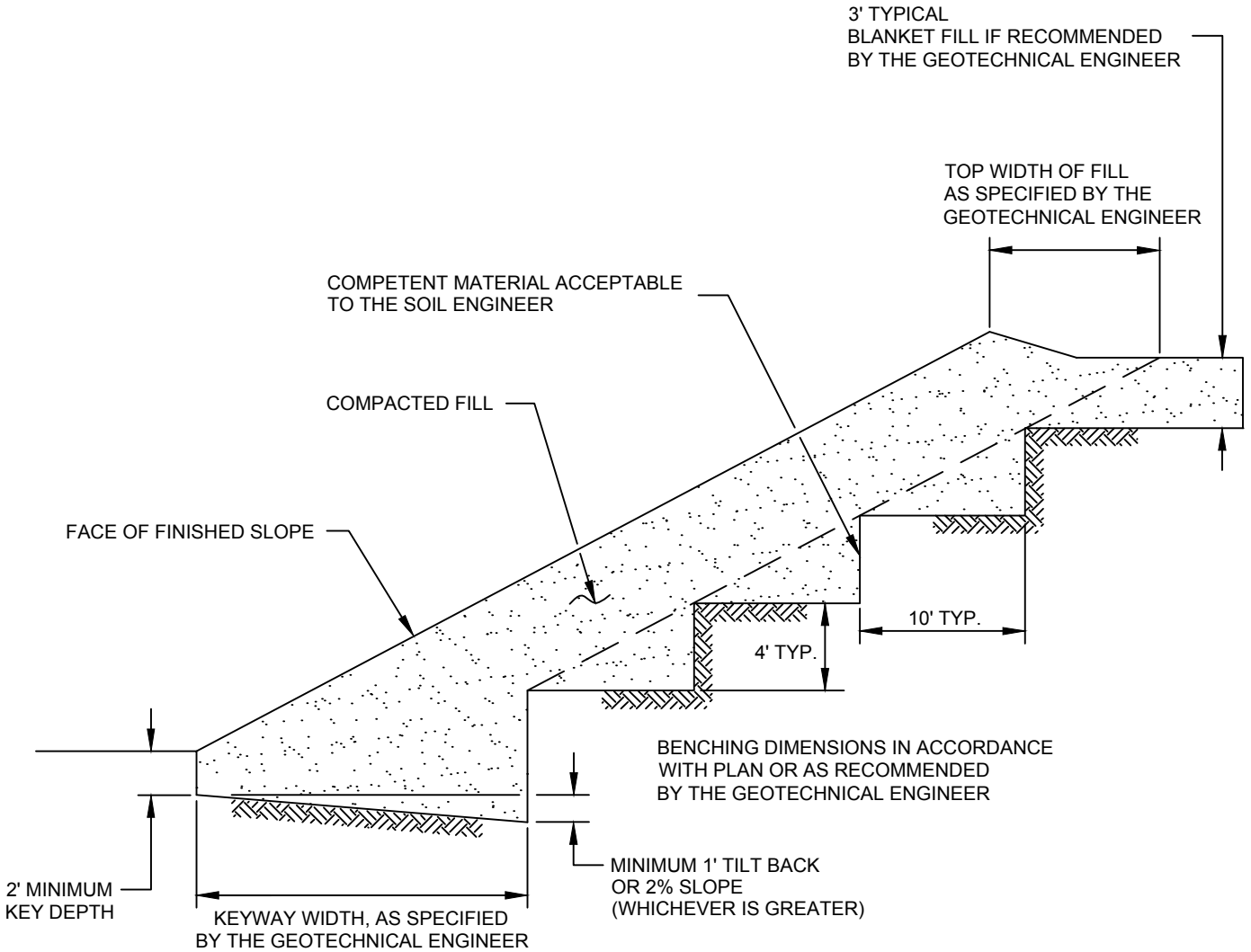
**SCHEMATIC ONLY
NOT TO SCALE**


CANYON SUBDRAIN DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-3	

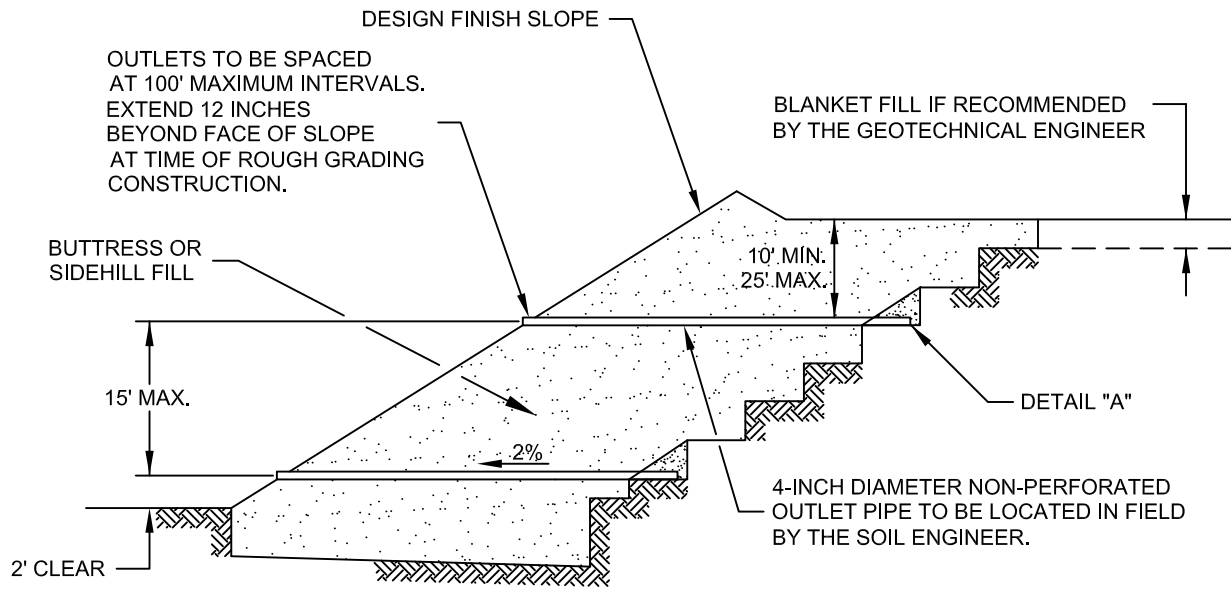


NOTE:
 BENCHING SHALL BE REQUIRED
 WHEN NATURAL SLOPES ARE
 EQUAL TO OR STEEPER THAN 5:1
 OR WHEN RECOMMENDED BY
 THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-4	



STABILIZATION FILL DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-5	



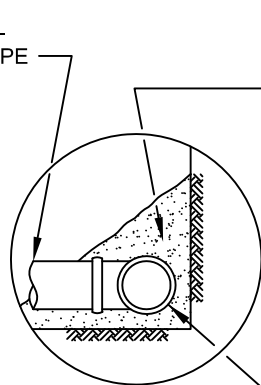
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8
SAND EQUIVALENT = MINIMUM OF 50	

OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW



DETAIL "A"

FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.


ALTERNATIVE: IN LIEU OF FILTER MATERIAL FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

NOTES:

1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-6	

MINIMUM ONE FOOT THICK LAYER OF LOW PERMEABILITY SOIL IF NOT COVERED WITH AN IMPERMEABLE SURFACE

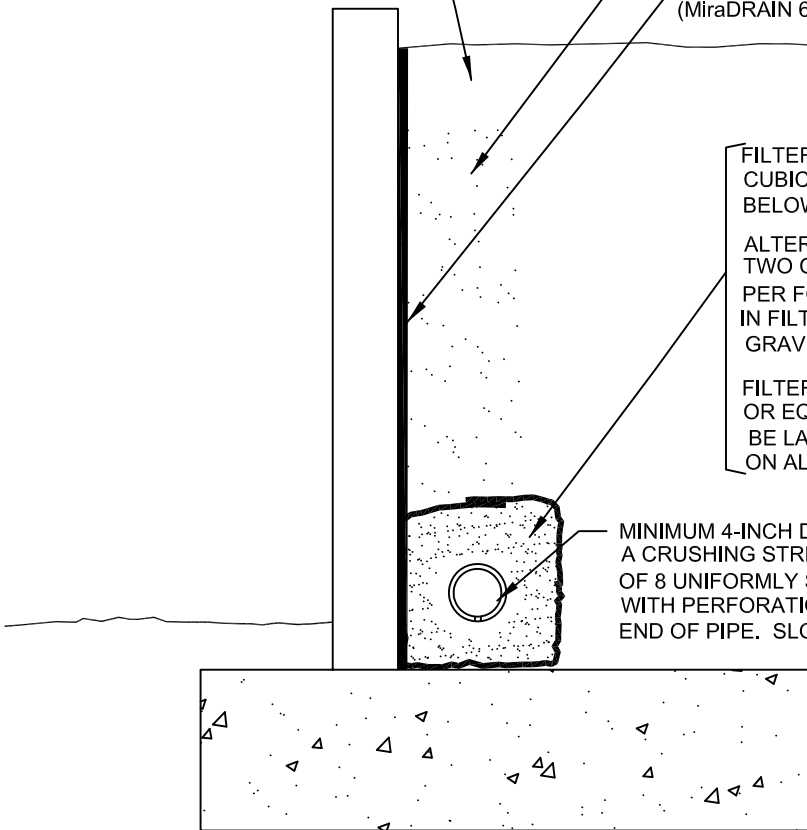
MINIMUM ONE FOOT WIDE LAYER OF FREE DRAINING MATERIAL (LESS THAN 5% PASSING THE #200 SIEVE) OR PROPERLY INSTALLED PREFABRICATED DRAINAGE COMPOSITE (MiraDRAIN 6000 OR APPROVED EQUIVALENT).

FILTER MATERIAL - MINIMUM OF TWO CUBIC FEET PER FOOT OF PIPE. SEE BELOW FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL TWO CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE BELOW FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 6 INCHES ON ALL JOINTS.

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8
SAND EQUIVALENT = MINIMUM OF 50	

**RETAINING WALL BACKDRAINS
GRADING GUIDE SPECIFICATIONS**

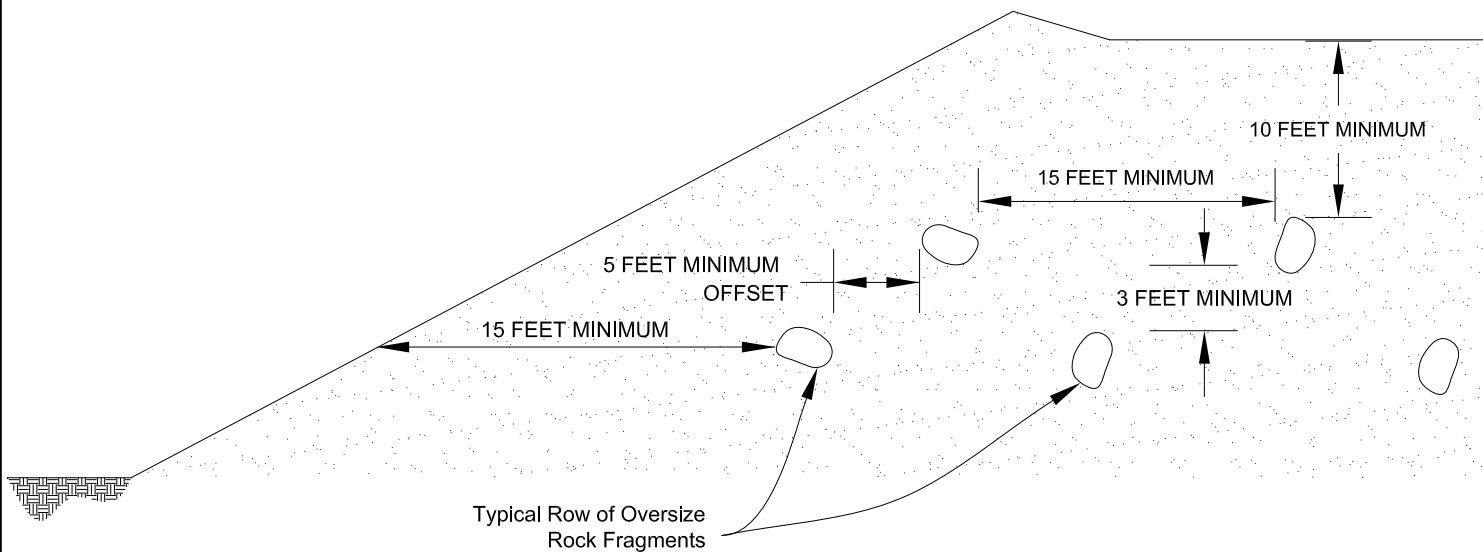
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

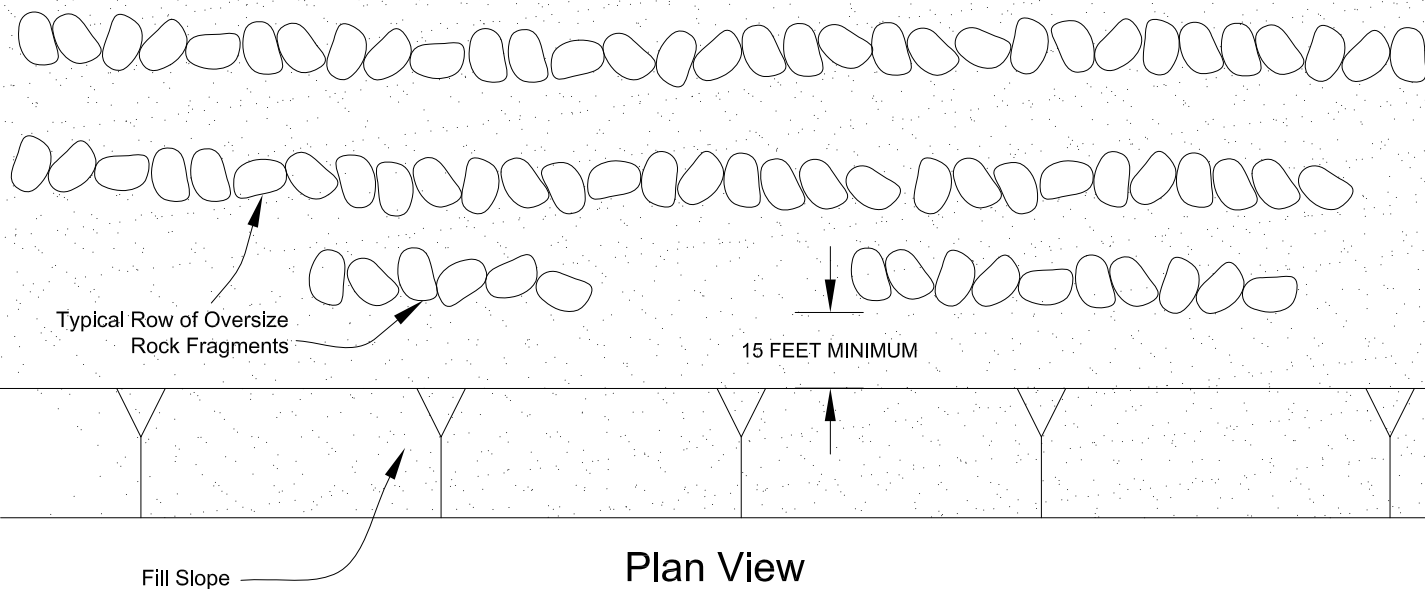
PLATE D-7



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**



Section View



Plan View

**PLACEMENT OF OVERSIZED MATERIAL
GRADING GUIDE SPECIFICATIONS**

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**

APPENDIX E



Latitude, Longitude: 33.744164, -117.180544



Date	2/23/2022, 10:19:50 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	1.421	MCE_R ground motion. (for 0.2 second period)
S_1	0.528	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.705	Site-modified spectral acceleration value
S_{M1}	0.777	Site-modified spectral acceleration value
S_{DS}	1.137	Numeric seismic design value at 0.2 second SA
S_{D1}	0.518	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	1.472	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
$SsRT$	1.421	Probabilistic risk-targeted ground motion. (0.2 second)
$SsUH$	1.52	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
$S1RT$	0.528	Probabilistic risk-targeted ground motion. (1.0 second)
$S1UH$	0.575	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
$S1D$	0.6	Factored deterministic acceleration value. (1.0 second)
PGA_d	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.935	Mapped value of the risk coefficient at short periods
C_{R1}	0.918	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>



SEISMIC DESIGN PARAMETERS - 2019 CBC	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
DRAWN: MD CHKD: DN SCG PROJECT 22G107-1 PLATE E-1	 SOUTHERN CALIFORNIA GEOTECHNICAL



SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

February 24, 2022

Hillwood
901 Via Piemonte, Suite 175
Ontario, California 91764

Attention: Mr. John Grace

Project No.: **22G107-2**

Subject: **Results of Infiltration Testing**
Proposed Warehouse
NWC Ethanac Road and Sherman Road
Perris, California

Reference: Geotechnical Investigation, Proposed Warehouse, NWC Ethanac Road and Sherman Road, Perris, California, prepared for Hillwood, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 22G107-1, dated February 23, 2022.

Mr. Grace:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 21P511, dated December 17, 2021. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The subject site is located at the northwest corner of Ethanac Road and Sherman Road in Perris, California. The site is bounded to the north by a commercial/industrial building and a vacant lot, to the west by Trumble Road, to the south by Ethanac Road, and to the east by Sherman Road. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of several contiguous rectangular-shaped parcels which total 24± acres in size. The site is currently vacant and undeveloped. The ground surface cover generally consists of exposed soil with moderate native grass and weed growth. Concrete debris, including concrete fragments and a concrete pipe, is scattered on the ground surface in the southern portion of the site. Several small to medium sized trees are also present in the southern region of the site.

Based on our review of readily available historical aerial photographs, two (2) small structures were present in the southwestern portion of the overall site, between 1966 and 1997.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography is relatively flat that gently slopes downward to the northwest at a gradient of less than 1 percent.

Proposed Development

A conceptual site plan for the proposed development, identified as Scheme 7, prepared by Herdman Architecture and Design, was provided to our office by the client. Based on this plan, the subject site will be developed with a 547,520± ft² warehouse, located in the central region of the site. Dock-high doors will be constructed along a portion of the northern and southern building walls. The proposed building is expected to be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck loading areas, and concrete flatwork with some landscaped areas.

The proposed development will include on-site storm water infiltration. Based on conversations with the project civil engineer, we understand that the infiltration system will consist a below-grade chamber system located in the southern area of the site. The bottom of the infiltration system will range from 10 to 12± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, which is referenced above. As part of this study, eight (8) borings were advanced to depths of 10 to 25± feet below existing site grades.

Older native alluvial soils were encountered at the ground surface at all of the boring locations, extending to depths of at least 5½ to 25± feet below ground surface. The older alluvium generally consists of stiff to hard fine sandy clays, fine to coarse sandy clays and medium dense to very dense clayey fine to medium sands. Granodiorite to Tonalite bedrock, map symbol Kdgv, was encountered beneath the older alluvium at Boring Nos. B-1, B-4, B-5, and B-6, at depths of 5½ to 12± feet below ground surface, extending to the maximum depths explored at each of these borings of 15 to 25± feet. The bedrock generally consists of medium dense to very dense gray brown, highly weathered, friable, fine- to coarse-grained granodiorite to tonalite.

Groundwater

Free water was not encountered during any of our subsurface explorations. Based on the lack of any water within the borings and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed readily available groundwater data in order to determine regional groundwater depths. The primary reference used to determine the groundwater depths in the subject site area is the California Department of Water Resources website,

<http://www.water.ca.gov/waterdatalibrary/>. The nearest monitoring well is located approximately 1,320 feet northwest from the site. Water level readings within this monitoring well indicates a high groundwater level of 95.6 feet below the ground surface in September 1995.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of two (2) backhoe-excavated trenches, extending to depths of 8 to 9± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 and I-2) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Older native alluvial soils were encountered at the ground surface at both of the infiltration test locations, extending to at least the maximum depths explored of 8 to 9± feet below ground surface. The older alluvium generally consists of very dense clayey fine to medium sands. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are presented in this report.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration system that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at both of the trench locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4 inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at the trench locations, the volumetric measurements were made at 15-minute increments. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

<u>Infiltration Test No.</u>	<u>Depth (feet)</u>	<u>Soil Description</u>	<u>Infiltration Rate (inches/hour)</u>
I-1	9	Clayey fine to medium Sand, little coarse Sand, little Silt	0.1
I-2	8	Clayey fine to medium Sand, trace coarse Sand, little Silt	0.2

Design Recommendations

Two (2) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 0.1 to 0.2 inches per hour. The major factors affecting the lack of infiltration at these locations is the presence of dense to very dense older alluvium. **Based on the lack of infiltration at the depths tested, infiltration is not considered feasible for this site. These areas are very likely to be underlain by much less permeable, denser older alluvium, which was encountered at the other boring and trench locations.**

Although infiltration is not considered feasible at the site, the client may desire to use storm water disposal systems that do not rely on infiltration at this site. The design of storm water disposal systems should be performed by the project civil engineer, in accordance with the City of Perris and/or County of Riverside guidelines. It is recommended any such systems be designed and constructed to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the flow rates through the system. It should be noted that the recommended infiltration rates are based on infiltration testing at two (2) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the

structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with

generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.



Oscar Sandoval
Staff Engineer

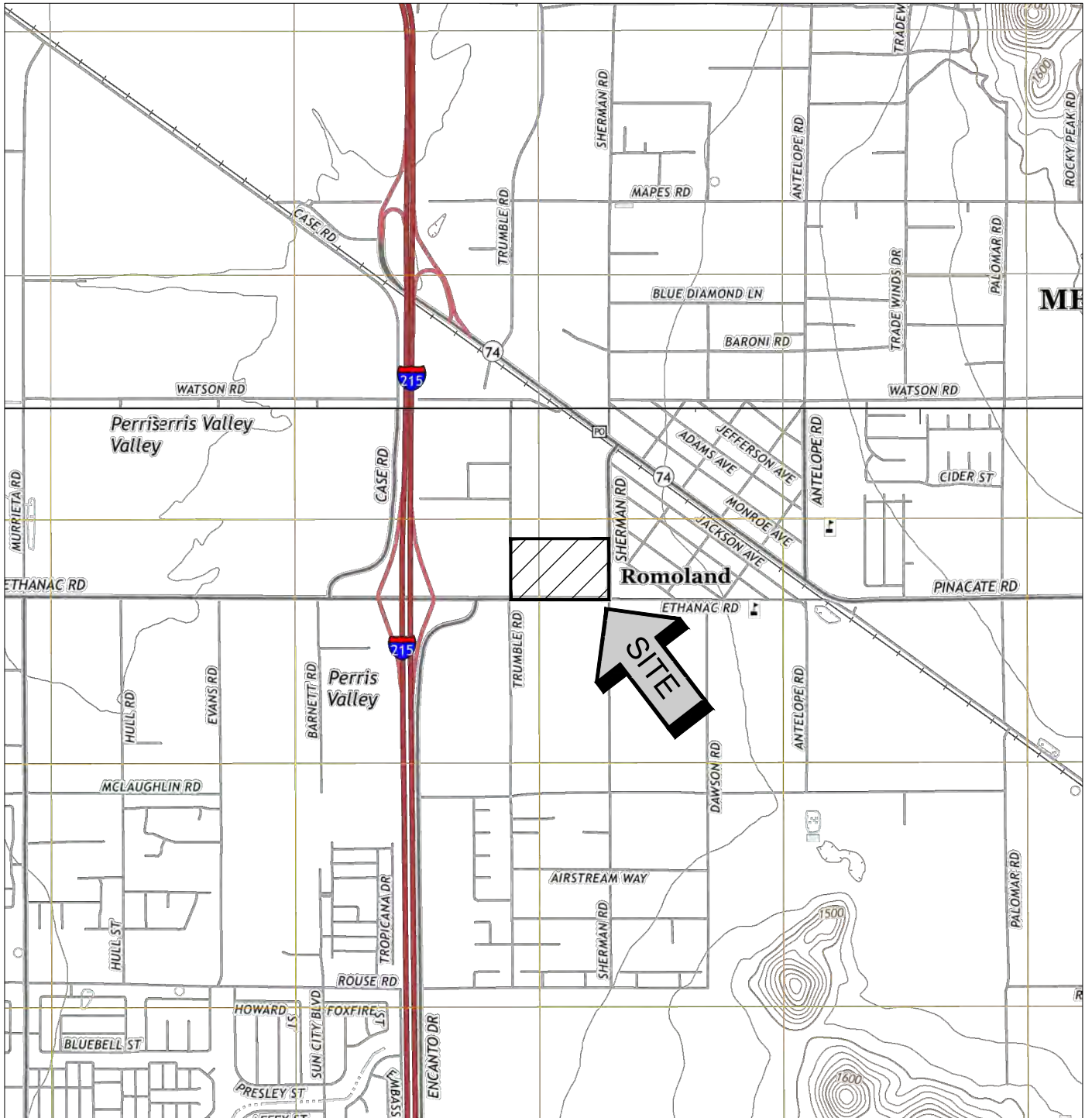


Robert G. Trazo, GE 2655
Principal Engineer



Distribution: (1) Addressee

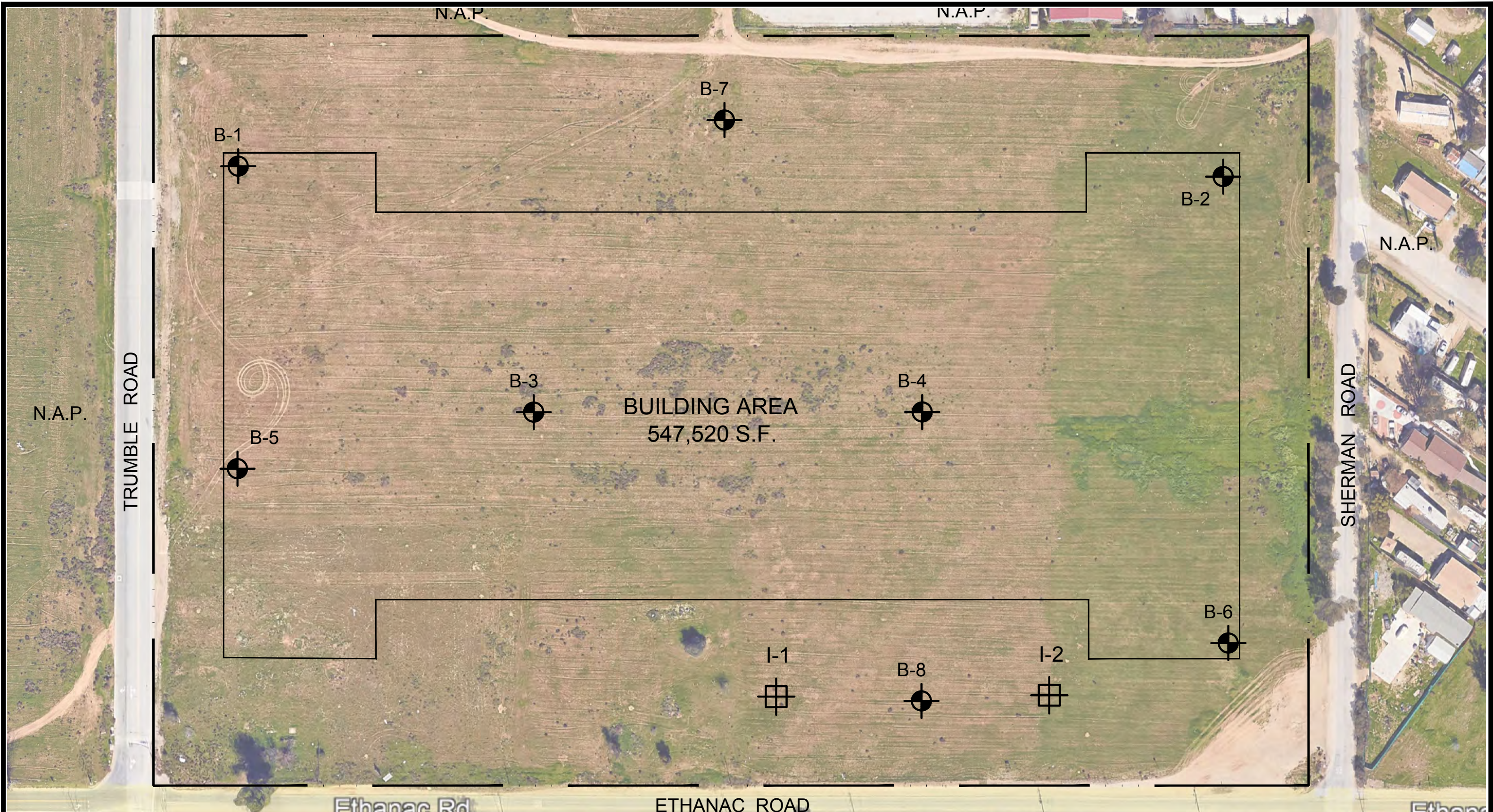
Enclosures: Plate 1: Site Location Map
Plate 2: Infiltration Test Location Plan
Trench Log Legend and Logs (4 pages)
Infiltration Test Results Spreadsheets (2 pages)
Grainsize Distribution Graphs (2 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF THE ROMOLAND & PERRIS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.



SITE LOCATION MAP	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000'	
DRAWN: MD	
CHKD: DN	
SCG PROJECT 22G107-2	
PLATE 1	SOUTHERN CALIFORNIA GEOTECHNICAL



N.A.P.

N.A.P.

N.A.P.

N.A.P.

TRUMBLE ROAD

SHERMAN ROAD

Ethanac Rd

ETHANAC ROAD

Ethanac Rd

BUILDING AREA
547,520 S.F.

B-1

B-7

B-2

B-3

B-4

B-5

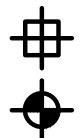
B-6

I-1

B-8

I-2

GEOTECHNICAL LEGEND



APPROXIMATE INFILTRATION TEST LOCATION




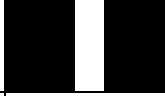

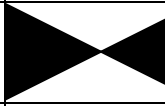

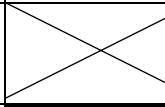


APPROXIMATE BORING LOCATION



NOTE: CONCEPTUAL SITE PLAN (SCHEME 7) PREPARED BY HERDMAN ARCHITECTURE + DESIGN.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH (2018)

INFILTRATION TEST LOCATION PLAN	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 100'	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: OS CHKD: RGT	
SCG PROJECT 22G107-2	
PLATE 2	

TRENCH LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



JOB NO.: 22G107-2	EXCAVATION DATE: 1/24/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	EXCAVATION METHOD: Backhoe	CAVE DEPTH: ---
LOCATION: Perris, California	LOGGED BY: Caleb Brackett	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG		DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
5					SURFACE ELEVATION: MSL OLDER ALLUVIUM: Light Brown Clayey fine to medium Sand, little Silt, little coarse Sand, trace Calcareous veining, cemented, slightly porous, very dense-damp to moist		11			29		
					Trench Terminated at 9' Due to Refusal on Very Dense Soils							

TBL 22G107-2.GPJ_SOCALGEO.GDT 2/24/22



JOB NO.: 22G107-2	EXCAVATION DATE: 1/24/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	EXCAVATION METHOD: Backhoe	CAVE DEPTH: ---
LOCATION: Perris, California	LOGGED BY: Caleb Brackett	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG		DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
5					SURFACE ELEVATION: MSL OLDER ALLUVIUM: Light Brown Clayey fine to medium Sand, little Silt, trace coarse Sand, cemented, slightly porous, very dense-damp to moist		10			26		
					Trench Terminated at 8' Due to Refusal on Very Dense Soils							

TBL 22G107-2.GPJ_SOCALGEO.GDT 2/24/22

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Perris, CA
Project Number	22G107-2
Engineer	CB

Infiltration Test No I-1

Constants			
	Diameter (ft)	Area (ft ²)	Area (cm ²)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval Elapsed (min)	Flow Readings				Infiltration Rates			
				Inner Ring (ml)	Ring Flow (cm ³)	Annular Ring (ml)	Space Flow (cm ³)	Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	9:20 AM	15	0		0	8000	0.55	14.62	0.22	5.76
	Final	9:35 AM	15	100	100	8000					
2	Initial	9:35 AM	15	0	0	8	5792	0.00	10.58	0.00	4.17
	Final	9:50 AM	30	0	0	5800					
3	Initial	9:50 AM	15	0	0	0	3900	0.00	7.13	0.00	2.81
	Final	10:05 AM	45	0	0	3900					
4	Initial	10:05 AM	15	0	0	0	3500	0.00	6.40	0.00	2.52
	Final	10:20 AM	60	0	0	3500					
5	Initial	10:20 AM	15	0	100	0	3600	0.55	6.58	0.22	2.59
	Final	10:35 AM	75	100	100	3600					
6	Initial	10:35 AM	15	0	50	0	3600	0.27	6.58	0.11	2.59
	Final	10:50 AM	90	50	50	3600					
7	Initial	10:50 AM	15	0	50	0	3600	0.27	6.58	0.11	2.59
	Final	11:05 AM	105	50	50	3600					
8	Initial	11:05 AM	15	0	50	0	3600	0.27	6.58	0.11	2.59
	Final	11:20 AM	120	50	50	3600					

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Perris, CA
Project Number	22G107-2
Engineer	CB

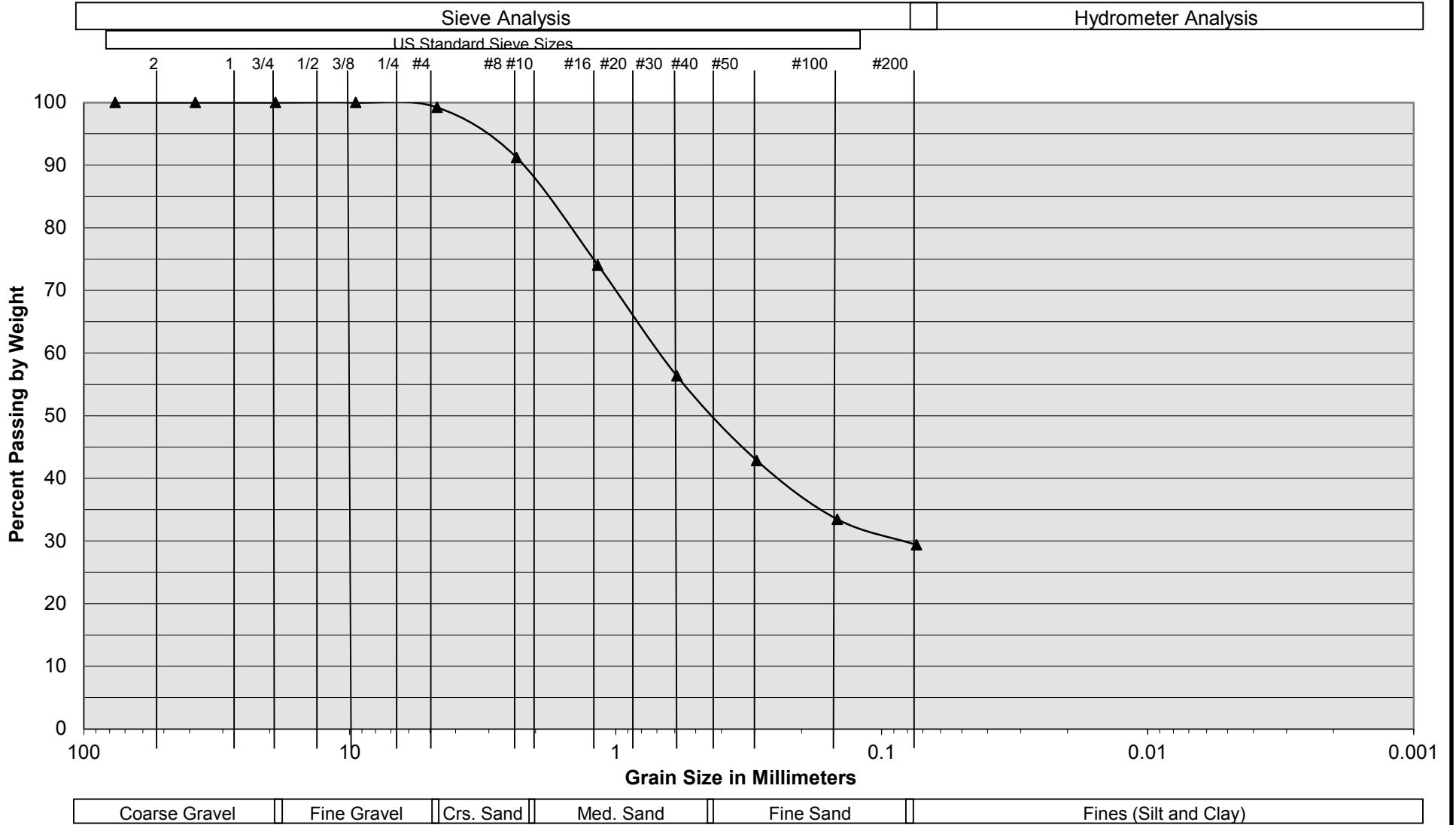
Infiltration Test No I-2

Constants			
	Diameter (ft)	Area (ft ²)	Area (cm ²)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval Elapsed (min)	Flow Readings				Infiltration Rates			
				Inner Ring (ml)	Ring Flow (cm ³)	Annular Ring (ml)	Space Flow (cm ³)	Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	7:00 AM	15	0	200	0	3500	1.10	6.40	0.43	2.52
	Final	7:15 AM	15	200	200	3500					
2	Initial	7:15 AM	15	0	150	0	4200	0.82	7.68	0.32	3.02
	Final	7:30 AM	30	150	150	4200					
3	Initial	7:30 AM	15	0	150	0	3000	0.82	5.48	0.32	2.16
	Final	7:45 AM	45	150	150	3000					
4	Initial	7:45 AM	15	0	100	0	2900	0.55	5.30	0.22	2.09
	Final	8:00 AM	60	100	100	2900					
5	Initial	8:00 AM	15	0	150	0	2900	0.82	5.30	0.32	2.09
	Final	8:15 AM	75	150	150	2900					
6	Initial	8:15 AM	15	0	100	0	2800	0.55	5.12	0.22	2.01
	Final	8:30 AM	90	100	100	2800					
7	Initial	8:30 AM	15	0	100	0	2900	0.55	5.30	0.22	2.09
	Final	8:45 AM	105	100	100	2900					
8	Initial	8:45 AM	15	0	100	0	2800	0.55	5.12	0.22	2.01
	Final	9:00 AM	120	100	100	2800					

Grain Size Distribution



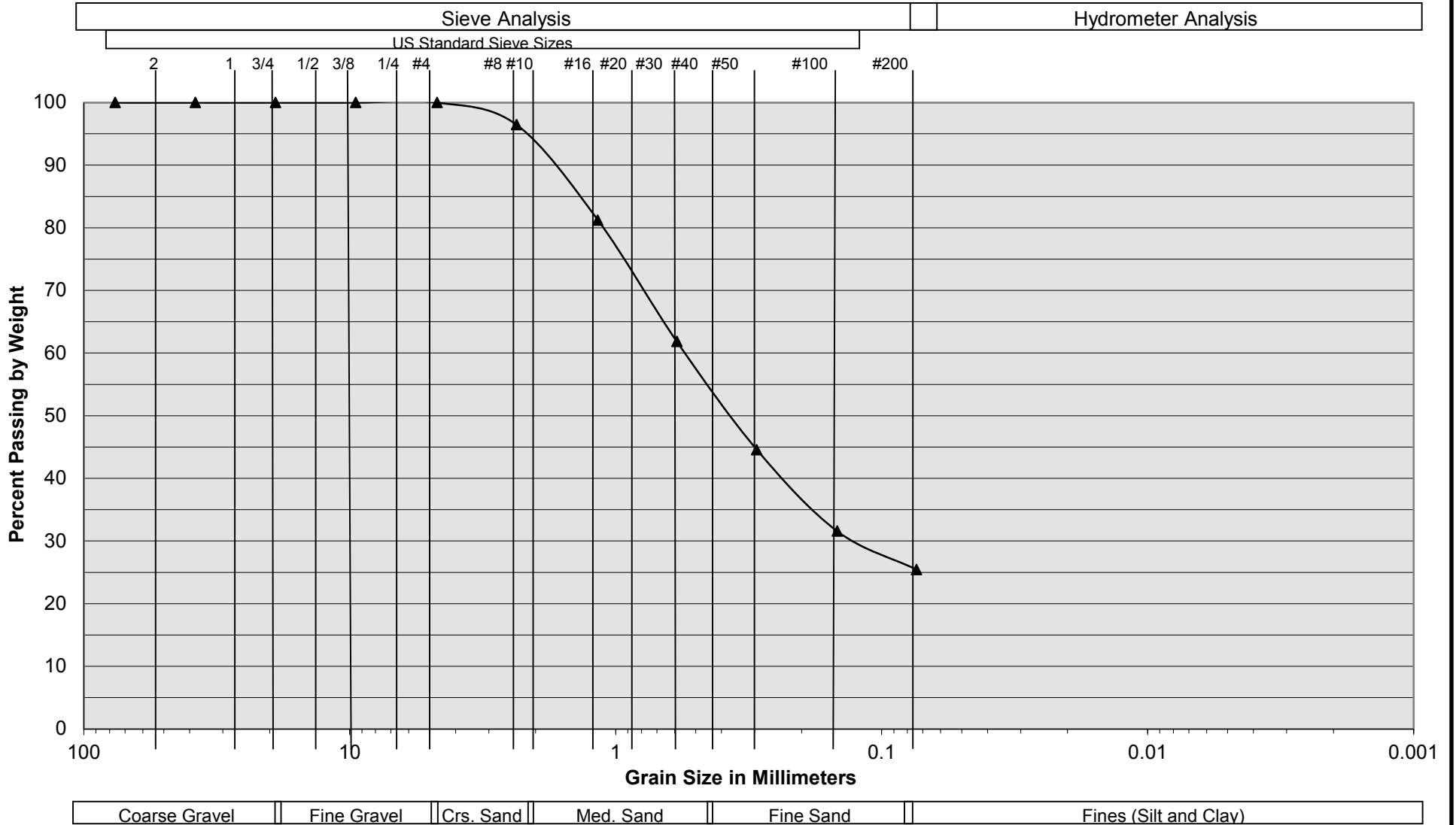
Sample Description	I-1 @ 8'
Soil Classification	Light Brown Clayey fine to medium Sand, little coarse Sand, little Silt

Proposed Warehouse
 Perris, CA
 Project No. 22G107-2
PLATE C- 1



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-2 @ 7'
Soil Classification	Light Brown Clayey fine to medium Sand, trace coarse Sand, little Silt

Proposed Warehouse
 Perris, CA
 Project No. 22G107-2
PLATE C- 2



Appendix 4: Historical Site Conditions

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

To be provided during final engineering

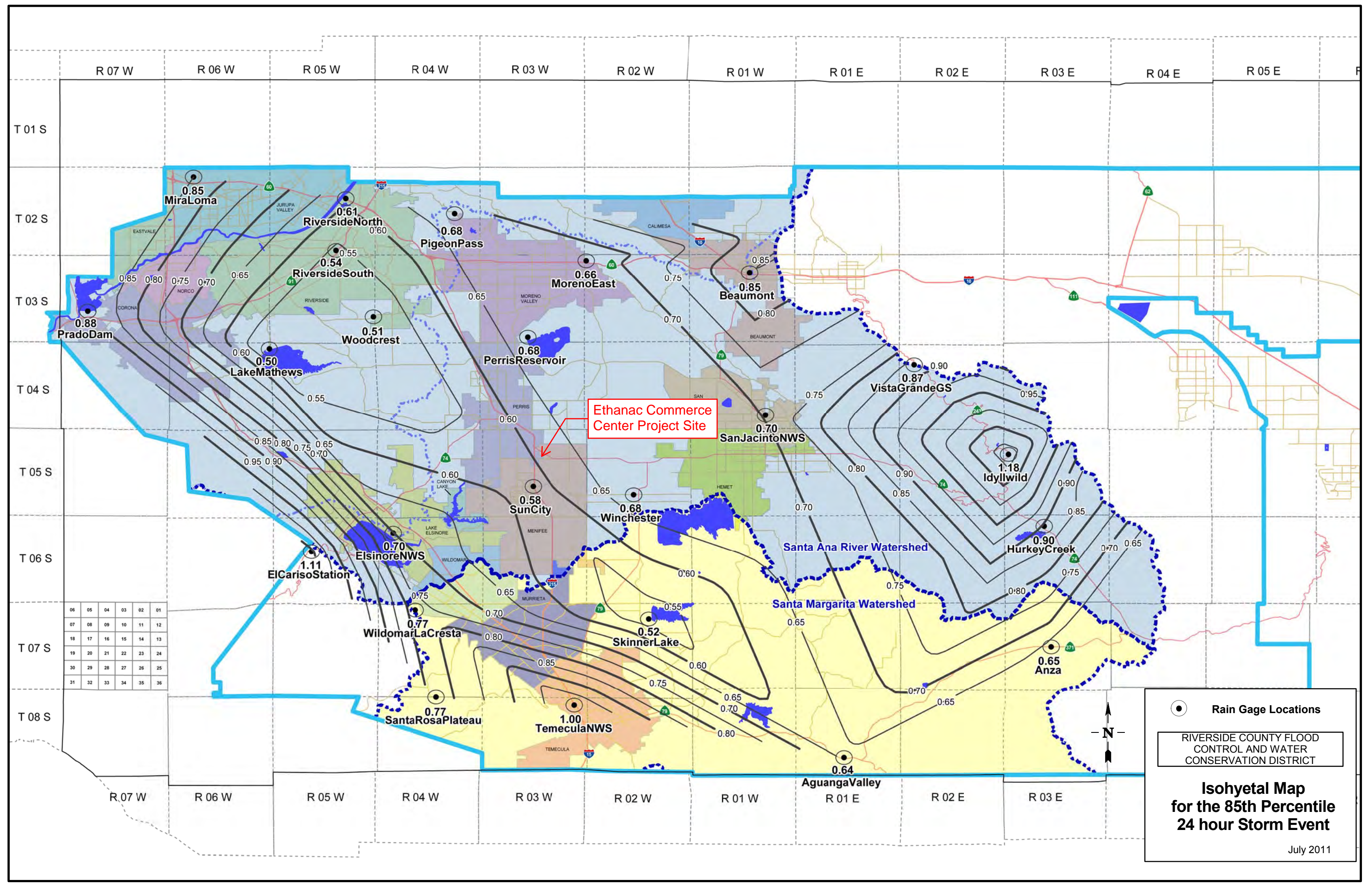
Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

N/A

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation



Ethanac Commerce
Center Project Site

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

● Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011



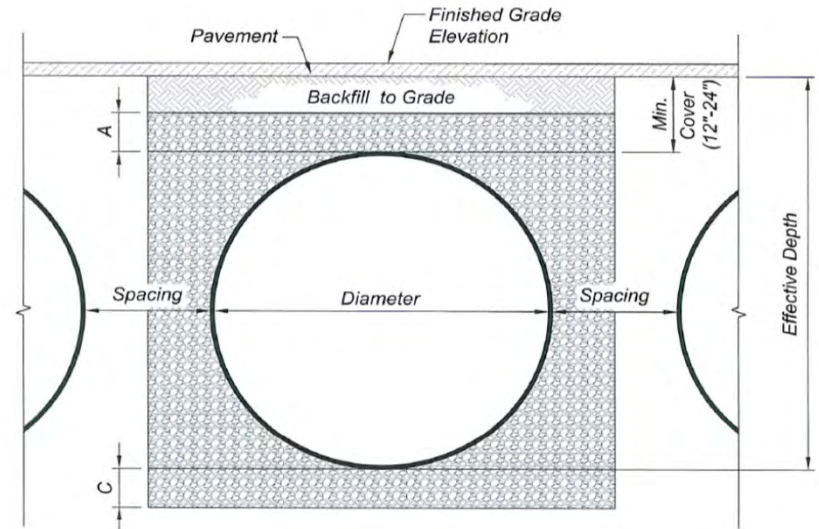
Project Summary

Date:	1/16/2024
Project Name:	Hillwood Ethanac
City / County:	City of Perris
State:	CA
Designed By:	RSB
Company:	Albert A. Webb Associates
Telephone:	

Enter Information in
Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	370,063	113.10 ft ² Pipe Area
Limiting Width (ft):	105.00	
Invert Depth Below Asphalt (ft):	14.00	
Solid or Perforated Pipe:	Perforated	
Shape Or Diameter (in):	144	
Number Of Headers:	2	
Spacing between Barrels (ft):	3.00	
Stone Width Around Perimeter of System (ft):	1.5	
Depth A: Porous Stone Above Pipe (in):	12	
Depth C: Porous Stone Below Pipe (in):	0	
Stone Porosity (0 to 40%):	40	



System Sizing

Pipe Storage:	289,077 cf	
Porous Stone Storage:	82,567 cf	
Total Storage Provided:	371,644 cf	100.4% Of Required Storage
Number of Barrels:	7 barrels	
Length per Barrel:	336.0 ft	
Length Per Header:	102.0 ft	
Rectangular Footprint (W x L):	105. ft x 363. ft	

System Layout

Barrel 12	
Barrel 11	
Barrel 10	
Barrel 9	
Barrel 8	
Barrel 7	336
Barrel 6	336
Barrel 5	336
Barrel 4	336
Barrel 3	336
Barrel 2	336
Barrel 1	336

Barrel Footage (w/o headers)

CONTECH Materials

Total CMP Footage:	2,556 ft
Approximate Total Pieces:	99 pcs
Approximate Coupling Bands:	104 bands
Approximate Truckloads:	99 trucks

Construction Quantities**

Total Excavation:	19764 cy
Porous Stone Backfill For Storage:	7645 cy stone
Backfill to Grade Excluding Stone:	1412 cy fill

**Construction quantities are approximate and should be verified upon final design

Water Quality Pump Rate Calculation

$$\frac{V_{BMP}}{t_{drain}} = Area * i = Q_{pump}$$

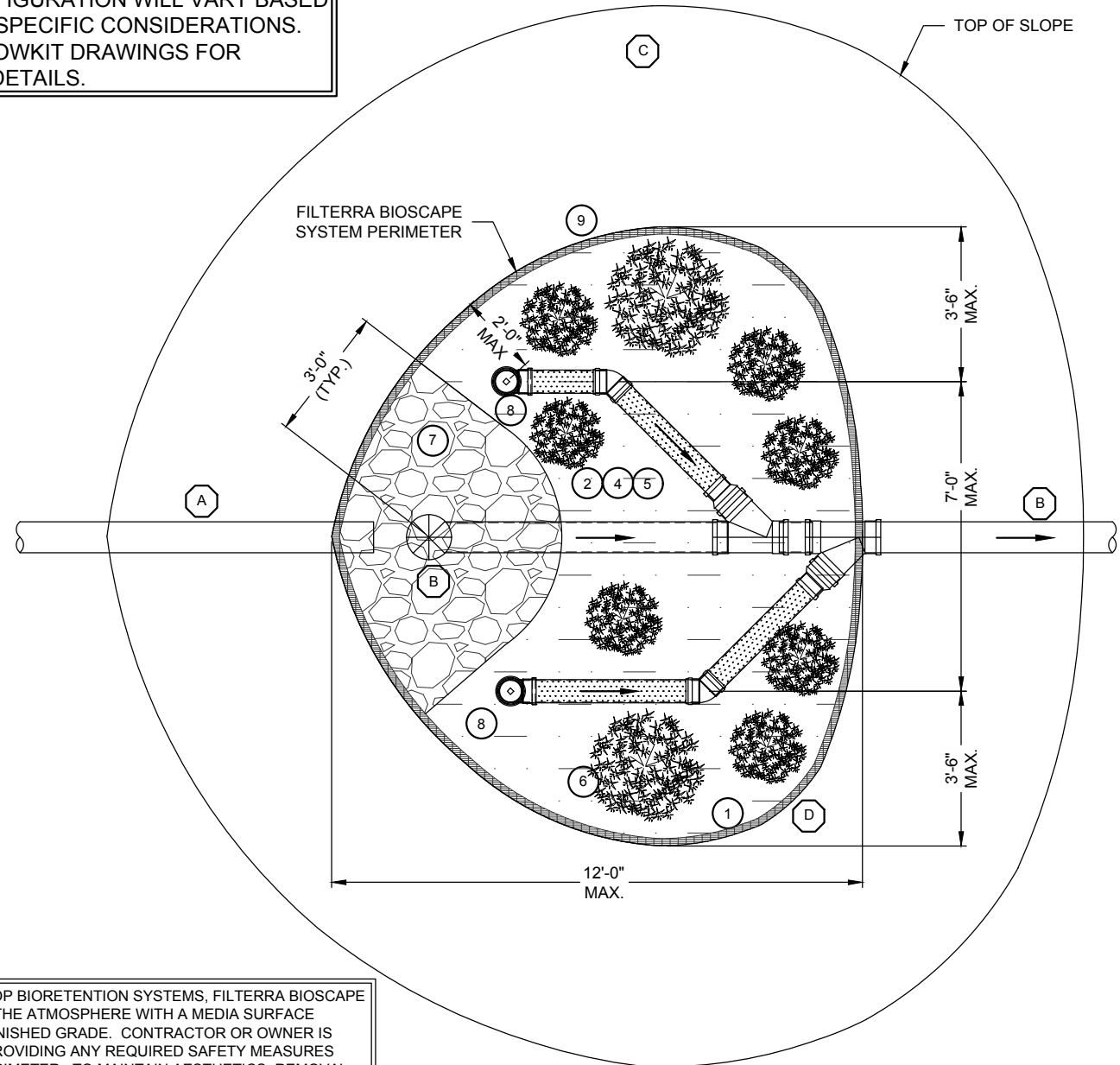
$$\frac{V_{BMP}}{t_{drain}} = Q_{pump}$$

$$Q_{pump} = \frac{ft^3}{hr} * \frac{1 hr}{3600 sec} * \frac{449 gpm}{1 \frac{ft^3}{sec}}$$

$$Q_{pump} = \frac{33,131 ft^3}{48 hr} * \frac{449 gpm}{3600 \frac{ft^3}{hr}} = 86 gpm$$

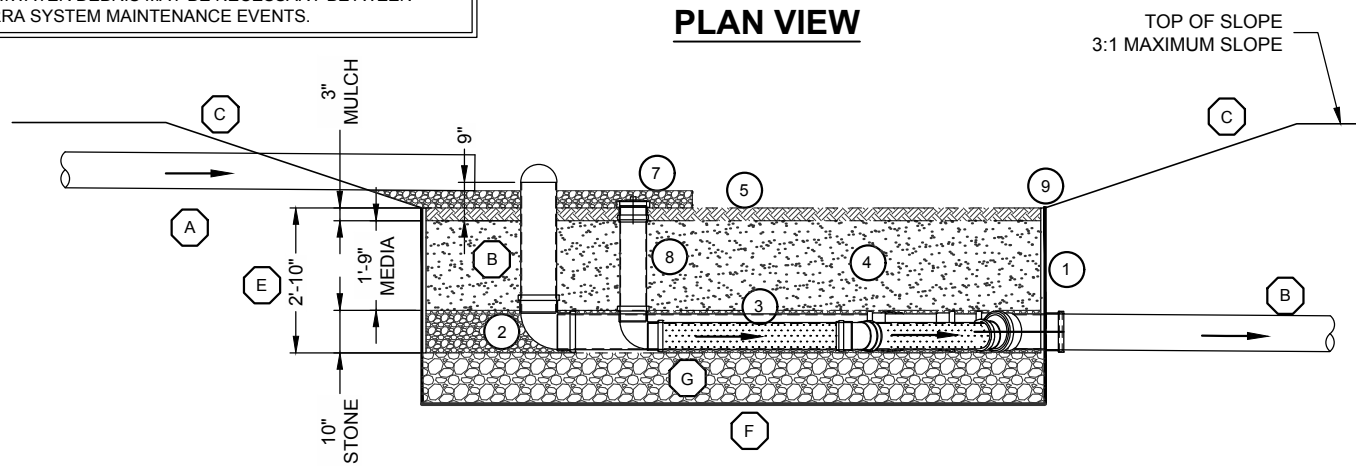
$$\mathbf{Q_{pump} = 86 gpm}$$

THIS IS A SCHEMATIC LAYOUT ONLY. ACTUAL CONFIGURATION WILL VARY BASED ON THE SITE SPECIFIC CONSIDERATIONS. REFER TO FLOWKIT DRAWINGS FOR ADDITIONAL DETAILS.



PLAN VIEW

AS WITH ALL OPEN TOP BIORETENTION SYSTEMS, FILTERRA BIOSCAPE SYSTEM IS OPEN TO THE ATMOSPHERE WITH A MEDIA SURFACE RECESSED BELOW FINISHED GRADE. CONTRACTOR OR OWNER IS RESPONSIBLE FOR PROVIDING ANY REQUIRED SAFETY MEASURES AROUND SYSTEM PERIMETER. TO MAINTAIN AESTHETICS, REMOVAL OF HEAVY STORMWATER DEBRIS MAY BE NECESSARY BETWEEN REGULAR FILTERRA SYSTEM MAINTENANCE EVENTS.



SECTION A-A VIEW

BILL OF MATERIALS		
COUNT	DESCRIPTION	INSTALLED BY
X	FILTERRA SURFACE AREA (SF)	CONTRACTOR
X	MULCH VOLUME (CY)	CONTRACTOR
XX	FILTERRA MEDIA VOLUME (CY)	CONTRACTOR
X	1/2" #4 ROUND AGGREGATE UNDERDRAIN STONE (CY)	CONTRACTOR
X	ENERGY DISSIPATION ROCK (CY)	CONTRACTOR
X	EROSION CONTROL (LF)	CONTRACTOR
X	FILTERRA FLOWKIT	CONTRACTOR

PLANTING SCHEDULE	
*NOTE: PLANTS PROVIDED BY OTHERS	
QUANTITY	FILTERRA BIOSCAPE SYSTEM PLANT PALETTE

GENERAL NOTES

- CONTRACTOR SHALL CONTACT CONTECH TO COORDINATE DELIVERY AND SUPERVISION OF PLACEMENT OF FILTERRA BIOSCAPE SYSTEM COMPONENTS (ACTIVATION). CONTRACTOR SHALL COMPLETE ITEMS IN THE LIST OF CONTRACTOR INSTALLATION RESPONSIBILITIES LISTED ON THIS DETAIL BEFORE CONTECH'S REPRESENTATIVE ATTENDS AND SUPERVISES THE ACTIVATION OF THE BIOSCAPE SYSTEM.
- PERFORM FILTERRA BIOSCAPE SYSTEM EXCAVATION ONLY AFTER ALL THE CONTRIBUTING DRAINAGE AREAS ARE PERMANENTLY STABILIZED. DO NOT CONSTRUCT FILTERRA BIOSCAPE SYSTEM IN AN AREA USED AS EROSION AND SEDIMENT CONTROL FACILITIES. DO NOT STOCKPILE MATERIALS NOR STORE EQUIPMENT IN THIS AREA.
- USE METHODS OF EXCAVATION THAT MINIMIZE COMPACTION OF THE UNDERLYING SOIL UNLESS THE SYSTEM IS TO BE LINED.
- CONTRACTOR SHALL COORDINATE WITH CONTECH BEFORE THE FILTERRA BIOSCAPE SYSTEM AREA IS EXCAVATED TO MINIMIZE TIME BETWEEN EXCAVATION AND DELIVERY AND ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM. ANY STANDING WATER THAT ACCUMULATES IN THE EXCAVATED AREA MUST BE REMOVED BY THE CONTRACTOR BEFORE CONTECH CAN PROVIDE ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM. ANY ADDITIONAL EXCAVATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. EXCAVATION DIMENSIONS SHOULD BE PROVIDED TO CONTECH IN THE ACTIVATION REQUEST CHECKLIST.
- CONTRACTOR SHALL PROVIDE ACCESS TO THE EXCAVATED AREA(S) FOR USE DURING THE ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM(S). ACCESS SHALL NOT PROHIBIT LIGHT DUTY EQUIPMENT THAT MAY BE USED TO INSTALL THE COMPONENTS (STONE, MEDIA, ETC). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY RE-STABILIZATION THAT MAY BE REQUIRED AFTER THE FILTERRA BIOSCAPE SYSTEM ACTIVATION.
- CONTECH AND/OR ITS REPRESENTATIVES MUST BE SCHEDULED TO BE ON SITE FOR THE LIST ENTITLED CONTRACTOR ACTIVATION RESPONSIBILITIES.

CONTRACTOR SITE PREPARATION RESPONSIBILITIES AS DENOTED BY (X) ON THIS DETAIL:

- (A) CONTRACTOR SHALL INSTALL PIPE OR SWALE THAT CONVEYS INFLUENT FLOWS AS WELL AS ANY REQUIRED INLET AND OUTLET STRUCTURES.
- (B) CONTRACTOR SHALL PROVIDE BYPASS PIPE AND RISER OR OTHER STRUCTURE AS SHOWN ON PLANS. THE BYPASS PIPE SHALL BE INSTALLED WITH WYE(S), OR OTHER PIPE FITTINGS, AND WITH REDUCER COUPLING(S) FOR CONNECTION OF UNDERDRAIN PIPE, PER PLANS. PIPES SHALL BE INSTALLED TO PROMOTE POSITIVE FLOW FROM THE FILTERRA BIOSCAPE SYSTEM.
- (C) IF REQUIRED, CONTRACTOR TO PROVIDE SHOULDER ACCORDING TO DIMENSION AND SLOPE SHOWN ON PLANS OR AS DESIGNED BY ENGINEER OF RECORD. SLOPE FROM SHOULDER TO FILTERRA BIOSCAPE SYSTEM SURFACE AREA SHALL NOT EXCEED 3:1. SOD IS REQUIRED TO STABILIZE SIDE SLOPES OR ADJACENT GRADE.
- (D) CONTRACTOR TO EXCAVATE MEDIA AREA CORRESPONDING TO THE SIZE OF THE FILTERRA BIOSCAPE SYSTEM SURFACE AREA AS SHOWN ON DETAIL AND ON PLAN SHEETS.
- (E) CONTRACTOR SHALL EXCAVATE VERTICALLY FROM BOTTOM OF UNDERDRAIN STONE, OR DRAINAGE STONE, IF REQUIRED, TO ELEVATION OF MULCH AS SHOWN ON THIS DETAIL.
- (F) CONTRACTOR TO PROVIDE AND INSTALL ANY GEOTEXTILE OR IMPERMEABLE LINER FOR BOTTOM OF THE FILTERRA BIOSCAPE SYSTEM IF REQUIRED PER THE PLANS.
- (G) CONTRACTOR TO PROVIDE AND INSTALL ANY ADDITIONAL DRAINAGE STONE BELOW THE FILTERRA BIOSCAPE SYSTEM AS CALLED OUT ON THE PLANS.

CONTRACTOR ACTIVATION RESPONSIBILITIES AS DENOTED BY (#) ON THIS DETAIL:

- (1) PLACE GEOTEXTILE FABRIC ALONG THE PERIMETER OF THE FILTERRA BIOSCAPE SYSTEM EXCAVATION.
- (2) PLACE 10" OF UNDERDRAIN STONE - 2" UNDER THE PIPING, 6" AROUND THE PIPING AND 2" ABOVE THE PIPING USING LIGHT DUTY EQUIPMENT ONLY.
- (3) PLACE 6" UNDERDRAIN PIPING UNLESS OTHERWISE APPROVED BY CONTECH, ASSOCIATED PIPING AND FITTINGS/ELBOWS TO CONNECT TO THE PIPING/FITTING(S) THAT IS PROVIDED BY CONTRACTOR (SEE CONTRACTOR INSTALLATION RESPONSIBILITIES THIS DETAIL).
- (4) PLACE 21" FILTERRA MEDIA USING LIGHT DUTY EQUIPMENT ONLY. DO NOT COMPACT MEDIA.
- (5) PLACE 3" DOUBLE SHREDDED HARDWOOD MULCH OVER ENTIRE FILTERRA BIOSCAPE SYSTEM SURFACE AREA USING LIGHT DUTY EQUIPMENT ONLY. DO NOT COMPACT MULCH.
- (6) PROVIDE AND PLANT VEGETATION AS INDICATED IN TABLE ON THIS DETAIL OR ON SITE PLANS.
- (7) PLACE ENERGY DISSIPATION ROCK APRON AS DESIGNED AND INDICATED ON THIS DETAIL OR PER ENGINEER OF RECORD PLANS.
- (8) PLACE CLEANOUT ADAPTER, PLUG AND PIPING.
- (9) PLACE ADDITIONAL EROSION CONTROL AROUND FILTERRA BIOSCAPE SYSTEM (IF REQUIRED).

I:\COMMON\CAD\TREATMENT\64 FILTERRA\40 STANDARD DRAWINGS\FTBS - BIOSCAPE SYSTEM (BOXLESS)\DWG\FILTERRA BIOSCAPE SUPERVISED SYSTEM - STD DETAIL.DWG 5/21/2020 8:57 AM

CONTECH
ENGINEERED SOLUTIONS LLC
 www.ContechES.com
 9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
 800-338-1122 513-645-7000 513-645-7993 FAX

FILTERRA BIOSCAPE™ SYSTEM
 STANDARD DETAIL



June 2020

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), ENHANCED, PHOSPHORUS & OIL TREATMENT

For

CONTECH Engineered Solutions Filterra®

Ecology's Decision:

Based on Contech's submissions, including the Final Technical Evaluation Reports, dated August 2019, March 2014, December 2009, and additional information provided to Ecology dated October 9, 2009, Ecology hereby issues the following use level designations:

1. A General Use Level Designation for Basic, Enhanced, Phosphorus, and Oil Treatment for the Filterra® system constructed with a minimum media thickness of 21 inches (1.75 feet), at the following water quality design hydraulic loading rates:

Treatment	Infiltration Rate (in/hr) for use in Sizing
Basic	175
Phosphorus	100
Oil	50
Enhanced	175

2. The Filterra is not appropriate for oil spill-control purposes.
3. Ecology approves Filterra systems for treatment at the hydraulic loading rates listed above, and sized based on the water quality design flow rate for an off-line system. Calculate the water quality design flow rates using the following procedures:

- Western Washington: for treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three flow rate based methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

4. This General Use Level Designation has no expiration date, but Ecology may revoke or amend the designation, and is subject to the conditions specified below.

Ecology's Conditions of Use:

Filtterra systems shall comply with these conditions shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the Filtterra systems in accordance with applicable Contech Filtterra manuals and this Ecology Decision.
2. The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in this Ecology Decision, Item 3, above) and the Infiltration Rate from the table above (use the lowest applicable Infiltration Rate depending on the level of treatment required). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the Infiltration Rate (converted to ft/sec) to obtain required surface area (sq-ft) of the Filtterra unit.
3. Each site plan must undergo Contech Filtterra review before Ecology can approve the unit for site installation. This will ensure that design parameters including site grading and slope are appropriate for use of a Filtterra unit.
4. Filtterra media shall conform to the specifications submitted to and approved by Ecology and shall be sourced from Contech Engineered Solutions, LLC with no substitutions.
5. Maintenance includes removing trash, degraded mulch, and accumulated debris from the filter surface and replacing the mulch layer. Use inspections to determine the site-specific maintenance schedules and requirements. Follow maintenance procedures given in the most recent version of the Filtterra Operation and Maintenance Manual.
6. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured treatment device.
 - Contech designs Filtterra systems for a target maintenance interval of 6 months in the Pacific Northwest. Maintenance includes removing and replacing the mulch layer above the media along with accumulated sediment, trash, and captured organic materials therein, evaluating plant health, and pruning the plant if deemed necessary.
 - Conduct maintenance following manufacturer's guidelines.
7. Filtterra systems come in standard sizes.
8. Install the Filtterra in such a manner that flows exceeding the maximum Filtterra operating rate are conveyed around the Filtterra mulch and media and will not resuspend captured sediment.
9. Discharges from the Filtterra units shall not cause or contribute to water quality standards violations in receiving waters.

Approved Alternate Configurations

Filtterra Internal Bypass - Pipe (FTIB-P)

1. The Filtterra® Internal Bypass – Pipe allows for piped-in flow from area drains, grated inlets, trench drains, and/or roof drains. Design capture flows and peak flows enter the structure through an internal slotted pipe. Filtterra® inverted the slotted pipe to allow design flows to drop through to a series of splash plates that then disperse the design flows over the top surface of the Filtterra® planter area. Higher flows continue to bypass the slotted pipe and convey out the structure.
2. To select a FTIB-P unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filtterra Internal Bypass – Curb (FTIB-C)

1. The Filtterra® Internal Bypass –Curb model (FTIB-C) incorporates a curb inlet, biofiltration treatment chamber, and internal high flow bypass in one single structure. Filtterra® designed the FTIB-C model for use in a “Sag” or “Sump” condition and will accept flows from both directions along a gutter line. An internal flume tray weir component directs treatment flows entering the unit through the curb inlet to the biofiltration treatment chamber. Flows in excess of the water quality treatment flow rise above the flume tray weir and discharge through a standpipe orifice; providing bypass of untreated peak flows. Americast manufactures the FTIB-C model in a variety of sizes and configurations and you may use the unit on a continuous grade when a single structure providing both treatment and high flow bypass is preferred. The FTIB-C model can also incorporate a separate junction box chamber to allow larger diameter discharge pipe connections to the structure.
2. To select a FTIB-C unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filtterra® Shallow

1. The Filtterra Shallow provides additional flexibility for design engineers and designers in situations where various elevation constraints prevent application of a standard Filtterra configuration. Engineers can design this system up to six inches shallower than any of the previous Filtterra unit configurations noted above.
2. Ecology requires that the Filtterra Shallow provide a media contact time equivalent to that of the standard unit. This means that with a smaller depth of media, the surface area must increase.
3. To select a Filtterra Shallow System unit, the designer must first identify the size of the standard unit using the modeling guidance described above.
4. Once the size of the standard Filtterra unit is established using the sizing technique described above, use information from the following table to select the appropriate size Filtterra Shallow System unit.

Shallow Unit Basic, Enhanced, Phosphorus, and Oil Treatment Sizing

Standard Depth	Equivalent Shallow Depth
4x4	4x6 or 6x4
4x6 or 6x4	6x6
4x8 or 8x4	6x8 or 8x6
6x6	6x10 or 10x6
6x8 or 8x6	6x12 or 12x6
6x10 or 10x6	13x7

Notes:

1. Shallow Depth Boxes are less than the standard depth of 3.5 feet but no less than 3.0 feet deep (TC to INV).

Applicant: Contech Engineered Solutions, LLC.

Applicant's Address: 11815 NE Glenn Widing Drive
Portland, OR 97220

Application Documents:

- State of Washington Department of Ecology Application for Conditional Use Designation, Americast (September 2006)
- Quality Assurance Project Plan Filterra® Bioretention Filtration System Performance Monitoring, Americast (April 2008)
- Quality Assurance Project Plan Addendum Filterra® Bioretention Filtration System Performance Monitoring, Americast (June 2008)
- Draft Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (August 2009)
- Final Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (December 2009)
- Technical Evaluation Report Appendices Filterra® Bioretention Filtration System Performance Monitoring, Americast, (August 2009)
- Memorandum to Department of Ecology Dated October 9, 2009 from Americast, Inc. and Herrera Environmental Consultants
- Quality Assurance Project Plan Filterra® Bioretention System Phosphorus treatment and Supplemental Basic and Enhanced Treatment Performance Monitoring, Americast (November 2011)
- Filterra® letter August 24, 2012 regarding sizing for the Filterra® Shallow System.
- University of Virginia Engineering Department Memo by Joanna Crowe Curran, Ph. D dated March 16, 2013 concerning capacity analysis of Filterra® internal weir inlet tray.
- Terraphase Engineering letter to Jodi Mills, P.E. dated April 2, 2013 regarding Terrafume Hydraulic Test, Filterra® Bioretention System and attachments.
- Technical Evaluation Report, Filterra® System Phosphorus Treatment and Supplemental Basic Treatment Performance Monitoring. March 27th, 2014.
- State of Washington Department of Ecology Application for Conditional Use Level Designation, Contech Engineered Solutions (May 2015)

- Quality Assurance Project Plan Filterra® Bioretention System, Contech Engineered Solutions (May 2015)
- Filterra Bioretention System Armco Avenue General Use Level Designation Technical Evaluation Report, Contech Engineered Solutions (August 2019)

Applicant’s Use Level Request:

General Level Use Designation for Basic (175 in/hr), Enhanced (175 in/hr), Phosphorus (100 in/hr), and Oil Treatment (50 in/hr).

Applicant’s Performance Claims:

Field-testing and laboratory testing show that the Filterra® unit is promising as a stormwater treatment best management practice and can meet Ecology’s performance goals for basic, enhanced, phosphorus, and oil treatment.

Findings of Fact:

Field Testing 2015-2019

1. Contech completed field testing of a 4 ft. x 4 ft. Filterra® unit at one site in Hillsboro, Oregon from September 2015 to July 2019. Throughout the monitoring period a total of 24 individual storm events were sampled, of which 23 qualified for TAPE sampling criteria.
2. Contech encountered several unanticipated events and challenges that prevented them from collecting continuous flow and rainfall data. An analysis of the flow data from the sampled events, including both the qualifying and non-qualifying events, demonstrated the system treated over 99 % of the influent flows. Peak flows during these events ranged from 25 % to 250 % of the design flow rate of 29 gallons per minute.
3. Of the 23 TAPE qualified sample events, 13 met requirements for TSS analysis. Influent concentrations ranged from 20.8 mg/L to 83 mg/L, with a mean concentration of 46.3 mg/L. The UCL95 mean effluent concentration was 15.9 mg/L, meeting the 20 mg/L performance goal for Basic Treatment.
4. All 23 TAPE qualified sample events met requirements for dissolved zinc analysis. Influent concentrations range from 0.0384 mg/L to 0.2680 mg/L, with a mean concentration of 0.0807 mg/L. The LCL 95 mean percent removal was 62.9 %, meeting the 60 % performance goal for Enhanced Treatment.
5. Thirteen of the 23 TAPE qualified sample events met requirements for dissolved copper analysis. Influent concentrations ranged from 0.00543 mg/L to 0.01660 mg/L, with a mean concentration of 0.0103 mg/L. The LCL 95 mean percent removal was 41.2 %, meeting the 30 % performance goal for Enhanced Treatment.
6. Total zinc concentrations were analyzed for all 24 sample events. Influent EMCs for total zinc ranged from 0.048 mg/L to 5.290 mg/L with a median of 0.162 mg/L. Corresponding effluent EMCs for total zinc ranged from 0.015 mg/L to 0.067 mg/L with a median of

0.029 mg/L. Total event loadings for the study for total zinc were 316.85 g at the influent and 12.92 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 95.9 %.

7. Total copper concentrations were analyzed for all 24 sample events. Influent EMCs for total copper ranged from 0.003 mg/L to 35.600 mg/L with a median value of 0.043 mg/L. Corresponding effluent EMCs for total copper ranged from 0.002 mg/L to 0.015 mg/L with a median of 0.004 mg/L. Total event loadings for total copper for the study were 1,810.06 g at the influent and 1.90 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 99.9 %.

Field Testing 2013

1. Filterra completed field-testing of a 6.5 ft x 4 ft. unit at one site in Bellingham, Washington. Continuous flow and rainfall data collected from January 1, 2013 through July 23, 2013 indicated that 59 storm events occurred. Water quality data was obtained from 22 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. The system treated 98.9 % of the total 8-month runoff volume during the testing period. Consequently, the system achieved the goal of treating 91 % of the volume from the site. Stormwater runoff bypassed Filterra treatment during four of the 59 storm events.
3. Of the 22 sampled events, 18 qualified for TSS analysis (influent TSS concentrations ranged from 25 to 138 mg/L). The data were segregated into sample pairs with influent concentration greater than and less than 100 mg/L. The UCL95 mean effluent concentration for the data with influent less than 100 mg/L was 5.2 mg/L, below the 20-mg/L threshold. Although the TAPE guidelines do not require an evaluation of TSS removal efficiency for influent concentrations below 100 mg/L, the mean TSS removal for these samples was 90.1 %. Average removal of influent TSS concentrations greater than 100 mg/L (three events) was 85 %. In addition, the system consistently exhibited TSS removal greater than 80 % at flow rates equivalent to a 100 in/hr infiltration rate and was observed at 150 in/hr.
4. Ten of the 22 sampled events qualified for TP analysis. Americast augmented the dataset using two sample pairs from previous monitoring at the site. Influent TP concentrations ranged from 0.11 to 0.52 mg/L. The mean TP removal for these twelve events was 72.6 %. The LCL95 mean percent removal was 66.0, well above the TAPE requirement of 50 %. Treatment above 50 % was evident at 100 in/hr infiltration rate and as high as 150 in/hr. Consequently, the Filterra test system met the TAPE Phosphorus Treatment goal at 100 in/hr. Influent ortho-P concentrations ranged from 0.005 to 0.012 mg/L; effluent ortho-P concentrations ranged from 0.005 to 0.013 mg/L. The reporting limit/resolution for the ortho-P test method is 0.01 mg/L, therefore the influent and effluent ortho-P concentrations were both at and near non-detect concentrations.

Field Testing 2008-2009

1. Filtterra completed field-testing at two sites at the Port of Tacoma. Continuous flow and rainfall data collected during the 2008-2009 monitoring period indicated that 89 storm events occurred. The monitoring obtained water quality data from 27 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. During the testing at the Port of Tacoma, 98.96 to 99.89 % of the annual influent runoff volume passed through the POT1 and POT2 test systems respectively. Stormwater runoff bypassed the POT1 test system during nine storm events and bypassed the POT2 test system during one storm event. Bypass volumes ranged from 0.13 % to 15.3% of the influent storm volume. Both test systems achieved the 91 % water quality treatment-goal over the 1-year monitoring period.
3. Consultants observed infiltration rates as high as 133 in/hr during the various storms. Filtterra did not provide any paired data that identified percent removal of TSS, metals, oil, or phosphorus at an instantaneous observed flow rate.
4. The maximum storm average hydraulic loading rate associated with water quality data is <40 in/hr, with the majority of flow rates < 25 in/hr. The average instantaneous hydraulic loading rate ranged from 8.6 to 53 in/hr.
5. The field data showed a removal rate greater than 80 % for TSS with an influent concentration greater than 20 mg/L at an average instantaneous hydraulic loading rate up to 53 in/hr (average influent concentration of 28.8 mg/L, average effluent concentration of 4.3 mg/L).
6. The field data showed a removal rate generally greater than 54 % for dissolved zinc at an average instantaneous hydraulic loading rate up to 60 in/hr and an average influent concentration of 0.266 mg/L (average effluent concentration of 0.115 mg/L).
7. The field data showed a removal rate generally greater than 40 % for dissolved copper at an average instantaneous hydraulic loading rate up to 35 in/hr and an average influent concentration of 0.0070 mg/L (average effluent concentration of 0.0036 mg/L).
8. The field data showed an average removal rate of 93 % for total petroleum hydrocarbon (TPH) at an average instantaneous hydraulic loading rate up to 53 in/hr and an average influent concentration of 52 mg/L (average effluent concentration of 2.3 mg/L). The data also shows achievement of less than 15 mg/L TPH for grab samples. Filtterra provided limited visible sheen data due to access limitations at the outlet monitoring location.
9. The field data showed low percentage removals of total phosphorus at all storm flows at an average influent concentration of 0.189 mg/L (average effluent concentration of 0.171 mg/L). We may relate the relatively poor treatment performance of the Filtterra system at this location to influent characteristics for total phosphorus that are unique to the Port of Tacoma site. It appears that the Filtterra system will not meet the 50 % removal performance goal when the majority of phosphorus in the runoff is expected to be in the dissolved form.

Laboratory Testing

1. Filterra performed laboratory testing on a scaled down version of the Filterra unit. The lab data showed an average removal from 83-91 % for TSS with influents ranging from 21 to 320 mg/L, 82-84 % for total copper with influents ranging from 0.94 to 2.3 mg/L, and 50-61 % for orthophosphate with influents ranging from 2.46 to 14.37 mg/L.
2. Filterra conducted permeability tests on the soil media.
3. Lab scale testing using Sil-Co-Sil 106 showed removals ranging from 70.1 % to 95.5 % with a median removal of 90.7 %, for influent concentrations ranging from 8.3 to 260 mg/L. Filterra ran these laboratory tests at an infiltration rate of 50 in/hr.
4. Supplemental lab testing conducted in September 2009 using Sil-Co-Sil 106 showed an average removal of 90.6 %. These laboratory tests were run at infiltration rates ranging from 25 to 150 in/hr for influent concentrations ranging from 41.6 to 252.5 mg/L. Regression analysis results indicate that the Filterra system’s TSS removal performance is independent of influent concentration in the concentration range evaluated at hydraulic loading rates of up to 150 in/hr.

Contact Information:

Applicant: Jeremiah Lehman
Contech Engineered Solutions, LLC.
11815 Glenn Widing Dr
Portland, OR 97220
(503) 258-3136
jlehman@conteches.com

Applicant’s Website: <http://www.conteches.com>

Ecology web link: <http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Date	Revision
December 2009	GULD for Basic, Enhanced, and Oil granted, CULD for Phosphorus
September 2011	Extended CULD for Phosphorus Treatment
September 2012	Revised design storm discussion, added Shallow System.
January 2013	Revised format to match Ecology standards, changed Filterra contact information
February 2013	Added FTIB-P system
March 2013	Added FTIB-C system
April 2013	Modified requirements for identifying appropriate size of unit

June 2013	Modified description of FTIB-C alternate configuration
March 2014	GULD awarded for Phosphorus Treatment. GULD updated for a higher flow-rate for Basic Treatment.
June 2014	Revised sizing calculation methods
March 2015	Revised Contact Information
June 2015	CULD for Basic and Enhanced at 100 in/hr infiltration rate
September 2019	GULD for Basic and Enhanced at 175 in/hr infiltration rate
February 2020	Revised sizing language to note sizing based on off-line calculations
June 2020	Added Phosphorus to Filterra Shallow sizing table

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

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

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
Study date 12/14/22 File: ONSITEPRE242.out

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

Program License Serial Number 4010

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

English Units used in output format

22-0198 - ETHANAC COMMERCE CENTER
ONSITE UNIT HYDROGRAPH ANALYSIS
EXISTING CONDITION, 2-YEAR 24-HOUR
FN: ONSITEPRE.OUT- RSB

Drainage Area = 19.80(Ac.) = 0.031 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 19.80(Ac.) =
0.031 Sq. Mi.
Length along longest watercourse = 1376.00(Ft.)
Length along longest watercourse measured to centroid = 686.00(Ft.)
Length along longest watercourse = 0.261 Mi.
Length along longest watercourse measured to centroid = 0.130 Mi.
Difference in elevation = 5.00(Ft.)
Slope along watercourse = 19.1860 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time = 0.113 Hr.
Lag time = 6.81 Min.
25% of lag time = 1.70 Min.
40% of lag time = 2.72 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	1.60	31.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	4.00	79.20

STORM EVENT (YEAR) = 2.00
 Area Averaged 2-Year Rainfall = 1.600(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 1.600(In)
 Areal adjustment factor = 100.00 %
 Adjusted average point rain = 1.600(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.800	89.00	0.000
Total Area Entered = 19.80(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
89.0	76.4	0.286	0.000	0.286	1.000	0.286
Sum (F) =						0.286

Area averaged mean soil loss (F) (In/Hr) = 0.286
 Minimum soil loss rate ((In/Hr)) = 0.143
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.900

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

Unit Hydrograph Data

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	73.448	11.521
2	0.167	146.895	41.791
3	0.250	220.343	21.981
4	0.333	293.790	8.716
5	0.417	367.238	5.287
6	0.500	440.685	3.444
7	0.583	514.133	2.371
8	0.667	587.580	1.770

9	0.750	661.028	1.252	0.250
10	0.833	734.475	0.845	0.169
11	0.917	807.923	1.022	0.204
			Sum = 100.000	Sum= 19.955

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

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.013	(0.508)	0.012	0.001
2	0.17	0.07	0.013	(0.506)	0.012	0.001
3	0.25	0.07	0.013	(0.504)	0.012	0.001
4	0.33	0.10	0.019	(0.502)	0.017	0.002
5	0.42	0.10	0.019	(0.500)	0.017	0.002
6	0.50	0.10	0.019	(0.498)	0.017	0.002
7	0.58	0.10	0.019	(0.496)	0.017	0.002
8	0.67	0.10	0.019	(0.494)	0.017	0.002
9	0.75	0.10	0.019	(0.492)	0.017	0.002
10	0.83	0.13	0.026	(0.490)	0.023	0.003
11	0.92	0.13	0.026	(0.488)	0.023	0.003
12	1.00	0.13	0.026	(0.486)	0.023	0.003
13	1.08	0.10	0.019	(0.485)	0.017	0.002
14	1.17	0.10	0.019	(0.483)	0.017	0.002
15	1.25	0.10	0.019	(0.481)	0.017	0.002
16	1.33	0.10	0.019	(0.479)	0.017	0.002
17	1.42	0.10	0.019	(0.477)	0.017	0.002
18	1.50	0.10	0.019	(0.475)	0.017	0.002
19	1.58	0.10	0.019	(0.473)	0.017	0.002
20	1.67	0.10	0.019	(0.471)	0.017	0.002
21	1.75	0.10	0.019	(0.469)	0.017	0.002
22	1.83	0.13	0.026	(0.467)	0.023	0.003
23	1.92	0.13	0.026	(0.466)	0.023	0.003
24	2.00	0.13	0.026	(0.464)	0.023	0.003
25	2.08	0.13	0.026	(0.462)	0.023	0.003
26	2.17	0.13	0.026	(0.460)	0.023	0.003
27	2.25	0.13	0.026	(0.458)	0.023	0.003
28	2.33	0.13	0.026	(0.456)	0.023	0.003
29	2.42	0.13	0.026	(0.454)	0.023	0.003
30	2.50	0.13	0.026	(0.452)	0.023	0.003
31	2.58	0.17	0.032	(0.451)	0.029	0.003
32	2.67	0.17	0.032	(0.449)	0.029	0.003
33	2.75	0.17	0.032	(0.447)	0.029	0.003
34	2.83	0.17	0.032	(0.445)	0.029	0.003
35	2.92	0.17	0.032	(0.443)	0.029	0.003
36	3.00	0.17	0.032	(0.441)	0.029	0.003
37	3.08	0.17	0.032	(0.440)	0.029	0.003
38	3.17	0.17	0.032	(0.438)	0.029	0.003

39	3.25	0.17	0.032	(0.436)	0.029	0.003
40	3.33	0.17	0.032	(0.434)	0.029	0.003
41	3.42	0.17	0.032	(0.432)	0.029	0.003
42	3.50	0.17	0.032	(0.430)	0.029	0.003
43	3.58	0.17	0.032	(0.429)	0.029	0.003
44	3.67	0.17	0.032	(0.427)	0.029	0.003
45	3.75	0.17	0.032	(0.425)	0.029	0.003
46	3.83	0.20	0.038	(0.423)	0.035	0.004
47	3.92	0.20	0.038	(0.422)	0.035	0.004
48	4.00	0.20	0.038	(0.420)	0.035	0.004
49	4.08	0.20	0.038	(0.418)	0.035	0.004
50	4.17	0.20	0.038	(0.416)	0.035	0.004
51	4.25	0.20	0.038	(0.414)	0.035	0.004
52	4.33	0.23	0.045	(0.413)	0.040	0.004
53	4.42	0.23	0.045	(0.411)	0.040	0.004
54	4.50	0.23	0.045	(0.409)	0.040	0.004
55	4.58	0.23	0.045	(0.407)	0.040	0.004
56	4.67	0.23	0.045	(0.406)	0.040	0.004
57	4.75	0.23	0.045	(0.404)	0.040	0.004
58	4.83	0.27	0.051	(0.402)	0.046	0.005
59	4.92	0.27	0.051	(0.400)	0.046	0.005
60	5.00	0.27	0.051	(0.399)	0.046	0.005
61	5.08	0.20	0.038	(0.397)	0.035	0.004
62	5.17	0.20	0.038	(0.395)	0.035	0.004
63	5.25	0.20	0.038	(0.393)	0.035	0.004
64	5.33	0.23	0.045	(0.392)	0.040	0.004
65	5.42	0.23	0.045	(0.390)	0.040	0.004
66	5.50	0.23	0.045	(0.388)	0.040	0.004
67	5.58	0.27	0.051	(0.387)	0.046	0.005
68	5.67	0.27	0.051	(0.385)	0.046	0.005
69	5.75	0.27	0.051	(0.383)	0.046	0.005
70	5.83	0.27	0.051	(0.382)	0.046	0.005
71	5.92	0.27	0.051	(0.380)	0.046	0.005
72	6.00	0.27	0.051	(0.378)	0.046	0.005
73	6.08	0.30	0.058	(0.376)	0.052	0.006
74	6.17	0.30	0.058	(0.375)	0.052	0.006
75	6.25	0.30	0.058	(0.373)	0.052	0.006
76	6.33	0.30	0.058	(0.371)	0.052	0.006
77	6.42	0.30	0.058	(0.370)	0.052	0.006
78	6.50	0.30	0.058	(0.368)	0.052	0.006
79	6.58	0.33	0.064	(0.366)	0.058	0.006
80	6.67	0.33	0.064	(0.365)	0.058	0.006
81	6.75	0.33	0.064	(0.363)	0.058	0.006
82	6.83	0.33	0.064	(0.362)	0.058	0.006
83	6.92	0.33	0.064	(0.360)	0.058	0.006
84	7.00	0.33	0.064	(0.358)	0.058	0.006
85	7.08	0.33	0.064	(0.357)	0.058	0.006
86	7.17	0.33	0.064	(0.355)	0.058	0.006
87	7.25	0.33	0.064	(0.353)	0.058	0.006
88	7.33	0.37	0.070	(0.352)	0.063	0.007

89	7.42	0.37	0.070	(0.350)	0.063	0.007
90	7.50	0.37	0.070	(0.349)	0.063	0.007
91	7.58	0.40	0.077	(0.347)	0.069	0.008
92	7.67	0.40	0.077	(0.345)	0.069	0.008
93	7.75	0.40	0.077	(0.344)	0.069	0.008
94	7.83	0.43	0.083	(0.342)	0.075	0.008
95	7.92	0.43	0.083	(0.341)	0.075	0.008
96	8.00	0.43	0.083	(0.339)	0.075	0.008
97	8.08	0.50	0.096	(0.337)	0.086	0.010
98	8.17	0.50	0.096	(0.336)	0.086	0.010
99	8.25	0.50	0.096	(0.334)	0.086	0.010
100	8.33	0.50	0.096	(0.333)	0.086	0.010
101	8.42	0.50	0.096	(0.331)	0.086	0.010
102	8.50	0.50	0.096	(0.330)	0.086	0.010
103	8.58	0.53	0.102	(0.328)	0.092	0.010
104	8.67	0.53	0.102	(0.327)	0.092	0.010
105	8.75	0.53	0.102	(0.325)	0.092	0.010
106	8.83	0.57	0.109	(0.323)	0.098	0.011
107	8.92	0.57	0.109	(0.322)	0.098	0.011
108	9.00	0.57	0.109	(0.320)	0.098	0.011
109	9.08	0.63	0.122	(0.319)	0.109	0.012
110	9.17	0.63	0.122	(0.317)	0.109	0.012
111	9.25	0.63	0.122	(0.316)	0.109	0.012
112	9.33	0.67	0.128	(0.314)	0.115	0.013
113	9.42	0.67	0.128	(0.313)	0.115	0.013
114	9.50	0.67	0.128	(0.311)	0.115	0.013
115	9.58	0.70	0.134	(0.310)	0.121	0.013
116	9.67	0.70	0.134	(0.308)	0.121	0.013
117	9.75	0.70	0.134	(0.307)	0.121	0.013
118	9.83	0.73	0.141	(0.305)	0.127	0.014
119	9.92	0.73	0.141	(0.304)	0.127	0.014
120	10.00	0.73	0.141	(0.303)	0.127	0.014
121	10.08	0.50	0.096	(0.301)	0.086	0.010
122	10.17	0.50	0.096	(0.300)	0.086	0.010
123	10.25	0.50	0.096	(0.298)	0.086	0.010
124	10.33	0.50	0.096	(0.297)	0.086	0.010
125	10.42	0.50	0.096	(0.295)	0.086	0.010
126	10.50	0.50	0.096	(0.294)	0.086	0.010
127	10.58	0.67	0.128	(0.292)	0.115	0.013
128	10.67	0.67	0.128	(0.291)	0.115	0.013
129	10.75	0.67	0.128	(0.290)	0.115	0.013
130	10.83	0.67	0.128	(0.288)	0.115	0.013
131	10.92	0.67	0.128	(0.287)	0.115	0.013
132	11.00	0.67	0.128	(0.285)	0.115	0.013
133	11.08	0.63	0.122	(0.284)	0.109	0.012
134	11.17	0.63	0.122	(0.282)	0.109	0.012
135	11.25	0.63	0.122	(0.281)	0.109	0.012
136	11.33	0.63	0.122	(0.280)	0.109	0.012
137	11.42	0.63	0.122	(0.278)	0.109	0.012
138	11.50	0.63	0.122	(0.277)	0.109	0.012

139	11.58	0.57	0.109	(0.276)	0.098	0.011
140	11.67	0.57	0.109	(0.274)	0.098	0.011
141	11.75	0.57	0.109	(0.273)	0.098	0.011
142	11.83	0.60	0.115	(0.271)	0.104	0.012
143	11.92	0.60	0.115	(0.270)	0.104	0.012
144	12.00	0.60	0.115	(0.269)	0.104	0.012
145	12.08	0.83	0.160	(0.267)	0.144	0.016
146	12.17	0.83	0.160	(0.266)	0.144	0.016
147	12.25	0.83	0.160	(0.265)	0.144	0.016
148	12.33	0.87	0.166	(0.263)	0.150	0.017
149	12.42	0.87	0.166	(0.262)	0.150	0.017
150	12.50	0.87	0.166	(0.261)	0.150	0.017
151	12.58	0.93	0.179	(0.259)	0.161	0.018
152	12.67	0.93	0.179	(0.258)	0.161	0.018
153	12.75	0.93	0.179	(0.257)	0.161	0.018
154	12.83	0.97	0.186	(0.256)	0.167	0.019
155	12.92	0.97	0.186	(0.254)	0.167	0.019
156	13.00	0.97	0.186	(0.253)	0.167	0.019
157	13.08	1.13	0.218	(0.252)	0.196	0.022
158	13.17	1.13	0.218	(0.250)	0.196	0.022
159	13.25	1.13	0.218	(0.249)	0.196	0.022
160	13.33	1.13	0.218	(0.248)	0.196	0.022
161	13.42	1.13	0.218	(0.247)	0.196	0.022
162	13.50	1.13	0.218	(0.245)	0.196	0.022
163	13.58	0.77	0.147	(0.244)	0.132	0.015
164	13.67	0.77	0.147	(0.243)	0.132	0.015
165	13.75	0.77	0.147	(0.242)	0.132	0.015
166	13.83	0.77	0.147	(0.240)	0.132	0.015
167	13.92	0.77	0.147	(0.239)	0.132	0.015
168	14.00	0.77	0.147	(0.238)	0.132	0.015
169	14.08	0.90	0.173	(0.237)	0.156	0.017
170	14.17	0.90	0.173	(0.236)	0.156	0.017
171	14.25	0.90	0.173	(0.234)	0.156	0.017
172	14.33	0.87	0.166	(0.233)	0.150	0.017
173	14.42	0.87	0.166	(0.232)	0.150	0.017
174	14.50	0.87	0.166	(0.231)	0.150	0.017
175	14.58	0.87	0.166	(0.230)	0.150	0.017
176	14.67	0.87	0.166	(0.228)	0.150	0.017
177	14.75	0.87	0.166	(0.227)	0.150	0.017
178	14.83	0.83	0.160	(0.226)	0.144	0.016
179	14.92	0.83	0.160	(0.225)	0.144	0.016
180	15.00	0.83	0.160	(0.224)	0.144	0.016
181	15.08	0.80	0.154	(0.223)	0.138	0.015
182	15.17	0.80	0.154	(0.221)	0.138	0.015
183	15.25	0.80	0.154	(0.220)	0.138	0.015
184	15.33	0.77	0.147	(0.219)	0.132	0.015
185	15.42	0.77	0.147	(0.218)	0.132	0.015
186	15.50	0.77	0.147	(0.217)	0.132	0.015
187	15.58	0.63	0.122	(0.216)	0.109	0.012
188	15.67	0.63	0.122	(0.215)	0.109	0.012

189	15.75	0.63	0.122	(0.214)	0.109	0.012
190	15.83	0.63	0.122	(0.213)	0.109	0.012
191	15.92	0.63	0.122	(0.211)	0.109	0.012
192	16.00	0.63	0.122	(0.210)	0.109	0.012
193	16.08	0.13	0.026	(0.209)	0.023	0.003
194	16.17	0.13	0.026	(0.208)	0.023	0.003
195	16.25	0.13	0.026	(0.207)	0.023	0.003
196	16.33	0.13	0.026	(0.206)	0.023	0.003
197	16.42	0.13	0.026	(0.205)	0.023	0.003
198	16.50	0.13	0.026	(0.204)	0.023	0.003
199	16.58	0.10	0.019	(0.203)	0.017	0.002
200	16.67	0.10	0.019	(0.202)	0.017	0.002
201	16.75	0.10	0.019	(0.201)	0.017	0.002
202	16.83	0.10	0.019	(0.200)	0.017	0.002
203	16.92	0.10	0.019	(0.199)	0.017	0.002
204	17.00	0.10	0.019	(0.198)	0.017	0.002
205	17.08	0.17	0.032	(0.197)	0.029	0.003
206	17.17	0.17	0.032	(0.196)	0.029	0.003
207	17.25	0.17	0.032	(0.195)	0.029	0.003
208	17.33	0.17	0.032	(0.194)	0.029	0.003
209	17.42	0.17	0.032	(0.193)	0.029	0.003
210	17.50	0.17	0.032	(0.192)	0.029	0.003
211	17.58	0.17	0.032	(0.191)	0.029	0.003
212	17.67	0.17	0.032	(0.190)	0.029	0.003
213	17.75	0.17	0.032	(0.189)	0.029	0.003
214	17.83	0.13	0.026	(0.188)	0.023	0.003
215	17.92	0.13	0.026	(0.187)	0.023	0.003
216	18.00	0.13	0.026	(0.186)	0.023	0.003
217	18.08	0.13	0.026	(0.185)	0.023	0.003
218	18.17	0.13	0.026	(0.185)	0.023	0.003
219	18.25	0.13	0.026	(0.184)	0.023	0.003
220	18.33	0.13	0.026	(0.183)	0.023	0.003
221	18.42	0.13	0.026	(0.182)	0.023	0.003
222	18.50	0.13	0.026	(0.181)	0.023	0.003
223	18.58	0.10	0.019	(0.180)	0.017	0.002
224	18.67	0.10	0.019	(0.179)	0.017	0.002
225	18.75	0.10	0.019	(0.178)	0.017	0.002
226	18.83	0.07	0.013	(0.177)	0.012	0.001
227	18.92	0.07	0.013	(0.177)	0.012	0.001
228	19.00	0.07	0.013	(0.176)	0.012	0.001
229	19.08	0.10	0.019	(0.175)	0.017	0.002
230	19.17	0.10	0.019	(0.174)	0.017	0.002
231	19.25	0.10	0.019	(0.173)	0.017	0.002
232	19.33	0.13	0.026	(0.173)	0.023	0.003
233	19.42	0.13	0.026	(0.172)	0.023	0.003
234	19.50	0.13	0.026	(0.171)	0.023	0.003
235	19.58	0.10	0.019	(0.170)	0.017	0.002
236	19.67	0.10	0.019	(0.169)	0.017	0.002
237	19.75	0.10	0.019	(0.169)	0.017	0.002
238	19.83	0.07	0.013	(0.168)	0.012	0.001

239	19.92	0.07	0.013	(0.167)	0.012	0.001
240	20.00	0.07	0.013	(0.166)	0.012	0.001
241	20.08	0.10	0.019	(0.166)	0.017	0.002
242	20.17	0.10	0.019	(0.165)	0.017	0.002
243	20.25	0.10	0.019	(0.164)	0.017	0.002
244	20.33	0.10	0.019	(0.163)	0.017	0.002
245	20.42	0.10	0.019	(0.163)	0.017	0.002
246	20.50	0.10	0.019	(0.162)	0.017	0.002
247	20.58	0.10	0.019	(0.161)	0.017	0.002
248	20.67	0.10	0.019	(0.161)	0.017	0.002
249	20.75	0.10	0.019	(0.160)	0.017	0.002
250	20.83	0.07	0.013	(0.159)	0.012	0.001
251	20.92	0.07	0.013	(0.159)	0.012	0.001
252	21.00	0.07	0.013	(0.158)	0.012	0.001
253	21.08	0.10	0.019	(0.157)	0.017	0.002
254	21.17	0.10	0.019	(0.157)	0.017	0.002
255	21.25	0.10	0.019	(0.156)	0.017	0.002
256	21.33	0.07	0.013	(0.156)	0.012	0.001
257	21.42	0.07	0.013	(0.155)	0.012	0.001
258	21.50	0.07	0.013	(0.155)	0.012	0.001
259	21.58	0.10	0.019	(0.154)	0.017	0.002
260	21.67	0.10	0.019	(0.153)	0.017	0.002
261	21.75	0.10	0.019	(0.153)	0.017	0.002
262	21.83	0.07	0.013	(0.152)	0.012	0.001
263	21.92	0.07	0.013	(0.152)	0.012	0.001
264	22.00	0.07	0.013	(0.151)	0.012	0.001
265	22.08	0.10	0.019	(0.151)	0.017	0.002
266	22.17	0.10	0.019	(0.150)	0.017	0.002
267	22.25	0.10	0.019	(0.150)	0.017	0.002
268	22.33	0.07	0.013	(0.149)	0.012	0.001
269	22.42	0.07	0.013	(0.149)	0.012	0.001
270	22.50	0.07	0.013	(0.148)	0.012	0.001
271	22.58	0.07	0.013	(0.148)	0.012	0.001
272	22.67	0.07	0.013	(0.148)	0.012	0.001
273	22.75	0.07	0.013	(0.147)	0.012	0.001
274	22.83	0.07	0.013	(0.147)	0.012	0.001
275	22.92	0.07	0.013	(0.146)	0.012	0.001
276	23.00	0.07	0.013	(0.146)	0.012	0.001
277	23.08	0.07	0.013	(0.146)	0.012	0.001
278	23.17	0.07	0.013	(0.145)	0.012	0.001
279	23.25	0.07	0.013	(0.145)	0.012	0.001
280	23.33	0.07	0.013	(0.145)	0.012	0.001
281	23.42	0.07	0.013	(0.145)	0.012	0.001
282	23.50	0.07	0.013	(0.144)	0.012	0.001
283	23.58	0.07	0.013	(0.144)	0.012	0.001
284	23.67	0.07	0.013	(0.144)	0.012	0.001
285	23.75	0.07	0.013	(0.144)	0.012	0.001
286	23.83	0.07	0.013	(0.143)	0.012	0.001
287	23.92	0.07	0.013	(0.143)	0.012	0.001
288	24.00	0.07	0.013	(0.143)	0.012	0.001

(Loss Rate Not Used)

Sum = 100.0 Sum = 1.9
 Flood volume = Effective rainfall 0.16(In)
 times area 19.8(Ac.)/[(In)/(Ft.)] = 0.3(Ac.Ft)
 Total soil loss = 1.44(In)
 Total soil loss = 2.376(Ac.Ft)
 Total rainfall = 1.60(In)
 Flood volume = 11499.4 Cubic Feet
 Total soil loss = 103494.6 Cubic Feet

 Peak flow rate of this hydrograph = 0.430(CFS)

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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0002	0.02	Q				
0+20	0.0004	0.02	Q				
0+25	0.0006	0.03	Q				
0+30	0.0008	0.03	Q				
0+35	0.0011	0.04	Q				
0+40	0.0013	0.04	Q				
0+45	0.0016	0.04	Q				
0+50	0.0019	0.04	Q				
0+55	0.0022	0.04	Q				
1+ 0	0.0025	0.05	Q				
1+ 5	0.0028	0.05	Q				
1+10	0.0031	0.04	Q				
1+15	0.0034	0.04	Q				
1+20	0.0037	0.04	Q				
1+25	0.0039	0.04	Q				
1+30	0.0042	0.04	Q				
1+35	0.0045	0.04	Q				
1+40	0.0047	0.04	Q				
1+45	0.0050	0.04	Q				
1+50	0.0053	0.04	Q				
1+55	0.0056	0.05	Q				
2+ 0	0.0059	0.05	Q				
2+ 5	0.0063	0.05	Q				
2+10	0.0066	0.05	Q				
2+15	0.0069	0.05	QV				
2+20	0.0073	0.05	QV				
2+25	0.0076	0.05	QV				

2+30	0.0080	0.05	QV
2+35	0.0084	0.05	QV
2+40	0.0088	0.06	QV
2+45	0.0092	0.06	QV
2+50	0.0096	0.06	QV
2+55	0.0100	0.06	QV
3+ 0	0.0105	0.06	QV
3+ 5	0.0109	0.06	QV
3+10	0.0113	0.06	QV
3+15	0.0118	0.06	QV
3+20	0.0122	0.06	QV
3+25	0.0127	0.06	QV
3+30	0.0131	0.06	QV
3+35	0.0135	0.06	Q V
3+40	0.0140	0.06	Q V
3+45	0.0144	0.06	Q V
3+50	0.0149	0.07	Q V
3+55	0.0153	0.07	Q V
4+ 0	0.0159	0.07	Q V
4+ 5	0.0164	0.07	Q V
4+10	0.0169	0.08	Q V
4+15	0.0174	0.08	Q V
4+20	0.0179	0.08	Q V
4+25	0.0185	0.08	Q V
4+30	0.0191	0.09	Q V
4+35	0.0197	0.09	Q V
4+40	0.0203	0.09	Q V
4+45	0.0209	0.09	Q V
4+50	0.0215	0.09	Q V
4+55	0.0222	0.10	Q V
5+ 0	0.0229	0.10	Q V
5+ 5	0.0236	0.10	Q V
5+10	0.0242	0.09	Q V
5+15	0.0247	0.08	Q V
5+20	0.0253	0.08	Q V
5+25	0.0259	0.09	Q V
5+30	0.0265	0.09	Q V
5+35	0.0271	0.09	Q V
5+40	0.0278	0.10	Q V
5+45	0.0284	0.10	Q V
5+50	0.0291	0.10	Q V
5+55	0.0298	0.10	Q V
6+ 0	0.0305	0.10	Q V
6+ 5	0.0312	0.10	Q V
6+10	0.0320	0.11	Q V
6+15	0.0327	0.11	Q V
6+20	0.0335	0.11	Q V
6+25	0.0343	0.11	Q V
6+30	0.0351	0.11	Q V
6+35	0.0359	0.12	Q V

6+40	0.0367	0.12	Q	V				
6+45	0.0376	0.12	Q	V				
6+50	0.0384	0.13	Q	V				
6+55	0.0393	0.13	Q	V				
7+ 0	0.0402	0.13	Q	V				
7+ 5	0.0411	0.13	Q	V				
7+10	0.0419	0.13	Q	V				
7+15	0.0428	0.13	Q	V				
7+20	0.0437	0.13	Q	V				
7+25	0.0446	0.13	Q	V				
7+30	0.0456	0.14	Q	V				
7+35	0.0465	0.14	Q	V				
7+40	0.0475	0.15	Q	V				
7+45	0.0486	0.15	Q	V				
7+50	0.0496	0.15	Q	V				
7+55	0.0507	0.16	Q	V				
8+ 0	0.0518	0.16	Q	V				
8+ 5	0.0530	0.17	Q	V				
8+10	0.0542	0.18	Q	V				
8+15	0.0555	0.18	Q	V				
8+20	0.0568	0.19	Q	V				
8+25	0.0580	0.19	Q	V				
8+30	0.0594	0.19	Q	V				
8+35	0.0607	0.19	Q	V				
8+40	0.0620	0.20	Q	V				
8+45	0.0634	0.20	Q	V				
8+50	0.0648	0.20	Q	V				
8+55	0.0663	0.21	Q	V				
9+ 0	0.0677	0.21	Q	V				
9+ 5	0.0692	0.22	Q	V				
9+10	0.0708	0.23	Q	V				
9+15	0.0724	0.24	Q	V				
9+20	0.0741	0.24	Q	V				
9+25	0.0758	0.25	Q	V				
9+30	0.0775	0.25	Q	V				
9+35	0.0792	0.25	Q	V				
9+40	0.0810	0.26	Q	V				
9+45	0.0829	0.26	Q	V				
9+50	0.0847	0.27	Q	V				
9+55	0.0866	0.27	Q	V				
10+ 0	0.0885	0.28	Q	V				
10+ 5	0.0903	0.27	Q	V				
10+10	0.0919	0.23	Q	V				
10+15	0.0934	0.21	Q	V				
10+20	0.0948	0.21	Q	V				
10+25	0.0962	0.20	Q	V				
10+30	0.0975	0.20	Q	V				
10+35	0.0989	0.20	Q	V				
10+40	0.1005	0.23	Q	V				
10+45	0.1022	0.24	Q	V				

15+ 0	0.2117	0.32	Q			V
15+ 5	0.2139	0.32	Q			V
15+10	0.2160	0.31	Q			V
15+15	0.2182	0.31	Q			V
15+20	0.2203	0.31	Q			V
15+25	0.2224	0.30	Q			V
15+30	0.2244	0.30	Q			V
15+35	0.2264	0.29	Q			V
15+40	0.2283	0.27	Q			V
15+45	0.2300	0.26	Q			V
15+50	0.2318	0.25	Q			V
15+55	0.2335	0.25	Q			V
16+ 0	0.2352	0.25	Q			V
16+ 5	0.2367	0.22	Q			V
16+10	0.2377	0.14	Q			V
16+15	0.2384	0.10	Q			V
16+20	0.2390	0.08	Q			V
16+25	0.2394	0.07	Q			V
16+30	0.2399	0.07	Q			V
16+35	0.2403	0.06	Q			V
16+40	0.2406	0.05	Q			V
16+45	0.2410	0.05	Q			V
16+50	0.2412	0.04	Q			V
16+55	0.2415	0.04	Q			V
17+ 0	0.2418	0.04	Q			V
17+ 5	0.2421	0.04	Q			V
17+10	0.2424	0.05	Q			V
17+15	0.2428	0.06	Q			V
17+20	0.2433	0.06	Q			V
17+25	0.2437	0.06	Q			V
17+30	0.2441	0.06	Q			V
17+35	0.2445	0.06	Q			V
17+40	0.2450	0.06	Q			V
17+45	0.2454	0.06	Q			V
17+50	0.2458	0.06	Q			V
17+55	0.2462	0.06	Q			V
18+ 0	0.2466	0.05	Q			V
18+ 5	0.2470	0.05	Q			V
18+10	0.2473	0.05	Q			V
18+15	0.2477	0.05	Q			V
18+20	0.2480	0.05	Q			V
18+25	0.2484	0.05	Q			V
18+30	0.2487	0.05	Q			V
18+35	0.2491	0.05	Q			V
18+40	0.2494	0.04	Q			V
18+45	0.2497	0.04	Q			V
18+50	0.2500	0.04	Q			V
18+55	0.2502	0.03	Q			V
19+ 0	0.2504	0.03	Q			V
19+ 5	0.2506	0.03	Q			V

19+10	0.2508	0.03	Q				V
19+15	0.2511	0.04	Q				V
19+20	0.2513	0.04	Q				V
19+25	0.2516	0.04	Q				V
19+30	0.2520	0.05	Q				V
19+35	0.2523	0.05	Q				V
19+40	0.2526	0.04	Q				V
19+45	0.2529	0.04	Q				V
19+50	0.2531	0.04	Q				V
19+55	0.2533	0.03	Q				V
20+ 0	0.2535	0.03	Q				V
20+ 5	0.2538	0.03	Q				V
20+10	0.2540	0.03	Q				V
20+15	0.2542	0.04	Q				V
20+20	0.2545	0.04	Q				V
20+25	0.2548	0.04	Q				V
20+30	0.2550	0.04	Q				V
20+35	0.2553	0.04	Q				V
20+40	0.2555	0.04	Q				V
20+45	0.2558	0.04	Q				V
20+50	0.2560	0.04	Q				V
20+55	0.2563	0.03	Q				V
21+ 0	0.2565	0.03	Q				V
21+ 5	0.2567	0.03	Q				V
21+10	0.2569	0.03	Q				V
21+15	0.2571	0.04	Q				V
21+20	0.2574	0.04	Q				V
21+25	0.2576	0.03	Q				V
21+30	0.2578	0.03	Q				V
21+35	0.2580	0.03	Q				V
21+40	0.2582	0.03	Q				V
21+45	0.2585	0.04	Q				V
21+50	0.2587	0.04	Q				V
21+55	0.2589	0.03	Q				V
22+ 0	0.2591	0.03	Q				V
22+ 5	0.2593	0.03	Q				V
22+10	0.2595	0.03	Q				V
22+15	0.2598	0.04	Q				V
22+20	0.2600	0.04	Q				V
22+25	0.2602	0.03	Q				V
22+30	0.2604	0.03	Q				V
22+35	0.2606	0.03	Q				V
22+40	0.2608	0.03	Q				V
22+45	0.2610	0.03	Q				V
22+50	0.2612	0.03	Q				V
22+55	0.2613	0.03	Q				V
23+ 0	0.2615	0.03	Q				V
23+ 5	0.2617	0.03	Q				V
23+10	0.2619	0.03	Q				V
23+15	0.2620	0.03	Q				V

23+20	0.2622	0.03	Q				V
23+25	0.2624	0.03	Q				V
23+30	0.2626	0.03	Q				V
23+35	0.2627	0.03	Q				V
23+40	0.2629	0.03	Q				V
23+45	0.2631	0.03	Q				V
23+50	0.2633	0.03	Q				V
23+55	0.2635	0.03	Q				V
24+ 0	0.2636	0.03	Q				V
24+ 5	0.2638	0.02	Q				V
24+10	0.2639	0.01	Q				V
24+15	0.2639	0.01	Q				V
24+20	0.2639	0.00	Q				V
24+25	0.2640	0.00	Q				V
24+30	0.2640	0.00	Q				V
24+35	0.2640	0.00	Q				V
24+40	0.2640	0.00	Q				V
24+45	0.2640	0.00	Q				V
24+50	0.2640	0.00	Q				V

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
Study date 12/14/22 File: ONSITEPROP242.out

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

Program License Serial Number 4010

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

English Units used in output format

22-0198 - ETHANAC COMMERCE CENTER
ONSITE UNIT HYDROGRAPH ANALYSIS
PROPOSED CONDITION, 2-YEAR 24-HOUR
FN: ONSITEPROP.OUT- RSB

Drainage Area = 19.80(Ac.) = 0.031 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 19.80(Ac.) =
0.031 Sq. Mi.
Length along longest watercourse = 553.00(Ft.)
Length along longest watercourse measured to centroid = 150.00(Ft.)
Length along longest watercourse = 0.105 Mi.
Length along longest watercourse measured to centroid = 0.028 Mi.
Difference in elevation = 7.00(Ft.)
Slope along watercourse = 66.8354 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.018 Hr.
Lag time = 1.07 Min.
25% of lag time = 0.27 Min.
40% of lag time = 0.43 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	1.60	31.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	4.00	79.20

STORM EVENT (YEAR) = 2.00
 Area Averaged 2-Year Rainfall = 1.600(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 1.600(In)
 Areal adjustment factor = 100.00 %
 Adjusted average point rain = 1.600(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.800	75.00	0.900
Total Area Entered = 19.80(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
75.0	57.0	0.501	0.900	0.095	1.000	0.095
Sum (F) =						0.095

Area averaged mean soil loss (F) (In/Hr) = 0.095
 Minimum soil loss rate ((In/Hr)) = 0.048
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.180

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

Unit Hydrograph Data

Unit time period	Time % of lag	Distribution	Unit Hydrograph
(hrs)		Graph %	(CFS)
1	0.083	469.158	69.318
2	0.167	938.316	30.682
		Sum = 100.000	Sum= 19.955

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

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.013	(0.169)	0.002	0.010
2	0.17	0.07	0.013	(0.168)	0.002	0.010
3	0.25	0.07	0.013	(0.167)	0.002	0.010
4	0.33	0.10	0.019	(0.167)	0.003	0.016
5	0.42	0.10	0.019	(0.166)	0.003	0.016
6	0.50	0.10	0.019	(0.165)	0.003	0.016
7	0.58	0.10	0.019	(0.165)	0.003	0.016
8	0.67	0.10	0.019	(0.164)	0.003	0.016
9	0.75	0.10	0.019	(0.163)	0.003	0.016
10	0.83	0.13	0.026	(0.163)	0.005	0.021
11	0.92	0.13	0.026	(0.162)	0.005	0.021
12	1.00	0.13	0.026	(0.162)	0.005	0.021
13	1.08	0.10	0.019	(0.161)	0.003	0.016
14	1.17	0.10	0.019	(0.160)	0.003	0.016
15	1.25	0.10	0.019	(0.160)	0.003	0.016
16	1.33	0.10	0.019	(0.159)	0.003	0.016
17	1.42	0.10	0.019	(0.158)	0.003	0.016
18	1.50	0.10	0.019	(0.158)	0.003	0.016
19	1.58	0.10	0.019	(0.157)	0.003	0.016
20	1.67	0.10	0.019	(0.156)	0.003	0.016
21	1.75	0.10	0.019	(0.156)	0.003	0.016
22	1.83	0.13	0.026	(0.155)	0.005	0.021
23	1.92	0.13	0.026	(0.155)	0.005	0.021
24	2.00	0.13	0.026	(0.154)	0.005	0.021
25	2.08	0.13	0.026	(0.153)	0.005	0.021
26	2.17	0.13	0.026	(0.153)	0.005	0.021
27	2.25	0.13	0.026	(0.152)	0.005	0.021
28	2.33	0.13	0.026	(0.151)	0.005	0.021
29	2.42	0.13	0.026	(0.151)	0.005	0.021
30	2.50	0.13	0.026	(0.150)	0.005	0.021
31	2.58	0.17	0.032	(0.150)	0.006	0.026
32	2.67	0.17	0.032	(0.149)	0.006	0.026
33	2.75	0.17	0.032	(0.148)	0.006	0.026
34	2.83	0.17	0.032	(0.148)	0.006	0.026
35	2.92	0.17	0.032	(0.147)	0.006	0.026
36	3.00	0.17	0.032	(0.147)	0.006	0.026
37	3.08	0.17	0.032	(0.146)	0.006	0.026
38	3.17	0.17	0.032	(0.145)	0.006	0.026
39	3.25	0.17	0.032	(0.145)	0.006	0.026
40	3.33	0.17	0.032	(0.144)	0.006	0.026
41	3.42	0.17	0.032	(0.144)	0.006	0.026
42	3.50	0.17	0.032	(0.143)	0.006	0.026
43	3.58	0.17	0.032	(0.142)	0.006	0.026
44	3.67	0.17	0.032	(0.142)	0.006	0.026
45	3.75	0.17	0.032	(0.141)	0.006	0.026
46	3.83	0.20	0.038	(0.141)	0.007	0.031
47	3.92	0.20	0.038	(0.140)	0.007	0.031

48	4.00	0.20	0.038	(0.139)	0.007	0.031
49	4.08	0.20	0.038	(0.139)	0.007	0.031
50	4.17	0.20	0.038	(0.138)	0.007	0.031
51	4.25	0.20	0.038	(0.138)	0.007	0.031
52	4.33	0.23	0.045	(0.137)	0.008	0.037
53	4.42	0.23	0.045	(0.136)	0.008	0.037
54	4.50	0.23	0.045	(0.136)	0.008	0.037
55	4.58	0.23	0.045	(0.135)	0.008	0.037
56	4.67	0.23	0.045	(0.135)	0.008	0.037
57	4.75	0.23	0.045	(0.134)	0.008	0.037
58	4.83	0.27	0.051	(0.134)	0.009	0.042
59	4.92	0.27	0.051	(0.133)	0.009	0.042
60	5.00	0.27	0.051	(0.132)	0.009	0.042
61	5.08	0.20	0.038	(0.132)	0.007	0.031
62	5.17	0.20	0.038	(0.131)	0.007	0.031
63	5.25	0.20	0.038	(0.131)	0.007	0.031
64	5.33	0.23	0.045	(0.130)	0.008	0.037
65	5.42	0.23	0.045	(0.129)	0.008	0.037
66	5.50	0.23	0.045	(0.129)	0.008	0.037
67	5.58	0.27	0.051	(0.128)	0.009	0.042
68	5.67	0.27	0.051	(0.128)	0.009	0.042
69	5.75	0.27	0.051	(0.127)	0.009	0.042
70	5.83	0.27	0.051	(0.127)	0.009	0.042
71	5.92	0.27	0.051	(0.126)	0.009	0.042
72	6.00	0.27	0.051	(0.126)	0.009	0.042
73	6.08	0.30	0.058	(0.125)	0.010	0.047
74	6.17	0.30	0.058	(0.124)	0.010	0.047
75	6.25	0.30	0.058	(0.124)	0.010	0.047
76	6.33	0.30	0.058	(0.123)	0.010	0.047
77	6.42	0.30	0.058	(0.123)	0.010	0.047
78	6.50	0.30	0.058	(0.122)	0.010	0.047
79	6.58	0.33	0.064	(0.122)	0.012	0.052
80	6.67	0.33	0.064	(0.121)	0.012	0.052
81	6.75	0.33	0.064	(0.121)	0.012	0.052
82	6.83	0.33	0.064	(0.120)	0.012	0.052
83	6.92	0.33	0.064	(0.119)	0.012	0.052
84	7.00	0.33	0.064	(0.119)	0.012	0.052
85	7.08	0.33	0.064	(0.118)	0.012	0.052
86	7.17	0.33	0.064	(0.118)	0.012	0.052
87	7.25	0.33	0.064	(0.117)	0.012	0.052
88	7.33	0.37	0.070	(0.117)	0.013	0.058
89	7.42	0.37	0.070	(0.116)	0.013	0.058
90	7.50	0.37	0.070	(0.116)	0.013	0.058
91	7.58	0.40	0.077	(0.115)	0.014	0.063
92	7.67	0.40	0.077	(0.115)	0.014	0.063
93	7.75	0.40	0.077	(0.114)	0.014	0.063
94	7.83	0.43	0.083	(0.114)	0.015	0.068
95	7.92	0.43	0.083	(0.113)	0.015	0.068
96	8.00	0.43	0.083	(0.113)	0.015	0.068
97	8.08	0.50	0.096	(0.112)	0.017	0.079

98	8.17	0.50	0.096	(0.112)	0.017	0.079
99	8.25	0.50	0.096	(0.111)	0.017	0.079
100	8.33	0.50	0.096	(0.110)	0.017	0.079
101	8.42	0.50	0.096	(0.110)	0.017	0.079
102	8.50	0.50	0.096	(0.109)	0.017	0.079
103	8.58	0.53	0.102	(0.109)	0.018	0.084
104	8.67	0.53	0.102	(0.108)	0.018	0.084
105	8.75	0.53	0.102	(0.108)	0.018	0.084
106	8.83	0.57	0.109	(0.107)	0.020	0.089
107	8.92	0.57	0.109	(0.107)	0.020	0.089
108	9.00	0.57	0.109	(0.106)	0.020	0.089
109	9.08	0.63	0.122	(0.106)	0.022	0.100
110	9.17	0.63	0.122	(0.105)	0.022	0.100
111	9.25	0.63	0.122	(0.105)	0.022	0.100
112	9.33	0.67	0.128	(0.104)	0.023	0.105
113	9.42	0.67	0.128	(0.104)	0.023	0.105
114	9.50	0.67	0.128	(0.103)	0.023	0.105
115	9.58	0.70	0.134	(0.103)	0.024	0.110
116	9.67	0.70	0.134	(0.102)	0.024	0.110
117	9.75	0.70	0.134	(0.102)	0.024	0.110
118	9.83	0.73	0.141	(0.101)	0.025	0.115
119	9.92	0.73	0.141	(0.101)	0.025	0.115
120	10.00	0.73	0.141	(0.100)	0.025	0.115
121	10.08	0.50	0.096	(0.100)	0.017	0.079
122	10.17	0.50	0.096	(0.099)	0.017	0.079
123	10.25	0.50	0.096	(0.099)	0.017	0.079
124	10.33	0.50	0.096	(0.099)	0.017	0.079
125	10.42	0.50	0.096	(0.098)	0.017	0.079
126	10.50	0.50	0.096	(0.098)	0.017	0.079
127	10.58	0.67	0.128	(0.097)	0.023	0.105
128	10.67	0.67	0.128	(0.097)	0.023	0.105
129	10.75	0.67	0.128	(0.096)	0.023	0.105
130	10.83	0.67	0.128	(0.096)	0.023	0.105
131	10.92	0.67	0.128	(0.095)	0.023	0.105
132	11.00	0.67	0.128	(0.095)	0.023	0.105
133	11.08	0.63	0.122	(0.094)	0.022	0.100
134	11.17	0.63	0.122	(0.094)	0.022	0.100
135	11.25	0.63	0.122	(0.093)	0.022	0.100
136	11.33	0.63	0.122	(0.093)	0.022	0.100
137	11.42	0.63	0.122	(0.092)	0.022	0.100
138	11.50	0.63	0.122	(0.092)	0.022	0.100
139	11.58	0.57	0.109	(0.091)	0.020	0.089
140	11.67	0.57	0.109	(0.091)	0.020	0.089
141	11.75	0.57	0.109	(0.091)	0.020	0.089
142	11.83	0.60	0.115	(0.090)	0.021	0.094
143	11.92	0.60	0.115	(0.090)	0.021	0.094
144	12.00	0.60	0.115	(0.089)	0.021	0.094
145	12.08	0.83	0.160	(0.089)	0.029	0.131
146	12.17	0.83	0.160	(0.088)	0.029	0.131
147	12.25	0.83	0.160	(0.088)	0.029	0.131

148	12.33	0.87	0.166	(0.087)	0.030	0.136
149	12.42	0.87	0.166	(0.087)	0.030	0.136
150	12.50	0.87	0.166	(0.087)	0.030	0.136
151	12.58	0.93	0.179	(0.086)	0.032	0.147
152	12.67	0.93	0.179	(0.086)	0.032	0.147
153	12.75	0.93	0.179	(0.085)	0.032	0.147
154	12.83	0.97	0.186	(0.085)	0.033	0.152
155	12.92	0.97	0.186	(0.084)	0.033	0.152
156	13.00	0.97	0.186	(0.084)	0.033	0.152
157	13.08	1.13	0.218	(0.084)	0.039	0.178
158	13.17	1.13	0.218	(0.083)	0.039	0.178
159	13.25	1.13	0.218	(0.083)	0.039	0.178
160	13.33	1.13	0.218	(0.082)	0.039	0.178
161	13.42	1.13	0.218	(0.082)	0.039	0.178
162	13.50	1.13	0.218	(0.081)	0.039	0.178
163	13.58	0.77	0.147	(0.081)	0.026	0.121
164	13.67	0.77	0.147	(0.081)	0.026	0.121
165	13.75	0.77	0.147	(0.080)	0.026	0.121
166	13.83	0.77	0.147	(0.080)	0.026	0.121
167	13.92	0.77	0.147	(0.079)	0.026	0.121
168	14.00	0.77	0.147	(0.079)	0.026	0.121
169	14.08	0.90	0.173	(0.079)	0.031	0.142
170	14.17	0.90	0.173	(0.078)	0.031	0.142
171	14.25	0.90	0.173	(0.078)	0.031	0.142
172	14.33	0.87	0.166	(0.077)	0.030	0.136
173	14.42	0.87	0.166	(0.077)	0.030	0.136
174	14.50	0.87	0.166	(0.077)	0.030	0.136
175	14.58	0.87	0.166	(0.076)	0.030	0.136
176	14.67	0.87	0.166	(0.076)	0.030	0.136
177	14.75	0.87	0.166	(0.075)	0.030	0.136
178	14.83	0.83	0.160	(0.075)	0.029	0.131
179	14.92	0.83	0.160	(0.075)	0.029	0.131
180	15.00	0.83	0.160	(0.074)	0.029	0.131
181	15.08	0.80	0.154	(0.074)	0.028	0.126
182	15.17	0.80	0.154	(0.074)	0.028	0.126
183	15.25	0.80	0.154	(0.073)	0.028	0.126
184	15.33	0.77	0.147	(0.073)	0.026	0.121
185	15.42	0.77	0.147	(0.072)	0.026	0.121
186	15.50	0.77	0.147	(0.072)	0.026	0.121
187	15.58	0.63	0.122	(0.072)	0.022	0.100
188	15.67	0.63	0.122	(0.071)	0.022	0.100
189	15.75	0.63	0.122	(0.071)	0.022	0.100
190	15.83	0.63	0.122	(0.071)	0.022	0.100
191	15.92	0.63	0.122	(0.070)	0.022	0.100
192	16.00	0.63	0.122	(0.070)	0.022	0.100
193	16.08	0.13	0.026	(0.069)	0.005	0.021
194	16.17	0.13	0.026	(0.069)	0.005	0.021
195	16.25	0.13	0.026	(0.069)	0.005	0.021
196	16.33	0.13	0.026	(0.068)	0.005	0.021
197	16.42	0.13	0.026	(0.068)	0.005	0.021

198	16.50	0.13	0.026	(0.068)	0.005	0.021
199	16.58	0.10	0.019	(0.067)	0.003	0.016
200	16.67	0.10	0.019	(0.067)	0.003	0.016
201	16.75	0.10	0.019	(0.067)	0.003	0.016
202	16.83	0.10	0.019	(0.066)	0.003	0.016
203	16.92	0.10	0.019	(0.066)	0.003	0.016
204	17.00	0.10	0.019	(0.066)	0.003	0.016
205	17.08	0.17	0.032	(0.065)	0.006	0.026
206	17.17	0.17	0.032	(0.065)	0.006	0.026
207	17.25	0.17	0.032	(0.065)	0.006	0.026
208	17.33	0.17	0.032	(0.064)	0.006	0.026
209	17.42	0.17	0.032	(0.064)	0.006	0.026
210	17.50	0.17	0.032	(0.064)	0.006	0.026
211	17.58	0.17	0.032	(0.063)	0.006	0.026
212	17.67	0.17	0.032	(0.063)	0.006	0.026
213	17.75	0.17	0.032	(0.063)	0.006	0.026
214	17.83	0.13	0.026	(0.062)	0.005	0.021
215	17.92	0.13	0.026	(0.062)	0.005	0.021
216	18.00	0.13	0.026	(0.062)	0.005	0.021
217	18.08	0.13	0.026	(0.062)	0.005	0.021
218	18.17	0.13	0.026	(0.061)	0.005	0.021
219	18.25	0.13	0.026	(0.061)	0.005	0.021
220	18.33	0.13	0.026	(0.061)	0.005	0.021
221	18.42	0.13	0.026	(0.060)	0.005	0.021
222	18.50	0.13	0.026	(0.060)	0.005	0.021
223	18.58	0.10	0.019	(0.060)	0.003	0.016
224	18.67	0.10	0.019	(0.059)	0.003	0.016
225	18.75	0.10	0.019	(0.059)	0.003	0.016
226	18.83	0.07	0.013	(0.059)	0.002	0.010
227	18.92	0.07	0.013	(0.059)	0.002	0.010
228	19.00	0.07	0.013	(0.058)	0.002	0.010
229	19.08	0.10	0.019	(0.058)	0.003	0.016
230	19.17	0.10	0.019	(0.058)	0.003	0.016
231	19.25	0.10	0.019	(0.058)	0.003	0.016
232	19.33	0.13	0.026	(0.057)	0.005	0.021
233	19.42	0.13	0.026	(0.057)	0.005	0.021
234	19.50	0.13	0.026	(0.057)	0.005	0.021
235	19.58	0.10	0.019	(0.056)	0.003	0.016
236	19.67	0.10	0.019	(0.056)	0.003	0.016
237	19.75	0.10	0.019	(0.056)	0.003	0.016
238	19.83	0.07	0.013	(0.056)	0.002	0.010
239	19.92	0.07	0.013	(0.055)	0.002	0.010
240	20.00	0.07	0.013	(0.055)	0.002	0.010
241	20.08	0.10	0.019	(0.055)	0.003	0.016
242	20.17	0.10	0.019	(0.055)	0.003	0.016
243	20.25	0.10	0.019	(0.055)	0.003	0.016
244	20.33	0.10	0.019	(0.054)	0.003	0.016
245	20.42	0.10	0.019	(0.054)	0.003	0.016
246	20.50	0.10	0.019	(0.054)	0.003	0.016
247	20.58	0.10	0.019	(0.054)	0.003	0.016

248	20.67	0.10	0.019	(0.053)	0.003	0.016
249	20.75	0.10	0.019	(0.053)	0.003	0.016
250	20.83	0.07	0.013	(0.053)	0.002	0.010
251	20.92	0.07	0.013	(0.053)	0.002	0.010
252	21.00	0.07	0.013	(0.052)	0.002	0.010
253	21.08	0.10	0.019	(0.052)	0.003	0.016
254	21.17	0.10	0.019	(0.052)	0.003	0.016
255	21.25	0.10	0.019	(0.052)	0.003	0.016
256	21.33	0.07	0.013	(0.052)	0.002	0.010
257	21.42	0.07	0.013	(0.051)	0.002	0.010
258	21.50	0.07	0.013	(0.051)	0.002	0.010
259	21.58	0.10	0.019	(0.051)	0.003	0.016
260	21.67	0.10	0.019	(0.051)	0.003	0.016
261	21.75	0.10	0.019	(0.051)	0.003	0.016
262	21.83	0.07	0.013	(0.051)	0.002	0.010
263	21.92	0.07	0.013	(0.050)	0.002	0.010
264	22.00	0.07	0.013	(0.050)	0.002	0.010
265	22.08	0.10	0.019	(0.050)	0.003	0.016
266	22.17	0.10	0.019	(0.050)	0.003	0.016
267	22.25	0.10	0.019	(0.050)	0.003	0.016
268	22.33	0.07	0.013	(0.050)	0.002	0.010
269	22.42	0.07	0.013	(0.049)	0.002	0.010
270	22.50	0.07	0.013	(0.049)	0.002	0.010
271	22.58	0.07	0.013	(0.049)	0.002	0.010
272	22.67	0.07	0.013	(0.049)	0.002	0.010
273	22.75	0.07	0.013	(0.049)	0.002	0.010
274	22.83	0.07	0.013	(0.049)	0.002	0.010
275	22.92	0.07	0.013	(0.049)	0.002	0.010
276	23.00	0.07	0.013	(0.048)	0.002	0.010
277	23.08	0.07	0.013	(0.048)	0.002	0.010
278	23.17	0.07	0.013	(0.048)	0.002	0.010
279	23.25	0.07	0.013	(0.048)	0.002	0.010
280	23.33	0.07	0.013	(0.048)	0.002	0.010
281	23.42	0.07	0.013	(0.048)	0.002	0.010
282	23.50	0.07	0.013	(0.048)	0.002	0.010
283	23.58	0.07	0.013	(0.048)	0.002	0.010
284	23.67	0.07	0.013	(0.048)	0.002	0.010
285	23.75	0.07	0.013	(0.048)	0.002	0.010
286	23.83	0.07	0.013	(0.048)	0.002	0.010
287	23.92	0.07	0.013	(0.048)	0.002	0.010
288	24.00	0.07	0.013	(0.048)	0.002	0.010

(Loss Rate Not Used)

Sum = 100.0

Sum = 15.7

Flood volume = Effective rainfall 1.31(In)

times area 19.8(Ac.)/[((In)/(Ft.))] = 2.2(Ac.Ft)

Total soil loss = 0.29(In)

Total soil loss = 0.475(Ac.Ft)

Total rainfall = 1.60(In)

Flood volume = 94295.0 Cubic Feet

Total soil loss = 20698.9 Cubic Feet

 Peak flow rate of this hydrograph = 3.562(CFS)

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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0010	0.15	Q				
0+10	0.0024	0.21	Q				
0+15	0.0039	0.21	Q				
0+20	0.0058	0.28	VQ				
0+25	0.0080	0.31	VQ				
0+30	0.0102	0.31	VQ				
0+35	0.0123	0.31	VQ				
0+40	0.0145	0.31	VQ				
0+45	0.0167	0.31	VQ				
0+50	0.0193	0.39	VQ				
0+55	0.0222	0.42	VQ				
1+ 0	0.0251	0.42	VQ				
1+ 5	0.0275	0.35	VQ				
1+10	0.0296	0.31	VQ				
1+15	0.0318	0.31	VQ				
1+20	0.0340	0.31	VQ				
1+25	0.0361	0.31	VQ				
1+30	0.0383	0.31	VQ				
1+35	0.0405	0.31	VQ				
1+40	0.0426	0.31	VQ				
1+45	0.0448	0.31	VQ				
1+50	0.0475	0.39	VQ				
1+55	0.0503	0.42	VQ				
2+ 0	0.0532	0.42	VQ				
2+ 5	0.0561	0.42	Q				
2+10	0.0590	0.42	Q				
2+15	0.0619	0.42	Q				
2+20	0.0648	0.42	Q				
2+25	0.0677	0.42	Q				
2+30	0.0706	0.42	Q				
2+35	0.0739	0.49	Q				
2+40	0.0775	0.52	VQ				
2+45	0.0812	0.52	VQ				
2+50	0.0848	0.52	VQ				
2+55	0.0884	0.52	VQ				
3+ 0	0.0920	0.52	VQ				
3+ 5	0.0956	0.52	VQ				
3+10	0.0992	0.52	VQ				

3+15	0.1028	0.52	VQ				
3+20	0.1064	0.52	VQ				
3+25	0.1100	0.52	Q				
3+30	0.1136	0.52	Q				
3+35	0.1172	0.52	Q				
3+40	0.1208	0.52	Q				
3+45	0.1244	0.52	Q				
3+50	0.1286	0.60	Q				
3+55	0.1329	0.63	Q				
4+ 0	0.1372	0.63	Q				
4+ 5	0.1415	0.63	Q				
4+10	0.1459	0.63	Q				
4+15	0.1502	0.63	Q				
4+20	0.1550	0.70	Q				
4+25	0.1601	0.73	Q				
4+30	0.1651	0.73	QV				
4+35	0.1702	0.73	QV				
4+40	0.1752	0.73	QV				
4+45	0.1803	0.73	QV				
4+50	0.1858	0.81	Q				
4+55	0.1916	0.84	Q				
5+ 0	0.1974	0.84	Q				
5+ 5	0.2022	0.69	QV				
5+10	0.2065	0.63	QV				
5+15	0.2108	0.63	QV				
5+20	0.2156	0.70	QV				
5+25	0.2207	0.73	Q V				
5+30	0.2257	0.73	Q V				
5+35	0.2313	0.81	QV				
5+40	0.2371	0.84	QV				
5+45	0.2428	0.84	QV				
5+50	0.2486	0.84	QV				
5+55	0.2544	0.84	QV				
6+ 0	0.2602	0.84	QV				
6+ 5	0.2664	0.91	QV				
6+10	0.2729	0.94	Q V				
6+15	0.2794	0.94	Q V				
6+20	0.2859	0.94	Q V				
6+25	0.2924	0.94	Q V				
6+30	0.2989	0.94	Q V				
6+35	0.3059	1.02	QV				
6+40	0.3131	1.05	QV				
6+45	0.3203	1.05	QV				
6+50	0.3275	1.05	Q V				
6+55	0.3348	1.05	Q V				
7+ 0	0.3420	1.05	Q V				
7+ 5	0.3492	1.05	Q V				
7+10	0.3564	1.05	Q V				
7+15	0.3636	1.05	Q V				
7+20	0.3713	1.12	Q V				

7+25	0.3793	1.15	Q	V				
7+30	0.3872	1.15	Q	V				
7+35	0.3957	1.23	Q	V				
7+40	0.4043	1.26	Q	V				
7+45	0.4130	1.26	Q	V				
7+50	0.4221	1.33	Q	V				
7+55	0.4315	1.36	Q	V				
8+ 0	0.4409	1.36	Q	V				
8+ 5	0.4513	1.51	Q	V				
8+10	0.4621	1.57	Q	V				
8+15	0.4729	1.57	Q	V				
8+20	0.4837	1.57	Q	V				
8+25	0.4946	1.57	Q	V				
8+30	0.5054	1.57	Q	V				
8+35	0.5167	1.64	Q	V				
8+40	0.5283	1.68	Q	V				
8+45	0.5398	1.68	Q	V				
8+50	0.5518	1.75	Q	V				
8+55	0.5641	1.78	Q	V				
9+ 0	0.5764	1.78	Q	V				
9+ 5	0.5896	1.93	Q	V				
9+10	0.6034	1.99	Q	V				
9+15	0.6171	1.99	Q	V				
9+20	0.6313	2.06	Q	V				
9+25	0.6457	2.10	Q	V				
9+30	0.6601	2.10	Q	V				
9+35	0.6751	2.17	Q	V				
9+40	0.6902	2.20	Q	V				
9+45	0.7054	2.20	Q	V				
9+50	0.7210	2.27	Q	V				
9+55	0.7369	2.30	Q	V				
10+ 0	0.7528	2.30	Q	V				
10+ 5	0.7652	1.80	Q	V				
10+10	0.7760	1.57	Q	V				
10+15	0.7868	1.57	Q	V				
10+20	0.7976	1.57	Q	V				
10+25	0.8084	1.57	Q	V				
10+30	0.8193	1.57	Q	V				
10+35	0.8326	1.93	Q	V				
10+40	0.8470	2.10	Q	V				
10+45	0.8615	2.10	Q	V				
10+50	0.8759	2.10	Q	V				
10+55	0.8903	2.10	Q	V				
11+ 0	0.9048	2.10	Q	V				
11+ 5	0.9187	2.02	Q	V				
11+10	0.9324	1.99	Q	V				
11+15	0.9461	1.99	Q	V				
11+20	0.9598	1.99	Q	V				
11+25	0.9735	1.99	Q	V				
11+30	0.9872	1.99	Q	V				

11+35	0.9999	1.85	Q	V
11+40	1.0122	1.78	Q	V
11+45	1.0245	1.78	Q	V
11+50	1.0372	1.85	Q	V
11+55	1.0502	1.89	Q	V
12+ 0	1.0632	1.89	Q	V
12+ 5	1.0797	2.39	Q	V
12+10	1.0977	2.62	Q	V
12+15	1.1158	2.62	Q	V
12+20	1.1343	2.69	Q	V
12+25	1.1531	2.72	Q	V
12+30	1.1718	2.72	Q	V
12+35	1.1916	2.87	Q	V
12+40	1.2118	2.93	Q	V
12+45	1.2320	2.93	Q	V
12+50	1.2527	3.01	Q	V
12+55	1.2736	3.04	Q	V
13+ 0	1.2946	3.04	Q	V
13+ 5	1.3180	3.40	Q	V
13+10	1.3425	3.56	Q	V
13+15	1.3671	3.56	Q	V
13+20	1.3916	3.56	Q	V
13+25	1.4161	3.56	Q	V
13+30	1.4407	3.56	Q	V
13+35	1.4597	2.76	Q	V
13+40	1.4763	2.41	Q	V
13+45	1.4929	2.41	Q	V
13+50	1.5095	2.41	Q	V
13+55	1.5261	2.41	Q	V
14+ 0	1.5427	2.41	Q	V
14+ 5	1.5613	2.70	Q	V
14+10	1.5808	2.83	Q	V
14+15	1.6002	2.83	Q	V
14+20	1.6192	2.76	Q	V
14+25	1.6380	2.72	Q	V
14+30	1.6567	2.72	Q	V
14+35	1.6755	2.72	Q	V
14+40	1.6943	2.72	Q	V
14+45	1.7130	2.72	Q	V
14+50	1.7313	2.65	Q	V
14+55	1.7493	2.62	Q	V
15+ 0	1.7674	2.62	Q	V
15+ 5	1.7849	2.55	Q	V
15+10	1.8022	2.51	Q	V
15+15	1.8195	2.51	Q	V
15+20	1.8364	2.44	Q	V
15+25	1.8530	2.41	Q	V
15+30	1.8696	2.41	Q	V
15+35	1.8841	2.12	Q	V
15+40	1.8979	1.99	Q	V

15+45	1.9116	1.99		Q			V
15+50	1.9253	1.99		Q			V
15+55	1.9390	1.99		Q			V
16+ 0	1.9527	1.99		Q			V
16+ 5	1.9589	0.90	Q				V
16+10	1.9618	0.42	Q				V
16+15	1.9647	0.42	Q				V
16+20	1.9676	0.42	Q				V
16+25	1.9704	0.42	Q				V
16+30	1.9733	0.42	Q				V
16+35	1.9757	0.35	Q				V
16+40	1.9779	0.31	Q				V
16+45	1.9801	0.31	Q				V
16+50	1.9822	0.31	Q				V
16+55	1.9844	0.31	Q				V
17+ 0	1.9865	0.31	Q				V
17+ 5	1.9897	0.46	Q				V
17+10	1.9933	0.52	Q				V
17+15	1.9969	0.52	Q				V
17+20	2.0005	0.52	Q				V
17+25	2.0041	0.52	Q				V
17+30	2.0077	0.52	Q				V
17+35	2.0114	0.52	Q				V
17+40	2.0150	0.52	Q				V
17+45	2.0186	0.52	Q				V
17+50	2.0217	0.45	Q				V
17+55	2.0246	0.42	Q				V
18+ 0	2.0275	0.42	Q				V
18+ 5	2.0303	0.42	Q				V
18+10	2.0332	0.42	Q				V
18+15	2.0361	0.42	Q				V
18+20	2.0390	0.42	Q				V
18+25	2.0419	0.42	Q				V
18+30	2.0448	0.42	Q				V
18+35	2.0472	0.35	Q				V
18+40	2.0493	0.31	Q				V
18+45	2.0515	0.31	Q				V
18+50	2.0532	0.24	Q				V
18+55	2.0546	0.21	Q				V
19+ 0	2.0560	0.21	Q				V
19+ 5	2.0580	0.28	Q				V
19+10	2.0601	0.31	Q				V
19+15	2.0623	0.31	Q				V
19+20	2.0650	0.39	Q				V
19+25	2.0679	0.42	Q				V
19+30	2.0707	0.42	Q				V
19+35	2.0731	0.35	Q				V
19+40	2.0753	0.31	Q				V
19+45	2.0775	0.31	Q				V
19+50	2.0791	0.24	Q				V

$Q_{\text{peak,pre}} = 0.43 \text{ cfs}$
 $2.0246 - 0.0706 = 1.954 \text{ ac-ft}$
 85,116 cf
 110% preliminary
 93,628 cf

19+55	2.0806	0.21	Q				V
20+ 0	2.0820	0.21	Q				V
20+ 5	2.0840	0.28	Q				V
20+10	2.0861	0.31	Q				V
20+15	2.0883	0.31	Q				V
20+20	2.0905	0.31	Q				V
20+25	2.0926	0.31	Q				V
20+30	2.0948	0.31	Q				V
20+35	2.0969	0.31	Q				V
20+40	2.0991	0.31	Q				V
20+45	2.1013	0.31	Q				V
20+50	2.1029	0.24	Q				V
20+55	2.1044	0.21	Q				V
21+ 0	2.1058	0.21	Q				V
21+ 5	2.1078	0.28	Q				V
21+10	2.1099	0.31	Q				V
21+15	2.1121	0.31	Q				V
21+20	2.1138	0.24	Q				V
21+25	2.1152	0.21	Q				V
21+30	2.1166	0.21	Q				V
21+35	2.1186	0.28	Q				V
21+40	2.1208	0.31	Q				V
21+45	2.1229	0.31	Q				V
21+50	2.1246	0.24	Q				V
21+55	2.1260	0.21	Q				V
22+ 0	2.1275	0.21	Q				V
22+ 5	2.1294	0.28	Q				V
22+10	2.1316	0.31	Q				V
22+15	2.1337	0.31	Q				V
22+20	2.1354	0.24	Q				V
22+25	2.1369	0.21	Q				V
22+30	2.1383	0.21	Q				V
22+35	2.1397	0.21	Q				V
22+40	2.1412	0.21	Q				V
22+45	2.1426	0.21	Q				V
22+50	2.1441	0.21	Q				V
22+55	2.1455	0.21	Q				V
23+ 0	2.1470	0.21	Q				V
23+ 5	2.1484	0.21	Q				V
23+10	2.1498	0.21	Q				V
23+15	2.1513	0.21	Q				V
23+20	2.1527	0.21	Q				V
23+25	2.1542	0.21	Q				V
23+30	2.1556	0.21	Q				V
23+35	2.1571	0.21	Q				V
23+40	2.1585	0.21	Q				V
23+45	2.1599	0.21	Q				V
23+50	2.1614	0.21	Q				V
23+55	2.1628	0.21	Q				V
24+ 0	2.1643	0.21	Q				V

24+ 5

2.1647

0.06 Q

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

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Study date 04/04/23 File: ONSITEPROP24100.out

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

Program License Serial Number 4010

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

English Units used in output format

22-0198 - ETHANAC COMMERCE CENTER
ONSITE UNIT HYDROGRAPH ANALYSIS
PROPOSED CONDITION, 100-YEAR 24-HOUR
FN: ONSITEPROP.OUT- RSB

Drainage Area = 19.80(Ac.) = 0.031 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 19.80(Ac.) =

0.031 Sq. Mi.

Length along longest watercourse = 553.00(Ft.)
Length along longest watercourse measured to centroid = 150.00(Ft.)
Length along longest watercourse = 0.105 Mi.
Length along longest watercourse measured to centroid = 0.028 Mi.
Difference in elevation = 7.00(Ft.)
Slope along watercourse = 66.8354 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.018 Hr.
Lag time = 1.07 Min.
25% of lag time = 0.27 Min.
40% of lag time = 0.43 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	1.60	31.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	4.00	79.20

STORM EVENT (YEAR) = 100.00
 Area Averaged 2-Year Rainfall = 1.600(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 4.000(In)
 Areal adjustment factor = 100.00 %
 Adjusted average point rain = 4.000(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.800	75.00	0.900
Total Area Entered = 19.80(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-2	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
75.0	75.0	0.303	0.900	0.058	1.000	0.058
Sum (F) =						0.058

Area averaged mean soil loss (F) (In/Hr) = 0.058
 Minimum soil loss rate ((In/Hr)) = 0.029
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.180

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

Unit Hydrograph Data

Unit time period	Time % of lag	Distribution	Unit Hydrograph
(hrs)		Graph %	(CFS)
1	0.083	469.158	69.318
2	0.167	938.316	30.682
		Sum = 100.000	Sum= 19.955

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

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.032	(0.102)	0.006	0.026
2	0.17	0.07	0.032	(0.102)	0.006	0.026
3	0.25	0.07	0.032	(0.101)	0.006	0.026
4	0.33	0.10	0.048	(0.101)	0.009	0.039
5	0.42	0.10	0.048	(0.100)	0.009	0.039
6	0.50	0.10	0.048	(0.100)	0.009	0.039
7	0.58	0.10	0.048	(0.100)	0.009	0.039
8	0.67	0.10	0.048	(0.099)	0.009	0.039
9	0.75	0.10	0.048	(0.099)	0.009	0.039
10	0.83	0.13	0.064	(0.099)	0.012	0.052
11	0.92	0.13	0.064	(0.098)	0.012	0.052
12	1.00	0.13	0.064	(0.098)	0.012	0.052
13	1.08	0.10	0.048	(0.097)	0.009	0.039
14	1.17	0.10	0.048	(0.097)	0.009	0.039
15	1.25	0.10	0.048	(0.097)	0.009	0.039
16	1.33	0.10	0.048	(0.096)	0.009	0.039
17	1.42	0.10	0.048	(0.096)	0.009	0.039
18	1.50	0.10	0.048	(0.095)	0.009	0.039
19	1.58	0.10	0.048	(0.095)	0.009	0.039
20	1.67	0.10	0.048	(0.095)	0.009	0.039
21	1.75	0.10	0.048	(0.094)	0.009	0.039
22	1.83	0.13	0.064	(0.094)	0.012	0.052
23	1.92	0.13	0.064	(0.094)	0.012	0.052
24	2.00	0.13	0.064	(0.093)	0.012	0.052
25	2.08	0.13	0.064	(0.093)	0.012	0.052
26	2.17	0.13	0.064	(0.092)	0.012	0.052
27	2.25	0.13	0.064	(0.092)	0.012	0.052
28	2.33	0.13	0.064	(0.092)	0.012	0.052
29	2.42	0.13	0.064	(0.091)	0.012	0.052
30	2.50	0.13	0.064	(0.091)	0.012	0.052
31	2.58	0.17	0.080	(0.091)	0.014	0.066
32	2.67	0.17	0.080	(0.090)	0.014	0.066
33	2.75	0.17	0.080	(0.090)	0.014	0.066
34	2.83	0.17	0.080	(0.089)	0.014	0.066
35	2.92	0.17	0.080	(0.089)	0.014	0.066
36	3.00	0.17	0.080	(0.089)	0.014	0.066
37	3.08	0.17	0.080	(0.088)	0.014	0.066
38	3.17	0.17	0.080	(0.088)	0.014	0.066
39	3.25	0.17	0.080	(0.088)	0.014	0.066
40	3.33	0.17	0.080	(0.087)	0.014	0.066
41	3.42	0.17	0.080	(0.087)	0.014	0.066
42	3.50	0.17	0.080	(0.087)	0.014	0.066
43	3.58	0.17	0.080	(0.086)	0.014	0.066
44	3.67	0.17	0.080	(0.086)	0.014	0.066
45	3.75	0.17	0.080	(0.085)	0.014	0.066
46	3.83	0.20	0.096	(0.085)	0.017	0.079
47	3.92	0.20	0.096	(0.085)	0.017	0.079

48	4.00	0.20	0.096	(0.084)	0.017	0.079
49	4.08	0.20	0.096	(0.084)	0.017	0.079
50	4.17	0.20	0.096	(0.084)	0.017	0.079
51	4.25	0.20	0.096	(0.083)	0.017	0.079
52	4.33	0.23	0.112	(0.083)	0.020	0.092
53	4.42	0.23	0.112	(0.083)	0.020	0.092
54	4.50	0.23	0.112	(0.082)	0.020	0.092
55	4.58	0.23	0.112	(0.082)	0.020	0.092
56	4.67	0.23	0.112	(0.082)	0.020	0.092
57	4.75	0.23	0.112	(0.081)	0.020	0.092
58	4.83	0.27	0.128	(0.081)	0.023	0.105
59	4.92	0.27	0.128	(0.080)	0.023	0.105
60	5.00	0.27	0.128	(0.080)	0.023	0.105
61	5.08	0.20	0.096	(0.080)	0.017	0.079
62	5.17	0.20	0.096	(0.079)	0.017	0.079
63	5.25	0.20	0.096	(0.079)	0.017	0.079
64	5.33	0.23	0.112	(0.079)	0.020	0.092
65	5.42	0.23	0.112	(0.078)	0.020	0.092
66	5.50	0.23	0.112	(0.078)	0.020	0.092
67	5.58	0.27	0.128	(0.078)	0.023	0.105
68	5.67	0.27	0.128	(0.077)	0.023	0.105
69	5.75	0.27	0.128	(0.077)	0.023	0.105
70	5.83	0.27	0.128	(0.077)	0.023	0.105
71	5.92	0.27	0.128	(0.076)	0.023	0.105
72	6.00	0.27	0.128	(0.076)	0.023	0.105
73	6.08	0.30	0.144	(0.076)	0.026	0.118
74	6.17	0.30	0.144	(0.075)	0.026	0.118
75	6.25	0.30	0.144	(0.075)	0.026	0.118
76	6.33	0.30	0.144	(0.075)	0.026	0.118
77	6.42	0.30	0.144	(0.074)	0.026	0.118
78	6.50	0.30	0.144	(0.074)	0.026	0.118
79	6.58	0.33	0.160	(0.074)	0.029	0.131
80	6.67	0.33	0.160	(0.073)	0.029	0.131
81	6.75	0.33	0.160	(0.073)	0.029	0.131
82	6.83	0.33	0.160	(0.073)	0.029	0.131
83	6.92	0.33	0.160	(0.072)	0.029	0.131
84	7.00	0.33	0.160	(0.072)	0.029	0.131
85	7.08	0.33	0.160	(0.072)	0.029	0.131
86	7.17	0.33	0.160	(0.071)	0.029	0.131
87	7.25	0.33	0.160	(0.071)	0.029	0.131
88	7.33	0.37	0.176	(0.071)	0.032	0.144
89	7.42	0.37	0.176	(0.070)	0.032	0.144
90	7.50	0.37	0.176	(0.070)	0.032	0.144
91	7.58	0.40	0.192	(0.070)	0.035	0.157
92	7.67	0.40	0.192	(0.069)	0.035	0.157
93	7.75	0.40	0.192	(0.069)	0.035	0.157
94	7.83	0.43	0.208	(0.069)	0.037	0.171
95	7.92	0.43	0.208	(0.068)	0.037	0.171
96	8.00	0.43	0.208	(0.068)	0.037	0.171
97	8.08	0.50	0.240	(0.068)	0.043	0.197

98	8.17	0.50	0.240	(0.067)	0.043	0.197
99	8.25	0.50	0.240	(0.067)	0.043	0.197
100	8.33	0.50	0.240	(0.067)	0.043	0.197
101	8.42	0.50	0.240	(0.067)	0.043	0.197
102	8.50	0.50	0.240	(0.066)	0.043	0.197
103	8.58	0.53	0.256	(0.066)	0.046	0.210
104	8.67	0.53	0.256	(0.066)	0.046	0.210
105	8.75	0.53	0.256	(0.065)	0.046	0.210
106	8.83	0.57	0.272	(0.065)	0.049	0.223
107	8.92	0.57	0.272	(0.065)	0.049	0.223
108	9.00	0.57	0.272	(0.064)	0.049	0.223
109	9.08	0.63	0.304	(0.064)	0.055	0.249
110	9.17	0.63	0.304	(0.064)	0.055	0.249
111	9.25	0.63	0.304	(0.063)	0.055	0.249
112	9.33	0.67	0.320	(0.063)	0.058	0.262
113	9.42	0.67	0.320	(0.063)	0.058	0.262
114	9.50	0.67	0.320	(0.063)	0.058	0.262
115	9.58	0.70	0.336	(0.062)	0.060	0.276
116	9.67	0.70	0.336	(0.062)	0.060	0.276
117	9.75	0.70	0.336	(0.062)	0.060	0.276
118	9.83	0.73	0.352	0.061 (0.063)		0.291
119	9.92	0.73	0.352	0.061 (0.063)		0.291
120	10.00	0.73	0.352	0.061 (0.063)		0.291
121	10.08	0.50	0.240	(0.060)	0.043	0.197
122	10.17	0.50	0.240	(0.060)	0.043	0.197
123	10.25	0.50	0.240	(0.060)	0.043	0.197
124	10.33	0.50	0.240	(0.060)	0.043	0.197
125	10.42	0.50	0.240	(0.059)	0.043	0.197
126	10.50	0.50	0.240	(0.059)	0.043	0.197
127	10.58	0.67	0.320	(0.059)	0.058	0.262
128	10.67	0.67	0.320	(0.058)	0.058	0.262
129	10.75	0.67	0.320	(0.058)	0.058	0.262
130	10.83	0.67	0.320	(0.058)	0.058	0.262
131	10.92	0.67	0.320	(0.058)	0.058	0.262
132	11.00	0.67	0.320	0.057 (0.058)		0.263
133	11.08	0.63	0.304	(0.057)	0.055	0.249
134	11.17	0.63	0.304	(0.057)	0.055	0.249
135	11.25	0.63	0.304	(0.056)	0.055	0.249
136	11.33	0.63	0.304	(0.056)	0.055	0.249
137	11.42	0.63	0.304	(0.056)	0.055	0.249
138	11.50	0.63	0.304	(0.056)	0.055	0.249
139	11.58	0.57	0.272	(0.055)	0.049	0.223
140	11.67	0.57	0.272	(0.055)	0.049	0.223
141	11.75	0.57	0.272	(0.055)	0.049	0.223
142	11.83	0.60	0.288	(0.055)	0.052	0.236
143	11.92	0.60	0.288	(0.054)	0.052	0.236
144	12.00	0.60	0.288	(0.054)	0.052	0.236
145	12.08	0.83	0.400	0.054 (0.072)		0.346
146	12.17	0.83	0.400	0.053 (0.072)		0.347
147	12.25	0.83	0.400	0.053 (0.072)		0.347

148	12.33	0.87	0.416	0.053	(0.075)	0.363
149	12.42	0.87	0.416	0.053	(0.075)	0.363
150	12.50	0.87	0.416	0.052	(0.075)	0.364
151	12.58	0.93	0.448	0.052	(0.081)	0.396
152	12.67	0.93	0.448	0.052	(0.081)	0.396
153	12.75	0.93	0.448	0.052	(0.081)	0.396
154	12.83	0.97	0.464	0.051	(0.084)	0.413
155	12.92	0.97	0.464	0.051	(0.084)	0.413
156	13.00	0.97	0.464	0.051	(0.084)	0.413
157	13.08	1.13	0.544	0.051	(0.098)	0.493
158	13.17	1.13	0.544	0.050	(0.098)	0.494
159	13.25	1.13	0.544	0.050	(0.098)	0.494
160	13.33	1.13	0.544	0.050	(0.098)	0.494
161	13.42	1.13	0.544	0.050	(0.098)	0.494
162	13.50	1.13	0.544	0.049	(0.098)	0.495
163	13.58	0.77	0.368	0.049	(0.066)	0.319
164	13.67	0.77	0.368	0.049	(0.066)	0.319
165	13.75	0.77	0.368	0.049	(0.066)	0.319
166	13.83	0.77	0.368	0.048	(0.066)	0.320
167	13.92	0.77	0.368	0.048	(0.066)	0.320
168	14.00	0.77	0.368	0.048	(0.066)	0.320
169	14.08	0.90	0.432	0.048	(0.078)	0.384
170	14.17	0.90	0.432	0.047	(0.078)	0.385
171	14.25	0.90	0.432	0.047	(0.078)	0.385
172	14.33	0.87	0.416	0.047	(0.075)	0.369
173	14.42	0.87	0.416	0.047	(0.075)	0.369
174	14.50	0.87	0.416	0.046	(0.075)	0.370
175	14.58	0.87	0.416	0.046	(0.075)	0.370
176	14.67	0.87	0.416	0.046	(0.075)	0.370
177	14.75	0.87	0.416	0.046	(0.075)	0.370
178	14.83	0.83	0.400	0.045	(0.072)	0.355
179	14.92	0.83	0.400	0.045	(0.072)	0.355
180	15.00	0.83	0.400	0.045	(0.072)	0.355
181	15.08	0.80	0.384	0.045	(0.069)	0.339
182	15.17	0.80	0.384	0.045	(0.069)	0.339
183	15.25	0.80	0.384	0.044	(0.069)	0.340
184	15.33	0.77	0.368	0.044	(0.066)	0.324
185	15.42	0.77	0.368	0.044	(0.066)	0.324
186	15.50	0.77	0.368	0.044	(0.066)	0.324
187	15.58	0.63	0.304	0.043	(0.055)	0.261
188	15.67	0.63	0.304	0.043	(0.055)	0.261
189	15.75	0.63	0.304	0.043	(0.055)	0.261
190	15.83	0.63	0.304	0.043	(0.055)	0.261
191	15.92	0.63	0.304	0.042	(0.055)	0.261
192	16.00	0.63	0.304	0.042	(0.055)	0.262
193	16.08	0.13	0.064	(0.042)	0.012	0.052
194	16.17	0.13	0.064	(0.042)	0.012	0.052
195	16.25	0.13	0.064	(0.042)	0.012	0.052
196	16.33	0.13	0.064	(0.041)	0.012	0.052
197	16.42	0.13	0.064	(0.041)	0.012	0.052

198	16.50	0.13	0.064	(0.041)	0.012	0.052
199	16.58	0.10	0.048	(0.041)	0.009	0.039
200	16.67	0.10	0.048	(0.041)	0.009	0.039
201	16.75	0.10	0.048	(0.040)	0.009	0.039
202	16.83	0.10	0.048	(0.040)	0.009	0.039
203	16.92	0.10	0.048	(0.040)	0.009	0.039
204	17.00	0.10	0.048	(0.040)	0.009	0.039
205	17.08	0.17	0.080	(0.040)	0.014	0.066
206	17.17	0.17	0.080	(0.039)	0.014	0.066
207	17.25	0.17	0.080	(0.039)	0.014	0.066
208	17.33	0.17	0.080	(0.039)	0.014	0.066
209	17.42	0.17	0.080	(0.039)	0.014	0.066
210	17.50	0.17	0.080	(0.039)	0.014	0.066
211	17.58	0.17	0.080	(0.038)	0.014	0.066
212	17.67	0.17	0.080	(0.038)	0.014	0.066
213	17.75	0.17	0.080	(0.038)	0.014	0.066
214	17.83	0.13	0.064	(0.038)	0.012	0.052
215	17.92	0.13	0.064	(0.038)	0.012	0.052
216	18.00	0.13	0.064	(0.037)	0.012	0.052
217	18.08	0.13	0.064	(0.037)	0.012	0.052
218	18.17	0.13	0.064	(0.037)	0.012	0.052
219	18.25	0.13	0.064	(0.037)	0.012	0.052
220	18.33	0.13	0.064	(0.037)	0.012	0.052
221	18.42	0.13	0.064	(0.037)	0.012	0.052
222	18.50	0.13	0.064	(0.036)	0.012	0.052
223	18.58	0.10	0.048	(0.036)	0.009	0.039
224	18.67	0.10	0.048	(0.036)	0.009	0.039
225	18.75	0.10	0.048	(0.036)	0.009	0.039
226	18.83	0.07	0.032	(0.036)	0.006	0.026
227	18.92	0.07	0.032	(0.035)	0.006	0.026
228	19.00	0.07	0.032	(0.035)	0.006	0.026
229	19.08	0.10	0.048	(0.035)	0.009	0.039
230	19.17	0.10	0.048	(0.035)	0.009	0.039
231	19.25	0.10	0.048	(0.035)	0.009	0.039
232	19.33	0.13	0.064	(0.035)	0.012	0.052
233	19.42	0.13	0.064	(0.035)	0.012	0.052
234	19.50	0.13	0.064	(0.034)	0.012	0.052
235	19.58	0.10	0.048	(0.034)	0.009	0.039
236	19.67	0.10	0.048	(0.034)	0.009	0.039
237	19.75	0.10	0.048	(0.034)	0.009	0.039
238	19.83	0.07	0.032	(0.034)	0.006	0.026
239	19.92	0.07	0.032	(0.034)	0.006	0.026
240	20.00	0.07	0.032	(0.033)	0.006	0.026
241	20.08	0.10	0.048	(0.033)	0.009	0.039
242	20.17	0.10	0.048	(0.033)	0.009	0.039
243	20.25	0.10	0.048	(0.033)	0.009	0.039
244	20.33	0.10	0.048	(0.033)	0.009	0.039
245	20.42	0.10	0.048	(0.033)	0.009	0.039
246	20.50	0.10	0.048	(0.033)	0.009	0.039
247	20.58	0.10	0.048	(0.032)	0.009	0.039

248	20.67	0.10	0.048	(0.032)	0.009	0.039
249	20.75	0.10	0.048	(0.032)	0.009	0.039
250	20.83	0.07	0.032	(0.032)	0.006	0.026
251	20.92	0.07	0.032	(0.032)	0.006	0.026
252	21.00	0.07	0.032	(0.032)	0.006	0.026
253	21.08	0.10	0.048	(0.032)	0.009	0.039
254	21.17	0.10	0.048	(0.032)	0.009	0.039
255	21.25	0.10	0.048	(0.031)	0.009	0.039
256	21.33	0.07	0.032	(0.031)	0.006	0.026
257	21.42	0.07	0.032	(0.031)	0.006	0.026
258	21.50	0.07	0.032	(0.031)	0.006	0.026
259	21.58	0.10	0.048	(0.031)	0.009	0.039
260	21.67	0.10	0.048	(0.031)	0.009	0.039
261	21.75	0.10	0.048	(0.031)	0.009	0.039
262	21.83	0.07	0.032	(0.031)	0.006	0.026
263	21.92	0.07	0.032	(0.030)	0.006	0.026
264	22.00	0.07	0.032	(0.030)	0.006	0.026
265	22.08	0.10	0.048	(0.030)	0.009	0.039
266	22.17	0.10	0.048	(0.030)	0.009	0.039
267	22.25	0.10	0.048	(0.030)	0.009	0.039
268	22.33	0.07	0.032	(0.030)	0.006	0.026
269	22.42	0.07	0.032	(0.030)	0.006	0.026
270	22.50	0.07	0.032	(0.030)	0.006	0.026
271	22.58	0.07	0.032	(0.030)	0.006	0.026
272	22.67	0.07	0.032	(0.030)	0.006	0.026
273	22.75	0.07	0.032	(0.030)	0.006	0.026
274	22.83	0.07	0.032	(0.029)	0.006	0.026
275	22.92	0.07	0.032	(0.029)	0.006	0.026
276	23.00	0.07	0.032	(0.029)	0.006	0.026
277	23.08	0.07	0.032	(0.029)	0.006	0.026
278	23.17	0.07	0.032	(0.029)	0.006	0.026
279	23.25	0.07	0.032	(0.029)	0.006	0.026
280	23.33	0.07	0.032	(0.029)	0.006	0.026
281	23.42	0.07	0.032	(0.029)	0.006	0.026
282	23.50	0.07	0.032	(0.029)	0.006	0.026
283	23.58	0.07	0.032	(0.029)	0.006	0.026
284	23.67	0.07	0.032	(0.029)	0.006	0.026
285	23.75	0.07	0.032	(0.029)	0.006	0.026
286	23.83	0.07	0.032	(0.029)	0.006	0.026
287	23.92	0.07	0.032	(0.029)	0.006	0.026
288	24.00	0.07	0.032	(0.029)	0.006	0.026

(Loss Rate Not Used)

Sum = 100.0 Sum = 40.6

Flood volume = Effective rainfall 3.39(In)
times area 19.8(Ac.)/[((In)/(Ft.))] = 5.6(Ac.Ft)

Total soil loss = 0.61(In)
Total soil loss = 1.014(Ac.Ft)
Total rainfall = 4.00(In)
Flood volume = 243304.0 Cubic Feet
Total soil loss = 44180.9 Cubic Feet

 Peak flow rate of this hydrograph = 9.875(CFS)

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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

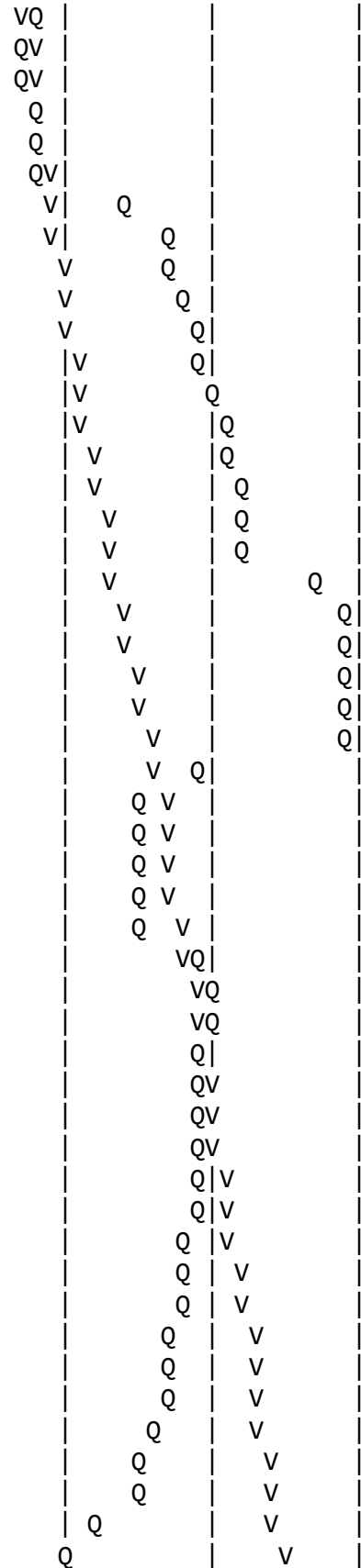
 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0025	0.36	VQ				
0+10	0.0061	0.52	V Q				
0+15	0.0097	0.52	V Q				
0+20	0.0146	0.71	V Q				
0+25	0.0200	0.79	V Q				
0+30	0.0254	0.79	V Q				
0+35	0.0308	0.79	V Q				
0+40	0.0362	0.79	V Q				
0+45	0.0416	0.79	V Q				
0+50	0.0483	0.97	V Q				
0+55	0.0555	1.05	V Q				
1+ 0	0.0627	1.05	V Q				
1+ 5	0.0687	0.87	V Q				
1+10	0.0741	0.79	V Q				
1+15	0.0795	0.79	V Q				
1+20	0.0849	0.79	V Q				
1+25	0.0903	0.79	V Q				
1+30	0.0958	0.79	V Q				
1+35	0.1012	0.79	V Q				
1+40	0.1066	0.79	V Q				
1+45	0.1120	0.79	V Q				
1+50	0.1186	0.97	V Q				
1+55	0.1259	1.05	V Q				
2+ 0	0.1331	1.05	V Q				
2+ 5	0.1403	1.05	V Q				
2+10	0.1475	1.05	V Q				
2+15	0.1547	1.05	V Q				
2+20	0.1619	1.05	V Q				
2+25	0.1692	1.05	V Q				
2+30	0.1764	1.05	V Q				
2+35	0.1848	1.23	V Q				
2+40	0.1939	1.31	V Q				
2+45	0.2029	1.31	V Q				
2+50	0.2119	1.31	V Q				
2+55	0.2209	1.31	V Q				
3+ 0	0.2299	1.31	V Q				
3+ 5	0.2390	1.31	V Q				
3+10	0.2480	1.31	V Q				

3+15	0.2570	1.31	V	Q
3+20	0.2660	1.31	V	Q
3+25	0.2750	1.31	V	Q
3+30	0.2841	1.31	V	Q
3+35	0.2931	1.31	V	Q
3+40	0.3021	1.31	V	Q
3+45	0.3111	1.31	V	Q
3+50	0.3214	1.49	V	Q
3+55	0.3322	1.57	V	Q
4+ 0	0.3430	1.57	V	Q
4+ 5	0.3539	1.57	V	Q
4+10	0.3647	1.57	V	Q
4+15	0.3755	1.57	V	Q
4+20	0.3876	1.75	V	Q
4+25	0.4002	1.83	V	Q
4+30	0.4128	1.83	V	Q
4+35	0.4255	1.83	V	Q
4+40	0.4381	1.83	V	Q
4+45	0.4507	1.83	V	Q
4+50	0.4646	2.02	V	Q
4+55	0.4790	2.10	V	Q
5+ 0	0.4935	2.10	V	Q
5+ 5	0.5054	1.73	V	Q
5+10	0.5162	1.57	V	Q
5+15	0.5270	1.57	V	Q
5+20	0.5391	1.75	V	Q
5+25	0.5517	1.83	V	Q
5+30	0.5644	1.83	V	Q
5+35	0.5782	2.02	V	Q
5+40	0.5927	2.10	V	Q
5+45	0.6071	2.10	V	Q
5+50	0.6215	2.10	V	Q
5+55	0.6360	2.10	V	Q
6+ 0	0.6504	2.10	V	Q
6+ 5	0.6661	2.28	V	Q
6+10	0.6823	2.36	V	Q
6+15	0.6986	2.36	V	Q
6+20	0.7148	2.36	V	Q
6+25	0.7310	2.36	V	Q
6+30	0.7473	2.36	V	Q
6+35	0.7647	2.54	V	Q
6+40	0.7828	2.62	V	Q
6+45	0.8008	2.62	V	Q
6+50	0.8189	2.62	V	Q
6+55	0.8369	2.62	V	Q
7+ 0	0.8549	2.62	V	Q
7+ 5	0.8730	2.62	V	Q
7+10	0.8910	2.62	V	Q
7+15	0.9091	2.62	V	Q
7+20	0.9283	2.80	V	Q

7+25	0.9482	2.88	V	Q				
7+30	0.9680	2.88	V	Q				
7+35	0.9891	3.06	V	Q				
7+40	1.0108	3.14	V	Q				
7+45	1.0324	3.14	V	Q				
7+50	1.0553	3.32	V	Q				
7+55	1.0788	3.41	V	Q				
8+ 0	1.1022	3.41	V	Q				
8+ 5	1.1282	3.77	V	Q				
8+10	1.1552	3.93	V	Q				
8+15	1.1823	3.93	V	Q				
8+20	1.2094	3.93	V	Q				
8+25	1.2364	3.93	V	Q				
8+30	1.2635	3.93	V	Q				
8+35	1.2918	4.11	V	Q				
8+40	1.3206	4.19	V	Q				
8+45	1.3495	4.19	V	Q				
8+50	1.3796	4.37	V	Q				
8+55	1.4103	4.45	V	Q				
9+ 0	1.4410	4.45	V	Q				
9+ 5	1.4741	4.82	V	Q				
9+10	1.5084	4.98	V	Q				
9+15	1.5427	4.98	V	Q				
9+20	1.5782	5.16	V	Q				
9+25	1.6143	5.24	V	Q				
9+30	1.6504	5.24	V	Q				
9+35	1.6877	5.42	V	Q				
9+40	1.7256	5.50	V	Q				
9+45	1.7634	5.50	V	Q				
9+50	1.8028	5.71	V	Q				
9+55	1.8428	5.81	V	Q				
10+ 0	1.8828	5.81	V	Q				
10+ 5	1.9138	4.51	V	Q				
10+10	1.9409	3.93	V	Q				
10+15	1.9679	3.93	V	Q				
10+20	1.9950	3.93	V	Q				
10+25	2.0221	3.93	V	Q				
10+30	2.0491	3.93	V	Q				
10+35	2.0824	4.84	V	Q				
10+40	2.1185	5.24	V	Q				
10+45	2.1546	5.24	V	Q				
10+50	2.1907	5.24	V	Q				
10+55	2.2267	5.24	V	Q				
11+ 0	2.2628	5.24	V	Q				
11+ 5	2.2977	5.06	V	Q				
11+10	2.3320	4.98	V	Q				
11+15	2.3662	4.98	V	Q				
11+20	2.4005	4.98	V	Q				
11+25	2.4348	4.98	V	Q				
11+30	2.4691	4.98	V	Q				

11+35	2.5008	4.61
11+40	2.5315	4.45
11+45	2.5622	4.45
11+50	2.5941	4.63
11+55	2.6266	4.71
12+ 0	2.6590	4.71
12+ 5	2.7020	6.24
12+10	2.7496	6.92
12+15	2.7973	6.92
12+20	2.8465	7.15
12+25	2.8965	7.25
12+30	2.9465	7.26
12+35	2.9995	7.71
12+40	3.0540	7.91
12+45	3.1085	7.91
12+50	3.1645	8.14
12+55	3.2213	8.24
13+ 0	3.2781	8.25
13+ 5	3.3425	9.36
13+10	3.4104	9.85
13+15	3.4783	9.86
13+20	3.5462	9.86
13+25	3.6142	9.87
13+30	3.6822	9.87
13+35	3.7335	7.44
13+40	3.7773	6.37
13+45	3.8213	6.38
13+50	3.8652	6.38
13+55	3.9092	6.39
14+ 0	3.9532	6.39
14+ 5	4.0033	7.28
14+10	4.0562	7.68
14+15	4.1091	7.68
14+20	4.1606	7.47
14+25	4.2113	7.37
14+30	4.2621	7.38
14+35	4.3130	7.38
14+40	4.3639	7.39
14+45	4.4148	7.39
14+50	4.4642	7.18
14+55	4.5130	7.08
15+ 0	4.5618	7.09
15+ 5	4.6091	6.87
15+10	4.6558	6.78
15+15	4.7025	6.78
15+20	4.7477	6.56
15+25	4.7922	6.47
15+30	4.8368	6.48
15+35	4.8753	5.59
15+40	4.9112	5.21



15+45	4.9471	5.21			Q	V
15+50	4.9830	5.22			Q	V
15+55	5.0189	5.22			Q	V
16+ 0	5.0549	5.22			Q	V
16+ 5	5.0710	2.33		Q		V
16+10	5.0782	1.05	Q			V
16+15	5.0854	1.05	Q			V
16+20	5.0926	1.05	Q			V
16+25	5.0998	1.05	Q			V
16+30	5.1070	1.05	Q			V
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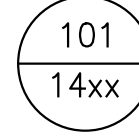
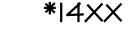
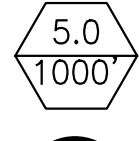

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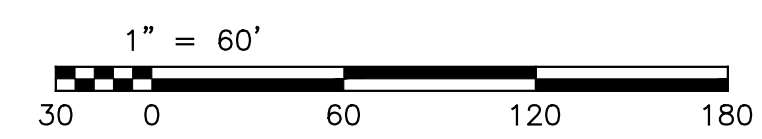
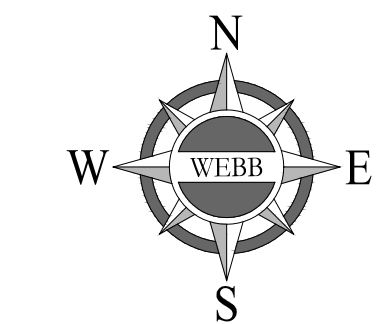
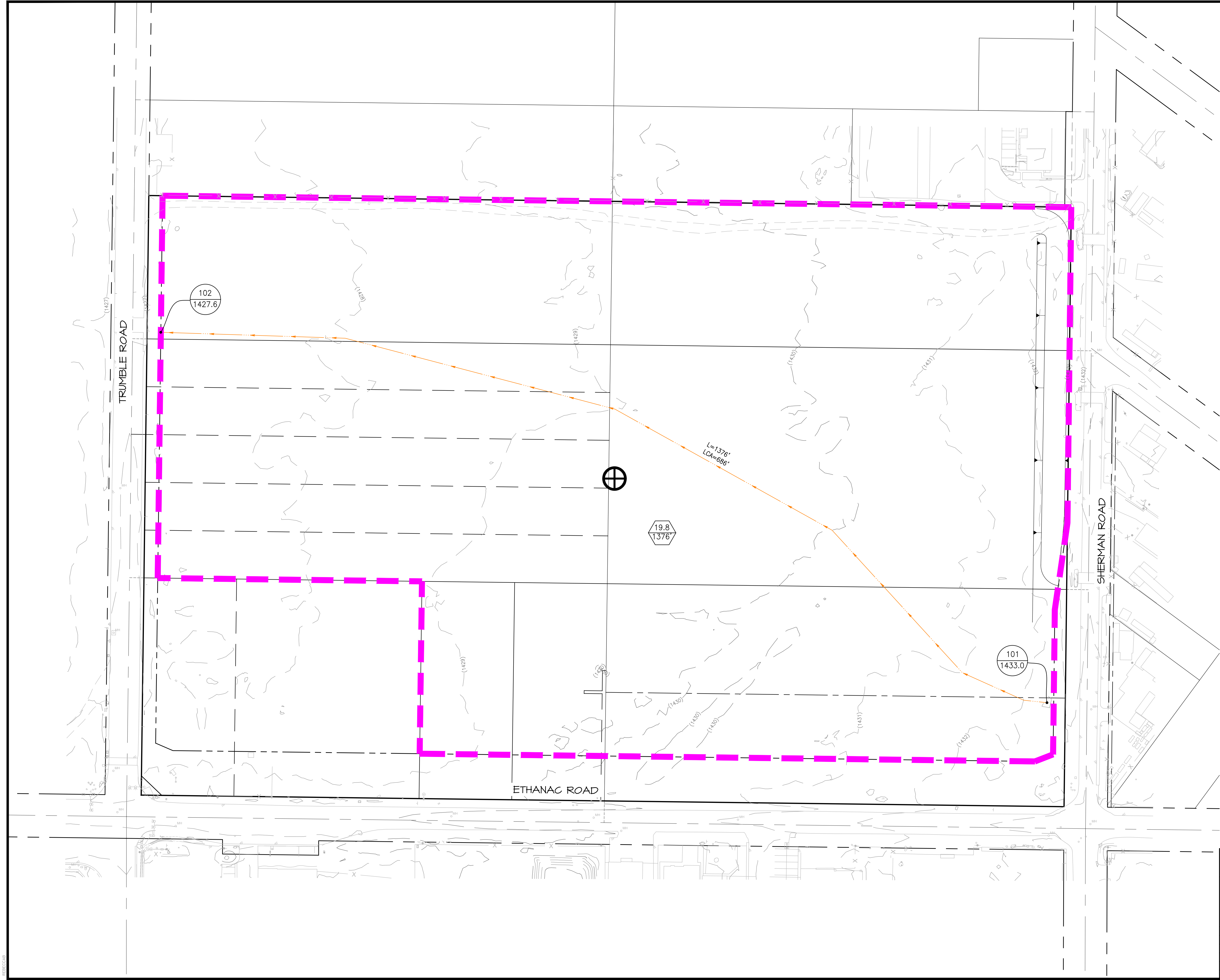
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LEGEND



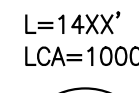
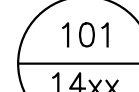
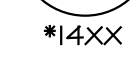
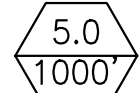

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-  FLOW DIRECTION
-  NODE DESIGNATION
NODE ELEVATION
-  *14XX
-  WATERSHED AREA (ACRES)
LONGEST WATER PATH (FT)
-  CENTROID



CITY OF PERRIS
 COUNTY OF RIVERSIDE
 EXISTING UNIT HYDROGRAPH HYDROLOGY
 ETHANAC LOGISTICS CENTER
 P22-00030

SCALE: 1"=60'	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256
DATE: 1/19/24	WEBB ASSOCIATES	W.O. 2022-0148
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CHECKED: SKK		OF 4 SHEETS
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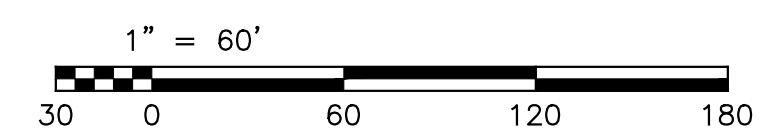
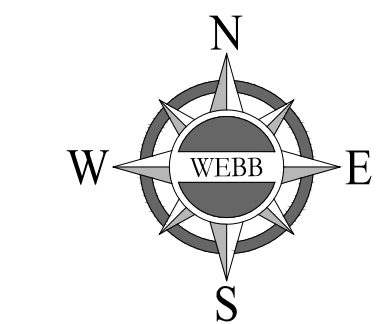
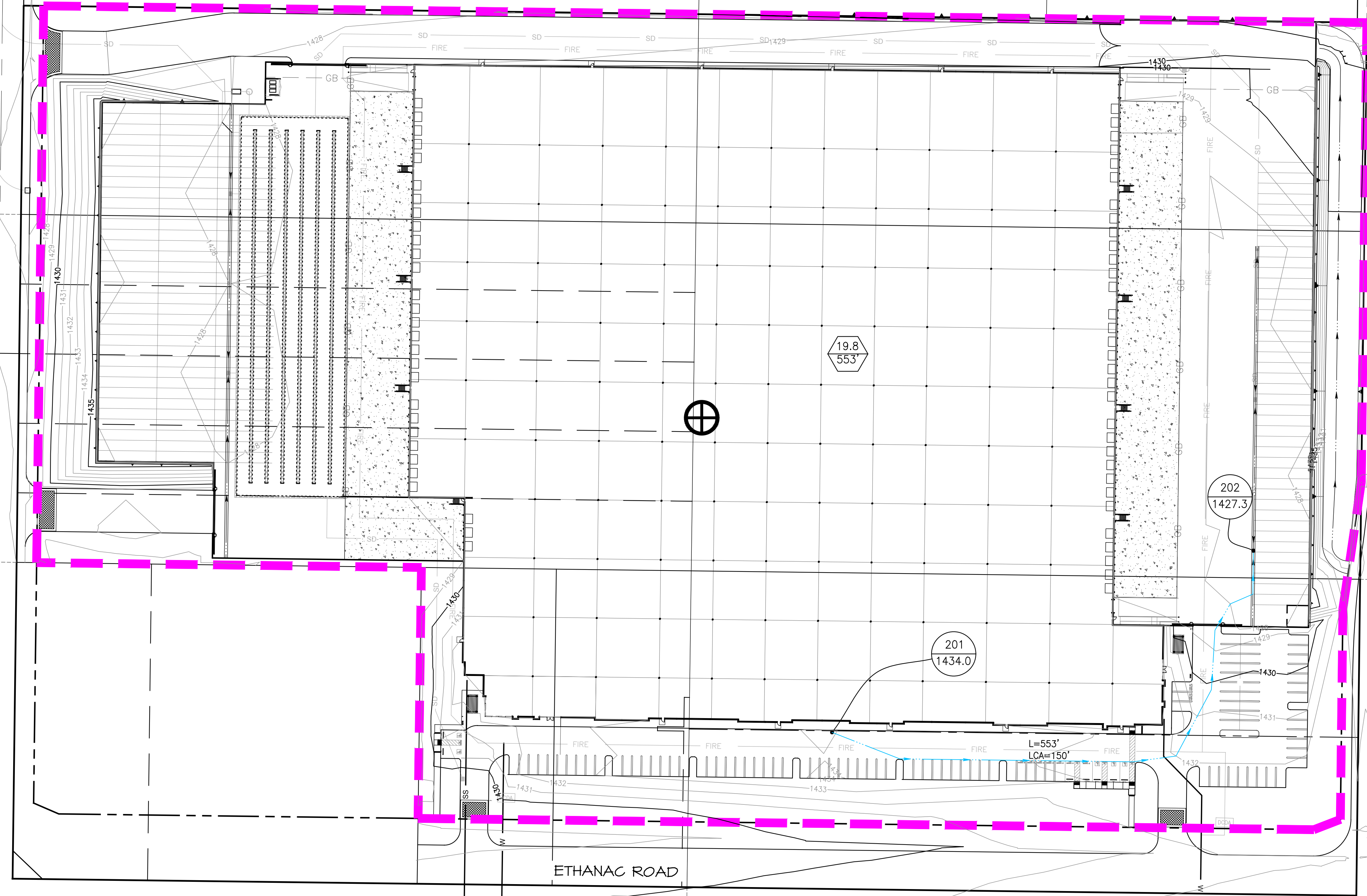
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 -  FLOW DIRECTION
 -  LONGEST FLOW PATH
CENTROIDAL LENGTH
 -  NODE DESIGNATION
NODE ELEVATION
 -  *14XX
*INVERT ELEVATION
 -  5.0
1000' WATERSHED AREA (ACRES)
LONGEST WATER PATH (FT)
 -  CENTROID


TRUMBLE ROAD

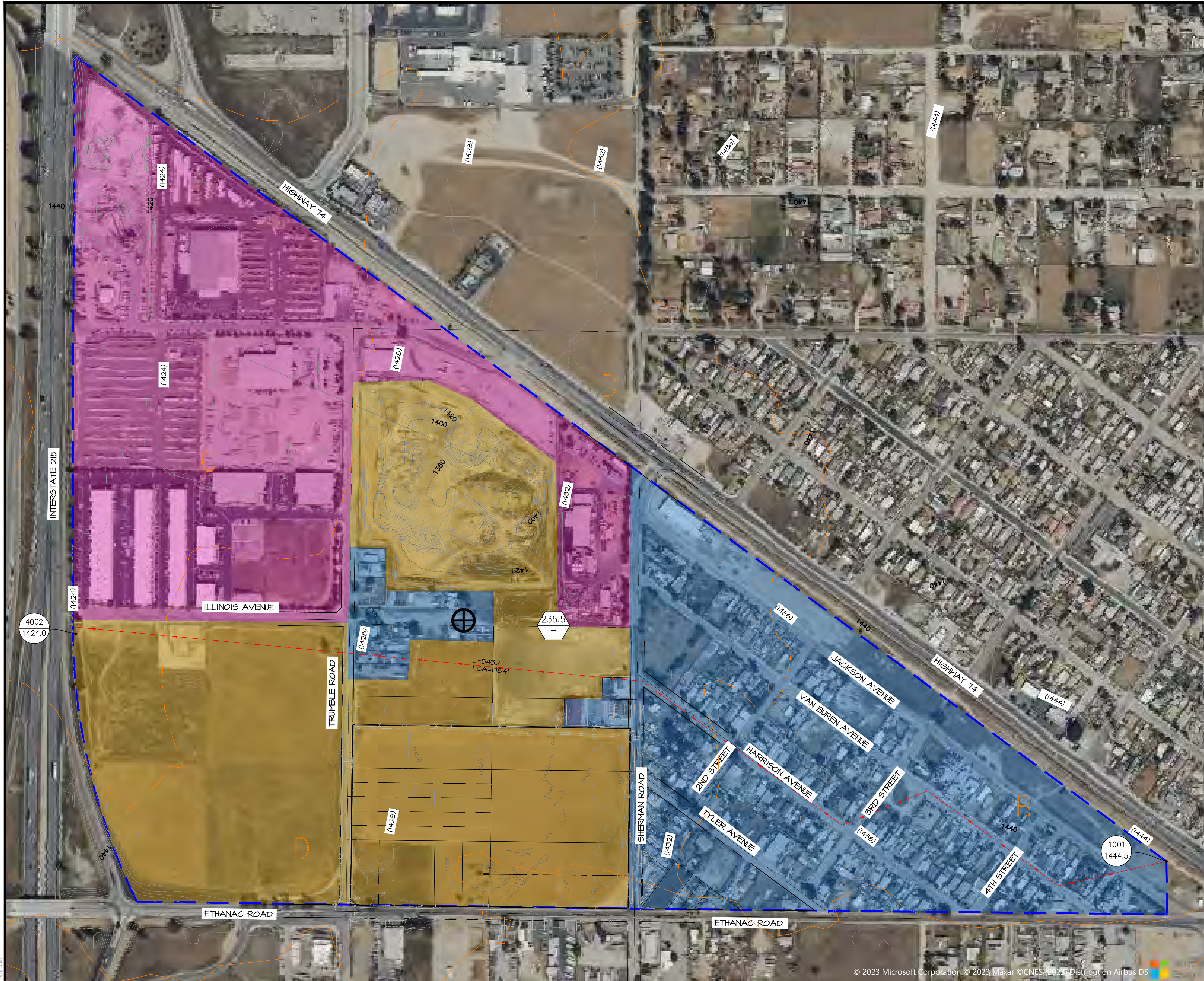
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ETHANAC ROAD

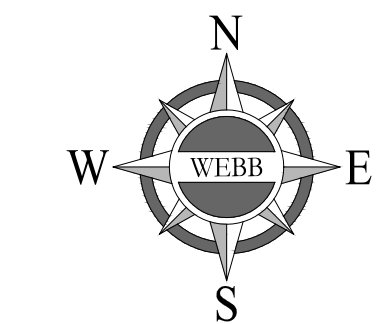


CITY OF PERRIS
 COUNTY OF RIVERSIDE
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 P22-00030

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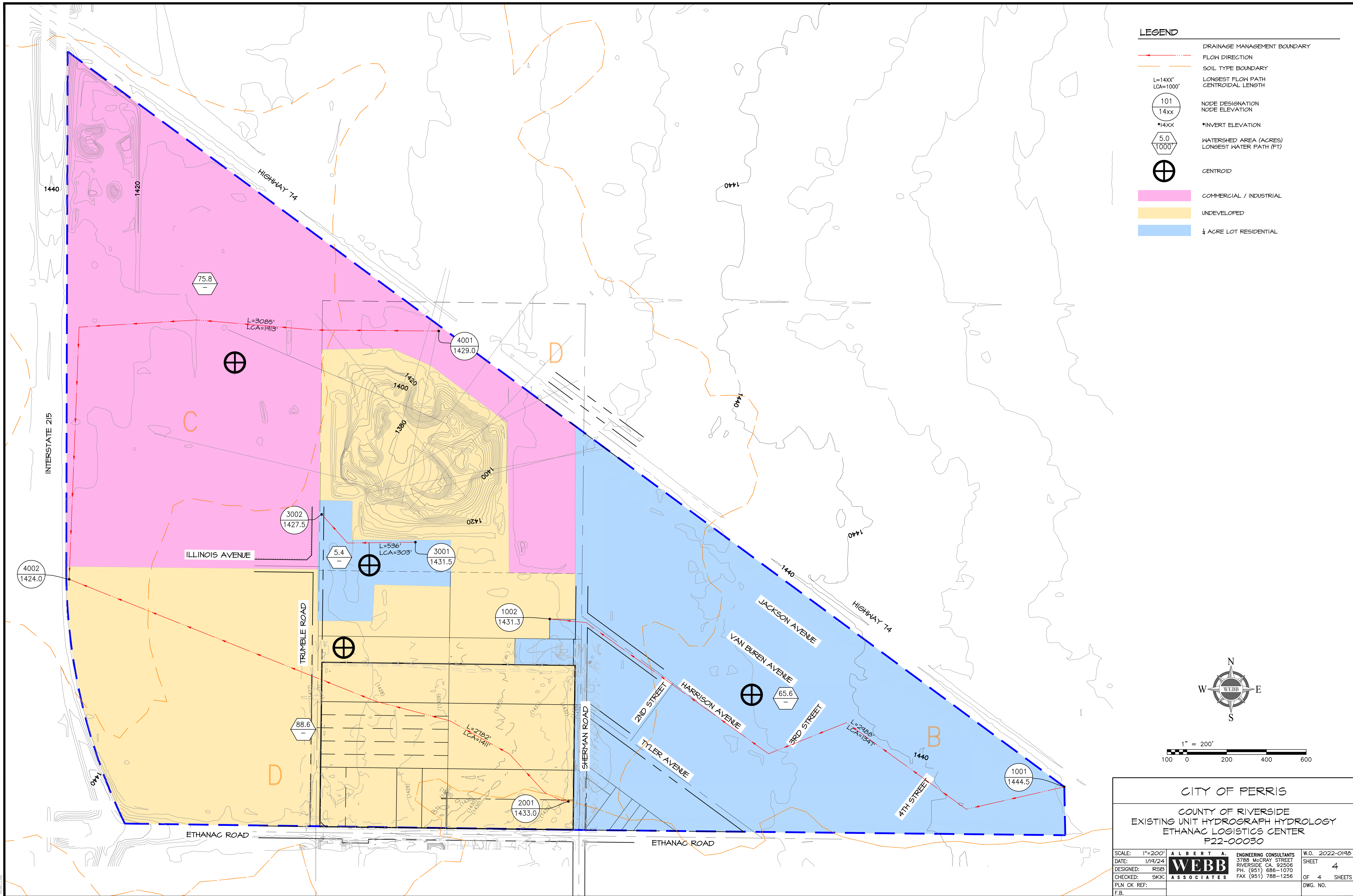
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 - FLOW DIRECTION
 - SOIL TYPE BOUNDARY
 - LONGEST FLOW PATH
 - CENTROIDAL LENGTH
 - NODE DESIGNATION
NODE ELEVATION
 - *INVERT ELEVATION
 - WATERSHED AREA (ACRES)
LONGEST WATER PATH (FT)
 - CENTROID
 - COMMERCIAL / INDUSTRIAL
 - UNDEVELOPED
 - 1/2 ACRE LOT RESIDENTIAL



CITY OF PERRIS
 COUNTY OF RIVERSIDE
 EXISTING UNIT HYDROGRAPH HYDROLOGY
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 P22-00030

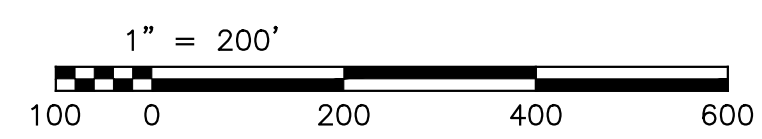
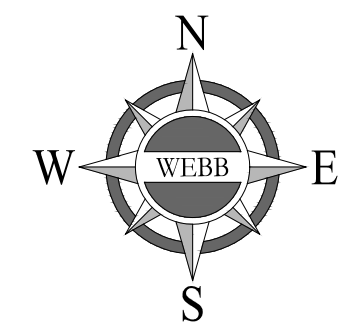
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LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- FLOW DIRECTION
- SOIL TYPE BOUNDARY
- LONGEST FLOW PATH
- CENTROIDAL LENGTH
- NODE DESIGNATION
- NODE ELEVATION
- *INVERT ELEVATION
- WATERSHED AREA (ACRES)
- LONGEST WATER PATH (FT)
- CENTROID
- COMMERCIAL / INDUSTRIAL
- UNDEVELOPED
- 1/4 ACRE LOT RESIDENTIAL



CITY OF PERRIS

COUNTY OF RIVERSIDE
EXISTING UNIT HYDROGRAPH HYDROLOGY
ETHANAC LOGISTICS CENTER
P22-00030

SCALE: 1"=200'	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256
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Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

***To be provided during final engineering**

Appendix 9: O&M

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

***To be provided during final engineering**

Appendix 10: Educational Materials

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

***To be provided during final engineering**

Preliminary Water Quality
Management Plan (PWQMP)
(Optional)

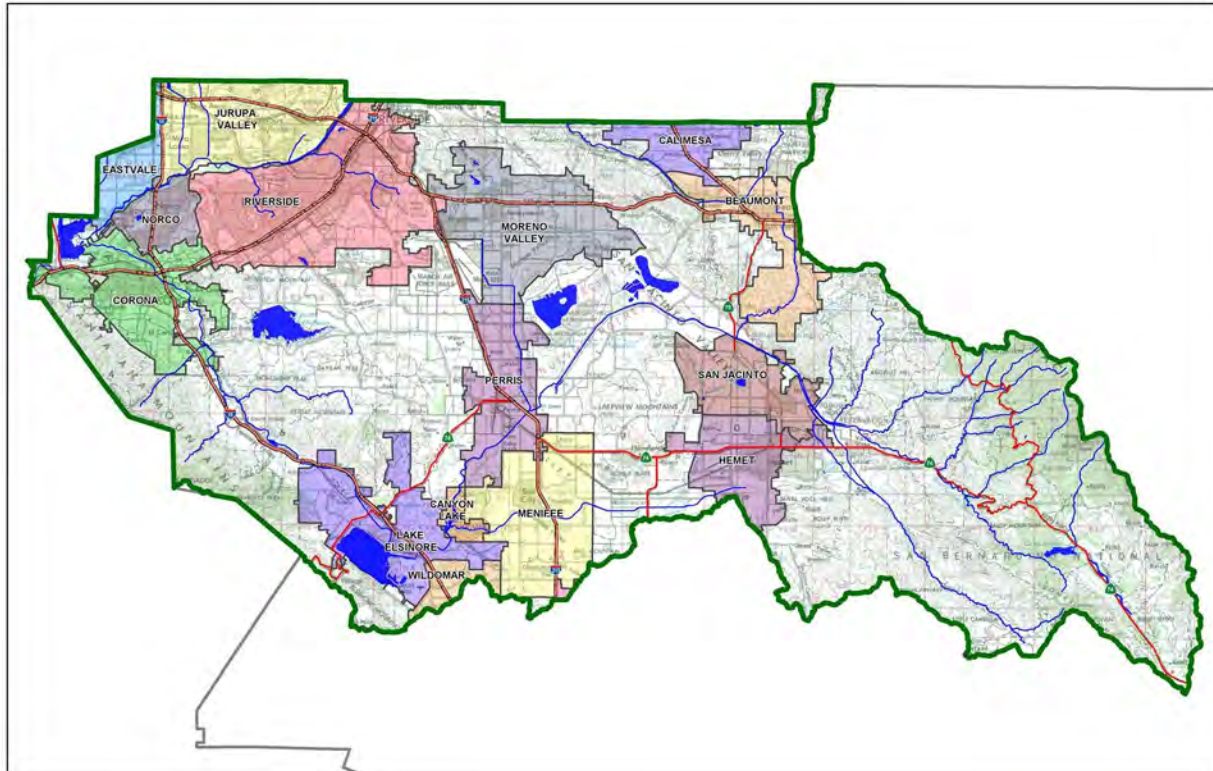
Project Specific Water Quality Management Plan

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

Project Title: Ethanac Logistics Center

Development No: TPM 38600

Design Review/Case No: DPR22-00030



Contact Information:

Prepared for: Hillwood
901 Via Piemonte Suite 175
Ontario, CA 91764

Prepared by:
Albert A. Webb Associates
3788 McCray St
Riverside, CA 92506
(951) 686 – 1070

- Preliminary
- Final

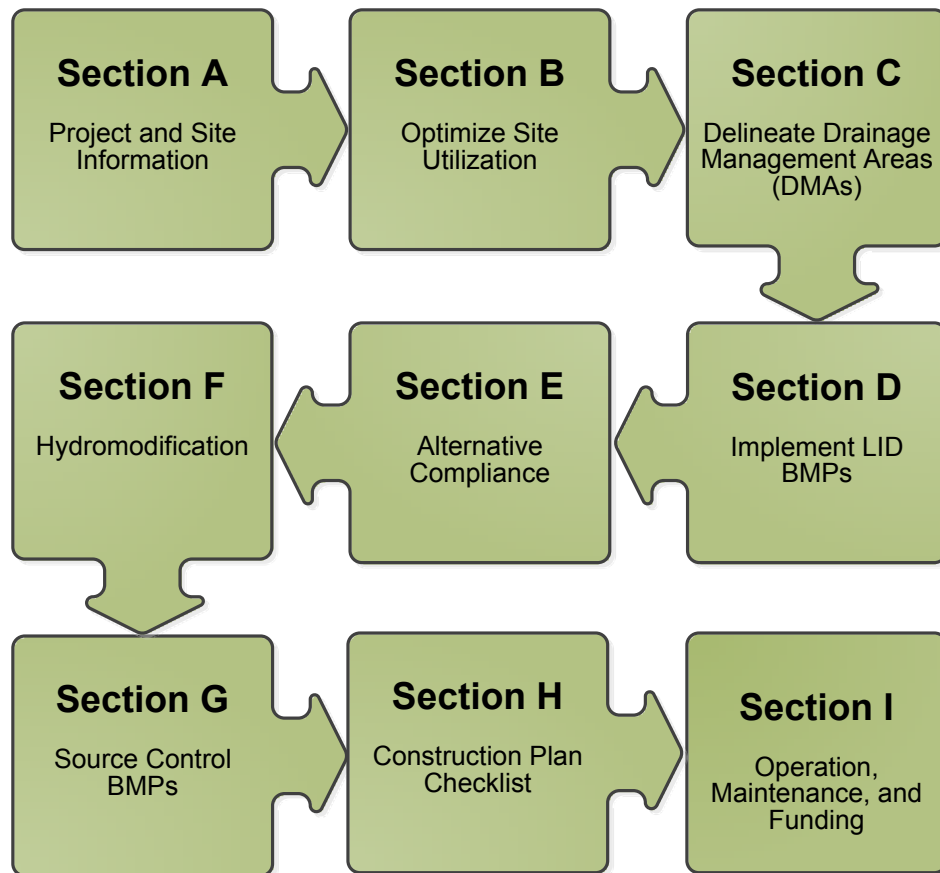
Original Date Prepared: December 2022

Revision Date(s): December 2023

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

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 Hillwood by Albert A. Webb Associates for the Ethanac Commerce Center project (P22-00030).

This WQMP is intended to comply with the requirements of City of Perris for Water Quality Ordinance No. 1194 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under City of Perris Water Quality Ordinance (Municipal Code Section 1194).

"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. **R8-2013-0024** and any subsequent amendments thereto."

DRAFT

Preparer's Signature

Date

Preparer's Printed Name

Senior Engineer

Preparer's Title/Position

Preparer's Licensure: **DRAFT**

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Commercial/Industrial
Planning Area:	City of Perris Redevelopment Project Area
Community Name:	N/A
Development Name:	Ethanac Commerce Center
PROJECT LOCATION	
Latitude & Longitude (DMS): 33°44'39.31" N, 117°10'57.29" W	
Project Watershed and Sub-Watershed: Santa Ana, San Jacinto	
Total Acres: 21 Ac	
APN(s): 329-240-016 thru -020, -023 thru -027	
Map Book and Page No.: Thomas Bros. Map Book Page: 838, Grid: C1 and D1	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Commercial/Industrial
Proposed or Potential SIC Code(s)	1541 (General Contractor-Industrial Building) 4225 (General Warehousing & Storage)
Area of Impervious Project Footprint (SF)	413,350 SF
Total Area of <u>proposed</u> Impervious Surfaces within the Project Limits (SF)/or Replacement	413,350 SF
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 (SF)	0 SF
Is the project located within any MSHCP Criteria Cell?	<input type="checkbox"/> Y <input checked="" type="checkbox"/> N
If so, identify the Cell number:	N/A
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?	0.61

A.1 Project Description

The Ethanac Commerce Center project site is located in the City of Perris, north of Ethanac Road, bounded by Sherman Road to east, Trumble Road to the west, and Illinois Avenue to the north. The project applicant proposes to build a commercial/industrial building (approximately 400,000 square feet) on approximately 21 gross acres of vacant land. Existing elevations across the site vary from 1433 in the southeast corner of the site to 1427.7 in the west end (NAVD88 datum). The site currently slopes down at approximately 1% grade to the west. The existing drainage pattern for the site and the general area is characterized by sheet flows that follow the slope to the west towards Trumble Road.

The project site is not located within a specific plan, but it is within the Romoland Master Drainage Plan watershed area.

In the proposed condition of Ethanac Commerce Center onsite runoff, represented by DMA-A, will be conveyed throughout the site via proposed ribbon gutters and curbs and gutters. Onsite runoff will then

be captured by a network of drainage inlets provided at low points. Proposed private underground storm drain conveys captured flows towards a Contech underground storage chamber (approximately 372,000 cubic feet storage provided) before being pumped to a proposed Contech Filterra Bioscape system for water quality treatment.

Treated stormwater will then gravity flow to proposed storm drain Line 4 in Trumble Road, which will be sized to convey the pumped, treated flows to City of Perris Line A (City Line A) in Illinois Avenue per P8-921. City Line A ultimately connects to Romoland MDP Line A-11 (MDP Line A-11), and thence Romoland MDP Line A (MDP Line A).

This project site is subject to HCOC mitigation. The 2-Year, 24-Hour unit hydrograph storm event was calculated and it was determined that the site would need to mitigate for volume of approximately 93,600 cubic feet. The underground chambers onsite have been sized to accommodate the HCOC volume. In addition to this and the water quality volume, the underground chambers have been sized to accommodate the onsite 100-year storm volume (unit hydrograph calculations provided in Appendix 6). The 100-year storm will gravity to the proposed public basin which is further described below.

The 100-year 24-hour storm unit hydrograph was run for the onsite in order to determine the volume needed to be stored in the underground chambers prior to being pumped offsite. The larger storm flows leave the underground chambers via Line 5, which will be 12" RCP. Line 5 was sized to allow 8 CFS of inflow into the public underground storage chambers, which detains offsite flows. The invert of Line 5 as it exits the chamber will be set at the top of the HCOC ponding elevation, making sure only larger storm flows exit through Line 5. This elevation will be determined in final engineering. The 100-year 24-hour unit hydrograph calculations and exhibit are referenced in Appendix 6.

Offsite flows from the east side of the project are intercepted by catch basins in Sherman Road. The flows are then conveyed through proposed storm drain Line 3 across the north end of the project site, ultimately confluent with the onsite flows in proposed public storm drain Line 4 in Trumble Road. As mentioned earlier, this project proposed to connect to existing City Line A within Illinois Avenue with proposed public Line 4. To maintain the gravity flow, the proposed upstream end of Line 4 at the project site is to be shallow with approximately 2 feet of cover from the future street finished surface. Due to the shallower elevation of the Line 4 pipe, these offsite flows need to be pumped up to Line 4 elevation. Line 3 discharges into a public maintained underground storage chamber, that is on the west side of the Ethanac Commerce Center project site. This storage chamber is sized to hold the 100-year, 3-hour storm peak volume. The flows will then be pumped out of the chamber utilizing a 10 CFS pump and will confluence with the treated onsite flows in Line 4.

The project contains some amount of self-retaining, and all trash enclosures will be covered. The impervious cover on site is 86.0% leaving 14.0% of pervious site coverage.

A.2 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
- Source Control BMPs

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

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

A.3 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
San Jacinto River (Reach 3) (HU#802.11)	NONE	AGR, GWR, WILD, RARE, REC1, REC2, WARM	2.5 MILES
Canyon Lake (HU#802.11, 802.12)	NUTRIENTS, PATHOGENS	AGR, COMM, GWR, WILD, MUN, REC1, REC2, WARM	NOT A WATER BODY CLASSIFIED AS RARE
San Jacinto River (Reach 1) (HU#802.11, 802.32, 802.31)	NONE	AGR, GWR, WILD, MUN, RARE, REC1, REC 2, WARM	10 MILES
Lake Elsinore (HU#302.31)	DDT< NUTRIENTS, LOW DO, PCBs, TOXICITY	COMM, RARE, REC1, REC2, WARM, WILD	13 MILES

A.4 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 (dependent on tenant)	<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 (please list in the space below as required) Grading Permit	<input checked="" type="checkbox"/> Y	<input type="checkbox"/> N

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

Section B: Optimize Site Utilization (LID Principles)

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

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

Site Optimization

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

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

The project proposes to preserve the existing drainage pattern to the west.

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

The site is vacant with minimal vegetal scrub. There are no dense areas of vegetation nor well-established trees.

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

Per the attached geotechnical and infiltration report, infiltration has an in-situ rate of 0.1-0.2 in/hr. However, self-retaining areas exist that will retain small amounts of rainfall in the topsoil.

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

The site contains the standard impervious area per code for the given land use.

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

All water quality runoff will be directed to the proposed underground chambers.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s) ¹	Area (Sq. Ft.)	DMA Type
L-A	LANDSCAPE	90,873	D
R-A	ROOFS	407,336	D
H-A	HARDSCAPE	336,113	D
SR-A	LANDSCAPE	30,345	B

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

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
N/A	N/A	N/A	N/A

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

Self-Retaining Area				Type 'C' DMAs that are draining to the Self-Retaining Area		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 [C]	Required Retention Depth (inches) [D]
SR-A	LANDSCAPE	30,345	0.61			0.61

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

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

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

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

DMA Name or ID	BMP Name or ID
L-A	BMP-A Contech Filterra BioScape System
R-A	
H-A	

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

Section D: Implement LID BMPs

D.1 Infiltration Applicability

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

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

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermitttee 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:		X
...have any DMAs located within 100 feet of a water supply well? If Yes, list affected DMAs:		X
...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:		X
...have measured in-situ infiltration rates of less than 1.6 inches / hour? If Yes, list affected DMAs: DMA-A	X	
...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:		X
...geotechnical report identify other site-specific factors that would preclude effective and safe infiltration? Describe here:		X

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 neither of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

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

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

Total Area of Irrigated Landscape: N/A

Type of Landscaping (Conservation Design or Active Turf): 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 2-1 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 2-3 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

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

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

Minimum required use: N/A

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

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

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

D.3 Bioretention and Biotreatment Assessment

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

Select one of the following:

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

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

D.4 Feasibility Assessment Summaries

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

Table D.2 LID Prioritization Summary Matrix

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

Based on the LID BMP Hierarchy, the project will utilize bioretention and biotreatment for water quality requirements. Infiltration based BMPs are not feasible due to the inadequate infiltration rates on the site as determined by the geotechnical investigation. Harvest and use BMPs are not feasible as reclaimed water will be used for the non-potable water demands.

Based on the functionality and composition of the Contech Bioscape Filterra system, it operates as a biotreatment facility and is proposed as the water quality treatment method for DMA-A. Due to the system being proprietary, it is being classified as "Alternative Compliance" in Table D.2. Sizing information can be found in Table D.3.

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	Enter BMP Name / Identifier Here		
	[A]		[B]	[C]	[A] x [C]			
L-A	90,768	Ornamental Landscaping	0.1	0.11	9,959.9	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
R-A	407,336	Roofs	1	0.89	363,343.7			
H-A	336,463	Concrete or Asphalt	1	0.89	300,659.3			
SR-A	30,358	Ornamental Landscaping	0.1	0.11	3,353.3			
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D] \times [E]}{12}$	[G]
	864,925				676,848.1	0.61	34,406.4	128,629

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

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

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

Section E: Alternative Compliance (LID Waiver Program)

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

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

- Or -

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

E.1 Identify Pollutants of Concern

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

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	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 checked="" 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 checked="" 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 checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" 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	
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									
						<i>Design Storm Depth (in)</i> <i>Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)</i> <i>Total Storm Water Credit % Reduction</i> <i>Proposed Volume or Flow on Plans (cubic feet or cfs)</i>			
	$A_T = \sum[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D] \times [E]}{[G]}$	$[F] \times (1-[H])$	[I]

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

[E] is 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
Contech Filterra BioScape (BMP-A)	TSS/TOC	66%-85%
	Nutrients	73%

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	INSERT VALUE	INSERT VALUE	INSERT VALUE
Volume (Cubic Feet)	INSERT VALUE	INSERT VALUE	INSERT VALUE

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

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

Does the project qualify for this HCOC Exemption? Y N

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

F.2 HCOC Mitigation

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

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

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

The 2-year, 24-hour storm unit hydrograph has been calculated and the underground chambers have been sized to adequately store the HCOC volume.

On-Site Unit Hydrograph Results

Storm Event	Existing Condition		Proposed Condition	
	Volume (Ac-ft)	Peak Flow (cfs)	Volume (Ac-ft)	Peak Flow (cfs)
2-Year, 24-Hour	0.3	0.43	2.2	3.56

Section G: Source Control BMPs

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

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

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
A. On-site storm drain inlets	<p>Mark all inlets with the works “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> <p>On-site drainage structures, including all storm drain clean outs, area drains, inlets, catch basins, inlet & outlet structures, forebays, & water treatment control basins shall be inspected and maintained on a regular basis to insure their</p>	<p>Maintain and periodically repaint or replace inlet markings.</p> <p>Provide stormwater pollution prevention information to new site owners, lessees, or operators.</p> <p>See applicable operational BMPs in Fact Sheet SC-44, “Drainage System Maintenance,” in Appendix 10 (CASQA Stormwater Quality Handbook at www.cabmphandbooks.com Include the following in lessee</p>

	<i>operational adequacy.</i>	<p><i>agreements: "Tenants 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"</i></p> <p><i>Maintenance should include removal of trash, debris, & sediment and the repair of any deficiencies or damage that may impact water quality.</i></p>
<i>B. Interior floor drains and elevator shaft sump</i>	<i>The interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer</i>	<i>Inspect and maintain drains to prevent blockages and overflow.</i>
<i>C. Need for future indoor & structural pest control</i>	<i>Note building design features that discourage entry of pests.</i>	<i>Provide Integrated Pest Management information to owners, lessees, and operators.</i>
<i>D. Landscape/Outdoor Pesticide Use</i>	<p><i>The final landscape shall be designed to accomplish all of the following:</i></p> <p><i>Preserve existing native trees, shrubs and ground cover to the maximum extent possible.</i></p> <p><i>Design landscape 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.</i></p> <p><i>Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.</i></p> <p><i>Consider using pest-resistant plants, especially adjacent to hardscape.</i></p> <p><i>To insure successful establishments, select plants appropriate to site, soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency and plant interactions.</i></p> <p><i>Pesticide usage should be at a necessary minimum and be consistent with the instructions contained on product labels and with the regulations administered by the State Department of Pesticide Regulation. Pesticides should be</i></p>	

	<p><i>used at an absolute minimum or not at all in the retention/infiltration basin. If used, it should not be applied in close proximity to the rainy season.</i></p>	
<p><i>E. Refuse Trash Storage areas</i></p>	<p><i>Trash container storage areas shall be paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements from the surrounding area, and screened or walled to prevent off-site transport of trash.</i></p> <p><i>Trash dumpsters (containers) shall be leak proof and have attached covers or lids.</i></p> <p><i>Trash enclosures shall be roofed per City standards and the details on the PWQMP Exhibit in Appendix 1. Trash compactors shall be roofed and set on a concrete pad per City standards. The pad shall be a minimum of one foot larger all around than the trash compactor and sloped to drain to a sanitary sewer line. Connection of trash area drains to the MS4 is prohibited.</i></p> <p><i>See CASQA SD-32 BMP Fact Sheets in Appendix 10 for additional information.</i></p> <p><i>Signs shall be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.</i></p>	<p><i>Adequate number of receptacles shall be provided. 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, in Appendix 10, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbook</i></p> <p><i>at www.cabmphandbooks.com</i></p>
<p><i>F. Loading Docks</i></p>	<p><i>Loading docks will not be covered and are 4 feet above finished pavement surface.</i></p> <p><i>Spill kits are to be kept on-site at all times per SC-11</i></p>	<p><i>Move loaded and unloaded items indoors as soon as possible.</i></p> <p><i>Inspect for accumulated trash and debris. Implement good housekeeping procedures on a regular basis. Sweep areas clean instead of using wash water. Loading docks will be kept in a clean and orderly condition, through a regular program of sweeping and litter control, and immediate clean up of any spills or broken containers. Property owner will ensure that loading docks will be swept as</i></p>

		<p><i>needed. Cleanup procedures will not include the use of wash-down water. Property owner will be responsible for implementation of loading dock housekeeping procedures</i></p> <p><i>See the Fact Sheet SC-30, in Appendix 10, "Outdoor Loading and Unloading" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com</i></p>
G. Fire Sprinkler Test Water	<p><i>Provide a means to drain fire sprinkler test water to the sanitary sewer.</i></p>	<p><i>See the note in the Fact Sheet SC-41, in Appendix 10, "Building and Grounds Maintenance", in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com</i></p>
H. Miscellaneous Drain or Wash Water or Other Sources	<p><i>Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system</i></p> <p><i>Boiler drain lines</i></p> <p><i>Condensate drain lines</i></p> <p><i>Rooftop equipment</i></p> <p><i>Drainage sumps</i></p> <p><i>Roofing, gutters and trim</i></p>	<p><i>Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur.</i></p> <p><i>Condensate drain lines may not discharge to the storm drain system.</i></p> <p><i>Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.</i></p> <p><i>Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.</i></p> <p><i>Avoid roofing, gutters and trim made of copper or other unprotected metals that may leach into runoff.</i></p>
I. Other sources	<p><i>Include controls for other sources as specified by local reviewer.</i></p>	
J. Plazas, sidewalks, and parking lots	<p><i>Spill kits are to be kept on-site at all times per SC-11</i></p>	<p><i>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.</i></p>

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)
*	*	*

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.

*This section will be completed in FWQMP

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: WQMP Covenant and Agreement

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

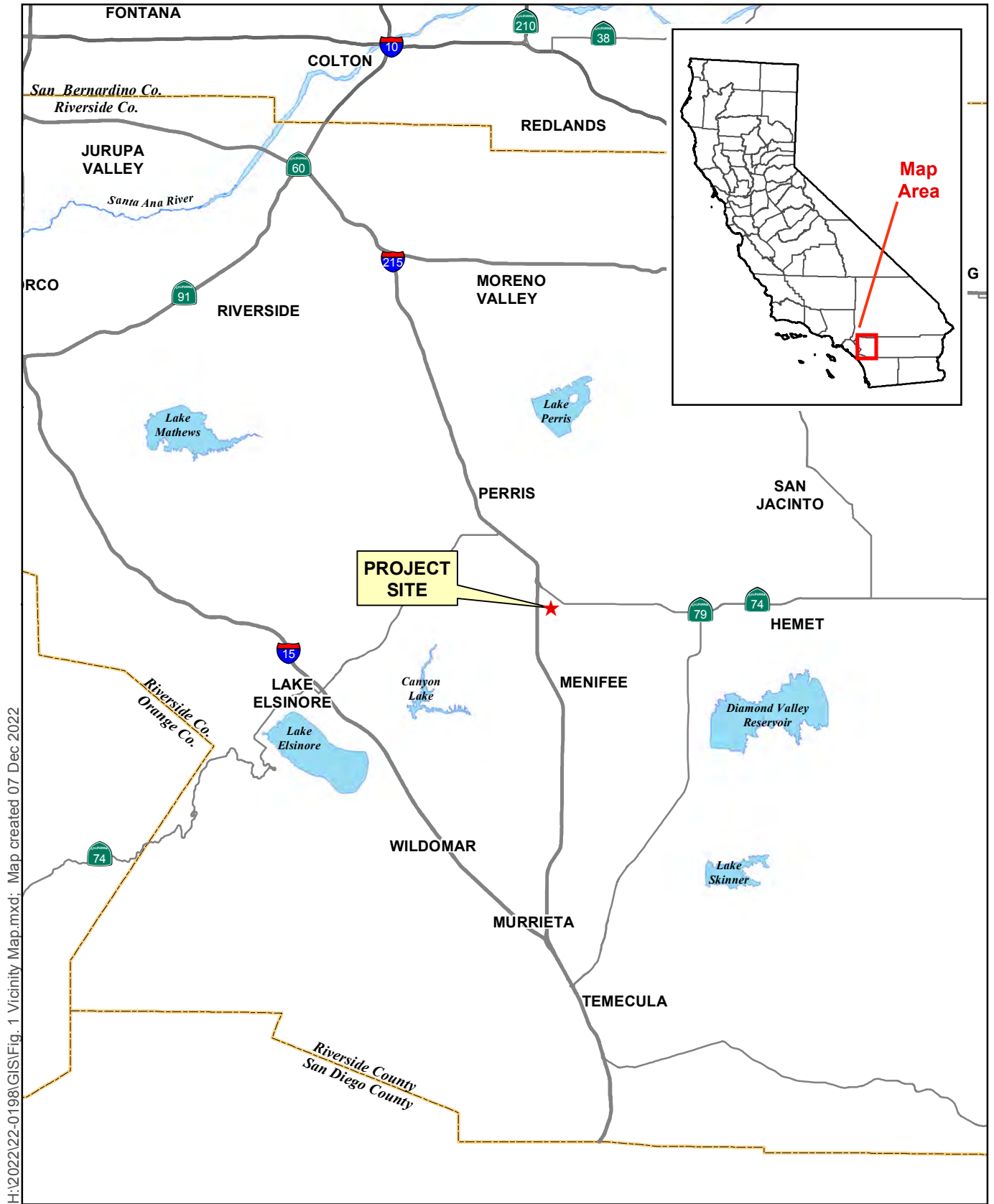
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Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP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

***To be completed in FWQMP**

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

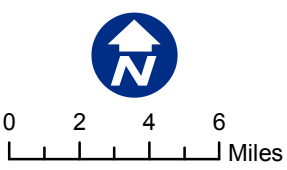


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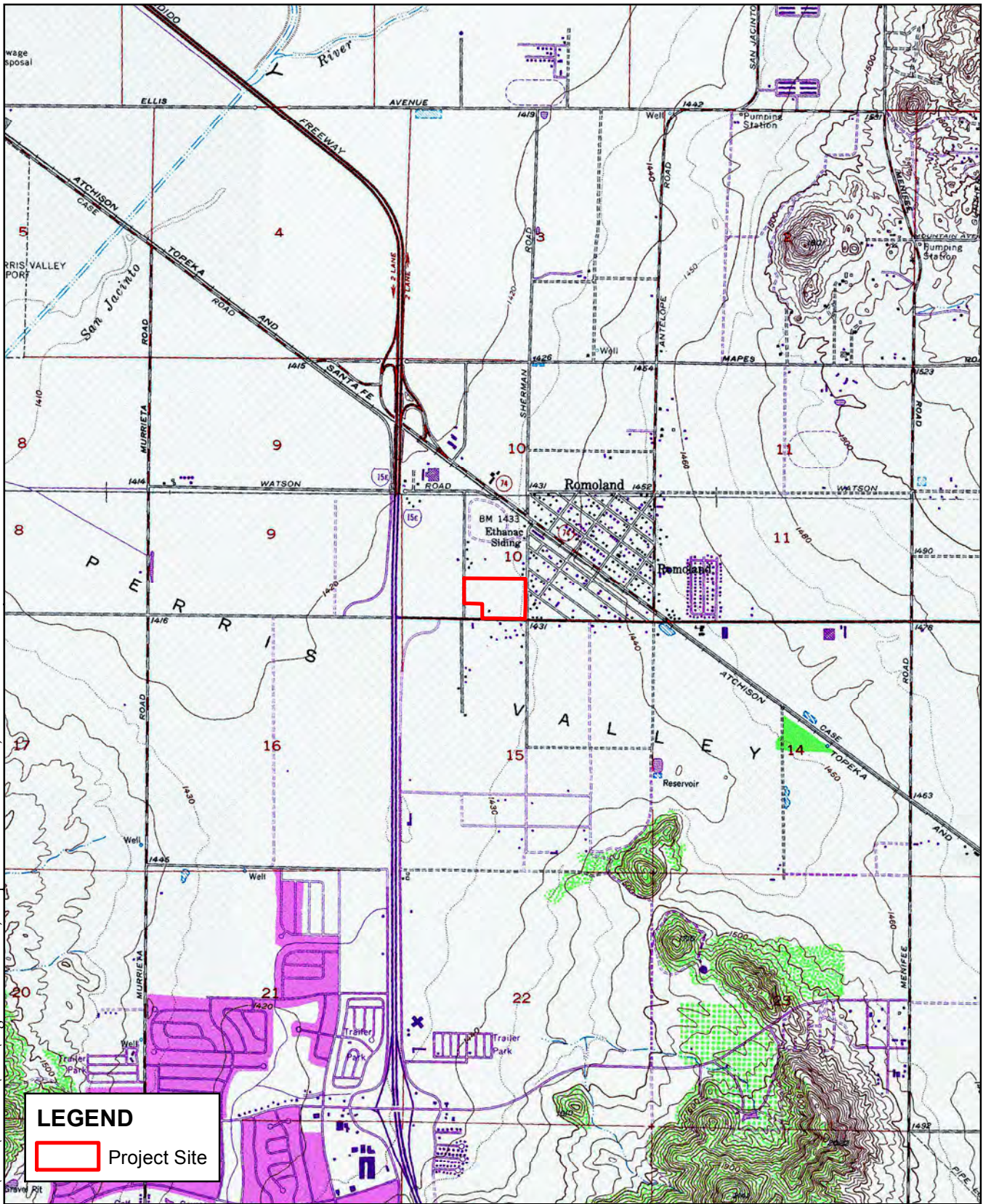
Source: Riverside County GIS, 2020

Figure 1 – Vicinity Map

Ethanac Logistics Center



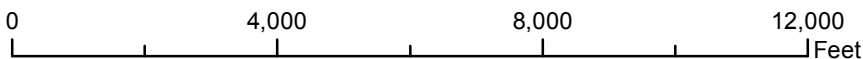
H:\2022\22-0198\GIS\Fig. 2 USGS.mxd; Map created 07 Dec 2022; rebeccab



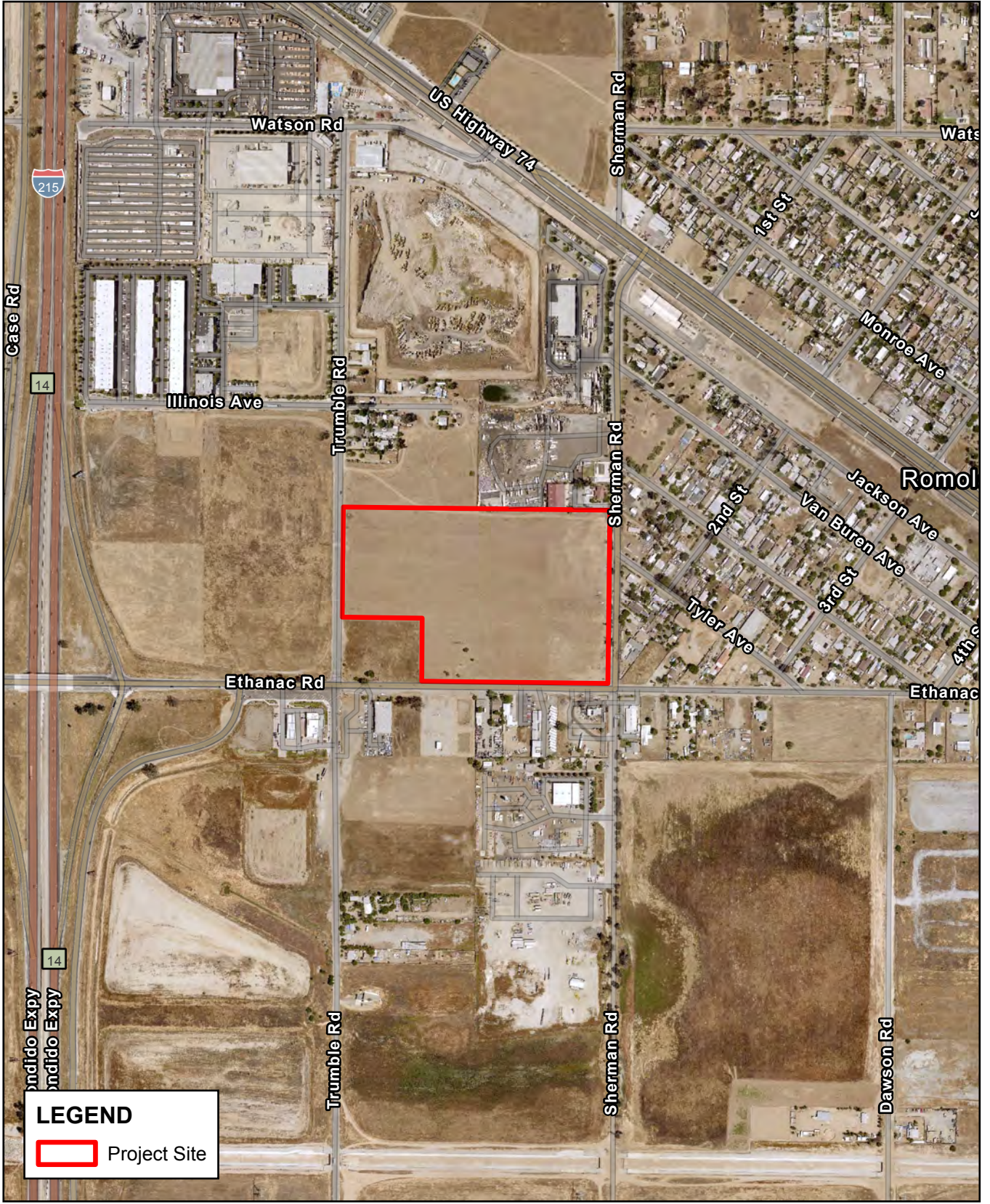
Sources: ESRI / USGS 7.5min Quads: CUCAMONGA PEAK, DEVORE, GUASTI, FONTANA

Figure 2 - USGS Map

Ethanac Logistics Center



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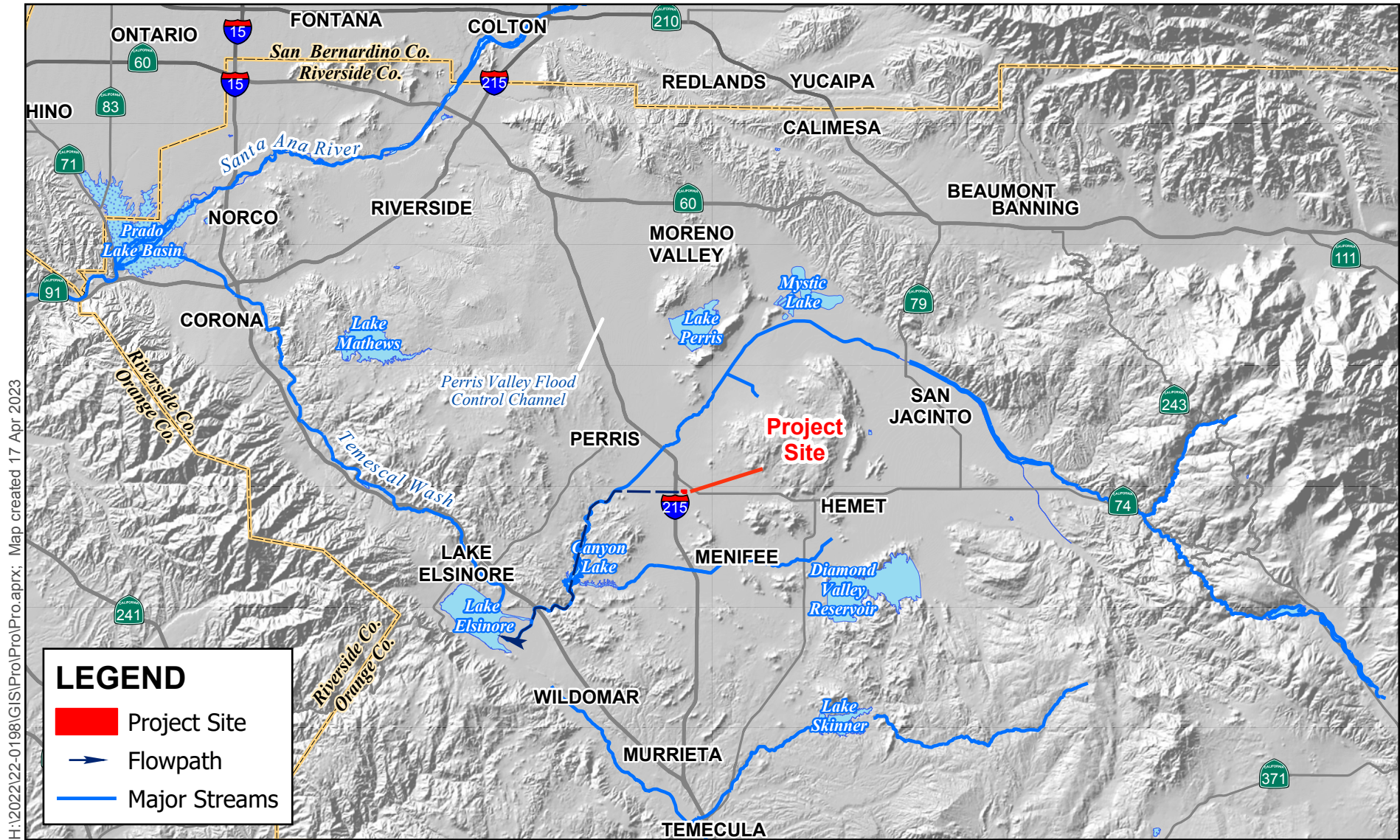


Sources: Riverside Co. GIS, 2022.



0 500 1,000 1,500
 Feet

Figure 3 - Aerial Map
 Ethanac Logistics Center



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Sources: US NHD; USGS 30 Meter DEM

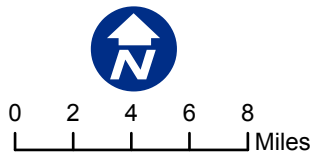
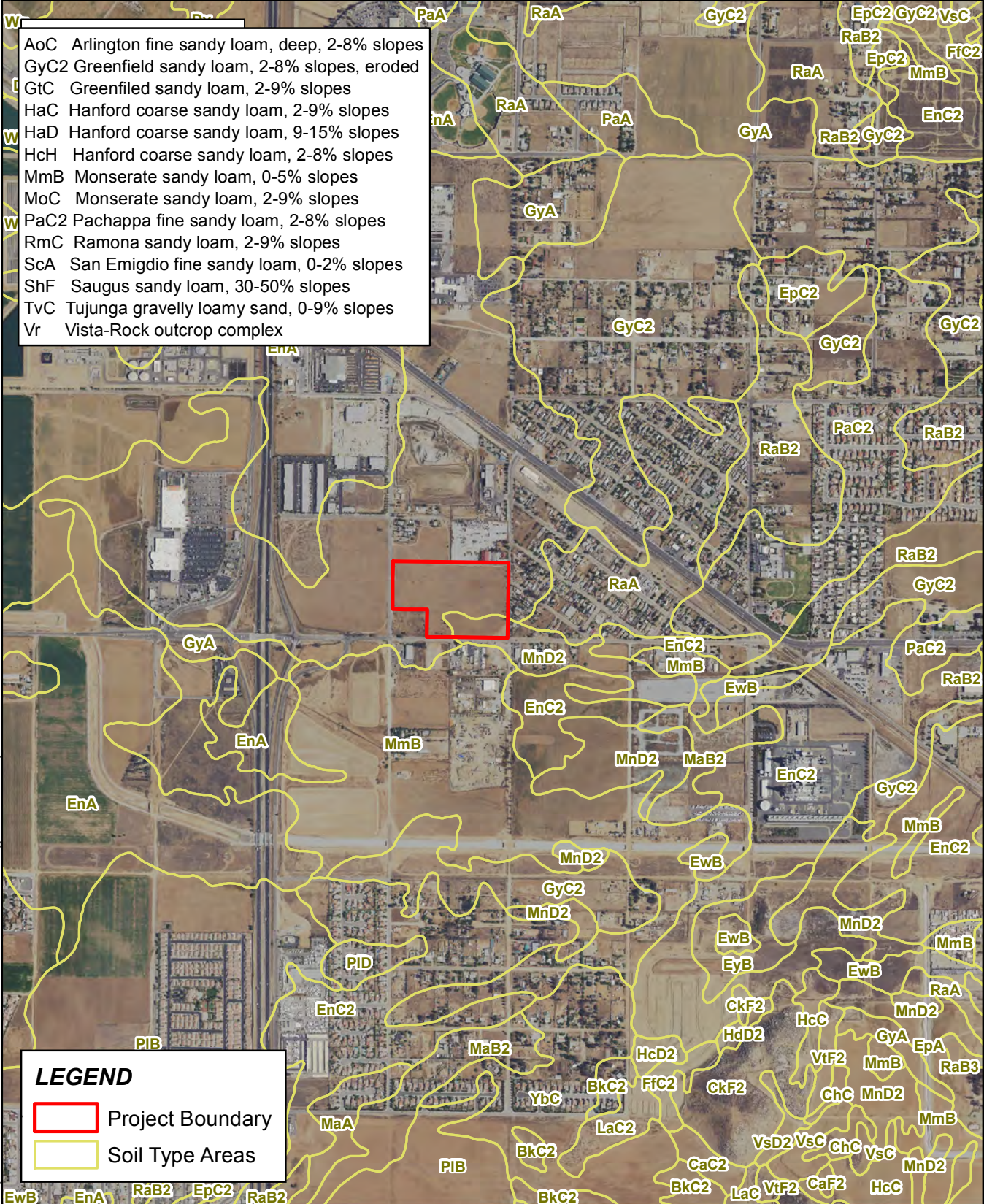


Figure 4 – Receiving Waterbodies

Ethanac Logistics Center



- AoC Arlington fine sandy loam, deep, 2-8% slopes
- GyC2 Greenfield sandy loam, 2-8% slopes, eroded
- GtC Greenfield sandy loam, 2-9% slopes
- HaC Hanford coarse sandy loam, 2-9% slopes
- HaD Hanford coarse sandy loam, 9-15% slopes
- HcH Hanford coarse sandy loam, 2-8% slopes
- MmB Monserate sandy loam, 0-5% slopes
- MoC Monserate sandy loam, 2-9% slopes
- PaC2 Pachappa fine sandy loam, 2-8% slopes
- RmC Ramona sandy loam, 2-9% slopes
- ScA San Emigdio fine sandy loam, 0-2% slopes
- ShF Saugus sandy loam, 30-50% slopes
- TvC Tujunga gravelly loamy sand, 0-9% slopes
- Vr Vista-Rock outcrop complex

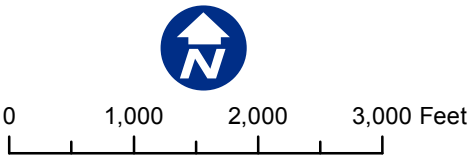


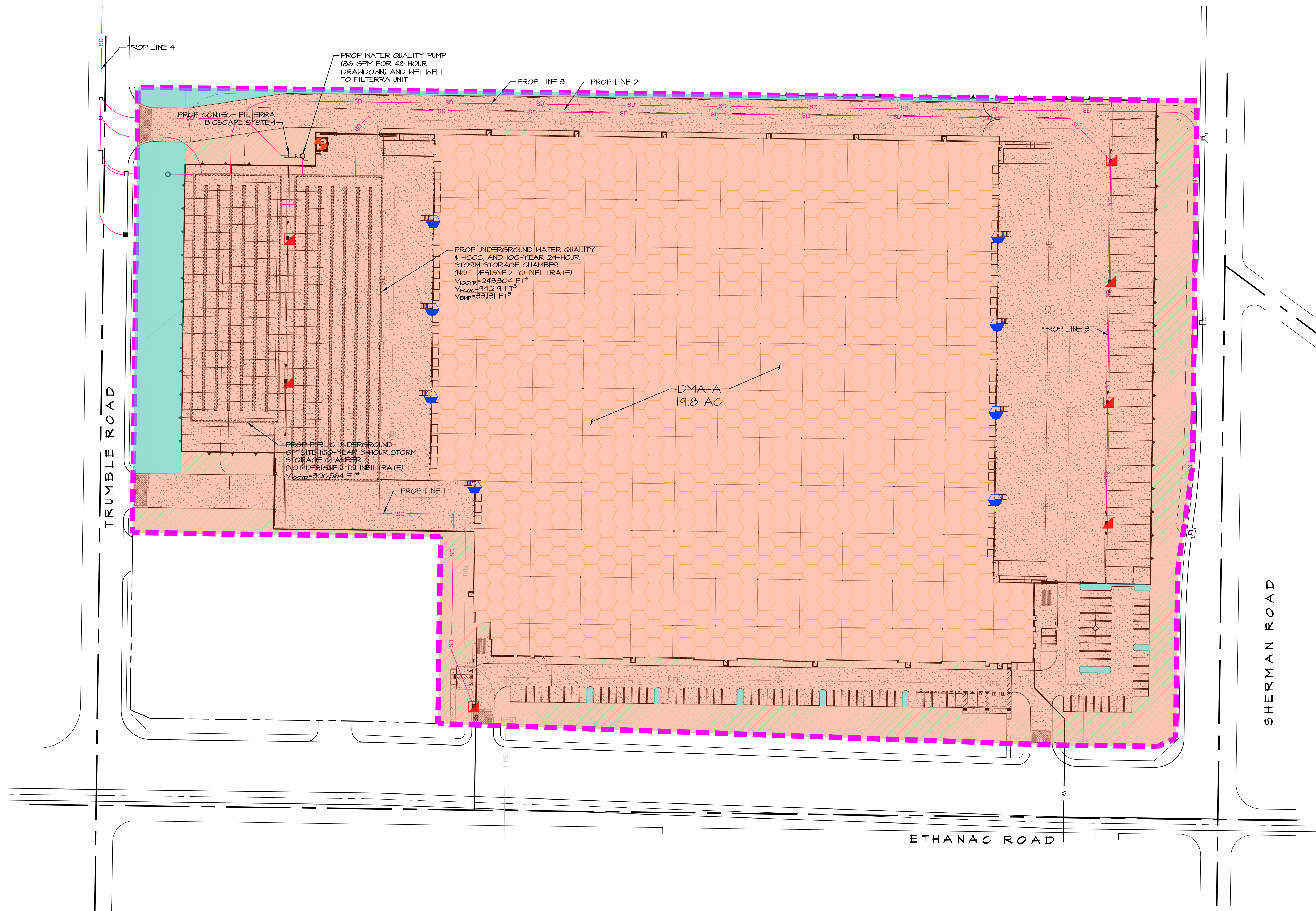
Map created 07 Dec 2022. H:\2022\22-0198\GIS\Fig. 5 Soils Map.mxd

Sources: USDA NRCS SSURGO, 2015;
Riverside Co. GIS, 2020; USDA NAIP, 2016.

Figure 5 – Soils Map

Ethanac Logistics Center





LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- LANDSCAPING
- ROOF
- CONCRETE OR ASPHALT
- SELF RETAINING - DMA-A (ONSITE FLOWS)
- SELF RETAINING - DMA-B (OFFSITE FLOWS)
- FLOW DIRECTION
- STORM DRAIN PIPE
- ROOF DRAIN DOWNSPOUT
- STORM INLET
- TRASH ENCLOSURE

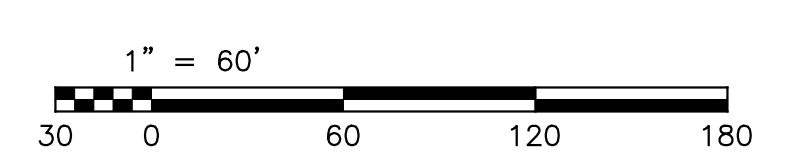
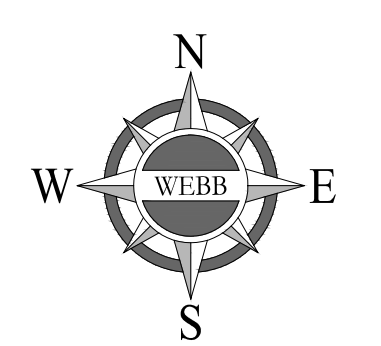
DRAINAGE MANAGEMENT AREAS

LEGEND	DMA-ID	TYPE	AREA (SF)
	L-A	LANDSCAPE	40873
	R-A	ROOF	407336
	H-A	HARDSCAPE	336113
	SR-A	SELF-RETAINING	30345

% IMPERVIOUS = (407336+336113)/864667 = 86.0%

DMA SITE MAP

DMA-A



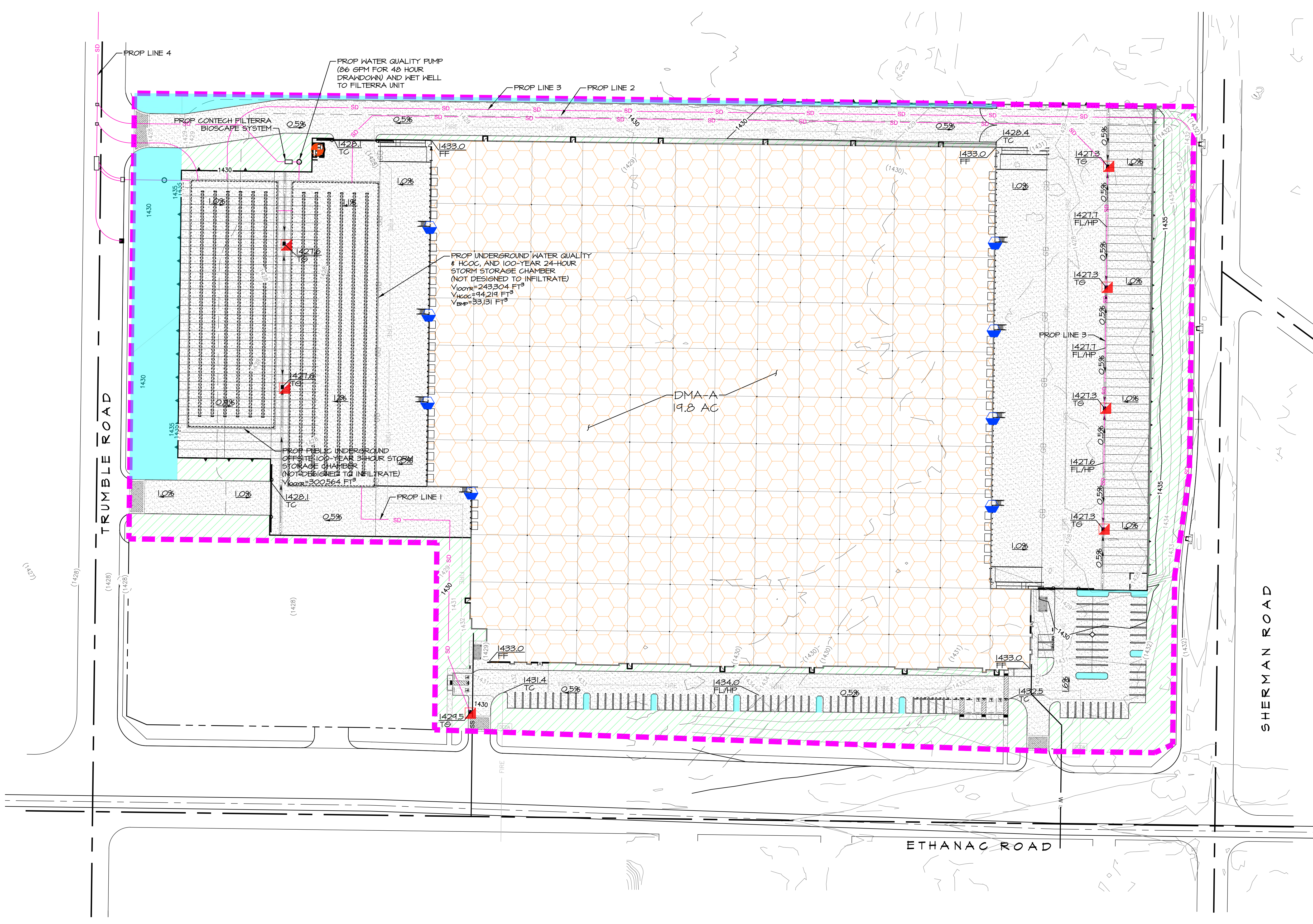
CITY OF PERRIS

**DMA SITE PLAN
ETHANAC LOGISTICS CENTER
P22-00030**

SCALE: 1" = 60'	ALBERTA ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCORAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 22-0198
DATE: 4/1/2023			SHEET 1
DESIGNED: RSB			OF 3 SHEETS
CHECKED: SKK			DWG. NO.
PLN CK REF:			
F.B.			

4/1/2023

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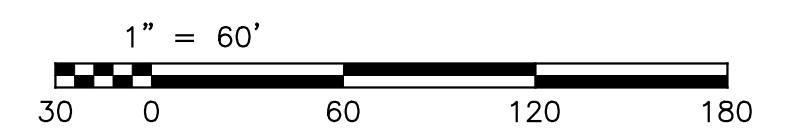
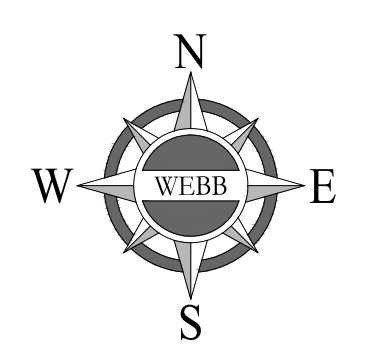
LEGEND

- DRAINAGE MANAGEMENT BOUNDARY
- LANDSCAPING
- ROOF
- CONCRETE OR ASPHALT
- SELF RETAINING - DMA-A (ONSITE FLOWS)
- SELF RETAINING - DMA-B (OFFSITE FLOWS)
- FLOW DIRECTION
- STORM DRAIN PIPE
- ROOF DRAIN DOWNSPOUT
- STORM INLET
- TRASH ENCLOSURE

DRAINAGE MANAGEMENT AREAS

LEGEND	DMA-ID	TYPE	AREA (SF)
	L-A	LANDSCAPE	40873
	R-A	ROOF	407336
	H-A	HARDSCAPE	336113
	SR-A	SELF-RETAINING	30345

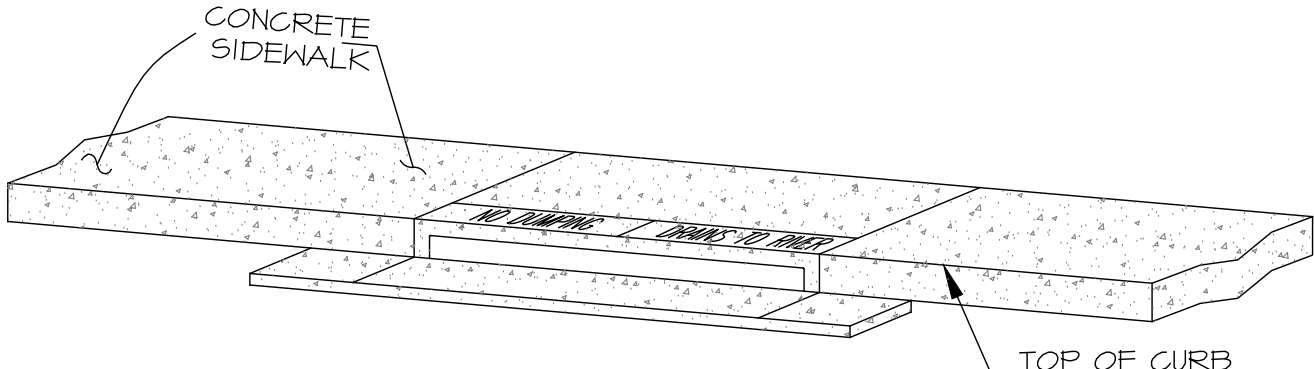
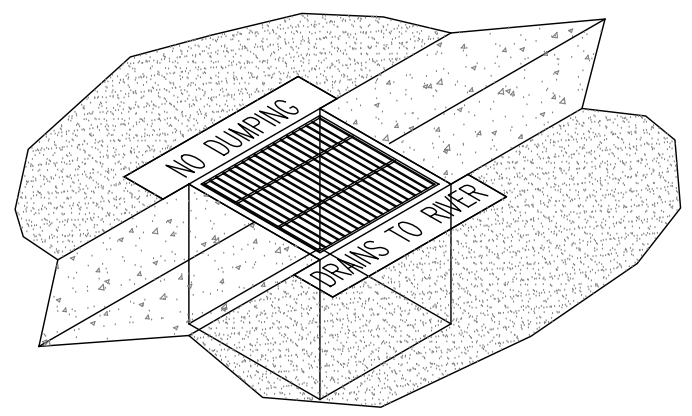
% IMPERVIOUS = $(407336 + 336113) / 864667 = 86.0\%$



CITY OF PERRIS

POST-CONSTRUCTION BMP SITE PLAN
ETHANAC LOGISTICS CENTER
P22-00030

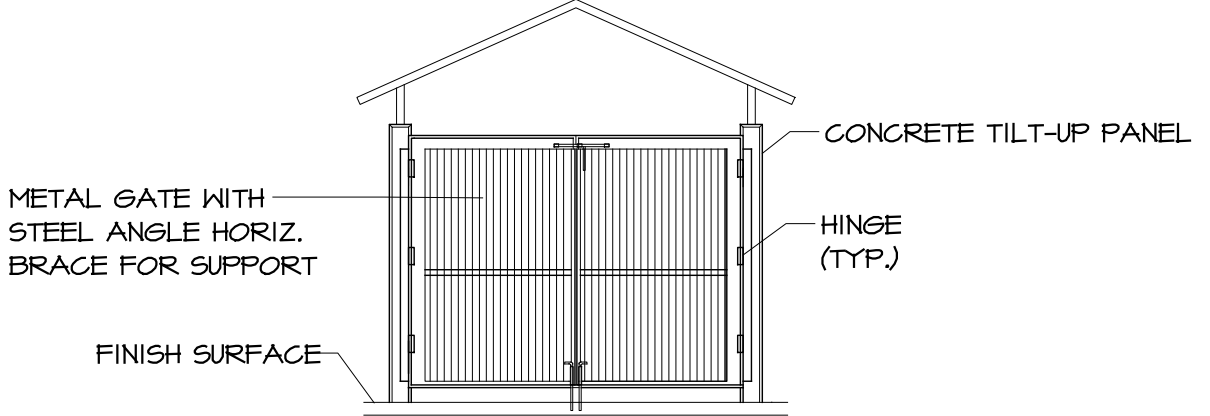
SCALE: 1" = 60'	<p>ALBERT A. ENGINEERING CONSULTANTS 3788 MCCRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256</p>	W.O. 22-0198
DATE: 4/1/2023		SHEET 2
DESIGNED: RSB		OF 3 SHEETS
CHECKED: SKK		DWG. NO.
PLN CK REF:		
F.B.		



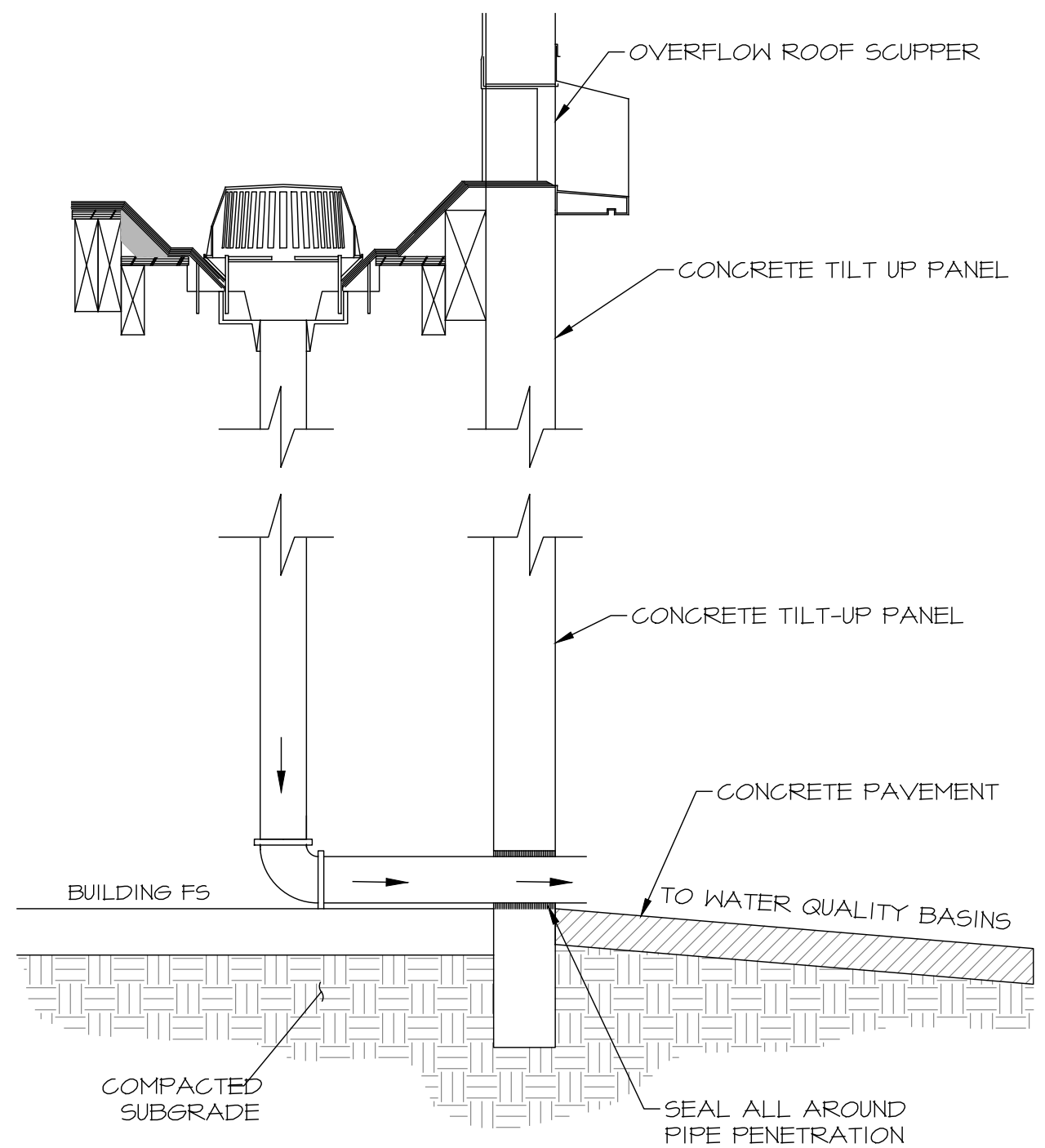
- 1 STENCILS TO HAVE 2" LETTERS AS FOLLOWS: "NO DUMPING - DRAINS TO RIVER"
- 2 PLACE BOTH STENCILS CENTERED WITHIN THE CATCHBASIN OPENINGS AND WITHIN THE TOP OF THE CURB.
- 3 SPRAY BOTH STENCILS WITH WHITE PAINT.
- 4 REMOVE STENCILS WHEN PAINT IS DRY.

CATCH BASIN STENCILING DETAIL
N.T.S.

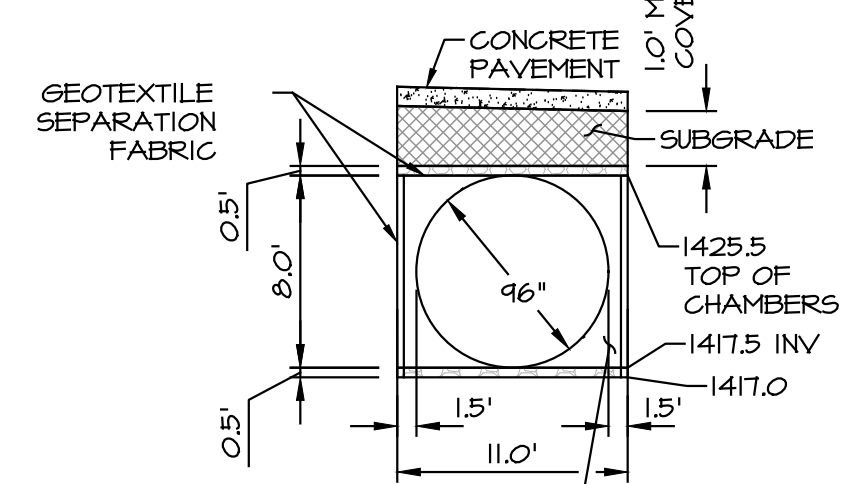
ALL TRASH ENCLOSURES SHALL BE COVERED PER CITY STANDARDS



TRASH ENCLOSURE GATE ELEVATION
N.T.S.

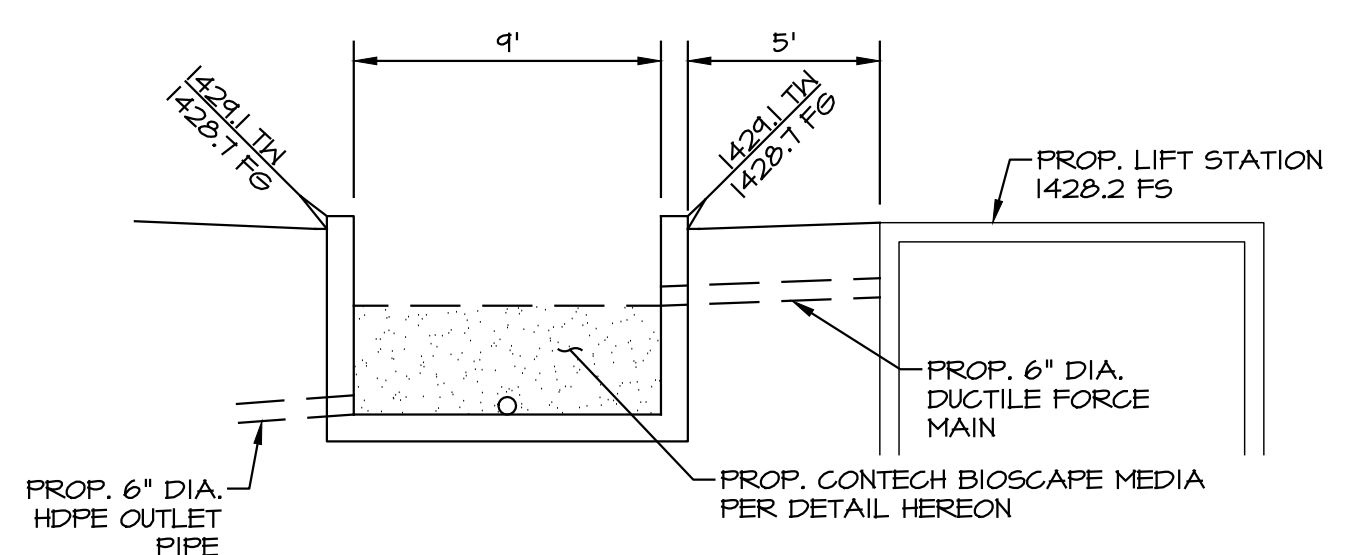
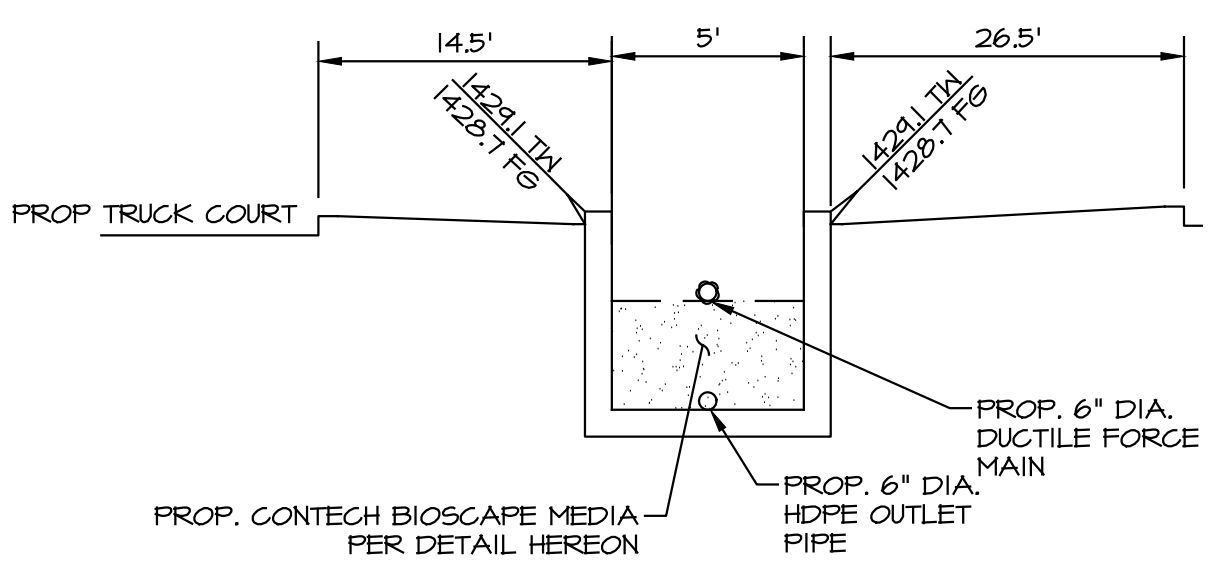


ROOF DRAIN DETAIL
N.T.S.



BACKFILL WITH GRAVEL PER AASHTO NO. 57 OR 61 COARSE AGGREGATE LAYER WITH 40% VOID RATIO PLACEMENT PER CONTECH SPECIFICATIONS

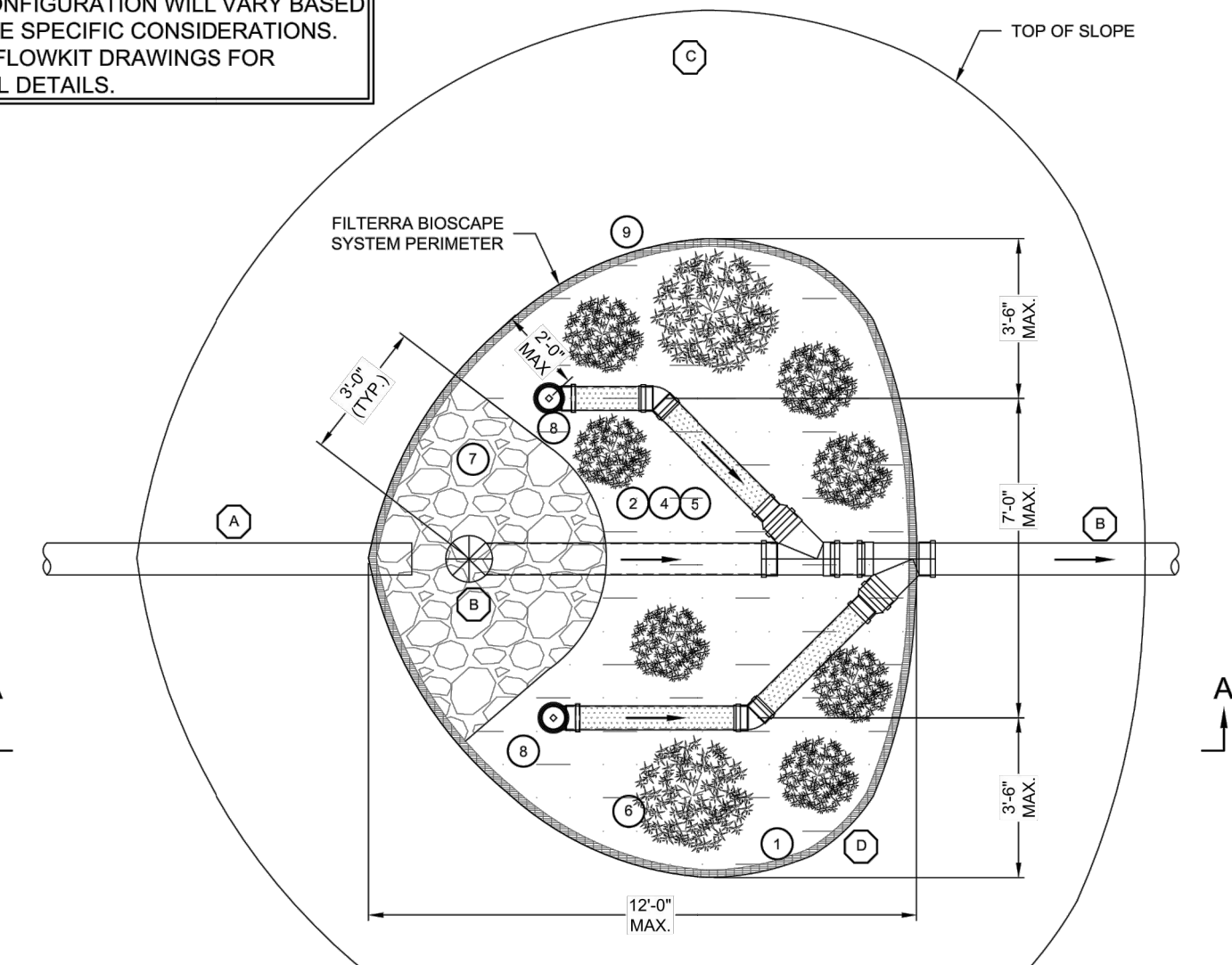
CONTECH CMP UNDERGROUND DETENTION SYSTEM TYPICAL ROW CROSS SECTION
N.T.S.



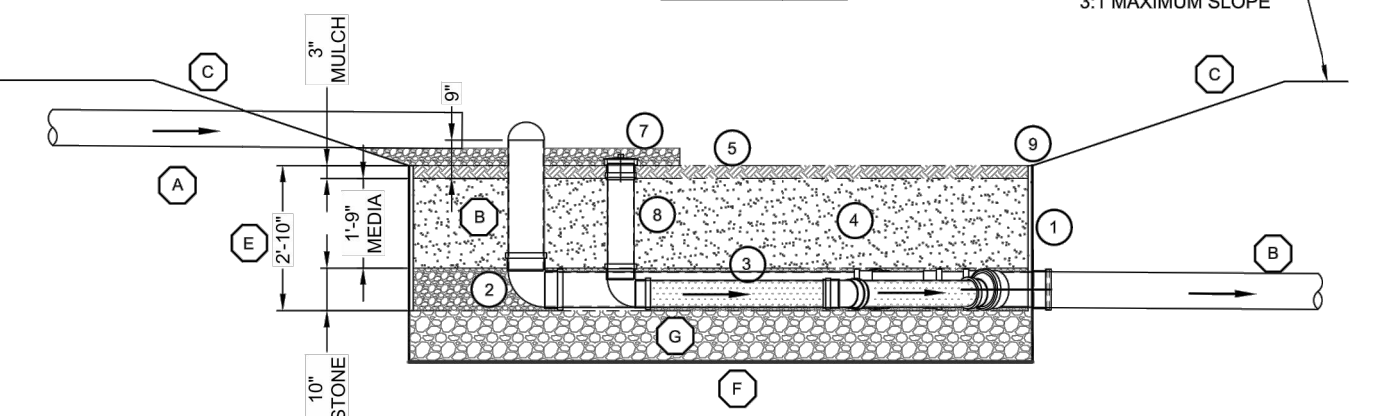
CONTECH FILTERRA UNIT DETAIL
N.T.S.
SEE DETAIL HEREON

THIS IS A SCHEMATIC LAYOUT ONLY. ACTUAL CONFIGURATION WILL VARY BASED ON THE SITE SPECIFIC CONSIDERATIONS. REFER TO FLOWKIT DRAWINGS FOR ADDITIONAL DETAILS.

16 COMMUNICATIONS FOR FILTERRA STANDARD DRAINAGE SYSTEM - BMP DETAIL DWG. 22-0198-B-01



PLAN VIEW



SECTION A-A VIEW

BILL OF MATERIALS		
COUNT	DESCRIPTION	INSTALLED BY
X	FILTERRA SURFACE AREA (SF)	CONTRACTOR
X	MULCH VOLUME (CY)	CONTRACTOR
XX	FILTERRA MEDIA VOLUME (CY)	CONTRACTOR
X	12" #4 ROUND AGGREGATE UNDERDRAIN STONE (CY)	CONTRACTOR
X	ENERGY DISSIPATION ROCK (CY)	CONTRACTOR
X	EROSION CONTROL (LF)	CONTRACTOR
X	FILTERRA FLOWKIT	CONTRACTOR

PLANTING SCHEDULE	
*NOTE: PLANTS PROVIDED BY OTHERS	
QUANTITY	FILTERRA BIOSCAPE SYSTEM PLANT PALETTE

- GENERAL NOTES**
1. CONTRACTOR SHALL CONTACT CONTECH TO COORDINATE DELIVERY AND SUPERVISION OF PLACEMENT OF FILTERRA BIOSCAPE SYSTEM COMPONENTS (ACTIVATION). CONTRACTOR SHALL COMPLETE ITEMS IN THE LIST OF CONTRACTOR INSTALLATION RESPONSIBILITIES LISTED ON THIS DETAIL. BEFORE CONTECH'S REPRESENTATIVE ATTENDS AND SUPERVISES THE ACTIVATION OF THE BIOSCAPE SYSTEM.
 2. PERFORM FILTERRA BIOSCAPE SYSTEM EXCAVATION ONLY AFTER ALL THE CONTRIBUTING DRAINAGE AREAS ARE PERMANENTLY STABILIZED. DO NOT STOCKPILE MATERIALS NOR STORE EQUIPMENT IN THIS AREA.
 3. USE METHODS OF EXCAVATION THAT MINIMIZE COMPACTION OF THE UNDERLYING SOIL UNLESS THE SYSTEM IS TO BE LINED. CONTRACTOR SHALL COORDINATE WITH CONTECH BEFORE THE FILTERRA BIOSCAPE SYSTEM AREA IS EXCAVATED TO MINIMIZE TIME BETWEEN EXCAVATION AND DELIVERY AND ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM. ANY STANDING WATER THAT ACCUMULATES IN THE EXCAVATED AREA MUST BE REMOVED BY THE CONTRACTOR BEFORE CONTECH CAN PROVIDE ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM. ANY ADDITIONAL EXCAVATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. EXCAVATION DIMENSIONS SHOULD BE PROVIDED TO CONTECH IN THE ACTIVATION REQUEST CHECKLIST.
 4. CONTRACTOR SHALL PROVIDE ACCESS TO THE EXCAVATED AREAS FOR USE DURING THE ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEMS. ACCESS SHALL NOT PROHIBIT LIGHT DUTY EQUIPMENT THAT MAY BE USED TO INSTALL THE COMPONENTS (STONE, MEDIA, ETC.). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY RE-STABILIZATION THAT MAY BE REQUIRED AFTER THE FILTERRA BIOSCAPE SYSTEM ACTIVATION.
 5. CONTECH AND/OR ITS REPRESENTATIVES MUST BE SCHEDULED TO BE ON SITE FOR THE LIST ENTITLED CONTRACTOR ACTIVATION RESPONSIBILITIES.

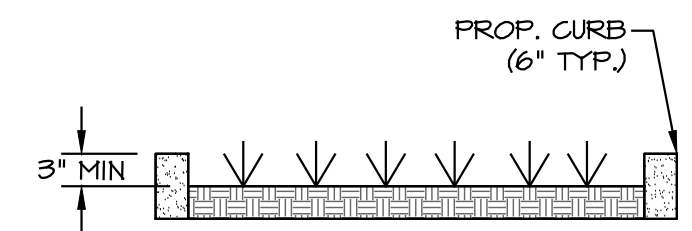
- CONTRACTOR SITE PREPARATION RESPONSIBILITIES AS DENOTED BY (A) ON THIS DETAIL:**
- (A) CONTRACTOR SHALL INSTALL PIPE OR SWALE THAT CONVEYS INFLUENT FLOWS AS WELL AS ANY REQUIRED INLET AND OUTLET STRUCTURES.
 - (B) CONTRACTOR SHALL PROVIDE BYPASS PIPE AND RISER OR OTHER STRUCTURE AS SHOWN ON PLANS. THE BYPASS PIPE SHALL BE INSTALLED WITH WYE(S) OR OTHER PIPE FITTINGS, AND WITH REDUCER COUPLING(S) FOR CONNECTION OF UNDERDRAIN PIPE, PER PLANS. PIPES SHALL BE INSTALLED TO PROMOTE POSITIVE FLOW FROM THE FILTERRA BIOSCAPE SYSTEM.
 - (C) IF REQUIRED, CONTRACTOR TO PROVIDE SHOULDER ACCORDING TO DIMENSION AND SLOPE SHOWN ON PLANS OR AS DESIGNED BY ENGINEER OF RECORD. SLOPE FROM SHOULDER TO FILTERRA BIOSCAPE SYSTEM SURFACE AREA SHALL NOT EXCEED 3:1. SOIL IS REQUIRED TO STABILIZE SIDE SLOPES OR ADJACENT GRADE.
 - (D) CONTRACTOR TO EXCAVATE MEDIA AREA CORRESPONDING TO THE SIZE OF THE FILTERRA BIOSCAPE SYSTEM SURFACE AREA AS SHOWN ON DETAIL AND ON PLAN SHEETS.
 - (E) CONTRACTOR SHALL EXCAVATE VERTICALLY FROM BOTTOM OF UNDERDRAIN STONE, OR DRAINAGE STONE, IF REQUIRED, TO ELEVATION OF MULCH AS SHOWN ON THIS DETAIL.
 - (F) CONTRACTOR TO PROVIDE AND INSTALL ANY GEOTEXTILE OR IMPERMEABLE LINER FOR BOTTOM OF THE FILTERRA BIOSCAPE SYSTEM IF REQUIRED PER THE PLANS.
 - (G) CONTRACTOR TO PROVIDE AND INSTALL ANY ADDITIONAL DRAINAGE STONE BELOW THE FILTERRA BIOSCAPE SYSTEM AS CALLED OUT ON THE PLANS.

- CONTRACTOR ACTIVATION RESPONSIBILITIES AS DENOTED BY (B) ON THIS DETAIL:**
- (B) PLACE GEOTEXTILE FABRIC ALONG THE PERIMETER OF THE FILTERRA BIOSCAPE SYSTEM EXCAVATION.
 - (C) PLACE 12" OF UNDERDRAIN STONE - 2" UNDER THE PIPING, 6" AROUND THE PIPING AND 2" ABOVE THE PIPING USING LIGHT DUTY EQUIPMENT ONLY.
 - (D) PLACE 6" UNDERDRAIN PIPING UNLESS OTHERWISE APPROVED BY CONTECH. ASSOCIATED PIPING AND FITTINGS/ELBOWS TO CONNECT TO THE PIPING/FITTING(S) THAT IS PROVIDED BY CONTRACTOR (SEE CONTRACTOR INSTALLATION RESPONSIBILITIES THIS DETAIL).
 - (E) PLACE 2" FILTERRA MEDIA USING LIGHT DUTY EQUIPMENT ONLY. DO NOT COMPACT MEDIA.
 - (F) PLACE 3" DOUBLE SHREDDED HARDWOOD MULCH OVER ENTIRE FILTERRA BIOSCAPE SYSTEM SURFACE AREA USING LIGHT DUTY EQUIPMENT ONLY. DO NOT COMPACT MULCH.
 - (G) PROVIDE AND PLANT VEGETATION AS INDICATED IN TABLE ON THIS DETAIL OR ON SITE PLANS.
 - (H) PLACE ENERGY DISSIPATION ROCK APRON AS DESIGNED AND INDICATED ON THIS DETAIL OR PER ENGINEER OF RECORD PLANS.
 - (I) PLACE CLEANOUT ADAPTER, PLUG AND PIPING.
 - (J) PLACE ADDITIONAL EROSION CONTROL AROUND FILTERRA BIOSCAPE SYSTEM (IF REQUIRED).

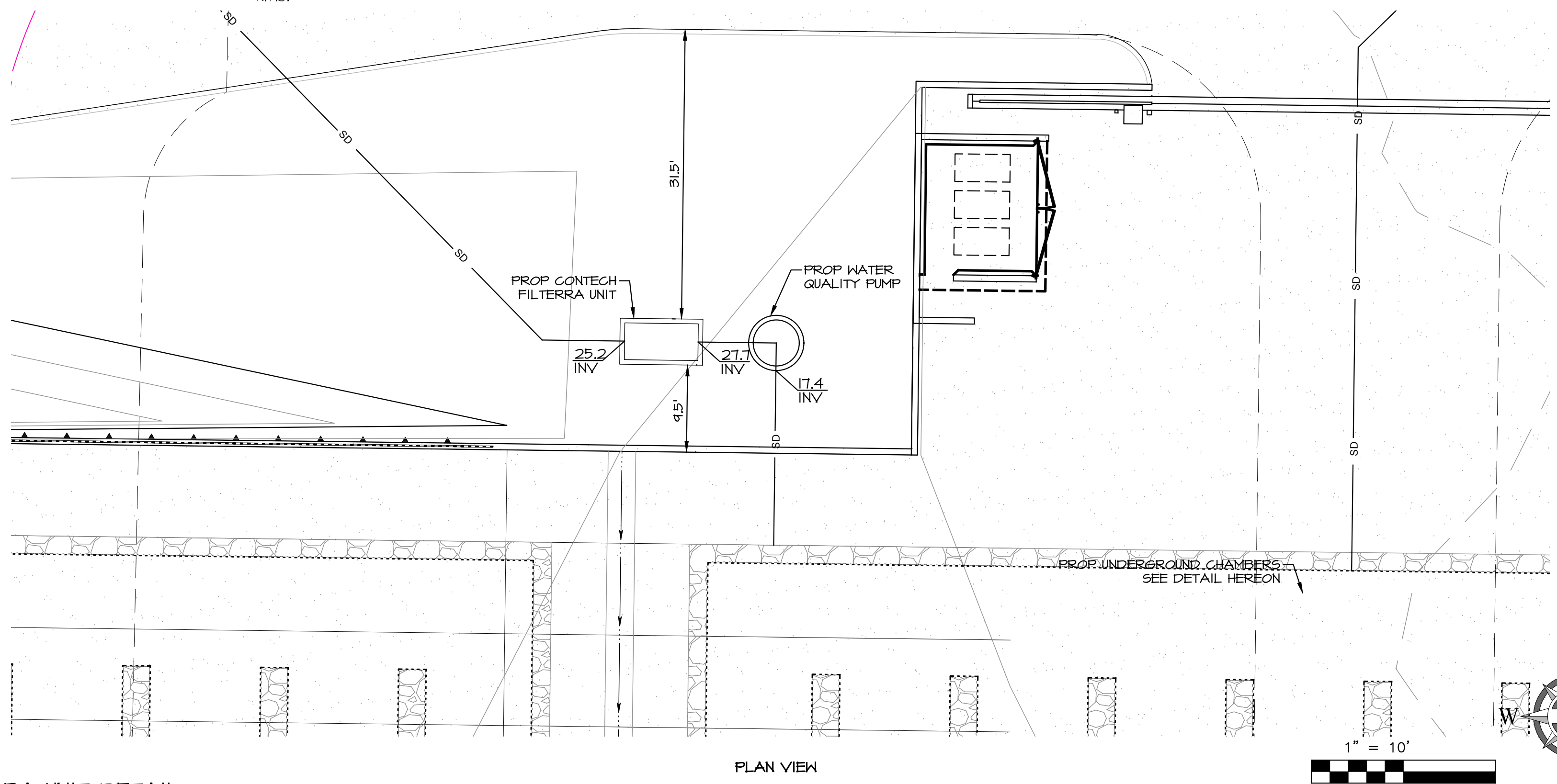


FILTERRA BIOSCAPE™ SYSTEM STANDARD DETAIL

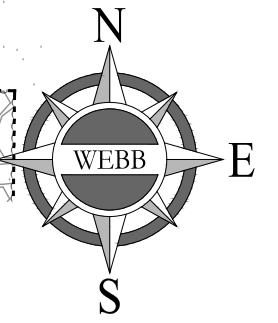
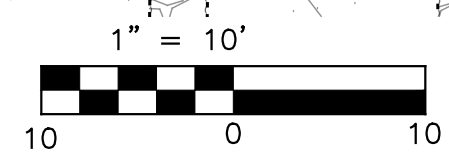
BMP-A
N.T.S.



SELF-RETAINING FINGER ISLAND
N.T.S.
ALL SELF-RETAINING AREAS WILL BE DEPRESSED A MINIMUM OF 3-INCHES



PLAN VIEW



CITY OF PERRIS

POST-CONSTRUCTION BMP DETAILS
ETHANAC LOGISTICS CENTER
P22-00030

SCALE: N/A	ALBERT A. ENGINEERING CONSULTANTS	W.O. 22-0198
DATE: 4/1/2023	3788 McCORAY STREET	SHEET 3
DESIGNED: RSB	RIVERSIDE CA 92506	OF 3 SHEETS
CHECKED: SKK	PH. (951) 686-1070	DWG. NO.
PLN CK REF: REF	FAX (951) 788-1256	
F.B.		

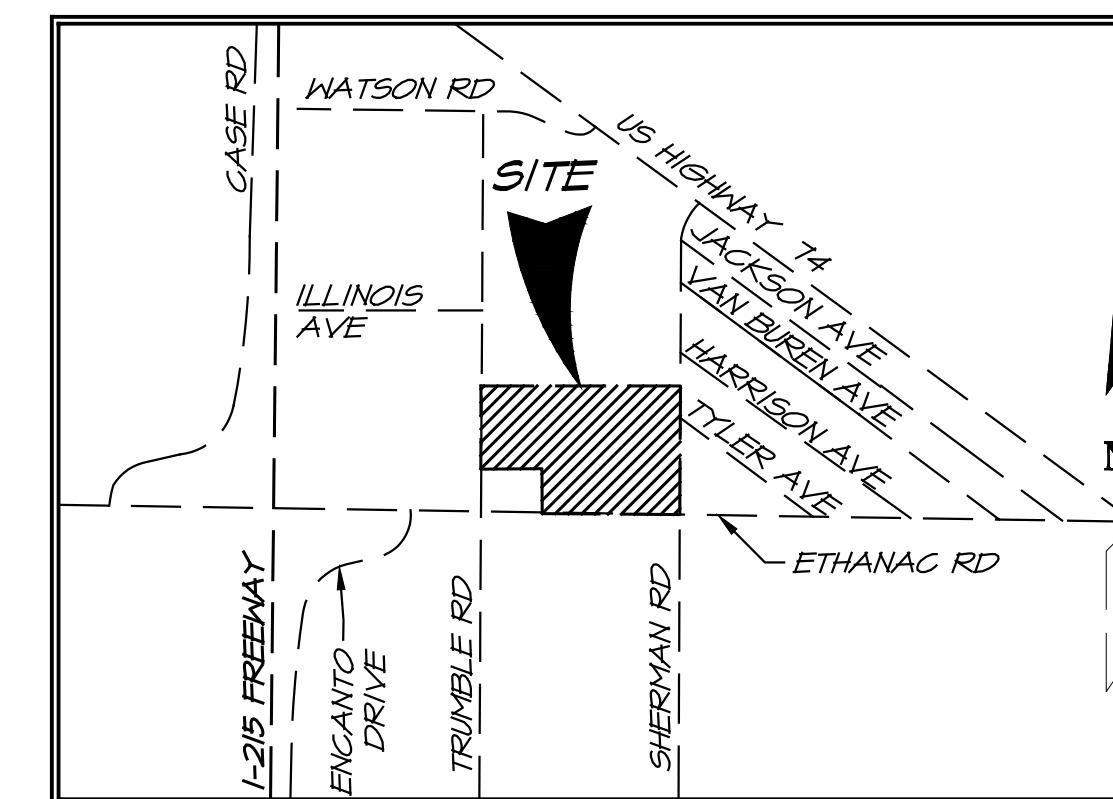
H:\2022\22-0198\DRAINAGE\WQMP\DWG DRAWINGS\WQMP\DWG 22-0198-PWQMP.DWG 9/1/2023 4:41:04 PM

Appendix 2: Construction Plans

Grading and Drainage Plans

IN THE CITY OF PERRIS, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA DEVELOPMENT PLAN REVIEW NO. 22-00030

LOCATED IN SECTION 10 SW, T. 5S., R. 3W., S.B.M.



VICINITY MAP
NTS

OWNER/APPLICANT

HILLWOOD INVESTMENT PROPERTIES
901 VIA PIEMONTE STE. 175
ONTARIO CA, 91764
CONTACT: JOHN GRACE
EMAIL: JOHN.GRACE@HILLWOOD.COM
PHONE: (909) 256-5424

PROJECT REPRESENTATIVE

ALBERT A. WEBB ASSOCIATES
3788 MCCRAY STREET
RIVERSIDE, CA 92506
CONTACT: RICHARD BELMUEZ
PHONE: (951) 686-1070
FAX: (951) 788-1256

SOILS ENGINEER

SOUTHERN CALIFORNIA GEOTECHNICAL
22885 E. SAVI RANCH PARKWAY,
SUITE E
YORBA LINDA, CA 92887
CONTACT: ROBERT TRAZO
PHONE: (714) 685-1115
FAX: (714) 685-1118

ENGINEER

ALBERT A. WEBB ASSOCIATES
3788 MCCRAY STREET
RIVERSIDE, CA 92506
CONTACT: SARAH KOWALSKI
PHONE: (951) 686-1070
FAX: (951) 788-1256

A.P.N.

324-240-016 THRU -020, -023,
THRU -027

ARCHITECT

HPA ARCHITECTS
18931 BARDEEN AVE., STE 100
IRVINE, CA 92612
CONTACT: INKON KIM
PHONE: (949) 863-1100
EMAIL: INKON@HPARCHS.COM

ACREAGE

GROSS 21.6 AC
NET 19.9 AC
R/W 1.7 AC

TOPOGRAPHY SOURCE

TOPOGRAPHY FLOWN BY INLAND AERIAL
SURVEYS INC. ON 02/15/2022

LAND USE

EXISTING LAND USE: VACANT
EXISTING GENERAL PLAN LAND USE: COMMERCIAL COMMUNITY (CC)
EXISTING ZONING: COMMERCIAL COMMUNITY (CC)
PROPOSED GENERAL PLAN LAND USE: LIGHT INDUSTRIAL (LI)
PROPOSED ZONING: LIGHT INDUSTRIAL (LI)

PROJECT DATA

BUILDING AREA	10,000 SF
OFFICE - FIRST FLOOR	5,000 SF
OFFICE - SECOND FLOOR	5,000 SF
WAREHOUSE	347,348 SF
TOTAL BUILDING FOOTPRINT	407,348 SF
TOTAL FLOOR AREA	412,348 SF

AUTO PARKING REQUIRED

OFFICE:	N/A
(1 STALL/300 SF IF LESS THAN 10% GFA)	
WAREHOUSE:	105 STALLS
400K SF @ (30 STALLS + 1 STALL/5,000 SF)	
TOTAL	105 STALLS

AUTO PARKING PROVIDED

STANDARD (9' x 19')	76 STALLS
ADA STANDARD (9' x 19')	3 STALLS
ADA VAN (12' x 19')	2 STALLS
EV ADA STANDARD (9' x 19')	1 STALLS
EV ADA VAN (12' x 19')	1 STALLS
EV AMBULATORY (10' x 19')	1 STALLS
EVCS STANDARD (9' x 19')	3 STALLS
EV CALPABLE (9' x 19')	14 STALLS
TOTAL	106 STALLS

TRAILER PARKING REQUIRED

17,500 SF	82 STALLS
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TRAILER PARKING PROVIDED

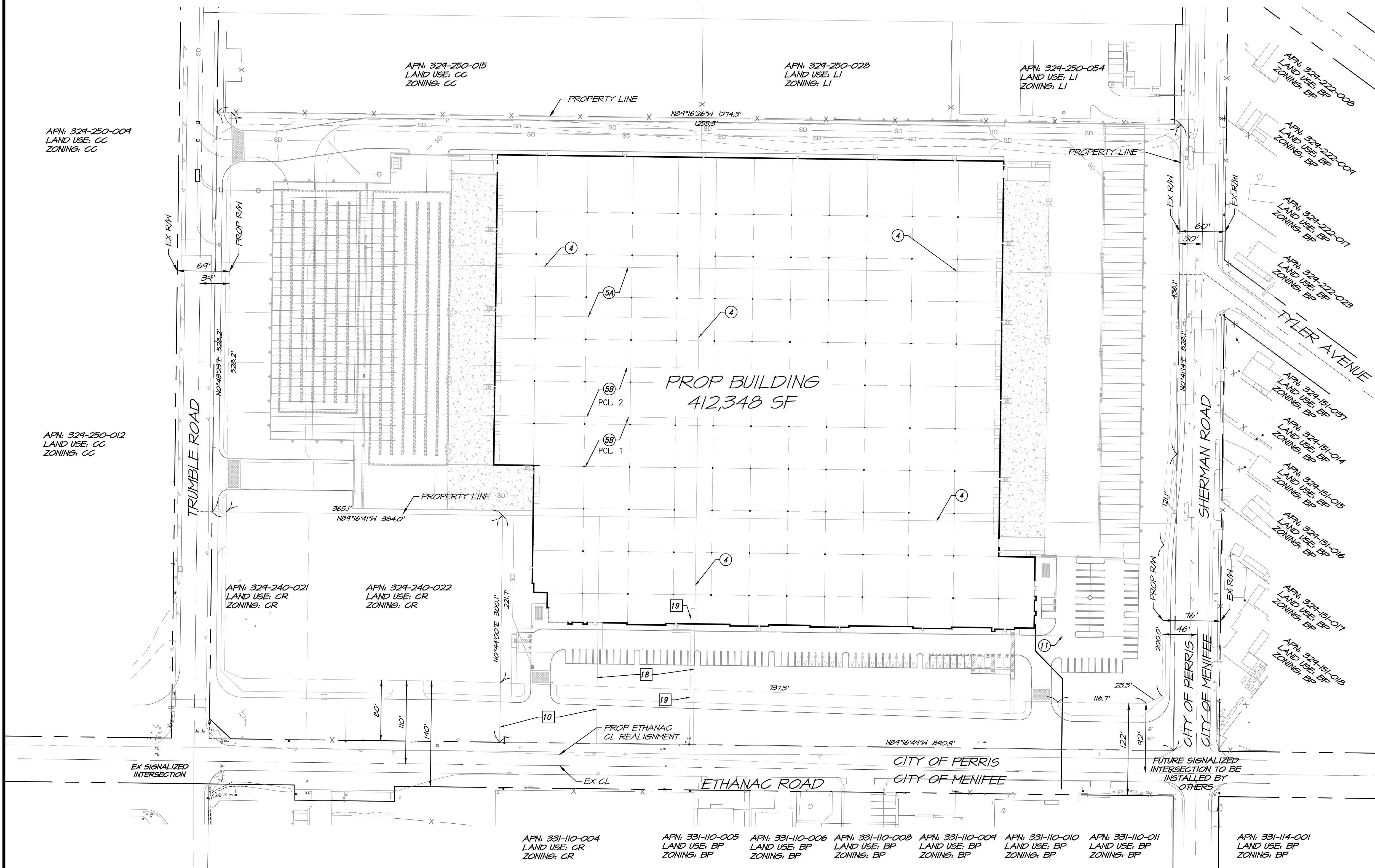
TYPICAL TRAILER (10' x 55')	157 STALLS
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EARTHWORK ESTIMATE

CUT:	15,800 CY
FILL:	66,100 CY
NET:	50,300 CY (FILL)

SHEET INDEX

SHEET 1 - TITLE SHEET
SHEET 2 - STREET AND GRADING SECTIONS
SHEET 3 - CONCEPTUAL GRADING
SHEETS 4-5 - CONCEPTUAL UTILITIES



GENERAL INFORMATION

- ALL PARCELS WITHIN PROJECT BOUNDARY TO BE COMBINED VIA PARCEL MAP
- THOMAS BROS. MAP BOOK PAGE: 038, GRID: C1 AND D1
- PROJECT IS NOT WITHIN A SPECIFIC PLAN
- PROJECT LIES WITHIN THE CITY OF PERRIS REDEVELOPMENT PROJECT AREA.
- PROJECT LIES WITHIN CPD NO. 1.
- EASEMENTS OF RECORD ARE PLOTTED HEREIN.
- PROJECT IS WITHIN EASTERN MUNICIPAL WATER DISTRICT
- THERE ARE NO EXISTING WELLS ON THE PROPERTY.
- ALL SLOPES ARE 2:1 RATIO, UNLESS OTHERWISE NOTED.
- LAND IS NOT WITHIN A SPECIAL STUDIES ZONE.
- LAND HAS LOW POTENTIAL FOR LIQUEFACTION PER SOCAL GEO REPORT DATED 02/23/2022.
- SUB-SURFACE SEPTIC DISPOSAL IS NOT INTENDED ON SITE.
- STRUCTURES AND/OR DWELLINGS DO NOT EXIST ON SITE.
- THE PROJECT WILL COMPLY WITH NPDES REQUIREMENTS AS REQUIRED BY NPDES SUPPLEMENT "A".
- FLOOD ZONE X, AREA OF LOW FLOODING PER FEMA PANEL 06065C2060H.
- PROJECT LIES WITHIN AIRPORT LAND USE COMPATIBILITY ZONE D
- ARCHITECTURAL SITE PLAN PROVIDED BY HPA ARCHITECTURE ON 04/12/23

UTILITY PROVIDERS

- WATER:** EASTERN MUNICIPAL WATER DISTRICT
PHONE: (951) 685-7434
- SEWER:** EASTERN MUNICIPAL WATER DISTRICT
PHONE: (951) 685-7434
- GAS:** SOUTHERN CALIFORNIA GAS COMPANY
PHONE: (909) 307-1070
- ELECTRIC:** SOUTHERN CALIFORNIA EDISON
PHONE: 1 (800) 655-4555
- TELEPHONE:** CHARTER COMMUNICATIONS (SPECTRUM)
PHONE: (951) 406-1666
- CABLE T.V.:** FRONTIER COMMUNICATIONS
PHONE: (310) 264-5100
- SCHOOL DISTRICT(S):** ROMOLAND SCHOOL DISTRICT (TK-8)
PHONE: (951) 426-4244
PERRIS UNION HIGH SCHOOL DISTRICT (9-12)
PHONE: (951) 943-6369

EASEMENT NOTES

SEE SHEET 2

LEGAL DESCRIPTION

SEE SHEET 2

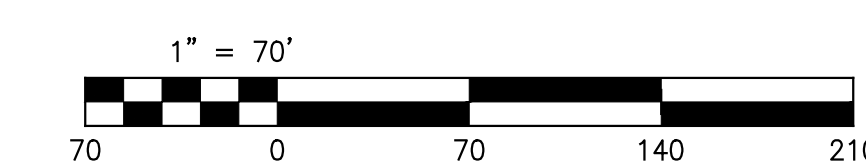
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REVISIONS	DATE	BY

CITY OF PERRIS
ETHANAC LOGISTICS CENTER
TITLE SHEET
DEVELOPMENT PLAN REVIEW NO. 22-00030

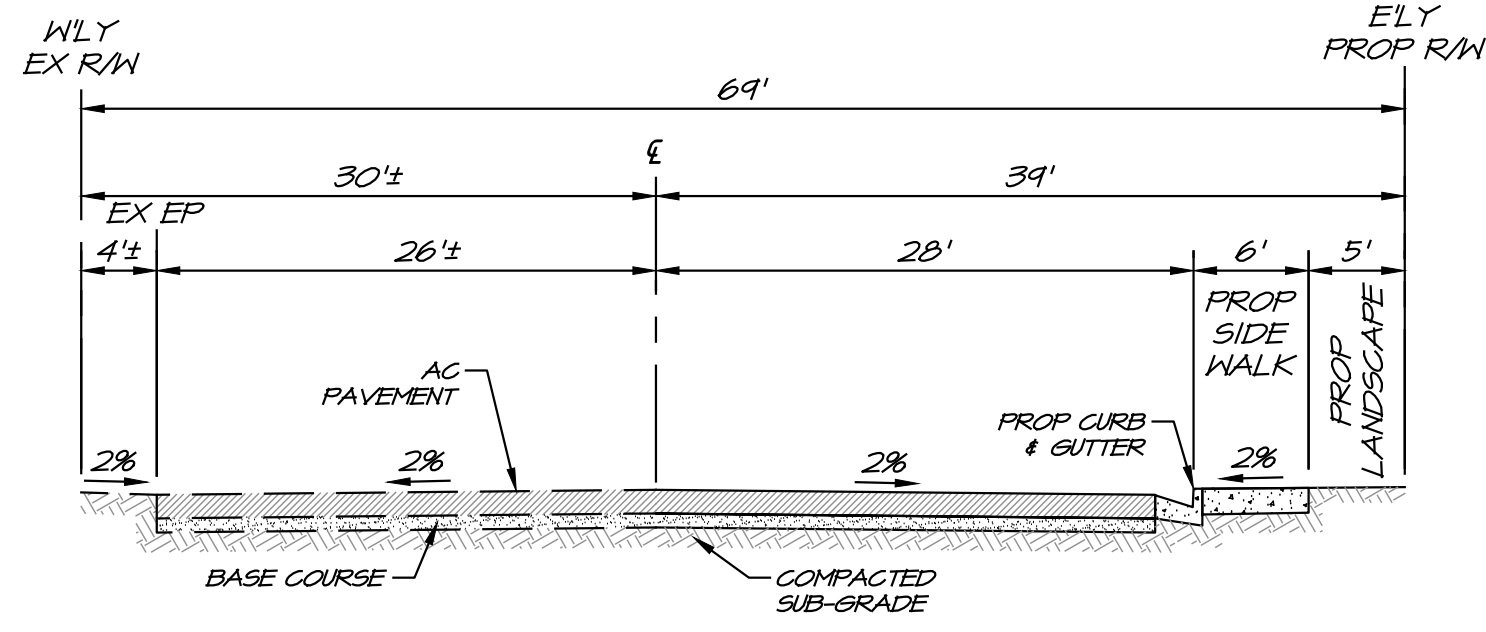
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CHECKED: SK
PLN CK REF: F.B.

ALBERT A. WEBB ASSOCIATES
ENGINEERING CONSULTANTS
3788 MCCRAY STREET
RIVERSIDE, CA 92506
PH. (951) 686-1070
FAX (951) 788-1256

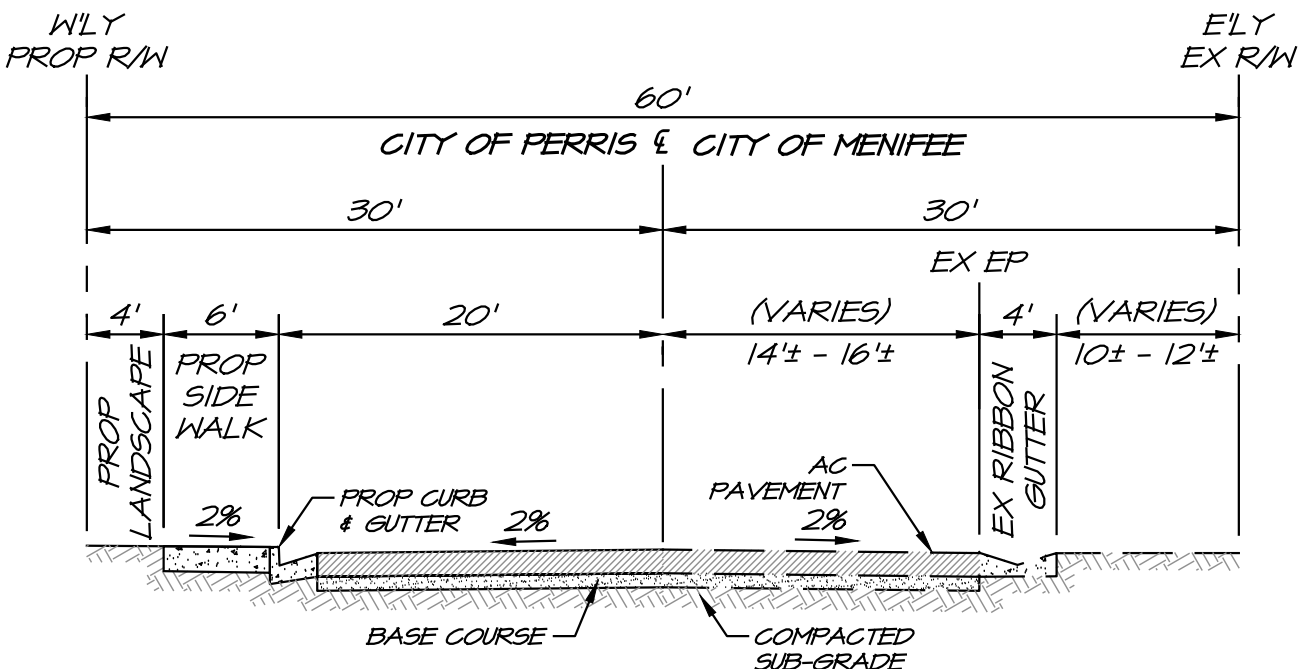
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SHEET 1
OF 5 SHEETS
DWG. NO.



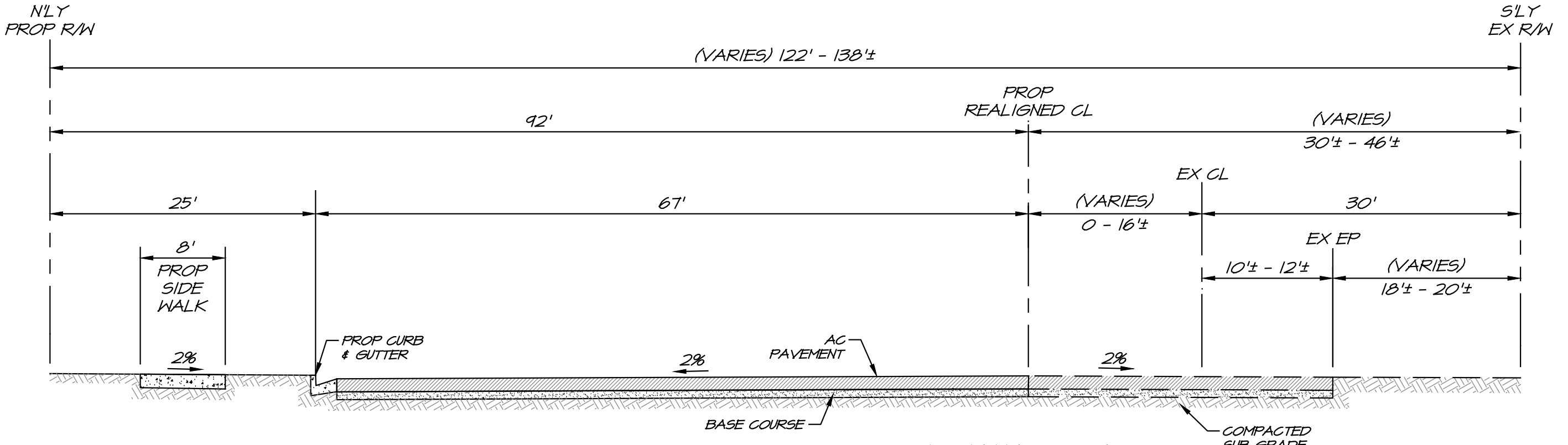
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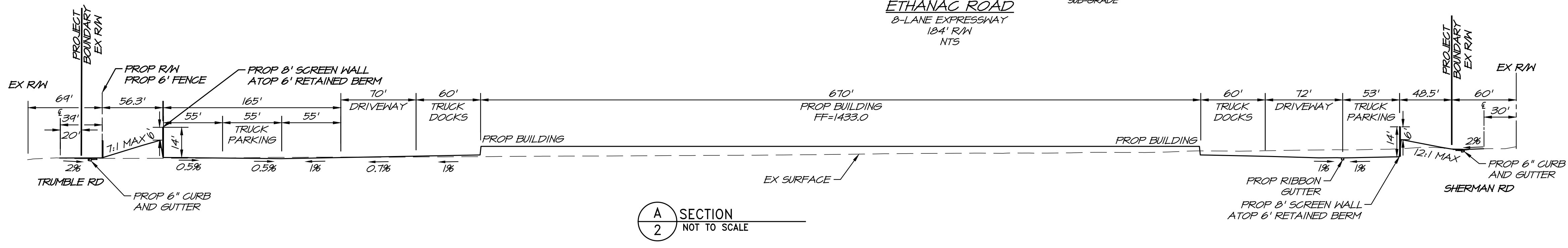
TRUMBLE ROAD
MAJOR COLLECTOR
18' R/W
NTS



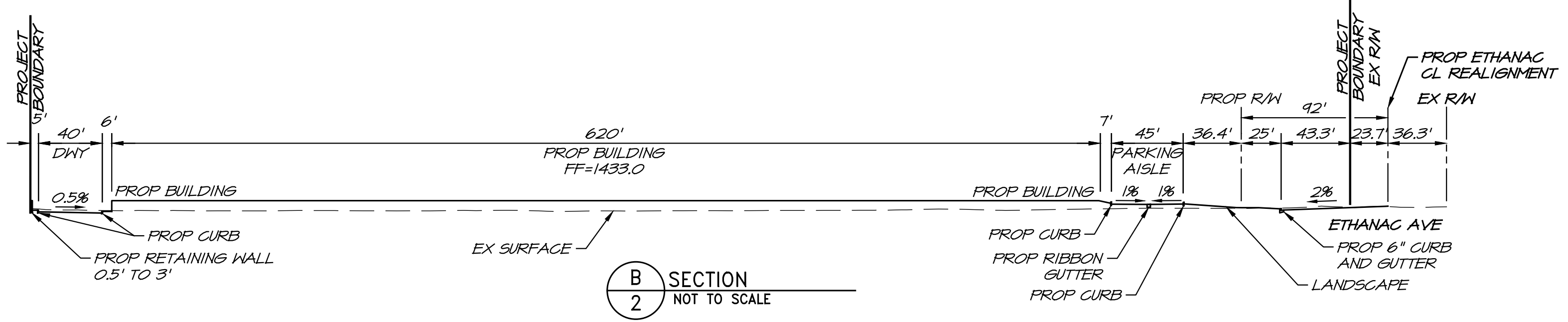
SHERMAN ROAD
LOCAL
60' R/W
NTS



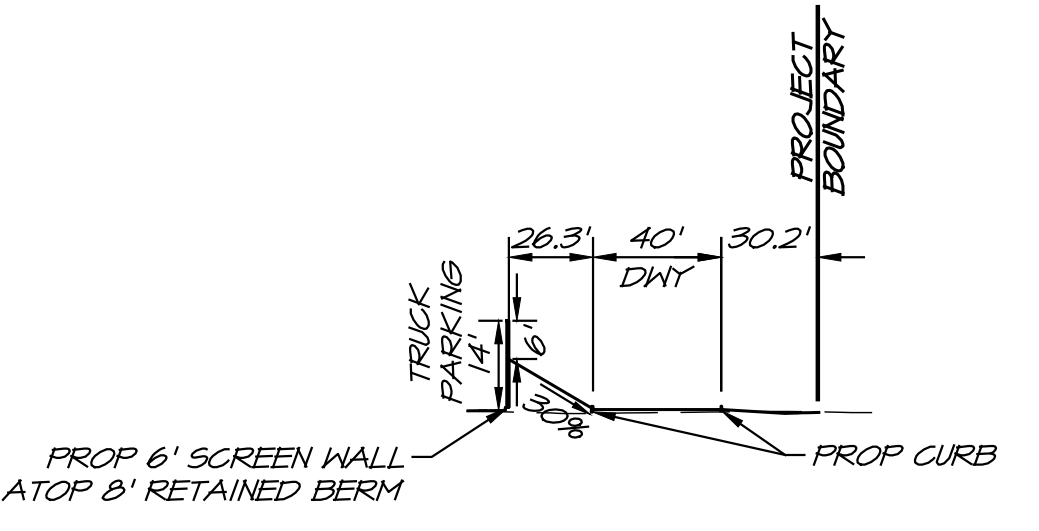
ETHANAC ROAD
8-LANE EXPRESSWAY
18'± R/W
NTS



A SECTION
2
NOT TO SCALE



B SECTION
2
NOT TO SCALE



C SECTION
2
NOT TO SCALE

EASEMENT NOTES

- APN: 324-240-016 THRU -020 AND 324-240-025 THRU -027.
- AN EASEMENT FOR PUBLIC UTILITIES AND INCIDENTAL PURPOSES, RECORDED JUNE 25, 1927 IN BOOK 120 OF DEEDS, PAGE 209, IN FAVOR OF SOUTHERN SIERRAS POWER COMPANY. THE LOCATION OF THE EASEMENT CANNOT BE DETERMINED FROM RECORD INFORMATION.
 - COVENANTS, CONDITIONS, RESTRICTIONS AND EASEMENTS IN THE DOCUMENT RECORDED APRIL 17, 1934 AS BOOK 170, PAGE 305 AND JANUARY 13, 1936 IN BOOK 259, PAGE 560 (BOTH) OF OFFICIAL RECORDS, BUT DELETING ANY COVENANT, CONDITION OR RESTRICTION INDICATING A PREFERENCE, LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEX, HANDICAP, FAMILIAL STATUS, NATIONAL ORIGIN, SEXUAL ORIENTATION, MARITAL STATUS, ANCESTRY, SOURCE OF INCOME OR DISABILITY, TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE TITLE 42, SECTION 3604(G), OF THE UNITED STATES CODES. LAWFUL RESTRICTIONS UNDER STATE AND FEDERAL LAW ON THE AGE OF OCCUPANTS IN SENIOR HOUSING OR HOUSING FOR OLDER PERSONS SHALL NOT BE CONSTRUED AS RESTRICTIONS BASED ON FAMILIAL STATUS. [(5A) BOOK 170, PAGE 305 & (5B) BOOK 259, PAGE 560]
 - AN EASEMENT FOR PUBLIC UTILITIES AND INCIDENTAL PURPOSES, RECORDED AUGUST 8, 1947 AS BOOK 846, PAGE 355 OF OFFICIAL RECORDS, IN FAVOR OF CALIFORNIA ELECTRIC POWER COMPANY. [± OF UNDISCLOSED WIDTH]

APN: 324-240-023 AND -024

- COVENANTS, CONDITIONS, RESTRICTIONS AND EASEMENTS IN THE DOCUMENT RECORDED APRIL 24, 1933 AS BOOK 120, PAGE 397 OF OFFICIAL RECORDS, WHICH PROVIDE THAT A VIOLATION THEREOF SHALL NOT DEFEAT OR RENDER INVALID THE LIEN OF ANY FIRST MORTGAGE OR DEED OF TRUST MADE IN GOOD FAITH AND FOR VALUE, BUT DELETING ANY COVENANT, CONDITION OR RESTRICTION INDICATING A PREFERENCE, LIMITATION OR DISCRIMINATION BASED ON RACE, COLOR, RELIGION, SEX, HANDICAP, FAMILIAL STATUS, NATIONAL ORIGIN, SEXUAL ORIENTATION, MARITAL STATUS, ANCESTRY, SOURCE OF INCOME OR DISABILITY, TO THE EXTENT SUCH COVENANTS, CONDITIONS OR RESTRICTIONS VIOLATE TITLE 42, SECTION 3604(G), OF THE UNITED STATES CODES OR SECTION 12955 OF THE CALIFORNIA GOVERNMENT CODE. LAWFUL RESTRICTIONS UNDER STATE AND FEDERAL LAW ON THE AGE OF OCCUPANTS IN SENIOR HOUSING OR HOUSING FOR OLDER PERSONS SHALL NOT BE CONSTRUED AS RESTRICTIONS BASED ON FAMILIAL STATUS.
- EASEMENTS, COVENANTS AND CONDITIONS CONTAINED IN THE DEED FROM ETHANAC RANCHO, LTD, AS GRANTOR, TO PHILA M. LAUDIG, AS GRANTEE, RECORDED APRIL 24, 1933 AS BOOK 123, PAGE 42 OF OFFICIAL RECORDS. REFERENCE BEING MADE TO THE DOCUMENT FOR FULL PARTICULARS. [BLANKET IN NATURE]
- AN EASEMENT FOR TELEPHONE LINE, CONSISTING OF POLES, NECESSARY GUYS AND ANCHORS, BRACES, CROSS-ARMS, WIRE, COILS, CABLES, AND OTHER FIXTURES AND APPLIANCES, FOR CONVEYING ELECTRIC ENERGY, TO BE USED FOR COMMUNICATION, TELEPHONE, TELEGRAPH AND/OR OTHER PURPOSES AND ACCESS FOR EXERCISING THE RIGHTS AND INCIDENTAL PURPOSES, RECORDED SEPTEMBER 18, 1961 AS INSTRUMENT NO. 194975, BOOK 2483, PAGE 446 OF OFFICIAL RECORDS, IN FAVOR OF CALIFORNIA WATER & TELEPHONE COMPANY, A CORPORATION, AND ITS SUCCESSORS.

LEGAL DESCRIPTION

APN: 324-240-016 (AFFECTS THE PORTION OF LOT 133), 324-240-017 (AFFECTS THE PORTION OF LOT 134), 324-240-018 (AFFECTS THE PORTION OF LOT 134), 324-240-019 (AFFECTS THE PORTION OF LOT 134), 324-240-020 (AFFECTS THE PORTION OF LOT 134), 324-240-026 (AFFECTS THE LOT 131), 324-240-021 (AFFECTS THE PORTION OF LOT 130), 324-240-025 (AFFECT LOT 136).

REAL PROPERTY IN THE CITY OF PERRIS, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

PARCEL A:
LOTS 134, 137 AND THE SOUTH 198 FEET OF LOTS 133 AND 138 OF ROMOLA FARMS NO. 6A, IN THE CITY OF PERRIS, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 14, PAGES 63, 64, AND 65 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

PARCEL B:
LOT 136 OF ROMOLA FARMS NO. 6A, IN THE CITY OF PERRIS, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS SHOWN BY MAP ON FILE IN BOOK 14, PAGES 63, 64, AND 65 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

APN: 324-240-023 (AFFECTS PARCEL A) AND 324-240-024 (AFFECTS PARCEL B)

PARCEL A:

THE WESTERLY 128.00 FEET OF THE EASTERLY 256.00 FEET OF LOT 135 OF ROMOLA FARMS NO. 6-A, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AS PER MAP RECORDED IN BOOK 14, PAGES 63, 64 AND 65 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

PARCEL B:

THAT PORTION OF LOT 135 OF ROMOLA FARMS NO. 6A, AS SHOWN BY MAP OF SAID TRACT ON FILE IN BOOK 14, PAGES 63, 64, AND 65 OF MAPS, RIVERSIDE COUNTY RECORDS, DESCRIBED AS FOLLOWS:

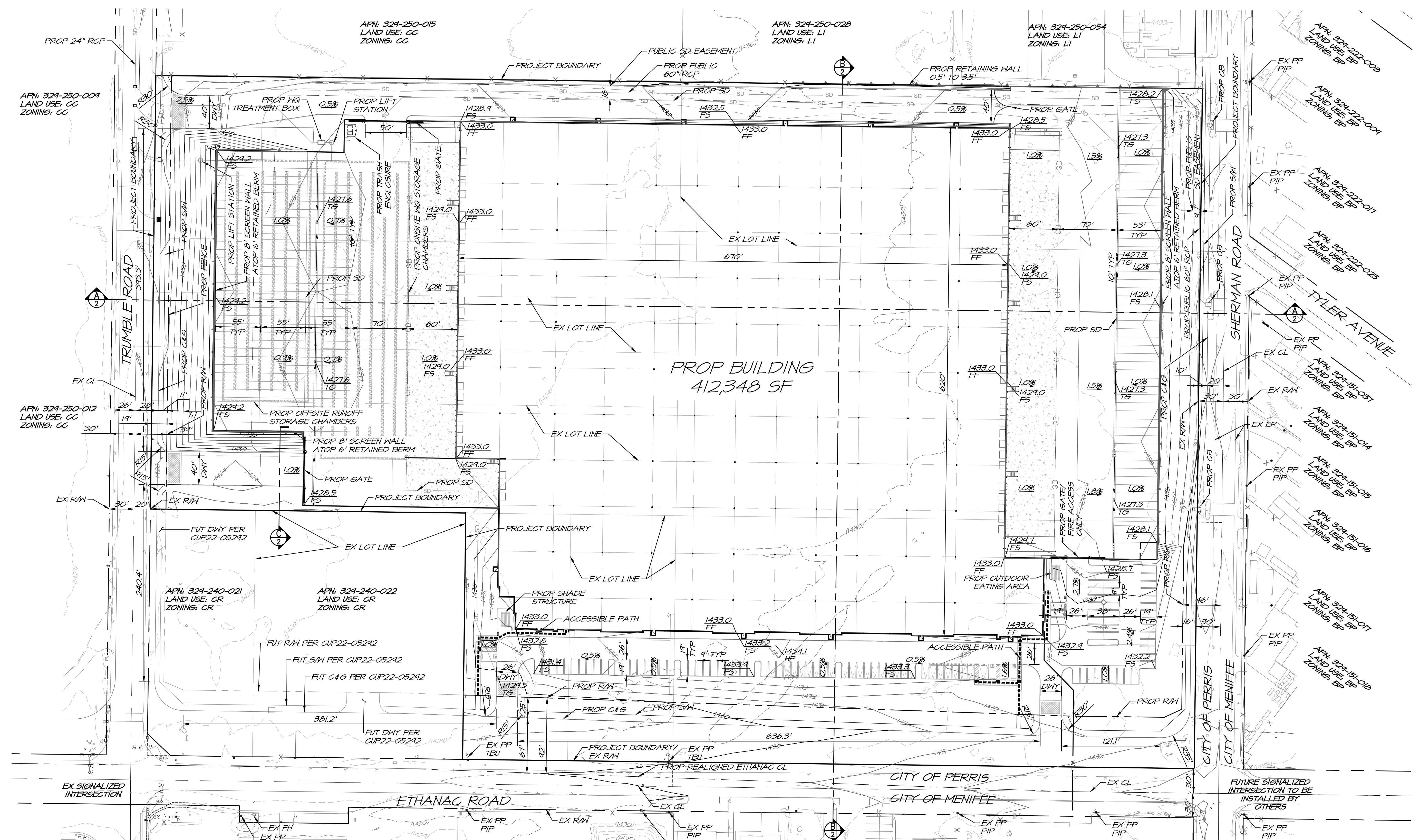
BEGINNING AT THE SOUTHEAST CORNER OF SAID LOT 135; THENCE WEST, ON THE SOUTH LINE OF SAID LOT, 128 FEET; THENCE NORTH, PARALLEL WITH THE EAST LINE OF SAID LOT, 300 FEET, TO A POINT ON THE NORTH LINE OF SAID LOT, 128 FEET WEST OF THE NORTHEAST CORNER THEREOF; THENCE EAST, ON THE NORTH LINE OF SAID LOT, 128 FEET, TO THE NORTHEAST CORNER THEREOF; THENCE SOUTH, ON THE EAST LINE OF SAID LOT, 300 FEET, TO THE POINT OF BEGINNING.

REVISED SECTIONS FOR PUBLIC DETENTION BASIN	4/23	AG
REVISIONS	DATE	BY

CITY OF PERRIS
ETHANAC LOGISTICS CENTER
GRADING AND STREET SECTIONS
DEVELOPMENT PLAN REVIEW NO. 22-00030

SCALE: NTS	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3785 MCGRAW STREET RIVERSIDE, CA 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 22-0198
DATE: 9/1/2023	DESIGNED: AG	CHECKED: SK	SHEET 2
PLN CK REF:	F.B.		OF 5 SHEETS
			DWG. NO.

PRELIMINARY
9/1/2023 4:00:02 PM Rebecca



LEGEND

- (1430) --- EXISTING CONTOUR
- EXISTING CENTER LINE
- EXISTING EASEMENT
- EXISTING EDGE OF PAVEMENT
- X EXISTING FENCE
- EXISTING LOT LINE
- GB --- GRADE BREAK
- PROJECT BOUNDARY
- PROPOSED CENTER LINE
- (1430) --- PROPOSED CONTOUR
- PROPOSED CURB
- PROPOSED RIGHT OF WAY

ABBREVIATIONS

- CB CATCH BASIN
- EP EDGE OF PAVEMENT
- EX EXISTING
- FF FINISHED FLOOR
- FH FIRE HYDRANT
- FS FINISHED SURFACE
- PIP PROTECT IN PLACE
- PROP PROPOSED
- R/W RIGHT-OF-WAY
- RCB REINFORCED CONCRETE BOX
- RCP REINFORCED CONCRETE PIPE
- S/W SIDEWALK
- TBU TO BE UNDERGROUNDED
- TG TOP OF GRATE
- TYP TYPICAL

APN: 331-110-004 LAND USE: CR ZONING: CR

APN: 331-110-005 LAND USE: BP ZONING: BP

APN: 331-110-006 LAND USE: BP ZONING: BP

APN: 331-110-008 LAND USE: BP ZONING: BP

APN: 331-110-009 LAND USE: BP ZONING: BP

APN: 331-110-010 LAND USE: BP ZONING: BP

APN: 331-110-011 LAND USE: BP ZONING: BP

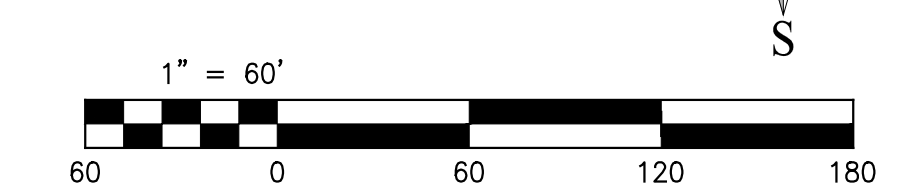
REVISIONS	DATE	BY
PUBLIC DETENTION BASIN ADDED	4/23	AG

CITY OF PERRIS

ETHANAC LOGISTICS CENTER
CONCEPTUAL GRADING
DEVELOPMENT PLAN REVIEW NO. 22-00030

SCALE: 1" = 60'
DATE: 9/1/2023
DESIGNED: AG
CHECKED: SK
PLN CK REF: F.B.

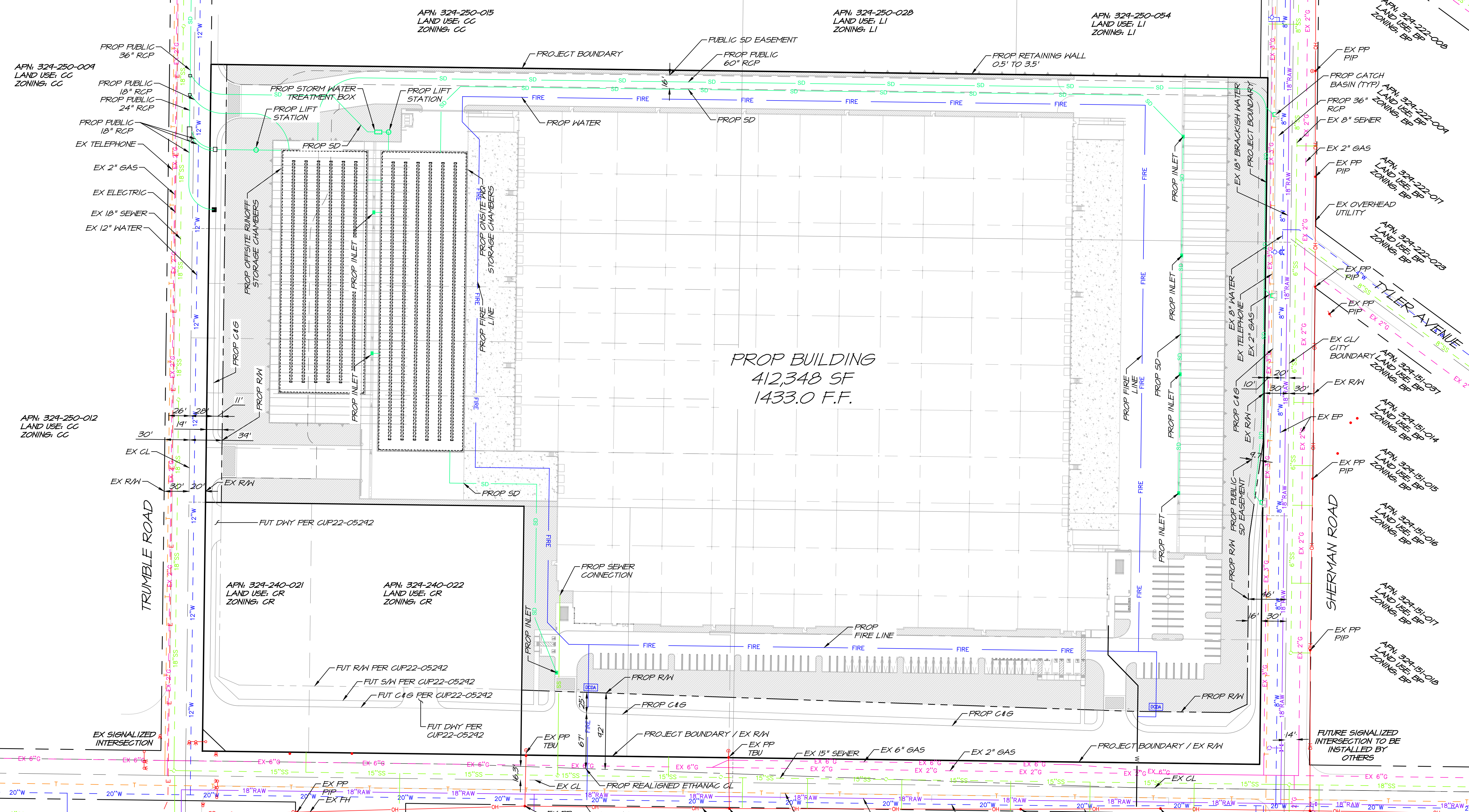
W.O. 22-0198
SHEET 3
OF 5 SHEETS
DWG. NO.



PRELIMINARY

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SEE SHEET 5



- LEGEND**
- 18"RAW EXISTING 18" BRACKISH WATER
 - EXISTING BRACKISH WATER BLOW OFF VALVE
 - EXISTING ELECTRIC
 - EXISTING FIRE HYDRANT
 - EX 2"G EXISTING 2" GAS
 - EX 3"G EXISTING 3" GAS
 - EX 6"G EXISTING 6" GAS
 - OH EXISTING OVERHEAD UTILITY
 - 6"SS EXISTING 6" SEWER
 - 8"SS EXISTING 8" SEWER
 - 15"SS EXISTING 15" SEWER
 - 18"SS EXISTING 18" SEWER
 - EXISTING SEWER MANHOLE
 - 36"SD EXISTING 36" STORM DRAIN
 - 48"SD EXISTING 48" STORM DRAIN
 - EXISTING TELEPHONE
 - 8"W EXISTING 8" WATER
 - 12"W EXISTING 12" WATER
 - 20"W EXISTING 20" WATER
 - PROJECT BOUNDARY

- ABBREVIATIONS**
- CL CENTER LINE
 - C&G CURB AND GUTTER
 - EX EXISTING
 - PP POWER POLE
 - PROP PROPOSED
 - PIP PROTECT IN PLACE
 - RCB REINFORCED CONCRETE BOX
 - RCP REINFORCED CONCRETE PIPE
 - R/W RIGHT-OF-WAY
 - SD STORM DRAIN
 - TB TO BE UNDERGROUNDED
 - TYP TYPICAL

- W PROPOSED WATER
- FIRE PROPOSED FIRE LINE
- SS PROPOSED SEWER
- SD PROPOSED STORM DRAIN

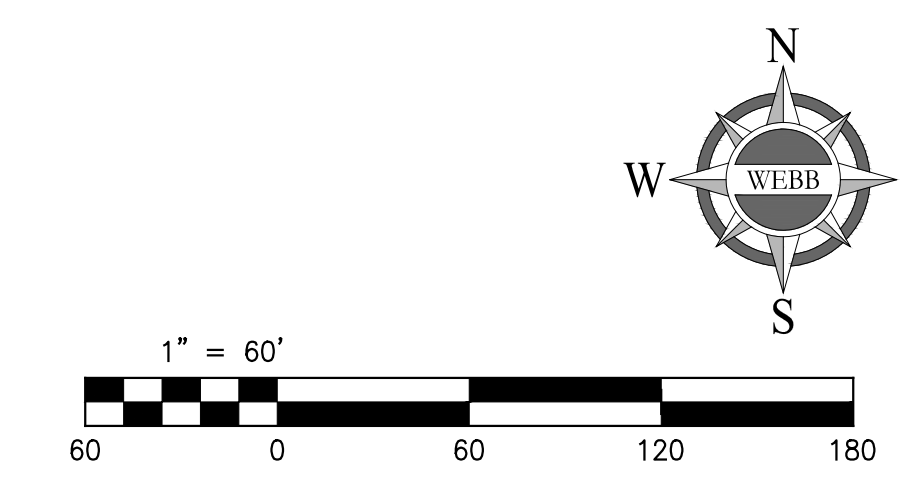
REVISIONS	DATE	BY
PUBLIC DETENTION BASIN ADDED	4/23	AG

CITY OF PERRIS

**ETHANAC LOGISTICS CENTER
CONCEPTUAL UTILITY
DEVELOPMENT PLAN REVIEW NO. 22-00030**

SCALE: 1" = 60'
DATE: 9/1/2023
DESIGNED: AG
CHECKED: SK
PLN CK REF: F.B.

W.O. 22-0192
SHEET 4
OF 5 SHEETS
DWG. NO.



PRELIMINARY

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SEE SHEET 4

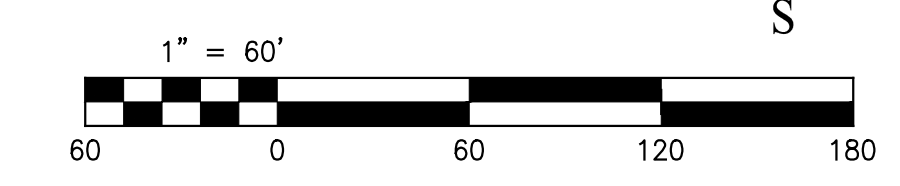
LEGEND

18"RAW	EXISTING 18" BRACKISH WATER
	EXISTING BRACKISH WATER BLOW OFF VALVE
	EXISTING ELECTRIC
	EXISTING FIRE HYDRANT
EX 2"G	EXISTING 2" GAS
EX 3"G	EXISTING 3" GAS
EX 6"G	EXISTING 6" GAS
OH	EXISTING OVERHEAD UTILITY
6"SS	EXISTING 6" SEWER
8"SS	EXISTING 8" SEWER
15"SS	EXISTING 15" SEWER
18"SS	EXISTING 18" SEWER
	EXISTING SEWER MANHOLE
36"SD	EXISTING 36" STORM DRAIN
48"SD	EXISTING 48" STORM DRAIN
T	EXISTING TELEPHONE
8"W	EXISTING 8" WATER
12"W	EXISTING 12" WATER
20"W	EXISTING 20" WATER
---	PROJECT BOUNDARY

---	RIGHT-OF-WAY (EXISTING/PROPOSED)
W	PROPOSED WATER
FIRE	PROPOSED FIRE LINE
SS	PROPOSED SEWER
SD	PROPOSED STORM DRAIN

ABBREVIATIONS

CL	CENTER LINE
C&G	CURB AND GUTTER
EX	EXISTING
PP	POWER POLE
PROP	PROPOSED
PIP	PROTECT IN PLACE
RCB	REINFORCED CONCRETE BOX
RCP	REINFORCED CONCRETE PIPE
R/W	RIGHT-OF-WAY
SD	STORM DRAIN
TBU	TO BE UNDERGROUNDED
TYP	TYPICAL



REFERENCE TO MDP LINE A-II ADDED	DATE	BY
	4/23	AG
REVISIONS		
	DATE	BY

CITY OF PERRIS

**ETHANAC LOGISTICS CENTER
CONCEPTUAL UTILITY
DEVELOPMENT PLAN REVIEW NO. 22-00030**

SCALE: 1" = 60'	<p>ALBERT A. WEBB ASSOCIATES ENGINEERING CONSULTANTS 3785 MCGRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256</p>	W.O. 22-0192
DATE: 9/1/2023		SHEET 5
DESIGNED: AG		OF 5 SHEETS
CHECKED: SK		DWG. NO.
PLN CK REF:		
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PRELIMINARY
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Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

**GEOTECHNICAL INVESTIGATION
PROPOSED WAREHOUSE**

NWC Ethanac Road and Sherman Road
Perris, California
for
Hillwood



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**
A California Corporation

February 23, 2022

Hillwood
901 Via Piemonte, Suite 175
Ontario, California 91764



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**
A California Corporation

Attention: Mr. John Grace
Vice President, Development

Project No.: **22G107-1**

Subject: **Geotechnical Investigation**
Proposed Warehouse
NWC Ethanac Road and Sherman Road
Perris, California

Ms. Buckle/Mr. Morse:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

A handwritten signature in blue ink that reads "Daniel W. Nielsen".

Daniel W. Nielsen, GE 3166
Senior Engineer



A handwritten signature in blue ink that reads "Robert G. Trazo".

Robert G. Trazo, GE 2655
Principal Engineer



Distribution: (1) Addressee

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1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Geotechnical Design Considerations

- The near-surface soils encountered at the boring locations consist of older alluvium which possesses high strengths and favorable consolidation/collapse characteristics.
- Granodiorite to tonalite bedrock was encountered at four (4) of the boring locations at depths of 5½ to 12± feet below the ground surface, extending to at least to the maximum depth explored of 25± feet.
- The near-surface alluvial soils possess varying strengths. These soils, in their present condition, are not considered suitable for support of the foundation loads of the new structure.
- Remedial grading is recommended in the proposed building pad area in order to provide more uniform support characteristics in the proposed foundation and floor slab areas and to help reduce the potential for differential settlements.

Site Preparation

- Remedial grading is recommended to be performed within the proposed building area in order to provide consistent support characteristics throughout the proposed building pad area and to help limit potential differential settlements to within tolerable limits. The proposed building area should be overexcavated to a depth of at least 2 feet below existing grade and to a depth of 2 feet below proposed building pad subgrade elevation, whichever is greater. Within the foundation influence zones, the overexcavation should extend to a depth of at least 2 feet below proposed foundation bearing grade. The overexcavation should extend horizontally at least 5 feet beyond the building and foundation perimeters.
- After the overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be removed. The resulting subgrade should then be scarified to a depth of 12 inches and moisture conditioned (or air dried) to 2 to 4 percent above optimum. The previously excavated soils may then be replaced as compacted structural fill. All structural fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density.
- The new pavement and flatwork subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft² maximum allowable soil bearing pressure.
- Reinforcement consisting of at least four (4) No. 5 rebars (2 top and 2 bottom) in strip footings, due to the presence of medium expansive soils. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab

- Conventional Slab-on-Grade: minimum 6 inches thick.

- Modulus of Subgrade Reaction: $k = 125$ psi/in.
- Minimum slab reinforcement: No. 3 bars at 18 inches on center in both directions due to the presence of medium expansive soils. The actual floor slab reinforcement should be determined by the structural engineer, based on the imposed loading.

Pavement Design Recommendations

ASPHALT PAVEMENTS (R= 20)					
Materials	Thickness (inches)				
	Auto Parking (TI = 4.0)	Auto Drive Lanes (TI = 5.0)	Truck Traffic		
			(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3	3½	4	5
Aggregate Base	6	8	10	12	14
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R=20)				
Materials	Thickness (inches)			
	Auto Parking & Drives (TI = 5.0)	Truck Traffic		
		(TI =6.0)	(TI =7.0)	(TI =8.0)
PCC	5	5	5½	7
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 21P511, dated December 17, 2021. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slab, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the northwest corner of Ethanac Road and Sherman Road in Perris, California. The site is bounded to the north by a commercial/industrial building and a vacant lot, to the west by Trumble Road, to the south by Ethanac Road, and to the east by Sherman Road. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of several contiguous rectangular-shaped parcels which total 24± acres in size. The site is currently vacant and undeveloped. The ground surface cover generally consists of exposed soil with moderate native grass and weed growth. Concrete debris, including concrete fragments and a concrete pipe, is scattered on the ground surface in the southern portion of the site. Several small to medium sized trees are also present in the southern region of the site.

Based on our review of readily available historical aerial photographs, two (2) small structures were present in the southwestern portion of the overall site, between 1966 and 1997.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography is relatively flat that gently slopes downward to the northwest at a gradient of less than 1 percent.

3.2 Proposed Development

A conceptual site plan for the proposed development, identified as Scheme 7, prepared by Herdman Architecture and Design, was provided to our office by the client. Based on this plan, the subject site will be developed with a 547,520± ft² warehouse, located in the central region of the site. Dock-high doors will be constructed along a portion of the northern and southern building walls. The proposed building is expected to be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck loading areas, and concrete flatwork with some landscaped areas.

Detailed structural information has not been provided. We assume that the new building will be a single-story structure of tilt-up concrete construction, typically supported on a conventional shallow foundation system with a concrete slab-on-grade floor. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 6 kips per linear foot, respectively.

No significant amounts of below-grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of up to 4 to 7± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of eight (8) borings (identified as Boring Nos. B-1 through B-8) advanced to depths of 10 to 25± feet below the existing site grades. All of the borings were logged during drilling by a member of our staff.

The borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed soil samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. Samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Older Alluvium

Older native alluvial soils were encountered at the ground surface at all of the boring locations, extending to depths of at least 5½ to 25± feet below ground surface. The older alluvium generally consists of stiff to hard fine sandy clays, fine to coarse sandy clays and medium dense to very dense clayey fine to medium sands.

Granodiorite to Tonalite (Kdgv)

Granodiorite to Tonalite bedrock, map symbol Kdgv, was encountered beneath the older alluvium at Boring Nos. B-1, B-4, B-5, and B-6, at depths of 5½ to 12± feet below ground surface, extending to the maximum depths explored at each of these borings of 15 to 25± feet. The bedrock generally consists of medium dense to very dense gray brown, highly weathered, friable, fine- to coarse-grained granodiorite to tonalite.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static groundwater table is at a greater depth than 25± feet below existing site grades.

As part of our research, we reviewed readily available groundwater data in order to determine regional groundwater depths. The primary reference used to determine the groundwater depths in the subject site area is the California Department of Water Resources website, <http://www.water.ca.gov/waterdatalibrary/>. The nearest monitoring well is located approximately 1,320 feet northwest from the site. Water level readings within this monitoring well indicates a high groundwater level of 95.6 feet below the ground surface in September 1995.

4.3 Geologic Conditions

Regional geologic conditions were obtained from the Preliminary Geologic Map of the Romoland 7.5' Quadrangle, Riverside County, California, by Douglas M. Morton, published by the U.S. Geologic Survey Department of Sciences University of California Riverside. A portion of this map indicating the location of the subject site, is included as Plate 3 in Appendix A of this report. This map indicates that the site is underlain by old alluvial-fan deposits (Map Symbol Qof). Qof is described as indurated, sandy alluvial-fan deposits.

Bedrock materials were encountered beneath the older alluvial soils at Boring Nos. B-1, B-4, B-5, and B-6 at depths of 6½ to 12± feet below the existing site grades. The bedrock is weathered, friable, and fine- to coarse- grained. Based on the characteristics of these bedrock materials and the geologic mapping in the vicinity of the subject site, it is our opinion that these bedrock materials consist of Granodiorite to Tonalite, (Map Symbol Kgdy). The Granodiorite to Tonalite unit is described on this map as relatively uniform, massive hornblende biotite granodiorite grading into tonalite.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. Field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Consolidation

One selected soil sample has been tested to determine its consolidation and collapse potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch-high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plate C-1 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-2 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829. The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50 ± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water and allowed

to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the EI testing are as follows:

<u>Sample Identification</u>	<u>Expansion Index</u>	<u>Expansive Potential</u>
B-6 @ 0 to 5 feet	62	Medium

Soluble Sulfates

A representative sample of the near-surface soils was submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

<u>Sample Identification</u>	<u>Soluble Sulfates (%)</u>	<u>Sulfate Classification</u>
B-1 @ 0 to 5 feet	0.003	Not Applicable (S0)

Corrosivity Testing

One representative bulk sample of the near-surface soils was submitted to a subcontracted corrosion engineering laboratory to identify potentially corrosive characteristics with respect to common construction materials. The corrosivity testing included a determination of the electrical resistivity, pH, and chloride and nitrate concentrations of the soils, as well as other tests. The results of some of these tests are presented below.

<u>Sample Identification</u>	<u>Saturated Resistivity (ohm-cm)</u>	<u>pH</u>	<u>Chlorides (mg/kg)</u>	<u>Nitrates (mg/kg)</u>
B-1 @ 0 to 5 feet	3,400	7.9	3.0	5.7

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site-specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The potential for other geologic hazards such as seismically induced settlement, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The 2019 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of

the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2019 edition of the California Building Code (CBC), which was adopted on January 1, 2020.

The 2019 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-16, upon which the 2019 CBC is based. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The tables below were created using data obtained from the application. The output generated from this program is included as Plate E-1 in Appendix E of this report. Based on this output, the following parameters may be utilized for the subject site:

2019 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_s	1.421
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.528
Site Class	---	C
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.705
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.777
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.137
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.518

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and plasticity characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The Riverside County GIS website indicates that the subject site is located within a zone of low liquefaction susceptibility. In addition, the subsurface conditions encountered at the boring locations are not considered to be conducive to liquefaction. These conditions consist of moderate

to high strength alluvial soils underlain by bedrock, with no evidence of a long-term groundwater table within the depths explored by the borings. Based on these considerations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

The proposed building area is underlain by relatively high strength older alluvial soils. The results of consolidation testing indicate that the near surface soils may be subject to minor consolidation settlement when loaded. In order to provide more uniform support characteristics below the floor slab and foundation areas, and to help limit potential differential settlements, some remedial grading is considered warranted within the proposed building pad area in order to remove the upper portion of the existing soils and replace them as compacted structural fill.

Settlement

The recommended remedial grading will remove the upper portion of the near-surface native alluvium, and replace these soils as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation generally possess favorable consolidation characteristics and will not be subject to significant load increases from the foundations of the new structure. Provided that the recommended remedial grading is completed, the post-construction static settlements of the proposed structure is expected to be within tolerable limits.

Expansion

Laboratory testing performed on a representative sample of the near surface soils indicates that these materials possess a medium expansion potential ($EI = 62$). Based on the presence of expansive soils at this site, care should be given to proper moisture conditioning of all building pad subgrade soils to a moisture content of 2 to 4 percent above the ASTM D-1557 optimum during site grading. In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintaining moisture content of these soils at 2 to 4 percent above the optimum moisture content. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather.

Soluble Sulfates

The results of the soluble sulfate testing indicated a sulfate concentration of approximately 0.003 percent for the selected sample of the near-surface soils. This concentration is considered to be "not applicable" (S0) with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building area.

Corrosion Potential

The results of laboratory testing indicate that the on-site soils possess a saturated resistivity of 3,400 ohm-cm, and a pH value of 7.9. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity and pH are two of the five factors that enter into the evaluation procedure. Redox potential, relative soil moisture content and sulfides are also included. Although sulfide testing was not part of the scope of services for this project, we have evaluated the corrosivity characteristics of the on-site soils using resistivity, pH and moisture content. Based on these factors, and utilizing the DIPRA procedure, the on-site soils are not considered to be corrosive to ductile iron pipe.

A relatively low concentration (3.0 mg/kg) of chlorides were detected in the sample submitted for corrosivity testing. In general, soils possessing chloride concentrations in excess of 500 parts per million (ppm) are considered to be corrosive with respect to steel reinforcement within reinforced concrete. Based on the lack of any significant chlorides in the tested sample, the site is considered to have a C1 chloride exposure in accordance with the American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary. Therefore, a specialized concrete mix design for reinforced concrete for protection against chloride exposure is not considered warranted.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested sample possess a nitrate concentration of 5.7 mg/kg. Based on this test result, the on-site soils are not considered to be corrosive to copper pipe.

Since SCG does not practice in the area of corrosion engineering, we recommend that the client contact a corrosion engineer to provide a more thorough evaluation.

Shrinkage/Subsidence

Based on the results of the laboratory testing, removal and recompaction of the near-surface older native alluvium will result in an average shrinkage of 0 to 6 percent. It should be noted that the potential shrinkage estimate is based on dry density testing performed on small-diameter samples taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.10 feet.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

It is recommended that we be provided with copies of the finalized grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping

Initial site preparation should include stripping of any surficial vegetation. This includes the removal of the moderate native grass, weeds, and shrubs present at the site. These materials should be disposed of off-site. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

At the time of site stripping, trash and concrete debris should also be removed from the site. Any remnants of the previous structures, if present, should be demolished. Demolition should include all subsurface remnants of the previous structures, including foundations, floor slabs, septic systems and any utilities that will not be reutilized with the proposed development. Any debris resultant from demolition should be disposed of offsite in accordance with local regulations. Any excavations associated with demolition should be backfilled with compacted fill soils.

Treatment of Existing Soils: Building Pad

Remedial grading should be performed within the proposed building pad area in order to remove the upper portion of the near-surface alluvial soils in order to provide more uniform support characteristics below the floor slab and foundation areas. The overexcavation is recommended to extend to a depth of at least 2 feet below existing grade, and to a depth of at least 2 feet below proposed grade, whichever is greater. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 2 feet below proposed foundation bearing grade.

The overexcavation areas should extend at least 5 feet beyond the building perimeters, and to an extent equal to the depth of fill below the new foundations. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the overexcavation areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure. This

evaluation should include proofrolling and probing to identify any soft, loose, or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if additional fill or loose, porous, or low-density native soils are encountered at the base of the overexcavation.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches and moisture conditioned or air dried to achieve a moisture content of 2 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

The building pad area may then be raised to grade with previously excavated soils or imported, very low expansive structural fill. All structural fill soils present within the proposed building area should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 2 feet below foundation bearing grade and replaced as compacted structural fill. Subgrades for erection pads for concrete tilt-up walls are considered to be a part of the foundation system and should also be overexcavated. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning and recompacting the upper 12 inches of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

If the full lateral extent of overexcavation is not achievable for the proposed walls, the foundations should be redesigned using a lower bearing pressure. The geotechnical engineer of record should be contacted for recommendations pertaining to this type of condition.

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing soils in the new parking and drive areas is not considered warranted, with the exception of areas where lower strength, or unstable soils are identified by the geotechnical engineer during grading.

Subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping. The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 2 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking areas. The grading recommendations presented above do not provide remedial grading throughout the entire parking areas. As such, settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the parking and drive areas should be overexcavated to a depth of 2 feet below

proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Fill Placement

- Fill soils should be placed in thin ($6\pm$ inches), near-horizontal lifts, moisture conditioned to 2 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2019 CBC and the grading code of the city of Perris.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

All imported structural fill should consist of very low to low expansive ($EI < 50$), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. As an alternative, a clean sand (minimum Sand Equivalent of 30) may be placed within trenches and compacted in place (jetting or flooding is not recommended). Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Perris. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Excavation Considerations

The near-surface soils generally consist of moderate to high strength sandy clays and clayey sands. These materials may be subject to minor to moderate caving within shallow excavations. Where caving does occur, flattened excavation slopes may be sufficient to provide excavation

stability. On a preliminary basis, the inclination of temporary slopes should not exceed 1½h:1v. Temporary excavations into bedrock may be laid back at a 1h:1v, at the discretion of the geotechnical engineer. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Medium dense to very dense granodiorite to tonalite bedrock was encountered at Boring Nos. B-1, B-4, B-5, and B-6, at depths of 5½ to 12± feet below the existing site grades. The recovered samples of the bedrock materials generally friable, and refusal conditions were not encountered during drilling. Based on the conditions at the boring locations, we expect that the near surface bedrock materials will be rippable using conventional grading equipment.

Expansive Soils

Based on results of laboratory testing, the near-surface soils at this site possess medium expansion potentials. Due to the presence of expansive soils at this site, provisions should be made to limit the potential for surface water to penetrate the soils immediately adjacent to the structures. These provisions should include directing surface runoff into rain gutters and area drains, reducing the extent of landscaped areas around the structures, and sloping the ground surface away from the buildings. Where possible, it is recommended that landscaped planters not be located immediately adjacent to the buildings. If landscaped planters around the buildings are necessary, it is recommended that drought tolerant plants or a drip irrigation system be utilized, to minimize the potential for deep moisture penetration around the structures. Presented below is a list of additional soil moisture control recommendations that should be considered by the owner, developer, and civil engineer:

- Ponding and areas of low flow gradients in unpaved walkways, grass and planter areas should be avoided. In general, minimum drainage gradients of 2 percent should be maintained in unpaved areas.
- Bare soil within five feet of proposed structures should be sloped at a minimum five percent gradient away from the structure (about three inches of fall in five feet), or the same area could be paved with a minimum surface gradient of one percent. Pavement is preferable.
- Decorative gravel ground cover tends to provide a reservoir for surface water and may hide areas of ponding or poor drainage. Decorative gravel is, therefore, not recommended and should not be utilized for landscaping unless equipped with a subsurface drainage system designed by a licensed landscape architect.
- Positive drainage devices, such as graded swales, paved ditches, and catch basins should be installed at appropriate locations within the area of proposed development.
- Concrete walks and flatwork should not obstruct the free flow of surface water to the appropriate drainage devices.
- Area drains should be recessed below grade to allow free flow of water into the drain. Concrete or brick flatwork joints should be sealed with mortar or flexible mastic.
- Gutter and downspout systems should be installed to capture all discharge from roof areas. Downspouts should discharge directly into a pipe or paved surface system to be conveyed offsite.
- Enclosed planters adjoining, or in close proximity to proposed structures, should be sealed at the bottom and provided with subsurface collection systems and outlet pipes.
- Depressed planters should be raised with soil to promote runoff (minimum drainage gradient two percent or five percent, see above), and/or equipped with area drains to eliminate ponding.

- Drainage outfall locations should be selected to avoid erosion of slopes and/or properly armored to prevent erosion of graded surfaces. No drainage should be directed over or towards adjoining slopes.
- All drainage devices should be maintained on a regular basis, including frequent observations during the rainy season to keep the drains free of leaves, soil and other debris.
- Landscape irrigation should conform to the recommendations of the landscape architect and should be performed judiciously to preclude either soaking or excessive drying of the foundation soils. This should entail regular watering during the drier portions of the year and little or no irrigation during the rainy season. Automatic sprinkler systems should, therefore, be switched to manual operation during the rainy season. Good irrigation practice typically requires frequent application of limited quantities of water that are sufficient to sustain plant growth, but do not excessively wet the soils. Ponding and/or run-off of irrigation water are indications of excessive watering.

Other provisions, as determined by the landscape architect or civil engineer, may also be appropriate.

Moisture Sensitive Subgrade Soils

Most of the near surface soils possess appreciable silt and clay content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

Groundwater

The static groundwater table is considered to exist at a depth greater than 25± feet below the existing site grades. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pad will be underlain by newly placed structural fill soils extending to a depth of at least 2 feet below foundation bearing grade. Based on this subsurface profile, the proposed structure may be supported on shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft².
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Four (4) No. 5 rebars (2 top and 2 bottom). Due to the presence of expansive soils. Additional reinforcement may be necessary for structural considerations.

- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on standard geotechnical practice. Additional rigidity may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Soils suitable for direct foundation support should consist of newly placed structural fill compacted at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill, with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 2 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential static settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively, under static conditions. Differential movements are expected to occur over a 50-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slab and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 250 lbs/ft³
- Friction Coefficient: 0.28

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill soils. The maximum allowable passive pressure is 3,000 lbs/ft².

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slab should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floor of the proposed structure may be constructed as a conventional slab-on-grade, supported on newly placed structural fill (or densified existing soils), extending to a depth of at least 2 feet below finished pad grade. Based on geotechnical considerations, the floor slabs may be designed as follows:

- Minimum slab thickness: 6 inches.
- Modulus of Subgrade Reaction: 100 psi/in.
- Minimum slab reinforcement: No. 3 bars at 18 inches on center in both directions due to the presence of low expansive soils. The actual floor slab reinforcement should be determined by the structural engineer, based on the imposed loading.
- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where such moisture sensitive floor coverings are expected. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as a 15-mil Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.
- Moisture condition the floor slab subgrade soils to 2 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.
- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Retaining Wall Design and Construction

Although not indicated on the site plan, some small (less than 6 feet in height) retaining walls may be required in truck court area and to facilitate the new site grades. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. The near surface soils generally consist of sandy clays and have been determined to possess a medium expansion potential. We do not recommend that the on-site soils be used to backfill retaining walls, based on their expansion potential. The following parameters assume that imported fill soils, consisting of very low expansive sands or silty sands will be utilized for retaining wall backfill. These materials are expected to possess a friction angle of at least 30 degrees when compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type
		Imported Silty Sands and Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		130 lbs/ft ³
Equivalent Fluid Pressure:	Active Condition (level backfill)	43 lbs/ft ³
	Active Condition (2h:1v backfill)	70 lbs/ft ³
	At-Rest Condition (level backfill)	65 lbs/ft ³

Regardless of the backfill type, the walls should be designed using a soil-footing coefficient of friction of 0.28 and an equivalent passive pressure of 250 lbs/ft³. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect.

such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Seismic Lateral Earth Pressures

In accordance with the 2019 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 2 feet below proposed foundation bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

On-site soils may be used to backfill the retaining walls. However, all backfill material placed within 3 feet of the back-wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls be used. If the drainage composite material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The drainage composite should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering-controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, the weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.
- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system. The actual design of this type of system should be determined by the civil engineer to verify that the drainage system possesses the adequate capacity and slope for its intended use.

6.8 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of fine sandy clays, fine to coarse sandy clays, and clayey sands. These soils are generally considered to possess poor to fair pavement support characteristics with estimated R-values ranging from 20 to 30. The subsequent pavement design is therefore based upon an assumed R-value of 20. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering-controlled conditions. It is recommended that R-value testing be performed at the completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20-year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R= 20)					
Materials	Thickness (inches)				
	Auto Parking (TI = 4.0)	Auto Drive Lanes (TI = 5.0)	Truck Traffic		
			(TI = 6.0)	(TI = 7.0)	(TI = 8.0)
Asphalt Concrete	3	3	3½	4	5
Aggregate Base	6	8	10	12	14
Compacted Subgrade	12	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the batch plant-reported maximum density. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R=20)				
Materials	Thickness (inches)			
	Auto Parking & Drives (TI = 5.0)	Truck Traffic		
		(TI =6.0)	(TI =7.0)	(TI =8.0)
PCC	5	5	5½	7
Compacted Subgrade (95% minimum compaction)	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. The actual joint spacing and reinforcing of the Portland cement concrete pavements.

7.0 GENERAL COMMENTS

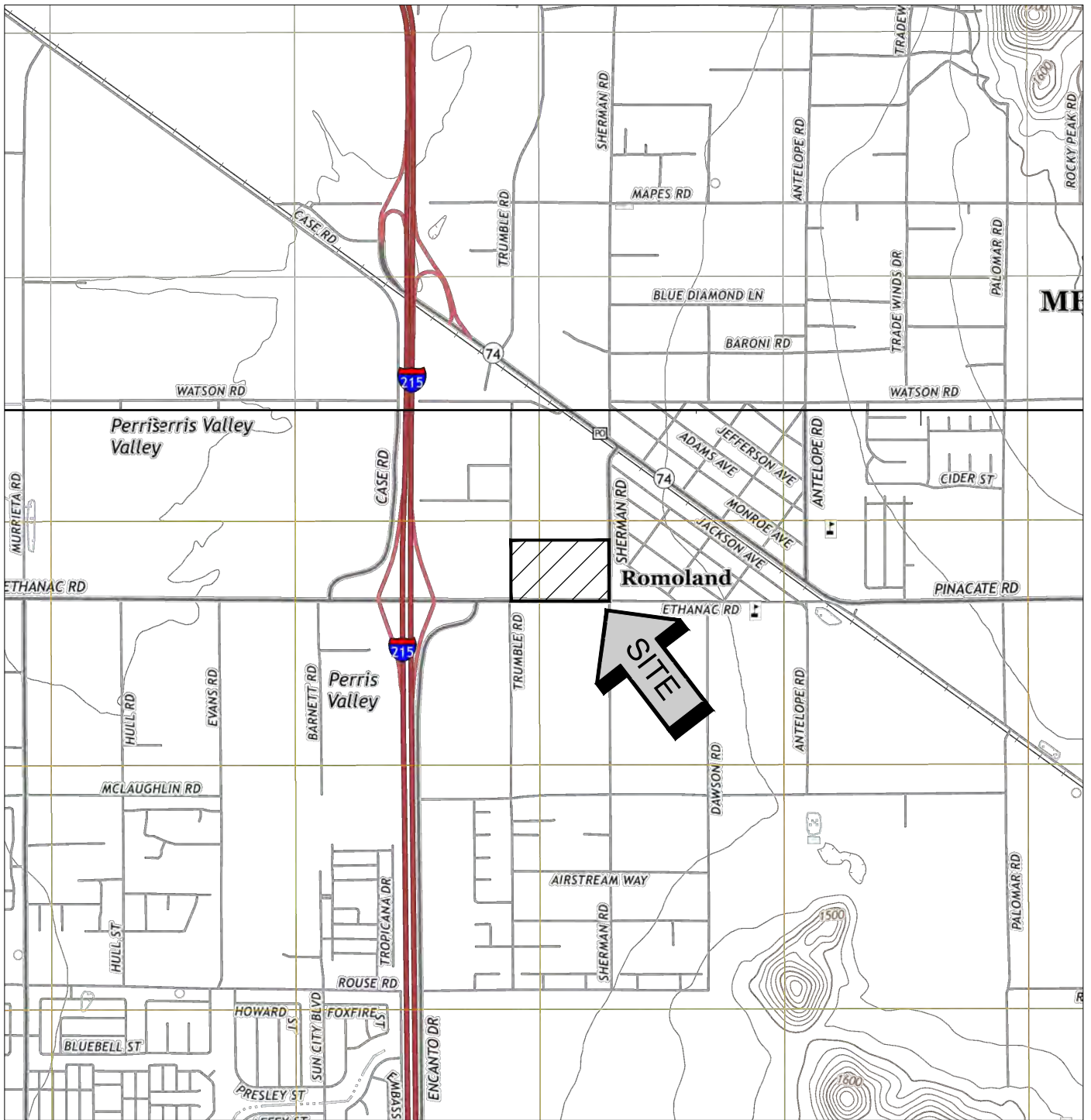
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

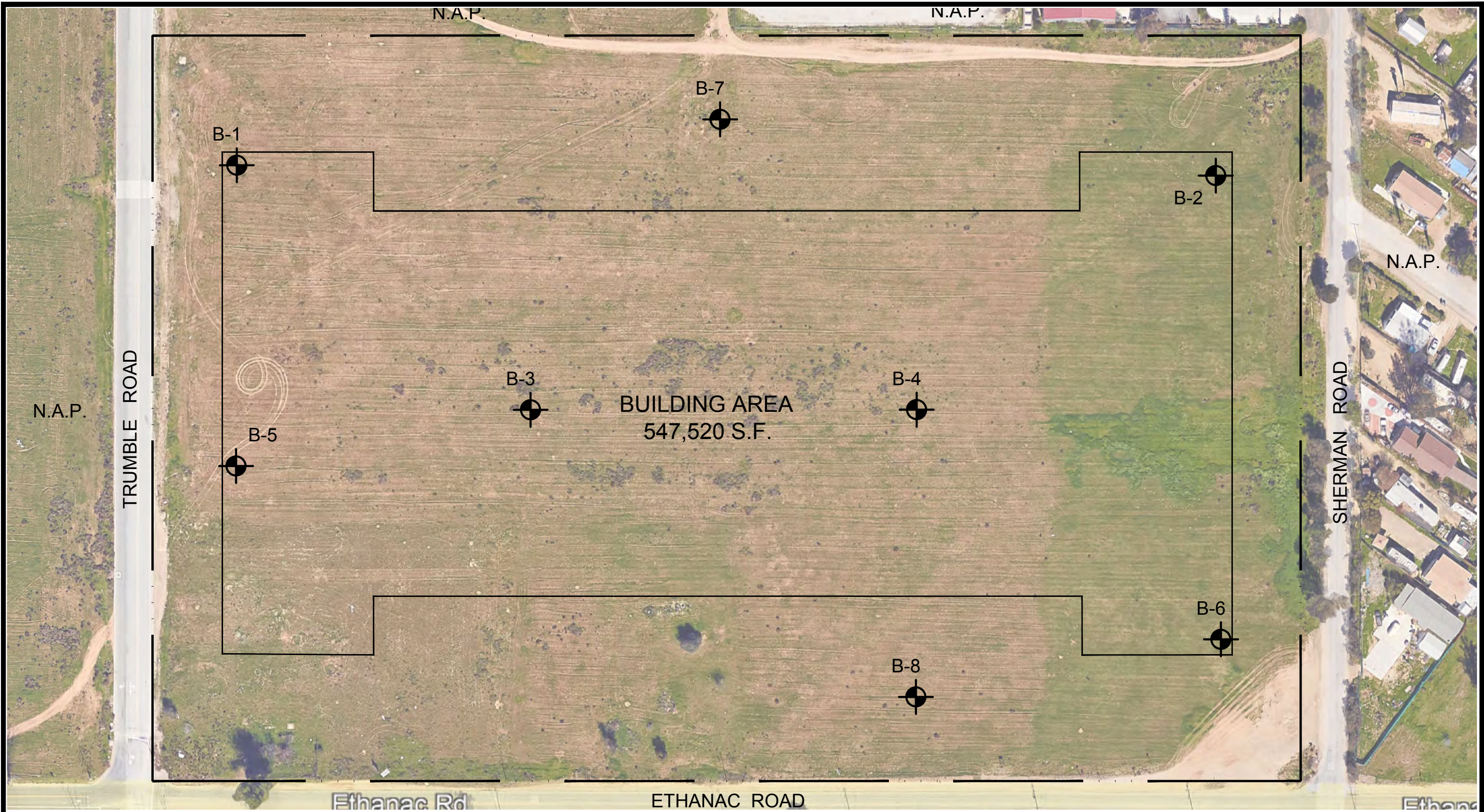
APPENDIX A



SOURCE: USGS TOPOGRAPHIC MAP OF THE ROMOLAND & PERRIS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.



SITE LOCATION MAP	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000'	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: MD	
CHKD: DN	
SCG PROJECT 22G107-1	
PLATE 1	



N.A.P.

N.A.P.

N.A.P.

N.A.P.

TRUMBLE ROAD

SHERMAN ROAD

Ethanac Rd

ETHANAC ROAD

Ethanac

BUILDING AREA
547,520 S.F.

B-1

B-7

B-2

B-3

B-4

B-5

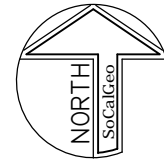
B-6

B-8

GEOTECHNICAL LEGEND



APPROXIMATE BORING LOCATION



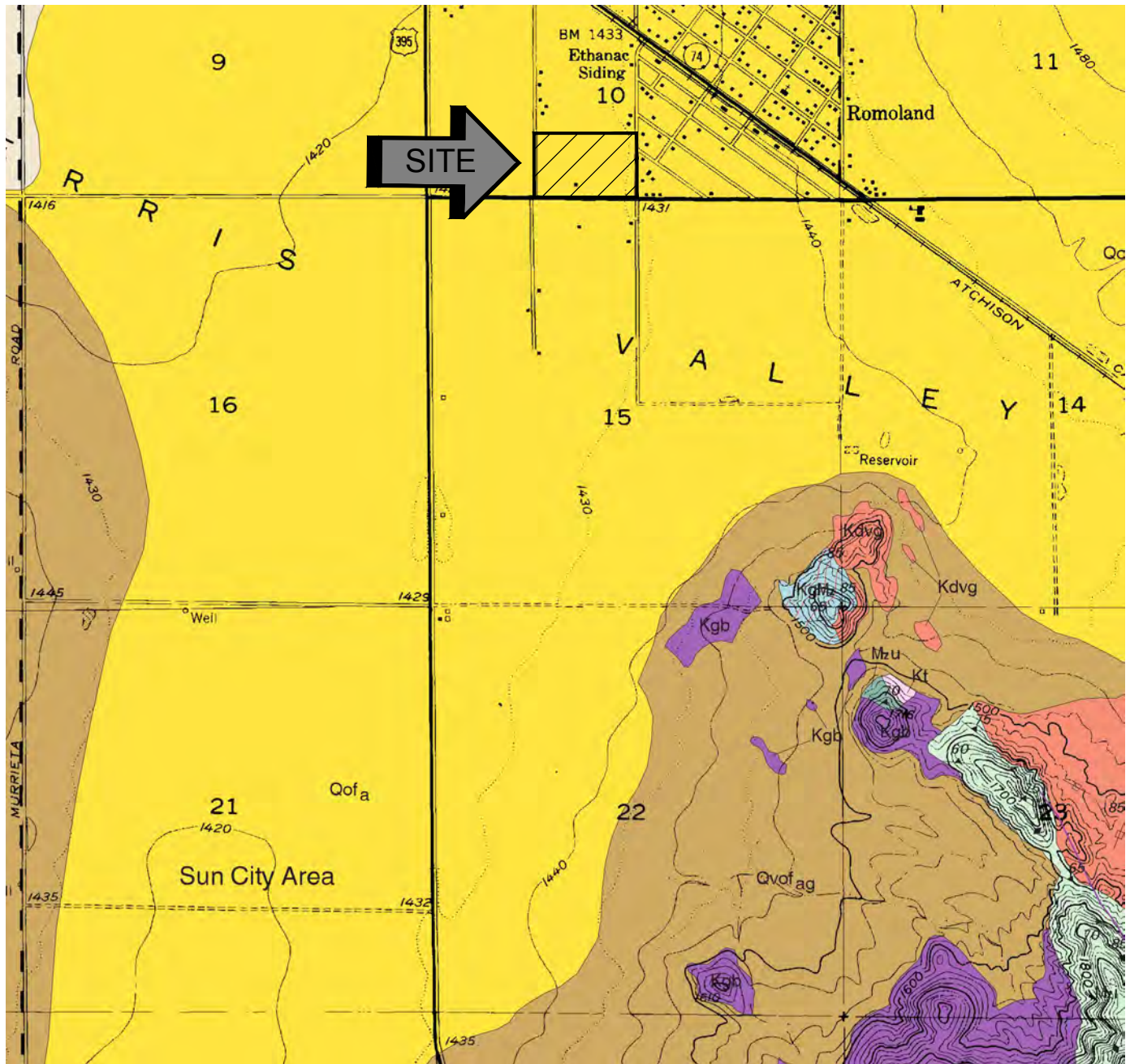
NOTE: CONCEPTUAL SITE PLAN (SCHEME 7) PREPARED BY HERDMAN ARCHITECTURE + DESIGN.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH (2018)

BORING LOCATION PLAN
PROPOSED WAREHOUSE
PERRIS, CALIFORNIA

SCALE: 1" = 100'
DRAWN: OS
CHKD: RGT
SCG PROJECT
22G107-1
PLATE 2



SOUTHERN CALIFORNIA GEOTECHNICAL



DESCRIPTION OF MAP UNITS

- Qof** Old alluvial fan deposits (late to middle Pleistocene)—Reddish brown, gravel and sand alluvial fan deposits; indurated, commonly slightly dissected. In places includes thin alluvial fan deposits of Holocene age

- Kdvg** Granodiorite to tonalite—Relatively uniform, massive hornblende biotite granodiorite grading into tonalite. Principal rock type of Domenigoni Valley pluton. Contains some mafic rich rocks in southern part of pluton. Common accessory minerals are zircon, sphene, apatite, and magnetite-ilmenite.


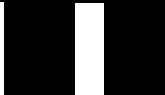



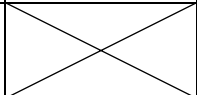
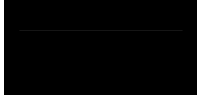



SOURCE: "GEOLOGIC MAP OF THE ROMOLAND 7.5' QUADRANGLE, RIVERSIDE COUNTY, CALIFORNIA" BY D. M. MORTON.

GEOLOGIC MAP	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000' DRAWN: JAH CHKD: DN SCG PROJECT 22G107-1 PLATE 3	 SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 11 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
				OLDER ALLUVIUM: Red Brown fine to coarse Sandy Clay, trace Silt, hard-moist							
		47	4.5			123	10				
		50/5"				116	11				
5		77/11"	4.5	Red Brown fine Sandy Clay, trace Silt, hard-damp to moist		124	8				
		82	4.5			125	9				
10		80/10"		@ 8½ feet, trace medium to coarse Sand		116	8				
				GRANODIORITE TO TONALITE (Kdvg): Light Gray Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, dense to very dense-moist							
15		59					10				
20		53					7				
25		46					8				
Boring Terminated at 25'											

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 5 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
					OLDER ALLUVIUM: Light Brown fine to coarse Sandy Clay, trace Silt, hard-damp		8				
5		82/11"					8				
					Light Brown to Brown fine Sandy Clay, very stiff to hard-moist to very moist		11				
10		80/11"	3.5				23				
					Light Brown Clayey fine to coarse Sand to fine to coarse Sandy Clay, trace Silt, medium dense to very stiff-damp to moist to very moist		6				
15		24	2.5				15				
					Light Brown to Brown fine to coarse Sand, trace Silt, medium dense-damp		6				
20		16									
					Boring Terminated at 20'						

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 7 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
		70/9"	4.5		OLDER ALLUVIUM: Dark Brown fine to coarse Sandy Clay, trace Silt, hard-damp to moist		8				
		50/4"					6				
5		42	4.5				11				
		43				Brown Clayey fine to coarse Sand, dense-damp		5			
10											
		40					6				
15											
Boring Terminated at 20'											

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: MSL												
					OLDER ALLUVIUM: Dark Red Brown fine to medium Sandy Clay, trace Silt, very stiff to hard-moist to very moist	126	9					
						120	15					
5		72/10"	4.5			131	10					
					GRANODIORITE TO TONALITE (Kdvg): Light Gray Brown Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, medium dense to dense-moist	122	9					
10						121	8					
15			26				7					
					Boring Terminated at 15'							

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
				OLDER ALLUVIUM	OLDER ALLUVIUM: Red Brown fine to medium Sandy Clay, trace Silt, hard-moist		10				
5		42	4.5	GRANODIORITE TO TONALITE (Kdvg)	GRANODIORITE TO TONALITE (Kdvg): Light Gray Brown Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, medium dense to dense-moist		10				
		73	3.0								
		31					9				
10		39					9				
		18					12				
15		41					8				
20											
Boring Terminated at 15'											

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 6 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				GRAPHIC LOG	DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
SURFACE ELEVATION: MSL												
					OLDER ALLUVIUM: Dark Red Brown fine to medium Sandy Clay, trace Silt, hard-moist	114	14					El = 62 @ 0 to 5'
						113	13					
5						123	10					
						130	10					
10						128	11					
					GRANODIORITE TO TONALITE (Kdvg): Light Gray Brown Clayey fine- to coarse-grained granodiorite to tonalite, friable, highly weathered, very dense-moist		10					
15												
							10					
20												
							9					
25												
Boring Terminated at 25'												

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22



JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 4 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
5		80	4.5	[Hatched Box]	OLDER ALLUVIUM: Light Brown fine Sandy Clay, trace medium Sand, trace Silt, hard-damp to moist @ 8½ feet, stiff to very stiff		10				
		60					7				
		80	4.5				9				
		50/5"	2.0				9				
10					Boring Terminated at 10'						

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

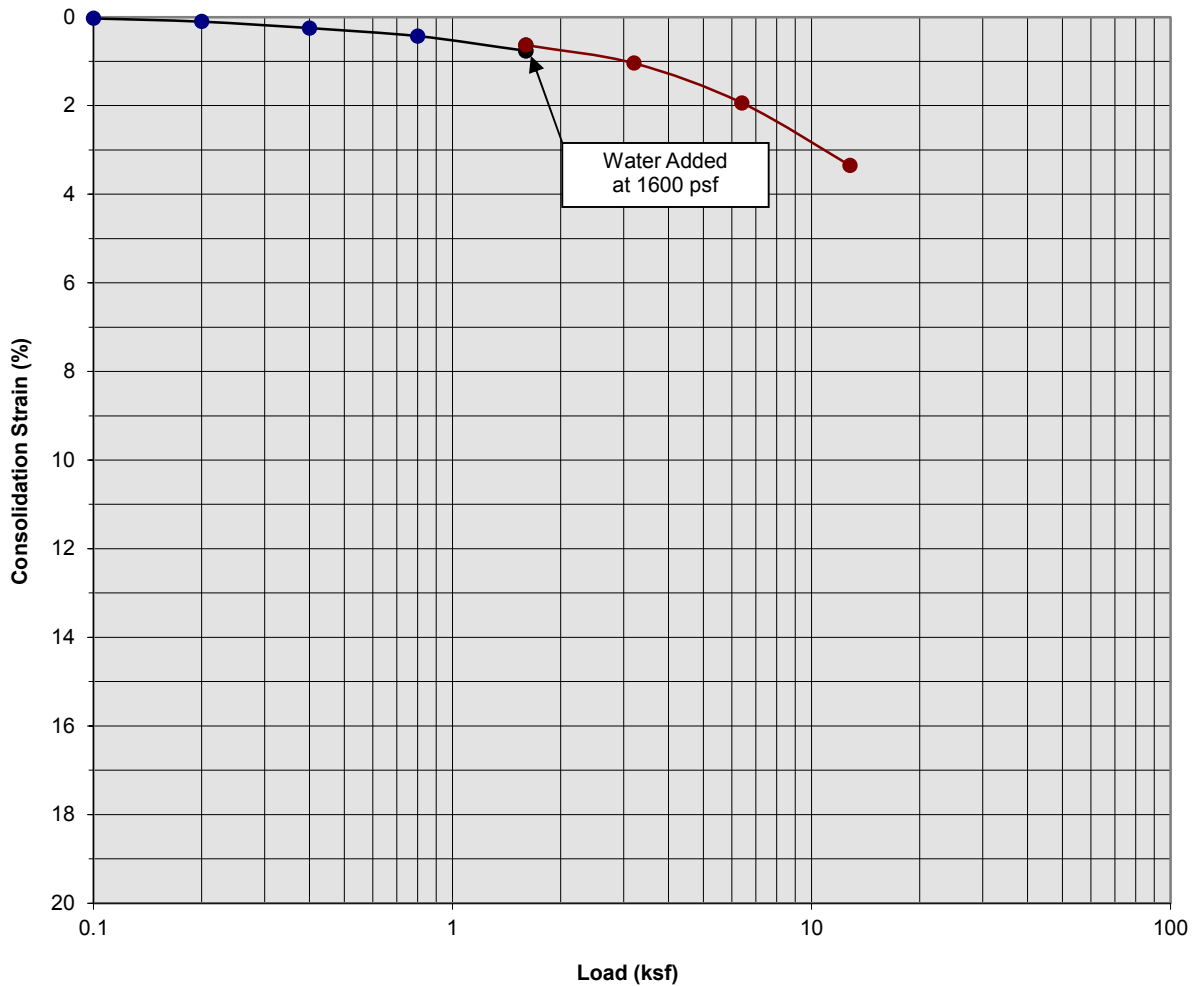
JOB NO.: 22G107-1	DRILLING DATE: 1/21/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	DRILLING METHOD: Hollow Stem Auger	CAVE DEPTH: 8 feet
LOCATION: Perris, California	LOGGED BY: Oscar Sandoval	READING TAKEN: At Completion

FIELD RESULTS				DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)		GRAPHIC LOG	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	
SURFACE ELEVATION: MSL											
				[Hatched Box]	OLDER ALLUVIUM: Dark Brown fine to medium Sandy Clay, trace Silt, trace coarse Sand, hard-moist		10				
5	X	85	4.5				9				
	X	65/11"					9				
	X	50/5"	4.5				12				
10	X	87/10"									
Boring Terminated at 10'											

TBL_22G107-1.GPJ_SOCALGEO.GDT_2/23/22

A P P E N D I X C

Consolidation/Collapse Test Results



Classification: Dark Red Brown fine to medium Sandy Clay, trace Silt

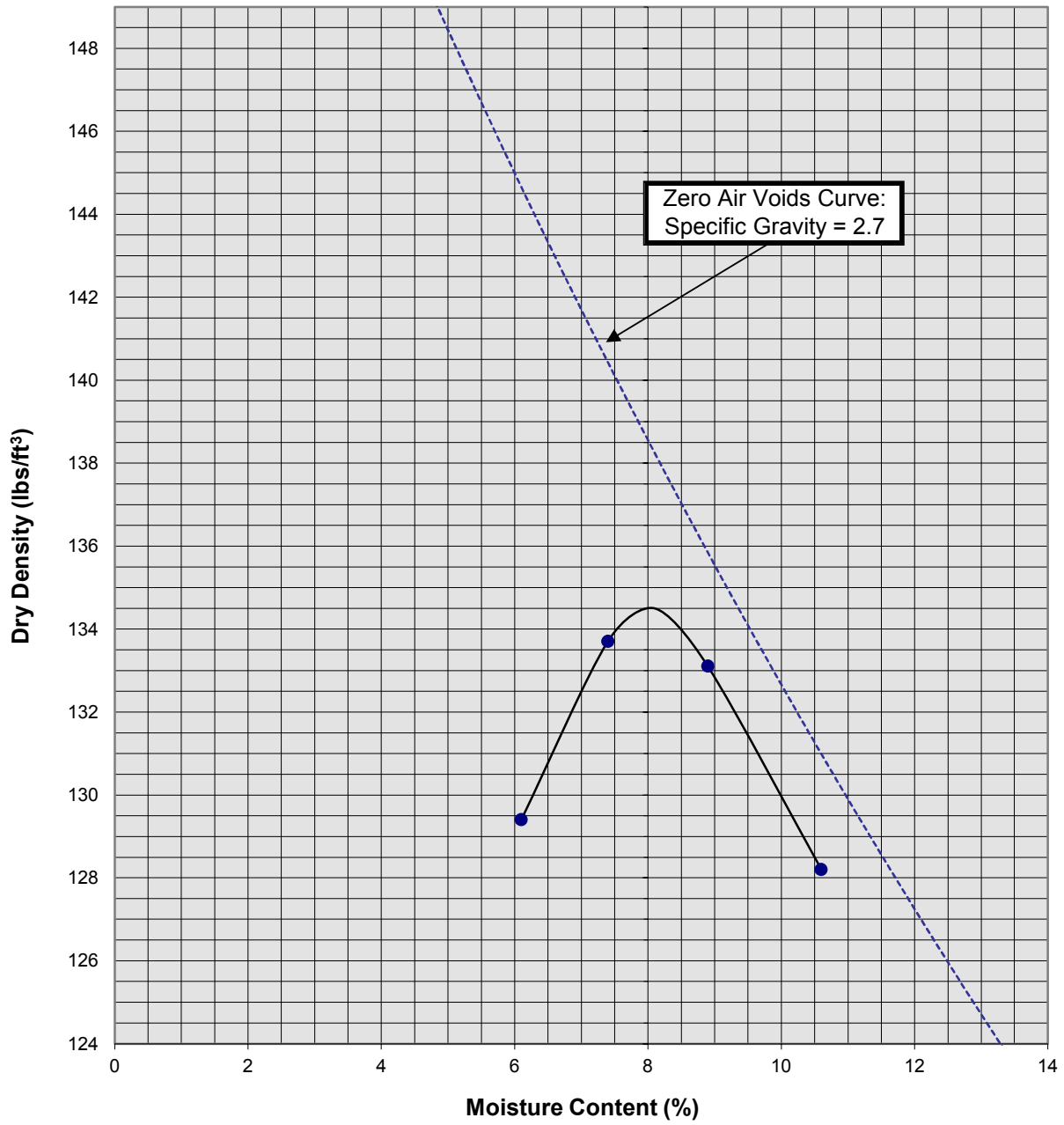
Boring Number:	B-4	Initial Moisture Content (%)	15
Sample Number:	---	Final Moisture Content (%)	19
Depth (ft)	3 to 4	Initial Dry Density (pcf)	119.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	124.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	-0.13

Proposed Warehouse
 Perris, California
 Project No. 22G107-1
PLATE C- 1



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Moisture/Density Relationship ASTM D-1557



Soil ID Number	B-1 @ 0 to 5'
Optimum Moisture (%)	8
Maximum Dry Density (pcf)	134.5
Soil Classification	Red Brown fine to coarse Sandy Clay, trace Silt

Proposed Warehouse
Perris, CA
Project No. 22G107-1
PLATE C-2



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.
- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.
- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.
- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.
- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.
- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.
- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.
- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.
- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.
- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.
- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted
- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated," and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.
- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.
- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.
- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:
 - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.
 - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.
- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.
- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.
- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.
- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.
- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.
- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.
- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.
- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.
- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.
- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.
- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.
- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core
- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.
- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.
- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).
- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.
- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

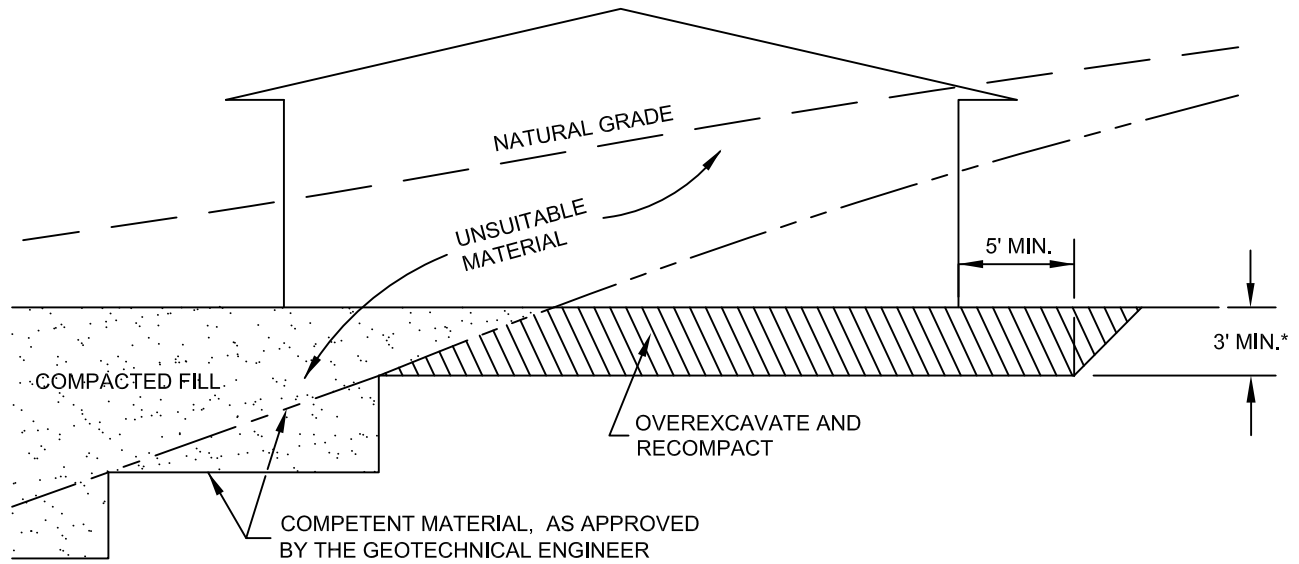
- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.
- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.
- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

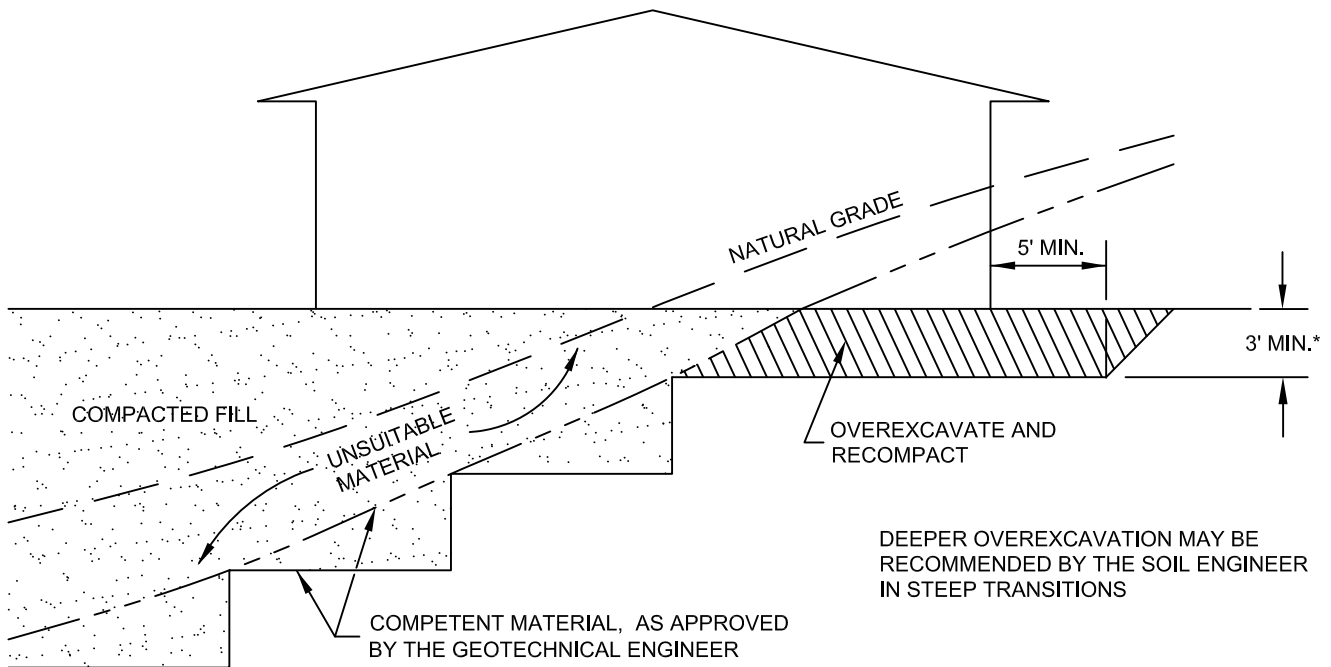
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.
- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean $\frac{3}{4}$ -inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT

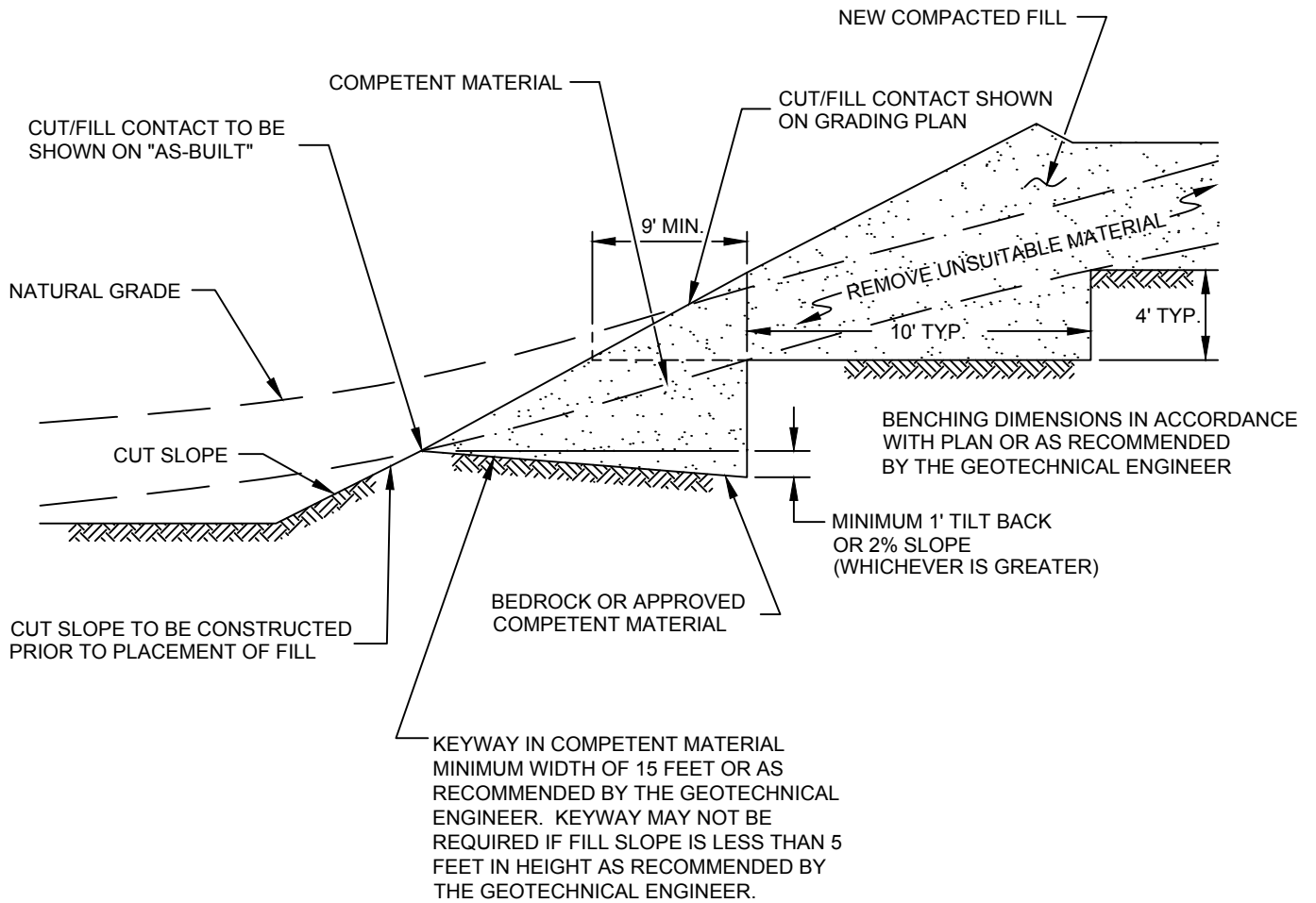



CUT/FILL LOT (TRANSITION)

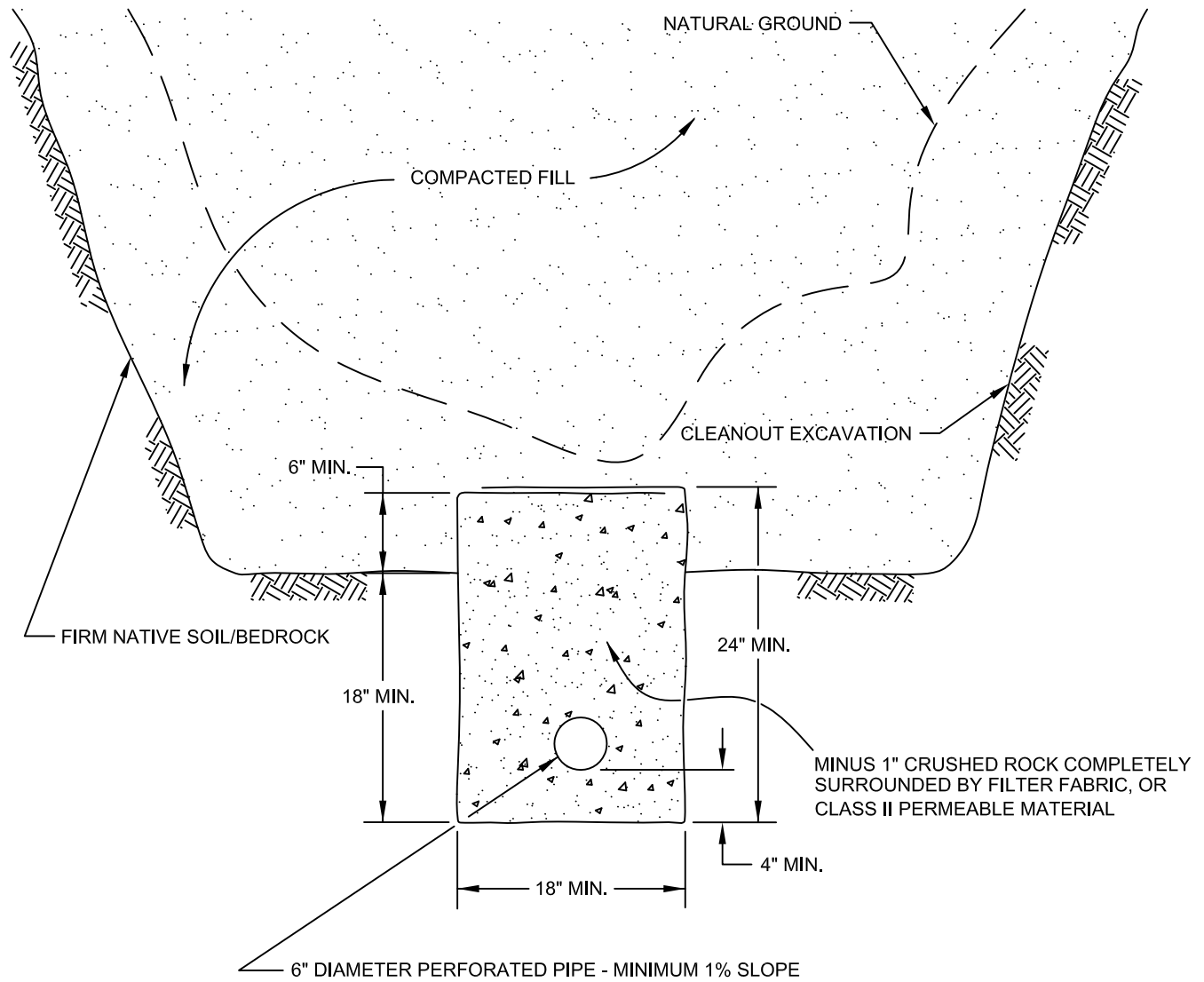


*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION. ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-1	




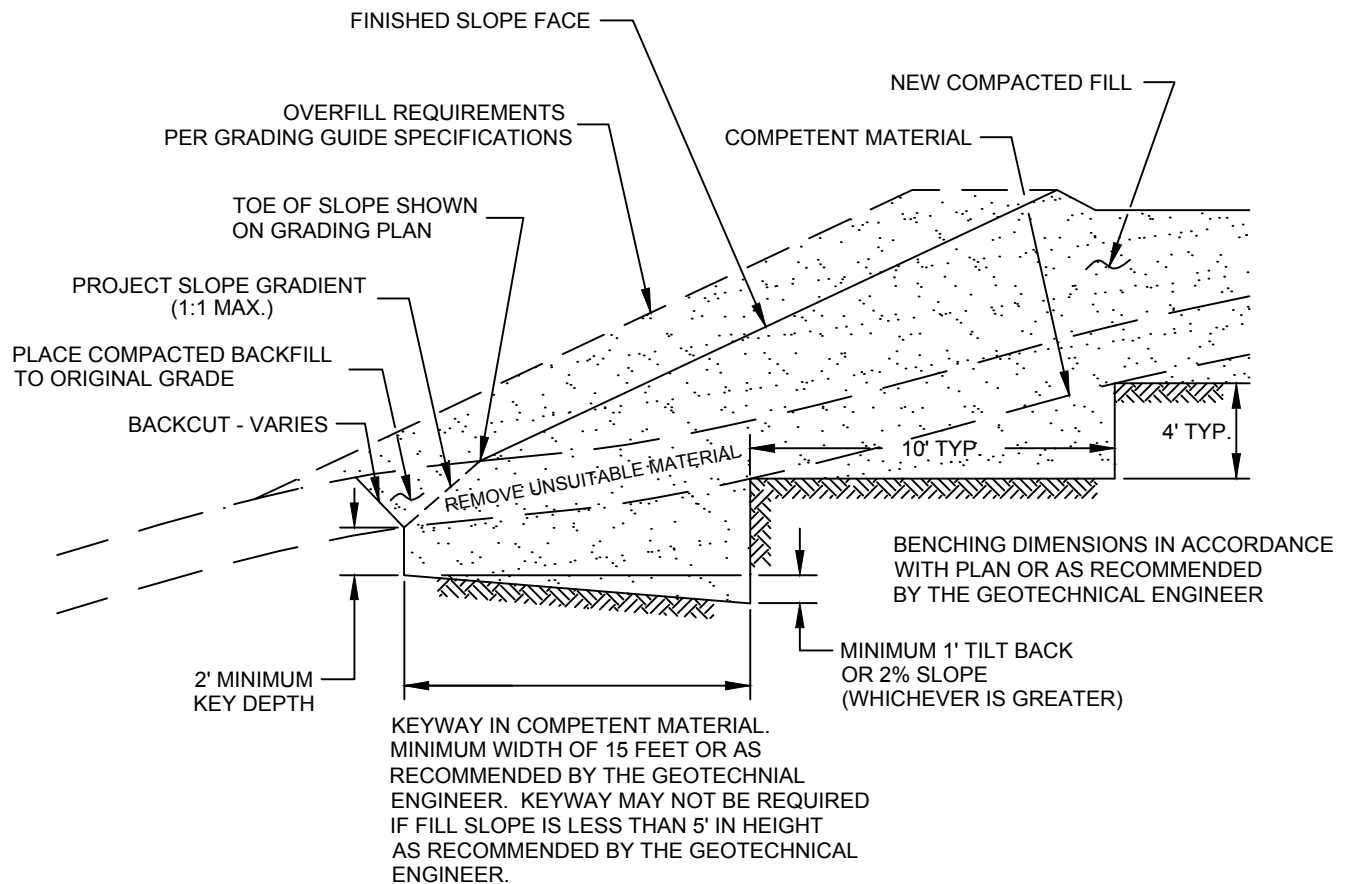
FILL ABOVE CUT SLOPE DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-2	



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

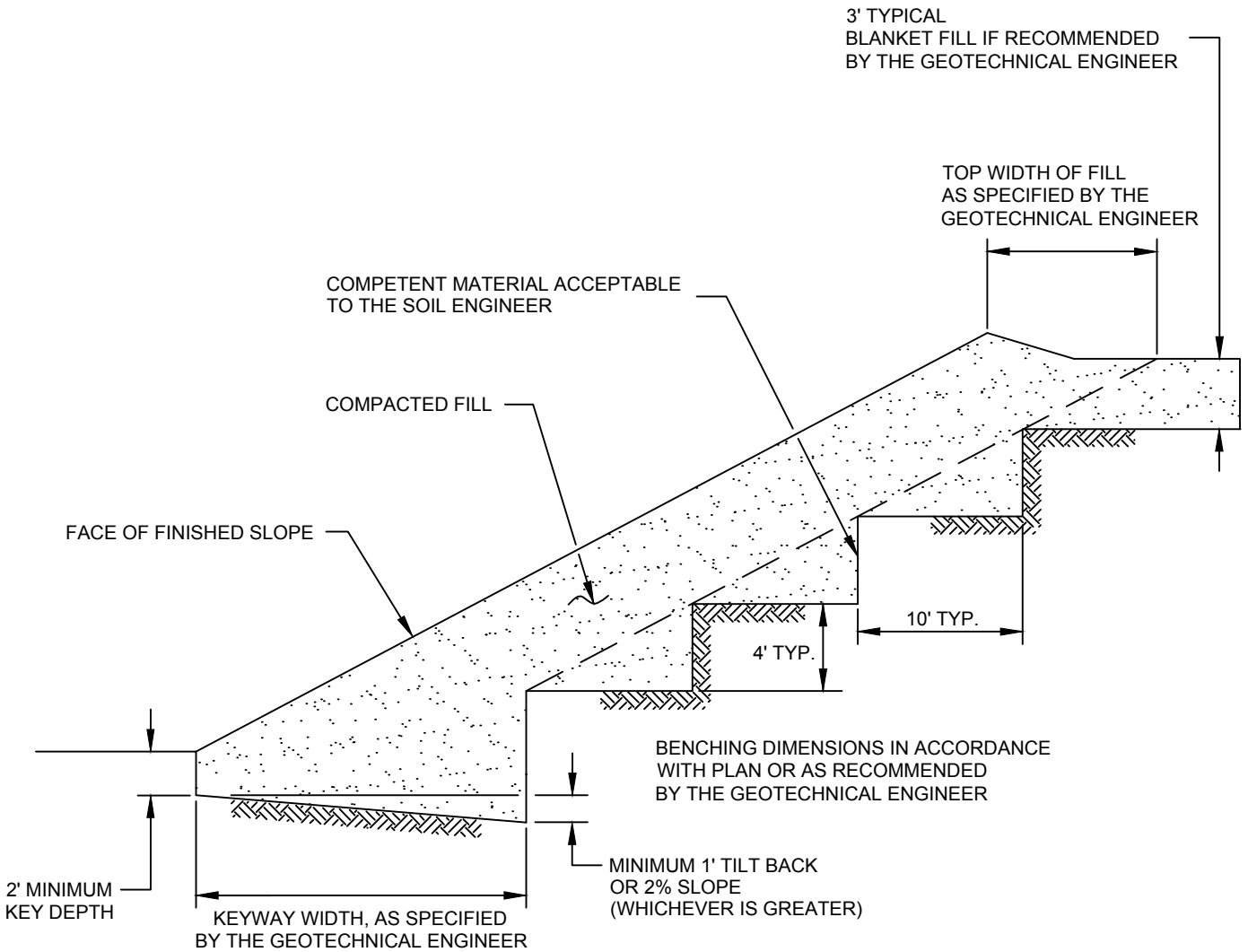
**SCHEMATIC ONLY
NOT TO SCALE**


CANYON SUBDRAIN DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-3	

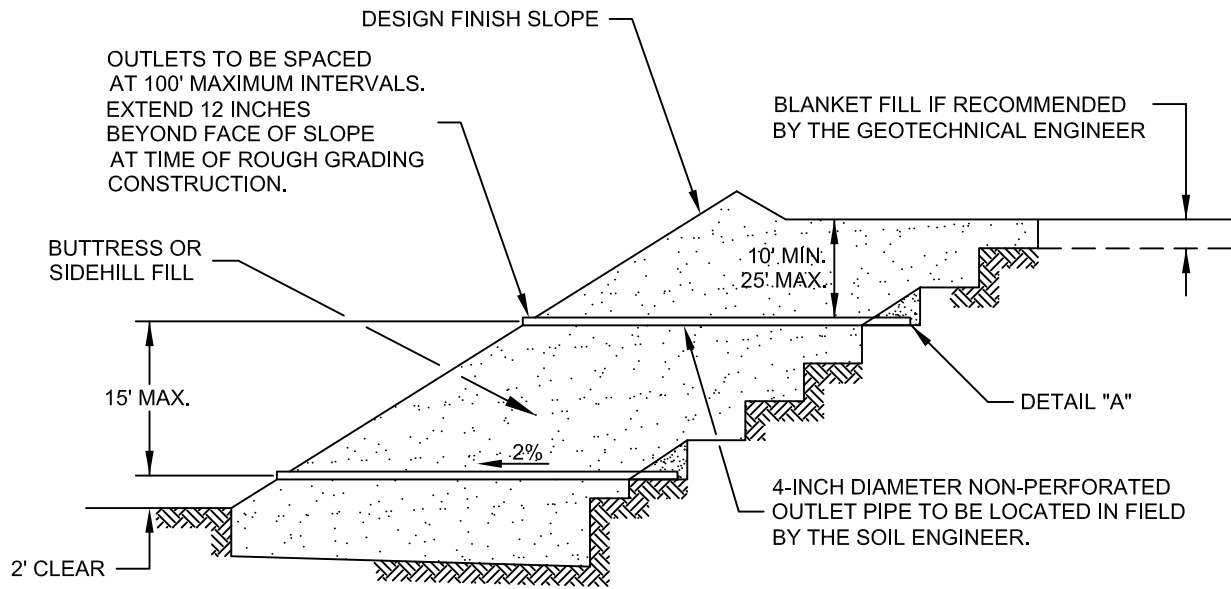


NOTE:
 BENCHING SHALL BE REQUIRED
 WHEN NATURAL SLOPES ARE
 EQUAL TO OR STEEPER THAN 5:1
 OR WHEN RECOMMENDED BY
 THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-4	



STABILIZATION FILL DETAIL	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-5	



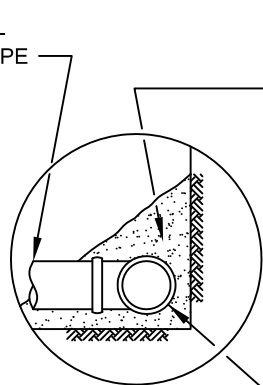
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8
SAND EQUIVALENT = MINIMUM OF 50	

OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW



DETAIL "A"

FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.


ALTERNATIVE: IN LIEU OF FILTER MATERIAL FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

NOTES:

- TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-6	

MINIMUM ONE FOOT THICK LAYER OF LOW PERMEABILITY SOIL IF NOT COVERED WITH AN IMPERMEABLE SURFACE

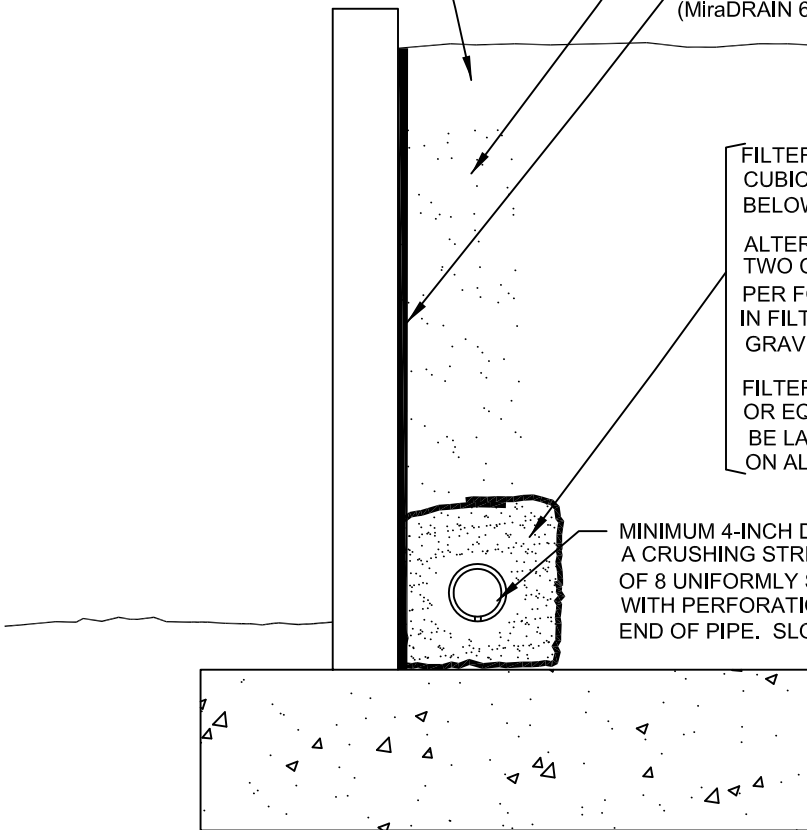
MINIMUM ONE FOOT WIDE LAYER OF FREE DRAINING MATERIAL (LESS THAN 5% PASSING THE #200 SIEVE) OR PROPERLY INSTALLED PREFABRICATED DRAINAGE COMPOSITE (MiraDRAIN 6000 OR APPROVED EQUIVALENT).

FILTER MATERIAL - MINIMUM OF TWO CUBIC FEET PER FOOT OF PIPE. SEE BELOW FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL TWO CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE BELOW FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 6 INCHES ON ALL JOINTS.

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8
SAND EQUIVALENT = MINIMUM OF 50	

**RETAINING WALL BACKDRAINS
GRADING GUIDE SPECIFICATIONS**

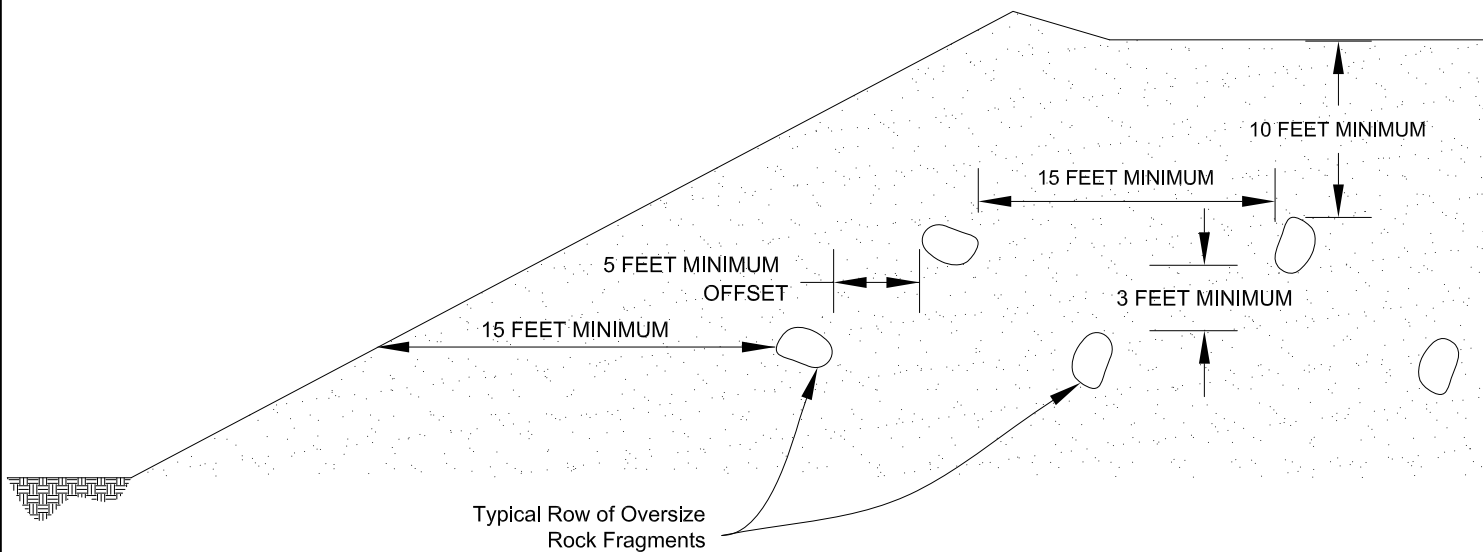
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

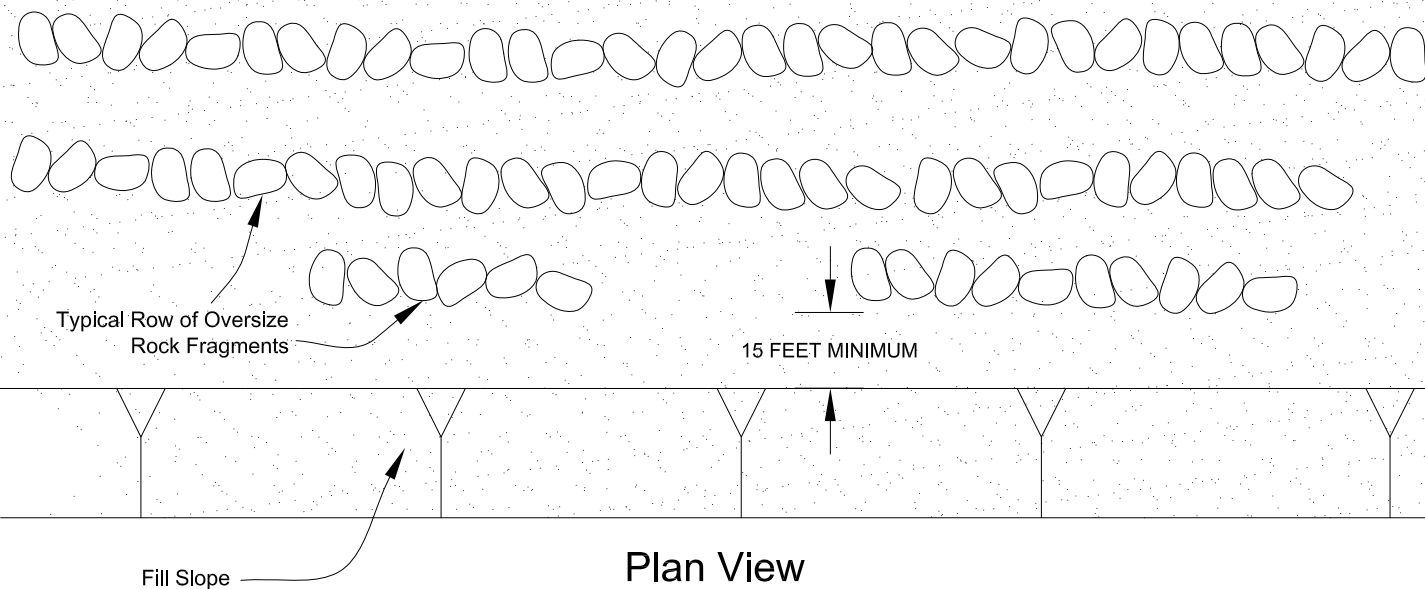
PLATE D-7



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**



Section View



Plan View

**PLACEMENT OF OVERSIZED MATERIAL
GRADING GUIDE SPECIFICATIONS**

NOT TO SCALE

DRAWN: PM
CHKD: GKM

PLATE D-8



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**

APPENDIX E



Latitude, Longitude: 33.744164, -117.180544



Date	2/23/2022, 10:19:50 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	C - Very Dense Soil and Soft Rock

Type	Value	Description
S_S	1.421	MCE_R ground motion. (for 0.2 second period)
S_1	0.528	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.705	Site-modified spectral acceleration value
S_{M1}	0.777	Site-modified spectral acceleration value
S_{DS}	1.137	Numeric seismic design value at 0.2 second SA
S_{D1}	0.518	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	1.472	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
$SsRT$	1.421	Probabilistic risk-targeted ground motion. (0.2 second)
$SsUH$	1.52	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
$S1RT$	0.528	Probabilistic risk-targeted ground motion. (1.0 second)
$S1UH$	0.575	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
$S1D$	0.6	Factored deterministic acceleration value. (1.0 second)
PGA_d	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.935	Mapped value of the risk coefficient at short periods
C_{R1}	0.918	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>



SEISMIC DESIGN PARAMETERS - 2019 CBC	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
DRAWN: MD CHKD: DN SCG PROJECT 22G107-1 PLATE E-1	 SOUTHERN CALIFORNIA GEOTECHNICAL



**SOUTHERN
CALIFORNIA
GEOTECHNICAL**
A California Corporation

February 24, 2022

Hillwood
901 Via Piemonte, Suite 175
Ontario, California 91764

Attention: Mr. John Grace

Project No.: **22G107-2**

Subject: **Results of Infiltration Testing**
Proposed Warehouse
NWC Ethanac Road and Sherman Road
Perris, California

Reference: Geotechnical Investigation, Proposed Warehouse, NWC Ethanac Road and Sherman Road, Perris, California, prepared for Hillwood, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 22G107-1, dated February 23, 2022.

Mr. Grace:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 21P511, dated December 17, 2021. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The subject site is located at the northwest corner of Ethanac Road and Sherman Road in Perris, California. The site is bounded to the north by a commercial/industrial building and a vacant lot, to the west by Trumble Road, to the south by Ethanac Road, and to the east by Sherman Road. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of several contiguous rectangular-shaped parcels which total 24± acres in size. The site is currently vacant and undeveloped. The ground surface cover generally consists of exposed soil with moderate native grass and weed growth. Concrete debris, including concrete fragments and a concrete pipe, is scattered on the ground surface in the southern portion of the site. Several small to medium sized trees are also present in the southern region of the site.

Based on our review of readily available historical aerial photographs, two (2) small structures were present in the southwestern portion of the overall site, between 1966 and 1997.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall site topography is relatively flat that gently slopes downward to the northwest at a gradient of less than 1 percent.

Proposed Development

A conceptual site plan for the proposed development, identified as Scheme 7, prepared by Herdman Architecture and Design, was provided to our office by the client. Based on this plan, the subject site will be developed with a 547,520± ft² warehouse, located in the central region of the site. Dock-high doors will be constructed along a portion of the northern and southern building walls. The proposed building is expected to be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck loading areas, and concrete flatwork with some landscaped areas.

The proposed development will include on-site storm water infiltration. Based on conversations with the project civil engineer, we understand that the infiltration system will consist a below-grade chamber system located in the southern area of the site. The bottom of the infiltration system will range from 10 to 12± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, which is referenced above. As part of this study, eight (8) borings were advanced to depths of 10 to 25± feet below existing site grades.

Older native alluvial soils were encountered at the ground surface at all of the boring locations, extending to depths of at least 5½ to 25± feet below ground surface. The older alluvium generally consists of stiff to hard fine sandy clays, fine to coarse sandy clays and medium dense to very dense clayey fine to medium sands. Granodiorite to Tonalite bedrock, map symbol Kdgv, was encountered beneath the older alluvium at Boring Nos. B-1, B-4, B-5, and B-6, at depths of 5½ to 12± feet below ground surface, extending to the maximum depths explored at each of these borings of 15 to 25± feet. The bedrock generally consists of medium dense to very dense gray brown, highly weathered, friable, fine- to coarse-grained granodiorite to tonalite.

Groundwater

Free water was not encountered during any of our subsurface explorations. Based on the lack of any water within the borings and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed readily available groundwater data in order to determine regional groundwater depths. The primary reference used to determine the groundwater depths in the subject site area is the California Department of Water Resources website,

<http://www.water.ca.gov/waterdatalibrary/>. The nearest monitoring well is located approximately 1,320 feet northwest from the site. Water level readings within this monitoring well indicates a high groundwater level of 95.6 feet below the ground surface in September 1995.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of two (2) backhoe-excavated trenches, extending to depths of 8 to 9± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 and I-2) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Older native alluvial soils were encountered at the ground surface at both of the infiltration test locations, extending to at least the maximum depths explored of 8 to 9± feet below ground surface. The older alluvium generally consists of very dense clayey fine to medium sands. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are presented in this report.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration system that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at both of the trench locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4 inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at the trench locations, the volumetric measurements were made at 15-minute increments. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

<u>Infiltration Test No.</u>	<u>Depth (feet)</u>	<u>Soil Description</u>	<u>Infiltration Rate (inches/hour)</u>
I-1	9	Clayey fine to medium Sand, little coarse Sand, little Silt	0.1
I-2	8	Clayey fine to medium Sand, trace coarse Sand, little Silt	0.2

Design Recommendations

Two (2) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 0.1 to 0.2 inches per hour. The major factors affecting the lack of infiltration at these locations is the presence of dense to very dense older alluvium. **Based on the lack of infiltration at the depths tested, infiltration is not considered feasible for this site. These areas are very likely to be underlain by much less permeable, denser older alluvium, which was encountered at the other boring and trench locations.**

Although infiltration is not considered feasible at the site, the client may desire to use storm water disposal systems that do not rely on infiltration at this site. The design of storm water disposal systems should be performed by the project civil engineer, in accordance with the City of Perris and/or County of Riverside guidelines. It is recommended any such systems be designed and constructed to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the flow rates through the system. It should be noted that the recommended infiltration rates are based on infiltration testing at two (2) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the

structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with

generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.



Oscar Sandoval
Staff Engineer

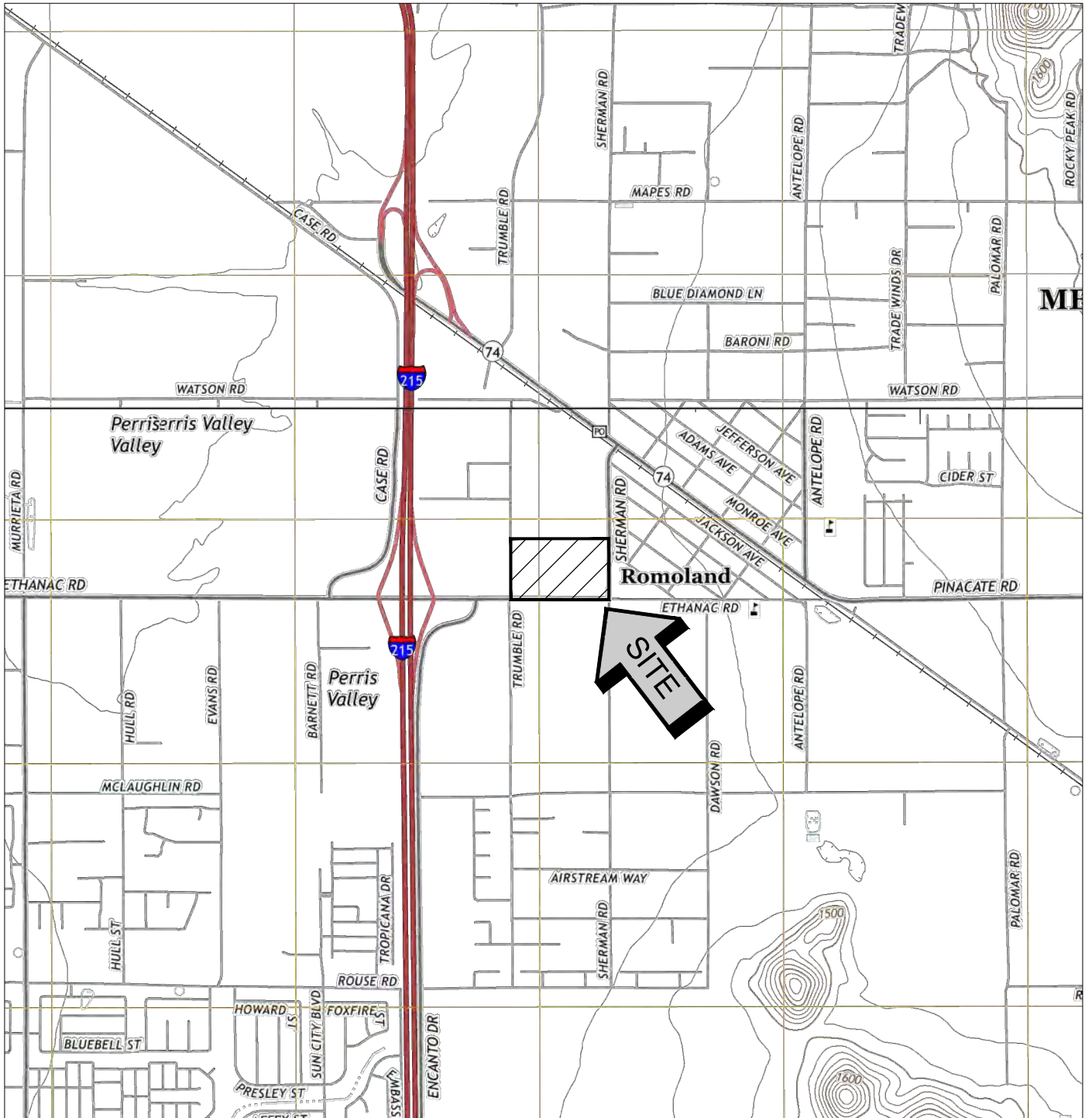


Robert G. Trazo, GE 2655
Principal Engineer



Distribution: (1) Addressee

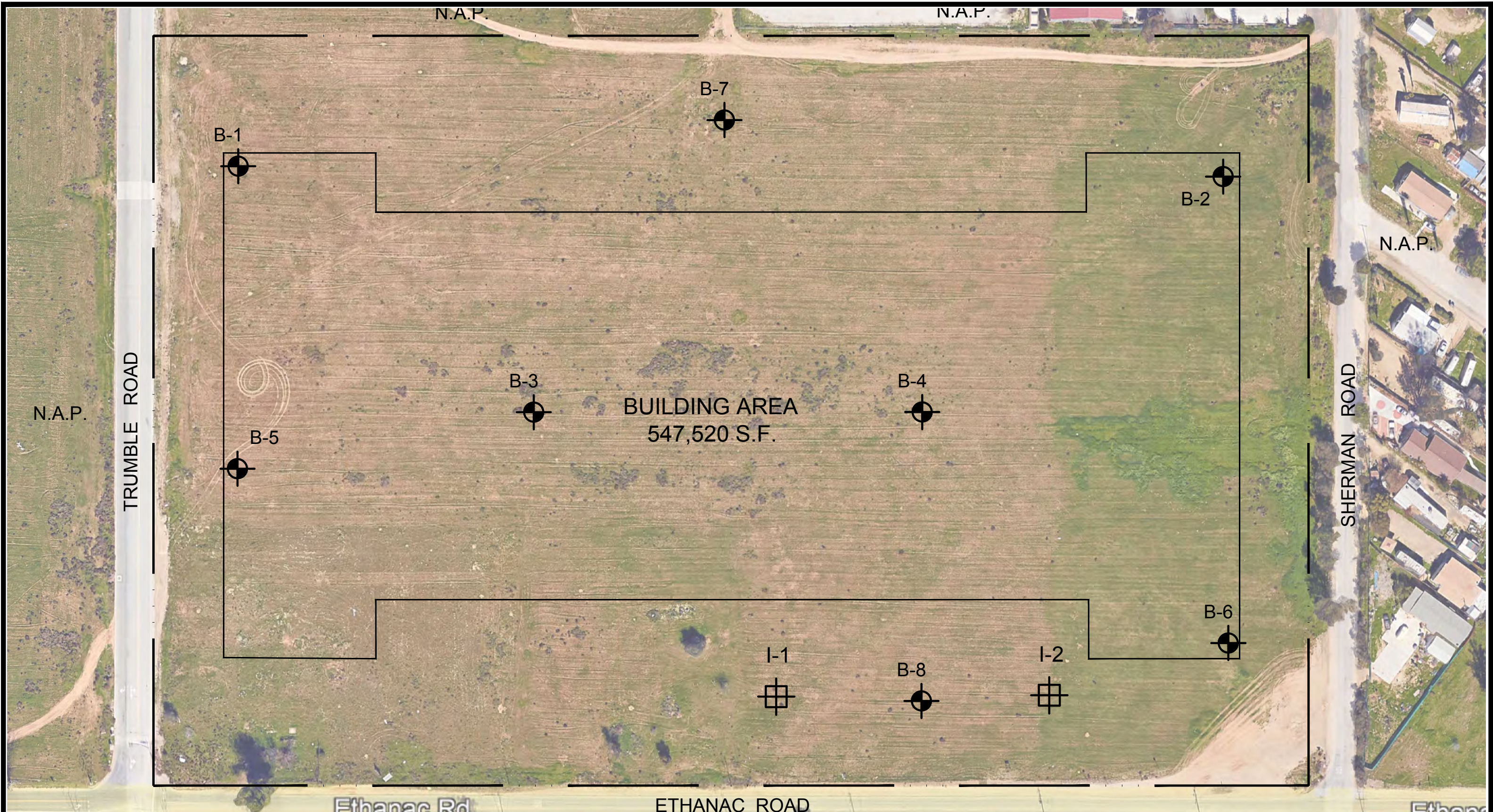
Enclosures: Plate 1: Site Location Map
Plate 2: Infiltration Test Location Plan
Trench Log Legend and Logs (4 pages)
Infiltration Test Results Spreadsheets (2 pages)
Grainsize Distribution Graphs (2 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF THE ROMOLAND & PERRIS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.



SITE LOCATION MAP	
PROPOSED WAREHOUSE	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000'	 SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: MD	
CHKD: DN	
SCG PROJECT 22G107-2	
PLATE 1	



N.A.P.

N.A.P.

N.A.P.

N.A.P.

TRUMBLE ROAD

SHERMAN ROAD

Ethanac Rd

ETHANAC ROAD

Ethanac Rd

BUILDING AREA
547,520 S.F.

B-1

B-7

B-2

B-3

B-4

B-5

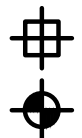
B-6

I-1

B-8

I-2

GEOTECHNICAL LEGEND



APPROXIMATE INFILTRATION TEST LOCATION



APPROXIMATE BORING LOCATION



NOTE: CONCEPTUAL SITE PLAN (SCHEME 7) PREPARED BY HERDMAN ARCHITECTURE + DESIGN.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH (2018)


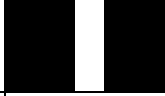

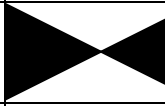

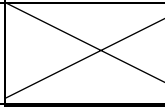


INFILTRATION TEST LOCATION PLAN
PROPOSED WAREHOUSE
PERRIS, CALIFORNIA

SCALE: 1" = 100'
DRAWN: OS
CHKD: RGT
SCG PROJECT
22G107-2
PLATE 2



SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH:

Distance in feet below the ground surface.

SAMPLE:

Sample Type as depicted above.

BLOW COUNT:

Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.:

Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG:

Graphic Soil Symbol as depicted on the following page.

DRY DENSITY:

Dry density of an undisturbed or relatively undisturbed sample in lbs/ft³.

MOISTURE CONTENT:

Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT:

The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT:

The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE:

The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR:

The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



JOB NO.: 22G107-2	EXCAVATION DATE: 1/24/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	EXCAVATION METHOD: Backhoe	CAVE DEPTH: ---
LOCATION: Perris, California	LOGGED BY: Caleb Brackett	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG		DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
5					SURFACE ELEVATION: MSL OLDER ALLUVIUM: Light Brown Clayey fine to medium Sand, little Silt, little coarse Sand, trace Calcareous veining, cemented, slightly porous, very dense-damp to moist		11		29			
					Trench Terminated at 9' Due to Refusal on Very Dense Soils							

TBL 22G107-2.GPJ_SOCALGEO.GDT 2/24/22



JOB NO.: 22G107-2	EXCAVATION DATE: 1/24/22	WATER DEPTH: Dry
PROJECT: Proposed Warehouse	EXCAVATION METHOD: Backhoe	CAVE DEPTH: ---
LOCATION: Perris, California	LOGGED BY: Caleb Brackett	READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG		DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
5					SURFACE ELEVATION: MSL OLDER ALLUVIUM: Light Brown Clayey fine to medium Sand, little Silt, trace coarse Sand, cemented, slightly porous, very dense-damp to moist		10			26		
					Trench Terminated at 8' Due to Refusal on Very Dense Soils							

TBL 22G107-2.GPJ_SOCALGEO.GDT 2/24/22

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Perris, CA
Project Number	22G107-2
Engineer	CB

Infiltration Test No I-1

Constants			
	Diameter (ft)	Area (ft ²)	Area (cm ²)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval Elapsed (min)	Flow Readings				Infiltration Rates				
				Inner Ring (ml)	Ring Flow (cm ³)	Annular Ring (ml)	Space Flow (cm ³)	Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)	
1	Initial	9:20 AM	15	0		0						
	Final	9:35 AM	15	100	100	8000	8000	0.55	14.62	0.22	5.76	
2	Initial	9:35 AM	15	0	0	8	5792	0.00	10.58	0.00	4.17	
	Final	9:50 AM	30	0	0	5800						
3	Initial	9:50 AM	15	0	0	0	3900	0.00	7.13	0.00	2.81	
	Final	10:05 AM	45	0	0	3900						
4	Initial	10:05 AM	15	0	0	0	3500	0.00	6.40	0.00	2.52	
	Final	10:20 AM	60	0	0	3500						
5	Initial	10:20 AM	15	0	100	0	3600	0.55	6.58	0.22	2.59	
	Final	10:35 AM	75	100	100	3600						
6	Initial	10:35 AM	15	0	50	0	3600	0.27	6.58	0.11	2.59	
	Final	10:50 AM	90	50	50	3600						
7	Initial	10:50 AM	15	0	50	0	3600	0.27	6.58	0.11	2.59	
	Final	11:05 AM	105	50	50	3600						
8	Initial	11:05 AM	15	0	50	0	3600	0.27	6.58	0.11	2.59	
	Final	11:20 AM	120	50	50	3600						

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Perris, CA
Project Number	22G107-2
Engineer	CB

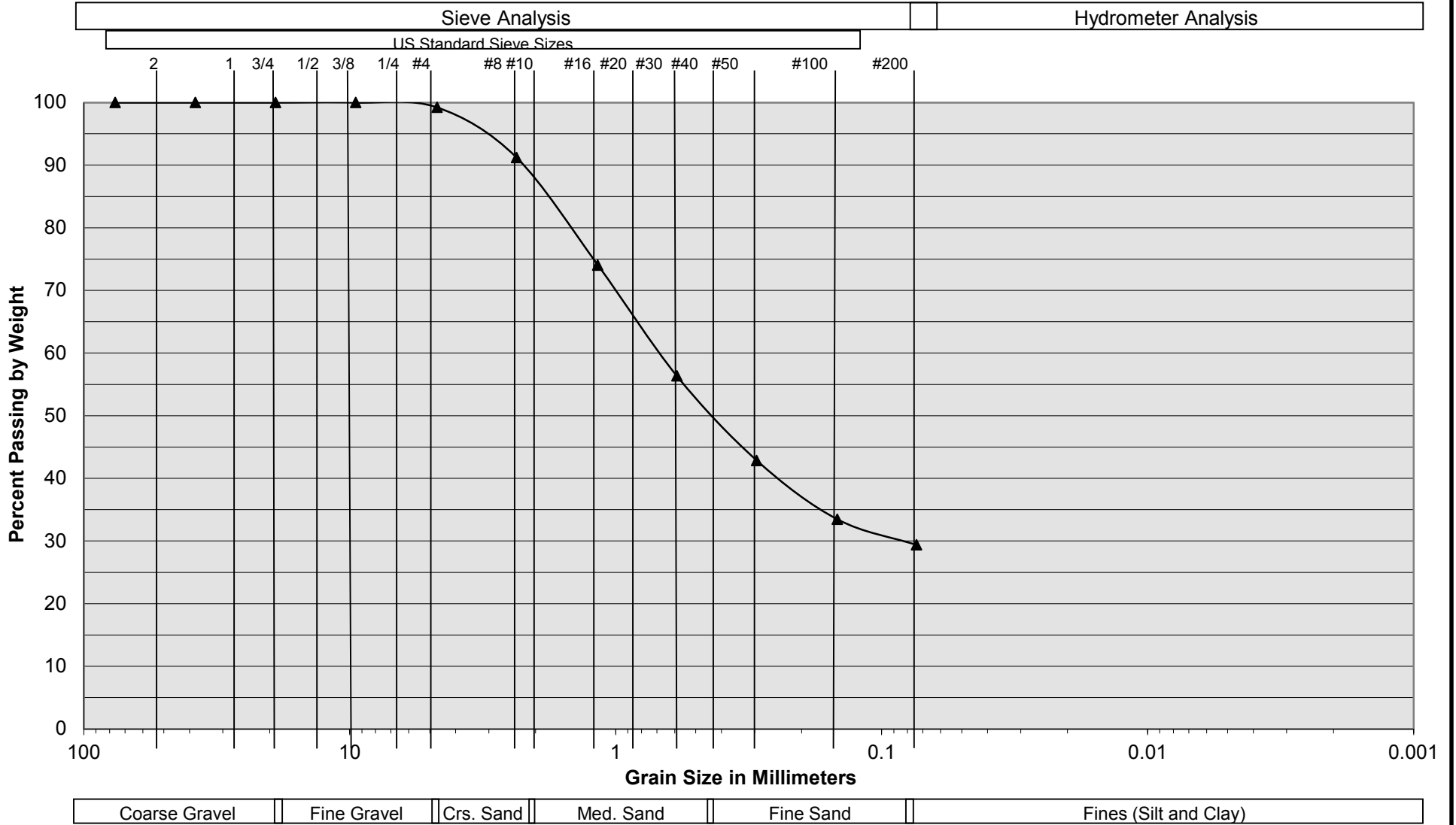
Infiltration Test No I-2

Constants			
	Diameter (ft)	Area (ft ²)	Area (cm ²)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval Elapsed (min)	Flow Readings				Infiltration Rates			
				Inner Ring (ml)	Ring Flow (cm ³)	Annular Ring (ml)	Space Flow (cm ³)	Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	7:00 AM	15	0	200	0	3500	1.10	6.40	0.43	2.52
	Final	7:15 AM	15	200	200	3500					
2	Initial	7:15 AM	15	0	150	0	4200	0.82	7.68	0.32	3.02
	Final	7:30 AM	30	150	150	4200					
3	Initial	7:30 AM	15	0	150	0	3000	0.82	5.48	0.32	2.16
	Final	7:45 AM	45	150	150	3000					
4	Initial	7:45 AM	15	0	100	0	2900	0.55	5.30	0.22	2.09
	Final	8:00 AM	60	100	100	2900					
5	Initial	8:00 AM	15	0	150	0	2900	0.82	5.30	0.32	2.09
	Final	8:15 AM	75	150	150	2900					
6	Initial	8:15 AM	15	0	100	0	2800	0.55	5.12	0.22	2.01
	Final	8:30 AM	90	100	100	2800					
7	Initial	8:30 AM	15	0	100	0	2900	0.55	5.30	0.22	2.09
	Final	8:45 AM	105	100	100	2900					
8	Initial	8:45 AM	15	0	100	0	2800	0.55	5.12	0.22	2.01
	Final	9:00 AM	120	100	100	2800					

Grain Size Distribution



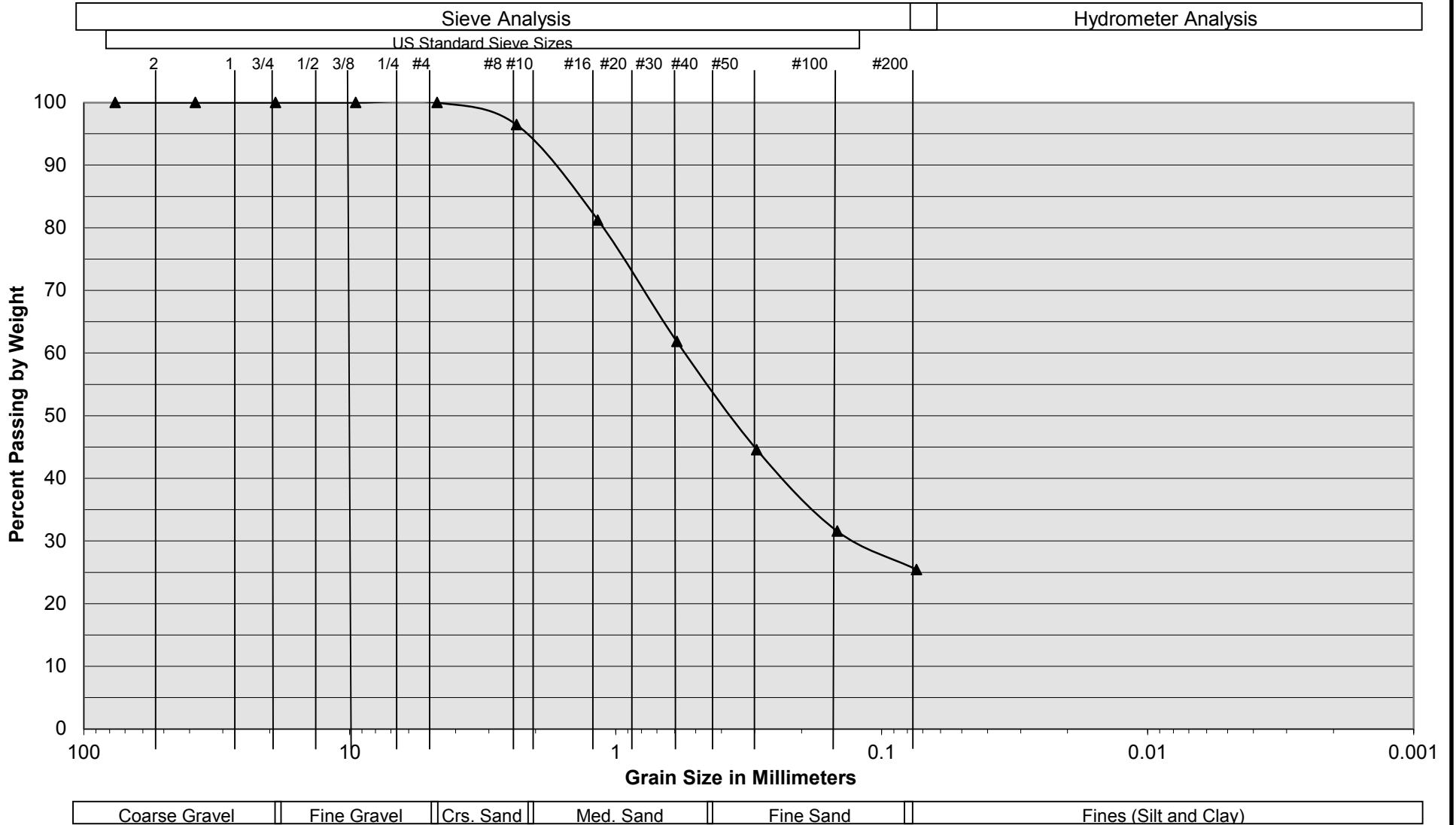
Sample Description	I-1 @ 8'
Soil Classification	Light Brown Clayey fine to medium Sand, little coarse Sand, little Silt

Proposed Warehouse
 Perris, CA
 Project No. 22G107-2
PLATE C- 1



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-2 @ 7'
Soil Classification	Light Brown Clayey fine to medium Sand, trace coarse Sand, little Silt

Proposed Warehouse
 Perris, CA
 Project No. 22G107-2
PLATE C- 2



SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Appendix 4: Historical Site Conditions

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

To be provided during final engineering

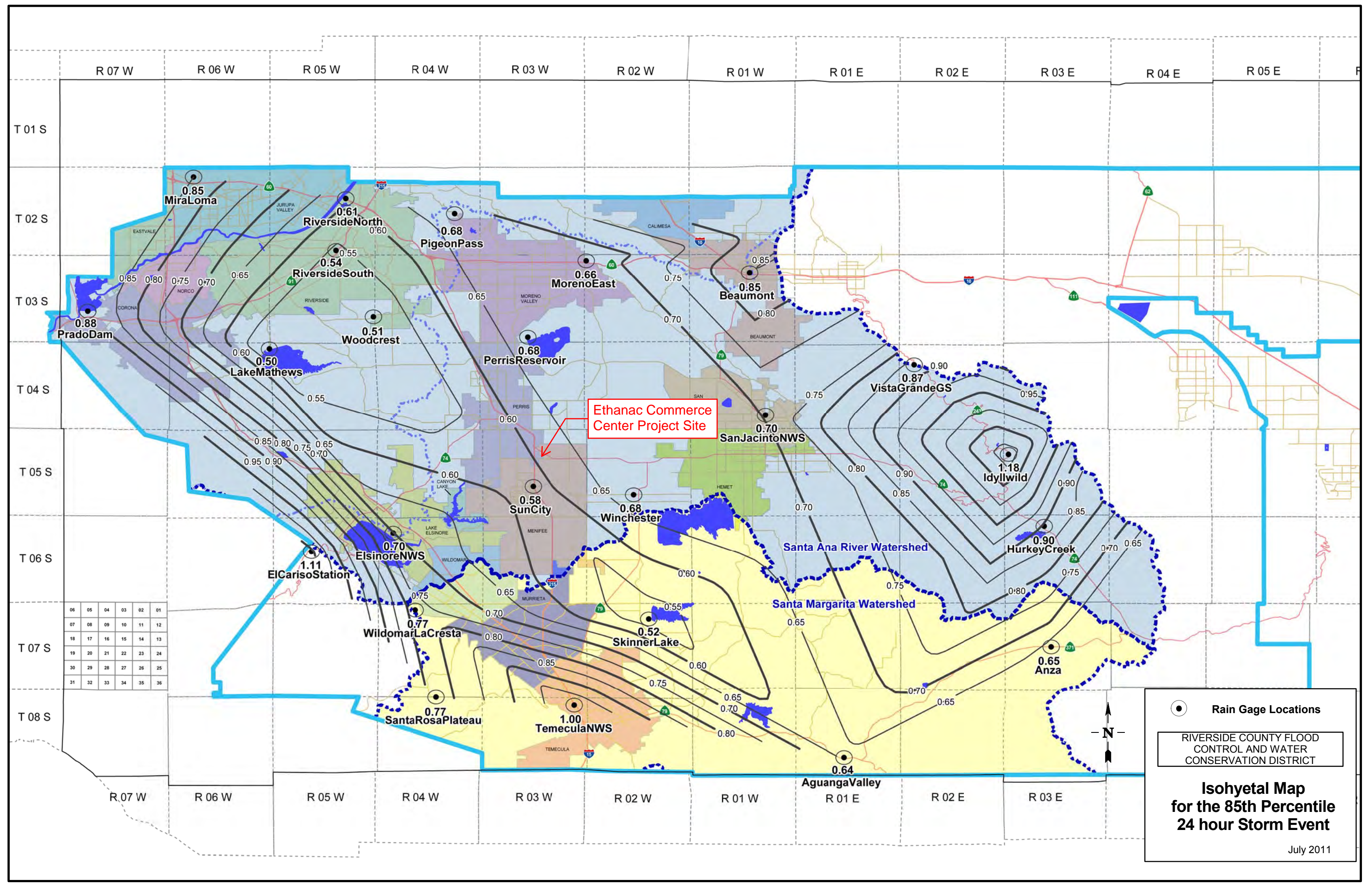
Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

N/A

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation



Ethanac Commerce Center Project Site

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

● Rain Gage Locations

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

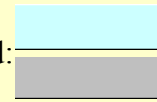
Isohyetal Map for the 85th Percentile 24 hour Storm Event

July 2011

Santa Ana Watershed - BMP Design 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 **Albert A. Webb Associates**

Date **12/5/2022**

Designed by **RSB**

Case No

Company Project Number/Name

2022-0198 Hillwood Ethanac

BMP Identification

BMP NAME / ID **BMP-A**

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

$D_{85} =$ **0.61** inches

Drainage Management Area Tabulation

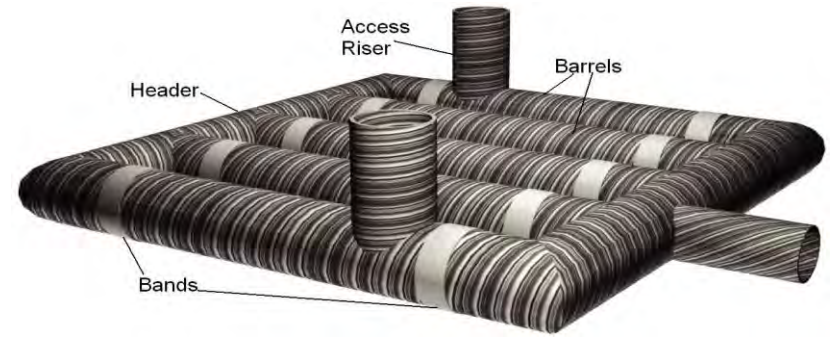
Insert additional rows if needed to accommodate all DMAs draining to the BMP

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)
L-A	90768	Ornamental Landscaping	0.1	0.11	10026.1			
R-A	407336	Roofs	1	0.89	363343.7			
H-A	336463	Concrete or Asphalt	1	0.89	300125			
SR-A	30358	Ornamental Landscaping	0.1	0.11	3353.3			
	864925				676848.1	0.61	34406.4	128,629

Notes:

Proposed volume on plans reflects the V_{BMP} + HCOC mitigation volume. HCOC mitigation volume is based on the 2-year 24-hour storm event. Calculations are found in Appendix 7.

For design assistance, drawings, and pricing send completed worksheet to:
dyods@contech-cpi.com



Project Summary

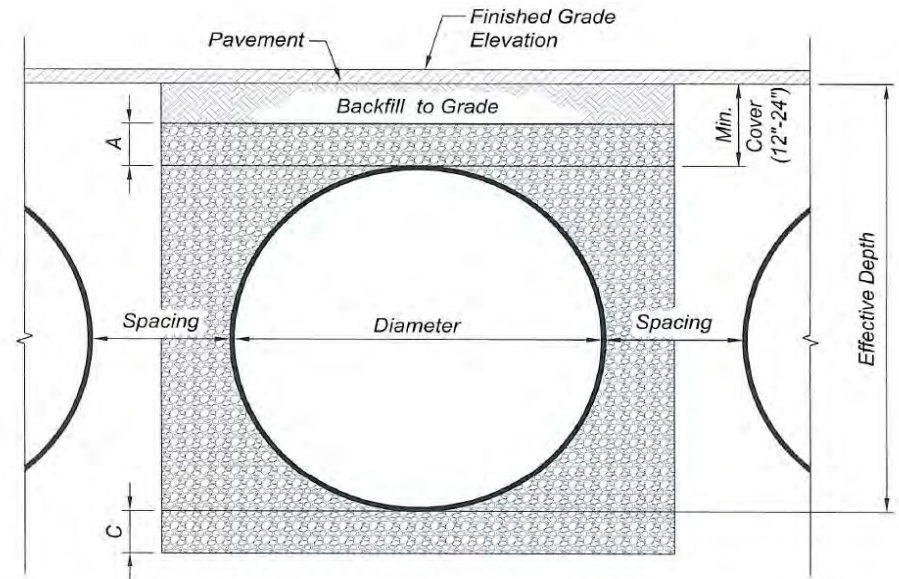
Date:	1/9/2023
Project Name:	Hillwood Ethanac
City / County:	City of Perris
State:	CA
Designed By:	RSB
Company:	Albert A. Webb Associates
Telephone:	

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	128,034
Limiting Width (ft):	55.00
Invert Depth Below Asphalt (ft):	10.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter (in):	96
Number Of Headers:	2
Spacing between Barrels (ft):	3.00
Stone Width Around Perimeter of System (ft):	1.5
Depth A: Porous Stone Above Pipe (in):	12
Depth C: Porous Stone Below Pipe (in):	0
Stone Porosity (0 to 40%):	40

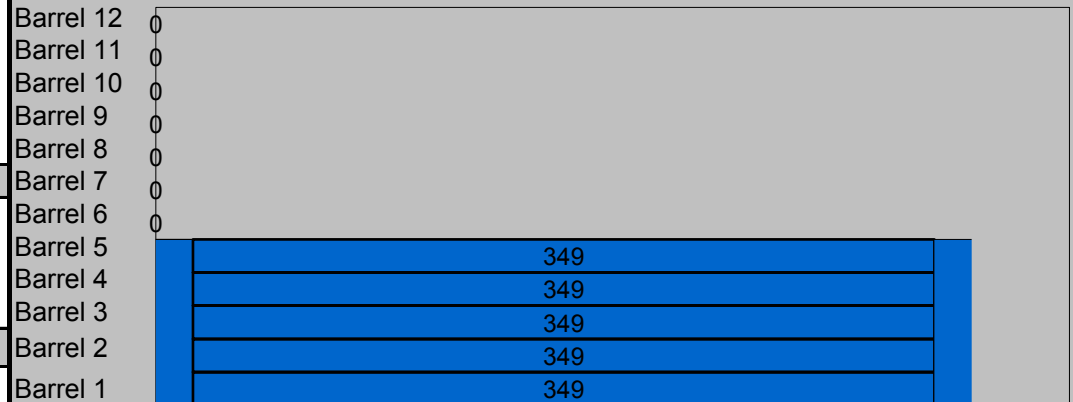
50.27 ft² Pipe Area



System Sizing

Pipe Storage:	92,941 cf	
Porous Stone Storage:	35,688 cf	
Total Storage Provided:	128,629 cf	100.5% Of Required Storage
Number of Barrels:	5 barrels	
Length per Barrel:	349.0 ft	
Length Per Header:	52.0 ft	
Rectangular Footprint (W x L):	55. ft x 368. ft	

System Layout



Barrel Footage (w/o headers)

CONTECH Materials

Total CMP Footage:	1,849 ft
Approximate Total Pieces:	81 pcs
Approximate Coupling Bands:	84 bands
Approximate Truckloads:	41 trucks

Construction Quantities**

Total Excavation:	7497 cy
Porous Stone Backfill For Storage:	3304 cy stone
Backfill to Grade Excluding Stone:	750 cy fill

**Construction quantities are approximate and should be verified upon final design

Water Quality Pump Rate Calculation

$$\frac{V_{BMP}}{t_{drain}} = Area * i = Q_{pump}$$

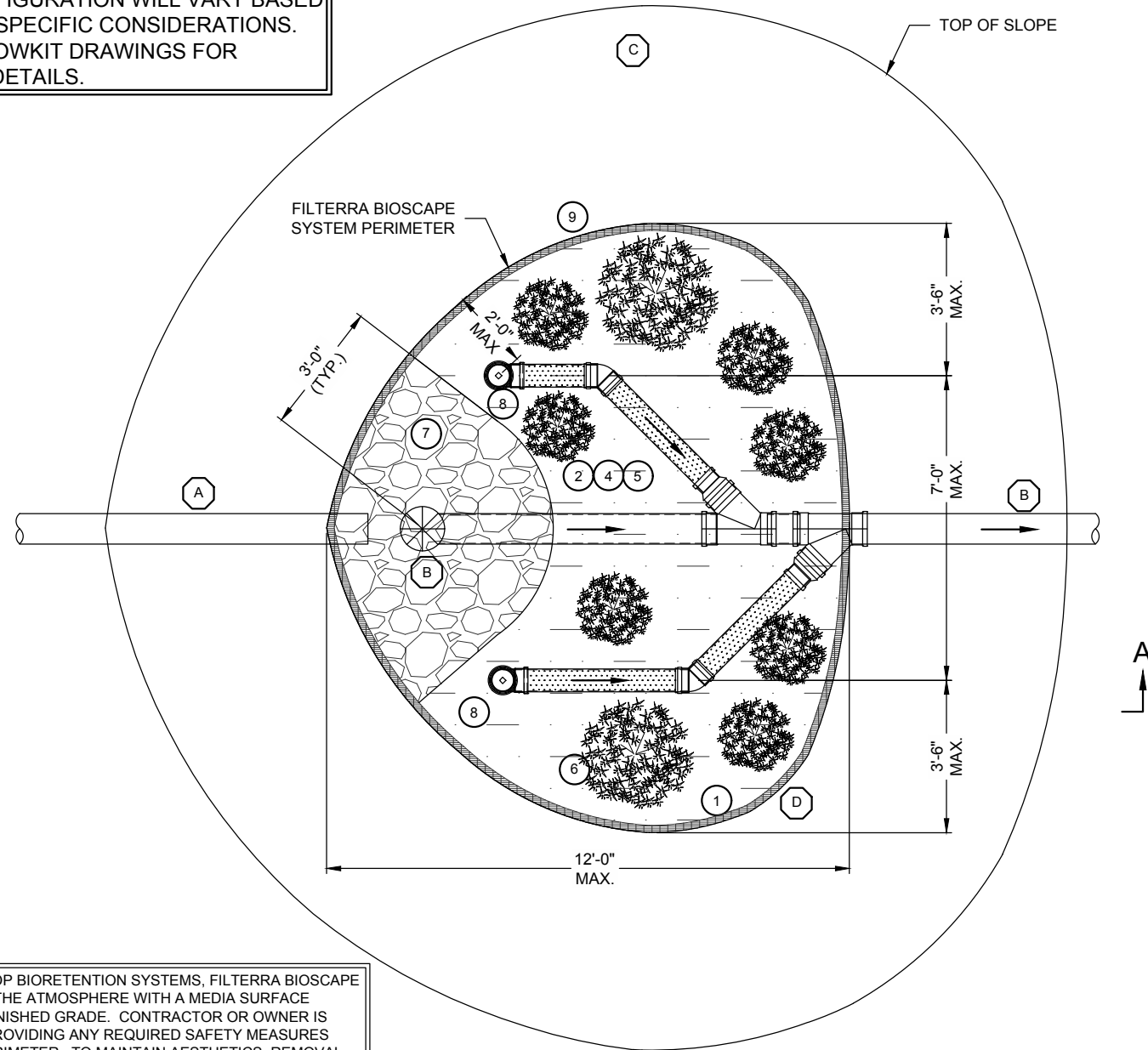
$$\frac{V_{BMP}}{t_{drain}} = Q_{pump}$$

$$Q_{pump} = \frac{ft^3}{hr} * \frac{1 hr}{3600 sec} * \frac{449 gpm}{1 \frac{ft^3}{sec}}$$

$$Q_{pump} = \frac{33,131 ft^3}{48 hr} * \frac{449 gpm}{3600 \frac{ft^3}{hr}} = 86 gpm$$

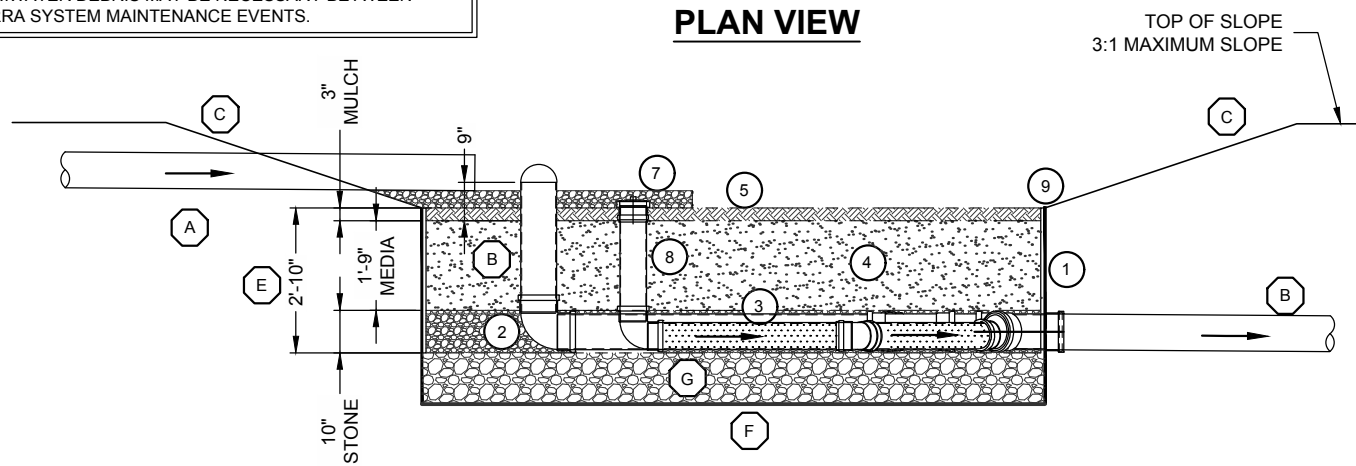
$$\mathbf{Q_{pump} = 86 gpm}$$

THIS IS A SCHEMATIC LAYOUT ONLY. ACTUAL CONFIGURATION WILL VARY BASED ON THE SITE SPECIFIC CONSIDERATIONS. REFER TO FLOWKIT DRAWINGS FOR ADDITIONAL DETAILS.



PLAN VIEW

AS WITH ALL OPEN TOP BIORETENTION SYSTEMS, FILTERRA BIOSCAPE SYSTEM IS OPEN TO THE ATMOSPHERE WITH A MEDIA SURFACE RECESSED BELOW FINISHED GRADE. CONTRACTOR OR OWNER IS RESPONSIBLE FOR PROVIDING ANY REQUIRED SAFETY MEASURES AROUND SYSTEM PERIMETER. TO MAINTAIN AESTHETICS, REMOVAL OF HEAVY STORMWATER DEBRIS MAY BE NECESSARY BETWEEN REGULAR FILTERRA SYSTEM MAINTENANCE EVENTS.



SECTION A-A VIEW

BILL OF MATERIALS

COUNT	DESCRIPTION	INSTALLED BY
X	FILTERRA SURFACE AREA (SF)	CONTRACTOR
X	MULCH VOLUME (CY)	CONTRACTOR
XX	FILTERRA MEDIA VOLUME (CY)	CONTRACTOR
X	1/2" #4 ROUND AGGREGATE UNDERDRAIN STONE (CY)	CONTRACTOR
X	ENERGY DISSIPATION ROCK (CY)	CONTRACTOR
X	EROSION CONTROL (LF)	CONTRACTOR
X	FILTERRA FLOWKIT	CONTRACTOR

PLANTING SCHEDULE

*NOTE: PLANTS PROVIDED BY OTHERS

QUANTITY	FILTERRA BIOSCAPE SYSTEM PLANT PALETTE

GENERAL NOTES

- CONTRACTOR SHALL CONTACT CONTECH TO COORDINATE DELIVERY AND SUPERVISION OF PLACEMENT OF FILTERRA BIOSCAPE SYSTEM COMPONENTS (ACTIVATION). CONTRACTOR SHALL COMPLETE ITEMS IN THE LIST OF CONTRACTOR INSTALLATION RESPONSIBILITIES LISTED ON THIS DETAIL BEFORE CONTECH'S REPRESENTATIVE ATTENDS AND SUPERVISES THE ACTIVATION OF THE BIOSCAPE SYSTEM.
- PERFORM FILTERRA BIOSCAPE SYSTEM EXCAVATION ONLY AFTER ALL THE CONTRIBUTING DRAINAGE AREAS ARE PERMANENTLY STABILIZED. DO NOT CONSTRUCT FILTERRA BIOSCAPE SYSTEM IN AN AREA USED AS EROSION AND SEDIMENT CONTROL FACILITIES. DO NOT STOCKPILE MATERIALS NOR STORE EQUIPMENT IN THIS AREA.
- USE METHODS OF EXCAVATION THAT MINIMIZE COMPACTION OF THE UNDERLYING SOIL UNLESS THE SYSTEM IS TO BE LINED.
- CONTRACTOR SHALL COORDINATE WITH CONTECH BEFORE THE FILTERRA BIOSCAPE SYSTEM AREA IS EXCAVATED TO MINIMIZE TIME BETWEEN EXCAVATION AND DELIVERY AND ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM. ANY STANDING WATER THAT ACCUMULATES IN THE EXCAVATED AREA MUST BE REMOVED BY THE CONTRACTOR BEFORE CONTECH CAN PROVIDE ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM. ANY ADDITIONAL EXCAVATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. EXCAVATION DIMENSIONS SHOULD BE PROVIDED TO CONTECH IN THE ACTIVATION REQUEST CHECKLIST.
- CONTRACTOR SHALL PROVIDE ACCESS TO THE EXCAVATED AREA(S) FOR USE DURING THE ACTIVATION OF THE FILTERRA BIOSCAPE SYSTEM(S). ACCESS SHALL NOT PROHIBIT LIGHT DUTY EQUIPMENT THAT MAY BE USED TO INSTALL THE COMPONENTS (STONE, MEDIA, ETC). THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY RE-STABILIZATION THAT MAY BE REQUIRED AFTER THE FILTERRA BIOSCAPE SYSTEM ACTIVATION.
- CONTECH AND/OR ITS REPRESENTATIVES MUST BE SCHEDULED TO BE ON SITE FOR THE LIST ENTITLED CONTRACTOR ACTIVATION RESPONSIBILITIES.

CONTRACTOR SITE PREPARATION RESPONSIBILITIES AS DENOTED BY (X) ON THIS DETAIL:

- (A) CONTRACTOR SHALL INSTALL PIPE OR SWALE THAT CONVEYS INFLUENT FLOWS AS WELL AS ANY REQUIRED INLET AND OUTLET STRUCTURES.
- (B) CONTRACTOR SHALL PROVIDE BYPASS PIPE AND RISER OR OTHER STRUCTURE AS SHOWN ON PLANS. THE BYPASS PIPE SHALL BE INSTALLED WITH WYE(S), OR OTHER PIPE FITTINGS, AND WITH REDUCER COUPLING(S) FOR CONNECTION OF UNDERDRAIN PIPE, PER PLANS. PIPES SHALL BE INSTALLED TO PROMOTE POSITIVE FLOW FROM THE FILTERRA BIOSCAPE SYSTEM.
- (C) IF REQUIRED, CONTRACTOR TO PROVIDE SHOULDER ACCORDING TO DIMENSION AND SLOPE SHOWN ON PLANS OR AS DESIGNED BY ENGINEER OF RECORD. SLOPE FROM SHOULDER TO FILTERRA BIOSCAPE SYSTEM SURFACE AREA SHALL NOT EXCEED 3:1. SOD IS REQUIRED TO STABILIZE SIDE SLOPES OR ADJACENT GRADE.
- (D) CONTRACTOR TO EXCAVATE MEDIA AREA CORRESPONDING TO THE SIZE OF THE FILTERRA BIOSCAPE SYSTEM SURFACE AREA AS SHOWN ON DETAIL AND ON PLAN SHEETS.
- (E) CONTRACTOR SHALL EXCAVATE VERTICALLY FROM BOTTOM OF UNDERDRAIN STONE, OR DRAINAGE STONE, IF REQUIRED, TO ELEVATION OF MULCH AS SHOWN ON THIS DETAIL.
- (F) CONTRACTOR TO PROVIDE AND INSTALL ANY GEOTEXTILE OR IMPERMEABLE LINER FOR BOTTOM OF THE FILTERRA BIOSCAPE SYSTEM IF REQUIRED PER THE PLANS.
- (G) CONTRACTOR TO PROVIDE AND INSTALL ANY ADDITIONAL DRAINAGE STONE BELOW THE FILTERRA BIOSCAPE SYSTEM AS CALLED OUT ON THE PLANS.

CONTRACTOR ACTIVATION RESPONSIBILITIES AS DENOTED BY (#) ON THIS DETAIL:

- (1) PLACE GEOTEXTILE FABRIC ALONG THE PERIMETER OF THE FILTERRA BIOSCAPE SYSTEM EXCAVATION.
- (2) PLACE 10" OF UNDERDRAIN STONE - 2" UNDER THE PIPING, 6" AROUND THE PIPING AND 2" ABOVE THE PIPING USING LIGHT DUTY EQUIPMENT ONLY.
- (3) PLACE 6" UNDERDRAIN PIPING UNLESS OTHERWISE APPROVED BY CONTECH, ASSOCIATED PIPING AND FITTINGS/ELBOWS TO CONNECT TO THE PIPING/FITTING(S) THAT IS PROVIDED BY CONTRACTOR (SEE CONTRACTOR INSTALLATION RESPONSIBILITIES THIS DETAIL).
- (4) PLACE 21" FILTERRA MEDIA USING LIGHT DUTY EQUIPMENT ONLY. DO NOT COMPACT MEDIA.
- (5) PLACE 3" DOUBLE SHREDDED HARDWOOD MULCH OVER ENTIRE FILTERRA BIOSCAPE SYSTEM SURFACE AREA USING LIGHT DUTY EQUIPMENT ONLY. DO NOT COMPACT MULCH.
- (6) PROVIDE AND PLANT VEGETATION AS INDICATED IN TABLE ON THIS DETAIL OR ON SITE PLANS.
- (7) PLACE ENERGY DISSIPATION ROCK APRON AS DESIGNED AND INDICATED ON THIS DETAIL OR PER ENGINEER OF RECORD PLANS.
- (8) PLACE CLEANOUT ADAPTER, PLUG AND PIPING.
- (9) PLACE ADDITIONAL EROSION CONTROL AROUND FILTERRA BIOSCAPE SYSTEM (IF REQUIRED).

I:\COMMON\CAD\TREATMENT\64 FILTERRA\40 STANDARD DRAWINGS\FTBS - BIOSCAPE SYSTEM (BOXLESS)\DWG\FILTERRA BIOSCAPE SUPERVISED SYSTEM - STD DETAIL.DWG 5/21/2020 8:57 AM

CONTECH
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

FILTERRA BIOSCAPE™ SYSTEM
STANDARD DETAIL



June 2020

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS), ENHANCED, PHOSPHORUS & OIL TREATMENT

For

CONTECH Engineered Solutions Filterra®

Ecology's Decision:

Based on Contech's submissions, including the Final Technical Evaluation Reports, dated August 2019, March 2014, December 2009, and additional information provided to Ecology dated October 9, 2009, Ecology hereby issues the following use level designations:

1. A General Use Level Designation for Basic, Enhanced, Phosphorus, and Oil Treatment for the Filterra® system constructed with a minimum media thickness of 21 inches (1.75 feet), at the following water quality design hydraulic loading rates:

Treatment	Infiltration Rate (in/hr) for use in Sizing
Basic	175
Phosphorus	100
Oil	50
Enhanced	175

2. The Filterra is not appropriate for oil spill-control purposes.
3. Ecology approves Filterra systems for treatment at the hydraulic loading rates listed above, and sized based on the water quality design flow rate for an off-line system. Calculate the water quality design flow rates using the following procedures:

- Western Washington: for treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
- Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three flow rate based methods described in Chapter 2.7.6 of the Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
- Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.

4. This General Use Level Designation has no expiration date, but Ecology may revoke or amend the designation, and is subject to the conditions specified below.

Ecology's Conditions of Use:

Filtterra systems shall comply with these conditions shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain the Filtterra systems in accordance with applicable Contech Filtterra manuals and this Ecology Decision.
2. The minimum size filter surface-area for use in Washington is determined by using the design water quality flow rate (as determined in this Ecology Decision, Item 3, above) and the Infiltration Rate from the table above (use the lowest applicable Infiltration Rate depending on the level of treatment required). Calculate the required area by dividing the water quality design flow rate (cu-ft/sec) by the Infiltration Rate (converted to ft/sec) to obtain required surface area (sq-ft) of the Filtterra unit.
3. Each site plan must undergo Contech Filtterra review before Ecology can approve the unit for site installation. This will ensure that design parameters including site grading and slope are appropriate for use of a Filtterra unit.
4. Filtterra media shall conform to the specifications submitted to and approved by Ecology and shall be sourced from Contech Engineered Solutions, LLC with no substitutions.
5. Maintenance includes removing trash, degraded mulch, and accumulated debris from the filter surface and replacing the mulch layer. Use inspections to determine the site-specific maintenance schedules and requirements. Follow maintenance procedures given in the most recent version of the Filtterra Operation and Maintenance Manual.
6. Maintenance: The required maintenance interval for stormwater treatment devices is often dependent upon the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured treatment device.
 - Contech designs Filtterra systems for a target maintenance interval of 6 months in the Pacific Northwest. Maintenance includes removing and replacing the mulch layer above the media along with accumulated sediment, trash, and captured organic materials therein, evaluating plant health, and pruning the plant if deemed necessary.
 - Conduct maintenance following manufacturer's guidelines.
7. Filtterra systems come in standard sizes.
8. Install the Filtterra in such a manner that flows exceeding the maximum Filtterra operating rate are conveyed around the Filtterra mulch and media and will not resuspend captured sediment.
9. Discharges from the Filtterra units shall not cause or contribute to water quality standards violations in receiving waters.

Approved Alternate Configurations

Filtterra Internal Bypass - Pipe (FTIB-P)

1. The Filtterra® Internal Bypass – Pipe allows for piped-in flow from area drains, grated inlets, trench drains, and/or roof drains. Design capture flows and peak flows enter the structure through an internal slotted pipe. Filtterra® inverted the slotted pipe to allow design flows to drop through to a series of splash plates that then disperse the design flows over the top surface of the Filtterra® planter area. Higher flows continue to bypass the slotted pipe and convey out the structure.
2. To select a FTIB-P unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filtterra Internal Bypass – Curb (FTIB-C)

1. The Filtterra® Internal Bypass –Curb model (FTIB-C) incorporates a curb inlet, biofiltration treatment chamber, and internal high flow bypass in one single structure. Filtterra® designed the FTIB-C model for use in a “Sag” or “Sump” condition and will accept flows from both directions along a gutter line. An internal flume tray weir component directs treatment flows entering the unit through the curb inlet to the biofiltration treatment chamber. Flows in excess of the water quality treatment flow rise above the flume tray weir and discharge through a standpipe orifice; providing bypass of untreated peak flows. Americast manufactures the FTIB-C model in a variety of sizes and configurations and you may use the unit on a continuous grade when a single structure providing both treatment and high flow bypass is preferred. The FTIB-C model can also incorporate a separate junction box chamber to allow larger diameter discharge pipe connections to the structure.
2. To select a FTIB-C unit, the designer must determine the size of the standard unit using the sizing guidance described above.

Filtterra® Shallow

1. The Filtterra Shallow provides additional flexibility for design engineers and designers in situations where various elevation constraints prevent application of a standard Filtterra configuration. Engineers can design this system up to six inches shallower than any of the previous Filtterra unit configurations noted above.
2. Ecology requires that the Filtterra Shallow provide a media contact time equivalent to that of the standard unit. This means that with a smaller depth of media, the surface area must increase.
3. To select a Filtterra Shallow System unit, the designer must first identify the size of the standard unit using the modeling guidance described above.
4. Once the size of the standard Filtterra unit is established using the sizing technique described above, use information from the following table to select the appropriate size Filtterra Shallow System unit.

Shallow Unit Basic, Enhanced, Phosphorus, and Oil Treatment Sizing

Standard Depth	Equivalent Shallow Depth
4x4	4x6 or 6x4
4x6 or 6x4	6x6
4x8 or 8x4	6x8 or 8x6
6x6	6x10 or 10x6
6x8 or 8x6	6x12 or 12x6
6x10 or 10x6	13x7

Notes:

1. Shallow Depth Boxes are less than the standard depth of 3.5 feet but no less than 3.0 feet deep (TC to INV).

Applicant: Contech Engineered Solutions, LLC.

Applicant's Address: 11815 NE Glenn Widing Drive
Portland, OR 97220

Application Documents:

- State of Washington Department of Ecology Application for Conditional Use Designation, Americast (September 2006)
- Quality Assurance Project Plan Filterra® Bioretention Filtration System Performance Monitoring, Americast (April 2008)
- Quality Assurance Project Plan Addendum Filterra® Bioretention Filtration System Performance Monitoring, Americast (June 2008)
- Draft Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (August 2009)
- Final Technical Evaluation Report Filterra® Bioretention Filtration System Performance Monitoring, Americast (December 2009)
- Technical Evaluation Report Appendices Filterra® Bioretention Filtration System Performance Monitoring, Americast, (August 2009)
- Memorandum to Department of Ecology Dated October 9, 2009 from Americast, Inc. and Herrera Environmental Consultants
- Quality Assurance Project Plan Filterra® Bioretention System Phosphorus treatment and Supplemental Basic and Enhanced Treatment Performance Monitoring, Americast (November 2011)
- Filterra® letter August 24, 2012 regarding sizing for the Filterra® Shallow System.
- University of Virginia Engineering Department Memo by Joanna Crowe Curran, Ph. D dated March 16, 2013 concerning capacity analysis of Filterra® internal weir inlet tray.
- Terraphase Engineering letter to Jodi Mills, P.E. dated April 2, 2013 regarding Terrafume Hydraulic Test, Filterra® Bioretention System and attachments.
- Technical Evaluation Report, Filterra® System Phosphorus Treatment and Supplemental Basic Treatment Performance Monitoring. March 27th, 2014.
- State of Washington Department of Ecology Application for Conditional Use Level Designation, Contech Engineered Solutions (May 2015)

- Quality Assurance Project Plan Filterra® Bioretention System, Contech Engineered Solutions (May 2015)
- Filterra Bioretention System Armco Avenue General Use Level Designation Technical Evaluation Report, Contech Engineered Solutions (August 2019)

Applicant's Use Level Request:

General Level Use Designation for Basic (175 in/hr), Enhanced (175 in/hr), Phosphorus (100 in/hr), and Oil Treatment (50 in/hr).

Applicant's Performance Claims:

Field-testing and laboratory testing show that the Filterra® unit is promising as a stormwater treatment best management practice and can meet Ecology's performance goals for basic, enhanced, phosphorus, and oil treatment.

Findings of Fact:

Field Testing 2015-2019

1. Contech completed field testing of a 4 ft. x 4 ft. Filterra® unit at one site in Hillsboro, Oregon from September 2015 to July 2019. Throughout the monitoring period a total of 24 individual storm events were sampled, of which 23 qualified for TAPE sampling criteria.
2. Contech encountered several unanticipated events and challenges that prevented them from collecting continuous flow and rainfall data. An analysis of the flow data from the sampled events, including both the qualifying and non-qualifying events, demonstrated the system treated over 99 % of the influent flows. Peak flows during these events ranged from 25 % to 250 % of the design flow rate of 29 gallons per minute.
3. Of the 23 TAPE qualified sample events, 13 met requirements for TSS analysis. Influent concentrations ranged from 20.8 mg/L to 83 mg/L, with a mean concentration of 46.3 mg/L. The UCL95 mean effluent concentration was 15.9 mg/L, meeting the 20 mg/L performance goal for Basic Treatment.
4. All 23 TAPE qualified sample events met requirements for dissolved zinc analysis. Influent concentrations range from 0.0384 mg/L to 0.2680 mg/L, with a mean concentration of 0.0807 mg/L. The LCL 95 mean percent removal was 62.9 %, meeting the 60 % performance goal for Enhanced Treatment.
5. Thirteen of the 23 TAPE qualified sample events met requirements for dissolved copper analysis. Influent concentrations ranged from 0.00543 mg/L to 0.01660 mg/L, with a mean concentration of 0.0103 mg/L. The LCL 95 mean percent removal was 41.2 %, meeting the 30 % performance goal for Enhanced Treatment.
6. Total zinc concentrations were analyzed for all 24 sample events. Influent EMCs for total zinc ranged from 0.048 mg/L to 5.290 mg/L with a median of 0.162 mg/L. Corresponding effluent EMCs for total zinc ranged from 0.015 mg/L to 0.067 mg/L with a median of

0.029 mg/L. Total event loadings for the study for total zinc were 316.85 g at the influent and 12.92 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 95.9 %.

7. Total copper concentrations were analyzed for all 24 sample events. Influent EMCs for total copper ranged from 0.003 mg/L to 35.600 mg/L with a median value of 0.043 mg/L. Corresponding effluent EMCs for total copper ranged from 0.002 mg/L to 0.015 mg/L with a median of 0.004 mg/L. Total event loadings for total copper for the study were 1,810.06 g at the influent and 1.90 g at the effluent sampling location, resulting in a summation of loads removal efficiency of 99.9 %.

Field Testing 2013

1. Filterra completed field-testing of a 6.5 ft x 4 ft. unit at one site in Bellingham, Washington. Continuous flow and rainfall data collected from January 1, 2013 through July 23, 2013 indicated that 59 storm events occurred. Water quality data was obtained from 22 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. The system treated 98.9 % of the total 8-month runoff volume during the testing period. Consequently, the system achieved the goal of treating 91 % of the volume from the site. Stormwater runoff bypassed Filterra treatment during four of the 59 storm events.
3. Of the 22 sampled events, 18 qualified for TSS analysis (influent TSS concentrations ranged from 25 to 138 mg/L). The data were segregated into sample pairs with influent concentration greater than and less than 100 mg/L. The UCL95 mean effluent concentration for the data with influent less than 100 mg/L was 5.2 mg/L, below the 20-mg/L threshold. Although the TAPE guidelines do not require an evaluation of TSS removal efficiency for influent concentrations below 100 mg/L, the mean TSS removal for these samples was 90.1 %. Average removal of influent TSS concentrations greater than 100 mg/L (three events) was 85 %. In addition, the system consistently exhibited TSS removal greater than 80 % at flow rates equivalent to a 100 in/hr infiltration rate and was observed at 150 in/hr.
4. Ten of the 22 sampled events qualified for TP analysis. Americast augmented the dataset using two sample pairs from previous monitoring at the site. Influent TP concentrations ranged from 0.11 to 0.52 mg/L. The mean TP removal for these twelve events was 72.6 %. The LCL95 mean percent removal was 66.0, well above the TAPE requirement of 50 %. Treatment above 50 % was evident at 100 in/hr infiltration rate and as high as 150 in/hr. Consequently, the Filterra test system met the TAPE Phosphorus Treatment goal at 100 in/hr. Influent ortho-P concentrations ranged from 0.005 to 0.012 mg/L; effluent ortho-P concentrations ranged from 0.005 to 0.013 mg/L. The reporting limit/resolution for the ortho-P test method is 0.01 mg/L, therefore the influent and effluent ortho-P concentrations were both at and near non-detect concentrations.

Field Testing 2008-2009

1. Filtterra completed field-testing at two sites at the Port of Tacoma. Continuous flow and rainfall data collected during the 2008-2009 monitoring period indicated that 89 storm events occurred. The monitoring obtained water quality data from 27 storm events. Not all the sampled storms produced information that met TAPE criteria for storm and/or water quality data.
2. During the testing at the Port of Tacoma, 98.96 to 99.89 % of the annual influent runoff volume passed through the POT1 and POT2 test systems respectively. Stormwater runoff bypassed the POT1 test system during nine storm events and bypassed the POT2 test system during one storm event. Bypass volumes ranged from 0.13 % to 15.3% of the influent storm volume. Both test systems achieved the 91 % water quality treatment-goal over the 1-year monitoring period.
3. Consultants observed infiltration rates as high as 133 in/hr during the various storms. Filtterra did not provide any paired data that identified percent removal of TSS, metals, oil, or phosphorus at an instantaneous observed flow rate.
4. The maximum storm average hydraulic loading rate associated with water quality data is <40 in/hr, with the majority of flow rates < 25 in/hr. The average instantaneous hydraulic loading rate ranged from 8.6 to 53 in/hr.
5. The field data showed a removal rate greater than 80 % for TSS with an influent concentration greater than 20 mg/L at an average instantaneous hydraulic loading rate up to 53 in/hr (average influent concentration of 28.8 mg/L, average effluent concentration of 4.3 mg/L).
6. The field data showed a removal rate generally greater than 54 % for dissolved zinc at an average instantaneous hydraulic loading rate up to 60 in/hr and an average influent concentration of 0.266 mg/L (average effluent concentration of 0.115 mg/L).
7. The field data showed a removal rate generally greater than 40 % for dissolved copper at an average instantaneous hydraulic loading rate up to 35 in/hr and an average influent concentration of 0.0070 mg/L (average effluent concentration of 0.0036 mg/L).
8. The field data showed an average removal rate of 93 % for total petroleum hydrocarbon (TPH) at an average instantaneous hydraulic loading rate up to 53 in/hr and an average influent concentration of 52 mg/L (average effluent concentration of 2.3 mg/L). The data also shows achievement of less than 15 mg/L TPH for grab samples. Filtterra provided limited visible sheen data due to access limitations at the outlet monitoring location.
9. The field data showed low percentage removals of total phosphorus at all storm flows at an average influent concentration of 0.189 mg/L (average effluent concentration of 0.171 mg/L). We may relate the relatively poor treatment performance of the Filtterra system at this location to influent characteristics for total phosphorus that are unique to the Port of Tacoma site. It appears that the Filtterra system will not meet the 50 % removal performance goal when the majority of phosphorus in the runoff is expected to be in the dissolved form.

Laboratory Testing

1. Filterra performed laboratory testing on a scaled down version of the Filterra unit. The lab data showed an average removal from 83-91 % for TSS with influents ranging from 21 to 320 mg/L, 82-84 % for total copper with influents ranging from 0.94 to 2.3 mg/L, and 50-61 % for orthophosphate with influents ranging from 2.46 to 14.37 mg/L.
2. Filterra conducted permeability tests on the soil media.
3. Lab scale testing using Sil-Co-Sil 106 showed removals ranging from 70.1 % to 95.5 % with a median removal of 90.7 %, for influent concentrations ranging from 8.3 to 260 mg/L. Filterra ran these laboratory tests at an infiltration rate of 50 in/hr.
4. Supplemental lab testing conducted in September 2009 using Sil-Co-Sil 106 showed an average removal of 90.6 %. These laboratory tests were run at infiltration rates ranging from 25 to 150 in/hr for influent concentrations ranging from 41.6 to 252.5 mg/L. Regression analysis results indicate that the Filterra system’s TSS removal performance is independent of influent concentration in the concentration range evaluated at hydraulic loading rates of up to 150 in/hr.

Contact Information:

Applicant: Jeremiah Lehman
Contech Engineered Solutions, LLC.
11815 Glenn Widing Dr
Portland, OR 97220
(503) 258-3136
jlehman@conteches.com

Applicant’s Website: <http://www.conteches.com>

Ecology web link: <http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html>

Ecology: Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Date	Revision
December 2009	GULD for Basic, Enhanced, and Oil granted, CULD for Phosphorus
September 2011	Extended CULD for Phosphorus Treatment
September 2012	Revised design storm discussion, added Shallow System.
January 2013	Revised format to match Ecology standards, changed Filterra contact information
February 2013	Added FTIB-P system
March 2013	Added FTIB-C system
April 2013	Modified requirements for identifying appropriate size of unit

June 2013	Modified description of FTIB-C alternate configuration
March 2014	GULD awarded for Phosphorus Treatment. GULD updated for a higher flow-rate for Basic Treatment.
June 2014	Revised sizing calculation methods
March 2015	Revised Contact Information
June 2015	CULD for Basic and Enhanced at 100 in/hr infiltration rate
September 2019	GULD for Basic and Enhanced at 175 in/hr infiltration rate
February 2020	Revised sizing language to note sizing based on off-line calculations
June 2020	Added Phosphorus to Filterra Shallow sizing table

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

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

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
Study date 12/14/22 File: ONSITEPRE242.out

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

Program License Serial Number 4010

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

English Units used in output format

22-0198 - ETHANAC COMMERCE CENTER
ONSITE UNIT HYDROGRAPH ANALYSIS
EXISTING CONDITION, 2-YEAR 24-HOUR
FN: ONSITEPRE.OUT- RSB

Drainage Area = 19.80(Ac.) = 0.031 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 19.80(Ac.) =
0.031 Sq. Mi.

Length along longest watercourse = 1376.00(Ft.)
Length along longest watercourse measured to centroid = 686.00(Ft.)
Length along longest watercourse = 0.261 Mi.
Length along longest watercourse measured to centroid = 0.130 Mi.
Difference in elevation = 5.00(Ft.)
Slope along watercourse = 19.1860 Ft./Mi.
Average Manning's 'N' = 0.030
Lag time = 0.113 Hr.
Lag time = 6.81 Min.
25% of lag time = 1.70 Min.
40% of lag time = 2.72 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	1.60	31.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	4.00	79.20

STORM EVENT (YEAR) = 2.00
 Area Averaged 2-Year Rainfall = 1.600(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 1.600(In)
 Areal adjustment factor = 100.00 %
 Adjusted average point rain = 1.600(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.800	89.00	0.000
Total Area Entered = 19.80(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
89.0	76.4	0.286	0.000	0.286	1.000	0.286
Sum (F) =						0.286

Area averaged mean soil loss (F) (In/Hr) = 0.286
 Minimum soil loss rate ((In/Hr)) = 0.143
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.900

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

Unit Hydrograph Data

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)
1	0.083	73.448	11.521
2	0.167	146.895	41.791
3	0.250	220.343	21.981
4	0.333	293.790	8.716
5	0.417	367.238	5.287
6	0.500	440.685	3.444
7	0.583	514.133	2.371
8	0.667	587.580	1.770

9	0.750	661.028	1.252	0.250
10	0.833	734.475	0.845	0.169
11	0.917	807.923	1.022	0.204
			Sum = 100.000	Sum= 19.955

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

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.013	(0.508)	0.012	0.001
2	0.17	0.07	0.013	(0.506)	0.012	0.001
3	0.25	0.07	0.013	(0.504)	0.012	0.001
4	0.33	0.10	0.019	(0.502)	0.017	0.002
5	0.42	0.10	0.019	(0.500)	0.017	0.002
6	0.50	0.10	0.019	(0.498)	0.017	0.002
7	0.58	0.10	0.019	(0.496)	0.017	0.002
8	0.67	0.10	0.019	(0.494)	0.017	0.002
9	0.75	0.10	0.019	(0.492)	0.017	0.002
10	0.83	0.13	0.026	(0.490)	0.023	0.003
11	0.92	0.13	0.026	(0.488)	0.023	0.003
12	1.00	0.13	0.026	(0.486)	0.023	0.003
13	1.08	0.10	0.019	(0.485)	0.017	0.002
14	1.17	0.10	0.019	(0.483)	0.017	0.002
15	1.25	0.10	0.019	(0.481)	0.017	0.002
16	1.33	0.10	0.019	(0.479)	0.017	0.002
17	1.42	0.10	0.019	(0.477)	0.017	0.002
18	1.50	0.10	0.019	(0.475)	0.017	0.002
19	1.58	0.10	0.019	(0.473)	0.017	0.002
20	1.67	0.10	0.019	(0.471)	0.017	0.002
21	1.75	0.10	0.019	(0.469)	0.017	0.002
22	1.83	0.13	0.026	(0.467)	0.023	0.003
23	1.92	0.13	0.026	(0.466)	0.023	0.003
24	2.00	0.13	0.026	(0.464)	0.023	0.003
25	2.08	0.13	0.026	(0.462)	0.023	0.003
26	2.17	0.13	0.026	(0.460)	0.023	0.003
27	2.25	0.13	0.026	(0.458)	0.023	0.003
28	2.33	0.13	0.026	(0.456)	0.023	0.003
29	2.42	0.13	0.026	(0.454)	0.023	0.003
30	2.50	0.13	0.026	(0.452)	0.023	0.003
31	2.58	0.17	0.032	(0.451)	0.029	0.003
32	2.67	0.17	0.032	(0.449)	0.029	0.003
33	2.75	0.17	0.032	(0.447)	0.029	0.003
34	2.83	0.17	0.032	(0.445)	0.029	0.003
35	2.92	0.17	0.032	(0.443)	0.029	0.003
36	3.00	0.17	0.032	(0.441)	0.029	0.003
37	3.08	0.17	0.032	(0.440)	0.029	0.003
38	3.17	0.17	0.032	(0.438)	0.029	0.003

39	3.25	0.17	0.032	(0.436)	0.029	0.003
40	3.33	0.17	0.032	(0.434)	0.029	0.003
41	3.42	0.17	0.032	(0.432)	0.029	0.003
42	3.50	0.17	0.032	(0.430)	0.029	0.003
43	3.58	0.17	0.032	(0.429)	0.029	0.003
44	3.67	0.17	0.032	(0.427)	0.029	0.003
45	3.75	0.17	0.032	(0.425)	0.029	0.003
46	3.83	0.20	0.038	(0.423)	0.035	0.004
47	3.92	0.20	0.038	(0.422)	0.035	0.004
48	4.00	0.20	0.038	(0.420)	0.035	0.004
49	4.08	0.20	0.038	(0.418)	0.035	0.004
50	4.17	0.20	0.038	(0.416)	0.035	0.004
51	4.25	0.20	0.038	(0.414)	0.035	0.004
52	4.33	0.23	0.045	(0.413)	0.040	0.004
53	4.42	0.23	0.045	(0.411)	0.040	0.004
54	4.50	0.23	0.045	(0.409)	0.040	0.004
55	4.58	0.23	0.045	(0.407)	0.040	0.004
56	4.67	0.23	0.045	(0.406)	0.040	0.004
57	4.75	0.23	0.045	(0.404)	0.040	0.004
58	4.83	0.27	0.051	(0.402)	0.046	0.005
59	4.92	0.27	0.051	(0.400)	0.046	0.005
60	5.00	0.27	0.051	(0.399)	0.046	0.005
61	5.08	0.20	0.038	(0.397)	0.035	0.004
62	5.17	0.20	0.038	(0.395)	0.035	0.004
63	5.25	0.20	0.038	(0.393)	0.035	0.004
64	5.33	0.23	0.045	(0.392)	0.040	0.004
65	5.42	0.23	0.045	(0.390)	0.040	0.004
66	5.50	0.23	0.045	(0.388)	0.040	0.004
67	5.58	0.27	0.051	(0.387)	0.046	0.005
68	5.67	0.27	0.051	(0.385)	0.046	0.005
69	5.75	0.27	0.051	(0.383)	0.046	0.005
70	5.83	0.27	0.051	(0.382)	0.046	0.005
71	5.92	0.27	0.051	(0.380)	0.046	0.005
72	6.00	0.27	0.051	(0.378)	0.046	0.005
73	6.08	0.30	0.058	(0.376)	0.052	0.006
74	6.17	0.30	0.058	(0.375)	0.052	0.006
75	6.25	0.30	0.058	(0.373)	0.052	0.006
76	6.33	0.30	0.058	(0.371)	0.052	0.006
77	6.42	0.30	0.058	(0.370)	0.052	0.006
78	6.50	0.30	0.058	(0.368)	0.052	0.006
79	6.58	0.33	0.064	(0.366)	0.058	0.006
80	6.67	0.33	0.064	(0.365)	0.058	0.006
81	6.75	0.33	0.064	(0.363)	0.058	0.006
82	6.83	0.33	0.064	(0.362)	0.058	0.006
83	6.92	0.33	0.064	(0.360)	0.058	0.006
84	7.00	0.33	0.064	(0.358)	0.058	0.006
85	7.08	0.33	0.064	(0.357)	0.058	0.006
86	7.17	0.33	0.064	(0.355)	0.058	0.006
87	7.25	0.33	0.064	(0.353)	0.058	0.006
88	7.33	0.37	0.070	(0.352)	0.063	0.007

89	7.42	0.37	0.070	(0.350)	0.063	0.007
90	7.50	0.37	0.070	(0.349)	0.063	0.007
91	7.58	0.40	0.077	(0.347)	0.069	0.008
92	7.67	0.40	0.077	(0.345)	0.069	0.008
93	7.75	0.40	0.077	(0.344)	0.069	0.008
94	7.83	0.43	0.083	(0.342)	0.075	0.008
95	7.92	0.43	0.083	(0.341)	0.075	0.008
96	8.00	0.43	0.083	(0.339)	0.075	0.008
97	8.08	0.50	0.096	(0.337)	0.086	0.010
98	8.17	0.50	0.096	(0.336)	0.086	0.010
99	8.25	0.50	0.096	(0.334)	0.086	0.010
100	8.33	0.50	0.096	(0.333)	0.086	0.010
101	8.42	0.50	0.096	(0.331)	0.086	0.010
102	8.50	0.50	0.096	(0.330)	0.086	0.010
103	8.58	0.53	0.102	(0.328)	0.092	0.010
104	8.67	0.53	0.102	(0.327)	0.092	0.010
105	8.75	0.53	0.102	(0.325)	0.092	0.010
106	8.83	0.57	0.109	(0.323)	0.098	0.011
107	8.92	0.57	0.109	(0.322)	0.098	0.011
108	9.00	0.57	0.109	(0.320)	0.098	0.011
109	9.08	0.63	0.122	(0.319)	0.109	0.012
110	9.17	0.63	0.122	(0.317)	0.109	0.012
111	9.25	0.63	0.122	(0.316)	0.109	0.012
112	9.33	0.67	0.128	(0.314)	0.115	0.013
113	9.42	0.67	0.128	(0.313)	0.115	0.013
114	9.50	0.67	0.128	(0.311)	0.115	0.013
115	9.58	0.70	0.134	(0.310)	0.121	0.013
116	9.67	0.70	0.134	(0.308)	0.121	0.013
117	9.75	0.70	0.134	(0.307)	0.121	0.013
118	9.83	0.73	0.141	(0.305)	0.127	0.014
119	9.92	0.73	0.141	(0.304)	0.127	0.014
120	10.00	0.73	0.141	(0.303)	0.127	0.014
121	10.08	0.50	0.096	(0.301)	0.086	0.010
122	10.17	0.50	0.096	(0.300)	0.086	0.010
123	10.25	0.50	0.096	(0.298)	0.086	0.010
124	10.33	0.50	0.096	(0.297)	0.086	0.010
125	10.42	0.50	0.096	(0.295)	0.086	0.010
126	10.50	0.50	0.096	(0.294)	0.086	0.010
127	10.58	0.67	0.128	(0.292)	0.115	0.013
128	10.67	0.67	0.128	(0.291)	0.115	0.013
129	10.75	0.67	0.128	(0.290)	0.115	0.013
130	10.83	0.67	0.128	(0.288)	0.115	0.013
131	10.92	0.67	0.128	(0.287)	0.115	0.013
132	11.00	0.67	0.128	(0.285)	0.115	0.013
133	11.08	0.63	0.122	(0.284)	0.109	0.012
134	11.17	0.63	0.122	(0.282)	0.109	0.012
135	11.25	0.63	0.122	(0.281)	0.109	0.012
136	11.33	0.63	0.122	(0.280)	0.109	0.012
137	11.42	0.63	0.122	(0.278)	0.109	0.012
138	11.50	0.63	0.122	(0.277)	0.109	0.012

139	11.58	0.57	0.109	(0.276)	0.098	0.011
140	11.67	0.57	0.109	(0.274)	0.098	0.011
141	11.75	0.57	0.109	(0.273)	0.098	0.011
142	11.83	0.60	0.115	(0.271)	0.104	0.012
143	11.92	0.60	0.115	(0.270)	0.104	0.012
144	12.00	0.60	0.115	(0.269)	0.104	0.012
145	12.08	0.83	0.160	(0.267)	0.144	0.016
146	12.17	0.83	0.160	(0.266)	0.144	0.016
147	12.25	0.83	0.160	(0.265)	0.144	0.016
148	12.33	0.87	0.166	(0.263)	0.150	0.017
149	12.42	0.87	0.166	(0.262)	0.150	0.017
150	12.50	0.87	0.166	(0.261)	0.150	0.017
151	12.58	0.93	0.179	(0.259)	0.161	0.018
152	12.67	0.93	0.179	(0.258)	0.161	0.018
153	12.75	0.93	0.179	(0.257)	0.161	0.018
154	12.83	0.97	0.186	(0.256)	0.167	0.019
155	12.92	0.97	0.186	(0.254)	0.167	0.019
156	13.00	0.97	0.186	(0.253)	0.167	0.019
157	13.08	1.13	0.218	(0.252)	0.196	0.022
158	13.17	1.13	0.218	(0.250)	0.196	0.022
159	13.25	1.13	0.218	(0.249)	0.196	0.022
160	13.33	1.13	0.218	(0.248)	0.196	0.022
161	13.42	1.13	0.218	(0.247)	0.196	0.022
162	13.50	1.13	0.218	(0.245)	0.196	0.022
163	13.58	0.77	0.147	(0.244)	0.132	0.015
164	13.67	0.77	0.147	(0.243)	0.132	0.015
165	13.75	0.77	0.147	(0.242)	0.132	0.015
166	13.83	0.77	0.147	(0.240)	0.132	0.015
167	13.92	0.77	0.147	(0.239)	0.132	0.015
168	14.00	0.77	0.147	(0.238)	0.132	0.015
169	14.08	0.90	0.173	(0.237)	0.156	0.017
170	14.17	0.90	0.173	(0.236)	0.156	0.017
171	14.25	0.90	0.173	(0.234)	0.156	0.017
172	14.33	0.87	0.166	(0.233)	0.150	0.017
173	14.42	0.87	0.166	(0.232)	0.150	0.017
174	14.50	0.87	0.166	(0.231)	0.150	0.017
175	14.58	0.87	0.166	(0.230)	0.150	0.017
176	14.67	0.87	0.166	(0.228)	0.150	0.017
177	14.75	0.87	0.166	(0.227)	0.150	0.017
178	14.83	0.83	0.160	(0.226)	0.144	0.016
179	14.92	0.83	0.160	(0.225)	0.144	0.016
180	15.00	0.83	0.160	(0.224)	0.144	0.016
181	15.08	0.80	0.154	(0.223)	0.138	0.015
182	15.17	0.80	0.154	(0.221)	0.138	0.015
183	15.25	0.80	0.154	(0.220)	0.138	0.015
184	15.33	0.77	0.147	(0.219)	0.132	0.015
185	15.42	0.77	0.147	(0.218)	0.132	0.015
186	15.50	0.77	0.147	(0.217)	0.132	0.015
187	15.58	0.63	0.122	(0.216)	0.109	0.012
188	15.67	0.63	0.122	(0.215)	0.109	0.012

189	15.75	0.63	0.122	(0.214)	0.109	0.012
190	15.83	0.63	0.122	(0.213)	0.109	0.012
191	15.92	0.63	0.122	(0.211)	0.109	0.012
192	16.00	0.63	0.122	(0.210)	0.109	0.012
193	16.08	0.13	0.026	(0.209)	0.023	0.003
194	16.17	0.13	0.026	(0.208)	0.023	0.003
195	16.25	0.13	0.026	(0.207)	0.023	0.003
196	16.33	0.13	0.026	(0.206)	0.023	0.003
197	16.42	0.13	0.026	(0.205)	0.023	0.003
198	16.50	0.13	0.026	(0.204)	0.023	0.003
199	16.58	0.10	0.019	(0.203)	0.017	0.002
200	16.67	0.10	0.019	(0.202)	0.017	0.002
201	16.75	0.10	0.019	(0.201)	0.017	0.002
202	16.83	0.10	0.019	(0.200)	0.017	0.002
203	16.92	0.10	0.019	(0.199)	0.017	0.002
204	17.00	0.10	0.019	(0.198)	0.017	0.002
205	17.08	0.17	0.032	(0.197)	0.029	0.003
206	17.17	0.17	0.032	(0.196)	0.029	0.003
207	17.25	0.17	0.032	(0.195)	0.029	0.003
208	17.33	0.17	0.032	(0.194)	0.029	0.003
209	17.42	0.17	0.032	(0.193)	0.029	0.003
210	17.50	0.17	0.032	(0.192)	0.029	0.003
211	17.58	0.17	0.032	(0.191)	0.029	0.003
212	17.67	0.17	0.032	(0.190)	0.029	0.003
213	17.75	0.17	0.032	(0.189)	0.029	0.003
214	17.83	0.13	0.026	(0.188)	0.023	0.003
215	17.92	0.13	0.026	(0.187)	0.023	0.003
216	18.00	0.13	0.026	(0.186)	0.023	0.003
217	18.08	0.13	0.026	(0.185)	0.023	0.003
218	18.17	0.13	0.026	(0.185)	0.023	0.003
219	18.25	0.13	0.026	(0.184)	0.023	0.003
220	18.33	0.13	0.026	(0.183)	0.023	0.003
221	18.42	0.13	0.026	(0.182)	0.023	0.003
222	18.50	0.13	0.026	(0.181)	0.023	0.003
223	18.58	0.10	0.019	(0.180)	0.017	0.002
224	18.67	0.10	0.019	(0.179)	0.017	0.002
225	18.75	0.10	0.019	(0.178)	0.017	0.002
226	18.83	0.07	0.013	(0.177)	0.012	0.001
227	18.92	0.07	0.013	(0.177)	0.012	0.001
228	19.00	0.07	0.013	(0.176)	0.012	0.001
229	19.08	0.10	0.019	(0.175)	0.017	0.002
230	19.17	0.10	0.019	(0.174)	0.017	0.002
231	19.25	0.10	0.019	(0.173)	0.017	0.002
232	19.33	0.13	0.026	(0.173)	0.023	0.003
233	19.42	0.13	0.026	(0.172)	0.023	0.003
234	19.50	0.13	0.026	(0.171)	0.023	0.003
235	19.58	0.10	0.019	(0.170)	0.017	0.002
236	19.67	0.10	0.019	(0.169)	0.017	0.002
237	19.75	0.10	0.019	(0.169)	0.017	0.002
238	19.83	0.07	0.013	(0.168)	0.012	0.001

239	19.92	0.07	0.013	(0.167)	0.012	0.001
240	20.00	0.07	0.013	(0.166)	0.012	0.001
241	20.08	0.10	0.019	(0.166)	0.017	0.002
242	20.17	0.10	0.019	(0.165)	0.017	0.002
243	20.25	0.10	0.019	(0.164)	0.017	0.002
244	20.33	0.10	0.019	(0.163)	0.017	0.002
245	20.42	0.10	0.019	(0.163)	0.017	0.002
246	20.50	0.10	0.019	(0.162)	0.017	0.002
247	20.58	0.10	0.019	(0.161)	0.017	0.002
248	20.67	0.10	0.019	(0.161)	0.017	0.002
249	20.75	0.10	0.019	(0.160)	0.017	0.002
250	20.83	0.07	0.013	(0.159)	0.012	0.001
251	20.92	0.07	0.013	(0.159)	0.012	0.001
252	21.00	0.07	0.013	(0.158)	0.012	0.001
253	21.08	0.10	0.019	(0.157)	0.017	0.002
254	21.17	0.10	0.019	(0.157)	0.017	0.002
255	21.25	0.10	0.019	(0.156)	0.017	0.002
256	21.33	0.07	0.013	(0.156)	0.012	0.001
257	21.42	0.07	0.013	(0.155)	0.012	0.001
258	21.50	0.07	0.013	(0.155)	0.012	0.001
259	21.58	0.10	0.019	(0.154)	0.017	0.002
260	21.67	0.10	0.019	(0.153)	0.017	0.002
261	21.75	0.10	0.019	(0.153)	0.017	0.002
262	21.83	0.07	0.013	(0.152)	0.012	0.001
263	21.92	0.07	0.013	(0.152)	0.012	0.001
264	22.00	0.07	0.013	(0.151)	0.012	0.001
265	22.08	0.10	0.019	(0.151)	0.017	0.002
266	22.17	0.10	0.019	(0.150)	0.017	0.002
267	22.25	0.10	0.019	(0.150)	0.017	0.002
268	22.33	0.07	0.013	(0.149)	0.012	0.001
269	22.42	0.07	0.013	(0.149)	0.012	0.001
270	22.50	0.07	0.013	(0.148)	0.012	0.001
271	22.58	0.07	0.013	(0.148)	0.012	0.001
272	22.67	0.07	0.013	(0.148)	0.012	0.001
273	22.75	0.07	0.013	(0.147)	0.012	0.001
274	22.83	0.07	0.013	(0.147)	0.012	0.001
275	22.92	0.07	0.013	(0.146)	0.012	0.001
276	23.00	0.07	0.013	(0.146)	0.012	0.001
277	23.08	0.07	0.013	(0.146)	0.012	0.001
278	23.17	0.07	0.013	(0.145)	0.012	0.001
279	23.25	0.07	0.013	(0.145)	0.012	0.001
280	23.33	0.07	0.013	(0.145)	0.012	0.001
281	23.42	0.07	0.013	(0.145)	0.012	0.001
282	23.50	0.07	0.013	(0.144)	0.012	0.001
283	23.58	0.07	0.013	(0.144)	0.012	0.001
284	23.67	0.07	0.013	(0.144)	0.012	0.001
285	23.75	0.07	0.013	(0.144)	0.012	0.001
286	23.83	0.07	0.013	(0.143)	0.012	0.001
287	23.92	0.07	0.013	(0.143)	0.012	0.001
288	24.00	0.07	0.013	(0.143)	0.012	0.001

2+30	0.0080	0.05	QV
2+35	0.0084	0.05	QV
2+40	0.0088	0.06	QV
2+45	0.0092	0.06	QV
2+50	0.0096	0.06	QV
2+55	0.0100	0.06	QV
3+ 0	0.0105	0.06	QV
3+ 5	0.0109	0.06	QV
3+10	0.0113	0.06	QV
3+15	0.0118	0.06	QV
3+20	0.0122	0.06	QV
3+25	0.0127	0.06	QV
3+30	0.0131	0.06	QV
3+35	0.0135	0.06	Q V
3+40	0.0140	0.06	Q V
3+45	0.0144	0.06	Q V
3+50	0.0149	0.07	Q V
3+55	0.0153	0.07	Q V
4+ 0	0.0159	0.07	Q V
4+ 5	0.0164	0.07	Q V
4+10	0.0169	0.08	Q V
4+15	0.0174	0.08	Q V
4+20	0.0179	0.08	Q V
4+25	0.0185	0.08	Q V
4+30	0.0191	0.09	Q V
4+35	0.0197	0.09	Q V
4+40	0.0203	0.09	Q V
4+45	0.0209	0.09	Q V
4+50	0.0215	0.09	Q V
4+55	0.0222	0.10	Q V
5+ 0	0.0229	0.10	Q V
5+ 5	0.0236	0.10	Q V
5+10	0.0242	0.09	Q V
5+15	0.0247	0.08	Q V
5+20	0.0253	0.08	Q V
5+25	0.0259	0.09	Q V
5+30	0.0265	0.09	Q V
5+35	0.0271	0.09	Q V
5+40	0.0278	0.10	Q V
5+45	0.0284	0.10	Q V
5+50	0.0291	0.10	Q V
5+55	0.0298	0.10	Q V
6+ 0	0.0305	0.10	Q V
6+ 5	0.0312	0.10	Q V
6+10	0.0320	0.11	Q V
6+15	0.0327	0.11	Q V
6+20	0.0335	0.11	Q V
6+25	0.0343	0.11	Q V
6+30	0.0351	0.11	Q V
6+35	0.0359	0.12	Q V

6+40	0.0367	0.12	Q	V				
6+45	0.0376	0.12	Q	V				
6+50	0.0384	0.13	Q	V				
6+55	0.0393	0.13	Q	V				
7+ 0	0.0402	0.13	Q	V				
7+ 5	0.0411	0.13	Q	V				
7+10	0.0419	0.13	Q	V				
7+15	0.0428	0.13	Q	V				
7+20	0.0437	0.13	Q	V				
7+25	0.0446	0.13	Q	V				
7+30	0.0456	0.14	Q	V				
7+35	0.0465	0.14	Q	V				
7+40	0.0475	0.15	Q	V				
7+45	0.0486	0.15	Q	V				
7+50	0.0496	0.15	Q	V				
7+55	0.0507	0.16	Q	V				
8+ 0	0.0518	0.16	Q	V				
8+ 5	0.0530	0.17	Q	V				
8+10	0.0542	0.18	Q	V				
8+15	0.0555	0.18	Q	V				
8+20	0.0568	0.19	Q	V				
8+25	0.0580	0.19	Q	V				
8+30	0.0594	0.19	Q	V				
8+35	0.0607	0.19	Q	V				
8+40	0.0620	0.20	Q	V				
8+45	0.0634	0.20	Q	V				
8+50	0.0648	0.20	Q	V				
8+55	0.0663	0.21	Q	V				
9+ 0	0.0677	0.21	Q	V				
9+ 5	0.0692	0.22	Q	V				
9+10	0.0708	0.23	Q	V				
9+15	0.0724	0.24	Q	V				
9+20	0.0741	0.24	Q	V				
9+25	0.0758	0.25	Q	V				
9+30	0.0775	0.25	Q	V				
9+35	0.0792	0.25	Q	V				
9+40	0.0810	0.26	Q	V				
9+45	0.0829	0.26	Q	V				
9+50	0.0847	0.27	Q	V				
9+55	0.0866	0.27	Q	V				
10+ 0	0.0885	0.28	Q	V				
10+ 5	0.0903	0.27	Q	V				
10+10	0.0919	0.23	Q	V				
10+15	0.0934	0.21	Q	V				
10+20	0.0948	0.21	Q	V				
10+25	0.0962	0.20	Q	V				
10+30	0.0975	0.20	Q	V				
10+35	0.0989	0.20	Q	V				
10+40	0.1005	0.23	Q	V				
10+45	0.1022	0.24	Q	V				

15+ 0	0.2117	0.32	Q			V
15+ 5	0.2139	0.32	Q			V
15+10	0.2160	0.31	Q			V
15+15	0.2182	0.31	Q			V
15+20	0.2203	0.31	Q			V
15+25	0.2224	0.30	Q			V
15+30	0.2244	0.30	Q			V
15+35	0.2264	0.29	Q			V
15+40	0.2283	0.27	Q			V
15+45	0.2300	0.26	Q			V
15+50	0.2318	0.25	Q			V
15+55	0.2335	0.25	Q			V
16+ 0	0.2352	0.25	Q			V
16+ 5	0.2367	0.22	Q			V
16+10	0.2377	0.14	Q			V
16+15	0.2384	0.10	Q			V
16+20	0.2390	0.08	Q			V
16+25	0.2394	0.07	Q			V
16+30	0.2399	0.07	Q			V
16+35	0.2403	0.06	Q			V
16+40	0.2406	0.05	Q			V
16+45	0.2410	0.05	Q			V
16+50	0.2412	0.04	Q			V
16+55	0.2415	0.04	Q			V
17+ 0	0.2418	0.04	Q			V
17+ 5	0.2421	0.04	Q			V
17+10	0.2424	0.05	Q			V
17+15	0.2428	0.06	Q			V
17+20	0.2433	0.06	Q			V
17+25	0.2437	0.06	Q			V
17+30	0.2441	0.06	Q			V
17+35	0.2445	0.06	Q			V
17+40	0.2450	0.06	Q			V
17+45	0.2454	0.06	Q			V
17+50	0.2458	0.06	Q			V
17+55	0.2462	0.06	Q			V
18+ 0	0.2466	0.05	Q			V
18+ 5	0.2470	0.05	Q			V
18+10	0.2473	0.05	Q			V
18+15	0.2477	0.05	Q			V
18+20	0.2480	0.05	Q			V
18+25	0.2484	0.05	Q			V
18+30	0.2487	0.05	Q			V
18+35	0.2491	0.05	Q			V
18+40	0.2494	0.04	Q			V
18+45	0.2497	0.04	Q			V
18+50	0.2500	0.04	Q			V
18+55	0.2502	0.03	Q			V
19+ 0	0.2504	0.03	Q			V
19+ 5	0.2506	0.03	Q			V

19+10	0.2508	0.03	Q				V
19+15	0.2511	0.04	Q				V
19+20	0.2513	0.04	Q				V
19+25	0.2516	0.04	Q				V
19+30	0.2520	0.05	Q				V
19+35	0.2523	0.05	Q				V
19+40	0.2526	0.04	Q				V
19+45	0.2529	0.04	Q				V
19+50	0.2531	0.04	Q				V
19+55	0.2533	0.03	Q				V
20+ 0	0.2535	0.03	Q				V
20+ 5	0.2538	0.03	Q				V
20+10	0.2540	0.03	Q				V
20+15	0.2542	0.04	Q				V
20+20	0.2545	0.04	Q				V
20+25	0.2548	0.04	Q				V
20+30	0.2550	0.04	Q				V
20+35	0.2553	0.04	Q				V
20+40	0.2555	0.04	Q				V
20+45	0.2558	0.04	Q				V
20+50	0.2560	0.04	Q				V
20+55	0.2563	0.03	Q				V
21+ 0	0.2565	0.03	Q				V
21+ 5	0.2567	0.03	Q				V
21+10	0.2569	0.03	Q				V
21+15	0.2571	0.04	Q				V
21+20	0.2574	0.04	Q				V
21+25	0.2576	0.03	Q				V
21+30	0.2578	0.03	Q				V
21+35	0.2580	0.03	Q				V
21+40	0.2582	0.03	Q				V
21+45	0.2585	0.04	Q				V
21+50	0.2587	0.04	Q				V
21+55	0.2589	0.03	Q				V
22+ 0	0.2591	0.03	Q				V
22+ 5	0.2593	0.03	Q				V
22+10	0.2595	0.03	Q				V
22+15	0.2598	0.04	Q				V
22+20	0.2600	0.04	Q				V
22+25	0.2602	0.03	Q				V
22+30	0.2604	0.03	Q				V
22+35	0.2606	0.03	Q				V
22+40	0.2608	0.03	Q				V
22+45	0.2610	0.03	Q				V
22+50	0.2612	0.03	Q				V
22+55	0.2613	0.03	Q				V
23+ 0	0.2615	0.03	Q				V
23+ 5	0.2617	0.03	Q				V
23+10	0.2619	0.03	Q				V
23+15	0.2620	0.03	Q				V

23+20	0.2622	0.03	Q				V
23+25	0.2624	0.03	Q				V
23+30	0.2626	0.03	Q				V
23+35	0.2627	0.03	Q				V
23+40	0.2629	0.03	Q				V
23+45	0.2631	0.03	Q				V
23+50	0.2633	0.03	Q				V
23+55	0.2635	0.03	Q				V
24+ 0	0.2636	0.03	Q				V
24+ 5	0.2638	0.02	Q				V
24+10	0.2639	0.01	Q				V
24+15	0.2639	0.01	Q				V
24+20	0.2639	0.00	Q				V
24+25	0.2640	0.00	Q				V
24+30	0.2640	0.00	Q				V
24+35	0.2640	0.00	Q				V
24+40	0.2640	0.00	Q				V
24+45	0.2640	0.00	Q				V
24+50	0.2640	0.00	Q				V

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
Study date 12/14/22 File: ONSITEPROP242.out

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

Program License Serial Number 4010

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

English Units used in output format

22-0198 - ETHANAC COMMERCE CENTER
ONSITE UNIT HYDROGRAPH ANALYSIS
PROPOSED CONDITION, 2-YEAR 24-HOUR
FN: ONSITEPROP.OUT- RSB

Drainage Area = 19.80(Ac.) = 0.031 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 19.80(Ac.) =
0.031 Sq. Mi.
Length along longest watercourse = 553.00(Ft.)
Length along longest watercourse measured to centroid = 150.00(Ft.)
Length along longest watercourse = 0.105 Mi.
Length along longest watercourse measured to centroid = 0.028 Mi.
Difference in elevation = 7.00(Ft.)
Slope along watercourse = 66.8354 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.018 Hr.
Lag time = 1.07 Min.
25% of lag time = 0.27 Min.
40% of lag time = 0.43 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	1.60	31.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	4.00	79.20

STORM EVENT (YEAR) = 2.00
 Area Averaged 2-Year Rainfall = 1.600(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 1.600(In)
 Areal adjustment factor = 100.00 %
 Adjusted average point rain = 1.600(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.800	75.00	0.900
Total Area Entered = 19.80(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-1	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
75.0	57.0	0.501	0.900	0.095	1.000	0.095
Sum (F) =						0.095

Area averaged mean soil loss (F) (In/Hr) = 0.095
 Minimum soil loss rate ((In/Hr)) = 0.048
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.180

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

Unit Hydrograph Data

Unit time period	Time % of lag	Distribution	Unit Hydrograph
(hrs)		Graph %	(CFS)
1	0.083	469.158	69.318
2	0.167	938.316	30.682
		Sum = 100.000	Sum= 19.955

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

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.013	(0.169)	0.002	0.010
2	0.17	0.07	0.013	(0.168)	0.002	0.010
3	0.25	0.07	0.013	(0.167)	0.002	0.010
4	0.33	0.10	0.019	(0.167)	0.003	0.016
5	0.42	0.10	0.019	(0.166)	0.003	0.016
6	0.50	0.10	0.019	(0.165)	0.003	0.016
7	0.58	0.10	0.019	(0.165)	0.003	0.016
8	0.67	0.10	0.019	(0.164)	0.003	0.016
9	0.75	0.10	0.019	(0.163)	0.003	0.016
10	0.83	0.13	0.026	(0.163)	0.005	0.021
11	0.92	0.13	0.026	(0.162)	0.005	0.021
12	1.00	0.13	0.026	(0.162)	0.005	0.021
13	1.08	0.10	0.019	(0.161)	0.003	0.016
14	1.17	0.10	0.019	(0.160)	0.003	0.016
15	1.25	0.10	0.019	(0.160)	0.003	0.016
16	1.33	0.10	0.019	(0.159)	0.003	0.016
17	1.42	0.10	0.019	(0.158)	0.003	0.016
18	1.50	0.10	0.019	(0.158)	0.003	0.016
19	1.58	0.10	0.019	(0.157)	0.003	0.016
20	1.67	0.10	0.019	(0.156)	0.003	0.016
21	1.75	0.10	0.019	(0.156)	0.003	0.016
22	1.83	0.13	0.026	(0.155)	0.005	0.021
23	1.92	0.13	0.026	(0.155)	0.005	0.021
24	2.00	0.13	0.026	(0.154)	0.005	0.021
25	2.08	0.13	0.026	(0.153)	0.005	0.021
26	2.17	0.13	0.026	(0.153)	0.005	0.021
27	2.25	0.13	0.026	(0.152)	0.005	0.021
28	2.33	0.13	0.026	(0.151)	0.005	0.021
29	2.42	0.13	0.026	(0.151)	0.005	0.021
30	2.50	0.13	0.026	(0.150)	0.005	0.021
31	2.58	0.17	0.032	(0.150)	0.006	0.026
32	2.67	0.17	0.032	(0.149)	0.006	0.026
33	2.75	0.17	0.032	(0.148)	0.006	0.026
34	2.83	0.17	0.032	(0.148)	0.006	0.026
35	2.92	0.17	0.032	(0.147)	0.006	0.026
36	3.00	0.17	0.032	(0.147)	0.006	0.026
37	3.08	0.17	0.032	(0.146)	0.006	0.026
38	3.17	0.17	0.032	(0.145)	0.006	0.026
39	3.25	0.17	0.032	(0.145)	0.006	0.026
40	3.33	0.17	0.032	(0.144)	0.006	0.026
41	3.42	0.17	0.032	(0.144)	0.006	0.026
42	3.50	0.17	0.032	(0.143)	0.006	0.026
43	3.58	0.17	0.032	(0.142)	0.006	0.026
44	3.67	0.17	0.032	(0.142)	0.006	0.026
45	3.75	0.17	0.032	(0.141)	0.006	0.026
46	3.83	0.20	0.038	(0.141)	0.007	0.031
47	3.92	0.20	0.038	(0.140)	0.007	0.031

48	4.00	0.20	0.038	(0.139)	0.007	0.031
49	4.08	0.20	0.038	(0.139)	0.007	0.031
50	4.17	0.20	0.038	(0.138)	0.007	0.031
51	4.25	0.20	0.038	(0.138)	0.007	0.031
52	4.33	0.23	0.045	(0.137)	0.008	0.037
53	4.42	0.23	0.045	(0.136)	0.008	0.037
54	4.50	0.23	0.045	(0.136)	0.008	0.037
55	4.58	0.23	0.045	(0.135)	0.008	0.037
56	4.67	0.23	0.045	(0.135)	0.008	0.037
57	4.75	0.23	0.045	(0.134)	0.008	0.037
58	4.83	0.27	0.051	(0.134)	0.009	0.042
59	4.92	0.27	0.051	(0.133)	0.009	0.042
60	5.00	0.27	0.051	(0.132)	0.009	0.042
61	5.08	0.20	0.038	(0.132)	0.007	0.031
62	5.17	0.20	0.038	(0.131)	0.007	0.031
63	5.25	0.20	0.038	(0.131)	0.007	0.031
64	5.33	0.23	0.045	(0.130)	0.008	0.037
65	5.42	0.23	0.045	(0.129)	0.008	0.037
66	5.50	0.23	0.045	(0.129)	0.008	0.037
67	5.58	0.27	0.051	(0.128)	0.009	0.042
68	5.67	0.27	0.051	(0.128)	0.009	0.042
69	5.75	0.27	0.051	(0.127)	0.009	0.042
70	5.83	0.27	0.051	(0.127)	0.009	0.042
71	5.92	0.27	0.051	(0.126)	0.009	0.042
72	6.00	0.27	0.051	(0.126)	0.009	0.042
73	6.08	0.30	0.058	(0.125)	0.010	0.047
74	6.17	0.30	0.058	(0.124)	0.010	0.047
75	6.25	0.30	0.058	(0.124)	0.010	0.047
76	6.33	0.30	0.058	(0.123)	0.010	0.047
77	6.42	0.30	0.058	(0.123)	0.010	0.047
78	6.50	0.30	0.058	(0.122)	0.010	0.047
79	6.58	0.33	0.064	(0.122)	0.012	0.052
80	6.67	0.33	0.064	(0.121)	0.012	0.052
81	6.75	0.33	0.064	(0.121)	0.012	0.052
82	6.83	0.33	0.064	(0.120)	0.012	0.052
83	6.92	0.33	0.064	(0.119)	0.012	0.052
84	7.00	0.33	0.064	(0.119)	0.012	0.052
85	7.08	0.33	0.064	(0.118)	0.012	0.052
86	7.17	0.33	0.064	(0.118)	0.012	0.052
87	7.25	0.33	0.064	(0.117)	0.012	0.052
88	7.33	0.37	0.070	(0.117)	0.013	0.058
89	7.42	0.37	0.070	(0.116)	0.013	0.058
90	7.50	0.37	0.070	(0.116)	0.013	0.058
91	7.58	0.40	0.077	(0.115)	0.014	0.063
92	7.67	0.40	0.077	(0.115)	0.014	0.063
93	7.75	0.40	0.077	(0.114)	0.014	0.063
94	7.83	0.43	0.083	(0.114)	0.015	0.068
95	7.92	0.43	0.083	(0.113)	0.015	0.068
96	8.00	0.43	0.083	(0.113)	0.015	0.068
97	8.08	0.50	0.096	(0.112)	0.017	0.079

98	8.17	0.50	0.096	(0.112)	0.017	0.079
99	8.25	0.50	0.096	(0.111)	0.017	0.079
100	8.33	0.50	0.096	(0.110)	0.017	0.079
101	8.42	0.50	0.096	(0.110)	0.017	0.079
102	8.50	0.50	0.096	(0.109)	0.017	0.079
103	8.58	0.53	0.102	(0.109)	0.018	0.084
104	8.67	0.53	0.102	(0.108)	0.018	0.084
105	8.75	0.53	0.102	(0.108)	0.018	0.084
106	8.83	0.57	0.109	(0.107)	0.020	0.089
107	8.92	0.57	0.109	(0.107)	0.020	0.089
108	9.00	0.57	0.109	(0.106)	0.020	0.089
109	9.08	0.63	0.122	(0.106)	0.022	0.100
110	9.17	0.63	0.122	(0.105)	0.022	0.100
111	9.25	0.63	0.122	(0.105)	0.022	0.100
112	9.33	0.67	0.128	(0.104)	0.023	0.105
113	9.42	0.67	0.128	(0.104)	0.023	0.105
114	9.50	0.67	0.128	(0.103)	0.023	0.105
115	9.58	0.70	0.134	(0.103)	0.024	0.110
116	9.67	0.70	0.134	(0.102)	0.024	0.110
117	9.75	0.70	0.134	(0.102)	0.024	0.110
118	9.83	0.73	0.141	(0.101)	0.025	0.115
119	9.92	0.73	0.141	(0.101)	0.025	0.115
120	10.00	0.73	0.141	(0.100)	0.025	0.115
121	10.08	0.50	0.096	(0.100)	0.017	0.079
122	10.17	0.50	0.096	(0.099)	0.017	0.079
123	10.25	0.50	0.096	(0.099)	0.017	0.079
124	10.33	0.50	0.096	(0.099)	0.017	0.079
125	10.42	0.50	0.096	(0.098)	0.017	0.079
126	10.50	0.50	0.096	(0.098)	0.017	0.079
127	10.58	0.67	0.128	(0.097)	0.023	0.105
128	10.67	0.67	0.128	(0.097)	0.023	0.105
129	10.75	0.67	0.128	(0.096)	0.023	0.105
130	10.83	0.67	0.128	(0.096)	0.023	0.105
131	10.92	0.67	0.128	(0.095)	0.023	0.105
132	11.00	0.67	0.128	(0.095)	0.023	0.105
133	11.08	0.63	0.122	(0.094)	0.022	0.100
134	11.17	0.63	0.122	(0.094)	0.022	0.100
135	11.25	0.63	0.122	(0.093)	0.022	0.100
136	11.33	0.63	0.122	(0.093)	0.022	0.100
137	11.42	0.63	0.122	(0.092)	0.022	0.100
138	11.50	0.63	0.122	(0.092)	0.022	0.100
139	11.58	0.57	0.109	(0.091)	0.020	0.089
140	11.67	0.57	0.109	(0.091)	0.020	0.089
141	11.75	0.57	0.109	(0.091)	0.020	0.089
142	11.83	0.60	0.115	(0.090)	0.021	0.094
143	11.92	0.60	0.115	(0.090)	0.021	0.094
144	12.00	0.60	0.115	(0.089)	0.021	0.094
145	12.08	0.83	0.160	(0.089)	0.029	0.131
146	12.17	0.83	0.160	(0.088)	0.029	0.131
147	12.25	0.83	0.160	(0.088)	0.029	0.131

148	12.33	0.87	0.166	(0.087)	0.030	0.136
149	12.42	0.87	0.166	(0.087)	0.030	0.136
150	12.50	0.87	0.166	(0.087)	0.030	0.136
151	12.58	0.93	0.179	(0.086)	0.032	0.147
152	12.67	0.93	0.179	(0.086)	0.032	0.147
153	12.75	0.93	0.179	(0.085)	0.032	0.147
154	12.83	0.97	0.186	(0.085)	0.033	0.152
155	12.92	0.97	0.186	(0.084)	0.033	0.152
156	13.00	0.97	0.186	(0.084)	0.033	0.152
157	13.08	1.13	0.218	(0.084)	0.039	0.178
158	13.17	1.13	0.218	(0.083)	0.039	0.178
159	13.25	1.13	0.218	(0.083)	0.039	0.178
160	13.33	1.13	0.218	(0.082)	0.039	0.178
161	13.42	1.13	0.218	(0.082)	0.039	0.178
162	13.50	1.13	0.218	(0.081)	0.039	0.178
163	13.58	0.77	0.147	(0.081)	0.026	0.121
164	13.67	0.77	0.147	(0.081)	0.026	0.121
165	13.75	0.77	0.147	(0.080)	0.026	0.121
166	13.83	0.77	0.147	(0.080)	0.026	0.121
167	13.92	0.77	0.147	(0.079)	0.026	0.121
168	14.00	0.77	0.147	(0.079)	0.026	0.121
169	14.08	0.90	0.173	(0.079)	0.031	0.142
170	14.17	0.90	0.173	(0.078)	0.031	0.142
171	14.25	0.90	0.173	(0.078)	0.031	0.142
172	14.33	0.87	0.166	(0.077)	0.030	0.136
173	14.42	0.87	0.166	(0.077)	0.030	0.136
174	14.50	0.87	0.166	(0.077)	0.030	0.136
175	14.58	0.87	0.166	(0.076)	0.030	0.136
176	14.67	0.87	0.166	(0.076)	0.030	0.136
177	14.75	0.87	0.166	(0.075)	0.030	0.136
178	14.83	0.83	0.160	(0.075)	0.029	0.131
179	14.92	0.83	0.160	(0.075)	0.029	0.131
180	15.00	0.83	0.160	(0.074)	0.029	0.131
181	15.08	0.80	0.154	(0.074)	0.028	0.126
182	15.17	0.80	0.154	(0.074)	0.028	0.126
183	15.25	0.80	0.154	(0.073)	0.028	0.126
184	15.33	0.77	0.147	(0.073)	0.026	0.121
185	15.42	0.77	0.147	(0.072)	0.026	0.121
186	15.50	0.77	0.147	(0.072)	0.026	0.121
187	15.58	0.63	0.122	(0.072)	0.022	0.100
188	15.67	0.63	0.122	(0.071)	0.022	0.100
189	15.75	0.63	0.122	(0.071)	0.022	0.100
190	15.83	0.63	0.122	(0.071)	0.022	0.100
191	15.92	0.63	0.122	(0.070)	0.022	0.100
192	16.00	0.63	0.122	(0.070)	0.022	0.100
193	16.08	0.13	0.026	(0.069)	0.005	0.021
194	16.17	0.13	0.026	(0.069)	0.005	0.021
195	16.25	0.13	0.026	(0.069)	0.005	0.021
196	16.33	0.13	0.026	(0.068)	0.005	0.021
197	16.42	0.13	0.026	(0.068)	0.005	0.021

198	16.50	0.13	0.026	(0.068)	0.005	0.021
199	16.58	0.10	0.019	(0.067)	0.003	0.016
200	16.67	0.10	0.019	(0.067)	0.003	0.016
201	16.75	0.10	0.019	(0.067)	0.003	0.016
202	16.83	0.10	0.019	(0.066)	0.003	0.016
203	16.92	0.10	0.019	(0.066)	0.003	0.016
204	17.00	0.10	0.019	(0.066)	0.003	0.016
205	17.08	0.17	0.032	(0.065)	0.006	0.026
206	17.17	0.17	0.032	(0.065)	0.006	0.026
207	17.25	0.17	0.032	(0.065)	0.006	0.026
208	17.33	0.17	0.032	(0.064)	0.006	0.026
209	17.42	0.17	0.032	(0.064)	0.006	0.026
210	17.50	0.17	0.032	(0.064)	0.006	0.026
211	17.58	0.17	0.032	(0.063)	0.006	0.026
212	17.67	0.17	0.032	(0.063)	0.006	0.026
213	17.75	0.17	0.032	(0.063)	0.006	0.026
214	17.83	0.13	0.026	(0.062)	0.005	0.021
215	17.92	0.13	0.026	(0.062)	0.005	0.021
216	18.00	0.13	0.026	(0.062)	0.005	0.021
217	18.08	0.13	0.026	(0.062)	0.005	0.021
218	18.17	0.13	0.026	(0.061)	0.005	0.021
219	18.25	0.13	0.026	(0.061)	0.005	0.021
220	18.33	0.13	0.026	(0.061)	0.005	0.021
221	18.42	0.13	0.026	(0.060)	0.005	0.021
222	18.50	0.13	0.026	(0.060)	0.005	0.021
223	18.58	0.10	0.019	(0.060)	0.003	0.016
224	18.67	0.10	0.019	(0.059)	0.003	0.016
225	18.75	0.10	0.019	(0.059)	0.003	0.016
226	18.83	0.07	0.013	(0.059)	0.002	0.010
227	18.92	0.07	0.013	(0.059)	0.002	0.010
228	19.00	0.07	0.013	(0.058)	0.002	0.010
229	19.08	0.10	0.019	(0.058)	0.003	0.016
230	19.17	0.10	0.019	(0.058)	0.003	0.016
231	19.25	0.10	0.019	(0.058)	0.003	0.016
232	19.33	0.13	0.026	(0.057)	0.005	0.021
233	19.42	0.13	0.026	(0.057)	0.005	0.021
234	19.50	0.13	0.026	(0.057)	0.005	0.021
235	19.58	0.10	0.019	(0.056)	0.003	0.016
236	19.67	0.10	0.019	(0.056)	0.003	0.016
237	19.75	0.10	0.019	(0.056)	0.003	0.016
238	19.83	0.07	0.013	(0.056)	0.002	0.010
239	19.92	0.07	0.013	(0.055)	0.002	0.010
240	20.00	0.07	0.013	(0.055)	0.002	0.010
241	20.08	0.10	0.019	(0.055)	0.003	0.016
242	20.17	0.10	0.019	(0.055)	0.003	0.016
243	20.25	0.10	0.019	(0.055)	0.003	0.016
244	20.33	0.10	0.019	(0.054)	0.003	0.016
245	20.42	0.10	0.019	(0.054)	0.003	0.016
246	20.50	0.10	0.019	(0.054)	0.003	0.016
247	20.58	0.10	0.019	(0.054)	0.003	0.016

 Peak flow rate of this hydrograph = 3.562(CFS)

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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0010	0.15	Q				
0+10	0.0024	0.21	Q				
0+15	0.0039	0.21	Q				
0+20	0.0058	0.28	VQ				
0+25	0.0080	0.31	VQ				
0+30	0.0102	0.31	VQ				
0+35	0.0123	0.31	VQ				
0+40	0.0145	0.31	VQ				
0+45	0.0167	0.31	VQ				
0+50	0.0193	0.39	VQ				
0+55	0.0222	0.42	VQ				
1+ 0	0.0251	0.42	VQ				
1+ 5	0.0275	0.35	VQ				
1+10	0.0296	0.31	VQ				
1+15	0.0318	0.31	VQ				
1+20	0.0340	0.31	VQ				
1+25	0.0361	0.31	VQ				
1+30	0.0383	0.31	VQ				
1+35	0.0405	0.31	VQ				
1+40	0.0426	0.31	VQ				
1+45	0.0448	0.31	VQ				
1+50	0.0475	0.39	VQ				
1+55	0.0503	0.42	VQ				
2+ 0	0.0532	0.42	VQ				
2+ 5	0.0561	0.42	Q				
2+10	0.0590	0.42	Q				
2+15	0.0619	0.42	Q				
2+20	0.0648	0.42	Q				
2+25	0.0677	0.42	Q				
2+30	0.0706	0.42	Q				
2+35	0.0739	0.49	Q				
2+40	0.0775	0.52	VQ				
2+45	0.0812	0.52	VQ				
2+50	0.0848	0.52	VQ				
2+55	0.0884	0.52	VQ				
3+ 0	0.0920	0.52	VQ				
3+ 5	0.0956	0.52	VQ				
3+10	0.0992	0.52	VQ				

3+15	0.1028	0.52	VQ				
3+20	0.1064	0.52	VQ				
3+25	0.1100	0.52	Q				
3+30	0.1136	0.52	Q				
3+35	0.1172	0.52	Q				
3+40	0.1208	0.52	Q				
3+45	0.1244	0.52	Q				
3+50	0.1286	0.60	Q				
3+55	0.1329	0.63	Q				
4+ 0	0.1372	0.63	Q				
4+ 5	0.1415	0.63	Q				
4+10	0.1459	0.63	Q				
4+15	0.1502	0.63	Q				
4+20	0.1550	0.70	Q				
4+25	0.1601	0.73	Q				
4+30	0.1651	0.73	QV				
4+35	0.1702	0.73	QV				
4+40	0.1752	0.73	QV				
4+45	0.1803	0.73	QV				
4+50	0.1858	0.81	Q				
4+55	0.1916	0.84	Q				
5+ 0	0.1974	0.84	Q				
5+ 5	0.2022	0.69	QV				
5+10	0.2065	0.63	QV				
5+15	0.2108	0.63	QV				
5+20	0.2156	0.70	QV				
5+25	0.2207	0.73	Q V				
5+30	0.2257	0.73	Q V				
5+35	0.2313	0.81	QV				
5+40	0.2371	0.84	QV				
5+45	0.2428	0.84	QV				
5+50	0.2486	0.84	QV				
5+55	0.2544	0.84	QV				
6+ 0	0.2602	0.84	QV				
6+ 5	0.2664	0.91	QV				
6+10	0.2729	0.94	Q V				
6+15	0.2794	0.94	Q V				
6+20	0.2859	0.94	Q V				
6+25	0.2924	0.94	Q V				
6+30	0.2989	0.94	Q V				
6+35	0.3059	1.02	QV				
6+40	0.3131	1.05	QV				
6+45	0.3203	1.05	QV				
6+50	0.3275	1.05	Q V				
6+55	0.3348	1.05	Q V				
7+ 0	0.3420	1.05	Q V				
7+ 5	0.3492	1.05	Q V				
7+10	0.3564	1.05	Q V				
7+15	0.3636	1.05	Q V				
7+20	0.3713	1.12	Q V				

7+25	0.3793	1.15	Q	V				
7+30	0.3872	1.15	Q	V				
7+35	0.3957	1.23	Q	V				
7+40	0.4043	1.26	Q	V				
7+45	0.4130	1.26	Q	V				
7+50	0.4221	1.33	Q	V				
7+55	0.4315	1.36	Q	V				
8+ 0	0.4409	1.36	Q	V				
8+ 5	0.4513	1.51	Q	V				
8+10	0.4621	1.57	Q	V				
8+15	0.4729	1.57	Q	V				
8+20	0.4837	1.57	Q	V				
8+25	0.4946	1.57	Q	V				
8+30	0.5054	1.57	Q	V				
8+35	0.5167	1.64	Q	V				
8+40	0.5283	1.68	Q	V				
8+45	0.5398	1.68	Q	V				
8+50	0.5518	1.75	Q	V				
8+55	0.5641	1.78	Q	V				
9+ 0	0.5764	1.78	Q	V				
9+ 5	0.5896	1.93	Q	V				
9+10	0.6034	1.99	Q	V				
9+15	0.6171	1.99	Q	V				
9+20	0.6313	2.06	Q	V				
9+25	0.6457	2.10	Q	V				
9+30	0.6601	2.10	Q	V				
9+35	0.6751	2.17	Q	V				
9+40	0.6902	2.20	Q	V				
9+45	0.7054	2.20	Q	V				
9+50	0.7210	2.27	Q	V				
9+55	0.7369	2.30	Q	V				
10+ 0	0.7528	2.30	Q	V				
10+ 5	0.7652	1.80	Q	V				
10+10	0.7760	1.57	Q	V				
10+15	0.7868	1.57	Q	V				
10+20	0.7976	1.57	Q	V				
10+25	0.8084	1.57	Q	V				
10+30	0.8193	1.57	Q	V				
10+35	0.8326	1.93	Q	V				
10+40	0.8470	2.10	Q	V				
10+45	0.8615	2.10	Q	V				
10+50	0.8759	2.10	Q	V				
10+55	0.8903	2.10	Q	V				
11+ 0	0.9048	2.10	Q	V				
11+ 5	0.9187	2.02	Q	V				
11+10	0.9324	1.99	Q	V				
11+15	0.9461	1.99	Q	V				
11+20	0.9598	1.99	Q	V				
11+25	0.9735	1.99	Q	V				
11+30	0.9872	1.99	Q	V				

11+35	0.9999	1.85	Q	V
11+40	1.0122	1.78	Q	V
11+45	1.0245	1.78	Q	V
11+50	1.0372	1.85	Q	V
11+55	1.0502	1.89	Q	V
12+ 0	1.0632	1.89	Q	V
12+ 5	1.0797	2.39	Q	V
12+10	1.0977	2.62	Q	V
12+15	1.1158	2.62	Q	V
12+20	1.1343	2.69	Q	V
12+25	1.1531	2.72	Q	V
12+30	1.1718	2.72	Q	V
12+35	1.1916	2.87	Q	V
12+40	1.2118	2.93	Q	V
12+45	1.2320	2.93	Q	V
12+50	1.2527	3.01	Q	V
12+55	1.2736	3.04	Q	V
13+ 0	1.2946	3.04	Q	V
13+ 5	1.3180	3.40	Q	V
13+10	1.3425	3.56	Q	V
13+15	1.3671	3.56	Q	V
13+20	1.3916	3.56	Q	V
13+25	1.4161	3.56	Q	V
13+30	1.4407	3.56	Q	V
13+35	1.4597	2.76	Q	V
13+40	1.4763	2.41	Q	V
13+45	1.4929	2.41	Q	V
13+50	1.5095	2.41	Q	V
13+55	1.5261	2.41	Q	V
14+ 0	1.5427	2.41	Q	V
14+ 5	1.5613	2.70	Q	V
14+10	1.5808	2.83	Q	V
14+15	1.6002	2.83	Q	V
14+20	1.6192	2.76	Q	V
14+25	1.6380	2.72	Q	V
14+30	1.6567	2.72	Q	V
14+35	1.6755	2.72	Q	V
14+40	1.6943	2.72	Q	V
14+45	1.7130	2.72	Q	V
14+50	1.7313	2.65	Q	V
14+55	1.7493	2.62	Q	V
15+ 0	1.7674	2.62	Q	V
15+ 5	1.7849	2.55	Q	V
15+10	1.8022	2.51	Q	V
15+15	1.8195	2.51	Q	V
15+20	1.8364	2.44	Q	V
15+25	1.8530	2.41	Q	V
15+30	1.8696	2.41	Q	V
15+35	1.8841	2.12	Q	V
15+40	1.8979	1.99	Q	V

15+45	1.9116	1.99		Q		V
15+50	1.9253	1.99		Q		V
15+55	1.9390	1.99		Q		V
16+ 0	1.9527	1.99		Q		V
16+ 5	1.9589	0.90	Q			V
16+10	1.9618	0.42	Q			V
16+15	1.9647	0.42	Q			V
16+20	1.9676	0.42	Q			V
16+25	1.9704	0.42	Q			V
16+30	1.9733	0.42	Q			V
16+35	1.9757	0.35	Q			V
16+40	1.9779	0.31	Q			V
16+45	1.9801	0.31	Q			V
16+50	1.9822	0.31	Q			V
16+55	1.9844	0.31	Q			V
17+ 0	1.9865	0.31	Q			V
17+ 5	1.9897	0.46	Q			V
17+10	1.9933	0.52	Q			V
17+15	1.9969	0.52	Q			V
17+20	2.0005	0.52	Q			V
17+25	2.0041	0.52	Q			V
17+30	2.0077	0.52	Q			V
17+35	2.0114	0.52	Q			V
17+40	2.0150	0.52	Q			V
17+45	2.0186	0.52	Q			V
17+50	2.0217	0.45	Q			V
17+55	2.0246	0.42	Q			V
18+ 0	2.0275	0.42	Q			V
18+ 5	2.0303	0.42	Q			V
18+10	2.0332	0.42	Q			V
18+15	2.0361	0.42	Q			V
18+20	2.0390	0.42	Q			V
18+25	2.0419	0.42	Q			V
18+30	2.0448	0.42	Q			V
18+35	2.0472	0.35	Q			V
18+40	2.0493	0.31	Q			V
18+45	2.0515	0.31	Q			V
18+50	2.0532	0.24	Q			V
18+55	2.0546	0.21	Q			V
19+ 0	2.0560	0.21	Q			V
19+ 5	2.0580	0.28	Q			V
19+10	2.0601	0.31	Q			V
19+15	2.0623	0.31	Q			V
19+20	2.0650	0.39	Q			V
19+25	2.0679	0.42	Q			V
19+30	2.0707	0.42	Q			V
19+35	2.0731	0.35	Q			V
19+40	2.0753	0.31	Q			V
19+45	2.0775	0.31	Q			V
19+50	2.0791	0.24	Q			V

$Q_{\text{peak,pre}} = 0.43 \text{ cfs}$
 $2.0246 - 0.0706 = 1.954 \text{ ac-ft}$
 85,116 cf
 110% preliminary
 93,628 cf

19+55	2.0806	0.21	Q				V
20+ 0	2.0820	0.21	Q				V
20+ 5	2.0840	0.28	Q				V
20+10	2.0861	0.31	Q				V
20+15	2.0883	0.31	Q				V
20+20	2.0905	0.31	Q				V
20+25	2.0926	0.31	Q				V
20+30	2.0948	0.31	Q				V
20+35	2.0969	0.31	Q				V
20+40	2.0991	0.31	Q				V
20+45	2.1013	0.31	Q				V
20+50	2.1029	0.24	Q				V
20+55	2.1044	0.21	Q				V
21+ 0	2.1058	0.21	Q				V
21+ 5	2.1078	0.28	Q				V
21+10	2.1099	0.31	Q				V
21+15	2.1121	0.31	Q				V
21+20	2.1138	0.24	Q				V
21+25	2.1152	0.21	Q				V
21+30	2.1166	0.21	Q				V
21+35	2.1186	0.28	Q				V
21+40	2.1208	0.31	Q				V
21+45	2.1229	0.31	Q				V
21+50	2.1246	0.24	Q				V
21+55	2.1260	0.21	Q				V
22+ 0	2.1275	0.21	Q				V
22+ 5	2.1294	0.28	Q				V
22+10	2.1316	0.31	Q				V
22+15	2.1337	0.31	Q				V
22+20	2.1354	0.24	Q				V
22+25	2.1369	0.21	Q				V
22+30	2.1383	0.21	Q				V
22+35	2.1397	0.21	Q				V
22+40	2.1412	0.21	Q				V
22+45	2.1426	0.21	Q				V
22+50	2.1441	0.21	Q				V
22+55	2.1455	0.21	Q				V
23+ 0	2.1470	0.21	Q				V
23+ 5	2.1484	0.21	Q				V
23+10	2.1498	0.21	Q				V
23+15	2.1513	0.21	Q				V
23+20	2.1527	0.21	Q				V
23+25	2.1542	0.21	Q				V
23+30	2.1556	0.21	Q				V
23+35	2.1571	0.21	Q				V
23+40	2.1585	0.21	Q				V
23+45	2.1599	0.21	Q				V
23+50	2.1614	0.21	Q				V
23+55	2.1628	0.21	Q				V
24+ 0	2.1643	0.21	Q				V

24+ 5

2.1647

0.06 Q

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|

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V|

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

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Study date 04/04/23 File: ONSITEPROP24100.out

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

Program License Serial Number 4010

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

English Units used in output format

22-0198 - ETHANAC COMMERCE CENTER
ONSITE UNIT HYDROGRAPH ANALYSIS
PROPOSED CONDITION, 100-YEAR 24-HOUR
FN: ONSITEPROP.OUT- RSB

Drainage Area = 19.80(Ac.) = 0.031 Sq. Mi.
Drainage Area for Depth-Area Areal Adjustment = 19.80(Ac.) =

0.031 Sq. Mi.

Length along longest watercourse = 553.00(Ft.)
Length along longest watercourse measured to centroid = 150.00(Ft.)
Length along longest watercourse = 0.105 Mi.
Length along longest watercourse measured to centroid = 0.028 Mi.
Difference in elevation = 7.00(Ft.)
Slope along watercourse = 66.8354 Ft./Mi.
Average Manning's 'N' = 0.015
Lag time = 0.018 Hr.
Lag time = 1.07 Min.
25% of lag time = 0.27 Min.
40% of lag time = 0.43 Min.
Unit time = 5.00 Min.
Duration of storm = 24 Hour(s)
User Entered Base Flow = 0.00(CFS)

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	1.60	31.68

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
19.80	4.00	79.20

STORM EVENT (YEAR) = 100.00
 Area Averaged 2-Year Rainfall = 1.600(In)
 Area Averaged 100-Year Rainfall = 4.000(In)

Point rain (area averaged) = 4.000(In)
 Areal adjustment factor = 100.00 %
 Adjusted average point rain = 4.000(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
19.800	75.00	0.900
Total Area Entered = 19.80(Ac.)		

RI	RI	Infil. Rate	Impervious	Adj. Infil. Rate	Area%	F
AMC2	AMC-2	(In/Hr)	(Dec.%)	(In/Hr)	(Dec.)	(In/Hr)
75.0	75.0	0.303	0.900	0.058	1.000	0.058
Sum (F) =						0.058

Area averaged mean soil loss (F) (In/Hr) = 0.058
 Minimum soil loss rate ((In/Hr)) = 0.029
 (for 24 hour storm duration)
 Soil low loss rate (decimal) = 0.180

 U n i t H y d r o g r a p h
 V A L L E Y S - C u r v e

Unit Hydrograph Data

Unit time period	Time % of lag	Distribution	Unit Hydrograph
(hrs)		Graph %	(CFS)
1	0.083	469.158	69.318
2	0.167	938.316	30.682
		Sum = 100.000	Sum= 19.955

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

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr)		Effective (In/Hr)
				Max	Low	
1	0.08	0.07	0.032	(0.102)	0.006	0.026
2	0.17	0.07	0.032	(0.102)	0.006	0.026
3	0.25	0.07	0.032	(0.101)	0.006	0.026
4	0.33	0.10	0.048	(0.101)	0.009	0.039
5	0.42	0.10	0.048	(0.100)	0.009	0.039
6	0.50	0.10	0.048	(0.100)	0.009	0.039
7	0.58	0.10	0.048	(0.100)	0.009	0.039
8	0.67	0.10	0.048	(0.099)	0.009	0.039
9	0.75	0.10	0.048	(0.099)	0.009	0.039
10	0.83	0.13	0.064	(0.099)	0.012	0.052
11	0.92	0.13	0.064	(0.098)	0.012	0.052
12	1.00	0.13	0.064	(0.098)	0.012	0.052
13	1.08	0.10	0.048	(0.097)	0.009	0.039
14	1.17	0.10	0.048	(0.097)	0.009	0.039
15	1.25	0.10	0.048	(0.097)	0.009	0.039
16	1.33	0.10	0.048	(0.096)	0.009	0.039
17	1.42	0.10	0.048	(0.096)	0.009	0.039
18	1.50	0.10	0.048	(0.095)	0.009	0.039
19	1.58	0.10	0.048	(0.095)	0.009	0.039
20	1.67	0.10	0.048	(0.095)	0.009	0.039
21	1.75	0.10	0.048	(0.094)	0.009	0.039
22	1.83	0.13	0.064	(0.094)	0.012	0.052
23	1.92	0.13	0.064	(0.094)	0.012	0.052
24	2.00	0.13	0.064	(0.093)	0.012	0.052
25	2.08	0.13	0.064	(0.093)	0.012	0.052
26	2.17	0.13	0.064	(0.092)	0.012	0.052
27	2.25	0.13	0.064	(0.092)	0.012	0.052
28	2.33	0.13	0.064	(0.092)	0.012	0.052
29	2.42	0.13	0.064	(0.091)	0.012	0.052
30	2.50	0.13	0.064	(0.091)	0.012	0.052
31	2.58	0.17	0.080	(0.091)	0.014	0.066
32	2.67	0.17	0.080	(0.090)	0.014	0.066
33	2.75	0.17	0.080	(0.090)	0.014	0.066
34	2.83	0.17	0.080	(0.089)	0.014	0.066
35	2.92	0.17	0.080	(0.089)	0.014	0.066
36	3.00	0.17	0.080	(0.089)	0.014	0.066
37	3.08	0.17	0.080	(0.088)	0.014	0.066
38	3.17	0.17	0.080	(0.088)	0.014	0.066
39	3.25	0.17	0.080	(0.088)	0.014	0.066
40	3.33	0.17	0.080	(0.087)	0.014	0.066
41	3.42	0.17	0.080	(0.087)	0.014	0.066
42	3.50	0.17	0.080	(0.087)	0.014	0.066
43	3.58	0.17	0.080	(0.086)	0.014	0.066
44	3.67	0.17	0.080	(0.086)	0.014	0.066
45	3.75	0.17	0.080	(0.085)	0.014	0.066
46	3.83	0.20	0.096	(0.085)	0.017	0.079
47	3.92	0.20	0.096	(0.085)	0.017	0.079

48	4.00	0.20	0.096	(0.084)	0.017	0.079
49	4.08	0.20	0.096	(0.084)	0.017	0.079
50	4.17	0.20	0.096	(0.084)	0.017	0.079
51	4.25	0.20	0.096	(0.083)	0.017	0.079
52	4.33	0.23	0.112	(0.083)	0.020	0.092
53	4.42	0.23	0.112	(0.083)	0.020	0.092
54	4.50	0.23	0.112	(0.082)	0.020	0.092
55	4.58	0.23	0.112	(0.082)	0.020	0.092
56	4.67	0.23	0.112	(0.082)	0.020	0.092
57	4.75	0.23	0.112	(0.081)	0.020	0.092
58	4.83	0.27	0.128	(0.081)	0.023	0.105
59	4.92	0.27	0.128	(0.080)	0.023	0.105
60	5.00	0.27	0.128	(0.080)	0.023	0.105
61	5.08	0.20	0.096	(0.080)	0.017	0.079
62	5.17	0.20	0.096	(0.079)	0.017	0.079
63	5.25	0.20	0.096	(0.079)	0.017	0.079
64	5.33	0.23	0.112	(0.079)	0.020	0.092
65	5.42	0.23	0.112	(0.078)	0.020	0.092
66	5.50	0.23	0.112	(0.078)	0.020	0.092
67	5.58	0.27	0.128	(0.078)	0.023	0.105
68	5.67	0.27	0.128	(0.077)	0.023	0.105
69	5.75	0.27	0.128	(0.077)	0.023	0.105
70	5.83	0.27	0.128	(0.077)	0.023	0.105
71	5.92	0.27	0.128	(0.076)	0.023	0.105
72	6.00	0.27	0.128	(0.076)	0.023	0.105
73	6.08	0.30	0.144	(0.076)	0.026	0.118
74	6.17	0.30	0.144	(0.075)	0.026	0.118
75	6.25	0.30	0.144	(0.075)	0.026	0.118
76	6.33	0.30	0.144	(0.075)	0.026	0.118
77	6.42	0.30	0.144	(0.074)	0.026	0.118
78	6.50	0.30	0.144	(0.074)	0.026	0.118
79	6.58	0.33	0.160	(0.074)	0.029	0.131
80	6.67	0.33	0.160	(0.073)	0.029	0.131
81	6.75	0.33	0.160	(0.073)	0.029	0.131
82	6.83	0.33	0.160	(0.073)	0.029	0.131
83	6.92	0.33	0.160	(0.072)	0.029	0.131
84	7.00	0.33	0.160	(0.072)	0.029	0.131
85	7.08	0.33	0.160	(0.072)	0.029	0.131
86	7.17	0.33	0.160	(0.071)	0.029	0.131
87	7.25	0.33	0.160	(0.071)	0.029	0.131
88	7.33	0.37	0.176	(0.071)	0.032	0.144
89	7.42	0.37	0.176	(0.070)	0.032	0.144
90	7.50	0.37	0.176	(0.070)	0.032	0.144
91	7.58	0.40	0.192	(0.070)	0.035	0.157
92	7.67	0.40	0.192	(0.069)	0.035	0.157
93	7.75	0.40	0.192	(0.069)	0.035	0.157
94	7.83	0.43	0.208	(0.069)	0.037	0.171
95	7.92	0.43	0.208	(0.068)	0.037	0.171
96	8.00	0.43	0.208	(0.068)	0.037	0.171
97	8.08	0.50	0.240	(0.068)	0.043	0.197

98	8.17	0.50	0.240	(0.067)	0.043	0.197
99	8.25	0.50	0.240	(0.067)	0.043	0.197
100	8.33	0.50	0.240	(0.067)	0.043	0.197
101	8.42	0.50	0.240	(0.067)	0.043	0.197
102	8.50	0.50	0.240	(0.066)	0.043	0.197
103	8.58	0.53	0.256	(0.066)	0.046	0.210
104	8.67	0.53	0.256	(0.066)	0.046	0.210
105	8.75	0.53	0.256	(0.065)	0.046	0.210
106	8.83	0.57	0.272	(0.065)	0.049	0.223
107	8.92	0.57	0.272	(0.065)	0.049	0.223
108	9.00	0.57	0.272	(0.064)	0.049	0.223
109	9.08	0.63	0.304	(0.064)	0.055	0.249
110	9.17	0.63	0.304	(0.064)	0.055	0.249
111	9.25	0.63	0.304	(0.063)	0.055	0.249
112	9.33	0.67	0.320	(0.063)	0.058	0.262
113	9.42	0.67	0.320	(0.063)	0.058	0.262
114	9.50	0.67	0.320	(0.063)	0.058	0.262
115	9.58	0.70	0.336	(0.062)	0.060	0.276
116	9.67	0.70	0.336	(0.062)	0.060	0.276
117	9.75	0.70	0.336	(0.062)	0.060	0.276
118	9.83	0.73	0.352	0.061 (0.063)		0.291
119	9.92	0.73	0.352	0.061 (0.063)		0.291
120	10.00	0.73	0.352	0.061 (0.063)		0.291
121	10.08	0.50	0.240	(0.060)	0.043	0.197
122	10.17	0.50	0.240	(0.060)	0.043	0.197
123	10.25	0.50	0.240	(0.060)	0.043	0.197
124	10.33	0.50	0.240	(0.060)	0.043	0.197
125	10.42	0.50	0.240	(0.059)	0.043	0.197
126	10.50	0.50	0.240	(0.059)	0.043	0.197
127	10.58	0.67	0.320	(0.059)	0.058	0.262
128	10.67	0.67	0.320	(0.058)	0.058	0.262
129	10.75	0.67	0.320	(0.058)	0.058	0.262
130	10.83	0.67	0.320	(0.058)	0.058	0.262
131	10.92	0.67	0.320	(0.058)	0.058	0.262
132	11.00	0.67	0.320	0.057 (0.058)		0.263
133	11.08	0.63	0.304	(0.057)	0.055	0.249
134	11.17	0.63	0.304	(0.057)	0.055	0.249
135	11.25	0.63	0.304	(0.056)	0.055	0.249
136	11.33	0.63	0.304	(0.056)	0.055	0.249
137	11.42	0.63	0.304	(0.056)	0.055	0.249
138	11.50	0.63	0.304	(0.056)	0.055	0.249
139	11.58	0.57	0.272	(0.055)	0.049	0.223
140	11.67	0.57	0.272	(0.055)	0.049	0.223
141	11.75	0.57	0.272	(0.055)	0.049	0.223
142	11.83	0.60	0.288	(0.055)	0.052	0.236
143	11.92	0.60	0.288	(0.054)	0.052	0.236
144	12.00	0.60	0.288	(0.054)	0.052	0.236
145	12.08	0.83	0.400	0.054 (0.072)		0.346
146	12.17	0.83	0.400	0.053 (0.072)		0.347
147	12.25	0.83	0.400	0.053 (0.072)		0.347

148	12.33	0.87	0.416	0.053	(0.075)	0.363
149	12.42	0.87	0.416	0.053	(0.075)	0.363
150	12.50	0.87	0.416	0.052	(0.075)	0.364
151	12.58	0.93	0.448	0.052	(0.081)	0.396
152	12.67	0.93	0.448	0.052	(0.081)	0.396
153	12.75	0.93	0.448	0.052	(0.081)	0.396
154	12.83	0.97	0.464	0.051	(0.084)	0.413
155	12.92	0.97	0.464	0.051	(0.084)	0.413
156	13.00	0.97	0.464	0.051	(0.084)	0.413
157	13.08	1.13	0.544	0.051	(0.098)	0.493
158	13.17	1.13	0.544	0.050	(0.098)	0.494
159	13.25	1.13	0.544	0.050	(0.098)	0.494
160	13.33	1.13	0.544	0.050	(0.098)	0.494
161	13.42	1.13	0.544	0.050	(0.098)	0.494
162	13.50	1.13	0.544	0.049	(0.098)	0.495
163	13.58	0.77	0.368	0.049	(0.066)	0.319
164	13.67	0.77	0.368	0.049	(0.066)	0.319
165	13.75	0.77	0.368	0.049	(0.066)	0.319
166	13.83	0.77	0.368	0.048	(0.066)	0.320
167	13.92	0.77	0.368	0.048	(0.066)	0.320
168	14.00	0.77	0.368	0.048	(0.066)	0.320
169	14.08	0.90	0.432	0.048	(0.078)	0.384
170	14.17	0.90	0.432	0.047	(0.078)	0.385
171	14.25	0.90	0.432	0.047	(0.078)	0.385
172	14.33	0.87	0.416	0.047	(0.075)	0.369
173	14.42	0.87	0.416	0.047	(0.075)	0.369
174	14.50	0.87	0.416	0.046	(0.075)	0.370
175	14.58	0.87	0.416	0.046	(0.075)	0.370
176	14.67	0.87	0.416	0.046	(0.075)	0.370
177	14.75	0.87	0.416	0.046	(0.075)	0.370
178	14.83	0.83	0.400	0.045	(0.072)	0.355
179	14.92	0.83	0.400	0.045	(0.072)	0.355
180	15.00	0.83	0.400	0.045	(0.072)	0.355
181	15.08	0.80	0.384	0.045	(0.069)	0.339
182	15.17	0.80	0.384	0.045	(0.069)	0.339
183	15.25	0.80	0.384	0.044	(0.069)	0.340
184	15.33	0.77	0.368	0.044	(0.066)	0.324
185	15.42	0.77	0.368	0.044	(0.066)	0.324
186	15.50	0.77	0.368	0.044	(0.066)	0.324
187	15.58	0.63	0.304	0.043	(0.055)	0.261
188	15.67	0.63	0.304	0.043	(0.055)	0.261
189	15.75	0.63	0.304	0.043	(0.055)	0.261
190	15.83	0.63	0.304	0.043	(0.055)	0.261
191	15.92	0.63	0.304	0.042	(0.055)	0.261
192	16.00	0.63	0.304	0.042	(0.055)	0.262
193	16.08	0.13	0.064	(0.042)	0.012	0.052
194	16.17	0.13	0.064	(0.042)	0.012	0.052
195	16.25	0.13	0.064	(0.042)	0.012	0.052
196	16.33	0.13	0.064	(0.041)	0.012	0.052
197	16.42	0.13	0.064	(0.041)	0.012	0.052

198	16.50	0.13	0.064	(0.041)	0.012	0.052
199	16.58	0.10	0.048	(0.041)	0.009	0.039
200	16.67	0.10	0.048	(0.041)	0.009	0.039
201	16.75	0.10	0.048	(0.040)	0.009	0.039
202	16.83	0.10	0.048	(0.040)	0.009	0.039
203	16.92	0.10	0.048	(0.040)	0.009	0.039
204	17.00	0.10	0.048	(0.040)	0.009	0.039
205	17.08	0.17	0.080	(0.040)	0.014	0.066
206	17.17	0.17	0.080	(0.039)	0.014	0.066
207	17.25	0.17	0.080	(0.039)	0.014	0.066
208	17.33	0.17	0.080	(0.039)	0.014	0.066
209	17.42	0.17	0.080	(0.039)	0.014	0.066
210	17.50	0.17	0.080	(0.039)	0.014	0.066
211	17.58	0.17	0.080	(0.038)	0.014	0.066
212	17.67	0.17	0.080	(0.038)	0.014	0.066
213	17.75	0.17	0.080	(0.038)	0.014	0.066
214	17.83	0.13	0.064	(0.038)	0.012	0.052
215	17.92	0.13	0.064	(0.038)	0.012	0.052
216	18.00	0.13	0.064	(0.037)	0.012	0.052
217	18.08	0.13	0.064	(0.037)	0.012	0.052
218	18.17	0.13	0.064	(0.037)	0.012	0.052
219	18.25	0.13	0.064	(0.037)	0.012	0.052
220	18.33	0.13	0.064	(0.037)	0.012	0.052
221	18.42	0.13	0.064	(0.037)	0.012	0.052
222	18.50	0.13	0.064	(0.036)	0.012	0.052
223	18.58	0.10	0.048	(0.036)	0.009	0.039
224	18.67	0.10	0.048	(0.036)	0.009	0.039
225	18.75	0.10	0.048	(0.036)	0.009	0.039
226	18.83	0.07	0.032	(0.036)	0.006	0.026
227	18.92	0.07	0.032	(0.035)	0.006	0.026
228	19.00	0.07	0.032	(0.035)	0.006	0.026
229	19.08	0.10	0.048	(0.035)	0.009	0.039
230	19.17	0.10	0.048	(0.035)	0.009	0.039
231	19.25	0.10	0.048	(0.035)	0.009	0.039
232	19.33	0.13	0.064	(0.035)	0.012	0.052
233	19.42	0.13	0.064	(0.035)	0.012	0.052
234	19.50	0.13	0.064	(0.034)	0.012	0.052
235	19.58	0.10	0.048	(0.034)	0.009	0.039
236	19.67	0.10	0.048	(0.034)	0.009	0.039
237	19.75	0.10	0.048	(0.034)	0.009	0.039
238	19.83	0.07	0.032	(0.034)	0.006	0.026
239	19.92	0.07	0.032	(0.034)	0.006	0.026
240	20.00	0.07	0.032	(0.033)	0.006	0.026
241	20.08	0.10	0.048	(0.033)	0.009	0.039
242	20.17	0.10	0.048	(0.033)	0.009	0.039
243	20.25	0.10	0.048	(0.033)	0.009	0.039
244	20.33	0.10	0.048	(0.033)	0.009	0.039
245	20.42	0.10	0.048	(0.033)	0.009	0.039
246	20.50	0.10	0.048	(0.033)	0.009	0.039
247	20.58	0.10	0.048	(0.032)	0.009	0.039

 Peak flow rate of this hydrograph = 9.875(CFS)

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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

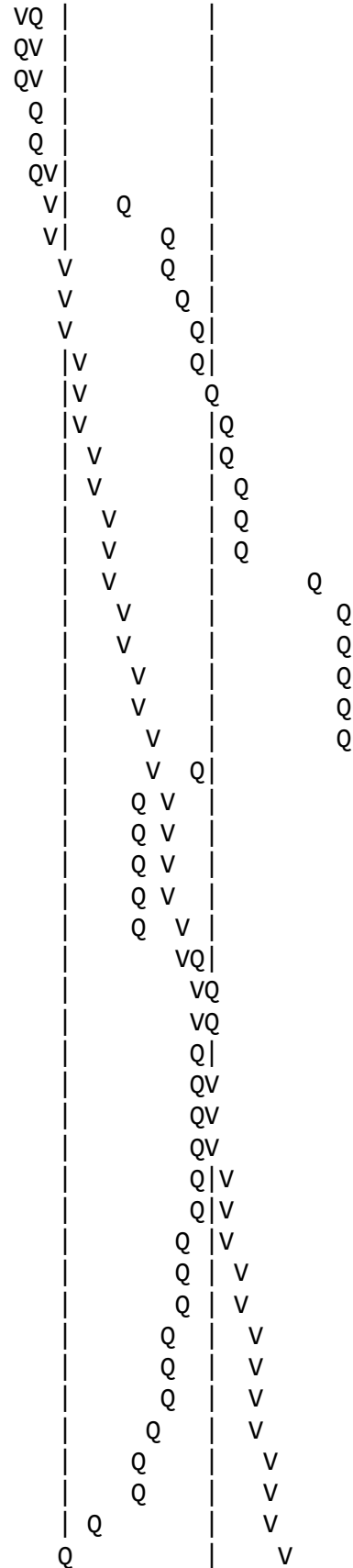
 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0025	0.36	VQ				
0+10	0.0061	0.52	V Q				
0+15	0.0097	0.52	V Q				
0+20	0.0146	0.71	V Q				
0+25	0.0200	0.79	V Q				
0+30	0.0254	0.79	V Q				
0+35	0.0308	0.79	V Q				
0+40	0.0362	0.79	V Q				
0+45	0.0416	0.79	V Q				
0+50	0.0483	0.97	V Q				
0+55	0.0555	1.05	V Q				
1+ 0	0.0627	1.05	V Q				
1+ 5	0.0687	0.87	V Q				
1+10	0.0741	0.79	V Q				
1+15	0.0795	0.79	V Q				
1+20	0.0849	0.79	V Q				
1+25	0.0903	0.79	V Q				
1+30	0.0958	0.79	V Q				
1+35	0.1012	0.79	V Q				
1+40	0.1066	0.79	V Q				
1+45	0.1120	0.79	V Q				
1+50	0.1186	0.97	V Q				
1+55	0.1259	1.05	V Q				
2+ 0	0.1331	1.05	V Q				
2+ 5	0.1403	1.05	V Q				
2+10	0.1475	1.05	V Q				
2+15	0.1547	1.05	V Q				
2+20	0.1619	1.05	V Q				
2+25	0.1692	1.05	V Q				
2+30	0.1764	1.05	V Q				
2+35	0.1848	1.23	V Q				
2+40	0.1939	1.31	V Q				
2+45	0.2029	1.31	V Q				
2+50	0.2119	1.31	V Q				
2+55	0.2209	1.31	V Q				
3+ 0	0.2299	1.31	V Q				
3+ 5	0.2390	1.31	V Q				
3+10	0.2480	1.31	V Q				

3+15	0.2570	1.31	V	Q
3+20	0.2660	1.31	V	Q
3+25	0.2750	1.31	V	Q
3+30	0.2841	1.31	V	Q
3+35	0.2931	1.31	V	Q
3+40	0.3021	1.31	V	Q
3+45	0.3111	1.31	V	Q
3+50	0.3214	1.49	V	Q
3+55	0.3322	1.57	V	Q
4+ 0	0.3430	1.57	V	Q
4+ 5	0.3539	1.57	V	Q
4+10	0.3647	1.57	V	Q
4+15	0.3755	1.57	V	Q
4+20	0.3876	1.75	V	Q
4+25	0.4002	1.83	V	Q
4+30	0.4128	1.83	V	Q
4+35	0.4255	1.83	V	Q
4+40	0.4381	1.83	V	Q
4+45	0.4507	1.83	V	Q
4+50	0.4646	2.02	V	Q
4+55	0.4790	2.10	V	Q
5+ 0	0.4935	2.10	V	Q
5+ 5	0.5054	1.73	V	Q
5+10	0.5162	1.57	V	Q
5+15	0.5270	1.57	V	Q
5+20	0.5391	1.75	V	Q
5+25	0.5517	1.83	V	Q
5+30	0.5644	1.83	V	Q
5+35	0.5782	2.02	V	Q
5+40	0.5927	2.10	V	Q
5+45	0.6071	2.10	V	Q
5+50	0.6215	2.10	V	Q
5+55	0.6360	2.10	V	Q
6+ 0	0.6504	2.10	V	Q
6+ 5	0.6661	2.28	V	Q
6+10	0.6823	2.36	V	Q
6+15	0.6986	2.36	V	Q
6+20	0.7148	2.36	V	Q
6+25	0.7310	2.36	V	Q
6+30	0.7473	2.36	V	Q
6+35	0.7647	2.54	V	Q
6+40	0.7828	2.62	V	Q
6+45	0.8008	2.62	V	Q
6+50	0.8189	2.62	V	Q
6+55	0.8369	2.62	V	Q
7+ 0	0.8549	2.62	V	Q
7+ 5	0.8730	2.62	V	Q
7+10	0.8910	2.62	V	Q
7+15	0.9091	2.62	V	Q
7+20	0.9283	2.80	V	Q

7+25	0.9482	2.88	V	Q				
7+30	0.9680	2.88	V	Q				
7+35	0.9891	3.06	V	Q				
7+40	1.0108	3.14	V	Q				
7+45	1.0324	3.14	V	Q				
7+50	1.0553	3.32	V	Q				
7+55	1.0788	3.41	V	Q				
8+ 0	1.1022	3.41	V	Q				
8+ 5	1.1282	3.77	V	Q				
8+10	1.1552	3.93	V	Q				
8+15	1.1823	3.93	V	Q				
8+20	1.2094	3.93	V	Q				
8+25	1.2364	3.93	V	Q				
8+30	1.2635	3.93	V	Q				
8+35	1.2918	4.11	V	Q				
8+40	1.3206	4.19	V	Q				
8+45	1.3495	4.19	V	Q				
8+50	1.3796	4.37	V	Q				
8+55	1.4103	4.45	V	Q				
9+ 0	1.4410	4.45	V	Q				
9+ 5	1.4741	4.82	V	Q				
9+10	1.5084	4.98	V	Q				
9+15	1.5427	4.98	V	Q				
9+20	1.5782	5.16	V	Q				
9+25	1.6143	5.24	V	Q				
9+30	1.6504	5.24	V	Q				
9+35	1.6877	5.42	V	Q				
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9+45	1.7634	5.50	V	Q				
9+50	1.8028	5.71	V	Q				
9+55	1.8428	5.81	V	Q				
10+ 0	1.8828	5.81	V	Q				
10+ 5	1.9138	4.51	V	Q				
10+10	1.9409	3.93	V	Q				
10+15	1.9679	3.93	V	Q				
10+20	1.9950	3.93	V	Q				
10+25	2.0221	3.93	V	Q				
10+30	2.0491	3.93	V	Q				
10+35	2.0824	4.84	V	Q				
10+40	2.1185	5.24	V	Q				
10+45	2.1546	5.24	V	Q				
10+50	2.1907	5.24	V	Q				
10+55	2.2267	5.24	V	Q				
11+ 0	2.2628	5.24	V	Q				
11+ 5	2.2977	5.06	V	Q				
11+10	2.3320	4.98	V	Q				
11+15	2.3662	4.98	V	Q				
11+20	2.4005	4.98	V	Q				
11+25	2.4348	4.98	V	Q				
11+30	2.4691	4.98	V	Q				

11+35	2.5008	4.61
11+40	2.5315	4.45
11+45	2.5622	4.45
11+50	2.5941	4.63
11+55	2.6266	4.71
12+ 0	2.6590	4.71
12+ 5	2.7020	6.24
12+10	2.7496	6.92
12+15	2.7973	6.92
12+20	2.8465	7.15
12+25	2.8965	7.25
12+30	2.9465	7.26
12+35	2.9995	7.71
12+40	3.0540	7.91
12+45	3.1085	7.91
12+50	3.1645	8.14
12+55	3.2213	8.24
13+ 0	3.2781	8.25
13+ 5	3.3425	9.36
13+10	3.4104	9.85
13+15	3.4783	9.86
13+20	3.5462	9.86
13+25	3.6142	9.87
13+30	3.6822	9.87
13+35	3.7335	7.44
13+40	3.7773	6.37
13+45	3.8213	6.38
13+50	3.8652	6.38
13+55	3.9092	6.39
14+ 0	3.9532	6.39
14+ 5	4.0033	7.28
14+10	4.0562	7.68
14+15	4.1091	7.68
14+20	4.1606	7.47
14+25	4.2113	7.37
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14+35	4.3130	7.38
14+40	4.3639	7.39
14+45	4.4148	7.39
14+50	4.4642	7.18
14+55	4.5130	7.08
15+ 0	4.5618	7.09
15+ 5	4.6091	6.87
15+10	4.6558	6.78
15+15	4.7025	6.78
15+20	4.7477	6.56
15+25	4.7922	6.47
15+30	4.8368	6.48
15+35	4.8753	5.59
15+40	4.9112	5.21



15+45	4.9471	5.21			Q	V
15+50	4.9830	5.22			Q	V
15+55	5.0189	5.22			Q	V
16+ 0	5.0549	5.22			Q	V
16+ 5	5.0710	2.33		Q		V
16+10	5.0782	1.05	Q			V
16+15	5.0854	1.05	Q			V
16+20	5.0926	1.05	Q			V
16+25	5.0998	1.05	Q			V
16+30	5.1070	1.05	Q			V
16+35	5.1130	0.87	Q			V
16+40	5.1184	0.79	Q			V
16+45	5.1238	0.79	Q			V
16+50	5.1292	0.79	Q			V
16+55	5.1347	0.79	Q			V
17+ 0	5.1401	0.79	Q			V
17+ 5	5.1480	1.15	Q			V
17+10	5.1570	1.31	Q			V
17+15	5.1660	1.31	Q			V
17+20	5.1750	1.31	Q			V
17+25	5.1841	1.31	Q			V
17+30	5.1931	1.31	Q			V
17+35	5.2021	1.31	Q			V
17+40	5.2111	1.31	Q			V
17+45	5.2201	1.31	Q			V
17+50	5.2279	1.13	Q			V
17+55	5.2351	1.05	Q			V
18+ 0	5.2423	1.05	Q			V
18+ 5	5.2496	1.05	Q			V
18+10	5.2568	1.05	Q			V
18+15	5.2640	1.05	Q			V
18+20	5.2712	1.05	Q			V
18+25	5.2784	1.05	Q			V
18+30	5.2856	1.05	Q			V
18+35	5.2916	0.87	Q			V
18+40	5.2970	0.79	Q			V
18+45	5.3024	0.79	Q			V
18+50	5.3066	0.60	Q			V
18+55	5.3102	0.52	Q			V
19+ 0	5.3138	0.52	Q			V
19+ 5	5.3187	0.71	Q			V
19+10	5.3241	0.79	Q			V
19+15	5.3295	0.79	Q			V
19+20	5.3361	0.97	Q			V
19+25	5.3434	1.05	Q			V
19+30	5.3506	1.05	Q			V
19+35	5.3565	0.87	Q			V
19+40	5.3619	0.79	Q			V
19+45	5.3674	0.79	Q			V
19+50	5.3715	0.60	Q			V

19+55	5.3751	0.52	Q				V
20+ 0	5.3787	0.52	Q				V
20+ 5	5.3836	0.71	Q				V
20+10	5.3890	0.79	Q				V
20+15	5.3944	0.79	Q				V
20+20	5.3998	0.79	Q				V
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20+50	5.4311	0.60	Q				V
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21+ 0	5.4383	0.52	Q				V
21+ 5	5.4431	0.71	Q				V
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21+25	5.4617	0.52	Q				V
21+30	5.4653	0.52	Q				V
21+35	5.4702	0.71	Q				V
21+40	5.4756	0.79	Q				V
21+45	5.4810	0.79	Q				V
21+50	5.4852	0.60	Q				V
21+55	5.4888	0.52	Q				V
22+ 0	5.4924	0.52	Q				V
22+ 5	5.4972	0.71	Q				V
22+10	5.5027	0.79	Q				V
22+15	5.5081	0.79	Q				V
22+20	5.5122	0.60	Q				V
22+25	5.5158	0.52	Q				V
22+30	5.5194	0.52	Q				V
22+35	5.5231	0.52	Q				V
22+40	5.5267	0.52	Q				V
22+45	5.5303	0.52	Q				V
22+50	5.5339	0.52	Q				V
22+55	5.5375	0.52	Q				V
23+ 0	5.5411	0.52	Q				V
23+ 5	5.5447	0.52	Q				V
23+10	5.5483	0.52	Q				V
23+15	5.5519	0.52	Q				V
23+20	5.5555	0.52	Q				V
23+25	5.5591	0.52	Q				V
23+30	5.5627	0.52	Q				V
23+35	5.5663	0.52	Q				V
23+40	5.5700	0.52	Q				V
23+45	5.5736	0.52	Q				V
23+50	5.5772	0.52	Q				V
23+55	5.5808	0.52	Q				V
24+ 0	5.5844	0.52	Q				V

24+ 5

5.5855



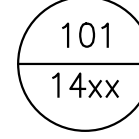
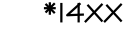
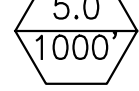

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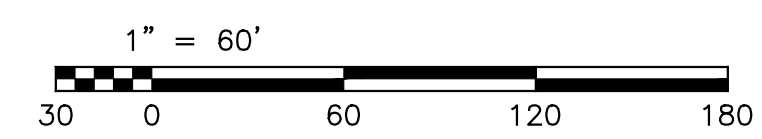
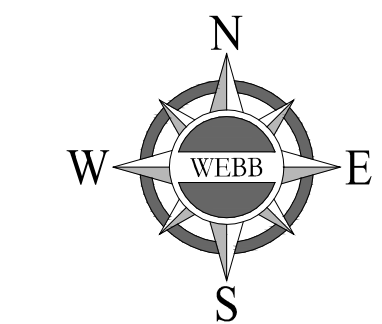
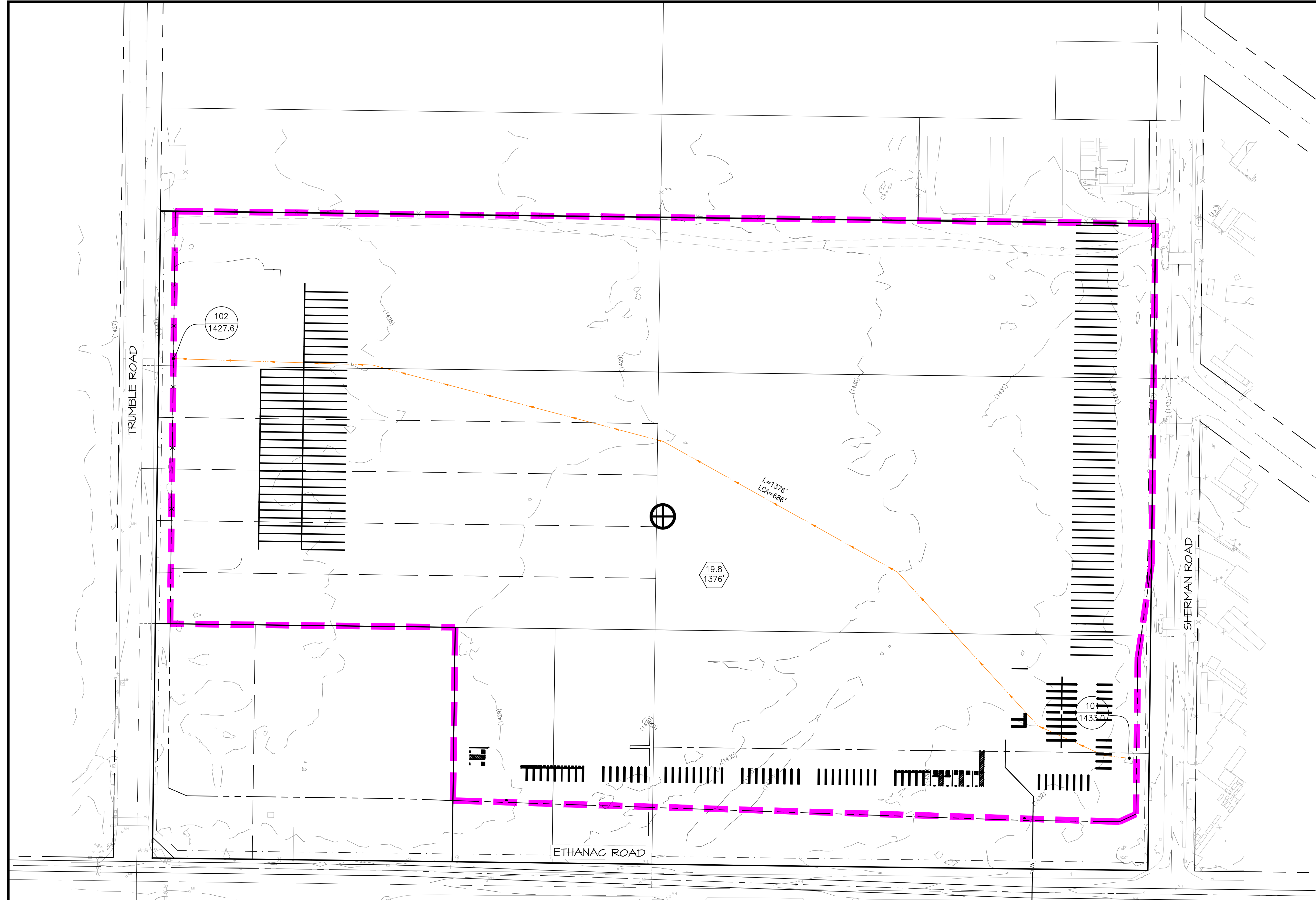
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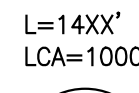
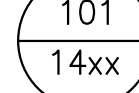
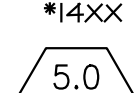



- LEGEND**
-  DRAINAGE MANAGEMENT BOUNDARY
 -  FLOW DIRECTION
 -  NODE DESIGNATION
NODE ELEVATION
 -  *14XX
 -  WATERSHED AREA (ACRES)
LONGEST WATER PATH (FT)
 -  CENTROID

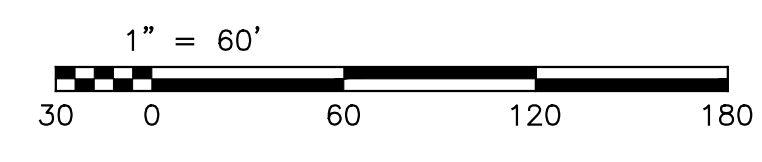
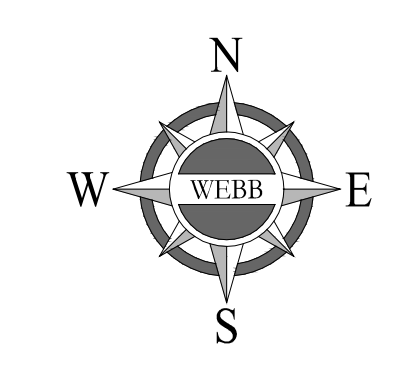
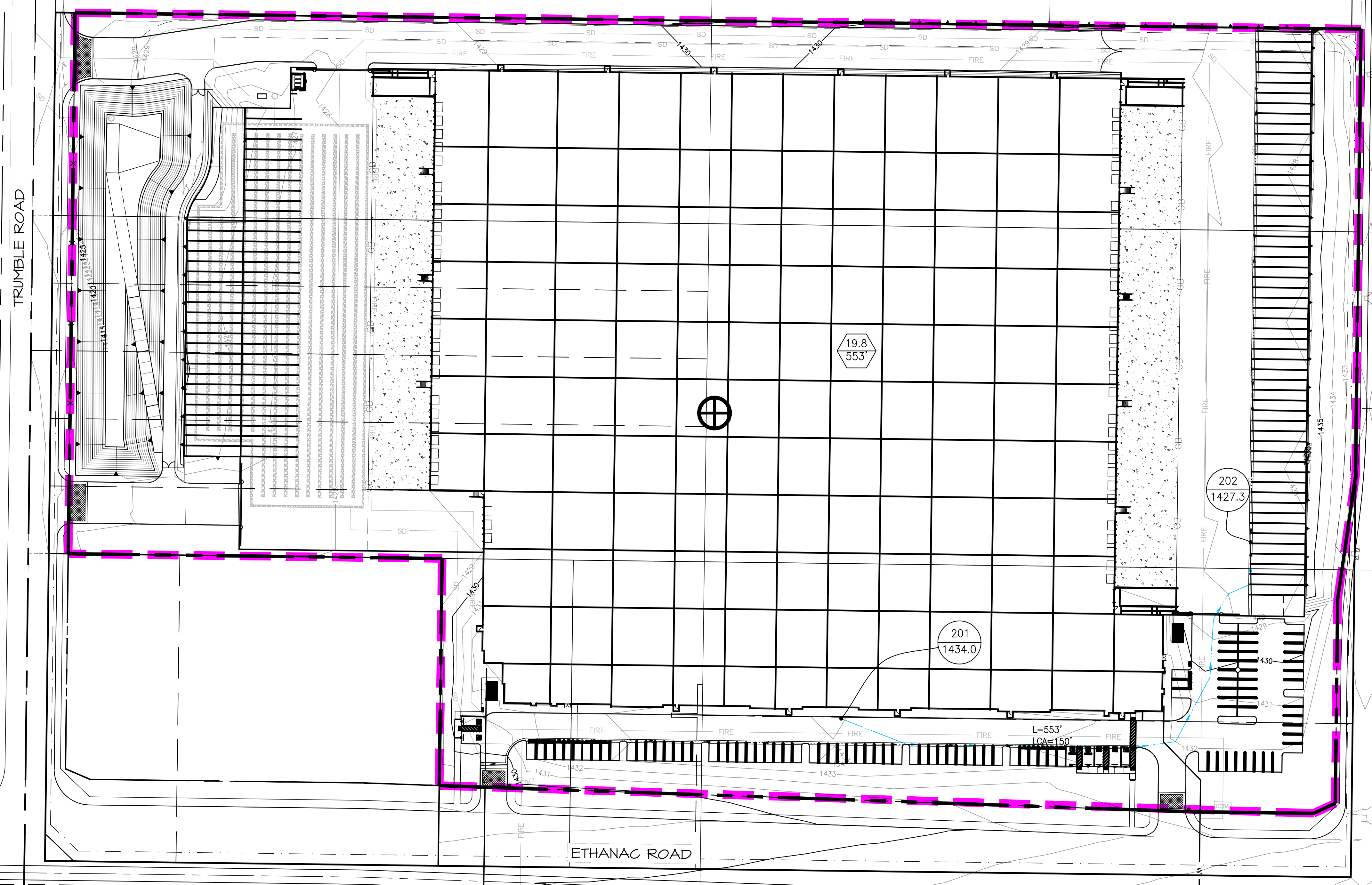


CITY OF PERRIS
 COUNTY OF RIVERSIDE
 EXISTING UNIT HYDROGRAPH HYDROLOGY
 ETHANAC COMMERCE CENTER
 P 22-00030

SCALE: 1"=60'	ALBERTA A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 2022-0148 SHEET 1 OF 3 SHEETS DWG. NO.
DATE: 4/14/23	DESIGNED: RSB	CHECKED: SKK	PLN CK REF: F.B.

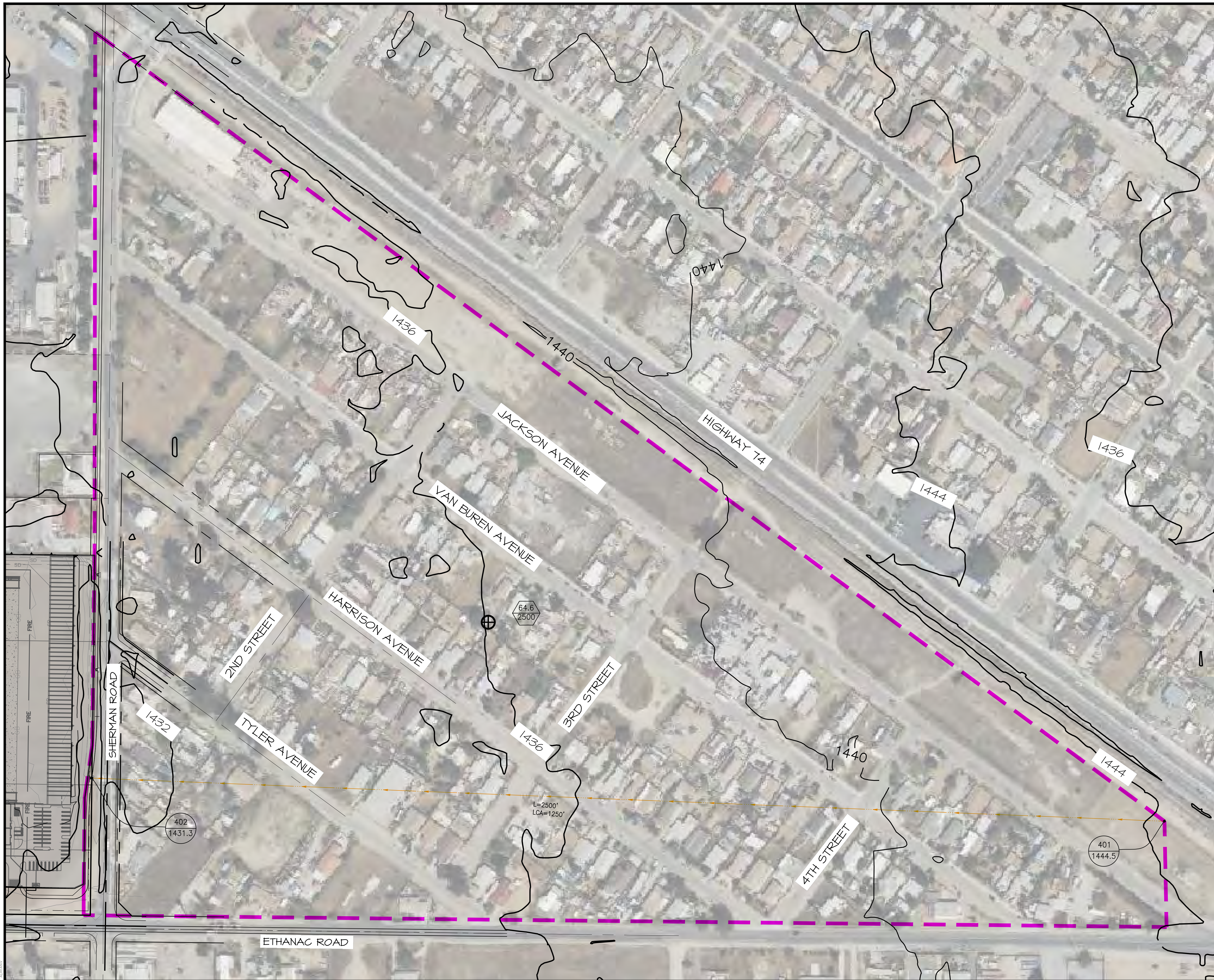
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- LEGEND**
-  DRAINAGE MANAGEMENT BOUNDARY
 -  FLOW DIRECTION
 -  L=14XX'
LCA=1000'
 -  101
14xx
 -  *14XX
*INVERT ELEVATION
 -  5.0
1000'
 -  WATERSHED AREA (ACRES)
LONGEST WATER PATH (FT)
 -  CENTROID

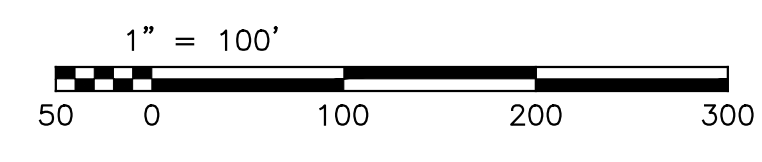
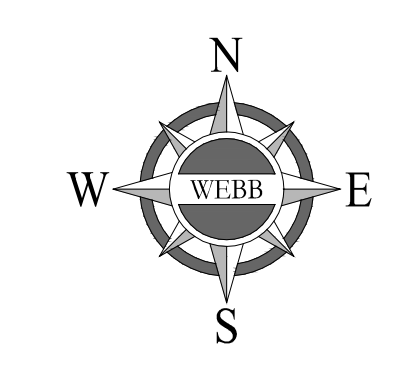


CITY OF PERRIS			
COUNTY OF RIVERSIDE PROPOSED UNIT HYDROGRAPH HYDROLOGY ETHANAC COMMERCE CENTER P 22-00030			
SCALE: 1"=60'	ALBERT A. WEBB ASSOCIATES	ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 2022-0198 SHEET 2 OF 3 SHEETS DWG. NO.
DATE: 4/14/23	DESIGNED: RSB	CHECKED: SKK	PLN CK REF: F.B.

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- LEGEND**
- DRAINAGE MANAGEMENT BOUNDARY
 - FLOW DIRECTION
 - L=14XX'
LCA=1000' LONGEST FLOW PATH
CENTROIDAL LENGTH
 - 101
14xx NODE DESIGNATION
NODE ELEVATION
 - *14XX *INVERT ELEVATION
 - 5.0
1000' WATERSHED AREA (ACRES)
LONGEST WATER PATH (FT)
 - + CENTROID



CITY OF PERRIS
 COUNTY OF RIVERSIDE
 OFFSITE UNIT HYDROGRAPH HYDROLOGY
 ETHANAC COMMERCE CENTER
 P 22-00030

SCALE: 1"=100'	ALBERTA A. WEBB ASSOCIATES ENGINEERING CONSULTANTS 3788 McCRAY STREET RIVERSIDE CA 92506 PH. (951) 686-1070 FAX (951) 788-1256	W.O. 2022-0198
DATE: 4/14/23		SHEET 3
DESIGNED: RSB		OF 3 SHEETS
CHECKED: SKK		DWG. NO.
PLN CK REF: F.B.		

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Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

***To be provided during final engineering**

Appendix 9: O&M

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

***To be provided during final engineering**

Appendix 10: Educational Materials

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

***To be provided during final engineering**