Drainage Report

2830 S Riverside Avenue

APN 0258-121-23, 33, & 34

Prepared for

Riverside XC
3010 Old Ranch Parkway, Suite 470
Seal Beach, CA

Prepared by

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December 21, 2022

Table of Contents

1. Introduction

This hydrologic analysis has been prepared for Riverside XC to support the proposed warehouse project at 2830 South Riverside Avenue in Rialto, California. The project proposes to construct a 9.95 acre site. The site in the existing condition consists of 3 lots that are to be merged into 1 lot in the developed condition. 2 of the 3 lots are fully developed and internally drained. The single undeveloped lot is a gravel and dirt lot that is also internally drained. The project proposes to mimic this condition, favoring onsite infiltration, prior to discharge to Riverside Avenue.

2. Purpose

The purpose of this report is to identify the change in hydrology and determine the 100-year storm flow rates for the project site.

3. Location

The project is bound on the north and west by existing development. The south is bound by a Southern California Edison easement lot, and on the east is Riverside Avenue.

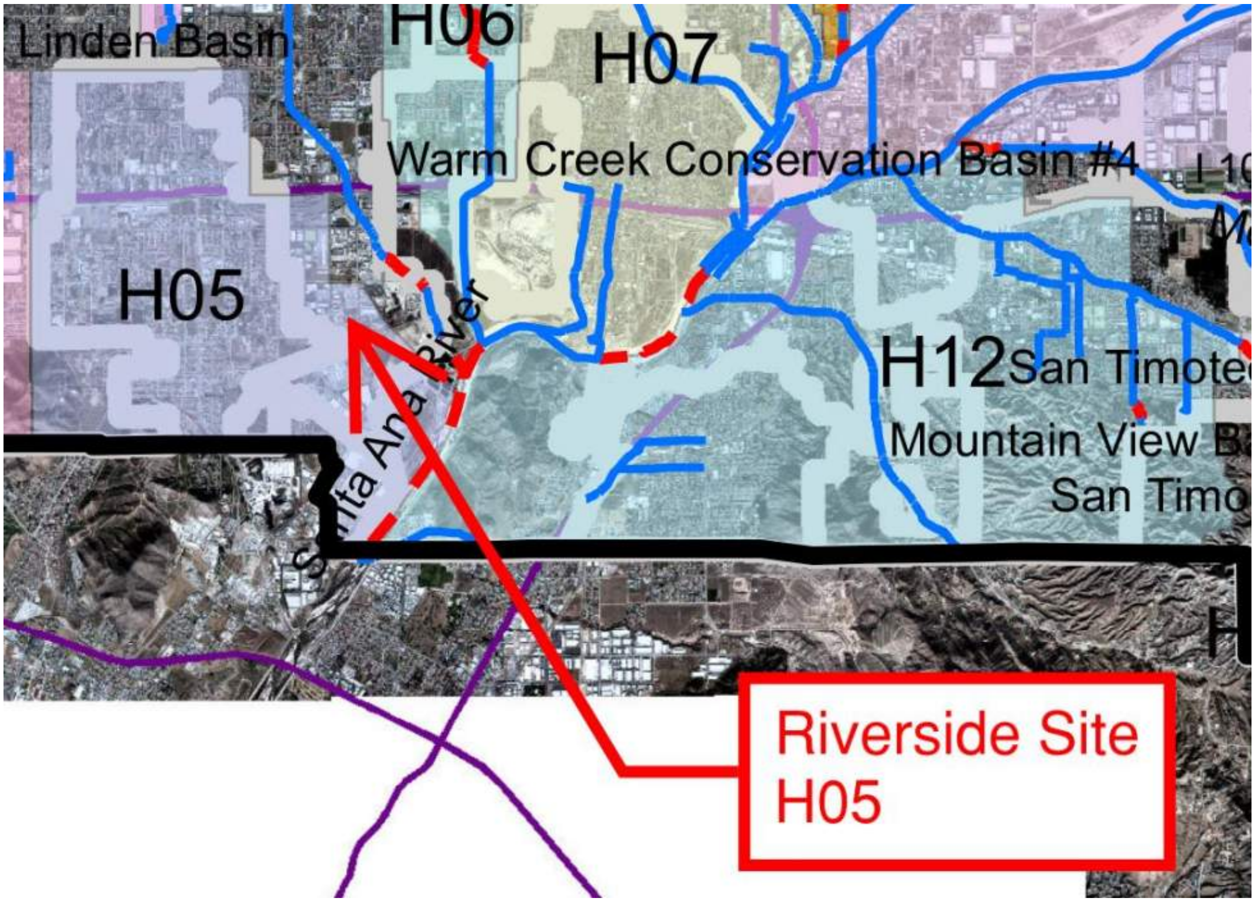
Figure 3-1 Vicinity Map

4. Existing Condition

From a site walk in June 2022, it was observed that the site’s primary overland release was to Riverside Avenue. From the review of available documents, it is assumed that the adjacent property to the north historically drains (run-on) onto the site. However, there is an existing chain link fence with fabric screening that may act as a silt fence, but it is assumed that the existing fence does not prevent run-on to the site. There is an existing curb along the western property line which sufficiently blocks drainage, therefore there is no run-on from the adjacent western properties The SCE easement lot to the south has a ridge along the property line, which prevents cross lot drainage. Therefore, there is no run-on or run-off along the southern property line.

Hydromodification Concerns

The entirety of the project site is within a Hydromodification Condition of Concern (HCOC) exempt area, “H05”.



Hydrologic Limitations

This report assumes that the site is restricted to the release rate of the existing rate of the project site. But, as the 2 of the 3 lots of the project site is fully developed, and the project proposes an emergency overflow, the project assumes that the site will be limited as follows during the 100-year, 24-hour event is required.

$$Q_{100(pre\text{-}developed)}\ (site) \geq Q_{100(\text{post development})}\ (\text{to Riverside Ave})$$

5. Proposed condition

The Project proposes to fully develop the project site with a light-industrial/warehouse building and associated infrastructure. Perimeter grades are similar to existing with the exception along the southern property line adjacent to the SCE easement lot where a retaining wall may be required. The project will capture first-flush runoff consistent with separate Water Quality Management Plan (WQMP) requirements, and infiltrate in two separate underground retention basins; one on the west and east end, respectively. The existing drainage system (if any) will be replaced.

Flows larger than WQMP-related flows, will still be routed towards the same underground retention basins for infiltration. Emergency overland released will be discharged into Riverside Avenue via surface runoff. Surface ponding less than 12” is anticipated.

The site will be graded such that there will be no run-off to adjacent properties. Emergency flows will be directed through the frontage of the site onto Riverside Avenue. The site is assumed to have historical run-on from the northern property line. This drainage will not be blocked and will be allowed to continue to run-on to the site by maintaining similar grades along the property line. The run-on will be routed and collected into the same onsite drainage system and underground retention basin for infiltration. Because of this, there will be incidental water quality treatment of the offsite run-on.

The site will only be responsible for attenuating the onsite flows, meaning only the onsite discharge rate is analyzed when comparing the pre-development and post-developed condition. However, due to the nature of the offsite run-on mixing with onsite flows, there will be incidental retention of offsite run-on flows during low flow storm events. However, any run-on flows exceeding the onsite 100-year storm event flows will be discharged into Riverside Avenue via emergency overland release. This is similar to pre-developed conditions.

6. Methodology

The existing and proposed peak flows for the project were developed utilizing Rational Methodology per the San Bernardino County Hydrology Manual. Utilizing the peak flows developed by the rational method, AES software was utilized to model the drainage management areas via the “small unit hydrograph analysis.” Once a hydrograph for the proposed condition was obtained, the runoff was routed through WQMP’s sub surface infiltration Best Management Practice (BMP) system to determine achieved attenuation.

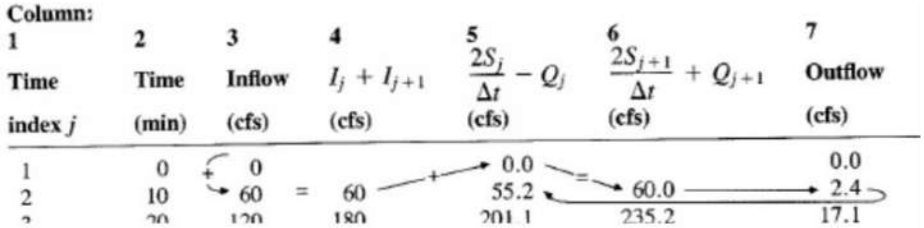
For basin routing/modeling, Modified PULS detention basin routing methodology was utilized for the portion of the storm drain system routed through the sub surface detention system. This method of level pool routing is generally described in Section F of the San Bernardino County Hydrology Manual. As shown below, equation F.4 of the Manual can be adapted to a different form used by Chow, Maidment, & Mays in Applied Hydrology (McGraw Hill, 1988) and utilized by the LA County Hydrology Manual (Equation 8.1).

$$S_2 + O_2\frac{\Delta T}{2} = (S_1 + O_1\frac{\Delta T}{2}) + (I_1 + I_2)\frac{\Delta T}{2} \qquad \text{SB Eq F.4}$$

$$\frac{2}{\Delta t} = \frac{2}{\Delta t}$$

$$\frac{2S_2}{\Delta t} + O_2 = \left(\frac{2S_1}{\Delta t} + O_1\right) + I_1 + I_2 \qquad \text{LA 8.1}$$

This equation (8.1) can be utilized in a tabular format consistent with references above.



Column: 1 Time index j	2 Time (min)	3 Inflow (cfs)	4 $I_j + I_{j+1}$ (cfs)	5 $\frac{2S_j}{\Delta t} - Q_j$ (cfs)	6 $\frac{2S_{j+1}}{\Delta t} + Q_{j+1}$ (cfs)	7 Outflow (cfs)
1	0	0		0.0		0.0
2	10	60	60	55.2	60.0	2.4
3	20	120	180	201.1	235.2	17.1

Chow Table 8.2.3

LA Table 8.2

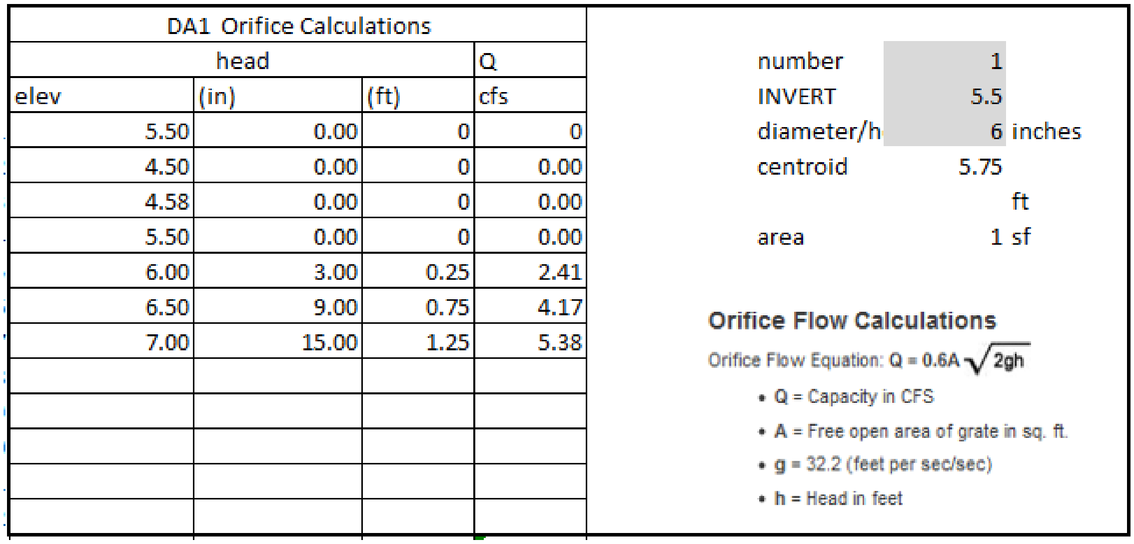
7. Peak Attenuation

General- BMP Design.

The ADS MC-3500, a 45” tall half-arch HDPE storm detention chamber system was selected for the site. Coupled with 12” stone above, 9”below, and along side the chamber, ADS publishes typical void storage at elevation intervals. This information was utilized in the analysis to develop a elevation-storage table. Generally the detention drains to a an outlet manhole, which is utilized for low flow outlet to BMP. The inlet manhole, however, is supplied with a high-flow relief outlet that is utilized for peak flow control. As supplemented visually by the hydrograph images herein, the storage below the overflow captures the first flush water quality volume, and the peak flows site atop this storage. Overall, the stone+chamber is 66” tall (5.5’).

First, the utilizing the BMP conditions described above, it is assumed large storm events exceeding the 100-year will overflow out of the BMP and into the parking lot. In additional excess stormwater will overflow into Riverside Avenue via surface drainage. Therefore, the orifice is assumed to be the upstream catch basin. However, to be conservative, the overflow invert was modeled to be at the top of the underground chamber system. This is conservative as the actual overflow invert is much higher, at the south driveway along the public right-of-way.

Table DA1-1 Orifice Calculations



DA1 Orifice Calculations			
	head		Q
elev	(in)	(ft)	cfs
5.50	0.00	0	0
4.50	0.00	0	0.00
4.58	0.00	0	0.00
5.50	0.00	0	0.00
6.00	3.00	0.25	2.41
6.50	9.00	0.75	4.17
7.00	15.00	1.25	5.38

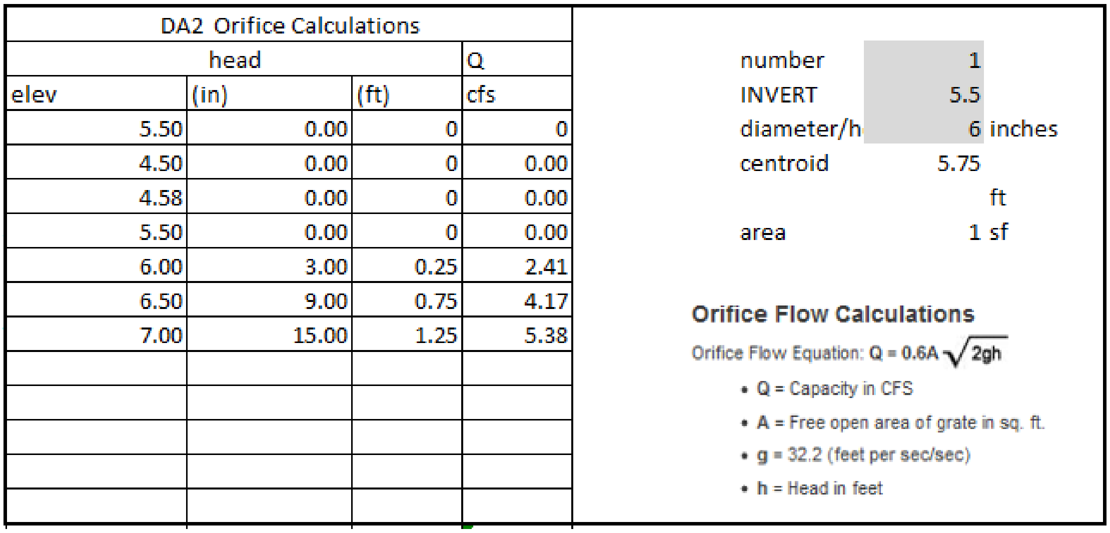
number	1	
INVERT	5.5	
diameter/h	6	inches
centroid	5.75	
		ft
area	1	sf

Orifice Flow Calculations

Orifice Flow Equation: $Q = 0.6A\sqrt{2gh}$

- Q = Capacity in CFS
- A = Free open area of grate in sq. ft.
- g = 32.2 (feet per sec/sec)
- h = Head in feet

Table DA2-1 Orifice Calculations



DA2 Orifice Calculations			
	head		Q
elev	(in)	(ft)	cfs
5.50	0.00	0	0
4.50	0.00	0	0.00
4.58	0.00	0	0.00
5.50	0.00	0	0.00
6.00	3.00	0.25	2.41
6.50	9.00	0.75	4.17
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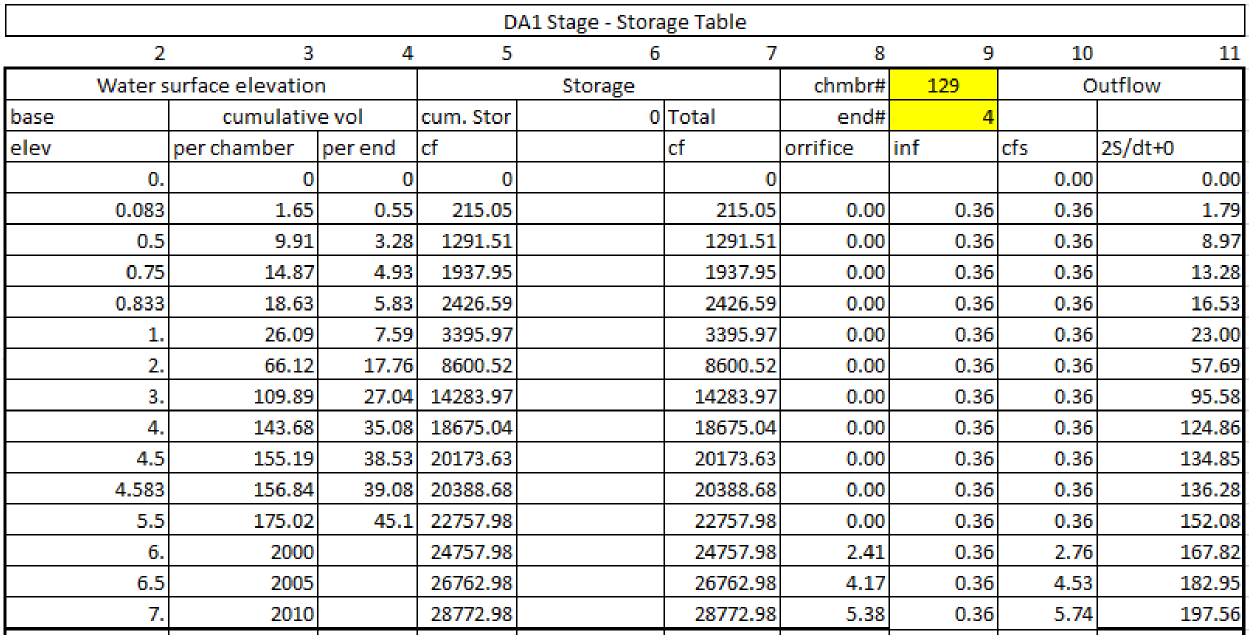
- **h** = Head in feet

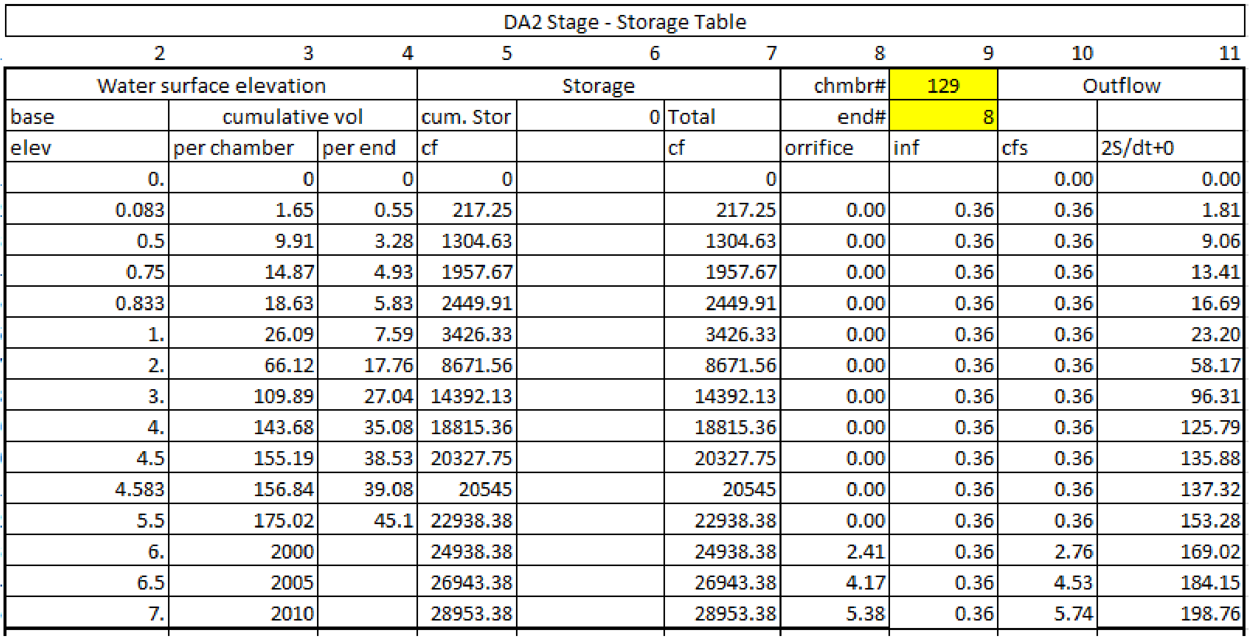
Secondly, the stage-storage relationship was determined (see following Table). The stage-storage table utilizes the Weir Flows at the various elevations as well as the static infiltration rate of the native soil. The static infiltration onsite average is 9.63 in/hr. This infiltration rate, after of a safety factor of 4 is 2.41 in/hr, and is applied to the bottom area of the chamber system. Please note that this table models the volume captured by the first flush, the WQMP drawdown, as well as the ‘space’ above the WQMP volume to attenuate larger flows.

Table DA1-2 Stage Storage Table



DA1 Stage - Storage Table									
2	3	4	5	6	7	8	9	10	11
Water surface elevation			Storage			chmbr#	129	Outflow	
base	cumulative vol		cum. Stor	0	Total	end#	4		
elev	per chamber	per end	cf		cf	orrifice	inf	cfs	2S/dt+0
0.	0	0	0		0			0.00	0.00
0.083	1.65	0.55	215.05		215.05	0.00	0.36	0.36	1.79
0.5	9.91	3.28	1291.51		1291.51	0.00	0.36	0.36	8.97
0.75	14.87	4.93	1937.95		1937.95	0.00	0.36	0.36	13.28
0.833	18.63	5.83	2426.59		2426.59	0.00	0.36	0.36	16.53
1.	26.09	7.59	3395.97		3395.97	0.00	0.36	0.36	23.00
2.	66.12	17.76	8600.52		8600.52	0.00	0.36	0.36	57.69
3.	109.89	27.04	14283.97		14283.97	0.00	0.36	0.36	95.58
4.	143.68	35.08	18675.04		18675.04	0.00	0.36	0.36	124.86
4.5	155.19	38.53	20173.63		20173.63	0.00	0.36	0.36	134.85
4.583	156.84	39.08	20388.68		20388.68	0.00	0.36	0.36	136.28
5.5	175.02	45.1	22757.98		22757.98	0.00	0.36	0.36	152.08
6.	2000		24757.98		24757.98	2.41	0.36	2.76	167.82
6.5	2005		26762.98		26762.98	4.17	0.36	4.53	182.95
7.	2010		28772.98		28772.98	5.38	0.36	5.74	197.56

Table DA1-2 Stage Storage Table

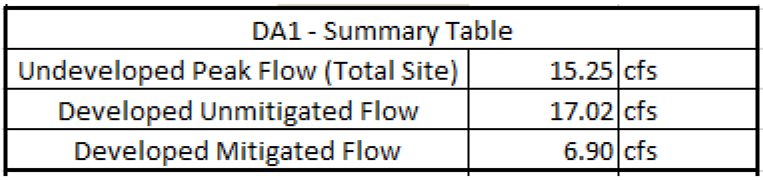


DA2 Stage - Storage Table

2	3	4	5	6	7	8	9	10	11
Water surface elevation			Storage			chmbr#	129	Outflow	
base	cumulative vol		cum. Stor	0	Total	end#	8		
elev	per chamber	per end	cf		cf	orrifice	inf	cfs	2S/dt+0
0.	0	0	0		0			0.00	0.00
0.083	1.65	0.55	217.25		217.25	0.00	0.36	0.36	1.81
0.5	9.91	3.28	1304.63		1304.63	0.00	0.36	0.36	9.06
0.75	14.87	4.93	1957.67		1957.67	0.00	0.36	0.36	13.41
0.833	18.63	5.83	2449.91		2449.91	0.00	0.36	0.36	16.69
1.	26.09	7.59	3426.33		3426.33	0.00	0.36	0.36	23.20
2.	66.12	17.76	8671.56		8671.56	0.00	0.36	0.36	58.17
3.	109.89	27.04	14392.13		14392.13	0.00	0.36	0.36	96.31
4.	143.68	35.08	18815.36		18815.36	0.00	0.36	0.36	125.79
4.5	155.19	38.53	20327.75		20327.75	0.00	0.36	0.36	135.88
4.583	156.84	39.08	20545		20545	0.00	0.36	0.36	137.32
5.5	175.02	45.1	22938.38		22938.38	0.00	0.36	0.36	153.28
6.	2000		24938.38		24938.38	2.41	0.36	2.76	169.02
6.5	2005		26943.38		26943.38	4.17	0.36	4.53	184.15
7.	2010		28953.38		28953.38	5.38	0.36	5.74	198.76

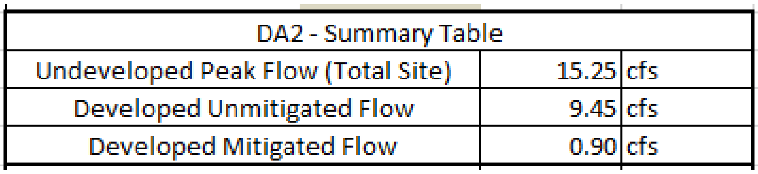
Secondly, the Peak Flow and Peak Elevation was determined by analysis of the resulting calculations (as shown in the Attachments). This information is summarized below with the hydrograph follows such that the initial capture of the WQMP flow and the latter releases of the high-flow can be visualized. The peak flows ‘rides’ over the top of this peak discharge volume, and discharge via overland release.

Table DA1-3 Drainage Calculation Summary



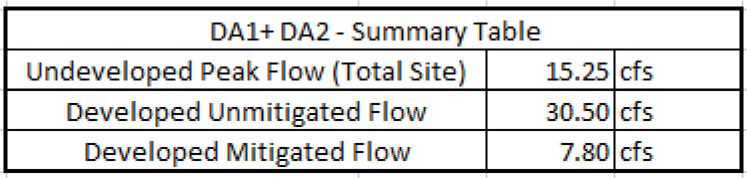
DA1 - Summary Table		
Undeveloped Peak Flow (Total Site)	15.25	cfs
Developed Unmitigated Flow	17.02	cfs
Developed Mitigated Flow	6.90	cfs

Table DA2-3 Drainage Calculation Summary



DA2 - Summary Table		
Undeveloped Peak Flow (Total Site)	15.25	cfs
Developed Unmitigated Flow	9.45	cfs
Developed Mitigated Flow	0.90	cfs

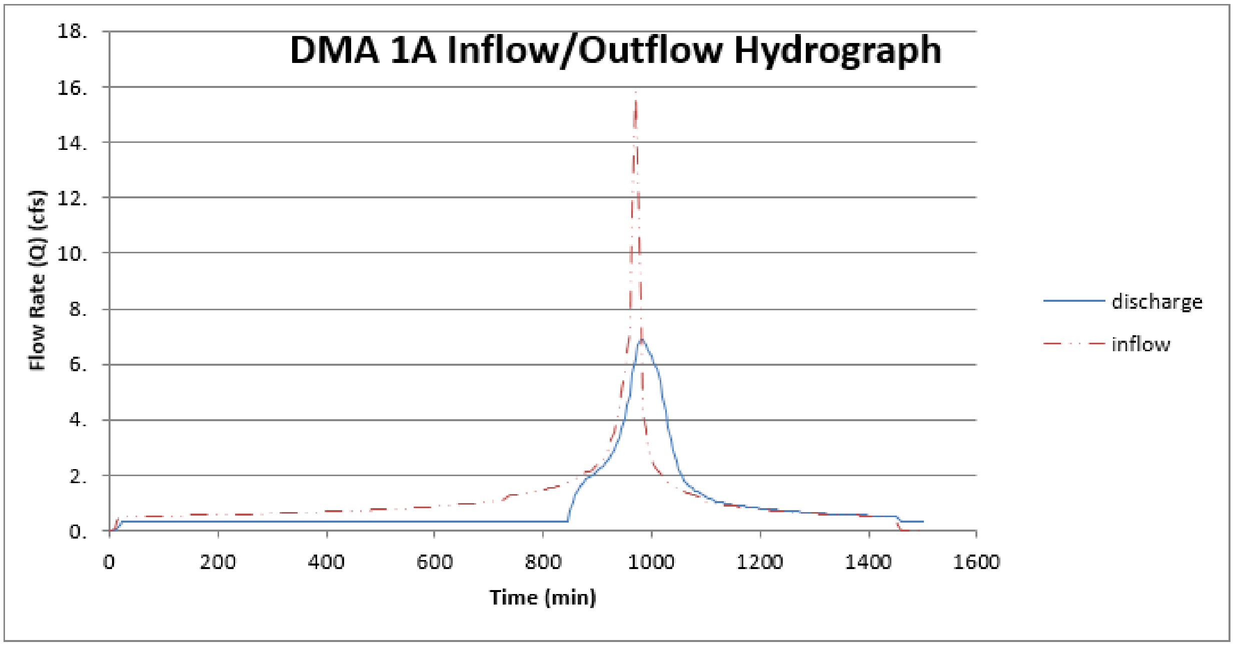
Table DA-3 Drainage Calculation Summary



DA1+ DA2 - Summary Table		
Undeveloped Peak Flow (Total Site)	15.25	cfs
Developed Unmitigated Flow	30.50	cfs
Developed Mitigated Flow	7.80	cfs

The following hydrographs represent the overall as well as the short duration around the peak of the inflow and outflow hydrographs. This depicts the reduction of the inflow/outflow hydrograph resulting from the infiltration.

Figure DA1-1 BMP Overall hydrographs (from attenuated DA 1)



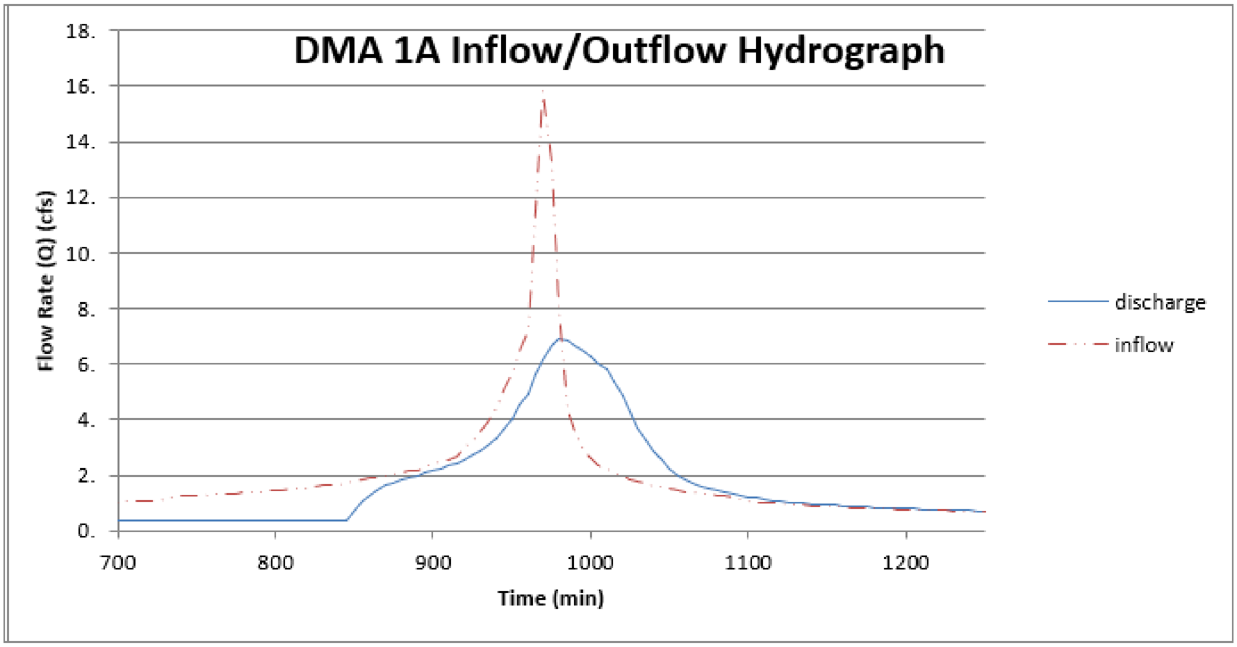
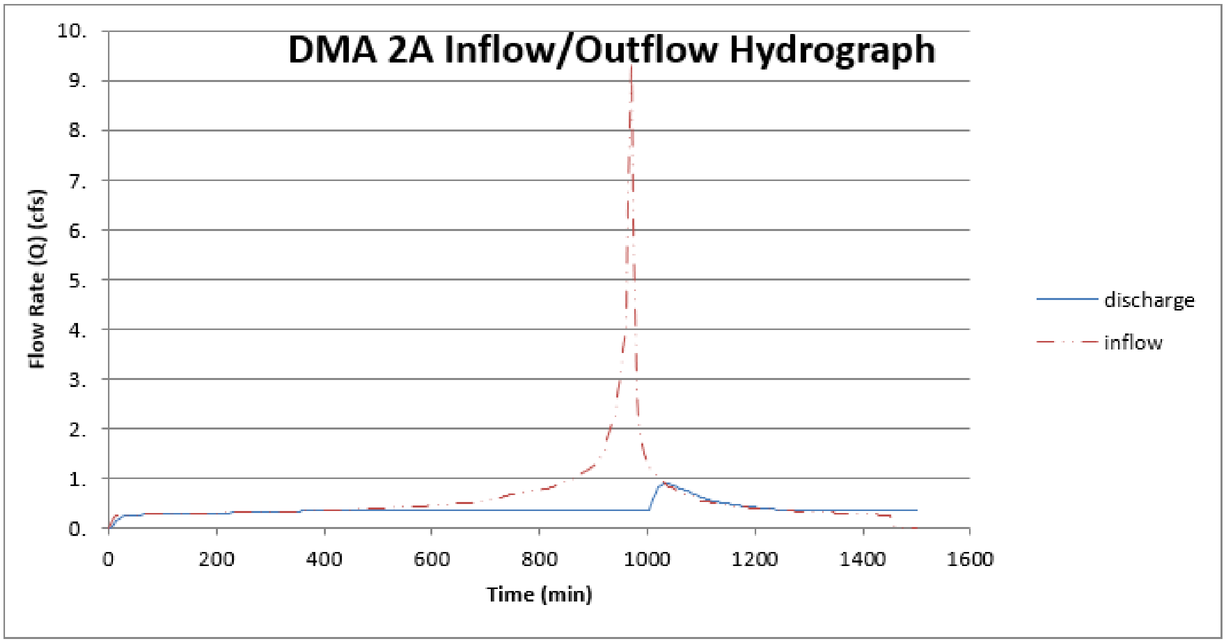
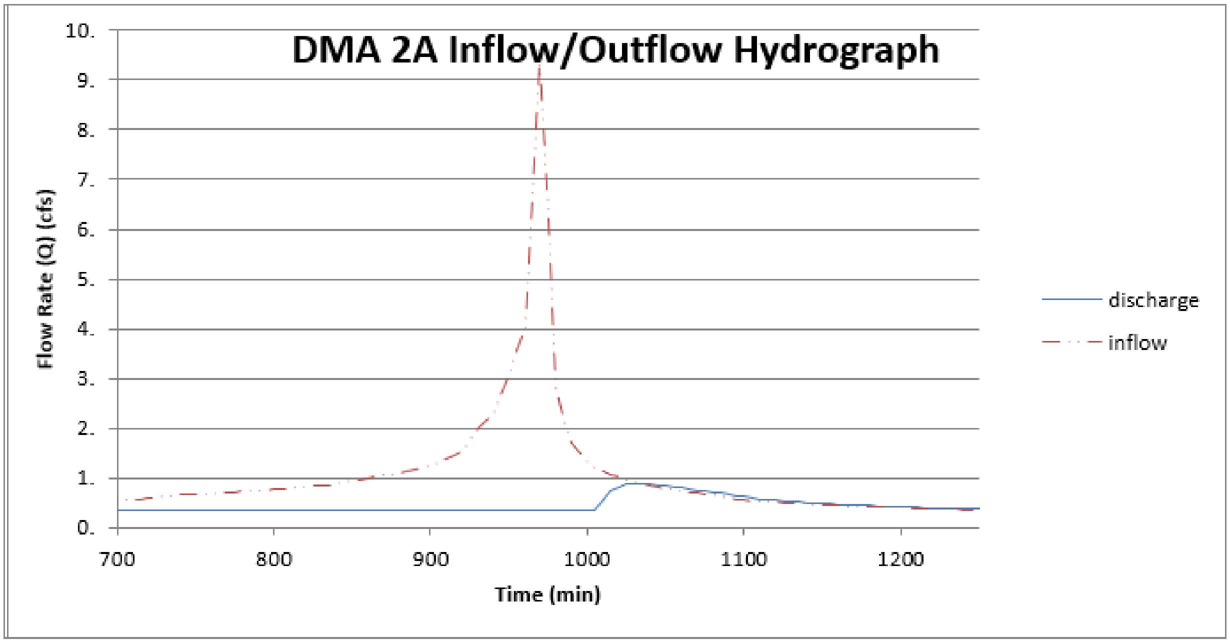


Figure DA2-1 BMP Overall hydrographs (from attenuated DA 2)





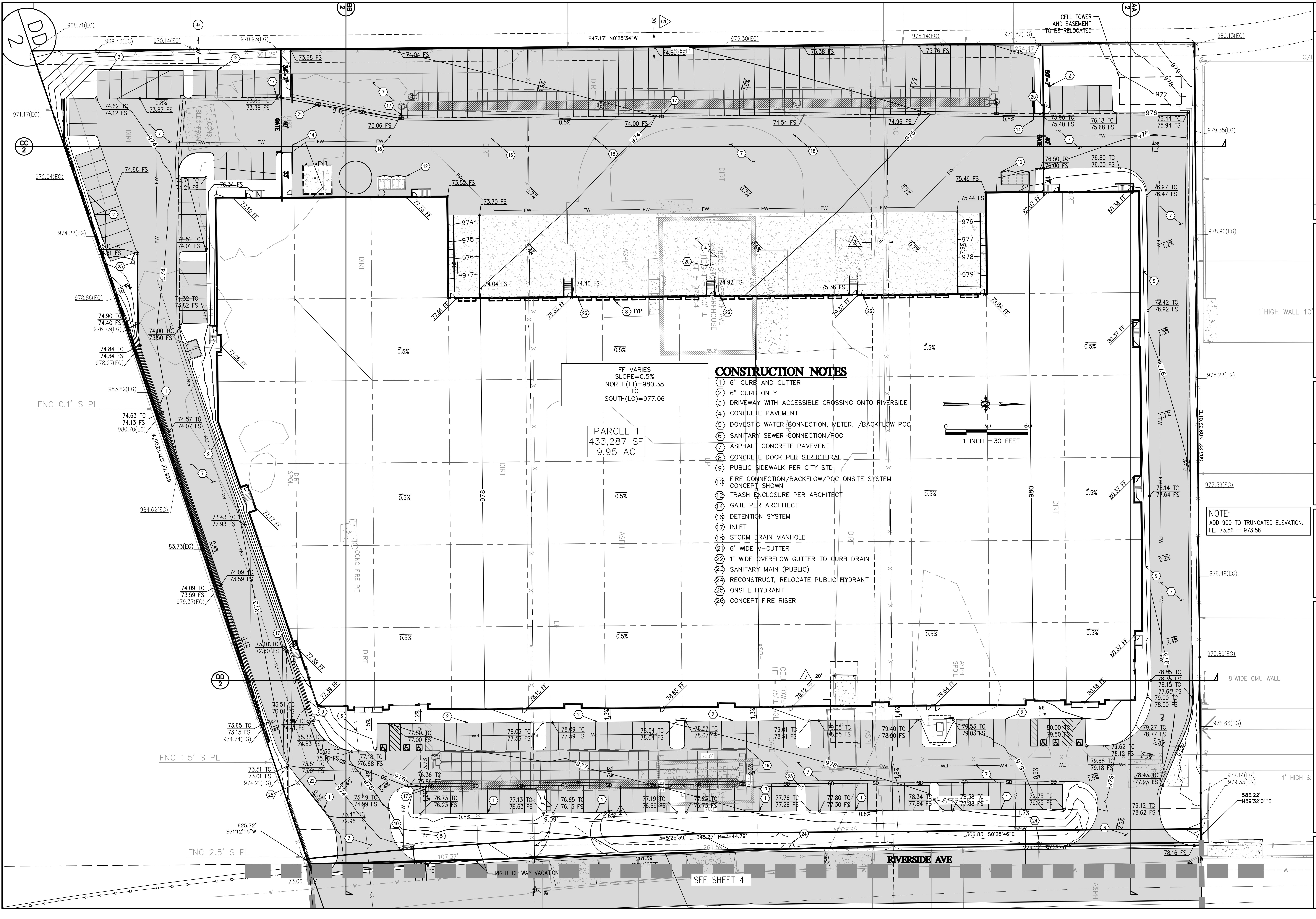
8. Discussion

As proposed, the project will attenuate the post-construction 100-year discharge rates to that of the pre-developed condition. This discharge, to Riverside Avenue, has been designed to accommodate existing drainage conditions in Riverside and so as not to impact adjacent or downstream properties.

9. List of Attachments

Attachment 1.	*Site Map*
Attachment 2.	*Hydrology Exhibits*
Attachment 3.	*NOAA Depth Duration & Intensity-Duration Values*
Attachment 4.	*Rational Method Results*
Attachment 5.	*AES Small Unit Hydrograph Output*
Attachment 6.	*Level Pool Routing Calculation Tables.*
Attachment 7.	*NRCS Hydrologic Soil Maps*
Attachment 8.	*Reference Geotechnical / Soil Data*

Attachment 1. Site Map



NOTE:
ADD 900 TO TRUNCATED ELEVATION.
I.E. 73.56 = 973.56

CONSTRUCTION NOTES

1. 6" CURB AND GUTTER
2. 6" CURB ONLY
3. DRIVEWAY WITH ACCESSIBLE CROSSING ONTO RIVERSIDE
4. CONCRETE PAVEMENT
5. DOMESTIC WATER CONNECTION, METER, /BACKFLOW POC
6. SANITARY SEWER CONNECTION/POC
7. ASPHALT CONCRETE PAVEMENT
8. CONCRETE DOCK PER STRUCTURAL
9. PUBLIC SIDEWALK PER CITY STD
10. FIRE CONNECTION/BACKFLOW/POC ONSITE SYSTEM CONCEPT SHOWN
12. TRASH ENCLOSURE PER ARCHITECT
14. GATE PER ARCHITECT
16. DETENTION SYSTEM
17. INLET
18. STORM DRAIN MANHOLE
21. 6' WIDE V-GUTTER
22. 1' WIDE OVERFLOW GUTTER TO CURB DRAIN
23. SANITARY MAIN (PUBLIC)
24. RECONSTRUCT, RELOCATE PUBLIC HYDRANT
25. ONSITE HYDRANT
26. CONCEPT FIRE RISER

REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD. BY	APRD BY

Cannon
16842 Von Kaman Avenue, Suite 150
Irvine, CA 92606
P 909.753.8111 F 909.753.0775

DRAWN BY SJJ
DATE 10/26/2022
CHECKED BY
SCALE 1" = 30'
CA JOB NO. 220139

RIVERSIDE XC
2830 S. RIVERSIDE
CONCEPTUAL GRADING PLAN
2830 S. RIVERSIDE
RIALTO, CA

SHEET
2
OF 4

PROJECT INFORMATION

ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS

Advanced Drainage Systems, Inc.

ADS SiteAssist™

FOR STORMTECH
INSTALLATION INSTRUCTIONS
VISIT OUR APP

220139 _1

RIVERSIDE, CA

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
    - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
    - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
    - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
    - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
    - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
    - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
    - STONESHOOTER LOCATED OFF THE CHAMBER BED.
    - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
    - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
    - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
    - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
    - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

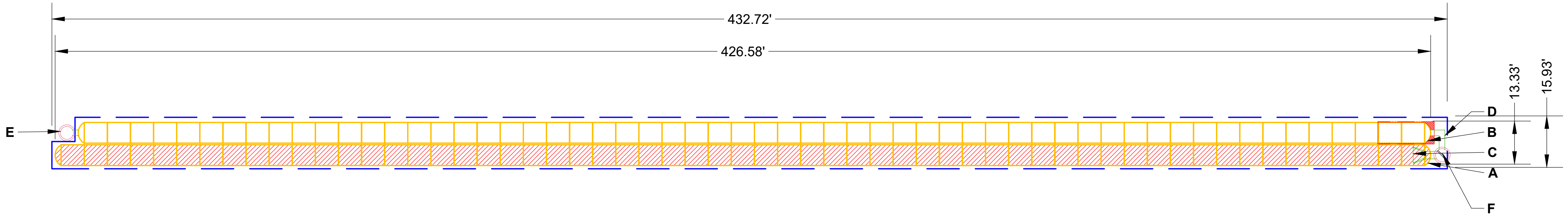
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT	
117	STORMTECH MC-3500 CHAMBERS
4	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
22804	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
6841	SYSTEM AREA (SF)
897.3	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.50
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6.50
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6.00
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6.00
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6.00
TOP OF STONE:	5.50
TOP OF MC-3500 CHAMBER:	4.50
24" ISOLATOR ROW PLUS INVERT:	0.92
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" BOTTOM CONNECTION INVERT:	0.90
BOTTOM OF MC-3500 CHAMBER:	0.75
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	E	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		4.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		5.5 CFS IN



▨	ISOLATOR ROW PLUS (SEE DETAIL)
▩	PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS
— —	BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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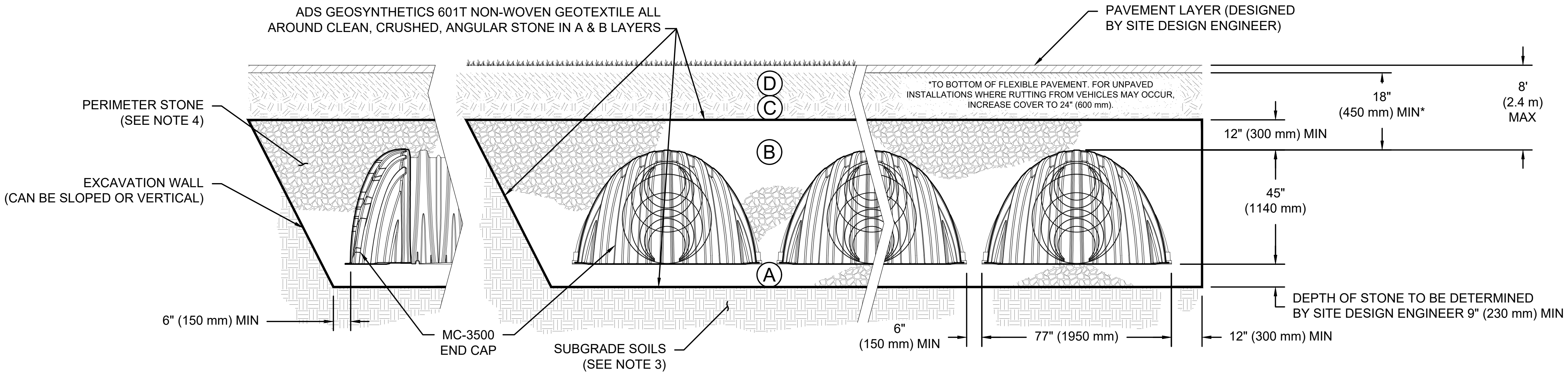
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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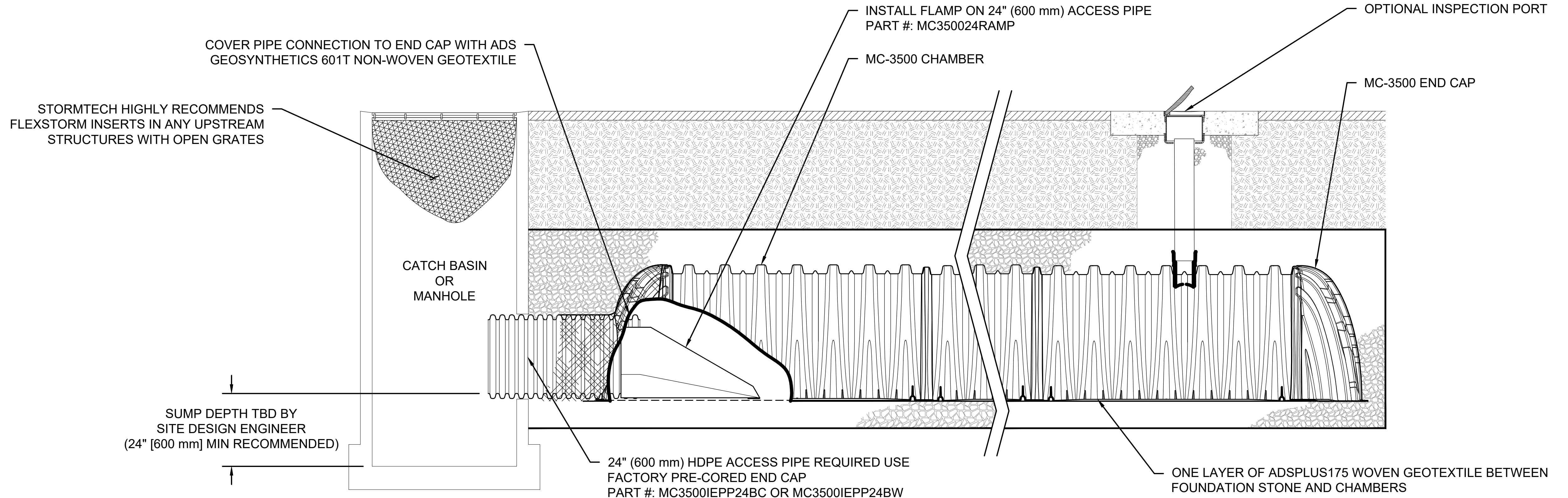

MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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MC-SERIES END CAP INSERTION DETAIL

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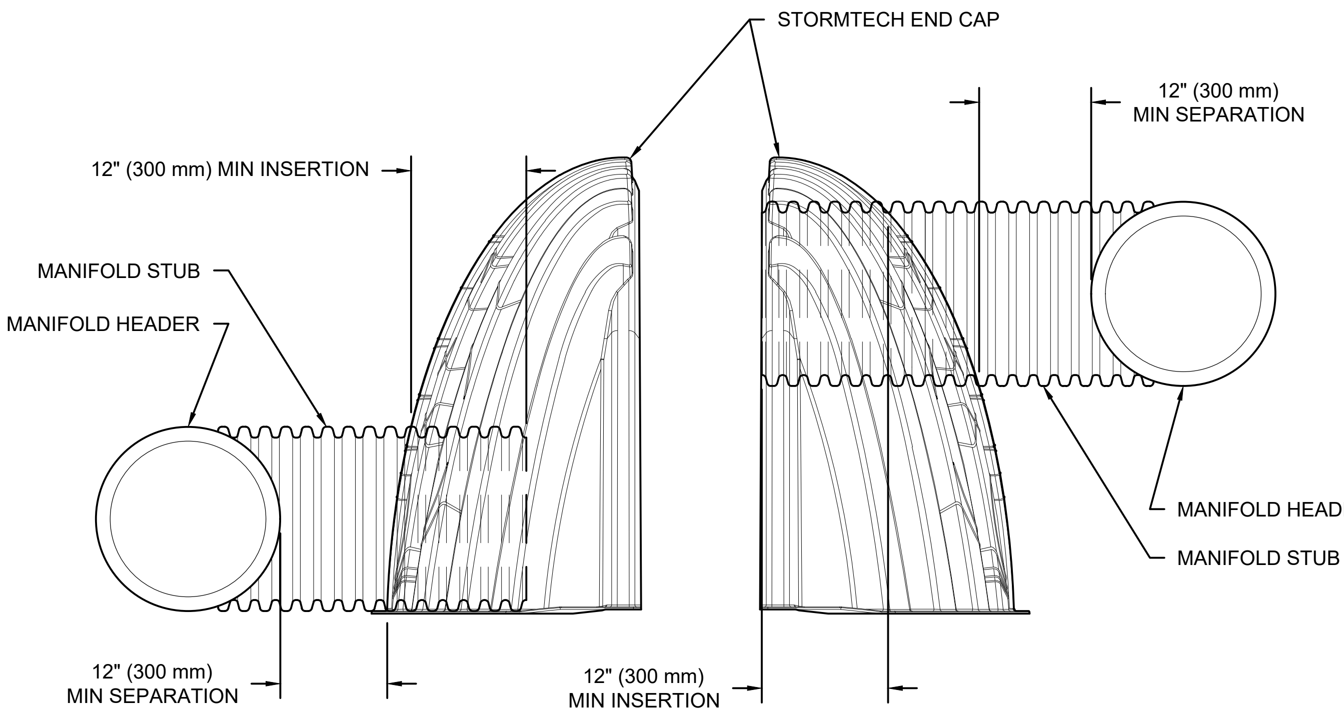

NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL
FOR A PROPER FIT IN END CAP OPENING.

MC-3500 TECHNICAL SPECIFICATION

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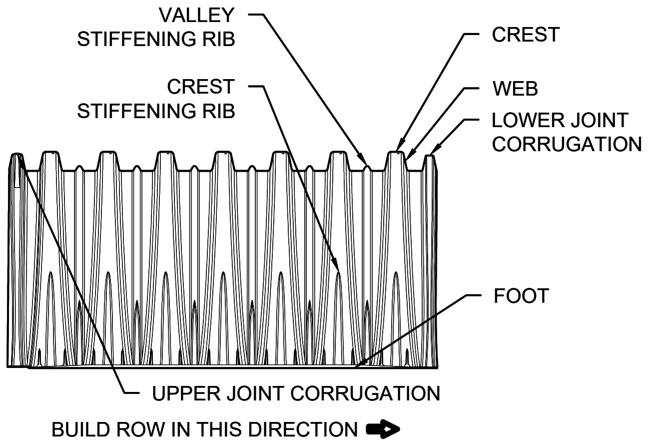
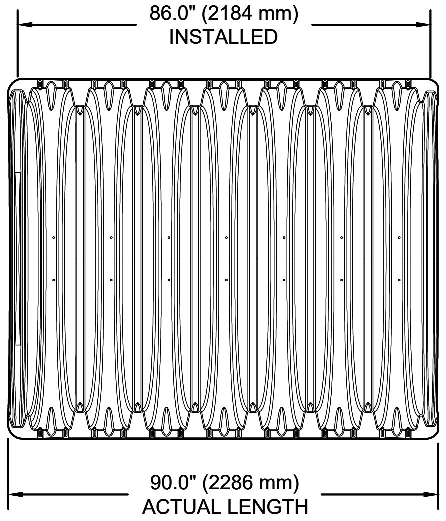
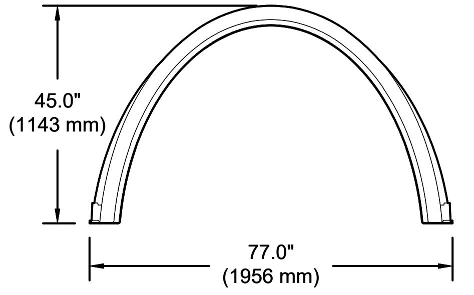
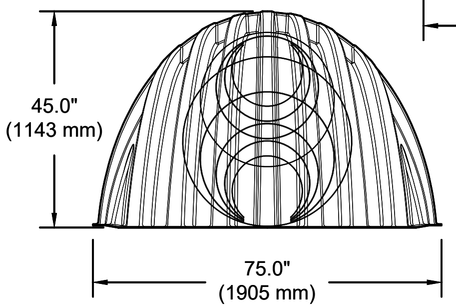
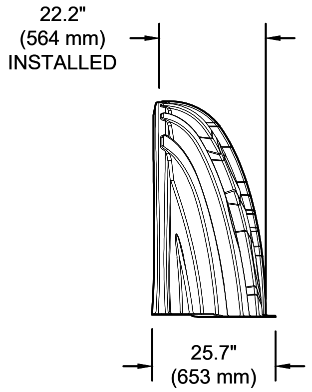










NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

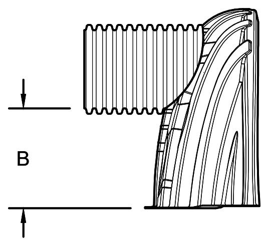
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

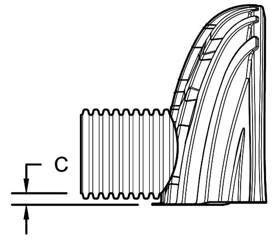
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL





CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

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RIVERSIDE, CA

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
    - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
    - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
    - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
    - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
    - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
    - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
    - STONESHOOTER LOCATED OFF THE CHAMBER BED.
    - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
    - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 6" (150 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 12" (300 mm) INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
    - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
    - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
    - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 36" (900 mm) OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT

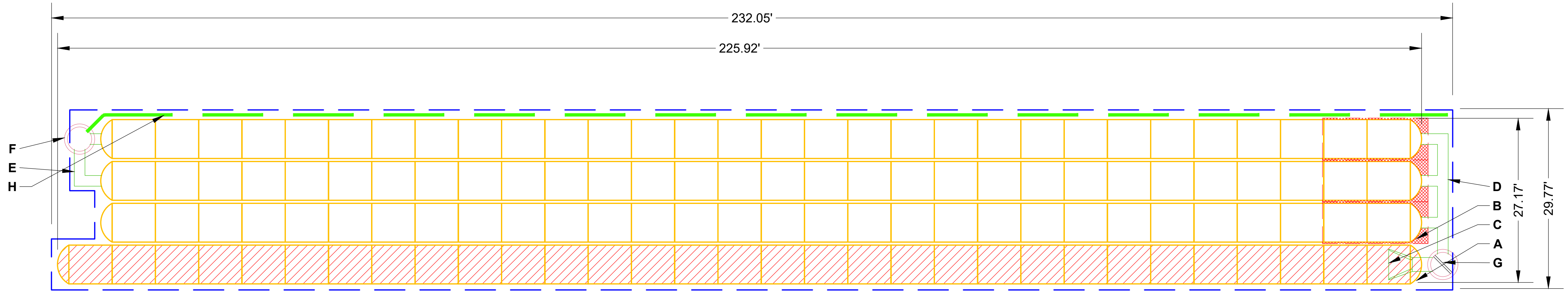
121	STORMTECH MC-3500 CHAMBERS
8	STORMTECH MC-3500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
23035	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
6810	SYSTEM AREA (SF)
531.9	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS

MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.50
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	6.50
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	6.00
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	6.00
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	6.00
TOP OF STONE:	5.50
TOP OF MC-3500 CHAMBER:	4.50
24" ISOLATOR ROW PLUS INVERT:	0.92
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" x 18" BOTTOM MANIFOLD INVERT:	0.90
18" BOTTOM CONNECTION INVERT:	0.90
BOTTOM OF MC-3500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM CORED END CAP, PART#: MC3500IEPP24BC / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.06"	
PREFABRICATED END CAP	B	18" BOTTOM CORED END CAP, PART#: MC3500IEPP18BC / TYP OF ALL 18" BOTTOM CONNECTIONS	1.77"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MC350024RAMP		
MANIFOLD	D	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
MANIFOLD	E	18" x 18" BOTTOM MANIFOLD, ADS N-12	1.77"	
CONCRETE STRUCTURE	F	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		8.0 CFS OUT
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		16.5 CFS IN
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



▨ ISOLATOR ROW PLUS (SEE DETAIL)

▩ PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

— — BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

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HILLIARD, OH 43026
1-800-733-7473

0 20 40

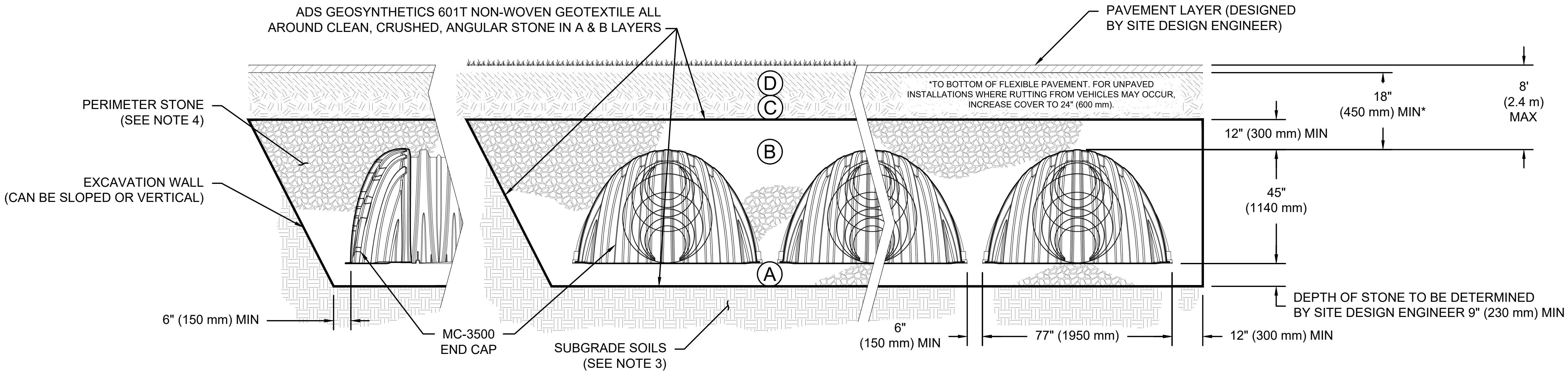
THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE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

SHEET
2 OF 5

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
    - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
    - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
    - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 450 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

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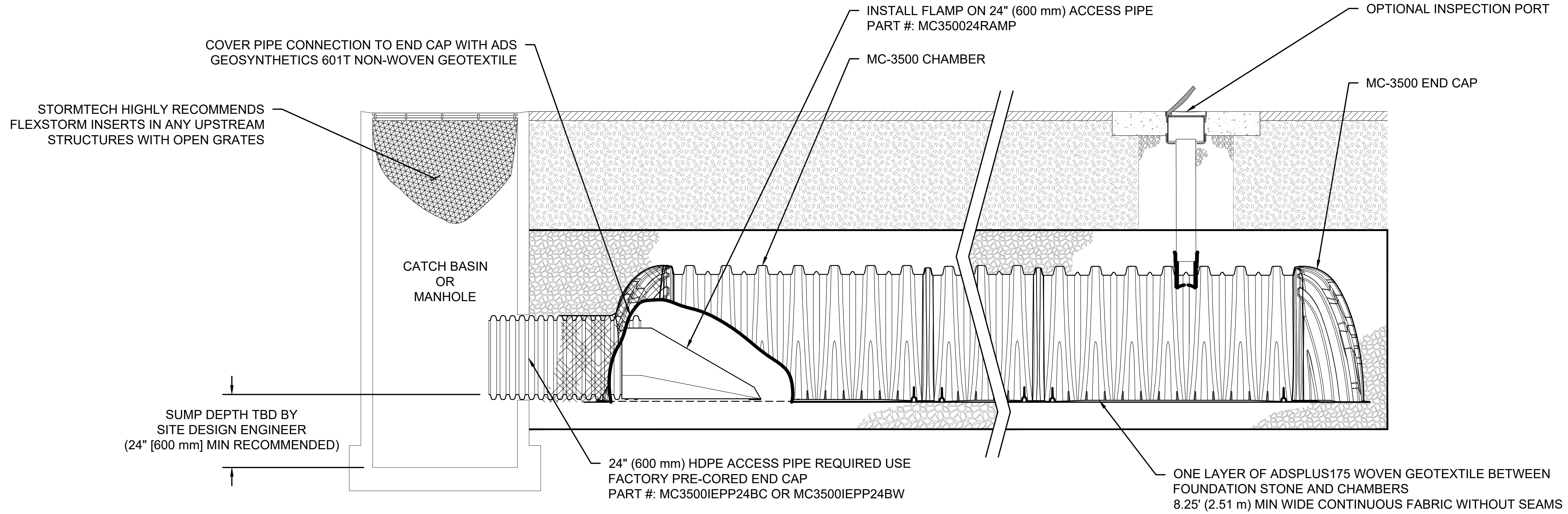

MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

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UNDERDRAIN DETAIL
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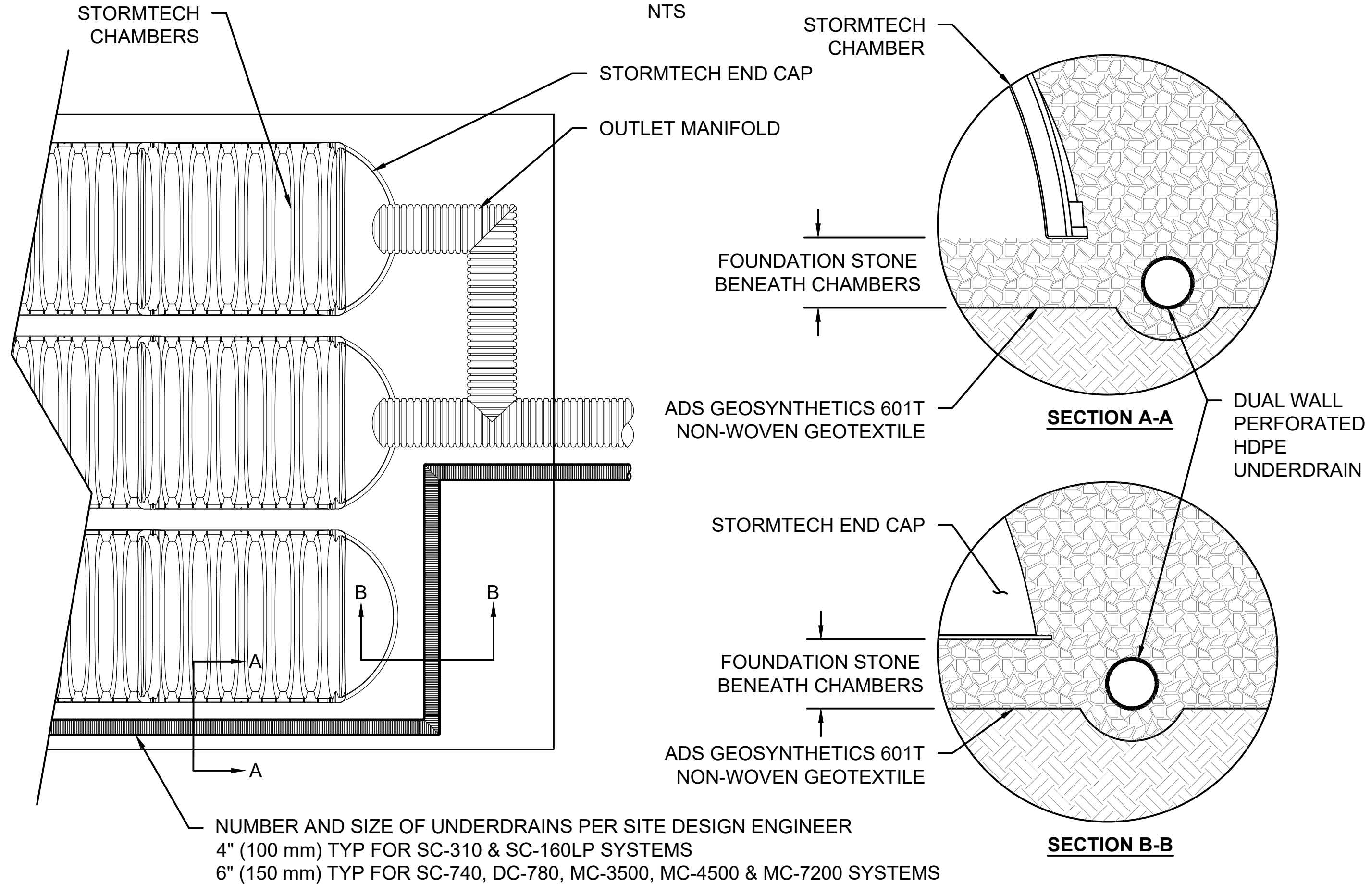
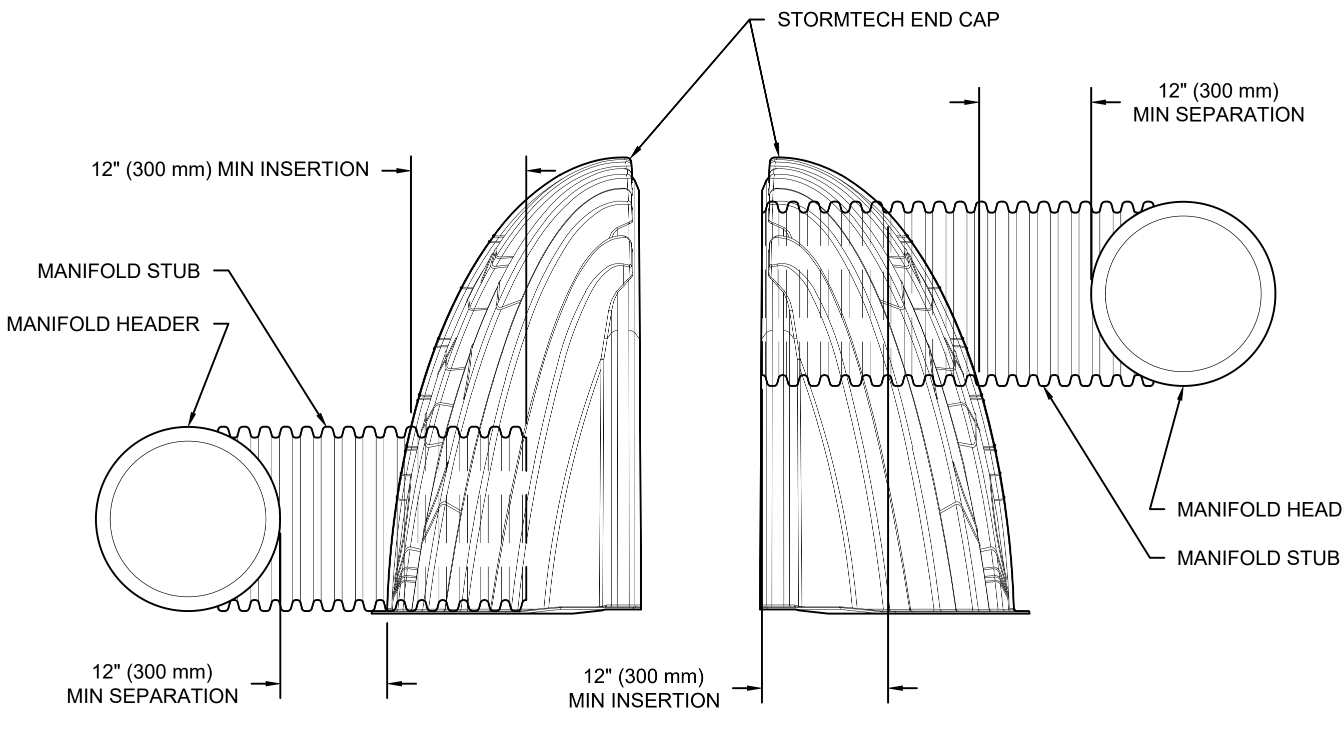


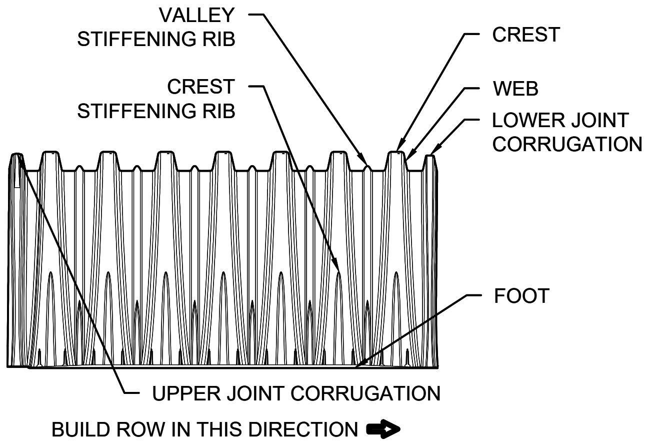
NUMBER AND SIZE OF UNDERDRAINS PER SITE DESIGN ENGINEER
4" (100 mm) TYP FOR SC-310 & SC-160LP SYSTEMS
6" (150 mm) TYP FOR SC-740, DC-780, MC-3500, MC-4500 & MC-7200 SYSTEMS

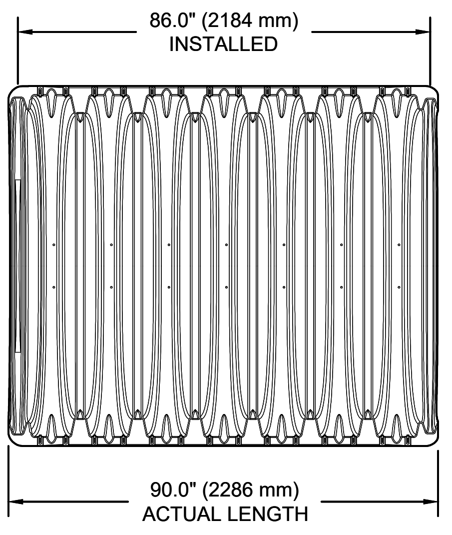
MC-SERIES END CAP INSERTION DETAIL
NTS

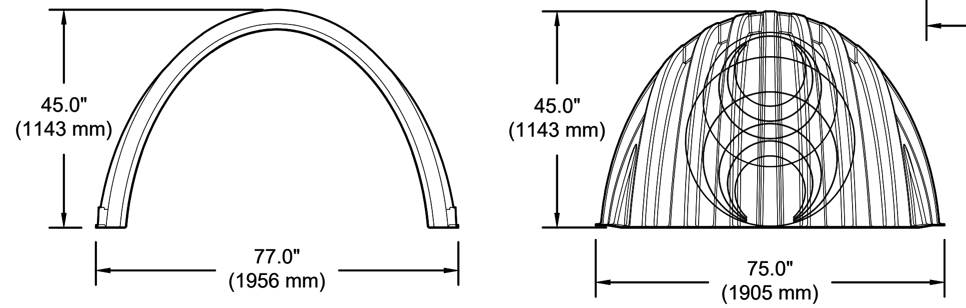


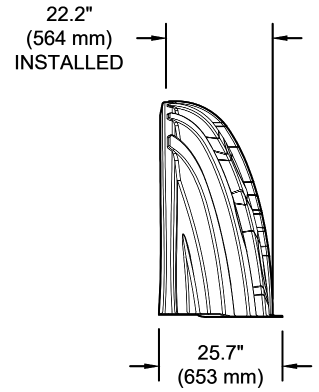
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

MC-3500 TECHNICAL SPECIFICATION
NTS









NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

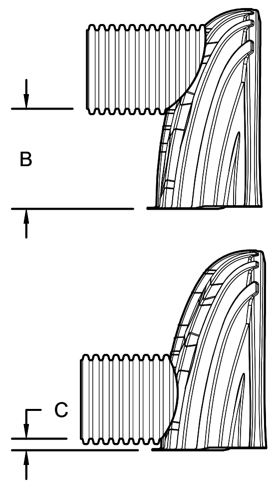
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" SPACING BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

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Attachment 2. Hydrology Exhibits

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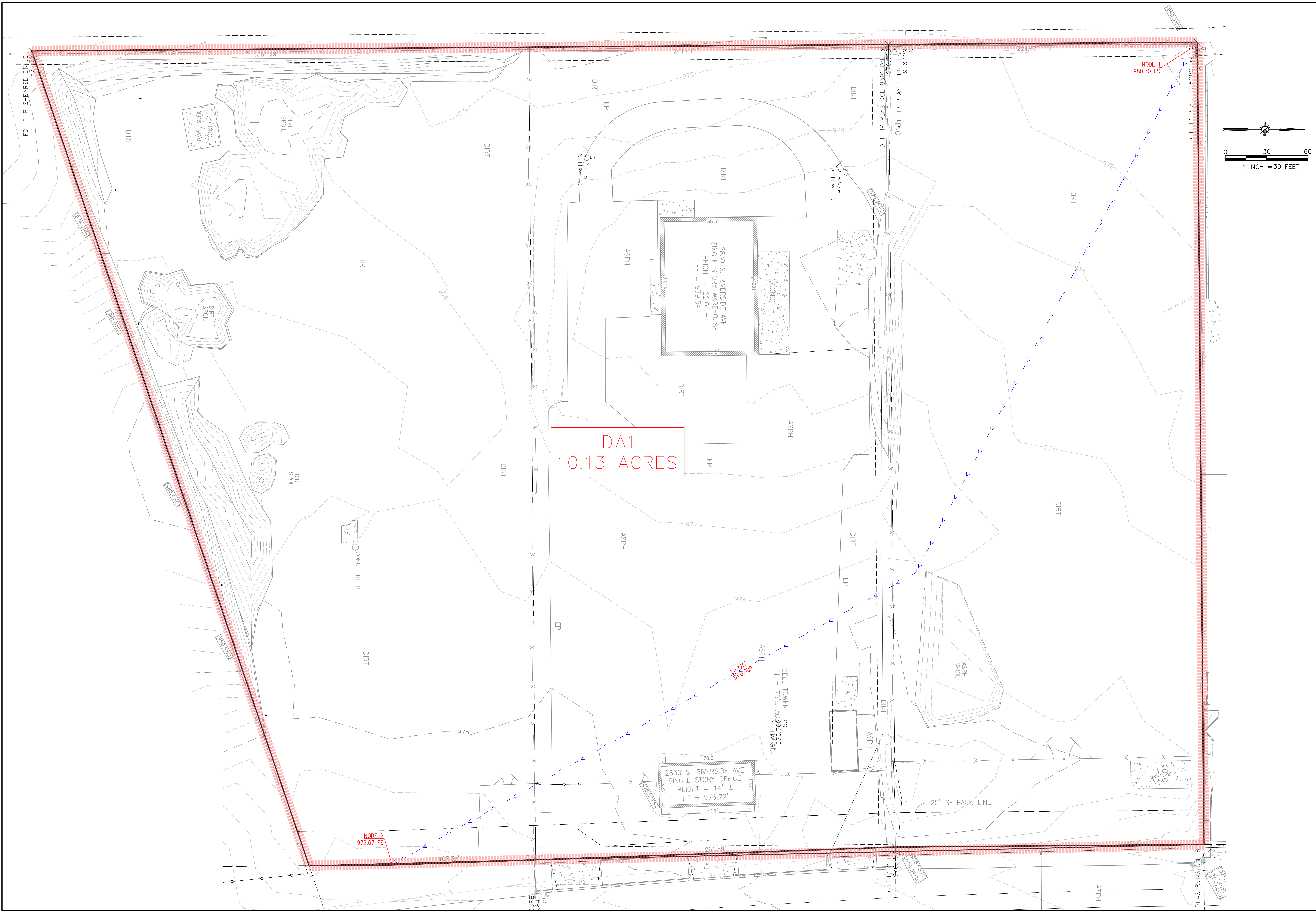

REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD. BY	APRD BY

Cannon

16842 Von Karman Avenue, Suite 150
Irvine, CA 92606
P 909.753.8111 F 909.753.0775

DRAWN BY SJJ	DATE 10/26/22
CHECKED BY	SCALE 1" = 30'
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EXISTING HYRDROLOGY EXHIBIT
2830 S. RIVERSIDE
RIALTO, CA

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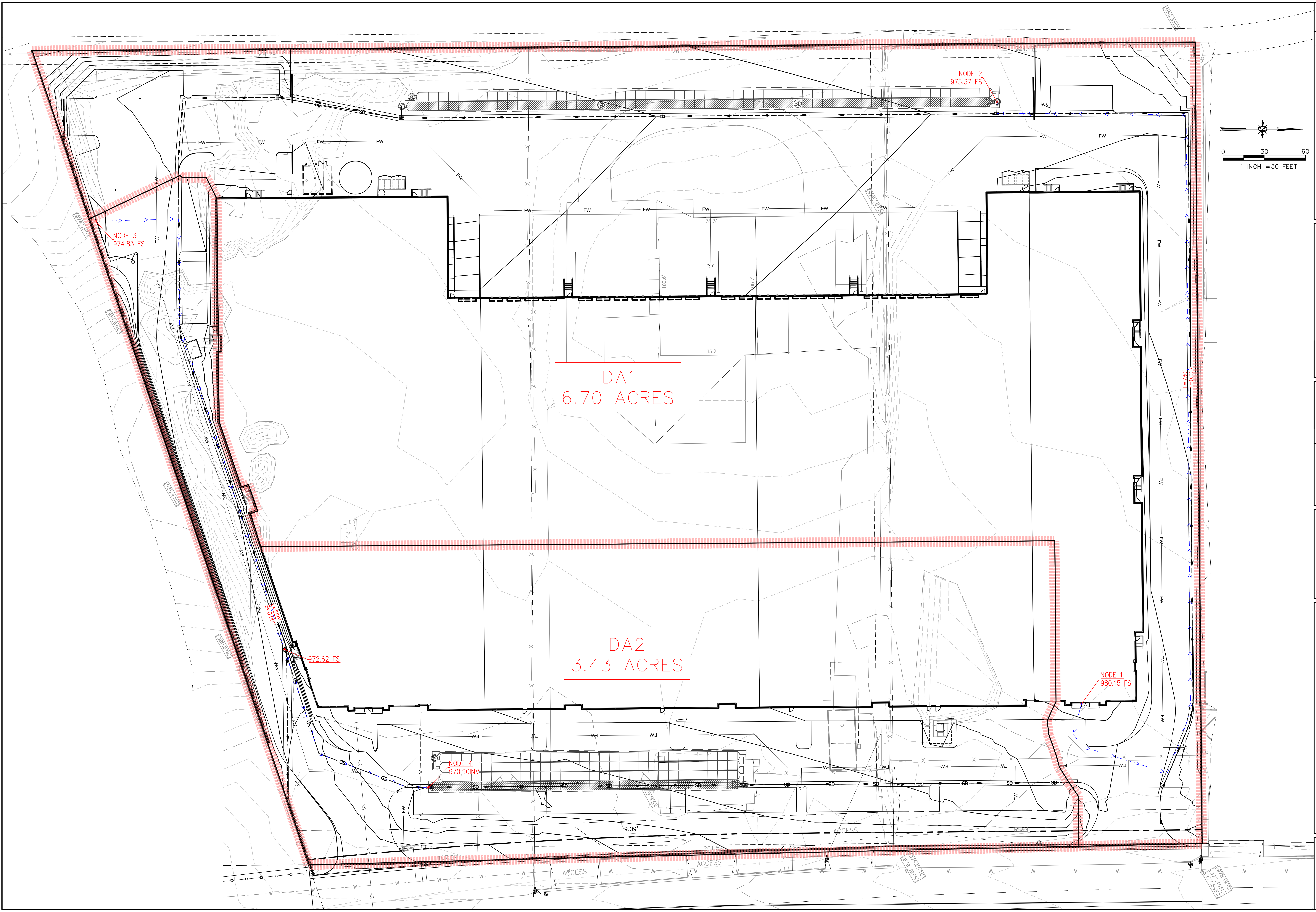
OF 2



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REV. NO	DATE	REVISED	DESTROY ALL PRINTS BEARING EARLIER DATE	REV. BY	CKD. BY	APRD BY

Cannon
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2830 S. RIVERSIDE2
PROPOSED HYDROLOGY EXHIBIT
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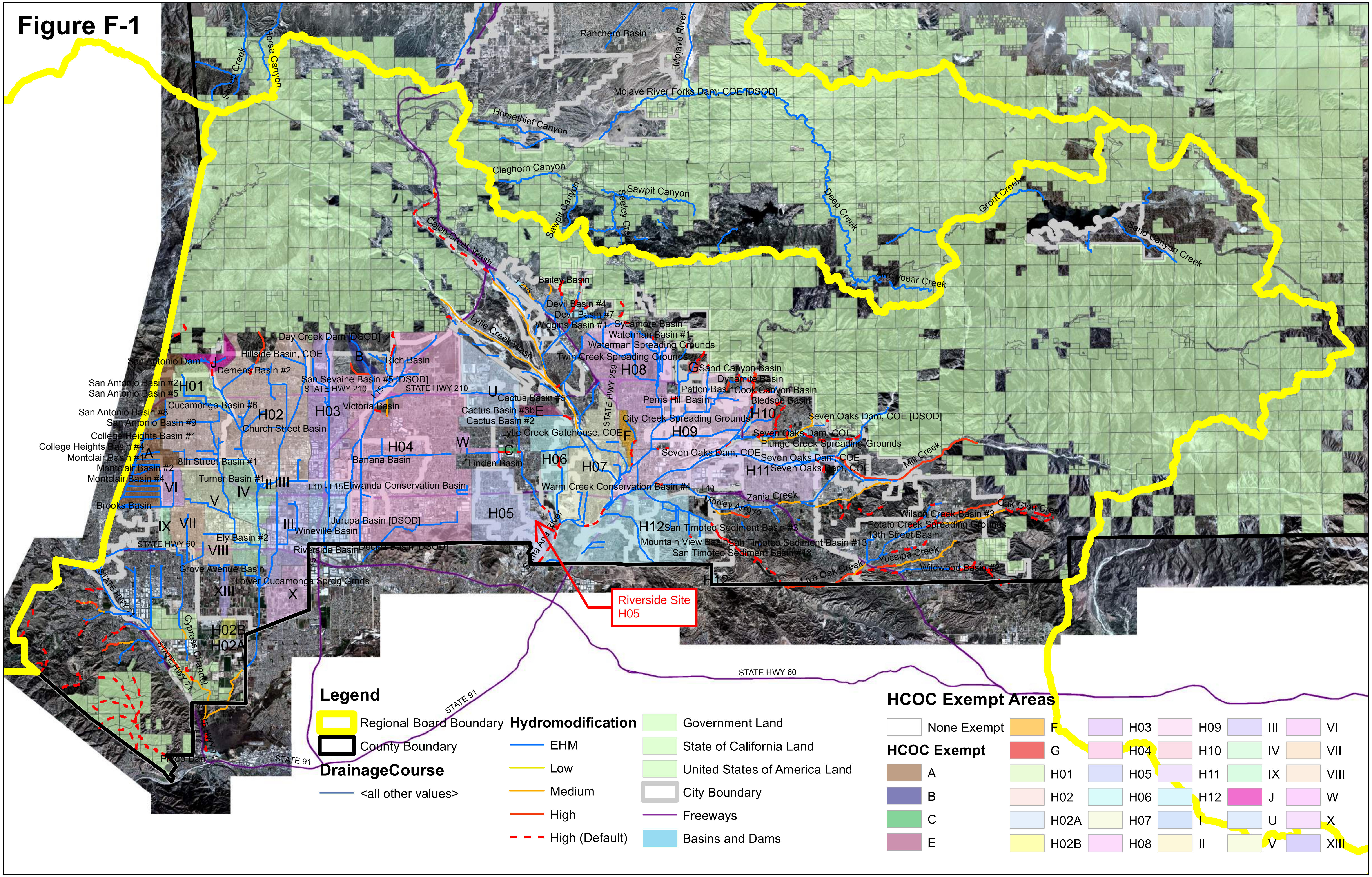
Figure F-1


Ranchero Basin
Mojave River
Horse Canyon
Sheep Creek
Mojave River Forks Dam: COE [DSOD]
Horsethief Canyon
Cleghorn Canyon
Sawpit Canyon
Seeley Creek
Deep Creek
Grout Creek
Sand Canyon Creek
Holcomb Creek
Cajon Creek Wash
Lytle Creek Wash
Bailey Basin
Devil Basin #4
Devil Basin #7
Wiggins Basin #1
Sycamore Basin
Waterman Basin #1
Waterman Spreading Grounds
Twin Creek Spreading Grounds
Day Creek Dam [DSOD]
Hillside Basin, COE
Rich Basin
San Antonio Dam
Demens Basin #2
San Sevaine Basin #5 [DSOD]
STATE HWY 210
San Antonio Basin #2
San Antonio Basin #5
Cucamonga Basin #6
San Antonio Basin #8
San Antonio Basin #9
Church Street Basin
Victoria Basin
College Heights Basin #1
College Heights Basin #4
Montclair Basin #1
Montclair Basin #2
Montclair Basin #4
8th Street Basin #1
Turner Basin #1
Banana Basin
Brooks Basin
Etiwanda Conservation Basin
Jurupa Basin [DSOD]
Wineville Basin
Riverside Basin
Ely Basin #2
Grove Avenue Basin
Lower Cucamonga Sprdg Grnds
STATE HWY 60
STATE HWY 71
Cypress Channel
Prado Dam
STATE 91
Cactus Basin #5
Cactus Basin #3
Cactus Basin #2
Lytle Creek Gatehouse, COE
Linden Basin
Warm Creek Conservation Basin #4
Santa Ana River
STATE HWY 259
Sand Canyon Basin
Dynamite Basin
Patton Basin
Cook Canyon Basin
Perris Hill Basin
Bledsoe Basin
City Creek Spreading Grounds
Seven Oaks Dam, COE [DSOD]
Seven Oaks Dam, COE
Plunge Creek Spreading Grounds
Mill Creek
Zanja Creek
Morrey Arroyo
I 10
I 15
215
Wilson Creek Basin #3
Oak Glen Creek
Potato Creek Spreading Grounds
13th Street Basin
San Timoteo Sediment Basin #3
Mountain View Basin
San Timoteo Sediment Basin #13
San Timoteo Sediment Basin #18
Yucaipa Creek
Live Oak Creek
Wildwood Basin #2
H01
H02
H02A
H02B
H03
H04
H05
H06
H07
H08
H09
H10
H11
H12
A
B
C
E
F
G
J
U
W
I
II
III
IIII
IV
V
VI
VII
VIII
IX
X
XIII
Riverside Site
H05
Legend
Regional Board Boundary
County Boundary
DrainageCourse
<all other values>
Hydromodification
EHM
Low
Medium
High
High (Default)
Government Land
State of California Land
United States of America Land
City Boundary
Freeways
Basins and Dams
HCOC Exempt Areas
None Exempt
HCOC Exempt
A
B
C
E
F
G
H01
H02
H02A
H02B
H03
H04
H05
H06
H07
H08
H09
H10
H11
H12
I
II
III
IV
IX
J
U
V
VI
VII
VIII
W
X
XIII

Attachment 3. NOAA Depth Duration & Intensity-Duration Values

NOAA Atlas 14, Volume 6, Version 2
Location name: Bloomington, California, USA*
Latitude: 34.0595°, Longitude: -117.3737°
Elevation: 1019.54 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.108** (0.090-0.131)	**0.139** (0.116-0.169)	**0.181** (0.150-0.221)	**0.216** (0.178-0.265)	**0.264** (0.210-0.335)	**0.302** (0.235-0.392)	**0.340** (0.258-0.453)	**0.381** (0.281-0.523)	**0.439** (0.310-0.627)	**0.484** (0.330-0.718)
10-min	**0.154** (0.129-0.187)	**0.200** (0.166-0.242)	**0.260** (0.215-0.316)	**0.310** (0.255-0.380)	**0.378** (0.301-0.481)	**0.432** (0.336-0.561)	**0.488** (0.370-0.650)	**0.547** (0.403-0.749)	**0.629** (0.444-0.899)	**0.694** (0.473-1.03)
15-min	**0.187** (0.156-0.226)	**0.241** (0.201-0.293)	**0.314** (0.261-0.382)	**0.374** (0.308-0.460)	**0.457** (0.364-0.581)	**0.523** (0.407-0.679)	**0.590** (0.448-0.786)	**0.661** (0.487-0.906)	**0.760** (0.537-1.09)	**0.840** (0.572-1.25)
30-min	**0.279** (0.232-0.338)	**0.360** (0.300-0.437)	**0.468** (0.389-0.570)	**0.558** (0.459-0.685)	**0.682** (0.542-0.867)	**0.780** (0.606-1.01)	**0.880** (0.668-1.17)	**0.986** (0.727-1.35)	**1.13** (0.800-1.62)	**1.25** (0.853-1.86)
60-min	**0.403** (0.336-0.489)	**0.521** (0.434-0.633)	**0.678** (0.563-0.825)	**0.808** (0.665-0.992)	**0.987** (0.785-1.25)	**1.13** (0.878-1.47)	**1.27** (0.966-1.70)	**1.43** (1.05-1.96)	**1.64** (1.16-2.35)	**1.81** (1.24-2.69)
2-hr	**0.585** (0.488-0.709)	**0.750** (0.624-0.911)	**0.967** (0.803-1.18)	**1.15** (0.943-1.41)	**1.39** (1.11-1.77)	**1.58** (1.23-2.05)	**1.78** (1.35-2.36)	**1.98** (1.46-2.71)	**2.26** (1.60-3.23)	**2.48** (1.69-3.68)
3-hr	**0.726** (0.605-0.880)	**0.928** (0.772-1.13)	**1.19** (0.991-1.45)	**1.41** (1.16-1.73)	**1.71** (1.36-2.17)	**1.94** (1.51-2.51)	**2.17** (1.65-2.89)	**2.41** (1.78-3.31)	**2.75** (1.94-3.93)	**3.02** (2.05-4.47)
6-hr	**1.02** (0.850-1.24)	**1.30** (1.09-1.58)	**1.68** (1.39-2.04)	**1.98** (1.63-2.43)	**2.39** (1.90-3.03)	**2.70** (2.10-3.51)	**3.02** (2.29-4.03)	**3.35** (2.47-4.60)	**3.81** (2.69-5.45)	**4.16** (2.84-6.17)
12-hr	**1.36** (1.13-1.65)	**1.74** (1.45-2.12)	**2.24** (1.86-2.73)	**2.65** (2.18-3.25)	**3.20** (2.54-4.06)	**3.62** (2.81-4.70)	**4.04** (3.07-5.38)	**4.48** (3.30-6.14)	**5.07** (3.58-7.26)	**5.54** (3.77-8.21)
24-hr	**1.81** (1.61-2.09)	**2.35** (2.08-2.71)	**3.04** (2.68-3.52)	**3.60** (3.15-4.20)	**4.36** (3.69-5.25)	**4.93** (4.09-6.07)	**5.52** (4.47-6.95)	**6.12** (4.83-7.93)	**6.94** (5.25-9.35)	**7.57** (5.54-10.6)
2-day	**2.21** (1.95-2.54)	**2.90** (2.57-3.35)	**3.81** (3.36-4.41)	**4.56** (3.99-5.31)	**5.57** (4.71-6.71)	**6.34** (5.26-7.80)	**7.14** (5.78-8.99)	**7.95** (6.27-10.3)	**9.07** (6.86-12.2)	**9.94** (7.27-13.9)
3-day	**2.36** (2.09-2.72)	**3.15** (2.79-3.64)	**4.20** (3.70-4.86)	**5.06** (4.42-5.90)	**6.24** (5.28-7.52)	**7.16** (5.94-8.80)	**8.10** (6.56-10.2)	**9.08** (7.16-11.8)	**10.4** (7.89-14.1)	**11.5** (8.40-16.0)
4-day	**2.53** (2.24-2.92)	**3.42** (3.02-3.94)	**4.59** (4.05-5.31)	**5.56** (4.86-6.48)	**6.89** (5.84-8.30)	**7.94** (6.59-9.76)	**9.01** (7.30-11.4)	**10.1** (7.99-13.1)	**11.7** (8.85-15.8)	**12.9** (9.45-18.0)
7-day	**2.89** (2.56-3.33)	**3.95** (3.49-4.55)	**5.34** (4.71-6.18)	**6.50** (5.68-7.58)	**8.10** (6.86-9.76)	**9.35** (7.76-11.5)	**10.6** (8.62-13.4)	**12.0** (9.46-15.5)	**13.9** (10.5-18.7)	**15.4** (11.3-21.5)
10-day	**3.14** (2.78-3.62)	**4.31** (3.81-4.97)	**5.87** (5.17-6.79)	**7.15** (6.26-8.35)	**8.94** (7.57-10.8)	**10.3** (8.58-12.7)	**11.8** (9.56-14.9)	**13.3** (10.5-17.3)	**15.5** (11.7-20.8)	**17.2** (12.5-23.9)
20-day	**3.81** (3.37-4.39)	**5.27** (4.66-6.09)	**7.23** (6.37-8.36)	**8.86** (7.75-10.3)	**11.1** (9.42-13.4)	**12.9** (10.7-15.9)	**14.8** (12.0-18.6)	**16.8** (13.2-21.7)	**19.5** (14.8-26.4)	**21.8** (15.9-30.4)
30-day	**4.52** (4.00-5.21)	**6.26** (5.53-7.22)	**8.59** (7.57-9.94)	**10.5** (9.22-12.3)	**13.3** (11.2-16.0)	**15.4** (12.8-19.0)	**17.7** (14.3-22.3)	**20.1** (15.9-26.0)	**23.5** (17.8-31.7)	**26.3** (19.2-36.7)
45-day	**5.40** (4.78-6.22)	**7.43** (6.57-8.57)	**10.2** (8.96-11.8)	**12.5** (10.9-14.5)	**15.7** (13.3-18.9)	**18.2** (15.1-22.4)	**21.0** (17.0-26.4)	**23.9** (18.8-30.9)	**28.0** (21.2-37.8)	**31.4** (23.0-43.8)
60-day	**6.31** (5.59-7.28)	**8.60** (7.61-9.93)	**11.7** (10.3-13.5)	**14.3** (12.5-16.7)	**18.0** (15.2-21.7)	**20.9** (17.3-25.7)	**24.0** (19.5-30.3)	**27.4** (21.6-35.4)	**32.2** (24.3-43.4)	**36.1** (26.4-50.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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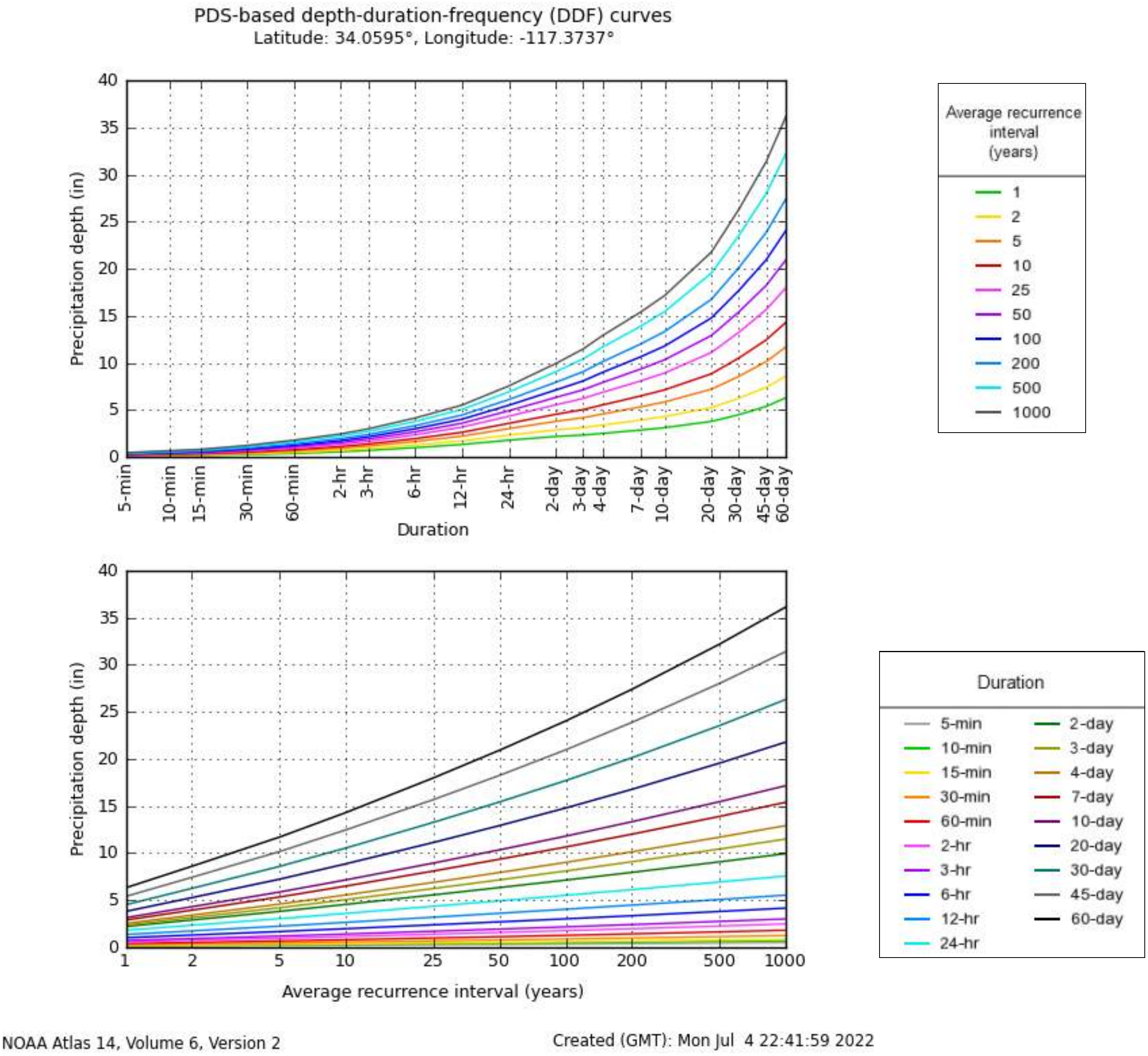
PF graphical



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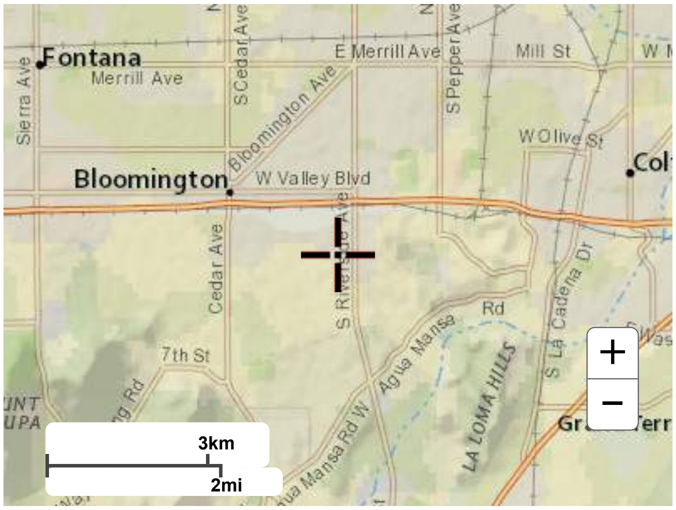
Maps & aerials

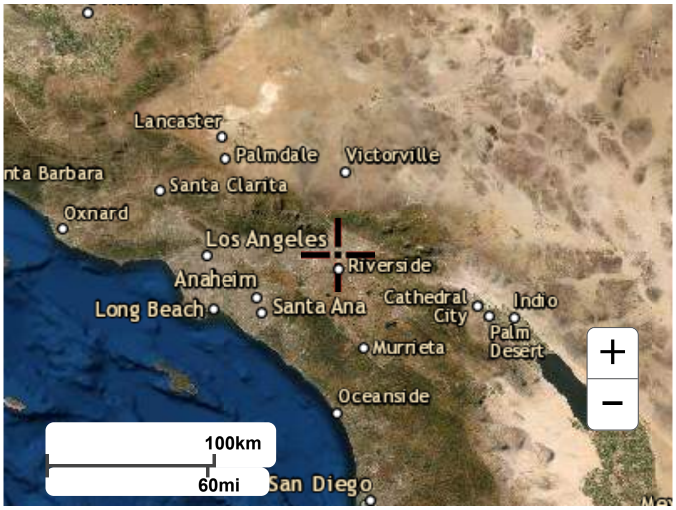
Small scale terrain



Large scale terrain

Large scale map

Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

NOAA Atlas 14, Volume 6, Version 2 REDLANDS
Station ID: 04-7306
Location name: Redlands, California, USA*
Latitude: 34.0528°, Longitude: -117.1894°
Elevation:
Elevation (station metadata): 1318 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**1.14** (0.948-1.38)	**1.46** (1.21-1.78)	**1.88** (1.56-2.30)	**2.24** (1.85-2.75)	**2.72** (2.16-3.47)	**3.11** (2.41-4.03)	**3.49** (2.65-4.64)	**3.89** (2.87-5.34)	**4.44** (3.13-6.36)	**4.87** (3.32-7.22)
10-min	**0.816** (0.678-0.990)	**1.04** (0.870-1.27)	**1.36** (1.12-1.65)	**1.61** (1.32-1.97)	**1.96** (1.55-2.48)	**2.23** (1.73-2.89)	**2.50** (1.90-3.33)	**2.79** (2.06-3.82)	**3.19** (2.25-4.55)	**3.50** (2.38-5.18)
15-min	**0.656** (0.548-0.796)	**0.844** (0.700-1.02)	**1.09** (0.904-1.33)	**1.30** (1.06-1.59)	**1.58** (1.25-2.00)	**1.79** (1.39-2.33)	**2.02** (1.53-2.69)	**2.25** (1.66-3.08)	**2.57** (1.81-3.67)	**2.82** (1.92-4.18)
30-min	**0.488** (0.406-0.592)	**0.626** (0.520-0.760)	**0.810** (0.672-0.986)	**0.960** (0.790-1.18)	**1.17** (0.928-1.49)	**1.33** (1.03-1.73)	**1.50** (1.13-1.99)	**1.67** (1.23-2.29)	**1.91** (1.34-2.73)	**2.09** (1.42-3.10)
60-min	**0.356** (0.296-0.432)	**0.457** (0.380-0.555)	**0.590** (0.489-0.719)	**0.701** (0.576-0.861)	**0.852** (0.677-1.08)	**0.970** (0.754-1.26)	**1.09** (0.827-1.45)	**1.22** (0.897-1.67)	**1.39** (0.981-1.99)	**1.53** (1.04-2.26)
2-hr	**0.252** (0.210-0.306)	**0.322** (0.268-0.392)	**0.416** (0.346-0.508)	**0.494** (0.406-0.606)	**0.600** (0.476-0.762)	**0.682** (0.530-0.886)	**0.766** (0.581-1.02)	**0.854** (0.629-1.17)	**0.974** (0.688-1.39)	**1.07** (0.727-1.58)
3-hr	**0.207** (0.172-0.252)	**0.266** (0.221-0.323)	**0.343** (0.284-0.418)	**0.406** (0.334-0.499)	**0.493** (0.392-0.627)	**0.560** (0.436-0.728)	**0.629** (0.477-0.838)	**0.700** (0.516-0.960)	**0.798** (0.563-1.14)	**0.874** (0.596-1.30)
6-hr	**0.147** (0.122-0.178)	**0.188** (0.157-0.229)	**0.243** (0.201-0.296)	**0.288** (0.236-0.353)	**0.349** (0.277-0.443)	**0.396** (0.308-0.514)	**0.444** (0.337-0.591)	**0.493** (0.364-0.677)	**0.561** (0.396-0.803)	**0.614** (0.418-0.910)
12-hr	**0.098** (0.082-0.119)	**0.126** (0.105-0.153)	**0.163** (0.135-0.198)	**0.192** (0.158-0.236)	**0.233** (0.185-0.296)	**0.264** (0.205-0.343)	**0.295** (0.224-0.393)	**0.328** (0.241-0.449)	**0.372** (0.262-0.532)	**0.405** (0.276-0.601)
24-hr	**0.066** (0.058-0.076)	**0.085** (0.075-0.098)	**0.110** (0.097-0.127)	**0.130** (0.114-0.152)	**0.158** (0.133-0.190)	**0.178** (0.148-0.219)	**0.199** (0.161-0.251)	**0.221** (0.174-0.286)	**0.250** (0.189-0.337)	**0.272** (0.199-0.379)
2-day	**0.041** (0.037-0.048)	**0.054** (0.048-0.062)	**0.071** (0.062-0.082)	**0.084** (0.074-0.098)	**0.103** (0.087-0.124)	**0.117** (0.097-0.144)	**0.131** (0.106-0.165)	**0.146** (0.115-0.189)	**0.167** (0.126-0.225)	**0.182** (0.133-0.254)
3-day	**0.030** (0.026-0.034)	**0.039** (0.035-0.046)	**0.052** (0.046-0.061)	**0.063** (0.055-0.074)	**0.078** (0.066-0.094)	**0.090** (0.074-0.110)	**0.102** (0.082-0.128)	**0.114** (0.090-0.148)	**0.132** (0.100-0.177)	**0.145** (0.106-0.202)
4-day	**0.024** (0.021-0.028)	**0.032** (0.029-0.037)	**0.043** (0.038-0.050)	**0.052** (0.046-0.061)	**0.065** (0.055-0.078)	**0.075** (0.062-0.092)	**0.086** (0.069-0.108)	**0.097** (0.076-0.125)	**0.112** (0.085-0.151)	**0.124** (0.091-0.173)
7-day	**0.016** (0.014-0.018)	**0.022** (0.019-0.025)	**0.029** (0.026-0.033)	**0.035** (0.031-0.041)	**0.044** (0.037-0.053)	**0.051** (0.042-0.062)	**0.058** (0.047-0.073)	**0.065** (0.051-0.084)	**0.076** (0.057-0.102)	**0.084** (0.061-0.117)
10-day	**0.012** (0.011-0.014)	**0.016** (0.014-0.019)	**0.022** (0.019-0.026)	**0.027** (0.023-0.031)	**0.033** (0.028-0.040)	**0.039** (0.032-0.048)	**0.044** (0.036-0.056)	**0.050** (0.039-0.065)	**0.058** (0.044-0.078)	**0.065** (0.047-0.090)
20-day	**0.008** (0.007-0.009)	**0.010** (0.009-0.012)	**0.014** (0.012-0.016)	**0.017** (0.015-0.020)	**0.021** (0.018-0.025)	**0.025** (0.020-0.030)	**0.028** (0.023-0.035)	**0.032** (0.025-0.041)	**0.037** (0.028-0.050)	**0.041** (0.030-0.058)
30-day	**0.006** (0.005-0.007)	**0.008** (0.007-0.009)	**0.011** (0.010-0.013)	**0.013** (0.012-0.016)	**0.017** (0.014-0.020)	**0.019** (0.016-0.024)	**0.022** (0.018-0.028)	**0.025** (0.020-0.033)	**0.030** (0.022-0.040)	**0.033** (0.024-0.046)
45-day	**0.005** (0.004-0.005)	**0.006** (0.006-0.007)	**0.009** (0.008-0.010)	**0.011** (0.009-0.012)	**0.013** (0.011-0.016)	**0.016** (0.013-0.019)	**0.018** (0.015-0.023)	**0.020** (0.016-0.026)	**0.024** (0.018-0.032)	**0.027** (0.020-0.037)
60-day	**0.004** (0.004-0.005)	**0.006** (0.005-0.006)	**0.008** (0.007-0.009)	**0.009** (0.008-0.011)	**0.012** (0.010-0.014)	**0.014** (0.011-0.017)	**0.016** (0.013-0.020)	**0.018** (0.014-0.023)	**0.021** (0.016-0.028)	**0.023** (0.017-0.033)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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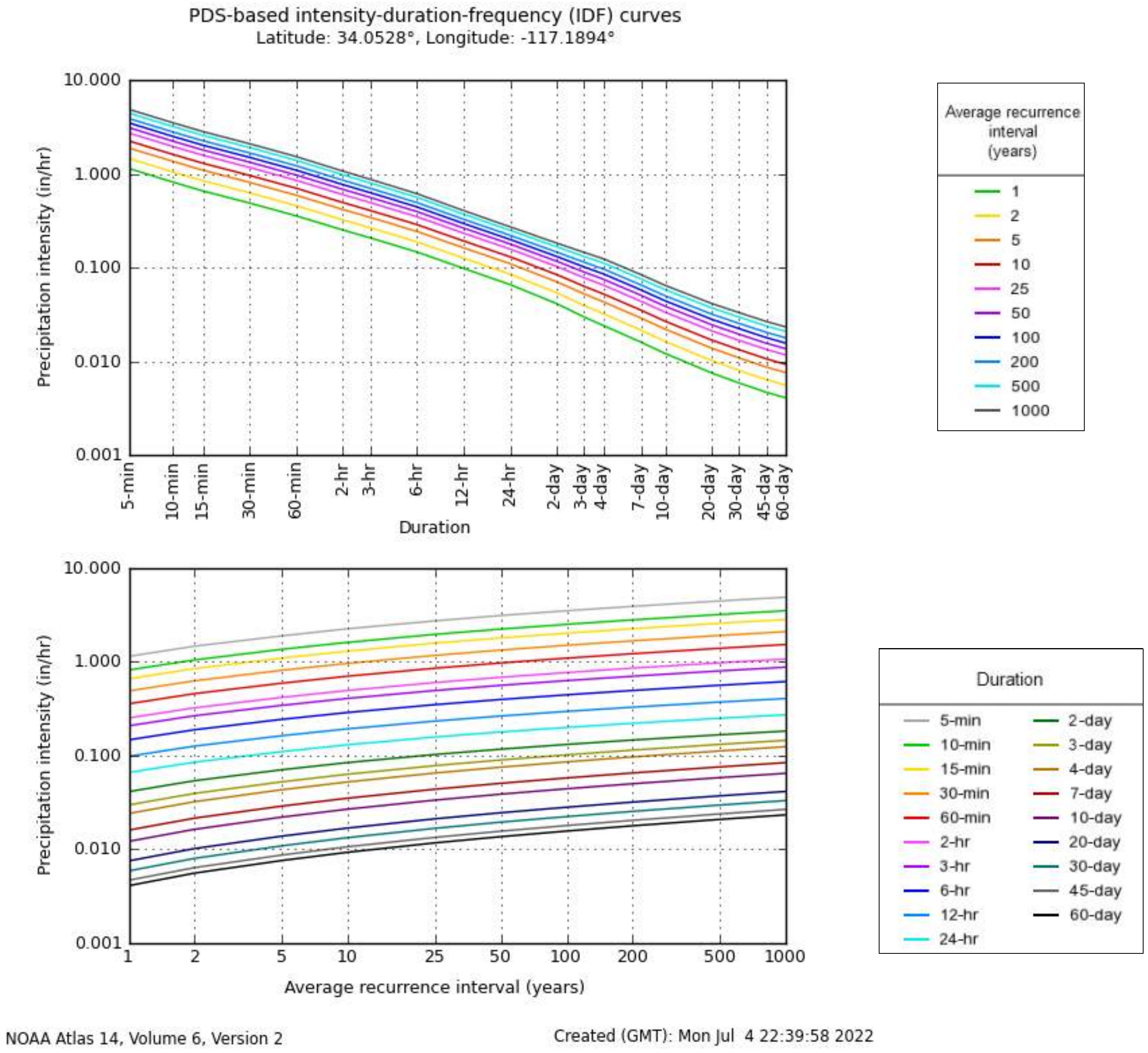
PF graphical



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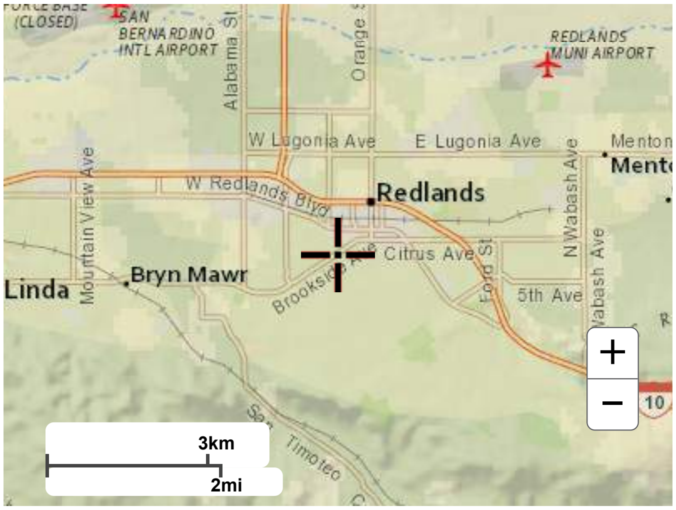
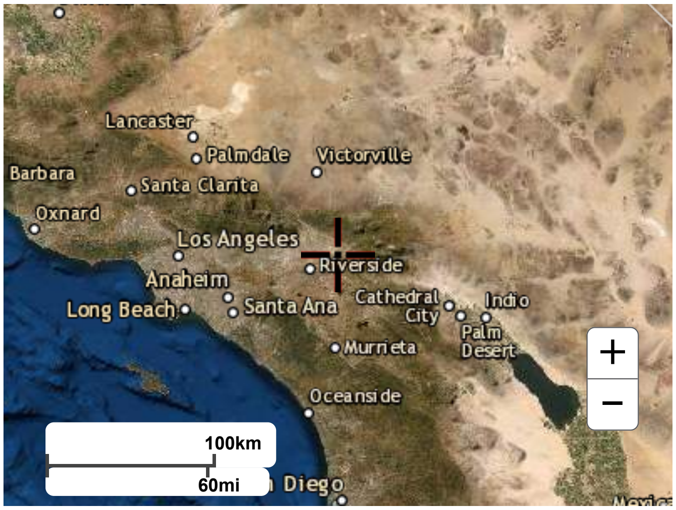
Small scale terrain



Large scale terrain

Large scale map

Large scale aerial



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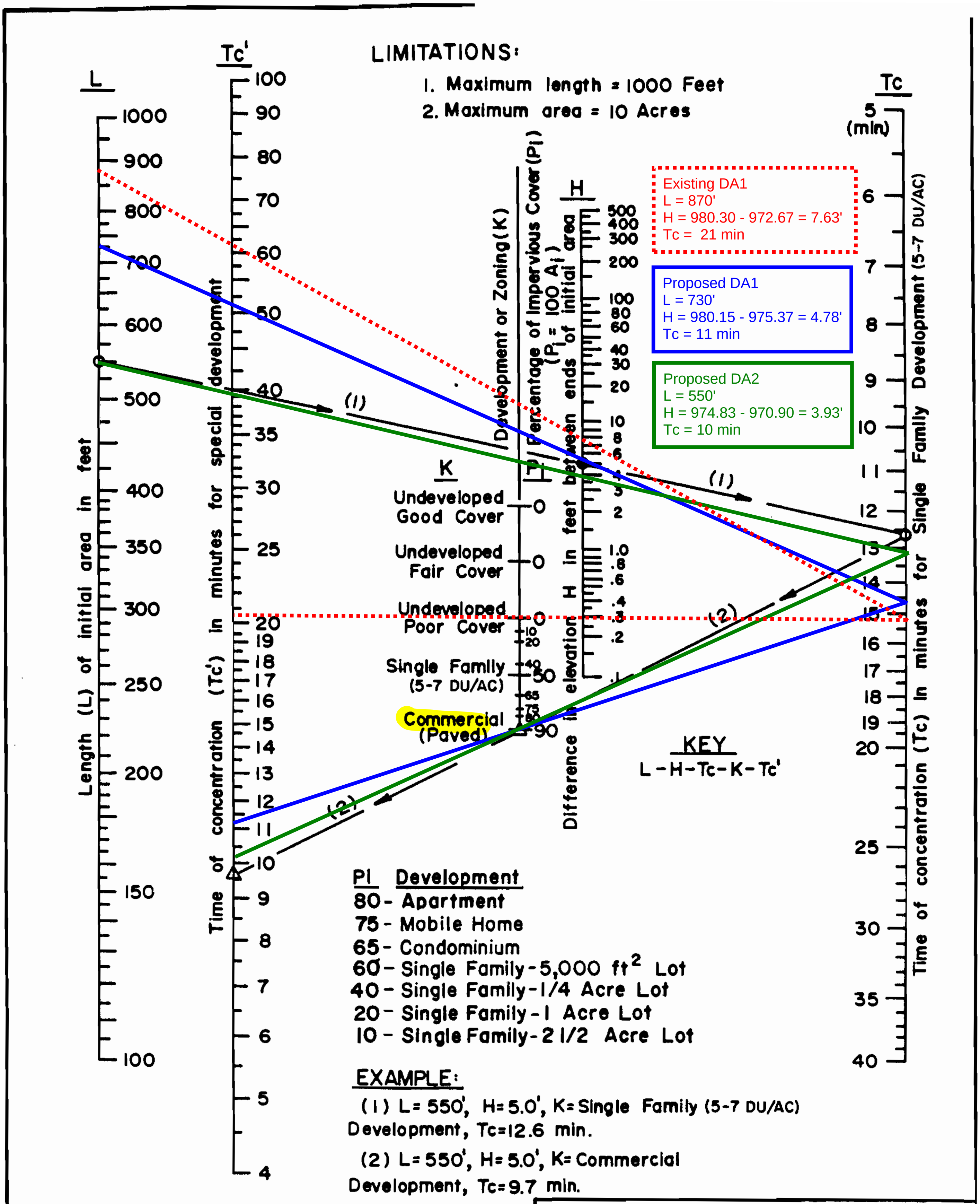
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Attachment 4. Rational Method Results



LIMITATIONS:

1. Maximum length = 1000 Feet
2. Maximum area = 10 Acres

Existing DA1
L = 870'
H = 980.30 - 972.67 = 7.63'
Tc = 21 min

Proposed DA1
L = 730'
H = 980.15 - 975.37 = 4.78'
Tc = 11 min

Proposed DA2
L = 550'
H = 974.83 - 970.90 = 3.93'
Tc = 10 min

Pi	Development
80	Apartment
75	Mobile Home
65	Condominium
60	Single Family-5,000 ft^2 Lot
40	Single Family-1/4 Acre Lot
20	Single Family-1 Acre Lot
10	Single Family-2 1/2 Acre Lot

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (5-7 DU/AC) Development, Tc = 12.6 min.

(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION
NOMOGRAPH
FOR INITIAL SUBAREA

Figure D-1

```
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
         (c) Copyright 1983-2013 Advanced Engineering Software (aes)
             Ver. 20.0  Release Date: 06/01/2013  License ID 1233

                           Analysis prepared by:

                           PENCO a Cannon Company
                            16842 Von Karman Ave
                                  Ste. 150


 ************************** DESCRIPTION OF STUDY **************************
* 220139 XBC RIVERSIDE                                                     *
* EXISTING 100-YEAR FOR DA 1 (ENTIRE SITE)                                 *
* CANNONCORP.US                                                            *
 **************************************************************************

  FILE NAME: 220139EX.DAT
  TIME/DATE OF STUDY: 18:39 12/14/2022
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.50
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.0900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   870.00
  ELEVATION DATA: UPSTREAM(FEET) =    980.30  DOWNSTREAM(FEET) =    972.67

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   20.294
```

```
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.089
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                    A       10.13      0.42      1.000    78   20.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.42
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =     15.25
  TOTAL AREA(ACRES) =     10.13   PEAK FLOW RATE(CFS) =     15.25
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       10.1  TC(MIN.) =     20.29
  EFFECTIVE AREA(ACRES) =     10.13  AREA-AVERAGED Fm(INCH/HR)=  0.42
  AREA-AVERAGED Fp(INCH/HR) =  0.42  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)    =      15.25
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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             Ver. 20.0  Release Date: 06/01/2013  License ID 1233

                           Analysis prepared by:

                           PENCO a Cannon Company
                            16842 Von Karman Ave
                                  Ste. 150


 ************************** DESCRIPTION OF STUDY **************************
 * 220139 XBC RIVERSIDE                                                     *
 * PROPOSED 100-YEAR                                                        *
 * CANNONCORP.US                                                            *
 **************************************************************************

  FILE NAME: 220139PR.DAT
  TIME/DATE OF STUDY: 08:59 12/15/2022
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   3.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.50
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.0900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)      (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
DA1  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   730.00
  ELEVATION DATA: UPSTREAM(FEET) =    980.15  DOWNSTREAM(FEET) =    975.37

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.614
```

```
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  2.920
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        6.70      0.98      0.100    32   11.61
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.97
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =     17.02
  TOTAL AREA(ACRES) =      6.70    PEAK FLOW RATE(CFS) =     17.02

****************************************************************************
```

DA2

```
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   550.00
  ELEVATION DATA: UPSTREAM(FEET) =    974.83  DOWNSTREAM(FEET) =    970.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   10.191
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.158
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  A        3.43      0.98      0.100    32   10.19
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      9.45
  TOTAL AREA(ACRES) =      3.43    PEAK FLOW RATE(CFS) =      9.45
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =         3.4  TC(MIN.) =     10.19
  EFFECTIVE AREA(ACRES) =       3.43  AREA-AVERAGED Fm(INCH/HR)=  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)    =       9.45
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Qsite = 17.02+9.45=26.47cfs

Attachment 5. AES Small Unit Hydrograph Output

```
****************************************************************************
                      SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
         (C) Copyright 1989-2013 Advanced Engineering Software (aes)
             Ver. 20.0  Release Date: 06/01/2013  License ID 1233

                           Analysis prepared by:

                           PENCO a Cannon Company
                            16842 Von Karman Ave
                                  Ste. 150


****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  220139 XBC RIVERSIDE
  PROPOSED 100-YR FOR DA1
  CANNONCORP.US

----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.96
    TOTAL CATCHMENT AREA(ACRES) =    6.70
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.100
    LOW LOSS FRACTION = 0.206
    TIME OF CONCENTRATION(MIN.) = 11.61
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.34
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.88
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.27
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.17
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.02
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.52

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.42
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.66

****************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.13      0.0000      0.00  Q         .         .         .         .
  0.32      0.0041      0.51  .Q        .         .         .         .
  0.51      0.0124      0.52  .Q        .         .         .         .
  0.71      0.0207      0.52  .Q        .         .         .         .
  0.90      0.0290      0.52  .Q        .         .         .         .
  1.10      0.0375      0.53  .Q        .         .         .         .
  1.29      0.0460      0.53  .Q        .         .         .         .
  1.48      0.0545      0.54  .Q        .         .         .         .
  1.68      0.0631      0.54  .Q        .         .         .         .
  1.87      0.0718      0.55  .Q        .         .         .         .
  2.06      0.0806      0.55  .Q        .         .         .         .
  2.26      0.0894      0.55  .Q        .         .         .         .
  2.45      0.0983      0.56  .Q        .         .         .         .
  2.64      0.1072      0.56  .Q        .         .         .         .
```

```
 2.84      0.1162      0.57  .Q        .         .         .         .
 3.03      0.1253      0.57  .Q        .         .         .         .
 3.22      0.1345      0.58  .Q        .         .         .         .
 3.42      0.1438      0.58  .Q        .         .         .         .
 3.61      0.1531      0.59  .Q        .         .         .         .
 3.81      0.1625      0.59  .Q        .         .         .         .
 4.00      0.1720      0.60  .Q        .         .         .         .
 4.19      0.1816      0.60  .Q        .         .         .         .
 4.39      0.1913      0.61  .Q        .         .         .         .
 4.58      0.2011      0.61  .Q        .         .         .         .
 4.77      0.2109      0.62  .Q        .         .         .         .
 4.97      0.2209      0.63  .Q        .         .         .         .
 5.16      0.2309      0.63  .Q        .         .         .         .
 5.35      0.2411      0.64  .Q        .         .         .         .
 5.55      0.2513      0.64  .Q        .         .         .         .
 5.74      0.2617      0.65  .Q        .         .         .         .
 5.93      0.2722      0.66  .Q        .         .         .         .
 6.13      0.2828      0.67  .Q        .         .         .         .
 6.32      0.2935      0.67  .Q        .         .         .         .
 6.52      0.3043      0.68  .Q        .         .         .         .
 6.71      0.3152      0.69  .Q        .         .         .         .
 6.90      0.3263      0.70  .Q        .         .         .         .
 7.10      0.3375      0.70  .Q        .         .         .         .
 7.29      0.3488      0.71  .Q        .         .         .         .
 7.48      0.3603      0.72  .Q        .         .         .         .
 7.68      0.3719      0.73  .Q        .         .         .         .
 7.87      0.3837      0.74  .Q        .         .         .         .
 8.06      0.3956      0.75  .Q        .         .         .         .
 8.26      0.4077      0.76  .Q        .         .         .         .
 8.45      0.4200      0.77  .Q        .         .         .         .
 8.64      0.4324      0.78  .Q        .         .         .         .
 8.84      0.4451      0.80  .Q        .         .         .         .
 9.03      0.4579      0.80  .Q        .         .         .         .
 9.23      0.4709      0.82  .Q        .         .         .         .
 9.42      0.4841      0.83  .Q        .         .         .         .
 9.61      0.4975      0.85  .Q        .         .         .         .
 9.81      0.5112      0.86  .Q        .         .         .         .
10.00      0.5251      0.88  .Q        .         .         .         .
10.19      0.5392      0.89  .Q        .         .         .         .
10.39      0.5536      0.91  .Q        .         .         .         .
10.58      0.5683      0.92  .Q        .         .         .         .
10.77      0.5833      0.95  .Q        .         .         .         .
10.97      0.5986      0.96  .Q        .         .         .         .
11.16      0.6142      0.99  .Q        .         .         .         .
11.35      0.6301      1.00  . Q       .         .         .         .
11.55      0.6464      1.04  . Q       .         .         .         .
11.74      0.6631      1.05  . Q       .         .         .         .
11.94      0.6803      1.09  . Q       .         .         .         .
12.13      0.6978      1.11  . Q       .         .         .         .
12.32      0.7168      1.26  . Q       .         .         .         .
12.52      0.7371      1.28  . Q       .         .         .         .
12.71      0.7580      1.33  . Q       .         .         .         .
12.90      0.7795      1.36  . Q       .         .         .         .
13.10      0.8016      1.42  . Q       .         .         .         .
13.29      0.8246      1.45  . Q       .         .         .         .
13.48      0.8483      1.52  .  Q      .         .         .         .
13.68      0.8730      1.56  .  Q      .         .         .         .
13.87      0.8987      1.65  .  Q      .         .         .         .
14.06      0.9256      1.70  .  Q      .         .         .         .
14.26      0.9541      1.86  .  Q      .         .         .         .
14.45      0.9845      1.93  .  Q      .         .         .         .
14.65      1.0168      2.10  .   Q     .         .         .         .
14.84      1.0512      2.20  .   Q     .         .         .         .
```

```
  15.03      1.0884      2.45  .   Q     .         .         .         .
  15.23      1.1292      2.65  .    Q    .         .         .         .
  15.42      1.1766      3.27  .     Q   .         .         .         .
  15.61      1.2346      3.98  .      Q  .         .         .         .
  15.81      1.3102      5.48  .         Q         .         .         .
  16.00      1.4117      7.21  .         .   Q     .         .         .
  16.19      1.6056     17.03  .         .         .         .   Q     .
  16.39      1.7783      4.56  .        Q.         .         .         .
  16.58      1.8380      2.90  .    Q    .         .         .         .
  16.77      1.8797      2.32  .   Q     .         .         .         .
  16.97      1.9143      2.01  .   Q     .         .         .         .
  17.16      1.9447      1.78  .  Q      .         .         .         .
  17.35      1.9718      1.61  .  Q      .         .         .         .
  17.55      1.9965      1.48  . Q       .         .         .         .
  17.74      2.0195      1.39  . Q       .         .         .         .
  17.94      2.0410      1.31  . Q       .         .         .         .
  18.13      2.0613      1.24  . Q       .         .         .         .
  18.32      2.0798      1.07  . Q       .         .         .         .
  18.52      2.0965      1.02  . Q       .         .         .         .
  18.71      2.1124      0.98  .Q        .         .         .         .
  18.90      2.1277      0.94  .Q        .         .         .         .
  19.10      2.1424      0.90  .Q        .         .         .         .
  19.29      2.1566      0.87  .Q        .         .         .         .
  19.48      2.1702      0.84  .Q        .         .         .         .
  19.68      2.1834      0.81  .Q        .         .         .         .
  19.87      2.1962      0.79  .Q        .         .         .         .
  20.06      2.2087      0.77  .Q        .         .         .         .
  20.26      2.2208      0.75  .Q        .         .         .         .
  20.45      2.2326      0.73  .Q        .         .         .         .
  20.65      2.2440      0.71  .Q        .         .         .         .
  20.84      2.2552      0.69  .Q        .         .         .         .
  21.03      2.2662      0.68  .Q        .         .         .         .
  21.23      2.2769      0.66  .Q        .         .         .         .
  21.42      2.2874      0.65  .Q        .         .         .         .
  21.61      2.2976      0.63  .Q        .         .         .         .
  21.81      2.3077      0.62  .Q        .         .         .         .
  22.00      2.3175      0.61  .Q        .         .         .         .
  22.19      2.3272      0.60  .Q        .         .         .         .
  22.39      2.3367      0.59  .Q        .         .         .         .
  22.58      2.3461      0.58  .Q        .         .         .         .
  22.77      2.3552      0.57  .Q        .         .         .         .
  22.97      2.3643      0.56  .Q        .         .         .         .
  23.16      2.3731      0.55  .Q        .         .         .         .
  23.36      2.3819      0.54  .Q        .         .         .         .
  23.55      2.3905      0.53  .Q        .         .         .         .
  23.74      2.3990      0.53  .Q        .         .         .         .
  23.94      2.4074      0.52  .Q        .         .         .         .
  24.13      2.4156      0.51  .Q        .         .         .         .
  24.32      2.4197      0.00  Q         .         .         .         .
 ----------------------------------------------------------------------------
--------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
               0%                            1440.1
              10%                             197.4
              20%                              58.1
              30%                              34.8
              40%                              23.2
```

50%	11.6
60%	11.6
70%	11.6
80%	11.6
90%	11.6

```
****************************************************************************
                     SMALL AREA UNIT HYDROGRAPH MODEL
============================================================================
         (C) Copyright 1989-2013 Advanced Engineering Software (aes)
             Ver. 20.0  Release Date: 06/01/2013  License ID 1233

                          Analysis prepared by:

                          PENCO a Cannon Company
                           16842 Von Karman Ave
                                 Ste. 150


****************************************************************************
----------------------------------------------------------------------------

 Problem Descriptions:
  220139 XBC RIVERSIDE
  PROPOSED 100-YR FOR DA2
  CANNONCORP.US

----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.98
    TOTAL CATCHMENT AREA(ACRES) =    3.43
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.100
    LOW LOSS FRACTION = 0.206
    TIME OF CONCENTRATION(MIN.) = 10.19
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) = 100
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.34
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.88
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  1.27
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  2.17
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  3.02
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  5.52

----------------------------------------------------------------------------

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     1.27
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.31

****************************************************************************
  TIME     VOLUME       Q    0.         2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.03      0.0000      0.00  Q          .         .         .         .
  0.20      0.0019      0.27  .Q         .         .         .         .
  0.37      0.0056      0.27  .Q         .         .         .         .
  0.54      0.0094      0.27  .Q         .         .         .         .
  0.71      0.0133      0.27  .Q         .         .         .         .
  0.88      0.0171      0.27  .Q         .         .         .         .
  1.05      0.0210      0.28  .Q         .         .         .         .
  1.22      0.0248      0.28  .Q         .         .         .         .
  1.39      0.0288      0.28  .Q         .         .         .         .
  1.56      0.0327      0.28  .Q         .         .         .         .
  1.73      0.0367      0.28  .Q         .         .         .         .
  1.90      0.0407      0.29  .Q         .         .         .         .
  2.07      0.0447      0.29  .Q         .         .         .         .
  2.24      0.0487      0.29  .Q         .         .         .         .
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```
 2.41      0.0528      0.29  .Q        .         .         .         .
 2.58      0.0569      0.29  .Q        .         .         .         .
 2.75      0.0610      0.29  .Q        .         .         .         .
 2.92      0.0652      0.30  .Q        .         .         .         .
 3.09      0.0694      0.30  .Q        .         .         .         .
 3.26      0.0736      0.30  .Q        .         .         .         .
 3.43      0.0778      0.30  .Q        .         .         .         .
 3.60      0.0821      0.31  .Q        .         .         .         .
 3.77      0.0865      0.31  .Q        .         .         .         .
 3.94      0.0908      0.31  .Q        .         .         .         .
 4.11      0.0952      0.31  .Q        .         .         .         .
 4.28      0.0996      0.32  .Q        .         .         .         .
 4.45      0.1041      0.32  .Q        .         .         .         .
 4.62      0.1086      0.32  .Q        .         .         .         .
 4.79      0.1131      0.32  .Q        .         .         .         .
 4.96      0.1177      0.33  .Q        .         .         .         .
 5.13      0.1223      0.33  .Q        .         .         .         .
 5.30      0.1269      0.33  .Q        .         .         .         .
 5.47      0.1316      0.34  .Q        .         .         .         .
 5.64      0.1364      0.34  .Q        .         .         .         .
 5.81      0.1411      0.34  .Q        .         .         .         .
 5.98      0.1460      0.35  .Q        .         .         .         .
 6.15      0.1508      0.35  .Q        .         .         .         .
 6.32      0.1557      0.35  .Q        .         .         .         .
 6.49      0.1607      0.35  .Q        .         .         .         .
 6.66      0.1657      0.36  .Q        .         .         .         .
 6.83      0.1708      0.36  .Q        .         .         .         .
 7.00      0.1759      0.37  .Q        .         .         .         .
 7.17      0.1811      0.37  .Q        .         .         .         .
 7.34      0.1863      0.37  .Q        .         .         .         .
 7.51      0.1916      0.38  .Q        .         .         .         .
 7.68      0.1969      0.38  .Q        .         .         .         .
 7.85      0.2023      0.39  .Q        .         .         .         .
 8.02      0.2078      0.39  .Q        .         .         .         .
 8.19      0.2133      0.40  .Q        .         .         .         .
 8.36      0.2189      0.40  .Q        .         .         .         .
 8.53      0.2246      0.41  .Q        .         .         .         .
 8.70      0.2303      0.41  .Q        .         .         .         .
 8.87      0.2361      0.42  .Q        .         .         .         .
 9.04      0.2420      0.42  .Q        .         .         .         .
 9.21      0.2480      0.43  .Q        .         .         .         .
 9.38      0.2540      0.44  .Q        .         .         .         .
 9.55      0.2602      0.44  .Q        .         .         .         .
 9.72      0.2664      0.45  .Q        .         .         .         .
 9.89      0.2727      0.45  .Q        .         .         .         .
10.06      0.2792      0.46  .Q        .         .         .         .
10.23      0.2857      0.47  .Q        .         .         .         .
10.39      0.2923      0.48  .Q        .         .         .         .
10.56      0.2991      0.48  .Q        .         .         .         .
10.73      0.3059      0.49  .Q        .         .         .         .
10.90      0.3129      0.50  . Q       .         .         .         .
11.07      0.3200      0.51  . Q       .         .         .         .
11.24      0.3273      0.52  . Q       .         .         .         .
11.41      0.3347      0.53  . Q       .         .         .         .
11.58      0.3422      0.54  . Q       .         .         .         .
11.75      0.3499      0.56  . Q       .         .         .         .
11.92      0.3578      0.57  . Q       .         .         .         .
12.09      0.3660      0.60  . Q       .         .         .         .
12.26      0.3747      0.65  . Q       .         .         .         .
12.43      0.3840      0.67  . Q       .         .         .         .
12.60      0.3935      0.68  . Q       .         .         .         .
12.77      0.4032      0.70  . Q       .         .         .         .
12.94      0.4131      0.72  . Q       .         .         .         .
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13.11      0.4234      0.74  . Q       .         .         .         .
13.28      0.4340      0.76  .  Q      .         .         .         .
13.45      0.4448      0.79  .  Q      .         .         .         .
13.62      0.4561      0.81  .  Q      .         .         .         .
13.79      0.4678      0.85  .  Q      .         .         .         .
13.96      0.4799      0.87  .  Q      .         .         .         .
14.13      0.4926      0.94  .  Q      .         .         .         .
14.30      0.5060      0.97  .  Q      .         .         .         .
14.47      0.5202      1.04  .   Q     .         .         .         .
14.64      0.5351      1.08  .   Q     .         .         .         .
14.81      0.5509      1.17  .   Q     .         .         .         .
14.98      0.5678      1.23  .   Q     .         .         .         .
15.15      0.5862      1.39  .    Q    .         .         .         .
15.32      0.6065      1.50  .     Q   .         .         .         .
15.49      0.6309      1.98  .      Q  .         .         .         .
15.66      0.6605      2.23  .       Q .         .         .         .
15.83      0.6977      3.07  .         . Q       .         .         .
16.00      0.7475      4.03  .         .     Q   .         .         .
16.17      0.8423      9.48  .         .         .         .      Q  .
16.34      0.9268      2.56  .         Q         .         .         .
16.51      0.9563      1.64  .     Q   .         .         .         .
16.68      0.9769      1.29  .    Q    .         .         .         .
16.85      0.9939      1.12  .   Q     .         .         .         .
17.02      1.0089      1.01  .   Q     .         .         .         .
17.19      1.0222      0.90  .  Q      .         .         .         .
17.36      1.0344      0.83  .  Q      .         .         .         .
17.53      1.0457      0.78  .  Q      .         .         .         .
17.70      1.0562      0.73  . Q       .         .         .         .
17.87      1.0662      0.69  . Q       .         .         .         .
18.04      1.0757      0.66  . Q       .         .         .         .
18.21      1.0843      0.57  . Q       .         .         .         .
18.38      1.0922      0.55  . Q       .         .         .         .
18.55      1.0998      0.53  . Q       .         .         .         .
18.72      1.1070      0.51  . Q       .         .         .         .
18.89      1.1140      0.49  .Q        .         .         .         .
19.06      1.1207      0.47  .Q        .         .         .         .
19.23      1.1273      0.46  .Q        .         .         .         .
19.40      1.1336      0.44  .Q        .         .         .         .
19.57      1.1397      0.43  .Q        .         .         .         .
19.74      1.1457      0.42  .Q        .         .         .         .
19.91      1.1515      0.41  .Q        .         .         .         .
20.08      1.1572      0.40  .Q        .         .         .         .
20.25      1.1627      0.39  .Q        .         .         .         .
20.42      1.1681      0.38  .Q        .         .         .         .
20.59      1.1734      0.37  .Q        .         .         .         .
20.76      1.1786      0.36  .Q        .         .         .         .
20.93      1.1836      0.36  .Q        .         .         .         .
21.10      1.1886      0.35  .Q        .         .         .         .
21.27      1.1935      0.34  .Q        .         .         .         .
21.44      1.1982      0.34  .Q        .         .         .         .
21.61      1.2029      0.33  .Q        .         .         .         .
21.77      1.2075      0.33  .Q        .         .         .         .
21.94      1.2121      0.32  .Q        .         .         .         .
22.11      1.2165      0.31  .Q        .         .         .         .
22.28      1.2209      0.31  .Q        .         .         .         .
22.45      1.2252      0.31  .Q        .         .         .         .
22.62      1.2295      0.30  .Q        .         .         .         .
22.79      1.2337      0.30  .Q        .         .         .         .
22.96      1.2378      0.29  .Q        .         .         .         .
23.13      1.2419      0.29  .Q        .         .         .         .
23.30      1.2459      0.28  .Q        .         .         .         .
23.47      1.2499      0.28  .Q        .         .         .         .
23.64      1.2538      0.28  .Q        .         .         .         .
```

```
  23.81      1.2577      0.27  .Q        .        .        .        .
  23.98      1.2615      0.27  .Q        .        .        .        .
  24.15      1.2652      0.27  .Q        .        .        .        .
  24.32      1.2671      0.00  Q         .        .        .        .
 ----------------------------------------------------------------------------
--------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                Duration
        Peak Flow Rate                     (minutes)
    =======================                =========
              0%                            1447.1
             10%                             173.2
             20%                              61.1
             30%                              30.6
             40%                              20.4
             50%                              10.2
             60%                              10.2
             70%                              10.2
             80%                              10.2
             90%                              10.2
```

Attachment 6. Level Pool Routing Calculation Tables.

DA1 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
0	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.
10	0.1	0.1	0.06	0.1	0.02
15	0.32	0.42	0.29	0.48	0.1
20	0.51	0.83	0.67	1.12	0.22
25	0.52	1.03	1.02	1.7	0.34
30	0.52	1.03	1.34	2.06	0.36
35	0.52	1.04	1.67	2.38	0.36
40	0.52	1.04	1.99	2.71	0.36
45	0.52	1.04	2.32	3.03	0.36
50	0.52	1.04	2.64	3.36	0.36
55	0.52	1.04	2.97	3.68	0.36
60	0.53	1.05	3.3	4.01	0.36
65	0.53	1.05	3.64	4.35	0.36
70	0.53	1.06	3.98	4.7	0.36
75	0.53	1.06	4.33	5.04	0.36
80	0.53	1.06	4.67	5.39	0.36
85	0.54	1.07	5.03	5.74	0.36
90	0.54	1.08	5.39	6.1	0.36
95	0.54	1.08	5.75	6.47	0.36
100	0.54	1.08	6.12	6.83	0.36
105	0.54	1.08	6.49	7.2	0.36
110	0.55	1.09	6.86	7.58	0.36
115	0.55	1.1	7.25	7.96	0.36
120	0.55	1.1	7.63	8.35	0.36
125	0.55	1.1	8.02	8.73	0.36
130	0.55	1.1	8.4	9.12	0.36
135	0.55	1.1	8.79	9.5	0.36
140	0.55	1.1	9.18	9.89	0.36
145	0.56	1.11	9.57	10.29	0.36
150	0.56	1.12	9.98	10.69	0.36
155	0.56	1.12	10.38	11.1	0.36
160	0.56	1.12	10.79	11.5	0.36
165	0.57	1.13	11.2	11.91	0.36
170	0.57	1.14	11.62	12.33	0.36
175	0.57	1.14	12.04	12.76	0.36
180	0.57	1.14	12.47	13.18	0.36
185	0.57	1.14	12.9	13.61	0.36
190	0.58	1.15	13.33	14.05	0.36
195	0.58	1.16	13.77	14.49	0.36
200	0.58	1.16	14.22	14.93	0.36
205	0.58	1.16	14.66	15.38	0.36
210	0.58	1.16	15.11	15.83	0.36
215	0.59	1.17	15.57	16.29	0.36
220	0.59	1.18	16.03	16.75	0.36
225	0.59	1.18	16.5	17.21	0.36
230	0.59	1.18	16.97	17.68	0.36
235	0.6	1.19	17.44	18.15	0.36
240	0.6	1.2	17.92	18.63	0.36
245	0.6	1.2	18.4	19.12	0.36
250	0.6	1.2	18.89	19.6	0.36
255	0.6	1.2	19.38	20.09	0.36
260	0.61	1.21	19.87	20.59	0.36
265	0.61	1.22	20.37	21.09	0.36
270	0.61	1.22	20.88	21.59	0.36
275	0.61	1.22	21.38	22.1	0.36

DA1 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
280	0.61	1.22	21.89	22.61	0.36
285	0.62	1.23	22.41	23.13	0.36
290	0.62	1.24	22.94	23.65	0.36
295	0.63	1.25	23.48	24.19	0.36
300	0.63	1.26	24.02	24.73	0.36
305	0.63	1.26	24.56	25.28	0.36
310	0.63	1.26	25.11	25.82	0.36
315	0.63	1.27	25.66	26.37	0.36
320	0.64	1.27	26.22	26.93	0.36
325	0.64	1.28	26.78	27.5	0.36
330	0.64	1.28	27.35	28.06	0.36
335	0.64	1.28	27.91	28.63	0.36
340	0.65	1.29	28.49	29.2	0.36
345	0.65	1.3	29.07	29.78	0.36
350	0.65	1.31	29.66	30.37	0.36
355	0.66	1.31	30.26	30.97	0.36
360	0.66	1.32	30.87	31.58	0.36
365	0.67	1.33	31.48	32.2	0.36
370	0.67	1.34	32.1	32.82	0.36
375	0.67	1.34	32.73	33.44	0.36
380	0.67	1.34	33.35	34.07	0.36
385	0.67	1.35	33.99	34.7	0.36
390	0.68	1.35	34.62	35.34	0.36
395	0.68	1.36	35.27	35.99	0.36
400	0.69	1.37	35.93	36.64	0.36
405	0.69	1.38	36.59	37.31	0.36
410	0.7	1.39	37.27	37.98	0.36
415	0.7	1.4	37.95	38.66	0.36
420	0.7	1.4	38.63	39.35	0.36
425	0.7	1.4	39.32	40.03	0.36
430	0.7	1.4	40.01	40.72	0.36
435	0.71	1.41	40.7	41.42	0.36
440	0.71	1.42	41.41	42.12	0.36
445	0.72	1.43	42.12	42.84	0.36
450	0.72	1.44	42.84	43.56	0.36
455	0.73	1.45	43.58	44.29	0.36
460	0.73	1.45	44.31	45.03	0.36
465	0.73	1.46	45.06	45.78	0.36
470	0.74	1.47	45.82	46.53	0.36
475	0.74	1.48	46.59	47.3	0.36
480	0.75	1.49	47.36	48.07	0.36
485	0.75	1.5	48.14	48.86	0.36
490	0.76	1.51	48.93	49.65	0.36
495	0.76	1.51	49.73	50.45	0.36
500	0.76	1.52	50.54	51.26	0.36
505	0.77	1.53	51.36	52.07	0.36
510	0.77	1.54	52.19	52.9	0.36
515	0.78	1.55	53.02	53.73	0.36
520	0.78	1.56	53.86	54.58	0.36
525	0.79	1.57	54.72	55.44	0.36
530	0.8	1.59	55.6	56.31	0.36
535	0.8	1.6	56.48	57.2	0.36
540	0.8	1.6	57.37	58.08	0.36
545	0.81	1.61	58.26	58.97	0.36
550	0.81	1.62	59.16	59.88	0.36
555	0.82	1.63	60.08	60.8	0.36
560	0.83	1.65	61.01	61.73	0.36

DA1 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
565	0.83	1.66	61.95	62.67	0.36
570	0.84	1.67	62.91	63.62	0.36
575	0.85	1.69	63.88	64.59	0.36
580	0.85	1.7	64.86	65.58	0.36
585	0.86	1.71	65.86	66.57	0.36
590	0.86	1.72	66.86	67.58	0.36
595	0.87	1.73	67.88	68.6	0.36
600	0.88	1.75	68.92	69.63	0.36
605	0.88	1.76	69.97	70.68	0.36
610	0.89	1.77	71.02	71.74	0.36
615	0.9	1.78	72.09	72.81	0.36
620	0.9	1.8	73.18	73.89	0.36
625	0.91	1.82	74.28	75.	0.36
630	0.92	1.83	75.39	76.11	0.36
635	0.92	1.84	76.51	77.23	0.36
640	0.93	1.85	77.65	78.37	0.36
645	0.95	1.88	78.82	79.53	0.36
650	0.95	1.9	80.	80.72	0.36
655	0.96	1.91	81.2	81.91	0.36
660	0.96	1.92	82.41	83.12	0.36
665	0.98	1.94	83.63	84.35	0.36
670	0.99	1.97	84.89	85.6	0.36
675	0.99	1.99	86.16	86.87	0.36
680	1.	1.99	87.44	88.15	0.36
685	1.01	2.01	88.73	89.45	0.36
690	1.03	2.04	90.06	90.78	0.36
695	1.04	2.07	91.42	92.13	0.36
700	1.05	2.09	92.79	93.51	0.36
705	1.05	2.1	94.18	94.89	0.36
710	1.07	2.12	95.58	96.3	0.36
715	1.09	2.15	97.02	97.73	0.36
720	1.1	2.18	98.49	99.2	0.36
725	1.11	2.2	99.97	100.69	0.36
730	1.14	2.24	101.5	102.22	0.36
735	1.2	2.34	103.13	103.85	0.36
740	1.26	2.47	104.88	105.6	0.36
745	1.27	2.53	106.7	107.41	0.36
750	1.28	2.55	108.53	109.25	0.36
755	1.3	2.57	110.39	111.11	0.36
760	1.32	2.62	112.29	113.01	0.36
765	1.34	2.65	114.23	114.95	0.36
770	1.35	2.69	116.2	116.92	0.36
775	1.37	2.71	118.2	118.92	0.36
780	1.39	2.76	120.24	120.96	0.36
785	1.42	2.81	122.33	123.05	0.36
790	1.43	2.85	124.46	125.18	0.36
795	1.44	2.87	126.62	127.34	0.36
800	1.47	2.91	128.82	129.53	0.36
805	1.5	2.96	131.06	131.78	0.36
810	1.52	3.02	133.37	134.08	0.36
815	1.54	3.06	135.72	136.43	0.36
820	1.56	3.1	138.1	138.82	0.36
825	1.59	3.15	140.54	141.25	0.36
830	1.63	3.23	143.05	143.76	0.36
835	1.66	3.29	145.63	146.34	0.36
840	1.68	3.35	148.26	148.97	0.36
845	1.72	3.4	150.95	151.66	0.36

DA1 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
850	1.79	3.5	153.01	154.45	0.72
855	1.85	3.64	154.53	156.65	1.06
860	1.89	3.74	155.66	158.27	1.31
865	1.92	3.8	156.49	159.47	1.49
870	1.97	3.89	157.13	160.38	1.63
875	2.04	4.02	157.65	161.14	1.74
880	2.11	4.15	158.12	161.81	1.85
885	2.15	4.26	158.51	162.38	1.93
890	2.2	4.35	158.85	162.86	2.01
895	2.3	4.5	159.18	163.34	2.08
900	2.41	4.71	159.56	163.89	2.16
905	2.5	4.91	159.97	164.48	2.25
910	2.59	5.09	160.37	165.06	2.34
915	2.72	5.3	160.8	165.68	2.44
920	2.99	5.7	161.38	166.5	2.56
925	3.26	6.25	162.15	167.62	2.73
930	3.57	6.83	163.18	168.98	2.9
935	3.88	7.45	164.44	170.63	3.09
940	4.41	8.29	166.06	172.73	3.34
945	5.03	9.44	168.17	175.49	3.66
950	5.69	10.72	170.78	178.9	4.06
955	6.45	12.14	173.88	182.93	4.53
960	7.21	13.66	177.72	187.54	4.91
965	11.52	18.73	185.15	196.45	5.65
970	15.82	27.34	200.14	212.49	6.17
975	13.29	29.11	215.93	229.26	6.66
980	8.09	21.38	223.52	237.32	6.9
985	4.33	12.42	222.23	235.94	6.86
990	3.6	7.93	216.78	230.16	6.69
995	2.89	6.49	210.29	223.27	6.49
1000	2.64	5.53	203.28	215.82	6.27
1005	2.38	5.02	196.19	208.29	6.05
1010	2.22	4.6	189.12	200.79	5.83
1015	2.09	4.31	182.64	193.44	5.4
1020	1.97	4.07	177.03	186.71	4.84
1025	1.87	3.85	172.3	180.87	4.29
1030	1.77	3.65	168.52	175.95	3.71
1035	1.7	3.47	165.49	172.	3.25
1040	1.62	3.32	163.06	168.82	2.88
1045	1.57	3.19	161.2	166.25	2.52
1050	1.51	3.08	159.83	164.28	2.22
1055	1.46	2.98	158.81	162.81	2.
1060	1.42	2.89	158.04	161.7	1.83
1065	1.39	2.81	157.45	160.85	1.7
1070	1.35	2.74	156.99	160.19	1.6
1075	1.32	2.67	156.63	159.67	1.52
1080	1.29	2.61	156.33	159.24	1.45
1085	1.26	2.55	156.08	158.88	1.4
1090	1.21	2.46	155.85	158.55	1.35
1095	1.13	2.34	155.61	158.19	1.29
1100	1.07	2.2	155.34	157.81	1.23
1105	1.05	2.11	155.09	157.45	1.18
1110	1.03	2.07	154.89	157.16	1.14
1115	1.01	2.03	154.73	156.92	1.1
1120	0.99	2.	154.59	156.72	1.07
1125	0.97	1.96	154.46	156.55	1.04
1130	0.95	1.93	154.36	156.39	1.02

DA1 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
1135	0.94	1.89	154.26	156.25	1.
1140	0.92	1.86	154.16	156.11	0.97
1145	0.9	1.82	154.08	155.99	0.96
1150	0.89	1.79	153.99	155.87	0.94
1155	0.88	1.77	153.92	155.76	0.92
1160	0.86	1.74	153.85	155.66	0.91
1165	0.85	1.71	153.78	155.56	0.89
1170	0.84	1.69	153.72	155.47	0.88
1175	0.82	1.66	153.65	155.38	0.86
1180	0.81	1.64	153.59	155.29	0.85
1185	0.8	1.61	153.53	155.21	0.84
1190	0.79	1.6	153.48	155.13	0.82
1195	0.79	1.58	153.43	155.06	0.81
1200	0.78	1.56	153.39	154.99	0.8
1205	0.77	1.54	153.34	154.93	0.79
1210	0.76	1.53	153.3	154.87	0.78
1215	0.75	1.51	153.26	154.81	0.78
1220	0.74	1.49	153.22	154.75	0.77
1225	0.73	1.48	153.18	154.7	0.76
1230	0.73	1.46	153.14	154.64	0.75
1235	0.72	1.44	153.1	154.58	0.74
1240	0.71	1.42	153.06	154.53	0.73
1245	0.7	1.41	153.02	154.47	0.72
1250	0.69	1.39	152.98	154.41	0.71
1255	0.69	1.38	152.95	154.36	0.71
1260	0.68	1.37	152.92	154.31	0.7
1265	0.67	1.36	152.89	154.27	0.69
1270	0.67	1.34	152.85	154.23	0.69
1275	0.66	1.33	152.82	154.18	0.68
1280	0.65	1.31	152.79	154.13	0.67
1285	0.65	1.3	152.76	154.1	0.67
1290	0.64	1.29	152.73	154.05	0.66
1295	0.63	1.27	152.7	154.01	0.65
1300	0.63	1.26	152.67	153.96	0.65
1305	0.62	1.25	152.64	153.92	0.64
1310	0.62	1.24	152.62	153.88	0.63
1315	0.61	1.23	152.59	153.85	0.63

DA2 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
0	0.	0.	0.	0.	0.
5	0.08	0.08	0.05	0.08	0.02
10	0.22	0.3	0.21	0.35	0.07
15	0.27	0.49	0.42	0.7	0.14
20	0.27	0.54	0.58	0.96	0.19
25	0.27	0.54	0.68	1.12	0.22
30	0.27	0.54	0.74	1.22	0.24
35	0.27	0.54	0.77	1.28	0.25
40	0.27	0.54	0.79	1.31	0.26
45	0.27	0.54	0.8	1.33	0.26
50	0.27	0.54	0.81	1.34	0.27
55	0.27	0.54	0.82	1.35	0.27
60	0.28	0.55	0.83	1.37	0.27
65	0.28	0.56	0.84	1.38	0.27
70	0.28	0.56	0.84	1.4	0.28
75	0.28	0.56	0.85	1.4	0.28
80	0.28	0.56	0.85	1.41	0.28
85	0.28	0.56	0.85	1.41	0.28
90	0.28	0.56	0.85	1.41	0.28
95	0.28	0.56	0.85	1.41	0.28
100	0.28	0.56	0.85	1.41	0.28
105	0.28	0.56	0.85	1.42	0.28
110	0.29	0.57	0.86	1.42	0.28
115	0.29	0.58	0.87	1.44	0.28
120	0.29	0.58	0.87	1.45	0.29
125	0.29	0.58	0.88	1.45	0.29
130	0.29	0.58	0.88	1.46	0.29
135	0.29	0.58	0.88	1.46	0.29
140	0.29	0.58	0.88	1.46	0.29
145	0.29	0.58	0.88	1.46	0.29
150	0.29	0.58	0.88	1.46	0.29
155	0.29	0.58	0.88	1.46	0.29
160	0.29	0.58	0.88	1.46	0.29
165	0.29	0.58	0.88	1.46	0.29
170	0.29	0.58	0.89	1.47	0.29
175	0.3	0.59	0.9	1.48	0.29
180	0.3	0.6	0.9	1.5	0.3
185	0.3	0.6	0.91	1.5	0.3
190	0.3	0.6	0.91	1.51	0.3
195	0.3	0.6	0.91	1.51	0.3
200	0.3	0.6	0.91	1.51	0.3
205	0.3	0.6	0.91	1.51	0.3
210	0.3	0.6	0.92	1.52	0.3
215	0.31	0.61	0.92	1.53	0.3
220	0.31	0.62	0.93	1.54	0.31
225	0.31	0.62	0.94	1.55	0.31
230	0.31	0.62	0.94	1.56	0.31
235	0.31	0.62	0.94	1.56	0.31
240	0.31	0.62	0.94	1.56	0.31
245	0.31	0.62	0.94	1.56	0.31
250	0.31	0.62	0.95	1.57	0.31
255	0.32	0.63	0.95	1.58	0.31
260	0.32	0.64	0.96	1.59	0.32
265	0.32	0.64	0.97	1.6	0.32
270	0.32	0.64	0.97	1.61	0.32
275	0.32	0.64	0.97	1.61	0.32

DA2 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
280	0.32	0.64	0.97	1.61	0.32
285	0.32	0.64	0.98	1.61	0.32
290	0.32	0.64	0.98	1.62	0.32
295	0.33	0.65	0.98	1.63	0.32
300	0.33	0.66	0.99	1.64	0.32
305	0.33	0.66	1.	1.65	0.33
310	0.33	0.66	1.	1.66	0.33
315	0.33	0.66	1.	1.66	0.33
320	0.33	0.66	1.01	1.67	0.33
325	0.34	0.67	1.01	1.67	0.33
330	0.34	0.68	1.02	1.69	0.33
335	0.34	0.68	1.03	1.7	0.34
340	0.34	0.68	1.03	1.71	0.34
345	0.34	0.68	1.03	1.71	0.34
350	0.34	0.68	1.04	1.71	0.34
355	0.35	0.69	1.04	1.72	0.34
360	0.35	0.7	1.05	1.74	0.34
365	0.35	0.7	1.06	1.75	0.35
370	0.35	0.7	1.06	1.76	0.35
375	0.35	0.7	1.06	1.76	0.35
380	0.35	0.7	1.07	1.76	0.35
385	0.35	0.7	1.07	1.77	0.35
390	0.35	0.7	1.07	1.77	0.35
395	0.36	0.71	1.07	1.77	0.35
400	0.36	0.72	1.08	1.79	0.35
405	0.36	0.72	1.09	1.8	0.36
410	0.36	0.72	1.09	1.81	0.36
415	0.37	0.73	1.1	1.82	0.36
420	0.37	0.74	1.12	1.84	0.36
425	0.37	0.74	1.15	1.86	0.36
430	0.37	0.74	1.17	1.89	0.36
435	0.37	0.74	1.2	1.91	0.36
440	0.37	0.74	1.22	1.94	0.36
445	0.37	0.74	1.25	1.97	0.36
450	0.38	0.75	1.29	2.01	0.36
455	0.38	0.76	1.34	2.05	0.36
460	0.38	0.76	1.38	2.1	0.36
465	0.38	0.76	1.43	2.14	0.36
470	0.39	0.77	1.49	2.2	0.36
475	0.39	0.78	1.55	2.27	0.36
480	0.39	0.78	1.62	2.33	0.36
485	0.39	0.78	1.69	2.4	0.36
490	0.4	0.79	1.76	2.48	0.36
495	0.4	0.8	1.85	2.56	0.36
500	0.4	0.8	1.93	2.65	0.36
505	0.4	0.8	2.02	2.74	0.36
510	0.41	0.81	2.12	2.83	0.36
515	0.41	0.82	2.22	2.93	0.36
520	0.41	0.82	2.32	3.04	0.36
525	0.41	0.82	2.43	3.15	0.36
530	0.42	0.83	2.55	3.26	0.36
535	0.42	0.84	2.67	3.39	0.36
540	0.42	0.84	2.8	3.51	0.36
545	0.42	0.84	2.92	3.64	0.36
550	0.43	0.85	3.06	3.77	0.36
555	0.43	0.86	3.2	3.92	0.36
560	0.44	0.87	3.36	4.07	0.36

DA2 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
565	0.44	0.88	3.52	4.24	0.36
570	0.44	0.88	3.69	4.4	0.36
575	0.44	0.88	3.85	4.57	0.36
580	0.45	0.89	4.03	4.74	0.36
585	0.45	0.9	4.21	4.92	0.36
590	0.45	0.9	4.39	5.11	0.36
595	0.45	0.9	4.58	5.3	0.36
600	0.46	0.91	4.77	5.49	0.36
605	0.46	0.92	4.98	5.69	0.36
610	0.47	0.93	5.19	5.9	0.36
615	0.47	0.94	5.41	6.13	0.36
620	0.48	0.95	5.64	6.36	0.36
625	0.48	0.96	5.89	6.6	0.36
630	0.48	0.96	6.13	6.85	0.36
635	0.48	0.96	6.38	7.09	0.36
640	0.49	0.97	6.63	7.34	0.36
645	0.49	0.98	6.89	7.61	0.36
650	0.5	0.99	7.16	7.88	0.36
655	0.5	1.	7.45	8.16	0.36
660	0.51	1.01	7.74	8.45	0.36
665	0.51	1.02	8.04	8.75	0.36
670	0.52	1.03	8.35	9.07	0.36
675	0.52	1.04	8.67	9.39	0.36
680	0.53	1.05	9.	9.72	0.36
685	0.53	1.06	9.34	10.06	0.36
690	0.54	1.07	9.7	10.41	0.36
695	0.54	1.08	10.06	10.77	0.36
700	0.55	1.09	10.43	11.15	0.36
705	0.56	1.11	10.83	11.54	0.36
710	0.56	1.12	11.24	11.95	0.36
715	0.57	1.13	11.66	12.37	0.36
720	0.58	1.15	12.1	12.81	0.36
725	0.6	1.18	12.56	13.28	0.36
730	0.62	1.22	13.07	13.78	0.36
735	0.65	1.27	13.62	14.34	0.36
740	0.66	1.31	14.22	14.93	0.36
745	0.67	1.33	14.83	15.54	0.36
750	0.67	1.34	15.45	16.17	0.36
755	0.68	1.35	16.09	16.81	0.36
760	0.69	1.37	16.74	17.46	0.36
765	0.7	1.39	17.42	18.13	0.36
770	0.71	1.41	18.11	18.82	0.36
775	0.72	1.42	18.82	19.53	0.36
780	0.73	1.44	19.54	20.26	0.36
785	0.74	1.46	20.29	21.01	0.36
790	0.75	1.48	21.06	21.78	0.36
795	0.76	1.5	21.85	22.57	0.36
800	0.77	1.53	22.66	23.38	0.36
805	0.78	1.55	23.5	24.21	0.36
810	0.8	1.58	24.36	25.08	0.36
815	0.81	1.6	25.25	25.97	0.36
820	0.82	1.63	26.16	26.88	0.36
825	0.84	1.66	27.11	27.82	0.36
830	0.86	1.7	28.09	28.81	0.36
835	0.86	1.72	29.1	29.81	0.36
840	0.89	1.75	30.13	30.85	0.36
845	0.92	1.81	31.22	31.94	0.36

DA2 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
850	0.95	1.87	32.38	33.09	0.36
855	0.96	1.91	33.57	34.28	0.36
860	0.98	1.94	34.8	35.51	0.36
865	1.02	2.	36.09	36.8	0.36
870	1.05	2.07	37.44	38.15	0.36
875	1.07	2.11	38.83	39.55	0.36
880	1.09	2.16	40.28	41.	0.36
885	1.14	2.23	41.8	42.51	0.36
890	1.18	2.32	43.4	44.11	0.36
895	1.21	2.39	45.07	45.78	0.36
900	1.25	2.46	46.81	47.53	0.36
905	1.33	2.58	48.67	49.39	0.36
910	1.4	2.73	50.69	51.4	0.36
915	1.45	2.86	52.83	53.54	0.36
920	1.54	2.99	55.1	55.82	0.36
925	1.77	3.31	57.7	58.41	0.36
930	1.99	3.77	60.75	61.47	0.36
935	2.12	4.11	64.15	64.86	0.36
940	2.26	4.38	67.81	68.53	0.36
945	2.67	4.94	72.04	72.75	0.36
950	3.09	5.76	77.09	77.8	0.36
955	3.56	6.65	83.02	83.73	0.36
960	4.03	7.59	89.89	90.61	0.36
965	6.7	10.73	99.91	100.62	0.36
970	9.37	16.07	115.27	115.98	0.36
975	6.22	15.6	130.15	130.87	0.36
980	2.83	9.05	138.49	139.21	0.36
985	2.15	4.98	142.75	143.47	0.36
990	1.69	3.84	145.88	146.59	0.36
995	1.49	3.18	148.34	149.06	0.36
1000	1.32	2.81	150.44	151.15	0.36
1005	1.22	2.54	152.26	152.97	0.36
1010	1.14	2.36	153.49	154.62	0.56
1015	1.08	2.21	154.25	155.71	0.73
1020	1.02	2.1	154.69	156.35	0.83
1025	0.97	1.99	154.93	156.69	0.88
1030	0.92	1.88	155.02	156.81	0.9
1035	0.88	1.79	155.01	156.81	0.9
1040	0.84	1.72	154.96	156.73	0.89
1045	0.81	1.65	154.88	156.61	0.87
1050	0.79	1.6	154.79	156.48	0.85
1055	0.76	1.55	154.69	156.34	0.83
1060	0.74	1.5	154.59	156.19	0.8
1065	0.72	1.46	154.48	156.05	0.78
1070	0.7	1.42	154.38	155.9	0.76
1075	0.68	1.38	154.29	155.76	0.74
1080	0.67	1.35	154.2	155.64	0.72
1085	0.64	1.3	154.11	155.51	0.7
1090	0.59	1.23	154.	155.34	0.67
1095	0.57	1.16	153.87	155.15	0.64
1100	0.56	1.12	153.75	154.99	0.62
1105	0.55	1.1	153.66	154.85	0.6
1110	0.54	1.08	153.58	154.74	0.58
1115	0.53	1.06	153.51	154.64	0.57
1120	0.52	1.04	153.45	154.55	0.55
1125	0.51	1.02	153.39	154.47	0.54
1130	0.5	1.	153.34	154.39	0.53

DA2 stage-storage routing

time	inflow	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow
1135	0.49	0.98	153.29	154.32	0.52
1140	0.48	0.96	153.24	154.25	0.51
1145	0.47	0.95	153.19	154.19	0.5
1150	0.46	0.93	153.15	154.13	0.49
1155	0.46	0.92	153.12	154.07	0.48
1160	0.45	0.91	153.08	154.02	0.47
1165	0.44	0.89	153.04	153.97	0.46
1170	0.43	0.87	153.01	153.91	0.45
1175	0.43	0.86	152.97	153.87	0.45
1180	0.42	0.85	152.94	153.83	0.44
1185	0.42	0.84	152.92	153.79	0.44
1190	0.41	0.83	152.89	153.75	0.43
1195	0.41	0.82	152.87	153.72	0.42
1200	0.4	0.81	152.84	153.68	0.42
1205	0.4	0.8	152.82	153.65	0.41
1210	0.39	0.79	152.8	153.62	0.41
1215	0.39	0.78	152.78	153.58	0.4
1220	0.39	0.78	152.75	153.55	0.4
1225	0.38	0.77	152.73	153.52	0.39
1230	0.38	0.76	152.71	153.49	0.39
1235	0.37	0.75	152.69	153.45	0.38
1240	0.37	0.74	152.66	153.42	0.38
1245	0.36	0.73	152.64	153.39	0.37
1250	0.36	0.72	152.62	153.36	0.37
1255	0.36	0.72	152.61	153.34	0.37
1260	0.36	0.72	152.6	153.32	0.36
1265	0.35	0.71	152.58	153.3	0.36
1270	0.35	0.7	152.56	153.28	0.36
1275	0.34	0.69	152.53	153.25	0.36
1280	0.34	0.68	152.5	153.22	0.36
1285	0.34	0.68	152.47	153.18	0.36
1290	0.34	0.68	152.43	153.14	0.36
1295	0.33	0.67	152.38	153.1	0.36
1300	0.33	0.66	152.33	153.04	0.36
1305	0.33	0.66	152.27	152.99	0.36
1310	0.33	0.66	152.21	152.93	0.36
1315	0.32	0.65	152.15	152.86	0.36

Attachment 7. NRCS Hydrologic Soil Maps

Hydrologic Soil Group—San Bernardino County Southwestern Part, California

Map Scale: 1:2,220 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 30, 60, 120, 180

Feet: 0, 100, 200, 400, 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- ■ A
- ■ A/D
- ■ B
- ■ B/D
- ■ C
- ■ C/D
- ■ D
- □ Not rated or not available

Soil Rating Lines

- ∿ A
- ∿ A/D
- ∿ B
- ∿ B/D
- ∿ C
- ∿ C/D
- ∿ D
- ∿ Not rated or not available

Soil Rating Points

- ▣ A
- ▣ A/D
- ▣ B
- ▣ B/D
- ▣ C
- ▣ C/D
- ▣ D
- ▣ Not rated or not available

Water Features

- ∿ Streams and Canals

Transportation

- ┼┼┼ Rails
- ∿ Interstate Highways
- ∿ US Routes
- ∿ Major Roads
- ∿ Local Roads

Background

- ■ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 14, Sep 6, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Db	Delhi fine sand	A	22.9	91.8%
HaC	Hanford coarse sandy loam, 2 to 9 percent slopes	A	2.1	8.2%
Totals for Area of Interest			**25.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Attachment 8. Reference Geotechnical / Soil Data

TGR

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

February 23, 2022 Project No. 22-7418

Xebec Realty
3010 Old Ranch Parkway, Suite 470
Seal Beach, CA 90740

Attention: Sam Salim, Analyst

Subject: Geotechnical Investigation Report, 2830 S. Riverside Avenue, Bloomington (APN 0258-121-33-0000), 11190 Riverside Avenue, Rialto (APN 0258-121-23-0000) and 11258 S. Riverside Avenue (APN 0258-121-34-0000), Bloomington, California

Sam,

In accordance with your request and authorization, TGR Geotechnical, Inc. (TGR) has performed a geotechnical investigation for the proposed development at the subject site in the city of Bloomington, California. The subject site is consists of 3 parcels of land totaling 10.15-acres. The northernmost parcel is a dirt covered lot which is currently being used for miscellaneous storage and trailer parking. The central parcel is an asphalt covered lot with two existing buildings and miscellaneous storage and trailer parking. The southernmost parcel is a dirt covered lot with miscellaneous storage and trailer parking and soil stockpiles in the southwest corner of the site. It is our understanding that the proposed development is anticipated to consist of a 221,000 sq. ft. Class A warehouse with associated truck docks, drive aisles, vehicle parking and landscaped areas. This report presents the findings of our geotechnical investigation, including site seismicity and seismic settlement, and provides geotechnical design recommendations for the proposed improvements. The work was performed in general accordance with our proposal dated January 20, 2022.

Based on our investigation the proposed development is feasible from a geotechnical viewpoint provided the recommendations presented in this report are implemented during design and construction.

If you have any questions regarding this report, please do not hesitate to contact this office. We appreciate this opportunity to be of service.

Respectfully submitted,

TGR GEOTECHNICAL, INC.

Sanjay Govil
No. GE2382
EXP. 6/30/2022

Edward Louis Burrows
No. 1750

Sanjay Govil, PhD, PE, GE 2382
Principal Geotechnical Engineer

Edward L. Burrows, MS, PG, CEG 1750
Principal Engineering Geologist

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ATTACHMENTS

Plate 1 – Boring Location Map

Figure 1 – Site Location Map
Figure 2 – Regional Geology Map
Figure 3 – Groundwater Monitoring Well Location Map
Figure 4 – Regional Fault Map
Figure 5 – Geologic Hazard Map

Table 1 – Percolation Test Worksheet

Appendix A – References
Appendix B – Log of Borings
Appendix C – Laboratory Testing Procedures and Results
Appendix D – Site Seismic Design and Deaggregated Parameters
Appendix E – Standard Grading Specifications

EXECUTIVE SUMMARY

Presented below are significant elements of our findings from a geotechnical viewpoint. These findings are based on our field exploration, laboratory testing, and geologic and engineering analysis.

Geotechnical/Geologic Concerns

- There are no known faults passing through or adjacent to the subject site. The subject site is not located within an Alquist-Priolo Earthquake Fault Zone. The nearest faults to the subject site are the Rialto-Colton fault mapped approximately 2.4 miles to the northeast of the site, the San Jacinto fault mapped approximately 4.2 miles to the northeast of the site, the Loma Linda fault mapped approximately 5.8 miles northeast of the site, the Lytle Creek fault mapped approximately 6.8 miles north of the site, the Live Oak Canyon fault mapped approximately 7.7 miles southeast of the site and the Redlands fault mapped approximately 10.5 miles to the southeast of the site.
- Site soils have a tested expansion index of 0, correlating to a “very low” expansion potential.
- All excavations deeper than 4 feet shall be properly shored or laid back 1:1 (horizontal to vertical) or flatter.
- At the time of our drilling, groundwater was not encountered to a depth of 26.5 feet below ground surface. USGS groundwater data from wells nearest to the subject site indicate that groundwater historically is more than 81 feet below the surface. Groundwater is not expected to impact the proposed development.
- The subject site is not located within an area having a potential for liquefaction.
- All depressions resulting from demolition activities shall be properly backfilled with engineered fill at a minimum of ninety (90) percent relative compaction under the direction of the geotechnical consultant.

Foundations

- The proposed buildings may be supported on conventional shallow pad or continuous foundation systems.
- An allowable bearing capacity of 2,500 psf may be utilized for foundation design for footings supported on minimum ninety (90) percent relative compacted engineered fill.
- The minimum recommended footing width is eighteen (18) inches for continuous footing and twenty-four (24) inches for pad footing.
- All shallow foundations should extend a minimum of twenty-four (24) inches below the lowest adjacent grade.
- All shallow foundations shall be supported on two (2) feet or half the width of the footing (whichever is greater) of engineered fill with minimum ninety (90) percent relative compaction at near optimum moisture content.

Slab-on-Grade

- The subgrade material should be compacted to a minimum of ninety (90) percent of the maximum laboratory dry density (ASTM D1557) to a minimum depth of two (2) feet.
- Areas requiring moisture sensitive flooring shall be underlain by a minimum 15-mil Visqueen (Stego Wrap or equivalent).

Preliminary Pavement Design

- Pavement subgrade material should be compacted to a minimum of ninety (90) percent of the maximum laboratory dry density (ASTM D1557) to a minimum depth of one (1) foot.
- The pavement section was developed based on a tested "R-Value" for compacted site subgrade soils of 77.

ASPHALT PAVEMENT SECTION					**PCC PAVEMENT SECTION**		
Pavement Utilization	Traffic Index	Asphalt (Inch)	Aggregate Base (Inch)	Total (Inch)	*PCC	Aggregate Base (Inch)	Total (Inch)
Parking Stalls	4.5	3.0	4.0	7.0	--	--	--
Auto Driveways	5.0	3.0	6.0	9.0	--	--	--
Truck Aisles/ Driveways	6.0	4.0	6.0	10.0	*7	-	7
Loading Dock	7.0	4.0	6.0	10.0	*7	-	7

*Minimum concrete compressive strength of 3,500 psi.

INTRODUCTION

Site Descriptions and Proposed Project Development

The subject site is located at 2830 S. Riverside Avenue, Bloomington (APN 0258-121-33-0000), 11190 Riverside Avenue, Rialto (APN 0258-121-23-0000) and 11258 S. Riverside Avenue (APN 0258-121-34-0000), Bloomington. The subject site consist of three (3) parcels of land totaling 10.15-acres. The northernmost parcel is a dirt covered lot which is currently being used for miscellaneous storage and trailer parking. The central parcel is an asphalt covered lot with two existing buildings and miscellaneous storage and trailer parking. The southernmost parcel is a dirt covered lot with miscellaneous storage and trailer parking and soil stockpiles in the southwest corner of the site. We understand that the proposed development is anticipated to consist of a 221,000 sq. ft. Class A warehouse with associated truck docks, drive aisles, vehicle parking and landscaped areas.

Scope of Work

The scope of work for this geotechnical investigation included the following:

- Site reconnaissance to assess current site conditions, mark boring locations, call Dig-Alert for utility clearance and review of readily available previous geotechnical reports for the subject and/or adjacent properties.
- Sampling and logging nine (9) hollow stem auger borings utilizing a hollow stem drill rig to approximate depths ranging from 11.5 to 26.5 feet at the subject site to evaluate subsurface soil conditions. The borings were backfilled with cuttings and surface repaired with cold patch asphalt, where appropriate, completion.
- Percolation testing of the near surface soils at two (2) locations at a depth of 5 feet. The testing procedures followed the County of San Bernardino guidelines.
- Laboratory testing of selected samples to include in-situ moisture density, maximum density and optimum moisture content, shear, consolidation, expansion index, passing No. 200 sieve, corrosion series and R-value.
- Engineering analysis including site seismicity, foundation design, and settlement potential for the proposed development.
- Preparation of this report summarizing subsurface soil conditions, site seismicity, settlement potential and provide pertinent geotechnical/geologic information that may influence the proposed development.

Field Investigation

Field exploration was performed on February 1, 2022 by members from our firm who logged the borings and obtained representative samples, which were subsequently transported to the laboratory for further review and testing. The approximate locations of the borings are indicated on the enclosed Boring Location Map (Plate 1).

The subsurface conditions were explored by drilling, sampling, and logging five (5) borings with a truck mounted hollow stem auger drill rig. Borings B-1, B-3, B-5, B-7 and B-9 were advanced to an approximate maximum depth of 26.5 feet below existing grade. Borings B-2, B-4, B-6 and B-8 were advanced to an approximate maximum depth of 11.5 feet below existing grade. Subsequent to drilling, all borings were backfilled with excavated soil and surface repaired with cold patch asphalt at B-4. The log of borings presenting soil conditions and descriptions are presented in Appendix B.

The drill rig was equipped with a sampling apparatus to allow for recovery of driven modified California Ring Sampler (CRS), 3-inch outside diameter, and 2.42-inch inside diameter and SPT samples.

The samples were driven using an automatic 140-pound hammer falling freely from a height of 30 inches. The blow counts for CRS were converted to equivalent SPT blow counts. Soil descriptions were entered on the logs in general accordance with the Unified Soil Classification System (USCS). Driven samples and bulk samples of the earth materials encountered at selected intervals were recovered from the borings. The locations and depths of the soil samples recovered are indicated on the boring logs in Appendix B.

Two (2) percolation test borings, P-1 and P-2, were advanced to a depth of approximately five (5) feet below existing ground surface. Subsequent to percolation testing the borings were backfilled with excavated soils and surface tamped.

Percolation Testing

Upon completion of drilling and sampling each borehole was converted into a field percolation test well. Field percolation testing was performed in general accordance with the San Bernardino Technical Guidance for WQMP for sandy soils.

The boreholes were converted to field percolation test wells by placing approximately two inches of gravel at the bottom of the borehole, installing three-inch diameter PVC pipes and backfilling the annular space with gravel. A correction factor was applied to account for the placement of gravel.

Infiltration test rates were determined utilizing the referenced County of San Bernardino guidelines. Results of the infiltration testing are summarized in Table 1 below:

Table 1 – Infiltration Rates

Test Location	Test Depth (feet)	Infiltration Rate (Inches/hour)
P-1	0-5	7.27
P-2	0-5	11.99

Suitability Assessment Safety Factor

Factor values (v), for Factor Category A, were assigned according to the San Bernardino Technical Guidance Document for WQMP, VII.4.

Table 3 (below) presents assigned factor values and the calculated Suitability Assessment Safety Factor (Σp) in Worksheet H from the San Bernardino Technical Guidance Document for WQMP Appendix VII.

Table 3 – Worksheet H

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w * v
A	Suitability Assessment	Soil assessment methods	0.25	2	0.5
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25

The above values should be used in conjunction with Factor Category B parameters (to be determined by others) as specified in Worksheet H of the San Bernardino Technical Guidance Document for WQMP Appendix VII.

Laboratory Testing

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to evaluate the geotechnical properties of the subsurface soils. The following tests were performed:

- In-situ Moisture Content (ASTM D2216) and Dry Density (ASTM D7263);
- Maximum Dry Density and Optimum Moisture Content (ASTM D1557);
- Direct Shear Strength (ASTM D3080);
- Consolidation (ASTM D2435);
- Expansion Index (ASTM 4829);
- Passing No. 200 Sieve (ASTM 1140);
- R-value (CAL 301); and
- Corrosion series:
    1. Soluble Sulfate (CAL.417A);
    2. Soluble Chlorides (CAL.422);
    3. Minimum Resistivity (CAL.643); and
    4. pH (CAL 747)

Laboratory tests for geotechnical characteristics were performed in general accordance with the ASTM procedures. The results of the in-situ moisture content and density tests are shown on the borings logs. The results of other laboratory tests are presented in Appendix C.

GEOTECHNICAL FINDINGS

Geology

Regional Geologic Setting

The project site is located in the southwest portion of the San Bernardino South 7.5-minute quadrangle, California. Per the Geologic Map of the Riverside East/South ½ of San Bernardino South quadrangles, California (Dibblee, 2003), the subject site is underlain by Quaternary drift sand, deposited by north winds. Figure 2 presents the Regional Geology Map.

Earth Units

Based on our subsurface investigation, the subject area is underlain by approximately 10 feet of brown silty sand with some gravel. The silty sand is underlain by approximately 10 feet of sand underlain by silty sand and gravelly sand. Detailed descriptions of the earth units encountered in our borings are presented in the log of the borings. (Appendix B)

Groundwater

Subsurface water was not encountered to a depth of approximately 25 feet below existing grade during the subsurface exploration.

USGS groundwater data from wells nearest to the subject site indicate a groundwater high of approximately 252 feet below existing grade (USGS 340521117212005 001S005W13B005S) and 81 feet below existing grade (USGS 340414117190205 001S004W20H005S) (Figure 3).

Seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations from our observations may occur. Static groundwater is not anticipated to impact the proposed development.

Static groundwater is not anticipated to impact the proposed development.

Seismic Review

Faulting and Seismicity

The subject site, like the rest of Southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto and Elsinore fault zones. These fault systems produce approximately 5 to 35 millimeters per year of slip between the plates.

We consider the most significant geologic hazard to be the potential for moderate to strong seismic shaking that is likely to occur at the subject site. The subject site is located in the highly seismic Southern California region within the influence of several faults that are considered to be Holocene-active or pre-Holocene faults. A Holocene-active fault is defined by the State of California as a fault that has exhibited surface displacement within the Holocene time (about the last 11,700 years). A pre-Holocene fault is defined by the State as a fault whose history of past movement is older than 11,700 years ago and does not meet the criteria for a Holocene-active fault.

These Holocene-active and pre-Holocene faults are capable of producing potentially damaging seismic shaking at the site. It is anticipated that the subject site will periodically experience ground acceleration as the result of small to moderate magnitude earthquakes. Other active faults without surface expression (blind faults) or other potentially active seismic sources that are not currently zoned and may be capable of generating an earthquake are known to be present under in the region.

The subject site is not included within any Earthquake Fault Zones as created by the Alquist-Priolo Earthquake Fault Zoning Act (Hart, 1997). Our review of geologic literature pertaining to the site area indicates that there are no known active or potentially active faults located within or immediately adjacent to the subject property.

The nearest fault to the subject site is the Rialto-Colton fault mapped approximately 2.4 miles to the northeast of the site. Other nearby faults include the San Jacinto fault mapped approximately 4.2 miles to the northeast of the site, the Loma Linda fault mapped approximately 5.8 miles northeast of the site, the Lytle Creek fault mapped approximately 6.8 miles north of the site, the Live Oak Canyon fault mapped approximately 7.7 miles southeast of the site and the Redlands fault mapped approximately 10.5 miles to the southeast of the site. The Regional Fault Map, Figure 4, shows the location of the subject site in respect to the regional faults.

Secondary Seismic Hazards

Surface Fault Rupture and Ground Shaking

Since no known faults are located within the site, surface fault rupture is not anticipated. However, due to the close proximity of known active and potentially active faults, severe ground shaking should be expected during the life of the proposed structures.

Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, fine-grained granular soils behave similarly to a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when these ground conditions exist: 1) Shallow groundwater; 2) Low density, fine, clean sandy soils; and 3) High-intensity ground motion. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below foundations.

A review of the San Bernardino County General Plan: Geologic Hazard Overlays, Map FH30 C indicates that the subject site is not located within an area mapped as having a potential for earthquake induced liquefaction (Figure 5).

Based on the above and depth to groundwater, potential for liquefaction is considered to be negligible.

Seismically Induced Settlement

Ground accelerations generated from a seismic event can produce settlements in sands or in granular earth materials both above and below the groundwater table. This phenomenon is often referred to as seismic settlement and is most common in relatively clean sands, although it can also occur in other soil materials. Seismic settlement is anticipated to be negligible.

Landsliding

Landsliding involves downhill motion of earth materials during or subsequent to earth shaking. Historically, landslides triggered by earthquakes have been a significant cause of damage. Areas that are most susceptible to earthquake induced landslides are areas with steep slopes in poorly cemented or highly fractured bedrock, areas underlain by loose, weak soils, and areas on or adjacent to existing landslide deposits.

A review of the San Bernardino County General Plan: Geologic Hazard Overlays of San Bernardino South, this property is not located within a mapped zone of landsliding and the property and adjacent areas are situated on relatively flat topography. Based on the above, the general landslide susceptibility is considered to be negligible.

Lateral Spreading

Seismically induced lateral spreading involves primarily movement of earth materials due to earth shaking. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography in the vicinity of the subject site is relatively flat. Therefore, the potential for lateral spreading at the subject site is considered very low.

DISCUSSIONS AND CONCLUSIONS

General

Based on our field exploration, laboratory testing and engineering analysis, it is our opinion that the proposed structure and proposed grading will be safe against hazard from landslide, settlement, or slippage and the proposed construction will have no adverse effect on the geologic stability of the adjacent properties provided our recommendations presented in this report are followed.

Conclusions

Based on our findings and analyses, the subject site is likely to be subjected to moderate to severe ground shaking due to the proximity of known active and potentially active faults. This may reasonably be expected during the life of the structure and should be designed accordingly.

The primary conditions affecting the proposed project site development are as follows:

- Potential for caving for near surface sandy soils.

The engineering evaluation performed concerning site preparation and the recommendations presented are based on information provided to us and obtained by us during our office and fieldwork. This report is prepared for the development of a 221,000 sq. ft. Class A warehouse with associated truck docks, drive aisles, vehicle parking and landscaped areas. In the event that any significant changes are made to the proposed development, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the recommendations of this report are verified or modified in writing by TGR.

RECOMMENDATIONS

Seismic Design Parameters

When reviewing the 2019 California Building Code the following data should be incorporated into the design.

Parameter	Value
Latitude (degree)	34.0503
Longitude (degree)	-117.3708
Site Class	D – Stiff Soil
Site Coefficient, F_a	1.0
Site Coefficient, F_v	N/A
Mapped Spectral Acceleration at 0.2-sec Period, S_s	1.682 g
Mapped Spectral Acceleration at 1.0-sec Period, S_1	0.656 g
Spectral Acceleration at 0.2-sec Period Adjusted for Site Class, S_{MS}	1.682 g
Spectral Acceleration at 1.0-sec Period Adjusted for Site Class, S_{M1}	N/A
Design Spectral Acceleration at 0.2-sec Period, S_{DS}	1.121 g
Design Spectral Acceleration at 1.0-sec Period, S_{D1}	N/A

Site Specific Response Spectra

The USGS Unified Hazard tool, the USGS RTGM Calculator and the USGS App for Deterministic Spectra Acceleration were utilized to develop site specific ground motion spectra. The analysis was performed utilizing the following attenuation relationships that are part of NGA as required by 2019 CBC code requirements.

- Campbell & Bozorgnia (2014)
- Boore, Stewart, Seyhan & Atkinson (2014)
- Chiou & Youngs (2014)
- Abrahamson, Silva & Kamal (2014)

The results of the Site Specific Response Spectra are incorporated in Table 1 and on Figure 1 in Appendix D. The results include deterministic spectra at 5% damping, maximum rotated component at 0.84 fractile and the probabilistic spectra, maximum rotated component at 5% damping for a return period of 2475 year and subsequently multiplied by risk coefficient to obtain the MCER probabilistic spectral acceleration. The Vs30 utilized was 260 m/s.

The probabilistic response spectrum was determined using the OSHPD generated seismic values and raw output generated from the U.S. Geological Survey Unified Hazard Tool. The spectral response acceleration data generated from the U.S. Geological Survey Unified Hazard Tool was entered into the U.S. Geological Survey Risk-Targeted Ground Motion Calculator tool for each time period. The data is presented on Table 2 in Appendix D.

The deterministic response spectrum was determined using the greatest Deaggregation Contributor from the U.S. Geological Survey Unified Hazard Tool. The largest contributing fault parameters were entered into the Pacific Earthquake Engineering Research Center NGAW2 tool with a user defined sigma + 5% damping. The data is presented on Table 3 in Appendix D.

The above generated spectral accelerations were compared against the minimum code requirements in ASCE7-16 (Chapters 11 and 21) resulting in the final design response spectra which is presented in Table 1 and on Figure 1 in Appendix D.

Based on Table 1 and Figure 1, the recommended Site Specific S_{DS} and S_{D1} are as follows:

S_{DS} = 1.310
S_{D1} = 1.750

Mapped values may be used in lieu of site-specific values to design structures on Site Class D sites with an S1 greater than or equal to 0.2, provided the value of the seismic response coefficient Cs is determined by Eq. (12.8-2) for values of T ≤ 1.5Ts and taken as equal to 1.5 times the value computed in accordance with either Eq. (12.8-3) for TL ≥ T > 1.5Ts or Eq. (12.8-4) for T > TL.

The structural consultant should review the above parameters and the 2019 California Building Code to evaluate the seismic design.

Conformance to the criteria presented in the above table for seismic design does not constitute any type of guarantee or assurance that significant structural damage or ground failure will not occur during a large earthquake event. The intent of the code is “life safety” and not to completely prevent damage of the structure, since such design may be economically prohibitive.

Foundation Design Recommendations

The proposed buildings may be supported on continuous and/or spread footings. Bearing capacity recommendations for shallow foundations are presented below. These recommendations assume that the footings will be supported on a minimum of two (2) feet or half the width of the footing (whichever is greater) of engineered fill.

For foundations supported on two (2) feet or half the width of the footing (whichever is greater) of engineered fill with minimum ninety (90) percent relative compaction at near optimum moisture content, an allowable bearing pressure of 2,500 pounds per square foot may be used in design.

All shallow foundations should extend a minimum of twenty-four (24) inches below the lowest adjacent grade. The minimum recommended footing width is eighteen (18) inches for continuous footing and twenty-four (24) inches for pad footing. A minimum reinforcement of two (2) No. 4 steel bar top and two (2) No. 4 steel bar bottom is required for continuous footings from a geotechnical viewpoint. Foundation design details such as concrete strength, reinforcements, etc should be established by the Structural Engineer.

A one-third (1/3) increase on the aforementioned bearing pressure may be used in design for short-term wind or seismic loads.

The total and differential static settlement is anticipated to be 1 inch and 0.5 inches over 60 feet or less.

Resistance to lateral loads including wind and seismic forces may be provided by frictional resistance between the bottom of concrete and the underlying fill soils and by passive pressure against the sides of the foundations. A coefficient of friction of 0.40 may be used between concrete foundation and underlying soil. The recommended passive pressure of the engineered fill may be taken as an equivalent fluid pressure of 250 pounds per cubic foot (2,500 psf max).

Footings located near property lines where the lateral removal cannot be achieved shall be designed for a reduced bearing capacity of 1,500 pounds per square foot and the passive resistance shall be ignored.

Slab-On-Grade

The subgrade material should be compacted to a minimum of ninety (90) percent of the maximum laboratory dry density at optimum moisture content to a minimum depth of two (2) feet.

The thickness and reinforcement of the slab shall be designed by the structural engineer per the 2019 California Building Code and should include the anticipated loading condition (forklift etc.), the anticipated use of the building and the expansion index of the soil. For moisture sensitive flooring, the floor slab should be underlain by minimum 15-mil impermeable polyethylene membrane (Stego Wrap, Moistop Plus, or any equivalent meeting the requirements of ASTM E1745, Class A rating) as a capillary break. Sand may be placed above and below the impermeable polyethylene membrane at the discretion of the project structural engineer/concrete contractor for proper curing and finish of the concrete slab-on-grade and protection of the membrane and is considered outside the scope of geotechnical engineering.

Flatwork

Flatwork should be a minimum of 4-inches thick should be reinforced with a minimum of No. 3 reinforcing bar on 24-inch centers in two horizontally perpendicular directions. Reinforcing should be properly supported to ensure placement near the vertical midpoint of the slab. "Hooking" of the reinforcement is not considered an acceptable method of positioning the steel. The subgrade material should be compacted to a minimum of ninety (90) percent of the maximum laboratory dry density (ASTM D1557) to a minimum depth of one (1) foot. Prior to placement of concrete, the subgrade soils should be moistened to near percent of optimum moisture content and verified by our field representative. The actual thickness and reinforcement of the slab shall be designed by the structural engineer and should include the anticipated loading condition.

Modulus of Subgrade Reaction

The modulus of subgrade reaction may be taken as 175 pci (K_1) for one (1) square foot footing/slab founded on site soils. This value should be reduced for change in size per the following formula:

$$K = K_1 \left(\frac{B+1}{B}\right)^2$$

Where B = Width of Mat;
K = Coefficient of Subgrade Reaction of Footings Measuring B (ft) x B (ft).

Cement Type and Corrosion

Based on laboratory testing concrete used should be designed in accordance with the provisions of ACI 318-14, Chapter 19 for Exposure Class S0: Cement with a minimum unconfined compressive strength of 2,500 psi, and for Exposure Class C1 (Moderate) – Concrete exposed to moisture but not a significant source of chlorides, per ACI 318-14 Table 19.3.1.1.

Corrosion tests indicate a moderate corrosion potential for ferrous metals exposed to site soils.

TGR does not practice corrosion engineering. If needed, a qualified specialist should review the site conditions and evaluate the corrosion potential of the site soil to the proposed improvements and to provide the appropriate corrosion mitigations for the project.

Expansive Soil

Site soils have a tested expansion index of 0, correlating to a “very low” expansion potential.

Shrinkage/Subsidence

Removal and recompaction of the near surface soils is estimated to result in shrinkage ranging from 5 to 10 percent. 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 between one and two tenths of a foot.

Site Development Recommendations

General

During earthwork construction, all site preparation and the general procedures of the contractor should be observed, and the fill selectively tested by a representative of TGR. If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and if warranted, modified and/or additional recommendations will be offered. During demolition of the existing buildings, large concrete slab and associated site work, voids created from removal of buried elements (footings, pipelines, septic pits, etc.) shall be backfilled with engineered fill (minimum 90% relative compaction per ASTM D1557) under the observation of TGR.

Grading

All grading should conform to the guidelines presented in the California Building Code (2019 edition), except where specifically superseded in the text of this report. Prior to grading, TGR’s representative should be present at the pre-construction meeting to provide grading guidelines, if needed, and review any earthwork. Oversize particles may be encountered during grading. All particles greater than 4-inches shall be removed and disposed offsite.

The footings shall be supported on a minimum two (2) feet or half the width of the footing (whichever is greater) of engineered fill. A minimum two (2) feet of engineered fill is recommended under slab-on-grade and minimum one (1) foot is recommended under flatwork and pavement. Site soils may be reused as engineered fill provided, they are free of oversized particles and the recommendations presented in this report are implemented. Exposed bottoms should be scarified a minimum of 6-inches, moisture conditioned to near optimum moisture and compacted to a minimum ninety (90) percent relative compaction. Subsequently, site fill soils should be re-compacted to a minimum of ninety (90) percent relative compaction at near optimum moisture content. The lateral extent of removals beyond the building/structure/footing limits should be equal to at least 5 feet.

The depth of over-excavation should be reviewed by the Geotechnical Consultant during the actual construction. Any subsurface obstruction buried structural elements, and unsuitable material encountered during grading, should be immediately brought to the attention of the Geotechnical Consultant for proper exposure, removal and processing, as recommended.

Fill Placement

Prior to any fill placement TGR should observe the exposed surface soils. The site soils may be re-used as engineered fill provided, they are free of organic content and particle size greater than 4-inches. All particles greater than 4-inches shall be removed and disposed offsite. Fill shall be moisture conditioned to near optimum moisture and compacted to a minimum relative compaction of ninety (90) percent in accordance with ASTM D1557. Any import soils shall be non-expansive and approved by TGR Geotechnical Inc.

Compaction

Prior to fill placement, the exposed surface should be scarified to a minimum depth of six (6) inches, fill placed in six (6) inch loose lifts moisture conditioned to near optimum moisture and compacted to a minimum relative compaction of ninety (90) percent in accordance with ASTM D1557.

Trenching

All excavations should conform to CAL-OSHA and local safety codes.

Temporary Excavation and Shoring

All excavations to a maximum depth of 4 feet may be excavated vertically. However, all excavations deeper than 4 feet must either be properly sloped or shored. Where sufficient space is available for sloped excavation, the excavation may be sloped to no steeper than 1:1 (horizontal to vertical). Flattened side slopes may be required where less stable localized deposits are encountered. The exposed slope faces should be kept moist and not allowed to dry out.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut from the toe of excavation unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any nearby adjacent existing site facilities should be properly shored to maintain foundation support at the adjacent structures. Temporary excavation adjacent to existing footings may require A-B-C slot cuts.

Utility Trench Backfill

All utility trench backfills in structural areas and beneath hardscape features should be brought to near optimum moisture content and compacted to a minimum relative compaction of ninety (90) percent of the laboratory standard. Flooding/jetting is not recommended.

Sand backfill, (unless trench excavation material), should not be allowed in parallel exterior trenches adjacent to and within an area extending below a 1:1 plane projected from the outside bottom edge of the footing. All trench excavations should minimally conform to CAL-OSHA and local safety codes. Soils generated from utility trench excavations may be used provided it is moisture conditioned and compacted to ninety (90) percent minimum relative compaction.

Drainage

Positive site drainage should be maintained at all times. Water should be directed away from foundations and not allowed to pond and/or seep into the ground. Pad drainage should be directed towards the street/parking or other approved area.

Preliminary Pavement Design

The Caltrans method of design was utilized to develop the following asphalt pavement section. The section was developed based on a tested "R-Value" for compacted site subgrade soils of 77.

Traffic indices of 4.5, 5, 6, and 7 were assumed for use in the evaluation of automobile parking stalls and driveways, and medium and heavy truck driveways, respectively. The traffic indices are subject to approval by controlling authorities and shall be approved by the project civil engineer.

ASPHALT PAVEMENT SECTION					**PCC PAVEMENT SECTION**		
Pavement Utilization	Traffic Index	Asphalt (Inch)	Aggregate Base (Inch)	Total (Inch)	*PCC	Aggregate Base (Inch)	Total (Inch)
Parking Stalls	4.5	3.0	4.0	7.0	--	--	--
Auto Driveways	5.0	3.0	6.0	9.0	--	--	--
Truck Aisles/ Driveways	6.0	4.0	6.0	10.0	*7	-	7
Loading Dock	7.0	4.0	6.0	10.0	*7	-	7

*Minimum concrete compressive strength of 3,500 psi.

Aggregate base material for Asphalt Pavement should consist of CAB/CMB complying with the specifications in Section 200-2.2/200-2.4 of the current "Standard Specifications for Public Works Construction" and should be compacted to at least ninety-five (95) percent of the maximum dry density (ASTM D1557). The surface of the base should exhibit a firm and unyielding condition just prior to the placement of asphalt concrete paving. The asphalt concrete shall be compacted to a minimum of ninety-five (95) percent relative compaction.

The pavement subgrade should be constructed in accordance with the recommendations presented in the grading section of this report.

The R-value and the associated pavement section should be confirmed at the completion of site grading.

An increase in the PCC pavement slab thickness, placement of steel reinforcement (or other alternatives such as Fibermesh) and joint spacing due to loading conditions including shrinkage and thermal effects may be necessary and should be incorporated by the structural engineer as necessary to prevent adverse impact on pavement performance and maintenance.

Geotechnical Review of Plans

All grading and foundation plans should be reviewed and accepted by the geotechnical consultant prior to construction. If significant time elapses since preparation of this report, the geotechnical consultant should verify the current site conditions, and provide any additional recommendations (if necessary) prior to construction.

Geotechnical Observation/Testing During Construction

Per sections 1705.6 and table 1705.6 of the 2019 California Building Code, periodic special inspection shall be performed to:

- Verify materials below shallow foundations are adequate to achieve the design bearing capacity;
- Verify excavations are extended to the proper depth and have reached proper material;
- Verify classification and test compacted materials; and
- Prior to placement of compacted fill, inspect subgrade and verify that the site has been prepared properly.

Per sections 1705.6 and table 1705.6 of the 2019 California Building Code, continuous special inspection shall be performed to:

- Verify use of proper materials, densities and lift thickness during placement and compaction of compacted fill.

The geotechnical consultant should also perform observation and/or testing at the following stages:

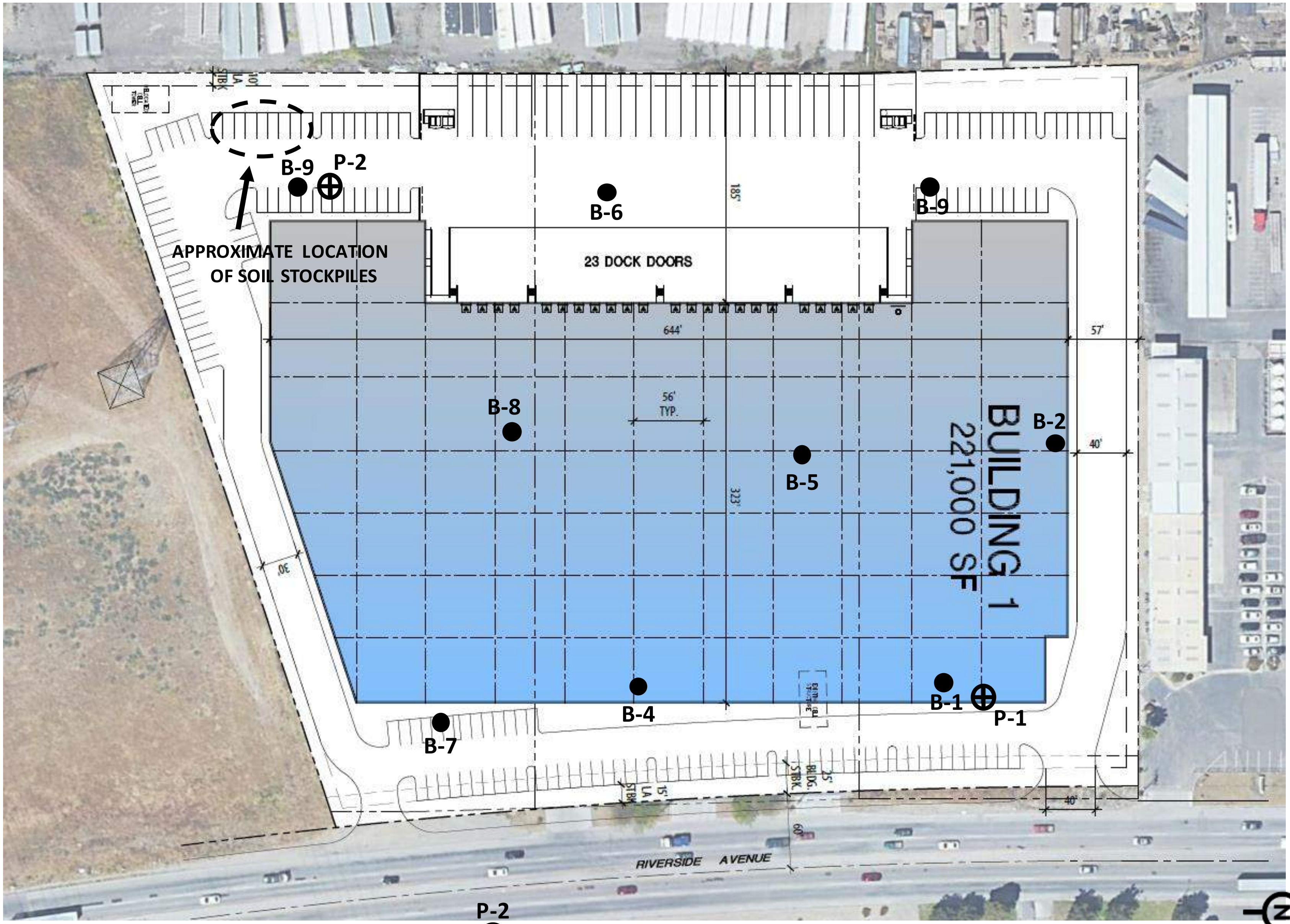
- During any grading and fill placement;
- After foundation excavation and prior to placing concrete;
- Prior to placing slab and flatwork concrete;
- During placement of aggregate base and asphalt or Portland cement concrete; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

Limitations

This report was prepared for a specific client and a specific project, based on the client's needs, directions and requirements at the time.

This report was necessarily based upon data obtained from a limited number of observances, site visits, soil and/or other samples, tests, analyses, histories of occurrences, spaced subsurface exploration and limited information on historical events and observations. Such information is necessarily incomplete. Variations can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time.

This report is not authorized for use by and is not to be relied upon by any party except the client with whom TGR contracted for the work. Use or reliance on this report by any other party is that party's sole risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify TGR from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of TGR.



B-9 ● APPROXIMATE LOCATION OF EXPLORATORY BORING

P-2 ⊕ APPROXIMATE LOCATION OF PERCOLATION BORING

40 Feet

N

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BORING LOCATION MAP
2830, 11190 & 11258 S RIVERSIDE AVENUE
BLOOMINGTON, CALIFORNIA

PROJECT NO. 22-7418

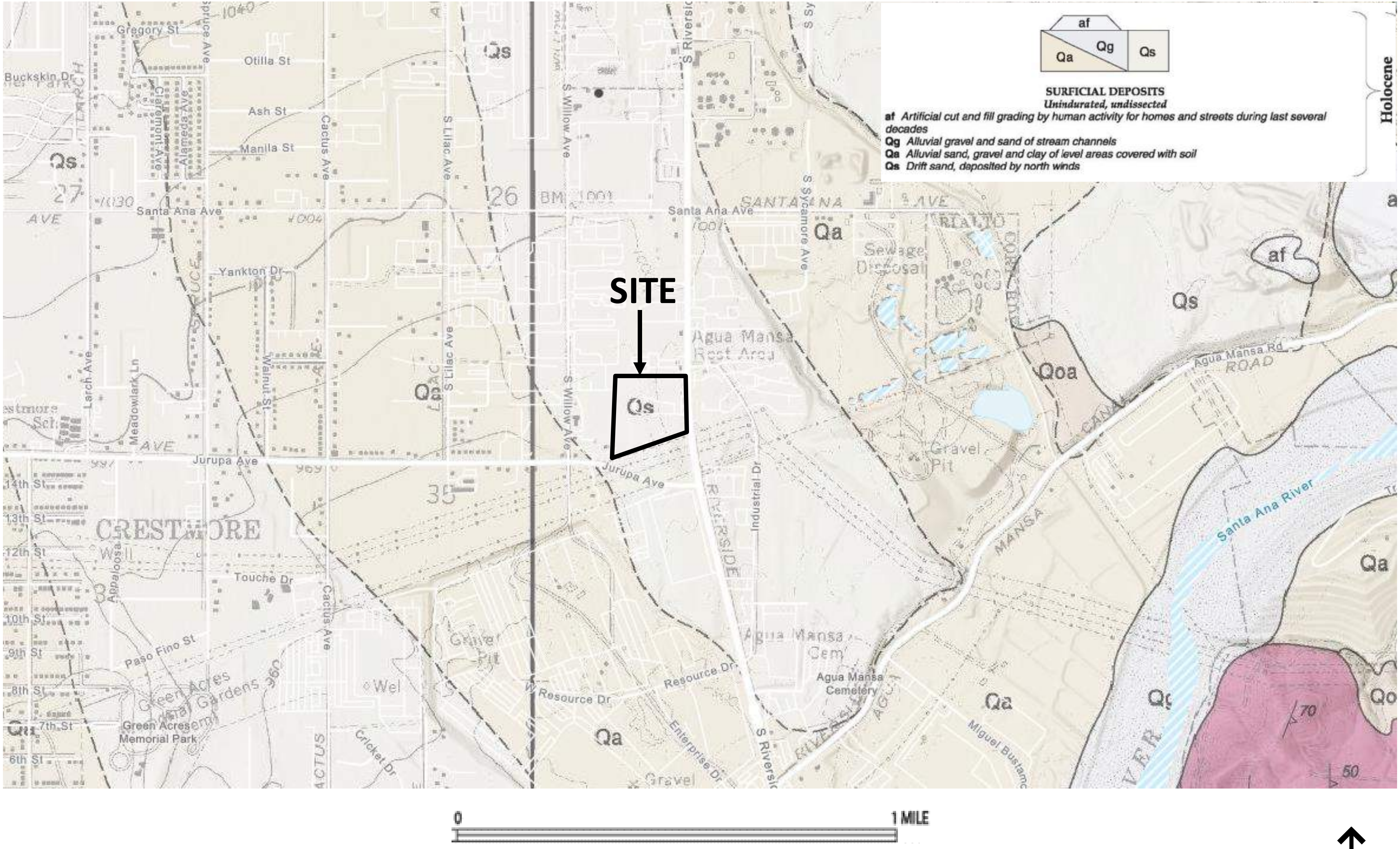
PLATE 1

TGR Geotechnical Environmental Hydrogeology Material Testing Construction Inspection

SITE LOCATION MAP
2830, 11190 & 11258 S RIVERSIDE AVENUE
BLOOMINGTON, CALIFORNIA

PROJECT NO. 22-7418

FIGURE 1



Modified From: Dibblee, T.W. and Minch, J.A., 2003, Geologic map of the Riverside East/south 1/2 of San Bernardino South quadrangles, San Bernardino and Riverside County, California, Dibblee Geological Foundation, Dibblee Foundation Map DF-109, 1:24,000.

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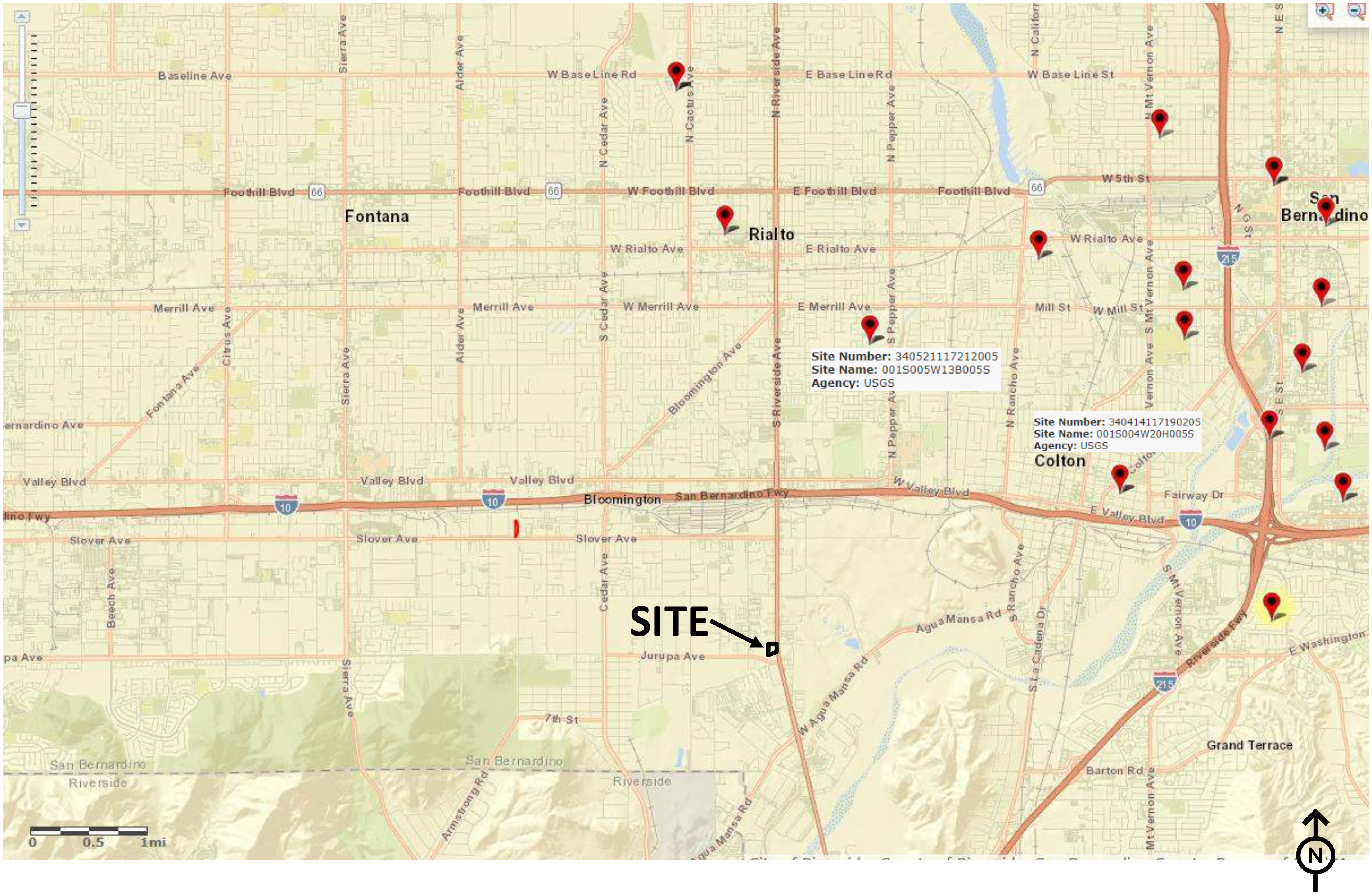
REGIONAL GEOLOGY MAP
2830, 11190 & 11258 S RIVERSIDE AVENUE
BLOOMINGTON, CALIFORNIA

PROJECT NO. 22-7418

FIGURE 2



Site Number: 340521117212005
Site Name: 001S005W13B005S
Agency: USGS

Site Number: 340414117190205
Site Name: 001S004W20H005S
Agency: USGS

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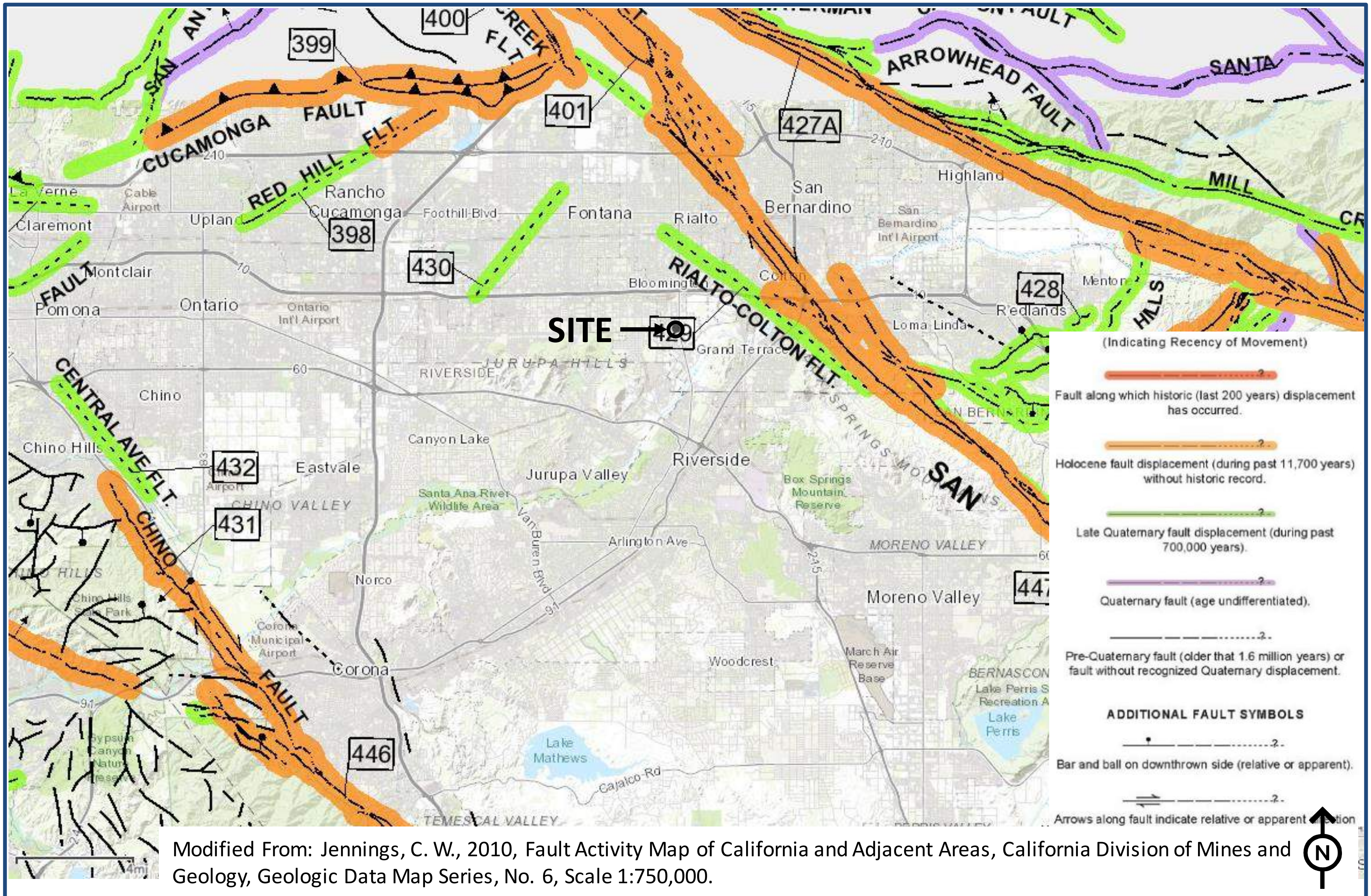
GROUNDWATER MONITORING WELL LOCATION MAP
2830, 11190 & 11258 S RIVERSIDE AVENUE
BLOOMINGTON, CALIFORNIA

PROJECT NO. 22-7418

FIGURE 3



Modified From: Jennings, C. W., 2010, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map Series, No. 6, Scale 1:750,000.

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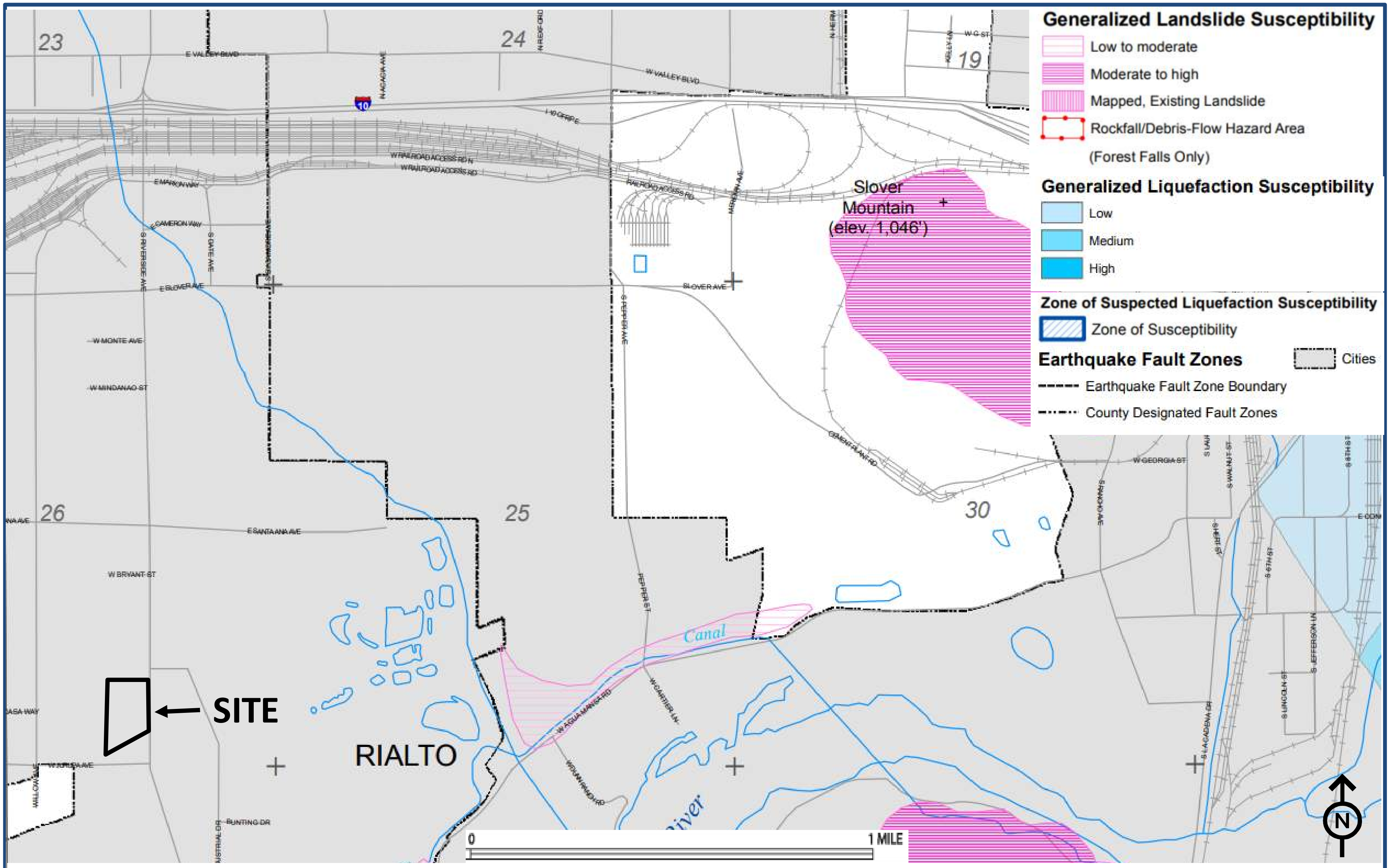
REGIONAL FAULT MAP
2830, 11190 & 11258 S RIVERSIDE AVENUE
BLOOMINGTON, CALIFORNIA

PROJECT NO. 22-7418

FIGURE 4



Modified From: San Bernardino County Land Use Plan, 2007, General Plan, Geologic Hazard Overlay, Map No. FH30-C, plotted March 09, 2010.

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SEISMIC HAZARD ZONE MAP
2830, 11190 & 11258 S RIVERSIDE AVENUE
BLOOMINGTON, CALIFORNIA

PROJECT NO. 22-7418

FIGURE 5

21-7401

Percolation Test Worksheet

Table 1

Test Hole	Total Depth (in)	Initial Depth (in)	Final Depth (in)	∆Water Level (in)	Initial Time (min)	Final Time (min)	∆ Time (min)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate (in/hr)
P-1	60	5.75	32.50	26.75	0.0	5.0	5.0	54.25	27.5	40.88	7.64
	60	6.00	32.00	26	0.0	5.0	5.0	54	28	41.00	7.40
	60	5.75	31.50	25.75	0.0	5.0	5.0	54.25	28.5	41.38	7.27
	60	6.50	32.25	25.75	0.0	5.0	5.0	53.5	27.75	40.63	7.39
	60	6.00	31.75	25.75	0.0	5.0	5.0	54	28.25	41.13	7.31
P-2	60	8.50	52.00	43.5	0.0	5.0	5.0	51.5	8	29.75	16.77
	60	8.00	46.25	38.25	0.0	5.0	5.0	52	13.75	32.88	13.42
	60	6.25	44.75	38.5	0.0	5.0	5.0	53.75	15.25	34.50	12.91
	60	6.75	43.50	36.75	0.0	5.0	5.0	53.25	16.5	34.88	12.20
	60	6.50	43.00	36.5	0.0	5.0	5.0	53.5	17	35.25	11.99
	60	8.00	45.00	37	0.0	5.0	5.0	52	15	33.50	12.76

$$I_t = \frac{\Delta H(60r) \times \mathrm{CF}}{\Delta t(r + 2H_{avg})}$$

ΔH = Change in height

Δt = Time interval

r = Radius

I_t Infiltration Rate

H_{ave} Average Head Height over the time interval

APPENDIX A
REFERENCES

APPENDIX A

References

California Department of Conservation – California Geological Survey, 2018, Earthquake Fault Zones, A Guide for Government Agencies, Property Owners/Developers and Geoscience Practitioners for Assessing Fault Rupture Hazards in California.

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Hart, E. W., 2018, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning with Index to Special Study Zones Maps: Department of Conservation, Division of Mines and Geology, Special Publication 42.

International Code Council (ICC), California Building Code, 2019 Edition.

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APPENDIX B
LOG OF BORINGS

THE FOLLOWING DESCRIBES THE TERMS AND SYMBOLS USED ON THE LOG OF BORINGS TO SUMMARIZE THE RESULTS OBTAINED IN THE FIELD INVESTIGATION AND SUBSEQUENT LABORATORY TESTING

DENSITY AND CONSISTENCY

The consistency of fine grained soils and the density of coarse grained soils are described on the basis of the Standard Penetration Test as follows:

COARSE GRAINED SOILS		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (Tsf)	FINE GRAINED SOILS	
Very Loose	< 4	< 0.25	Very Soft	< 2
Loose	4 – 10	0.35 – 0.50	Soft	2 – 4
Medium	10 – 30	0.50 – 1.0	Firm (Medium)	4 – 8
Dense	30 – 50	1.0 – 2.0	Stiff	8 – 15
Very Dense	> 50	2.0 – 4.0	Very Stiff	15 – 30
		> 4.0	Hard	> 30

PARTICLE SIZE DEFINITION (As per ASTM D2487 and D422)

Boulder	⇒ Larger than 12 inches	Coarse Sands	⇒ No. 10 to No. 4 sieve
Cobbles	⇒ 3 to 12 inches	Medium Sands	⇒ No. 40 to No. 10 sieve
Coarse Gravel	⇒ 3/4 to 3 inches	Fine Sands	⇒ No. 200 to 40 sieve
Fine Gravel	⇒ No. 4 to 3/4 inches	Silt	⇒ 5μm to No. 200 sieve
		Clay	⇒ Smaller than 5μm

SOIL CLASSIFICATION

Soils and bedrock are classified and described based on their engineering properties and characteristics using ASTM D2487 and D2488.

Percentage description of minor components:

Trace	1 – 10%	Some	20 – 35%
Little	10 – 20%	And or y	25 – 50%

Stratified soils description:

Parting	0 to 1/16 inch thick	Layer	½ to 12 inches thick
Seam	1/16 to ½ inch thick	Stratum	> 12 inches thick

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LOG OF BORING
EXPLANATION

SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

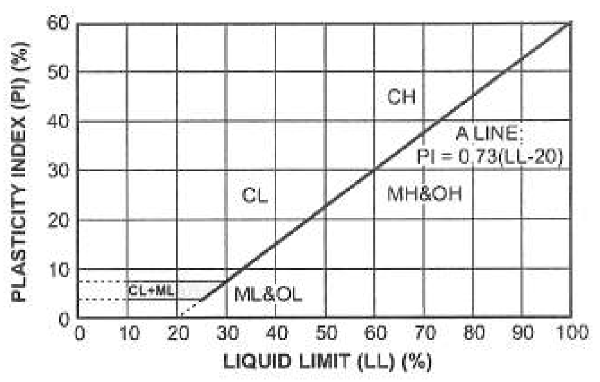
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART



PARTICLE SIZE LIMITS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

3" ¾" NO. 4 NO. 10 NO. 40 NO. 200

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LOG OF BORING EXPLANATION

LOG OF EXPLORATORY BORING B-1

Sheet **1** of **1**

Project Number:	**22-7418**	Logged By:	**RA**
Project Name:	**2830, 11190 & 11258 S. Riverside Ave**	Project Engineer:	**SG**
Date Drilled:	**2/1/22 - 2/1/22**	Drill Type:	**CME 75 Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube

☒ Standard Split Spoon

◉ No recovery

⧗ Modified California

▼ Water Table ATD

		FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
Depth (ft)	Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▩						Surface is approx. 1 ft of gravel			
	⁘						Native: SAND- brown, moist, medium dense, fine grained.			
5	⁘		⧗	15		SP	...Same as above	8	105	
10	⁘		⧗	16		SM	SiltySAND- brown, moist, medium dense, fine grained	12	119	Consol
15	⁘		⧗	34		SP	SAND- light brown, moist, dense, fine to coarse grained sand, some fine to coarse grained gravel.	4	147	
20	⁘		☒	50		SP	GravellySAND- light brown, moist, very dense, fine to coarse grained sand, fine to coarse grained gravel.	4		
25	⁘		☒	>50		SP	...Same as above	3		
							Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			

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LOG OF EXPLORATORY BORING B-2

Sheet **1** of **1**

Project Number:	**22-7418**	Logged By:	**RA**
Project Name:	**2830, 11190 & 11258 S. Riverside Ave**	Project Engineer:	**SG**
Date Drilled:	**2/1/22 - 2/1/22**	Drill Type:	**CME 75 Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube ☒ Standard Split Spoon ◉ No recovery

⧗ Modified California ▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▩	▤					Surface is 1 ft of gravel			
	⁙	▤					Native: SAND- golden brown, moist, medium dense, fine grained.			EI, SE, Corrosion
5	⁙		⧗	21		SP	...Same as above, light brown	4	103	
10	⁙		⧗	23		SM	Silty SAND- brown, moist, medium dense, fine grained, some coarse gravel.	15	121	
							Total Depth: 11.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 3

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-3

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS: Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS: Moisture Content (%)	Dry Density, (pcf)	Other Tests
0							Surface is 1 ft of gravel, crushed asphalt concrete			
1							Native: <u>SAND</u>- light brown, moist, medium dense, fine grained.			
5			⧓	14		SP	...Same as above.	5	109	Consol
10			⧓	16		SM	Silty <u>SAND</u>- brown, moist, medium dense, fine grained, some coarse gravel.	9	122	
15			⧓	27		SP	<u>SAND</u>- light brown, moist, very dense, fine to medium grained sand, some gravel.	4	115	
20			☒	47		SP	...Same as above, grey brown, dense	4		
25			☒	57		SP	<u>SAND</u>- grey, moist, very dense, fine to coarse grained sand, some gravel.	3		
26.5							Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			

PLATE 4

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-4

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▩						Surface is 2 inch of asphalt concrete over 2.5 inch concrete over 2 inch of gravel.			
	⁘						Native: <u>SAND</u>- brown, moist, medium dense, fine grained.			
5	⁘		⧗	22		SP	...Same as above, some gravel	4	100	
10	⁘		⧗	8		SP	Silty Sand to <u>SAND</u>- light brown, moist, medium dense to loose, fine grained, some coarse gravel.	8	107	
							Total Depth: 11.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings and patched with asphalt upon completion.			
15										
20										
25										

PLATE 5

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-5

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
		▤					Surface is gravel. Native: SAND - light brown, moist, medium dense, fine grained.			Max, Remolded Shear
5			⧓	14		SP	...Same as above.	6	112	Consol
10			⧓	16		SM	Silty SAND- light brown, moist, medium dense, very fine to fine grained sand, some coarse...	9	116	Consol
15			⧓	27		ML	Clayey SILT- tan brown, moist, hard, some very fine to fine sand.	19	114	
20			☒	47		SP	SAND - grey brown, moist, very dense, fine to coarse grained, some gravel.	3		
25			☒	57		SP	.....Same as above	3		
							Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 6

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-6

Sheet **1** of **1**

Project Number:	**22-7418**	Logged By:	**RA**
Project Name:	**2830, 11190 & 11258 S. Riverside Ave**	Project Engineer:	**SG**
Date Drilled:	**2/1/22 - 2/1/22**	Drill Type:	**CME 75 Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

		FIELD RESULTS						LAB RESULTS		
Depth (ft)	Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is 1 ft of gravel			
							Native: SAND- golden brown, moist, medium dense, fine grained.			
5			⧗	20		SP	...Same as above	6	111	
10			⧗	25		SM	Silty SAND- brown, moist, medium dense, very fine to fine grained, trace gravel.	12	104	
							Total Depth: 11.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion. Ground elevation estimated with Google Earth.			
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 7

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-7

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:
Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is dirt, sparse vegitation Native: SAND - light brown, moist, medium dense, fine grained.			
5			⧗	48		SP	...Same as above, brown, dense	6	115	Consol
10			⧗	12		SM	Silty SAND- light brown, moist, medium dense, very fine to fine grained sand	13	110	
15			⧗	30		SP	Sandy SILT to Silty SAND- light brown, moist, very stiff to hard, very fine to fine sand.	17	102	
20			☒	24		SP	SAND - grey, moist, medium dense, fine to coarse grained	3		
25			☒	45		SP	.....Same as above, dense	3		
							Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 8

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-8

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is gravel Native: SAND- light brown, moist, medium dense, fine grained.			
										R-Value
5			⧗	16		SP	...Same as above	6	108	
10			⧗	16		SM	Silty SAND- light brown, moist, medium dense, very fine to fine grained, trace gravel.	9	111	
							Total Depth: 11.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			
15										
20										
25										

LOG OF EXPLORATORY BORING B-9

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

		FIELD RESULTS						LAB RESULTS		
Depth (ft)	Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is gravel and dirt Native: SAND - light brown, moist, medium dense, fine grained.			
5			⧗	27		SP	...Same as above, brown, dense	4	108	
10			⧗	20		SM	Silty SAND- brown, moist, medium dense, fine grained sand, trace coarse gravel	8	114	
15			⧗	26		ML	Clayey SILT- tan brown, moist, hard, some very fine to fine sand.	17	114	
20			☒	62		SP	SAND - grey, moist, very dense, fine to coarse grained	3		
25			☒	60		SP	.....Same as above, some fine to coarse gravel	3		
							Total Depth: 26.5 feet. No groundwater encountered during drilling. No caving observed. Boring backfilled with soil cuttings upon completion.			

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 10

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-1

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▨	☰					Surface is approx. 2 ft of gravel			
	⁙	☰				SP	Native: <u>SAND</u>- brown, moist, medium dense, fine grained, some fine to coarse gravel.	4		-200= 7.2%
5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing. Boring backfilled with soil cuttings upon completion.			
10										
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 11

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-2

Sheet **1** of **1**

Project Number: **22-7418**
Project Name: **2830, 11190 & 11258 S. Riverside Ave**
Date Drilled: **2/1/22 - 2/1/22**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **CME 75 Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
0							Surface is dirt and gravel			
						SP	Native: SAND- light brown, moist, medium dense, fine grained	6		-200= 7.7%
5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing. Boring backfilled with soil cuttings upon completion.			
10										
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 12

TGR GEOTECHNICAL, INC.

APPENDIX C
LABORATORY TEST RESULTS

APPENDIX C

Laboratory Testing Procedures and Results

In-Situ Moisture and Dry Density Determination (ASTM D2216 and D7263): Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

Maximum Density and Optimum Moisture Content (ASTM D1557): The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM Test Method D1557. The results of these tests are presented in the table below:

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
B-5 @ 0-5 feet	Sand	116.0	8.5

Direct Shear Strength (ASTM D3080): Direct shear test was performed on selected remolded samples, which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1-hour prior to application of shearing force. The sample was tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of less than 0.001 to 0.5 inches per minute (depending upon the soil type). The test results are presented in the test data and in the table below:

Sample Location	Sample Description	Friction Angle (degrees)	Apparent Cohesion (psf)
B-2 @ 0-5 feet	Sand (Remolded)	31	48

Consolidation Tests (ASTM D2435): Consolidation test were performed on selected, relatively undisturbed ring samples. Samples were placed in a consolidometer and loads were applied in geometric progression. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. The consolidation pressure curves are presented in the test data.

Soluble Sulfate (CAL 417A): The soluble sulfate content of selected sample was determined by standard geochemical methods. The test results are presented in the test data and in the table below:

Sample Location	Sample Description	Water Soluble Sulfate in Soil, (% by Weight)	Sulfate Content (ppm)	Exposure Class*
B-2 @ 0-5 feet	Sand	0.0168	168	S0

* Based on the current version of ACI 318-14 Building Code, Table No. 19.3.1.1; Exposure Categories and Classes.

Corrosivity Tests (CAL 422, CAL 643 and CAL 747): Electrical conductivity, pH, and soluble chloride tests were conducted on representative samples and the results are provided in the test data and in the table below:

Sample Location	Sample Description	Soluble Chloride (CAL 422) (ppm)	Electrical Resistivity (CAL 643) (ohm-cm)	pH (CAL 747)	Potential Degree of Attack on Steel
B-2 @ 0-5 feet	Sand	61	1,700	8.0	Corrosive

Expansion Potential (ASTM D4829): The expansion potential of selected materials was evaluated by the Expansion Index Test, ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

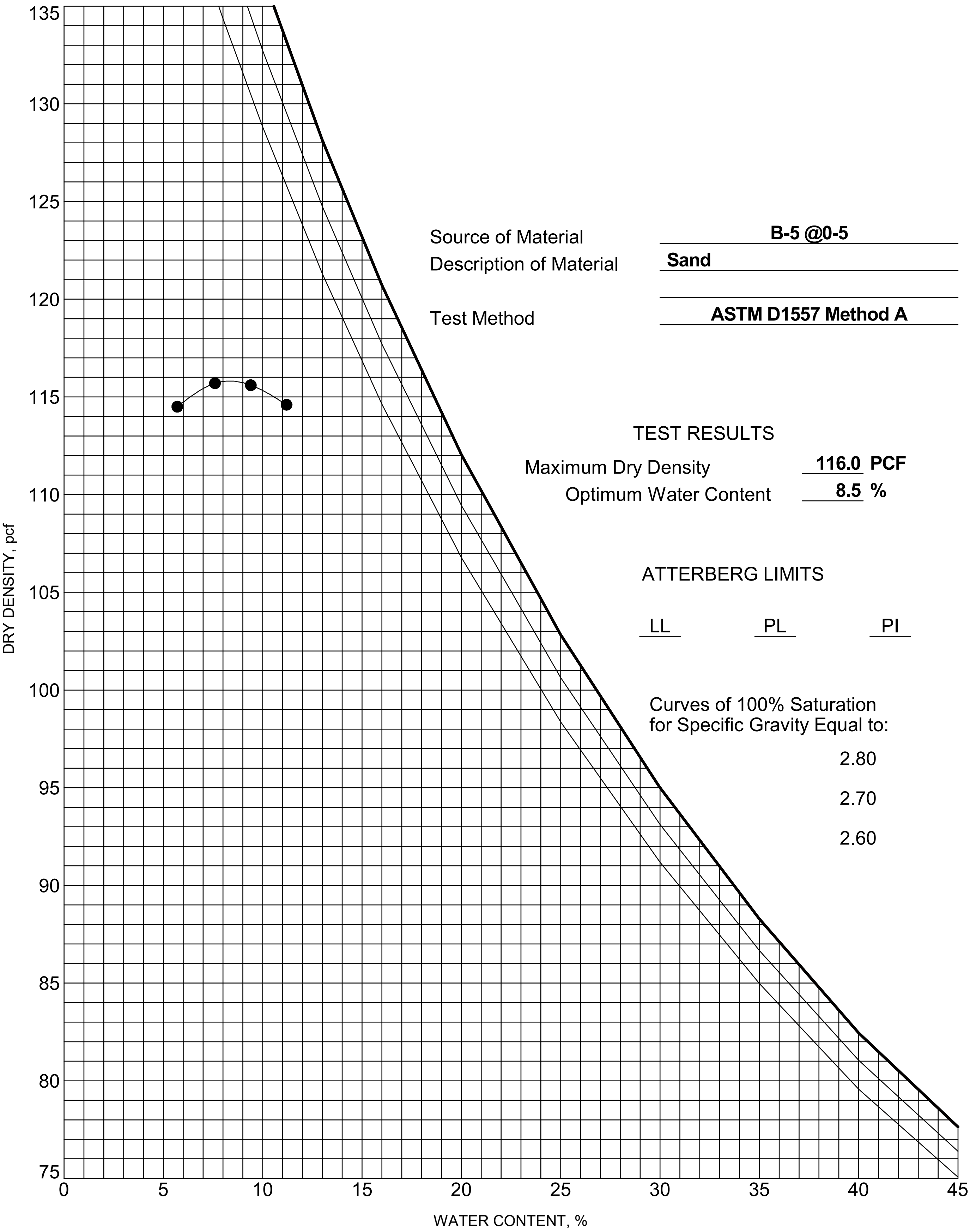
Sample Location	Sample Description	Expansion Index	Expansion Potential
B-8 @ 0-5 feet	Sand	0	Very Low

Passing No. 200 Sieve (ASTM D1140): Typical materials were washed over No. 200 sieve. The test results are presented in the boring logs and in the table below:

Sample Location	% Passing No. 200 Sieve
P-1 @ 0-5 feet	7.2
P-2 @ 0-5 feet	7.2

R-Value: The resistance "R"-Value was determined by the California Materials Method No. 301 for subgrade soils. One sample was prepared, and exudation pressure and "R"-Value determined. The graphically determined "R"-Value at exudation pressure of 300 psi is summarized in the table below:

Sample Location	Sample Description	R-Value
B-8 @ 0-5 feet	Sand	77



Source of Material **B-5 @0-5**

Description of Material **Sand**

Test Method **ASTM D1557 Method A**

TEST RESULTS

Maximum Dry Density **116.0 PCF**

Optimum Water Content **8.5 %**

ATTERBERG LIMITS

LL	PL	PI

Curves of 100% Saturation
for Specific Gravity Equal to:
2.80
2.70
2.60

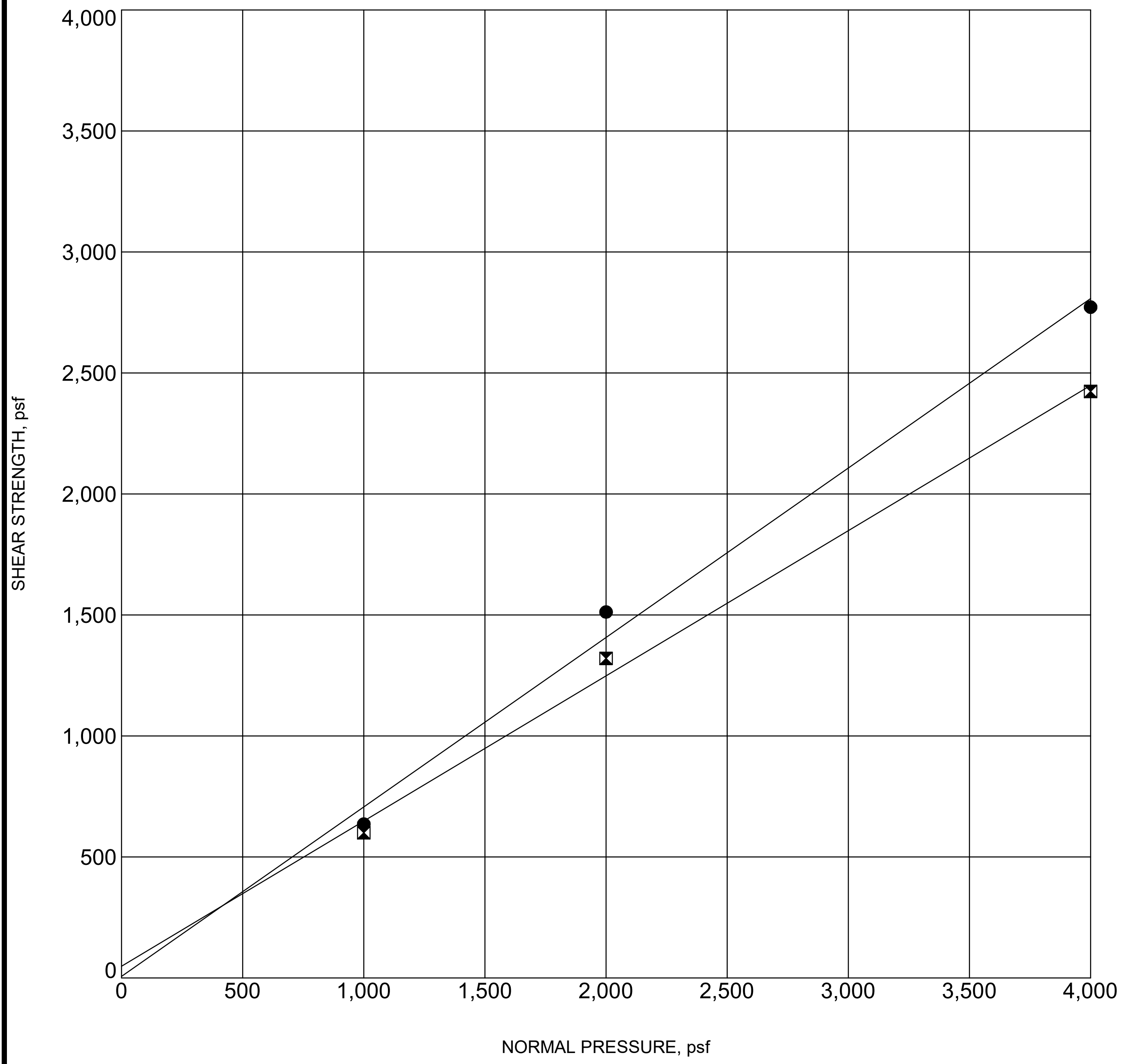
MOISTURE-DENSITY RELATIONSHIP

TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave



Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	**B-5**	**0.5**	**Sand-Remolded 90%, Peak**	**104**	**6**	**6**	**35**
☒	**B-5**	**0.5**	**Sand-Remolded 90%, Ultimate**	**104**	**6**	**48**	**31**

TGR GEOTECHNICAL, INC.

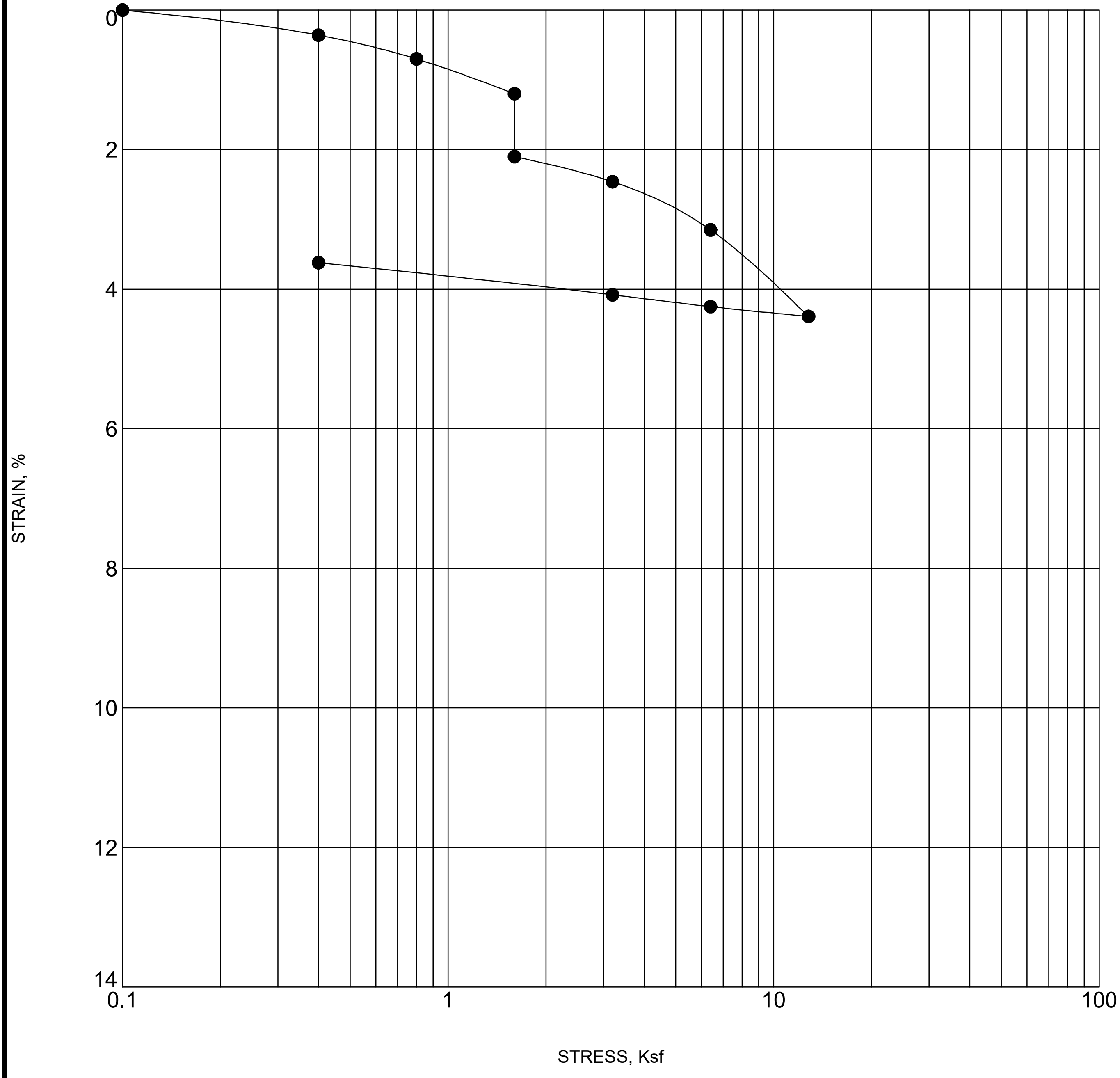
3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

DIRECT SHEAR TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave

US DIRECT SHEAR 22-7418 2830 RIVERSIDE AVE, BLOOMINGTON.GPJ TGR GEOTECH.GDT 2/21/22



	Specimen Identification		Classification	γ_d	MC%
●	**B-3**	**5.0**	**Sand**	**109**	**5**

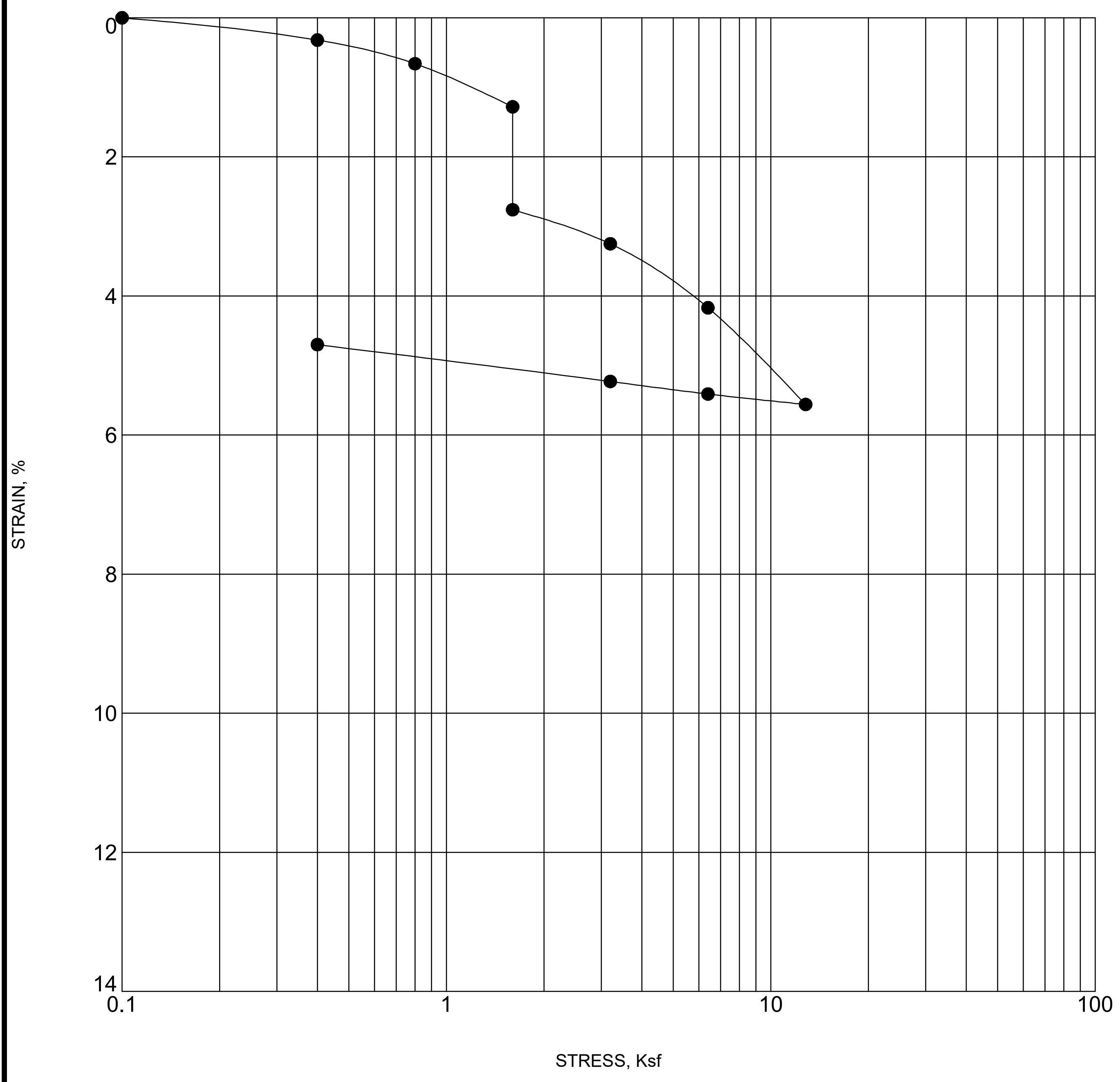
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

CONSOLIDATION TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave



Specimen Identification			Classification	γ_d	MC%
●	**B-5**	**5.0**	**Sand**	**112**	**6**

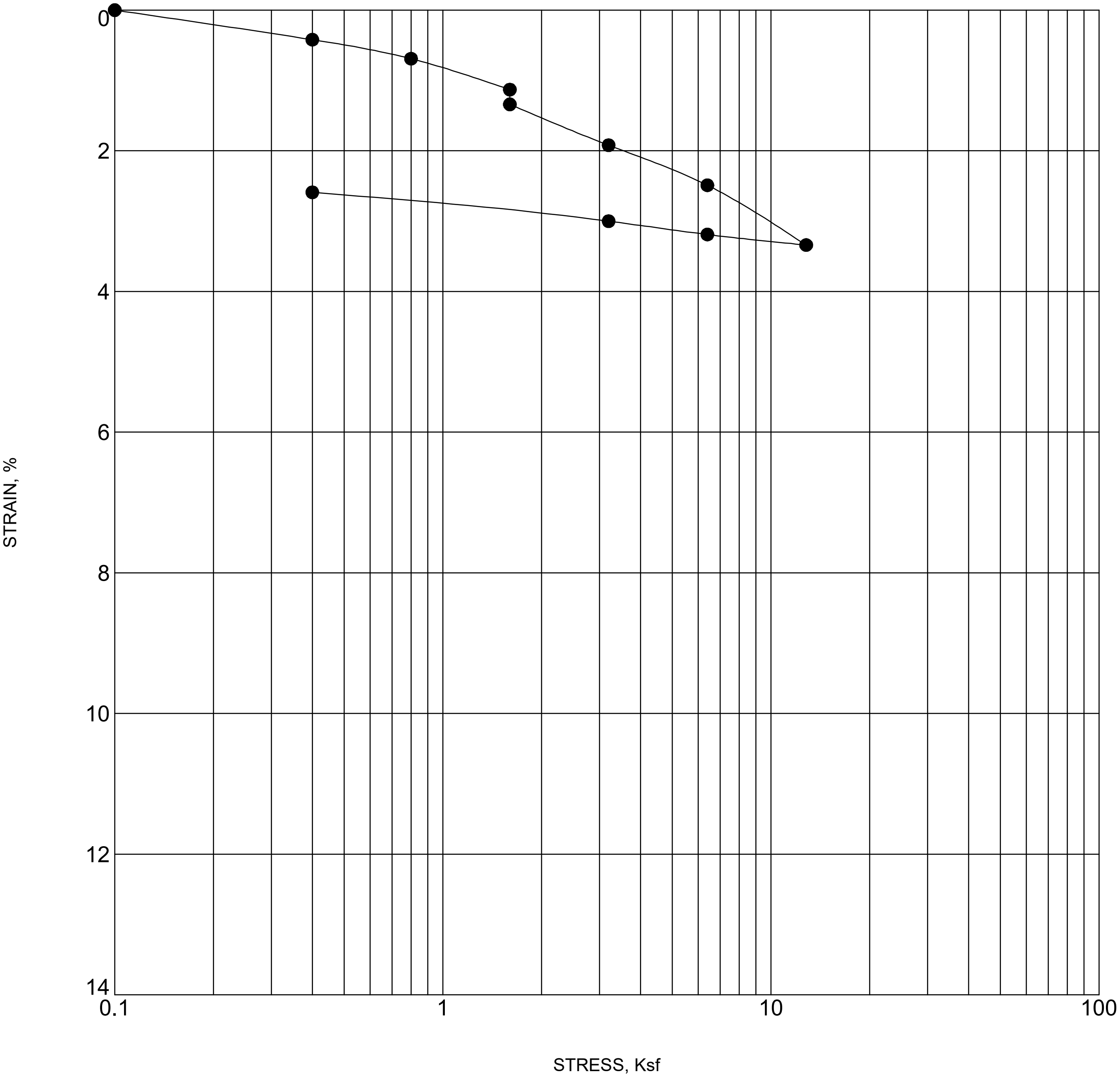
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

CONSOLIDATION TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave



	Specimen Identification		Classification	γ_d	MC%
●	**B-7**	**5.0**	**Sand**	**115**	**6**

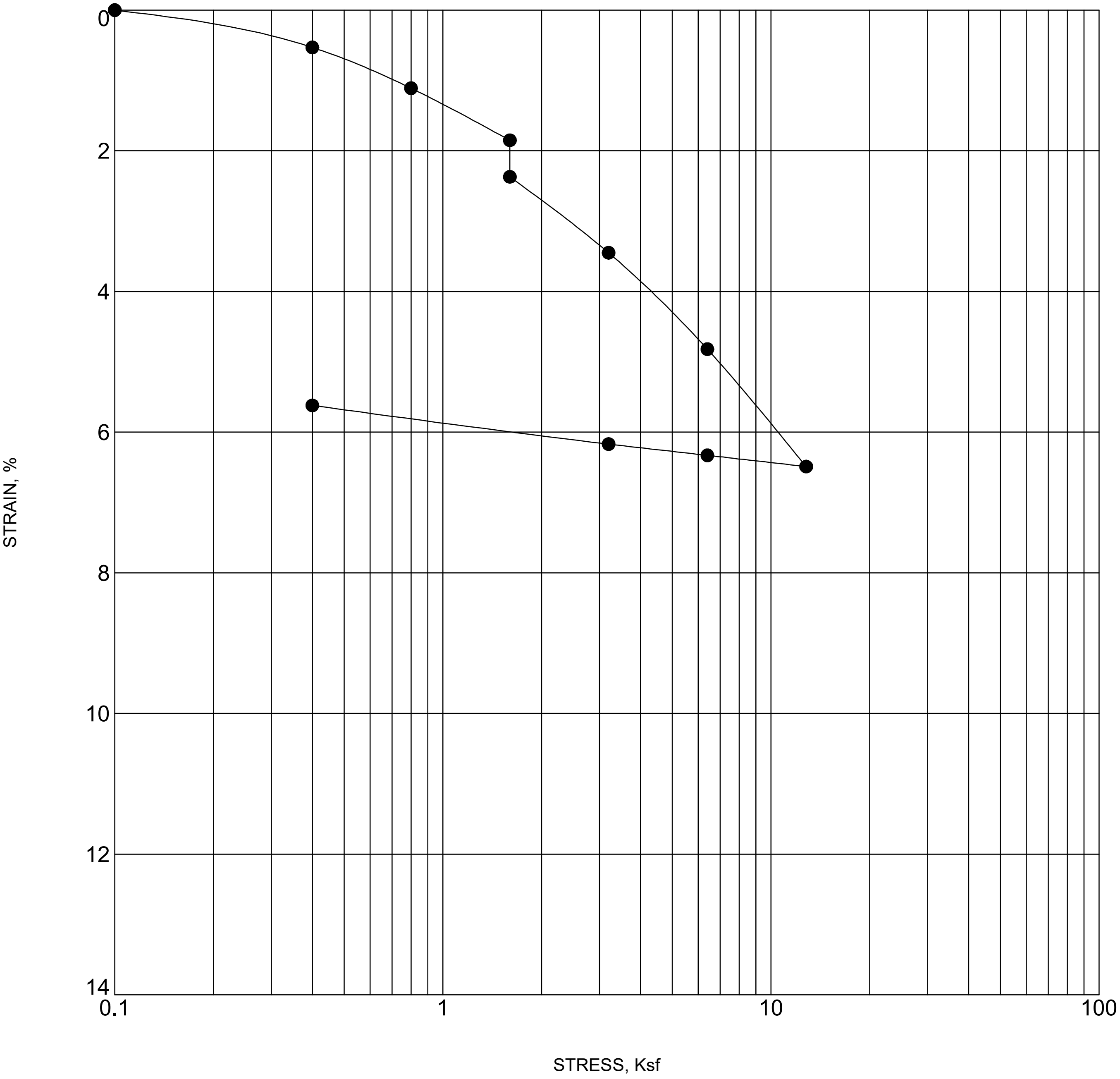
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

CONSOLIDATION TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave



	Specimen Identification		Classification	γ_d	MC%
●	**B-1**	**10.0**	**Silty Sand**	**119**	**12**

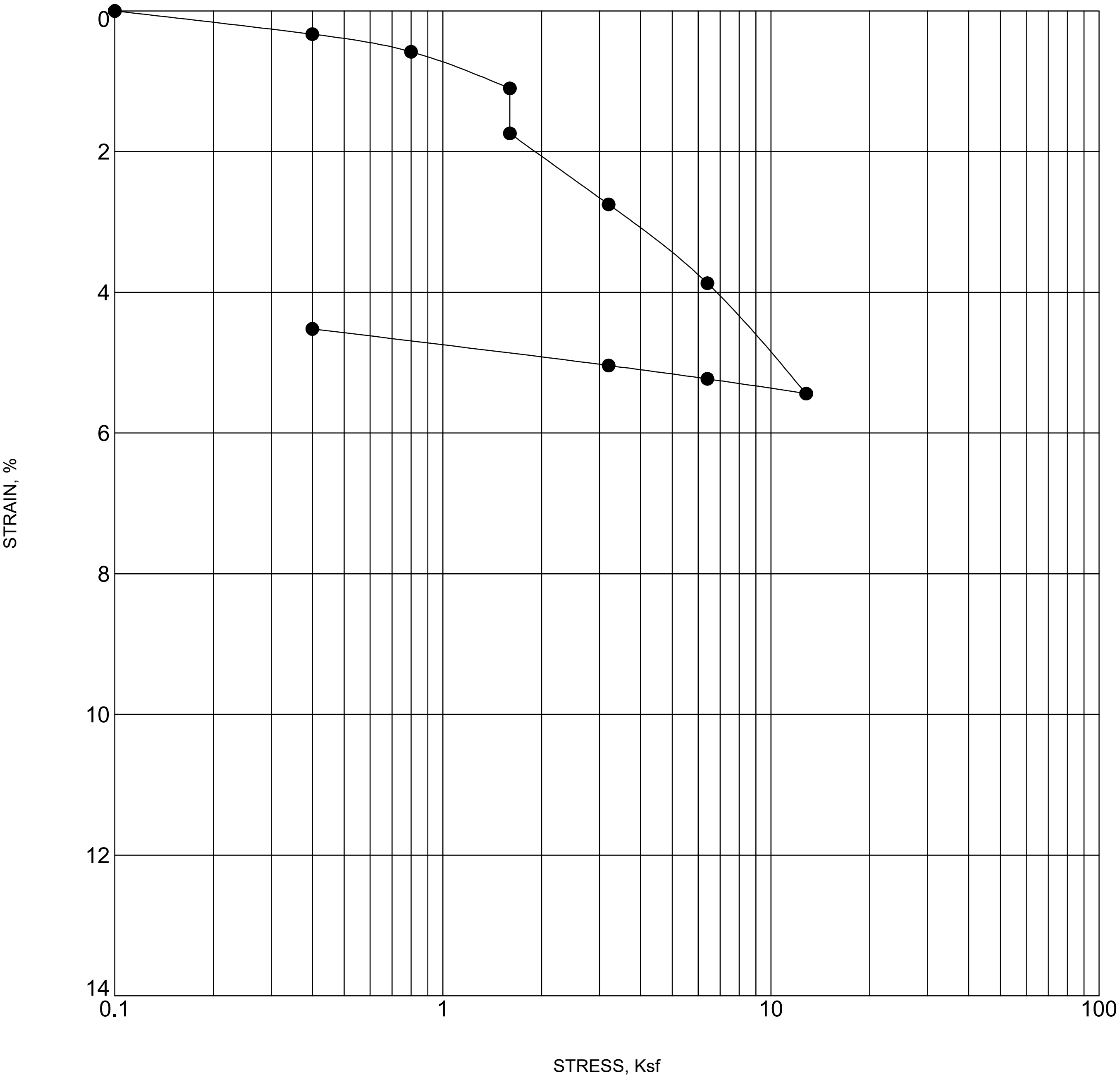
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

CONSOLIDATION TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave



Specimen Identification			Classification	γ_d	MC%
●	**B-5**	**10.0**	**Silty Sand**	**116**	**9**

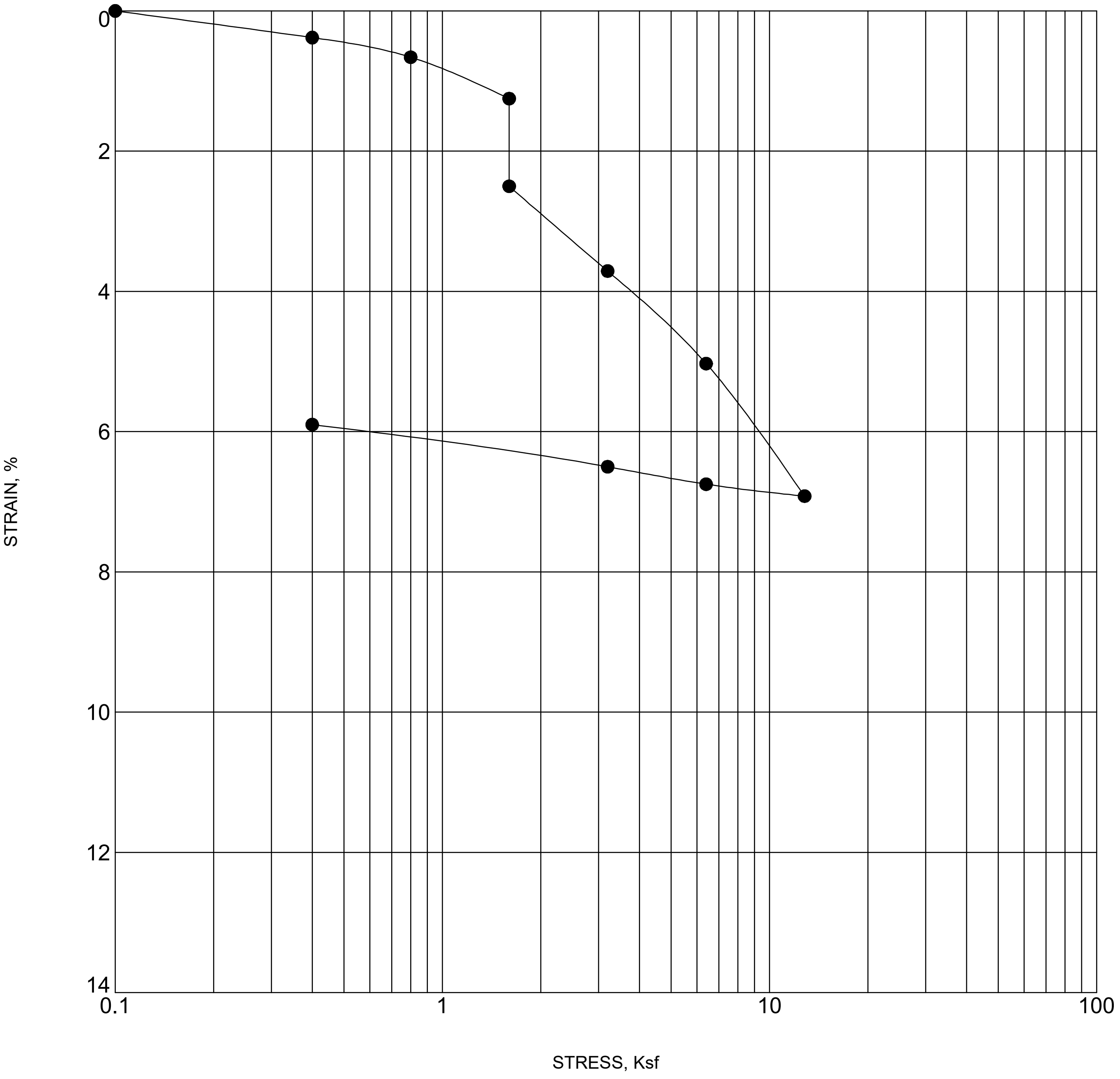
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

CONSOLIDATION TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave



	Specimen Identification		Classification	γ_d	MC%
●	**B-9**	**10.0**	**Silty Sand**	**114**	**8**

TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax:

CONSOLIDATION TEST

Project Number: 22-7418

Project Name: 2830, 11190 & 11258 S. Riverside Ave

ANAHEIM TEST LAB, INC
196 Technology Dr., Unit D
Irvine, CA 92618
Phone (949) 336-6544

TO:

TGR GEOTECHNICAL
3037 S. HARBOR BLVD.
SANTA ANA, CA 92704

DATE: 2/7/2022

P.O. NO: VERBAL

LAB NO: C-5657

SPECIFICATION: CTM-643/417/422

MATERIAL: Soil

Project No.: 22-7418
Project: 2830 S. Riverside
Sample ID: B2 @ 0-5’

ANALYTICAL REPORT

CORROSION SERIES

SUMMARY OF DATA

pH	MIN. RESISTIVITY per CT. 643 ohm-cm	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm
8.0	1,700	168	61

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

ANAHEIM TEST LAB, INC
196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

TO:

TGR GEOTECHNICAL
3037 S. HARBOR BLVD.
SANTA ANA, CA. 92704

DATE: 2/11/2022

P.O. NO.: VERBAL

LAB NO.: C-5659

SPECIFICATION: CTM- 301

MATERIAL: Brown, F. Silty Sand

Project No.: 22-7418
Project: 2830 S Riverside
Sample ID: B8 @ 0-5’

ANALYTICAL REPORT

“R” VALUE

BY EXUDATION	BY EXPANSION
77	N/A

RESPECTFULLY SUBMITTED

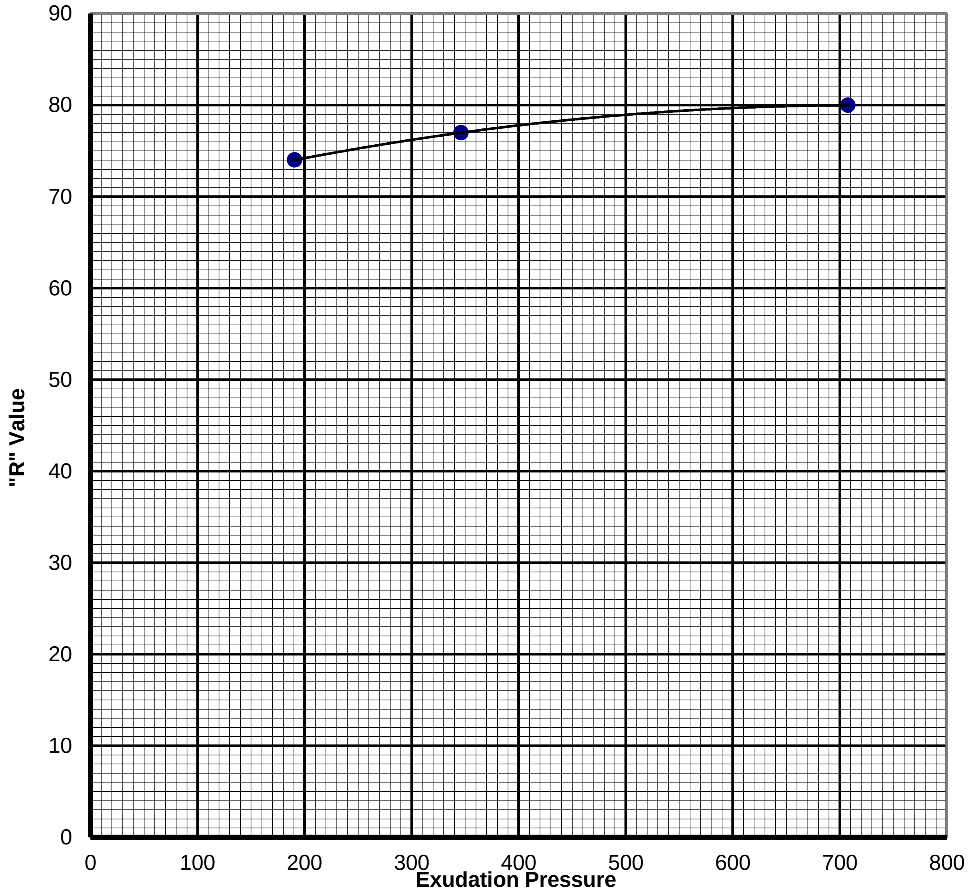
WES BRIDGER LAB MANAGER

"R" VALUE CA 301

Client: TGR Geotechnical **ATL No.:** C 5659 **Date:** 2/11/2022
Client Reference No.: 22-7418
Sample: B8 @ 0-5' **Soil Type:** Brown, F. Silty Sand
.

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	350	350	350	
Initial Moisture Content	%	5.1	5.1	5.1	
Moisture at Compaction	%	10.3	9.6	10.0	
Briquette Height	in.	2.53	2.53	2.49	
Dry Density	pcf	116.3	117.3	116.8	
EXUDATION PRESSURE	psi	191	708	346	
EXPANSION PRESSURE	psf	0	9	0	
Ph at 1000 pounds	psi	18	13	15	
Ph at 2000 pounds	psi	31	24	27	
Displacement	turns	3.7	3.54	3.66	
"R" Value		74	80	77	
CORRECTED "R" VALUE		74	80	77	

Final "R" Value	
BY EXUDATION: @ 300 psi	**77**
BY EXPANSION: TI = 5.0	**N/A**



APPENDIX D
SITE SEISMICITY AND DEAGGREGATED PARAMETERS

TABLE 1

SITE SPECIFIC GROUND MOTION ANALYSIS

22-7418 2830 S. Riverside Avenue, Bloomington

SA Period (sec)	Probabilistic Spectral Acceleration MCER (g)	Deterministic Spectral Acceleration (g)	Is Largest Deterministic Spectral Acceleration <1.5*Fa	Deterministic MCER	Site Specific MCER	2/3 of Site Specific MCER	80% Code Design	Site Specific Design Response Spectrum
	Rotated Maximum	Rotated Maximum 84th Percentile						
0	0.9724	0.7798	No	0.7798	0.7798	0.5199	0.3588	0.5199
0.1	1.6742	1.1330		1.1330	1.1330	0.7553	0.6348	0.7553
0.2	2.2011	1.5647		1.5647	1.5647	1.0431	0.8971	1.0431
0.3	2.4795	1.9357		1.9357	1.9357	1.2904	0.8971	1.2904
0.5	2.4746	2.1833		2.1833	2.1833	1.4555	0.8971	1.4555
0.75	2.1335	2.0118		2.0118	2.0118	1.3412	0.8971	1.3412
1	1.8902	1.8831		1.8831	1.8831	1.2554	0.8747	1.2554
2	1.1556	1.2351		1.2351	1.1556	0.7704	0.4373	0.7704
3	0.8414	0.9185		0.9185	0.8414	0.5609	0.2916	0.5609
4	0.6511	0.6961		0.6961	0.6511	0.4340	0.2187	0.4340
5	0.5250	0.5418		0.5418	0.5250	0.3500	0.1749	0.3500

Code Sds	1.121	Crs =	0.924	Code Ss =	1.682	**Site Specific S_{DS} =**	**1.310**
Code Sd1	1.093	Cr1 =	0.898	Code S1 =	0.656	**Site Specific S_{D1} =**	**1.750**
To	0.20	Code Fa =	1	Sms =	1.682		
Ts	0.98	Code Fv =	2.5	Sm1 =	1.64		
TL	8						
Input							

FIGURE 1

Site Specific Design Response Spectra

22-7418 2830 S. Riverside Avenue, Bloomington

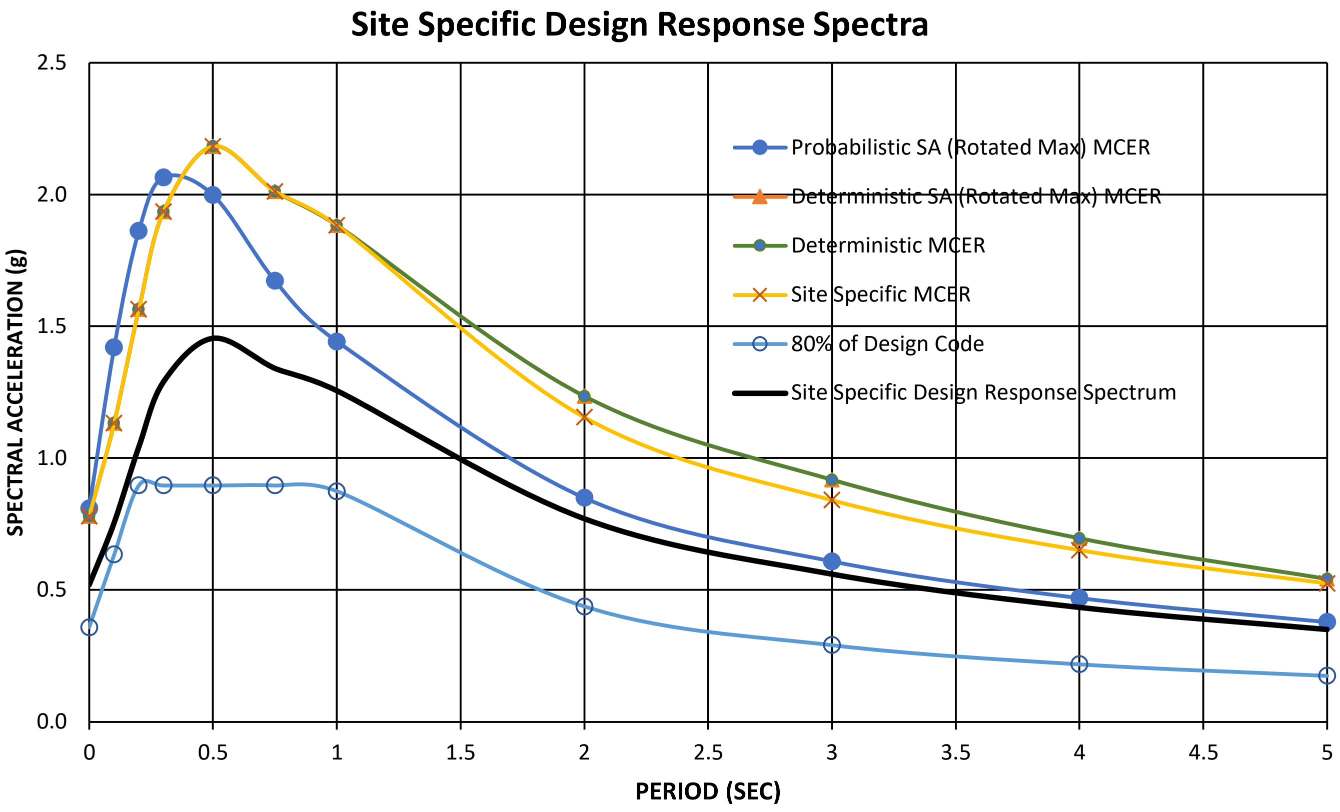


TABLE 2

Probabilistic Response Spectrum ASCE 7-16 Method 2

22-7418 2830 S. Riverside Avenue, Bloomington

Period (g)	UHGM (g)	RTGM (g)	Max Dir Scale factor	Max Dir RTGM (g)
0	0.900	0.884	1.1	0.972
0.1	1.528	1.522	1.1	1.674
0.2	1.987	2.001	1.1	2.201
0.3	2.260	2.204	1.125	2.480
0.5	2.243	2.106	1.175	2.475
0.75	1.863	1.724	1.2375	2.133
1	1.598	1.454	1.3	1.890
2	0.970	0.856	1.35	1.156
3	0.685	0.601	1.4	0.841
4	0.511	0.449	1.45	0.651
5	0.400	0.350	1.5	0.525

Probabilistic Response Spectra per ASCE 7-16

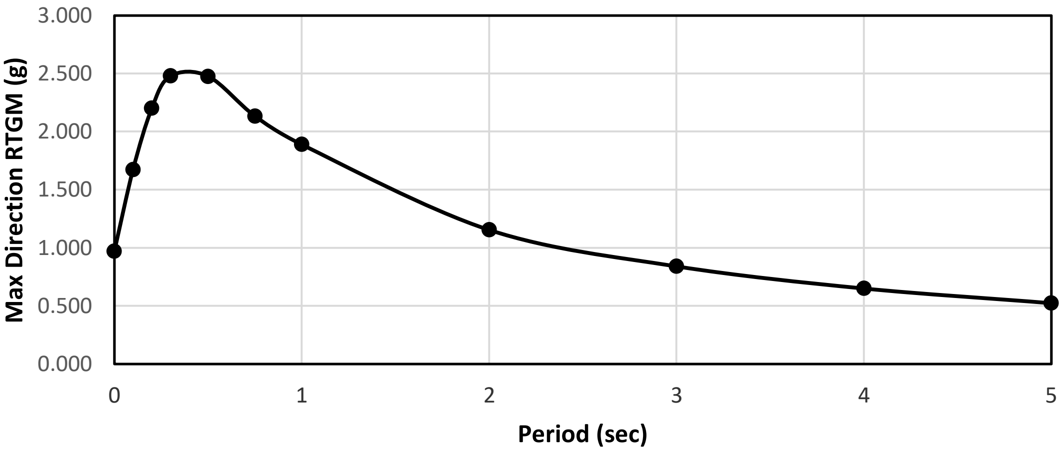
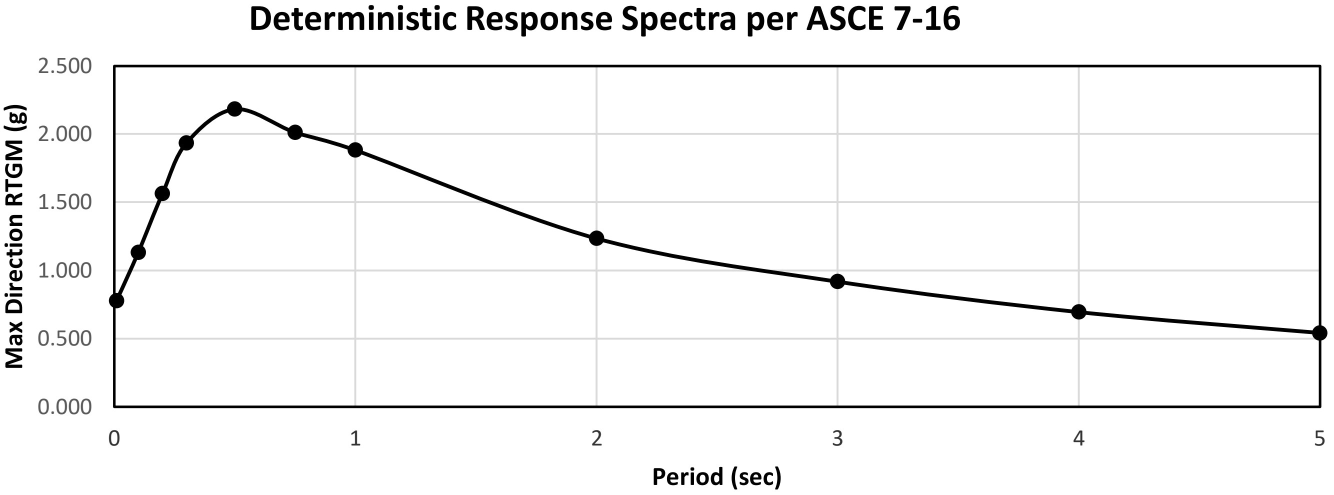


TABLE 3

Deterministic Response Spectrum ASCE 7-16

22-7418 2830 S. Riverside Avenue, Bloomington

Period (g)	84th-Percentile Spectral Acceleration (g)	Max Dir Scale factor	Max Dir Deterministic SA (g)
0.01	0.709	1.1	0.780
0.1	1.030	1.1	1.133
0.2	1.422	1.1	1.565
0.3	1.721	1.125	1.936
0.5	1.858	1.175	2.183
0.75	1.626	1.2375	2.012
1	1.449	1.3	1.883
2	0.915	1.35	1.235
3	0.656	1.4	0.919
4	0.480	1.45	0.696
5	0.361	1.5	0.542



APPENDIX E
STANDARD GRADING GUIDELINES

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for grading operations performed under the observation and testing of TGR Geotechnical, Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the Preliminary Geotechnical Investigation report, or in other written communication signed by the Soils Engineer or Engineering Geologist.

1.0 GENERAL

- The Soils Engineer and Engineering Geologist are the Owner's or Builder's representatives on the project. For the purpose of these specifications, observation and testing by the Soils Engineer includes that observation and testing performed by any person or persons employed by, and responsible to, the licensed Geotechnical Engineer or Geologist signing the grading report.

- All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the observation of the Geotechnical Engineer.

- It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Geotechnical Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Geotechnical Engineer. The Contractor shall also remove all material considered unsatisfactory by the Geotechnical Engineer.

- It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of Compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.

- A final report will be issued by the Geotechnical Engineer and Engineering Geologist attesting to the Contractor's conformance with these specifications.

2.0 SITE PREPARATION

- All vegetation and deleterious material such as rubbish shall be disposed of off-site. The removal must be concluded prior to placing fill.

- The Civil Engineer shall locate all houses, sheds, sewage disposal systems, large trees or structures on the site, or on the grading plan to the best of his knowledge prior to preparing the ground surface.

- Soil, alluvium or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as part of a compacted fill must be approved by the Geotechnical Engineer.

- After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

  The scarified ground surface shall then be brought to optimum moisture content, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches. Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Geotechnical Engineer.

- Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer.

3.0 COMPACTED FILLS

- Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Geotechnical Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Geotechnical Engineer.
- Rock fragments less than six inches in diameter may be utilized in the fill, provided:

  - They are not placed in concentrated pockets.
  - There is a sufficient percentage of fine-grained material to surround the rocks.
  - The distribution of the rocks is observed by the Geotechnical Engineer.

- Rocks greater than six inches in diameter shall be taken off-site, or placed in accordance with the recommendations of the Geotechnical Engineer in areas designated as suitable for rock disposal. Details for rock disposal such as location, moisture control, percentage of the rock placed, etc., will be referred to in the “Conclusions and Recommendations” section of the Geotechnical Report, if applicable.

  If rocks greater than six inches in diameter were not anticipated in the Preliminary Geotechnical report, rock disposal recommendations may not have been made in the “Conclusions and Recommendations” section. In this case, the Contractor shall notify the Geotechnical Engineer if rocks greater than six inches in diameter are encountered. The Geotechnical Engineer will then prepare a rock disposal recommendation or request that such rocks be taken off-site.

- Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

- Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Geotechnical Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Engineer as soon as possible.

- Material used in the compacting process shall be evenly spread, watered or dried, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

- If the moisture content or relative compaction varies from that required by the Geotechnical Engineer, the Contractor shall rework the fill until it is approved by the Geotechnical Engineer.

- Each layer shall be compacted to 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency; (in general, ASTM D1557 will be used.)

  If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use of expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the grading report.

- All fill shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Geotechnical Engineer.

- The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the Preliminary report. (See details)

- Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendation of the Geotechnical Engineer and Engineer Geologist.

- The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

The Contractor shall prepare a written detailed description of the method or methods he will employ to obtain the required slope compaction. Such documents shall be submitted to the Geotechnical Engineer for review and comments prior to the start of grading.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the contractor will be notified by the Geotechnical Engineer.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Geotechnical Engineer.

- All fill slopes should be planted or protected from erosion by methods specified in the preliminary report or by means approved by the governing authorities.

- Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill. (See detail)

4.0 CUT SLOPES

- The Engineering Geologist shall inspect all cut slopes excavated in rock, lithified or formation material at vertical intervals not exceeding ten feet.

- If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer; and recommendations shall be made to treat these problems.

- Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erosive interceptor swale placed at the top of the slope.

- Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

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

5.0 GRADING CONTROL

- Inspection of the fill placement shall be provided by the Geotechnical Engineer during the progress of grading.

- In general, density tests should be made at intervals not exceeding two feet of fill height or every 500 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction of being achieved.
- Density tests should be made on the surface material to receive fill as required by the Geotechnical Engineer.

- All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Geotechnical Engineer (and often by the governing authorities) prior to placing any fill. It shall be the Contractor’s responsibility to notify the Geotechnical Engineer and governing authorities when such areas are ready for inspection.

6.0 CONSTRUCTION CONSIDERATIONS

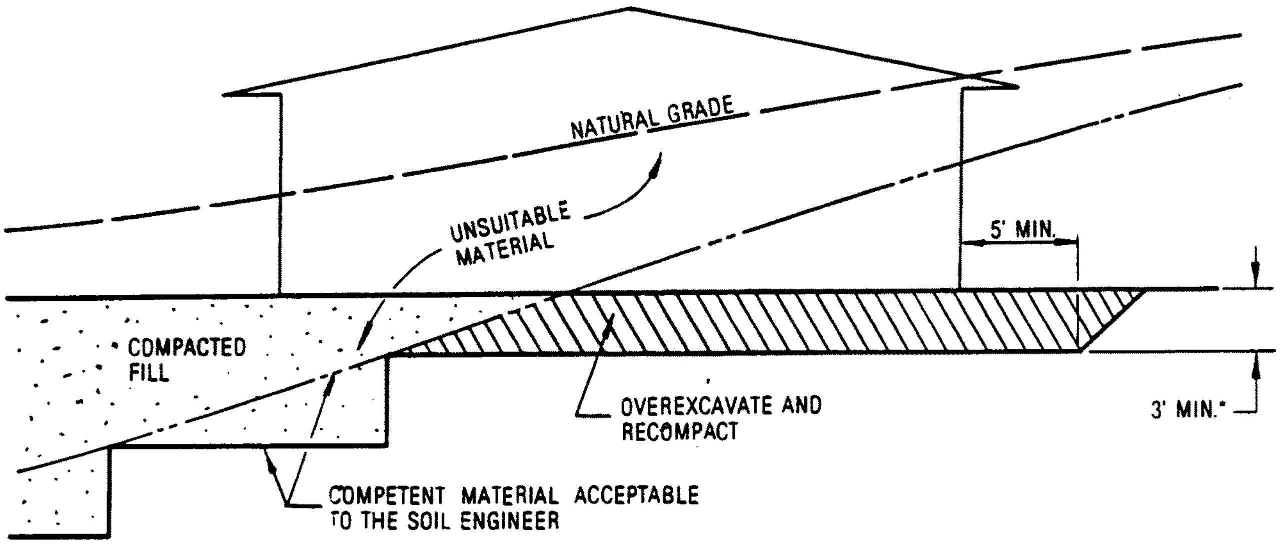
- Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

- Upon completion of grading and termination of observations by the Geotechnical Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Geotechnical Engineer or Engineering Geologist.

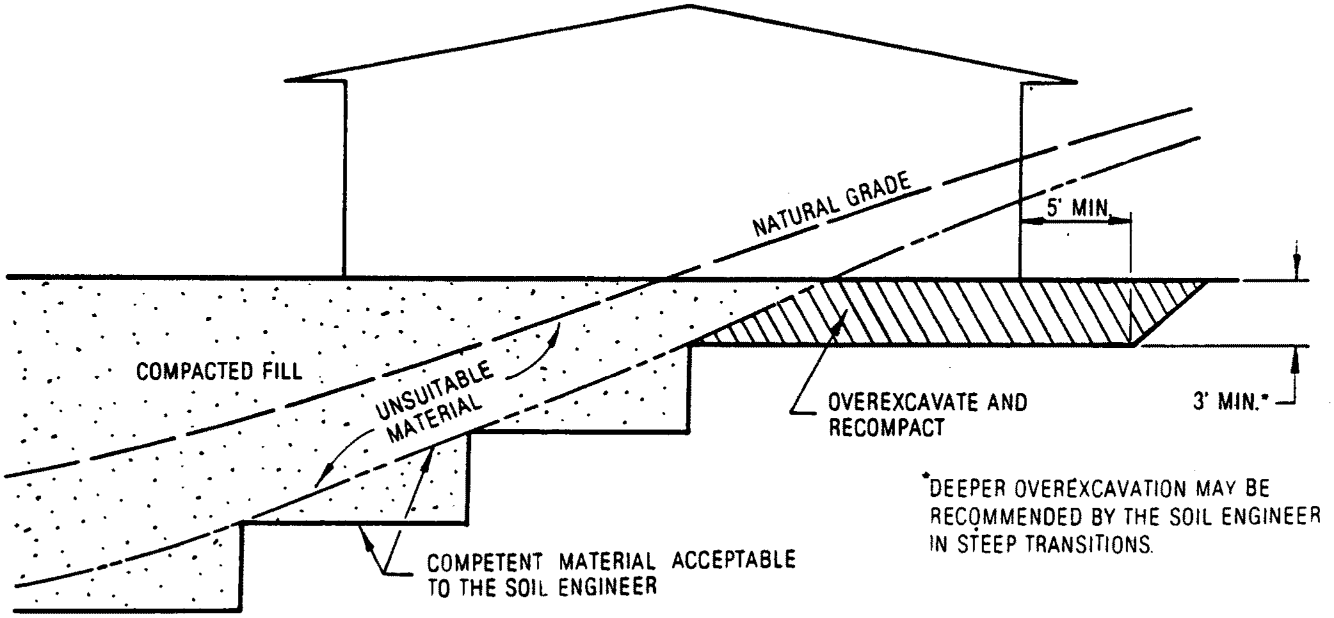
- Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

TYPICAL OVEREXCAVATION OF DAYLIGHT LINE

CUT LOT

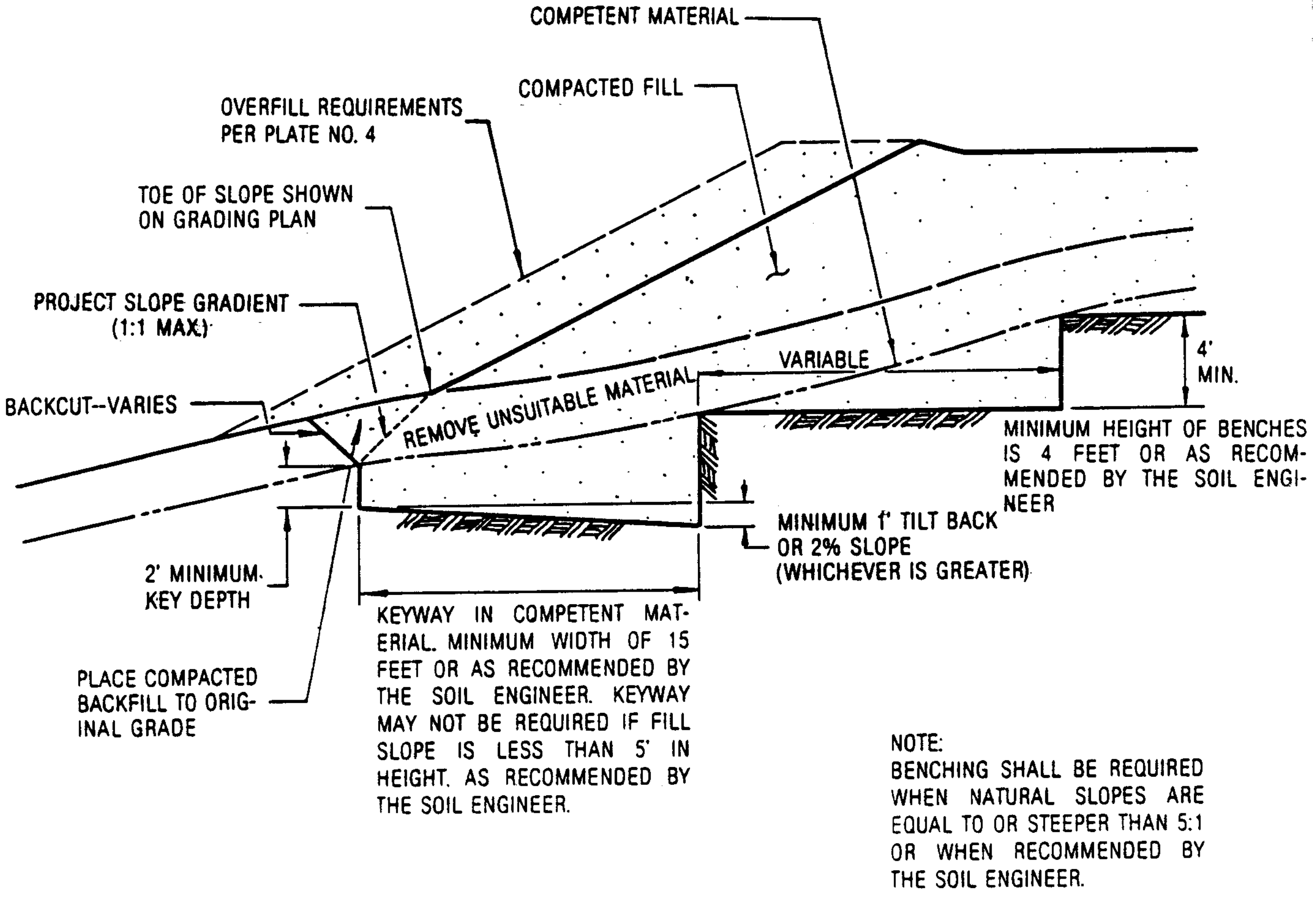


CUT FILL LOT (TRANSITION)



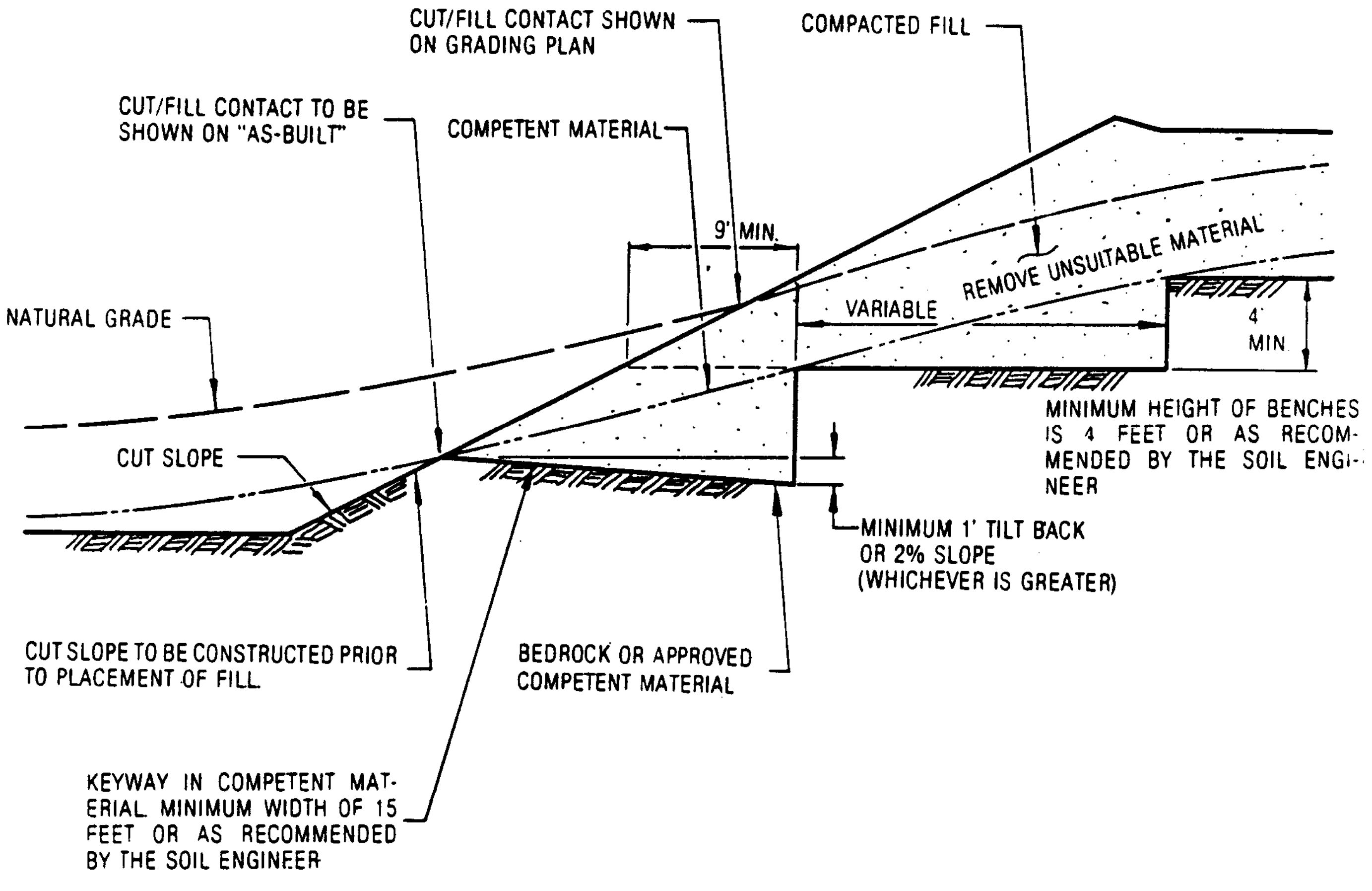
*DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOIL ENGINEER IN STEEP TRANSITIONS.

TYPICAL FILL OVER NATURAL SLOPE

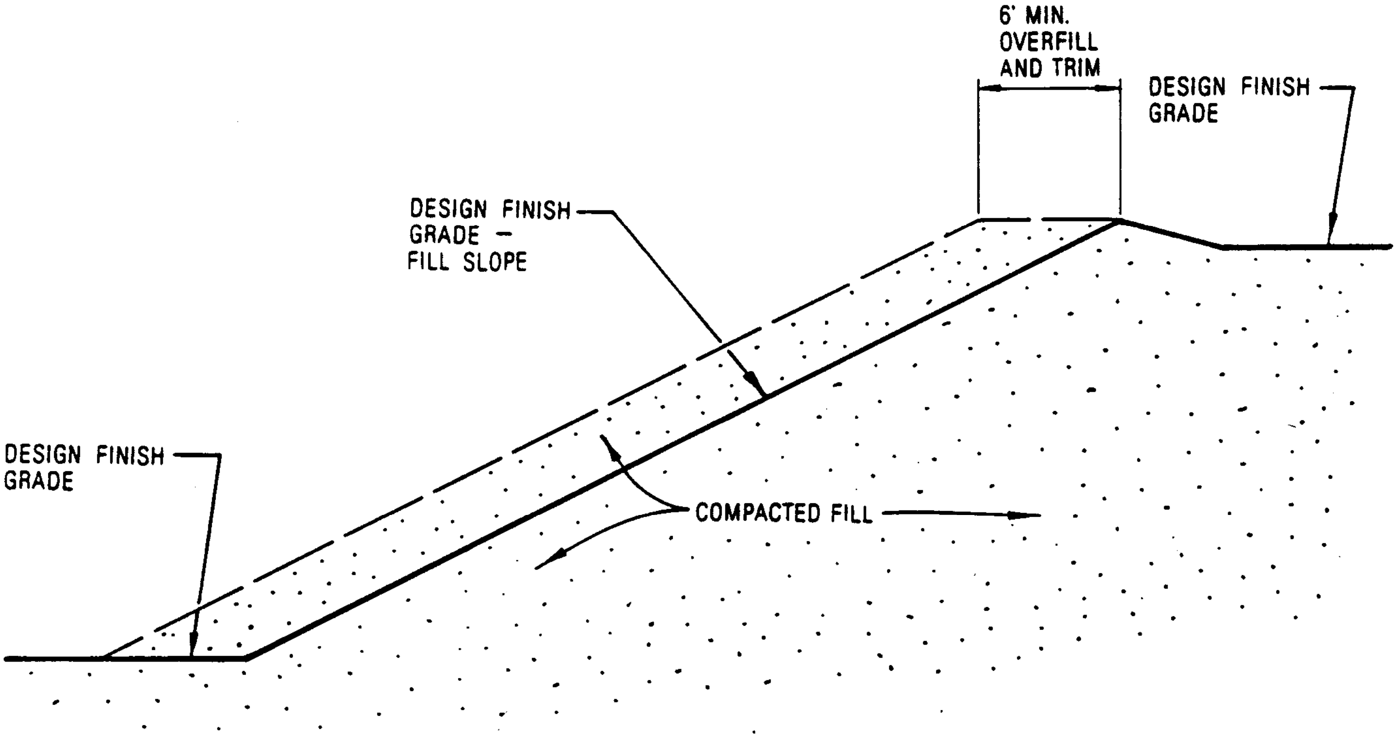


NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE SOIL ENGINEER.

TYPICAL FILL-OVER-CUT SLOPE



TYPICAL FILL SLOPE CONSTRUCTION

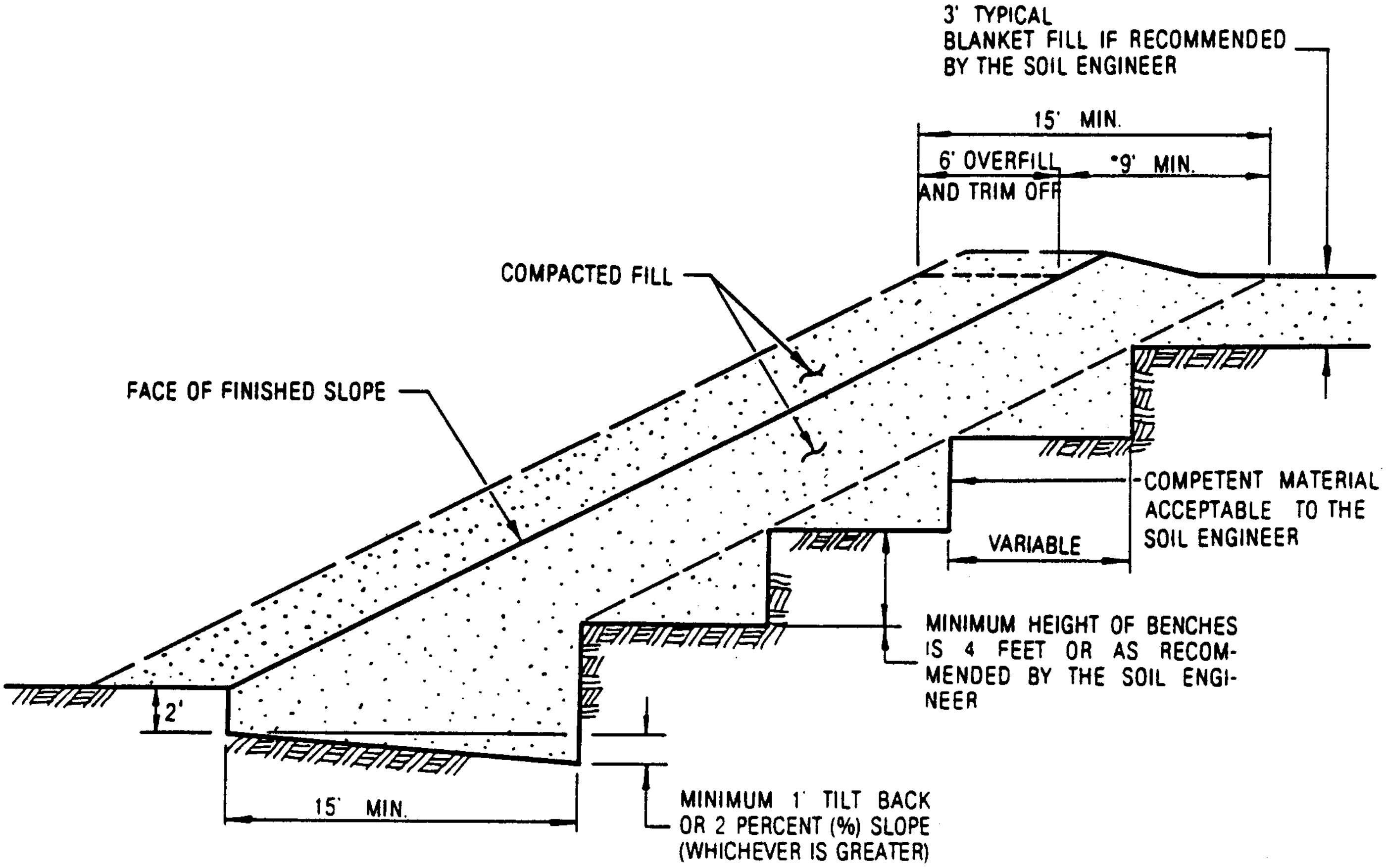


NOTES:

1. ALL FILL SLOPES, INCLUDING BUTTRESS AND STABILIZATION FILLS, SHALL BE OVERFILLED A MINIMUM OF SIX FEET HORIZONTALLY WITH COMPACTED FILL AND TRIMMED TO THE DESIGN FINISH GRADE.

   EXCEPTIONS:
   A. FILL SLOPE OVER CUT SLOPE.
   B. FILL SLOPE ADJACENT TO EXISTING IMPROVEMENTS.
2. THE EXCEPTIONS ABOVE WHICH DO NOT HAVE THE 6 FOOT SLOPE OVERFILL AND TRIM SHALL BE COMPACTED AS STATED IN THE PROJECT SPECIFICATIONS.

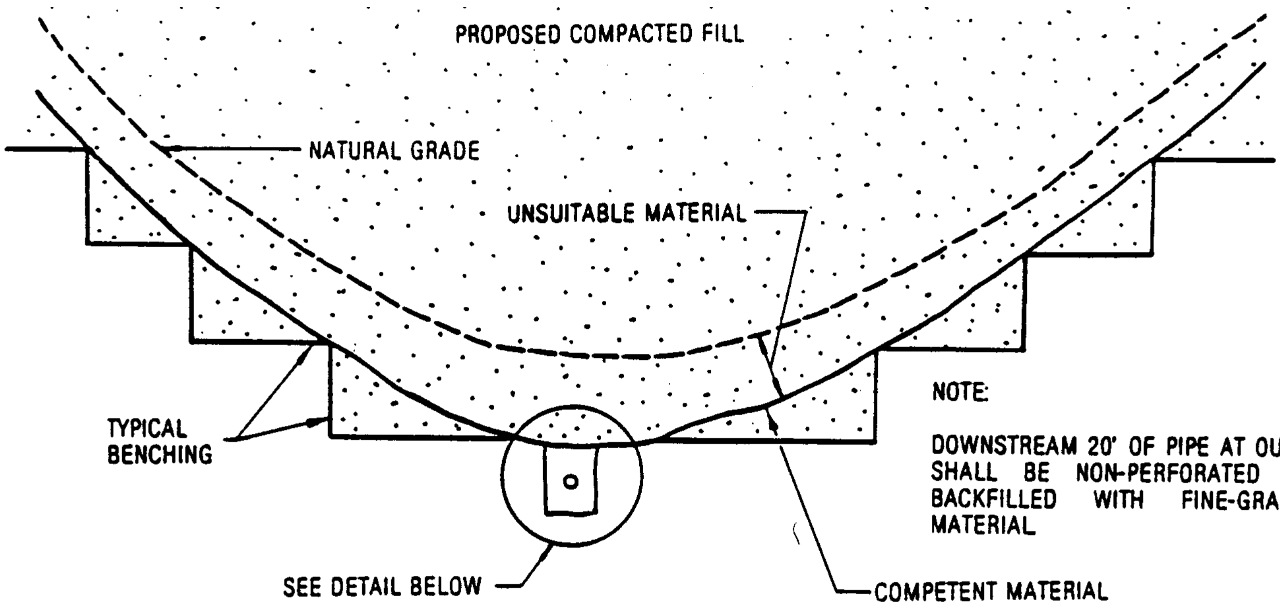
TYPICAL STABILIZATION FILL



NOTE:
SEE PLATE 6 FOR TYPICAL SUBDRAIN DETAILS FOR STABILIZATION FILLS. IF RECOMMENDED BY THE SOIL ENGINEER.

*GREATER THAN 9' IF RECOMMENDED BY THE SOIL ENGINEER: 15' WHERE NO 6' OVERFILL

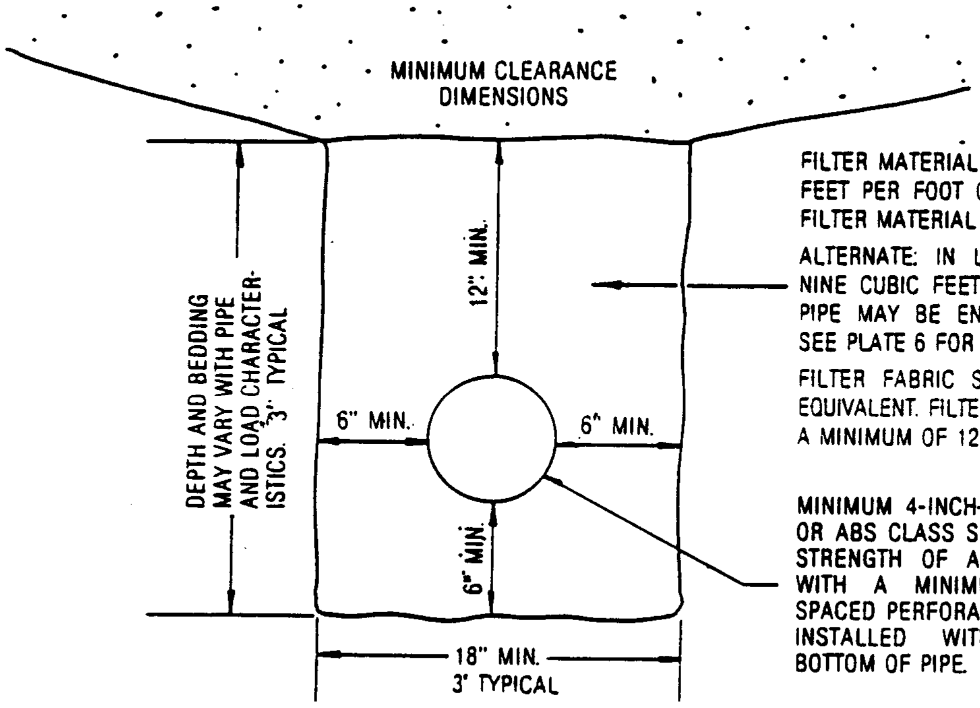
TYPICAL CANYON SUBDRAIN



NOTE:

DOWNSTREAM 20' OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL

NOTES:
PIPE SHALL BE A MINIMUM OF 4 INCHES DIAMETER AND RUNS OF 500 FEET OR MORE USE 6-INCH DIAMETER PIPE, OR AS RECOMMENDED BY THE SOIL ENGINEER



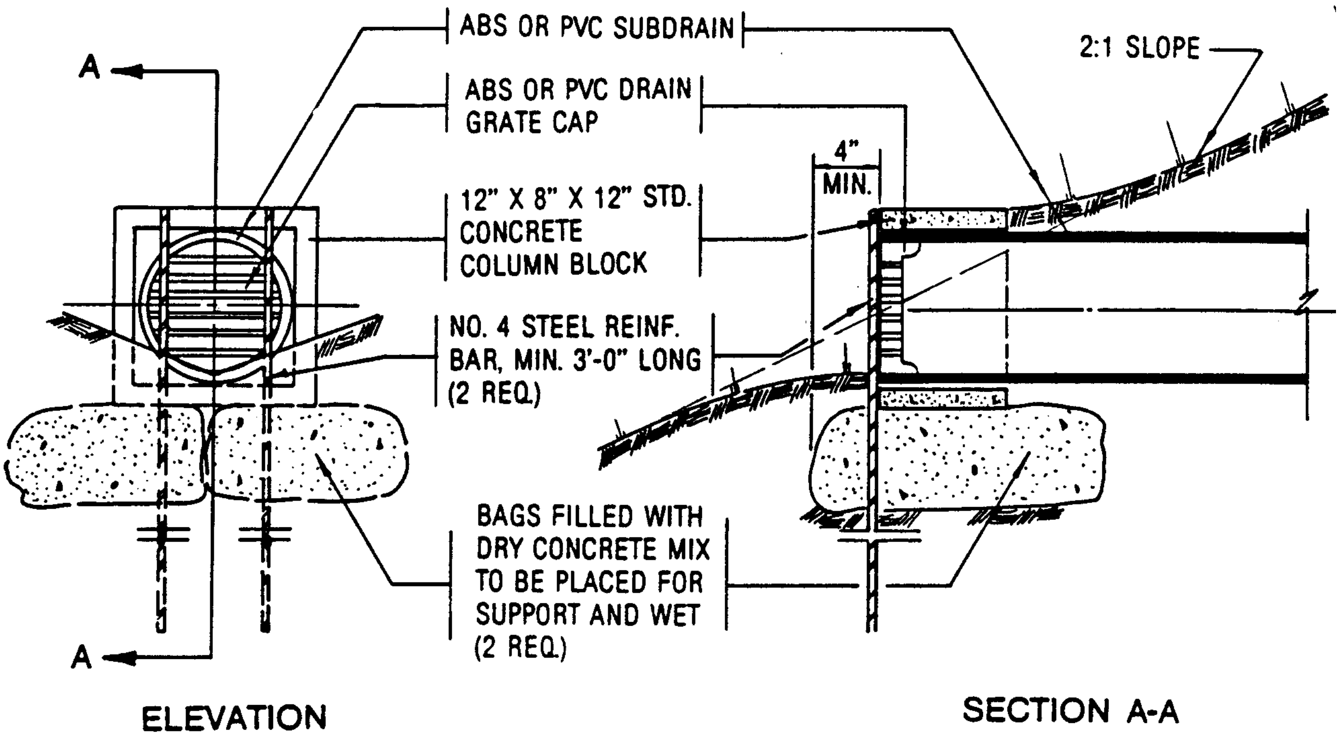
FILTER MATERIAL - MINIMUM OF NINE CUBIC FEET PER FOOT OF PIPE. SEE PLATE 6 FOR FILTER MATERIAL SPECIFICATION.

ALTERNATE: IN LIEU OF FILTER MATERIAL NINE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE PLATE 6 FOR GRAVEL SPECIFICATIONS.

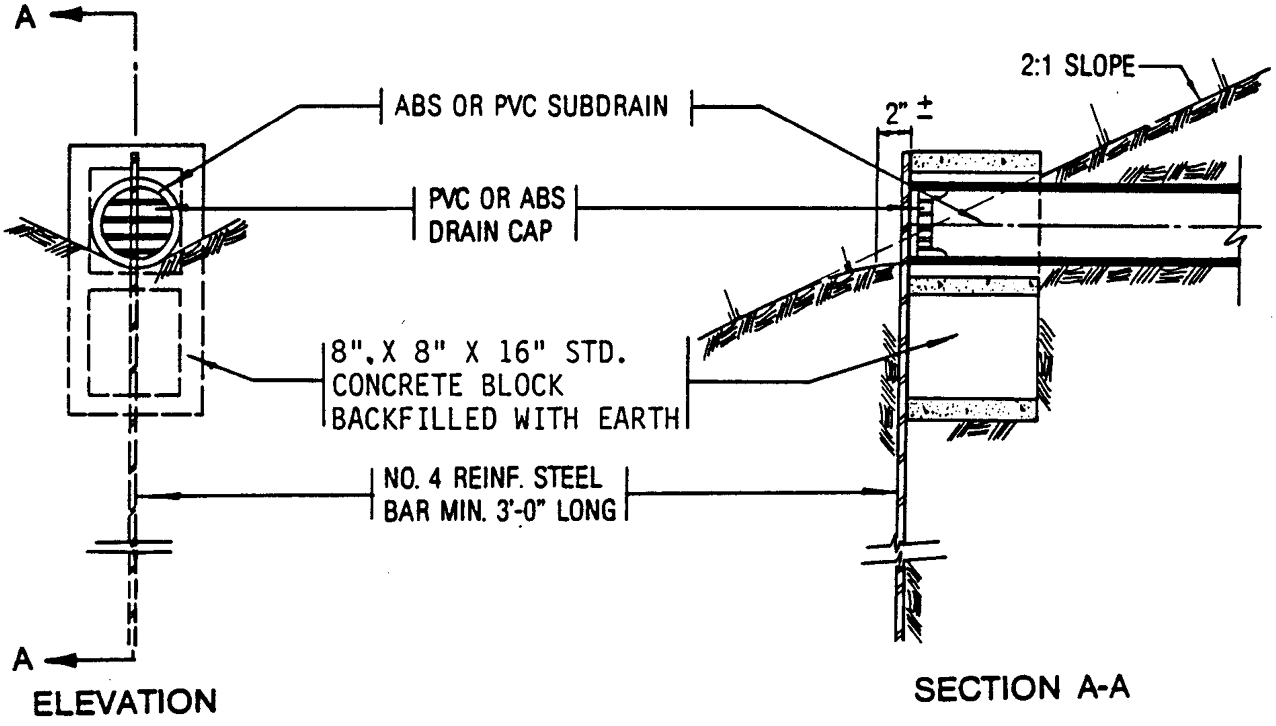
FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4-INCH-DIAMETER, PVC SCH. 40 OR ABS CLASS SDR-35 WITH A CRUSHING STRENGTH OF AT LEAST 1000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE, INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE.

SUBDRAIN OUTLET MARKER

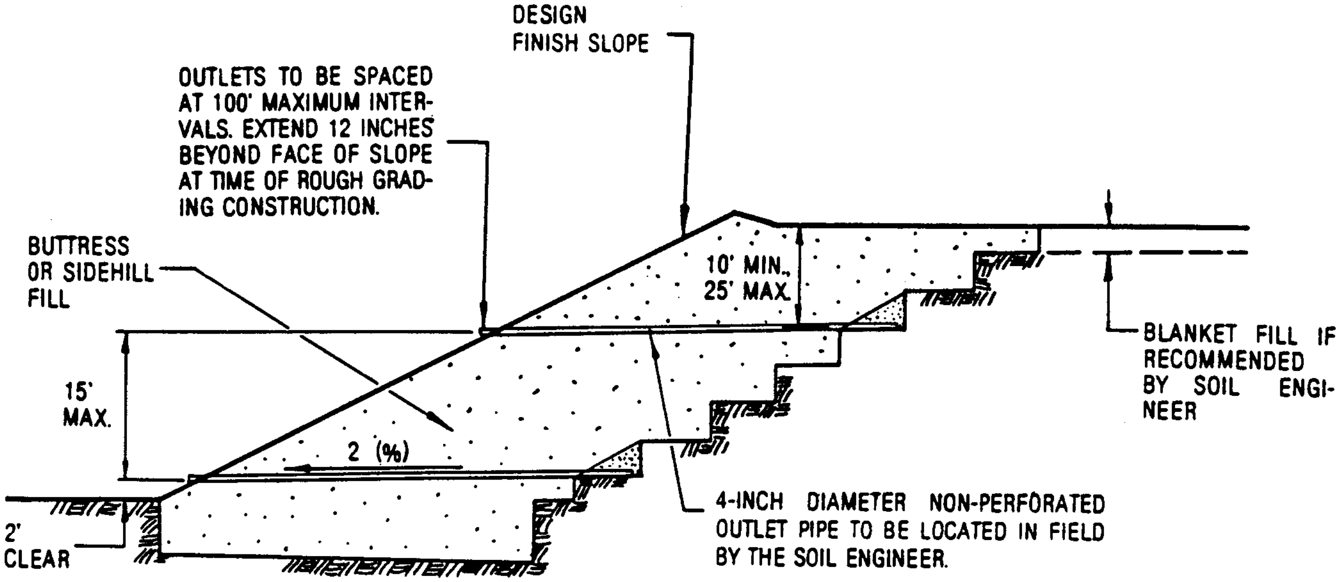


SUBDRAIN OUTLET MARKER FOR 6" AND 8" PIPES



SUBDRAIN OUTLET MARKER – 4" PIPE

TYPICAL STABILIZATION AND BUTTRESS FILL SUBDRAIN



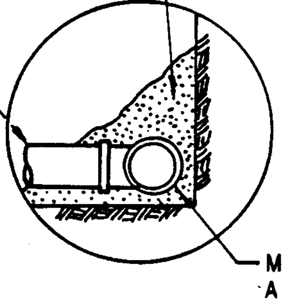
FILTER MATERIAL" TO MEET FOLLOWING SPECIFI-
:ATION OR APPROVED EQUIVALENT: (CONFORMS TO
:MA STD. PLAN 323)

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
1½"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



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

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 LEASE 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.

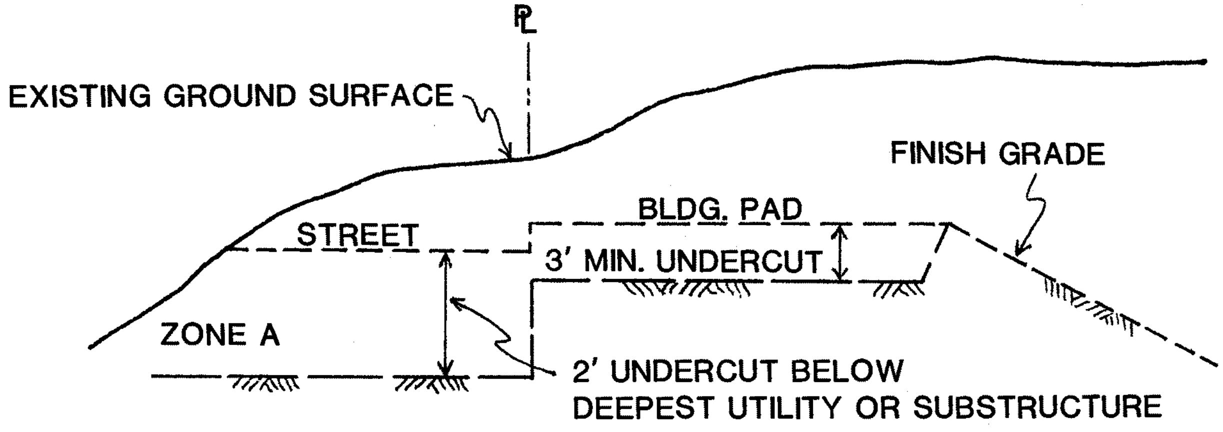
NOTES:

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

TGR Geotechnical, Inc.

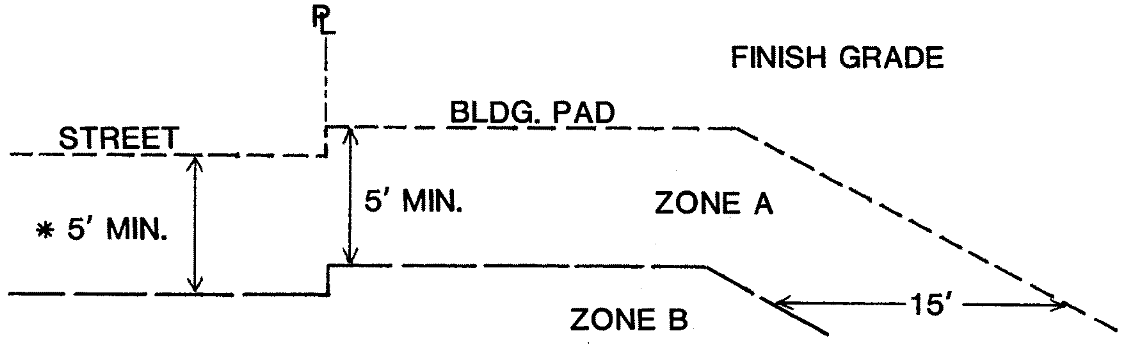
TYPICAL CUT AND FILL GRADING DETAILS

TYPICAL GRADING WITHIN PROPOSED DEEP BEDROCK CUT AREAS



NO SCALE

TYPICAL GRADING WITHIN PROPOSED FILL AREAS



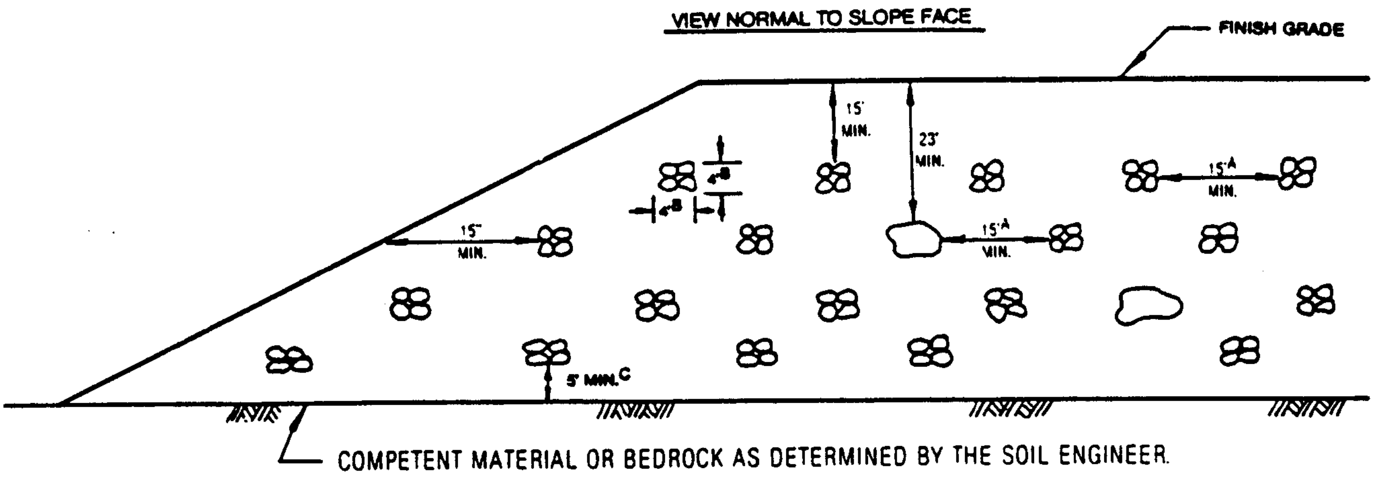
LEGEND

ZONE A ......"SOIL" FILL PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN SECTION 11.2.3 OF THIS REPORT

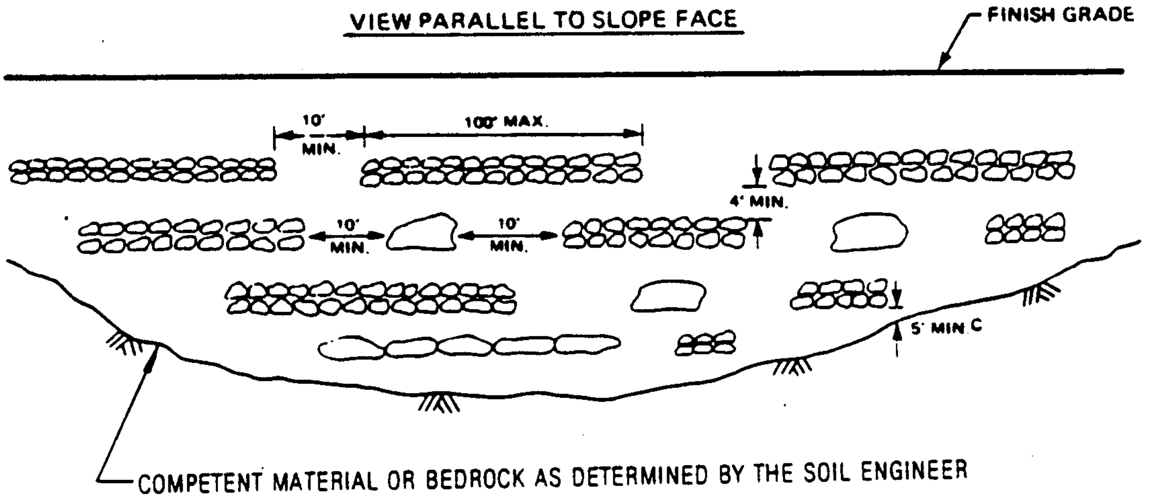
ZONE B ......"SOIL-ROCK" AND/OR "ROCK" FILL PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN SECTION 11.2.3 OF THIS REPORT

✻ 5′ OR 1′ BELOW DEEPEST UTILITY, WHICHEVER IS GREATER

TYPICAL OVERSIZE ROCK DISPOSAL – “SOIL-ROCK” FILL



NOTE:
ORIENTATION OF WINDROWS MAY VARY BUT SHALL BE AS RECOMMENDED BY SOIL ENGINEER.



NOTES:

A. ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.

B. HEIGHT AND WIDTH MAY VARY DEPENDING ON ROCK SIZE AND TYPE OF EQUIPMENT.

C. IF APPROVED BY THE SOIL ENGINEER, WINDROWS MAY BE PLACED DIRECTLY ON COMPETENT MATERIALS OR BEDROCK PROVIDING ADEQUATE SPACE IS AVAILABLE FOR COMPACTION.

D. VOIDS IN WINDROW TO BE FILLED BY FLOODING GRANULAR SOIL INTO PLACE. GRANULAR SOIL SHALL MEAN ANY SOIL WHICH HAS A UNIFIED SOIL CLASSIFICATION SYSTEM (UBC 29-1) DESIGNATION OF SM, SP, SW, GM, GP, OR GW.

E. AFTER FILL BETWEEN WINDROWS IS PLACED AND COMPACTED WITH THE LIFT OF FILL COVERING WINDROW, WINDROW SHALL BE PROOF-ROLLED WITH D-9 DOZER OR EQUIVALENT.

F. OVERSIZED ROCK IS DEFINED AS LARGER THAN 12" IN SIZE.