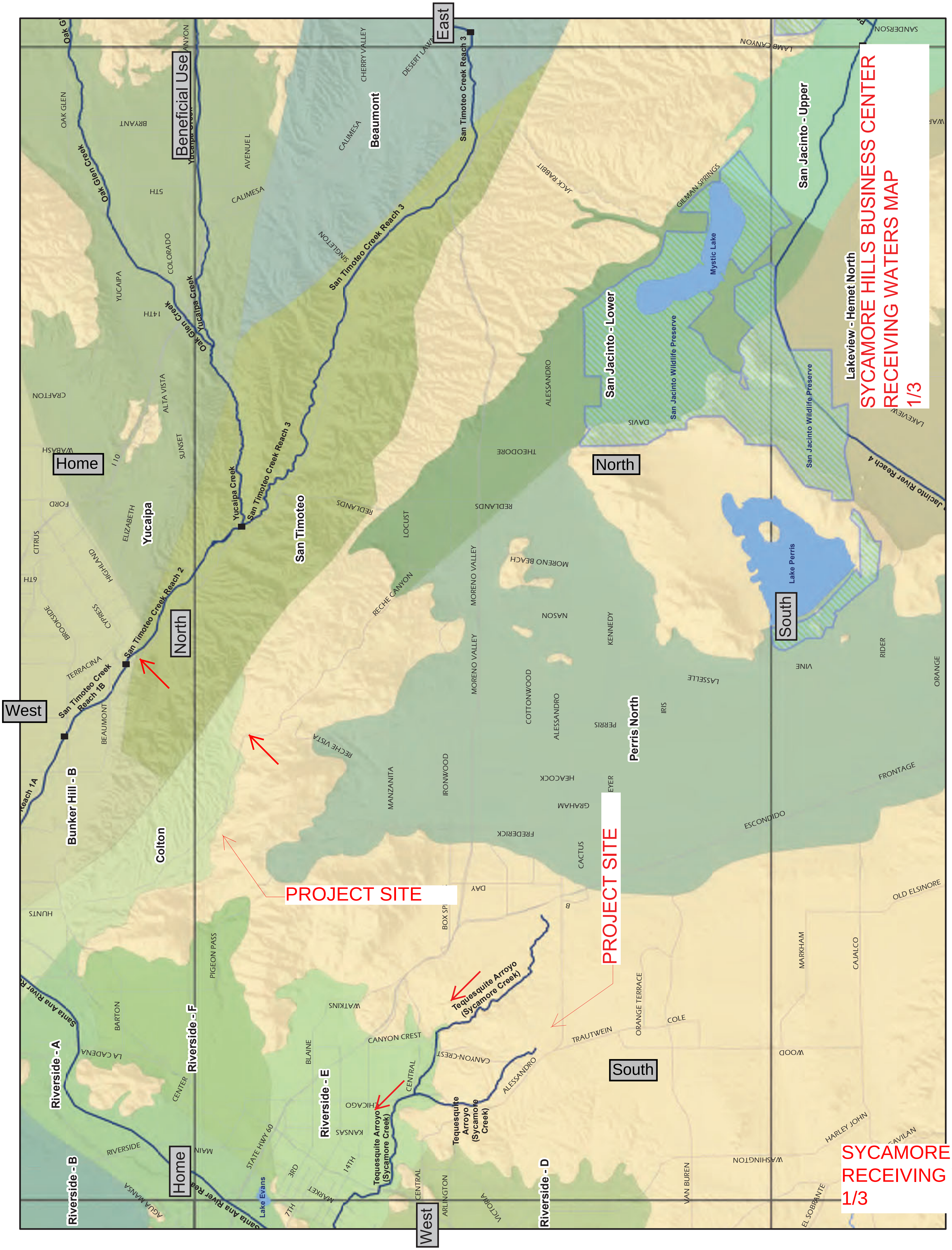
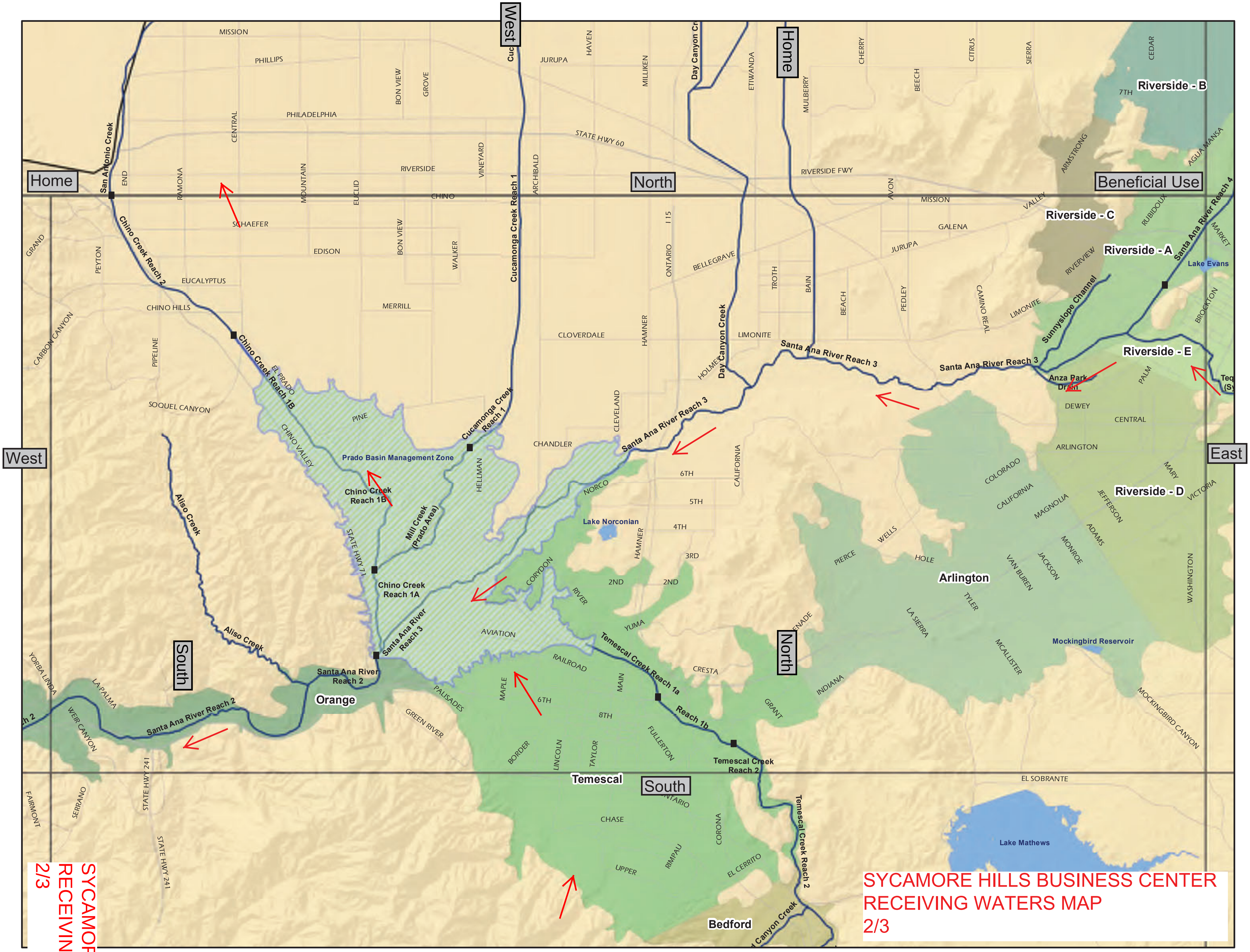


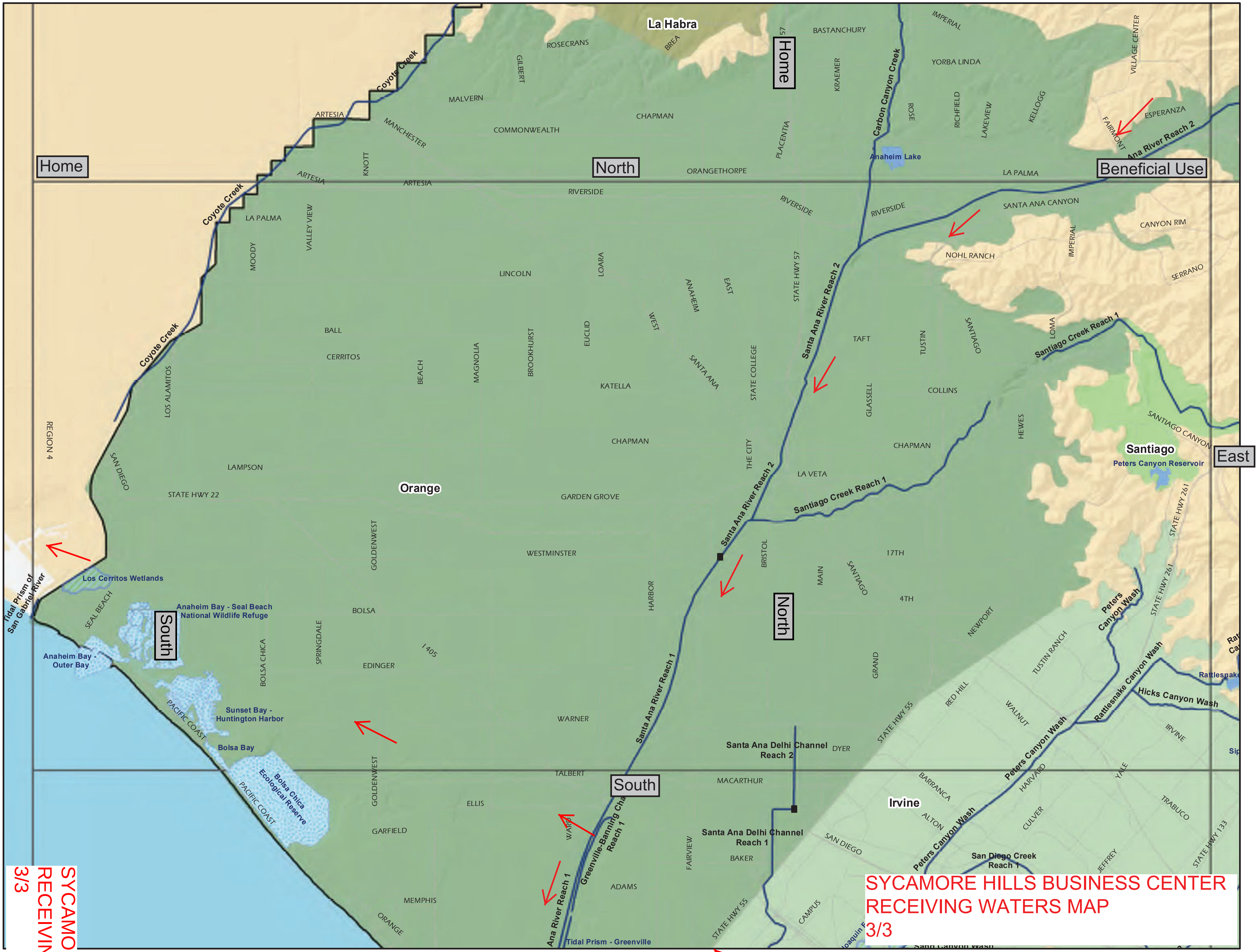
SYCAMORE HILLS BUSINESS CENTER
RECEIVING WATERS MAP
1/3

SYCAMORE H
RECEIVING W
1/3



SYCAMORE HILLS BUSINESS CENTER
RECEIVING WATERS MAP
2/3

SYCAMORE
RECEIVING
2/3



SYCAMORE HILLS BUSINESS CENTER RECEIVING WATERS MAP
3/3

SYCAMORE
RECEIVING
3/3

LEGEND

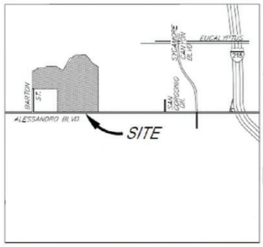
DMA BOUNDARY	🟥 — — —
SOIL BOUNDARY	— — —
BMP BASIN	▨
FILTERRA	🟩
PROHIBITIVE SIGNAGE (PER DETAIL, THIS SHEET)	△
ROOF DRAIN	⊠
FLOW ARROW	▲

SOURCE CONTROL BMP'S

SC-1: ON-SITE STORM DRAIN INLETS.
SC-2: LANDSCAPE/OUTDOOR PESTICIDE USE.
SC-3: REFUSE AREAS PER DETAIL SHEET 2.
SC-4: PLAZAS, SIDEWALKS, AND PARKING LOTS.

RUNOFF FROM THE WEST AND SOUTH OF THE PROJECT SITE TO BE CONVEYED VIA PROPOSED STORM DRAINS

SAMPLE PROHIBITIVE SIGNAGE

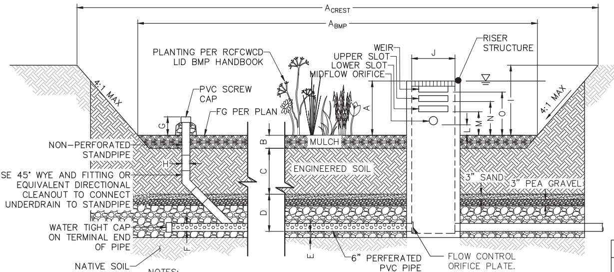


VICINITY MAP
NOT TO SCALE

SOURCE CONTROL BMP'S:

1. INTERIOR FLOOR DRAINS SHALL BE PLUMBED TO SANITARY SEWER
2. PROPOSED BUILDING TO INCORPORATE DESIGN FEATURES SUCH AS SEALANT BARRIERS AND FULLY CLOSING WINDOWS AND DOORS TO DISCOURAGE ENTRY OF PESTS.
3. LANDSCAPING TO BE DONE WITH NATIVE OR DROUGHT TOLERANT SPECIES
4. PESTICIDE USAGE WILL BE PERFORMED MINIMALLY IN ACCORDANCE WITH MANUFACTURES SPECIFICATIONS AND NOT WITHIN 72 HOURS OF A PREDICTED RAIN EVENT.
5. REFUSE WILL BE STORED OUTSIDE OF THE PROPOSED BUILDING IN SUCH A MANNER THAT IT CANNOT COME INTO DIRECT CONTACT WITH RAINWATER OR STORMWATER RUN-ON.
6. ALL PROCESS ACTIVITIES TO BE PERFORMED INDOORS. NO PROCESSES SHALL DRAIN TO EXTERIOR OR STORMDRAIN SYSTEM.
7. LOADING DOCKS ARE TO BE MAINTAINED IN A CLEAN AND ORDERLY FASHION.
8. FIRE SPRINKLER TEST WATER TO BE PLUMBED TO THE SANITARY SEWER
9. PROJECT DOES NOT INCLUDE ELEVATOR SUMP PUMPS, POOLS, SPAS, OR OTHER WATER FEATURES, FOOD SERVICE, INDUSTRIAL PROCESSES, OUTDOOR STORAGE AREAS, VEHICLE/EQUIPMENT, CLEANING, MAINTENANCE OR FUELING AREA
10. MISCELLANEOUS DRAIN OR WASH WATERS WILL EITHER BE PLUMBED TO THE SANITARY SEWER OR DIRECTED TO PERMEABLE AREAS ONSITE IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS.
11. PROPOSED LANDSCAPED AREAS THAT BECAME COMPACTED DURING CONSTRUCTION TO BE RE-TILLED AFTER CONSTRUCTION HAS BEEN COMPLETED.
12. RUNOFF FROM ROOFS AND DRIVEWAYS WILL BE CONVEYED TOWARDS BIORETENTION BASINS.
13. PLAZAS, SIDEWALKS, AND PARKING LOTS ARE TO BE MAINTAINED IN A CLEAN AND ORDERLY FASHION

BASIN-DEVELOPED AREAS							
AREA	PERVIOUS (AC)	IMPERVIOUS (AC)	TOTAL AREA (AC)	TOTAL AREA (SF)	SURFACE TYPE	DMA TYPE	DRAINS TO
DMA-1	0.07	0	0.07	3218	NATURAL LANDSCAPE	A-ST	POD-1
DMA-2A	0.28	0.43	0.72	31236	AC PAVEMENT	A-ST	POD-2
DMA-2B	0.63	5.22	5.85	254973	AC PAVEMENT & ROOF	D-BMP-2A	
DMA-2C	0.15	1.84	1.99	86788	AC PAVEMENT & ROOF	D-BMP-2B	
DMA-2D	0.14	1.81	1.95	84760	AC PAVEMENT & ROOF	D-BMP-2C	
DMA-2E	0.34	0.72	1.06	46289	AC PAVEMENT	D-BMP-2D	
DMA-2F	0.38	0.00	0.38	16652	NATURAL LANDSCAPE	A-ST	
DMA-3	6.21	0.00	6.21	270590	NATURAL LANDSCAPE	A-ST	POD-3
DMA-3A	0.27	4.3	4.57	198842	AC PAVEMENT & ROOF	D-BMP-3A	
DMA-3B	0.85	2.61	3.46	150662	AC PAVEMENT	D-BMP-3B	
DMA-4	1.50	12.31	13.81	601840	AC PAVEMENT & ROOF	A-ST	POD-4
DMA-4A	0.18	0	0.18	7808	NATURAL LANDSCAPE	A-ST	
DMA-5	7.97	0.00	7.97	347359	NATURAL LANDSCAPE	A-ST	POD-5
TOTAL	18.97	29.24	48.22	2101017		ST=SELF TREATING	



NOTES:
1. SOIL MIX PER COUNTY OF RIVERSIDE LID HANDBOOK
2. "WELL DRAINED SOIL" SHALL BE "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50-60% SAND, 20-30% COMPOST OR HARDWOOD MULCH, AND 20-30% TOPSOIL.
3. BMP 2B, 2A, 3A, AND 3B TO HAVE A WALL PER PLAN
4. BMP 2B CONSISTS OF 2 HYDRAULICALLY CONNECTED BASINS (SURFACE AND SUBSURFACE)
5. A_{BMP} IS EQUAL TO THE AREA AT THE FINISH GRADE OF THE BASIN
6. D INCLUDES 3" OF SAND AND 3" OF PEA GRAVEL

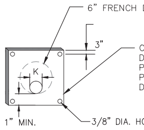
① BMP BASIN DETAILS

NOT TO SCALE

PRELIMINARY BROW DITCH/STORM DRAIN SYSTEM
TO CONVEY RUN-ON FROM 2-2, POD-2.
DESIGN TO BE PERFORMED AT A LATER DATE

BMP TABLE (TYPE D)

BMP #	TYPE	SIZE (ft²)
2A	FILTERRA FTIBC0604-C	24 SF MEDIA
2B	BIORETENTION BASIN	1,829
	BIORETENTION BASIN	4,912
2C	FILTERRA FTIBC1107-C	77 SF MEDIA
2D	FILTERRA FTIBC1107-C	77 SF MEDIA
2E	FILTERRA FTIBC0604-C	24 SF MEDIA
3A	BIORETENTION BASIN	6,757
3B	BIORETENTION BASIN	10,584
4	BIORETENTION BASIN	15,085



ORIFICE PLATE MIN. SQUARE DIMENSIONS 1.0 FT GREATER THAN PIPE DIA. HOT-DIP GALVANIZED PLATE AFTER HOLES HAVE BEEN DRILLED

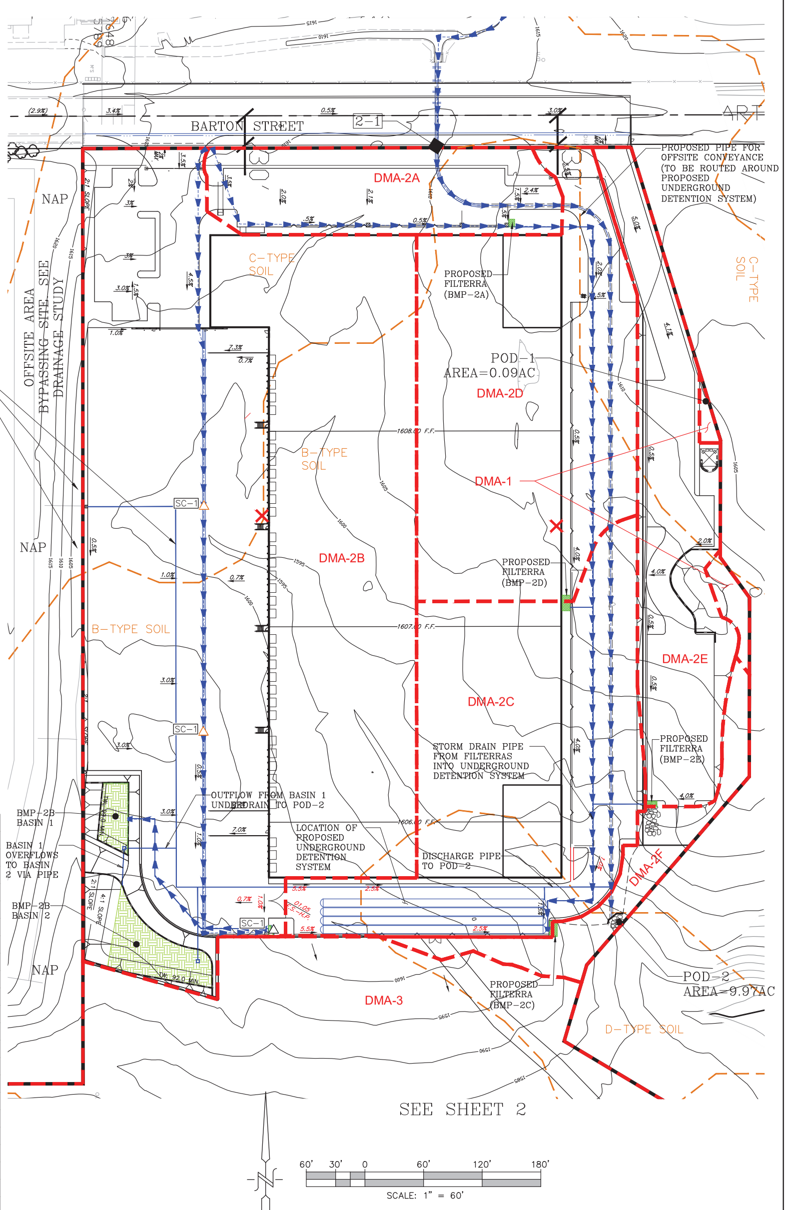
FLOW CONTROL ORIFICE PLATE

NTS

BIORETENTION BASIN TABULATED DATA

	BMP 2B-1	BMP 2B-2	BMP 3A	BMP 3B	BMP 4
A	2.75'	3.75'	4.25'	2.5'	4.75'
B	3"	3"	3"	3"	3"
C	33"	33"	33"	21"	33"
D	12"	12"	12"	12"	12"
E	3"	3"	3"	3"	3"
F	6"	6"	6"	6"	6"
G	3"	3"	3"	3"	3"
H	6"	6"	6"	6"	6"
I	3'	5'	4'	3.5'	6'
J	48"X48"	12"X12"	48"X48"	36"X36"	36"X36"
K	0.75"	1.65"	1.67"	1.125"	2.25"
MIDFLOW ORIFICE	–	–	0.875"	1.5"	1.75"
L	–	–	6"	6"	6"
LOWER SLOT(1)	6" X 2"	¼" X ¼"	–	–	24" X 3"
M	6"	39.6"	–	–	36"
UPPER SLOT(1)	–	–	0.96' X 0.167'	–	–
N	–	–	27"	–	–
WEIR	–	–	–	–	–
O	–	–	–	–	–
A_{BMP}	1,829 SF	4,912 SF	6,757 SF	10,584 SF	15,085 SF
A_{CREST}	1,829 SF	7,057 SF	6,757 SF	10,584 SF	25,275 SF
V_{CAP}	5,578 CF	28,827 CF	34,122 CF	37,044 CF	115,465 CF

(1): WIDTH X HEIGHT



REVISIONS			
NO.	DESCRIPTION	DATE	APP'D

R·E·C
Consultants, Inc.
Civil Engineering • Environmental
Land Surveying
2442 Second Avenue
San Diego, CA 92101
(619)232-9200 (619)232-9210 Fax

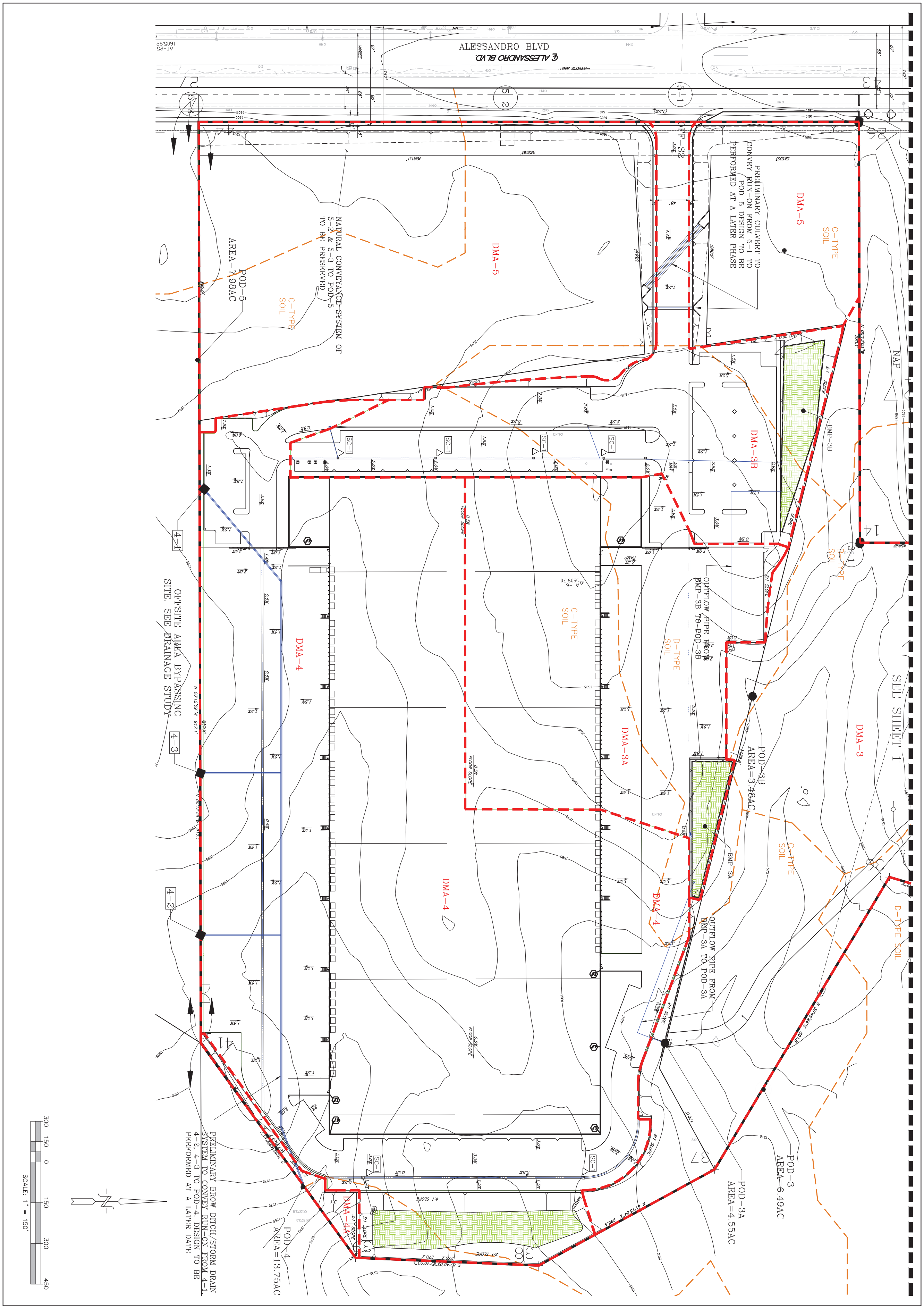
DATE: 7/29/19
SCALE: 1" = 150'
DRAWN: L.M.
CHECKED:

SHEET TITLE
BMP SITE PLAN

PROJECT
SYCAMORE HILLS BUSINESS CENTER
ALESSANDRO BLVD AND BARTON STREET
RIVERSIDE, CA

SHEET 1
OF 2 SHEETS

SAVE DATE: 5/8/2020 ~ PLOT DATE: 5/8/2020 ~ FILE NAME: P:\Acad\1467 SDH-Butler\Reports\Drainage\190626_1467-Drainage.dwg



SHEET 1 OF 1 SHEETS	SHEET TITLE	BMP SITE PLAN	DATE: 7/29/19
	PROJECT	SYCAMORE HILLS BUSINESS CENTER ALESSANDRO BLVD AND BARTON STREET RIVERSIDE, CA	SCALE: 1" = 150' DRAWN: L.M. CHECKED:

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Consultants, Inc.

Civil Engineering·Environmental
Land Surveying
2442 Second Avenue
San Diego, CA 92101
(619)232-9200 (619)232-9210 Fax

REVISIONS

NO.	DESCRIPTION	DATE	APP'D

SAVE DATE: 3/11/2020 ~ PLOT DATE: 3/11/2020 ~ FILE NAME: P:\Acad\1467 SDH-Butler\Reports\Drainage\190626_1467-Drainage.dwg

Appendix 2: Construction Plans

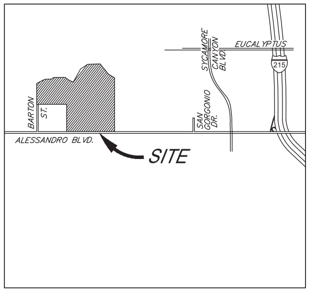
Grading and Drainage Plans

IN THE CITY RIVERSIDE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA.

PRELIMINARY GRADING PLAN
SYCAMORE HILLS DISTRIBUTION CENTER

APRIL 2020

PORT. SEC 10, T3S, R4W, SBBM



VICINITY MAP

NOT TO SCALE
THOMAS GUIDE PG. 716, PORT. GRID H-5 & H-6

OWNER/ APPLICANT

INLAND INVESTMENTS, INC.
ATTN: DARRELL BUTLER
3241 ALTA LAGUNA BLVD.
LAGUNA BEACH, CA 92651
VOICE: (949) 632-9892

ARCHITECT

HPA ARCHITECTURE
18831 BARDEEN AVE. STE. #100
IRVINE, CA 92612
VOICE: (949) 863-1700

ENGINEER

SDH & ASSOCIATES, INC.
14060 MERIDIAN PARKWAY 102
RIVERSIDE, CALIFORNIA 92518
TEL (951) 683-3691

ASSESSORS PARCEL NO.

263-060-022-7
263-060-024-9
263-060-026-1

PROJECT INFO

AREA OF SITE = 2,095,478 S.F. (48.1 AC)

SURROUNDING ZONING

NORTH..............................OS
EAST............................... BMP
SOUTH............................ COUNTY OF RIVERSIDE/ CR
WEST.............................. PUBLIC FACILITY (BMP)

CONSTRUCTION NOTES

① CONSTRUCT P.C.C. DRIVE ISLE & PARKING AREAS
② CONSTRUCT 6" CURB ONLY
③ CONSTRUCT 6" CURB AND GUTTER
④ CONSTRUCT 12" GAP IN CURB FOR DRAINAGE CONVEYANCE
⑤ CONSTRUCT P.C.C. SIDEWALK (FINISHED SURFACE MATERIALS PER ARCH. PLANS)
⑥ CONSTRUCT 3' RIBBON GUTTER
⑦ CONSTRUCT P.V.C. DRAIN
⑧ CONSTRUCT 24" X 24" DRAIN BOX
⑨ CONSTRUCT GATE PER ARCH. PLANS
⑩ CONSTRUCT A.D.A. COMPLIANT HANDICAP RAMP
⑪ CONSTRUCT RETAINING WALL
⑫ CONSTRUCT DEEPENED FOOTING
⑬ CONSTRUCT COBBLE RIPRAP PAD
⑭ CONSTRUCT 6" PERFORATED PIPE
⑮ CONSTRUCT 6" THICK STABILIZED D.G. 6" BASE
⑯ CONSTRUCT HDPE STORM DRAIN PIPE
⑰ CONSTRUCT 12" DIAMETER CMP RISER INLET
⑱ CONSTRUCT 18" DIAMETER CMP RISER INLET
⑲ CONSTRUCT HEADWALL WITH WINGWALL OUTLET AND 1/4 TON RIP RAP
⑳ CONSTRUCT UNDERGROUND STORAGE PER WQMP
㉑ CONSTRUCT 6' X 8' FILTERRA BIORETENTION UNIT
㉒ CONSTRUCT 8' X 16' FILTERRA BIORETENTION UNIT
㉓ CONSTRUCT 6' X 12' FILTERRA BIORETENTION UNIT
㉔ CONSTRUCT 24" OVERFLOW RISER INLET
㉕ CONSTRUCT 4' WIDE SIDE INLET CATCH BASIN

ZONING AND LAND USE

EXISTING ZONING - BMP
PROPOSED ZONING - BMP
EXISTING LAND USE - VACANT

SURROUNDING LAND USE

NORTH.................SYCAMORE CANYON PARK
EAST....................VACANT
SOUTH.................RESIDENTIAL/ COMMERCIAL
WEST................... MUNICIPAL

SCHOOL DISTRICT

RIVERSIDE UNIFIED
SCHOOL DISTRICT

UTILITY PURVEYORS

WATER.....................WMWD
GAS.........................SO. CALIF. GAS
ELECTRICAL.............CITY OF RIVERSIDE
TELEPHONE.............PACIFIC BELL
SEWER....................CITY OF RIVERSIDE/ PRIVATE
CABLE.....................CHARTER COMMUNICATION

LEGEND

T.C.B.	-	TOP CATCH BASIN
F.G.	-	FINISHED GRADE
F.L.	-	FLOW LINE
H.P.	-	HIGH POINT
EXIST.	-	EXISTING
P.E.	-	PAD ELEVATION
G.B.	-	GRADE BREAK
○	-	STEM WALL HEIGHT
━ ─ ─ ━		TRACT BOUNDARY
── ─ ──		CENTERLINE
═══		CURB AND GUTTER
~1280~		EXISTING CONTOUR LINE
────		LOT LINE
─Y─Y─		SLOPE

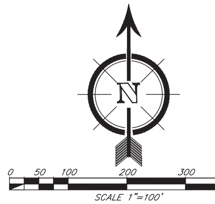
SOURCE OF TOPOGRAPHY

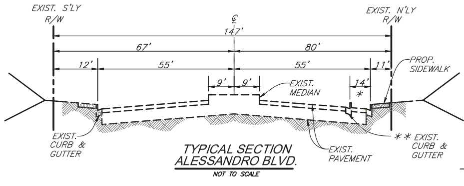
ARROWHEAD MAPPING
DATED 5-5-17

PROJECT NOTES

1. PRIOR TO MOBILIZING GRADING EQUIPMENT ONSITE OR STARTING ANY GRADING OPERATIONS, INSTALL TEMPORARY CHAIN LINK FENCE WITH POSTS DRIVEN INTO THE GROUND A MINIMUM OF 3' FROM THE LOT LINE IN THE PRIVATE PROPERTY SIDE TO PREVENT CONSTRUCTION VEHICLES FROM ENCROACHING ONTO ADJACENT PUBLIC AND PROTECTED LANDS. NO UNAUTHORIZED WORK SHALL OCCUR ON PUBLIC LANDS. VIOLATIONS ARE SUBJECT TO FINES

2. PROVIDE A JOINT EVERY 10' IN CURB WITHIN "TRAIL HEAD" PARKING AREA.



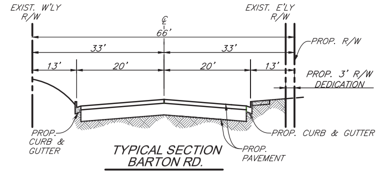


TYPICAL SECTION ALESSANDRO BLVD.

NOT TO SCALE

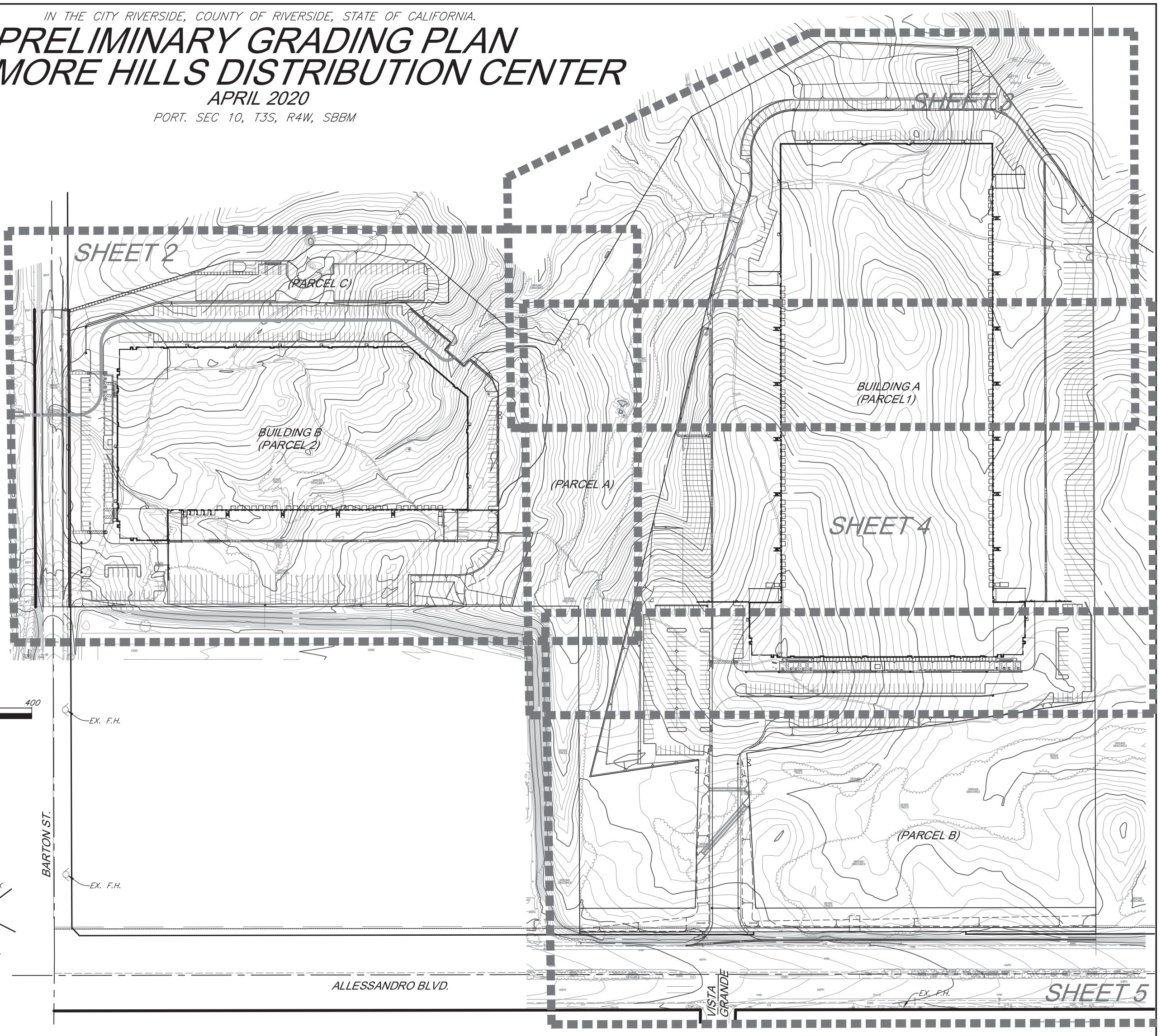
* PROPOSED CURB WIDTH AT DEDICATED RIGHT TURN LANE

** EXISTING CURB WIDTH TO REMAIN BEYOND DEDICATED RIGHT TURN LANE



TYPICAL SECTION BARTON RD.

NOT TO SCALE



BUSINESS TAX CERTIFICATE NO. 107994 EXP. 6-30-20

SEAL:

REGISTERED PROFESSIONAL ENGINEER
DANE A. SOMMERS
No. 90433
Exp. 9-30-21
CIVIL
STATE OF CALIFORNIA

PREPARED BY:

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

SCALE: 1"=100'

DATE: APRIL 2020

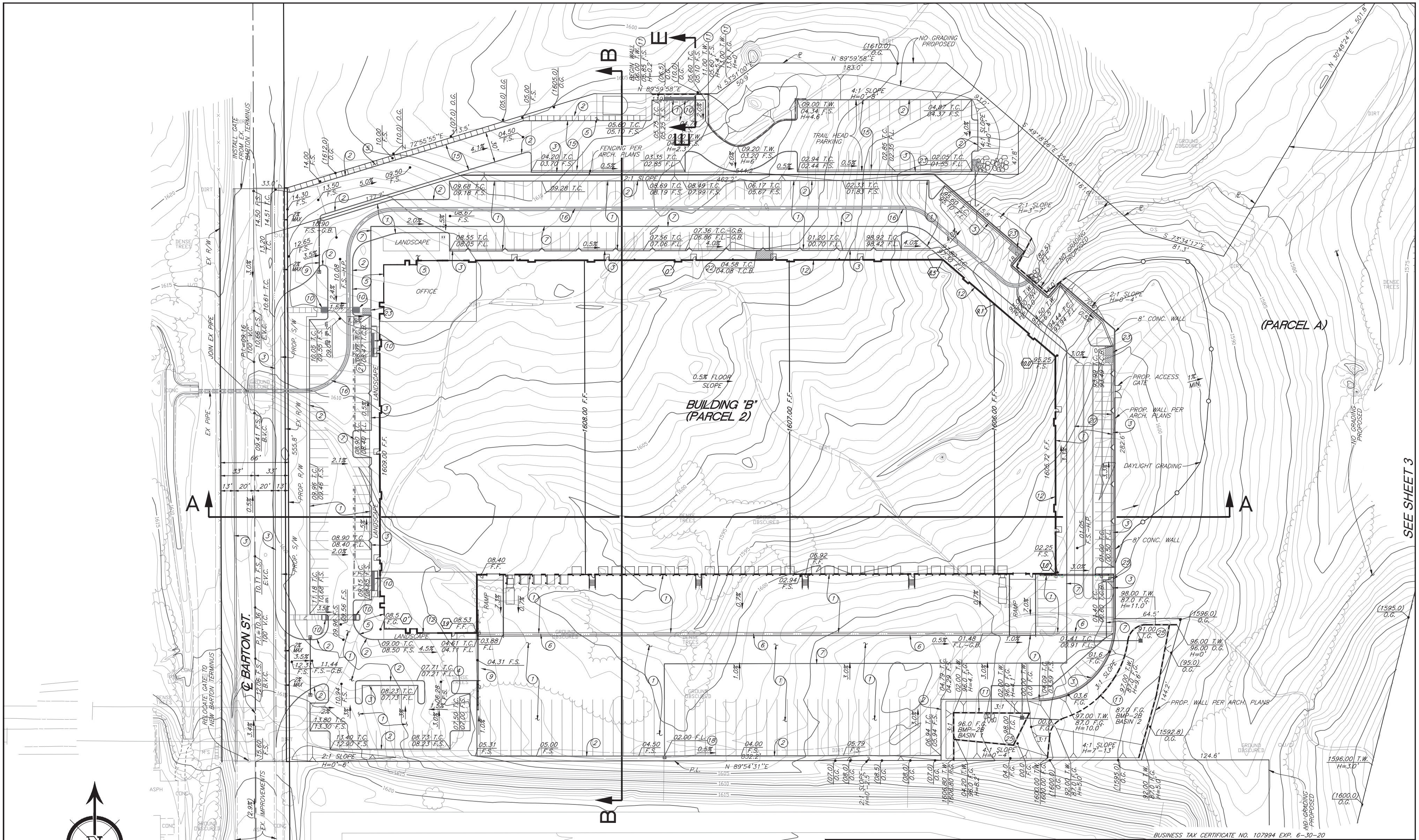
BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
ADJUSTMENT YEAR: 1996
AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

PRELIMINARY GRADING PLAN

SYCAMORE HILLS
DISTRIBUTION CENTER

1
OF
7
SHEETS



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14060 Meridian Parkway 102
Riverside, California 92518
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1" =40'

DATE: APRIL 2020

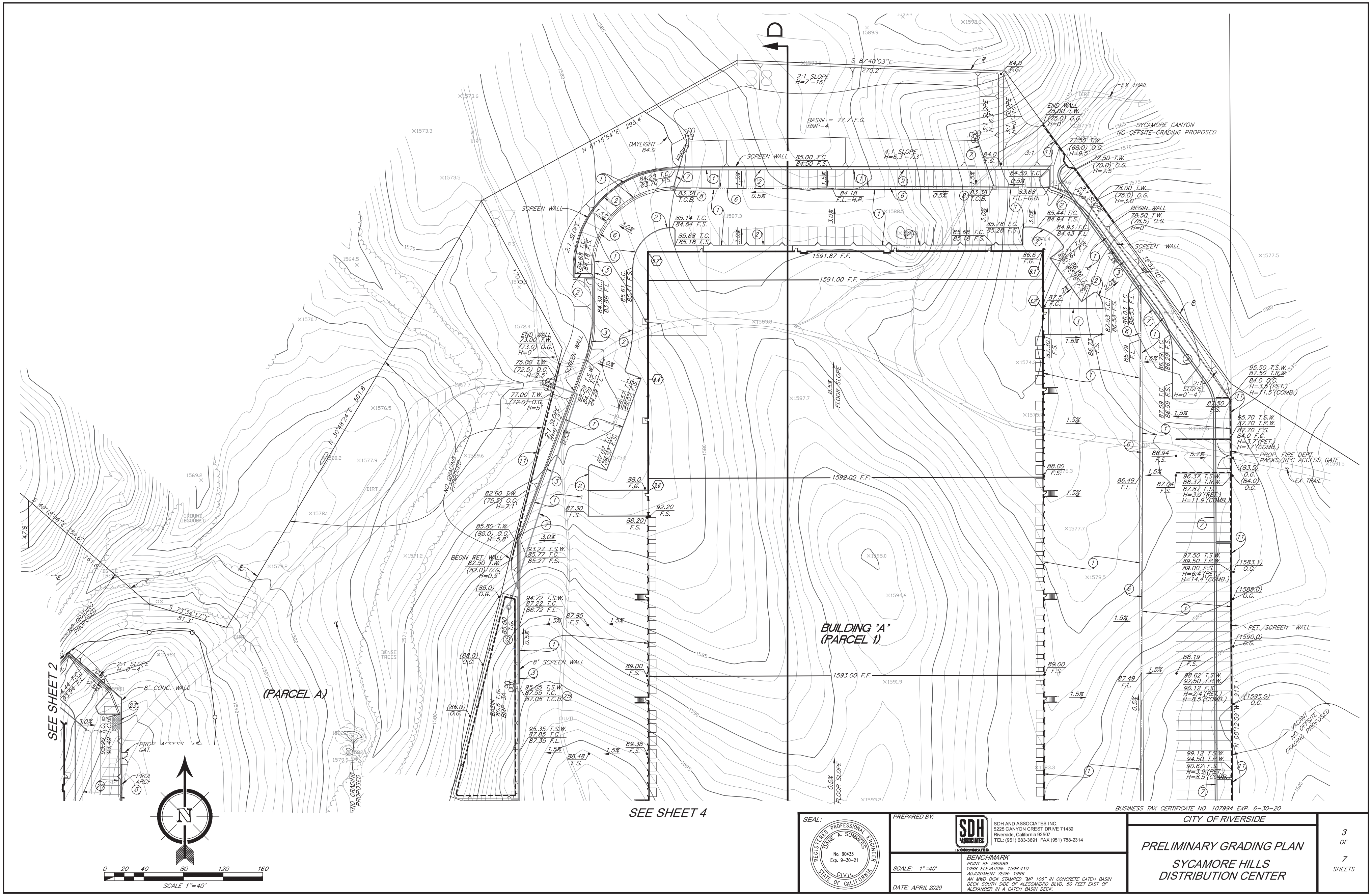
BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
ADJUSTMENT YEAR: 1996
AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

PRELIMINARY GRADING PLAN

SYCAMORE HILLS DISTRIBUTION CENTER

2
OF
7
SHEETS



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REGISTERED PROFESSIONAL ENGINEER
DANE A. SOMMERS
No. 90433
Exp. 9-30-21
CIVIL
STATE OF CALIFORNIA

PREPARED BY:

SDH & ASSOCIATES INCORPORATED

SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1" =40'

DATE: APRIL 2020

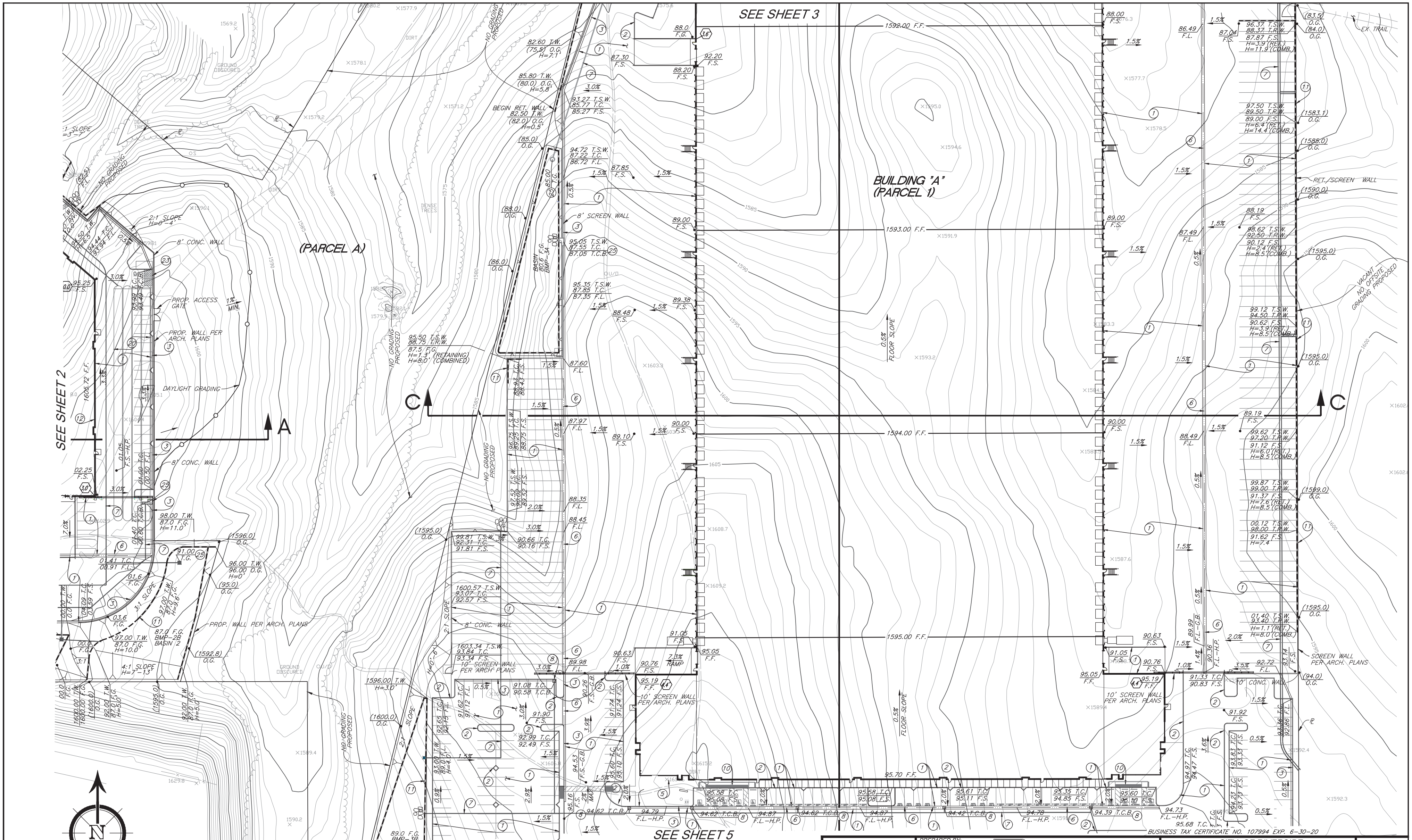
BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
ADJUSTMENT YEAR: 1996
AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

PRELIMINARY GRADING PLAN

SYCAMORE HILLS DISTRIBUTION CENTER

3
OF
7
SHEETS



SEAL:

REGISTERED PROFESSIONAL ENGINEER
DANE A. SOMMERS
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Exp. 9-30-21
CIVIL
STATE OF CALIFORNIA

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14060 Meridian Parkway 102
Riverside, California 92518
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1"=40'

DATE: APRIL 2020

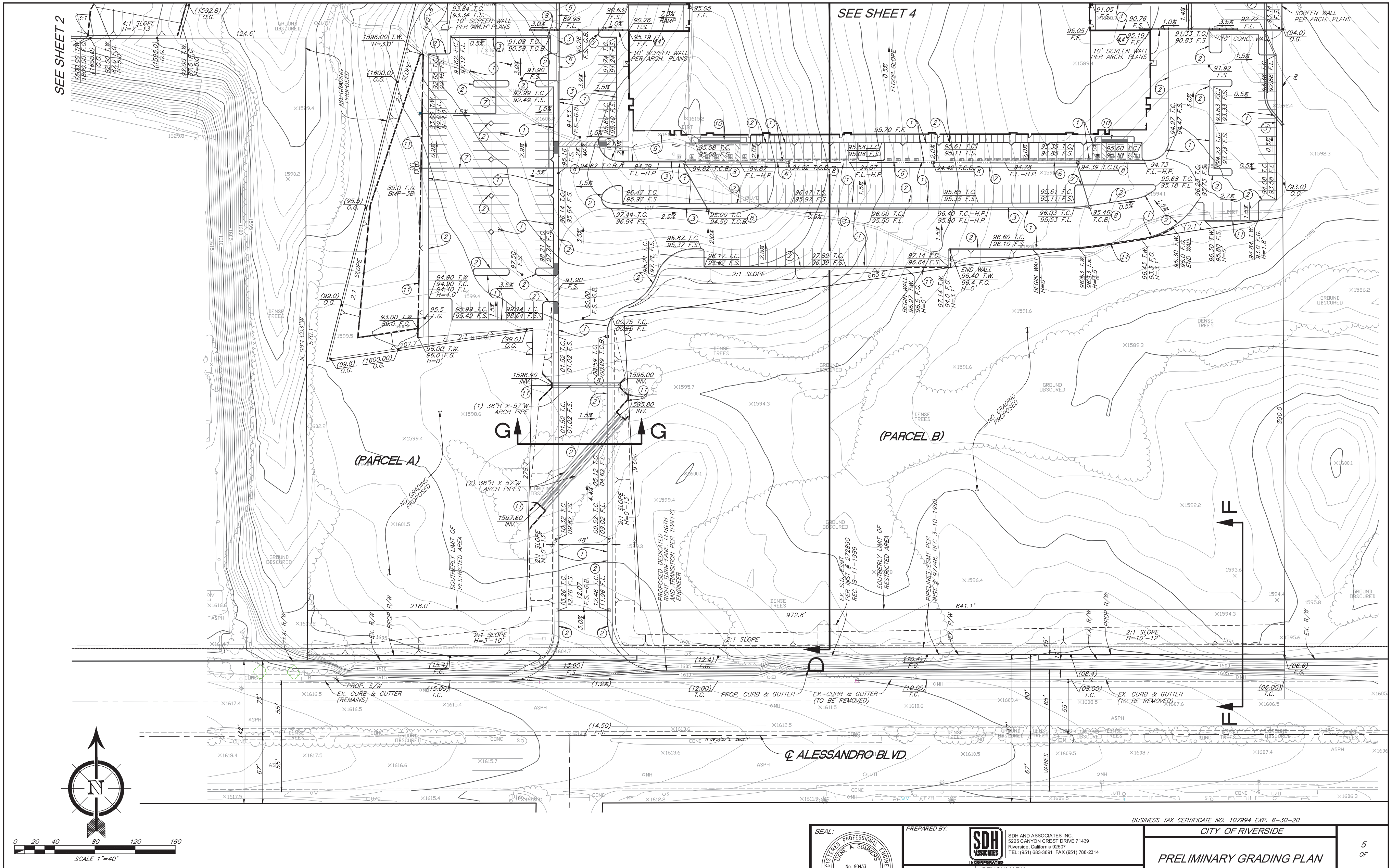
BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
ADJUSTMENT YEAR: 1996
AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

PRELIMINARY GRADING PLAN

SYCAMORE HILLS
DISTRIBUTION CENTER

4
OF
7
SHEETS



BUSINESS TAX CERTIFICATE NO. 107994 EXP. 6-30-20

SEAL:

REGISTERED PROFESSIONAL ENGINEER
DANE A. SOMMERS
No. 90433
Exp. 9-30-21
CIVIL
STATE OF CALIFORNIA

PREPARED BY:

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SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1" =40'

DATE: APRIL 2020

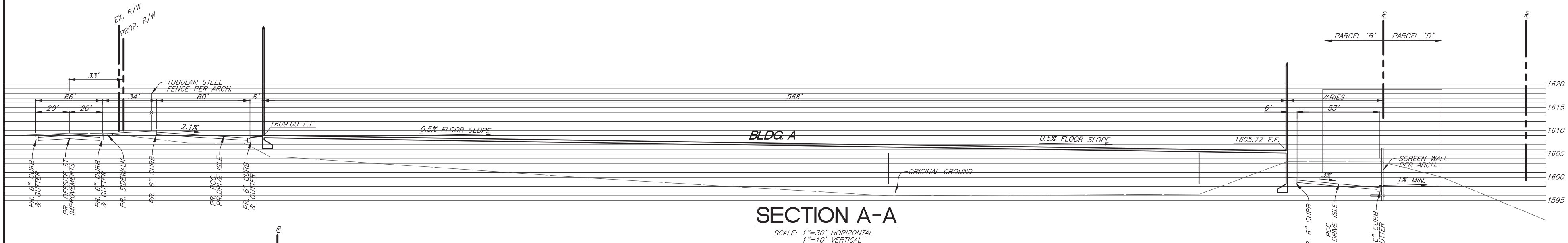
BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
ADJUSTMENT YEAR: 1996
AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

PRELIMINARY GRADING PLAN

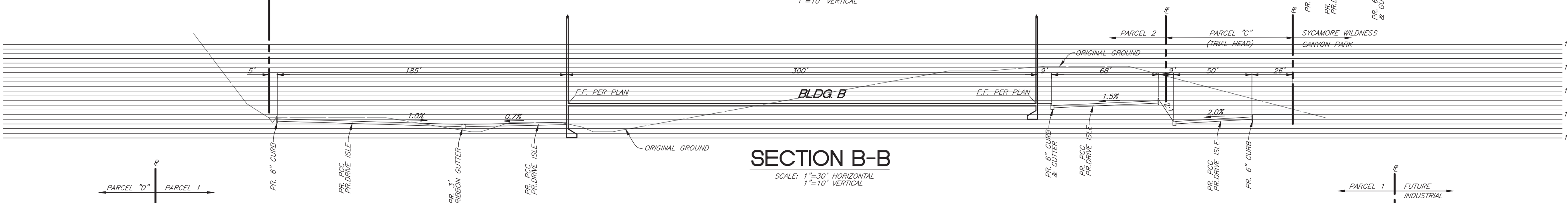
SYCAMORE HILLS
DISTRIBUTION CENTER

5
OF
7
SHEETS



SECTION A-A

SCALE: 1"=30' HORIZONTAL
1"=10' VERTICAL



SECTION B-B

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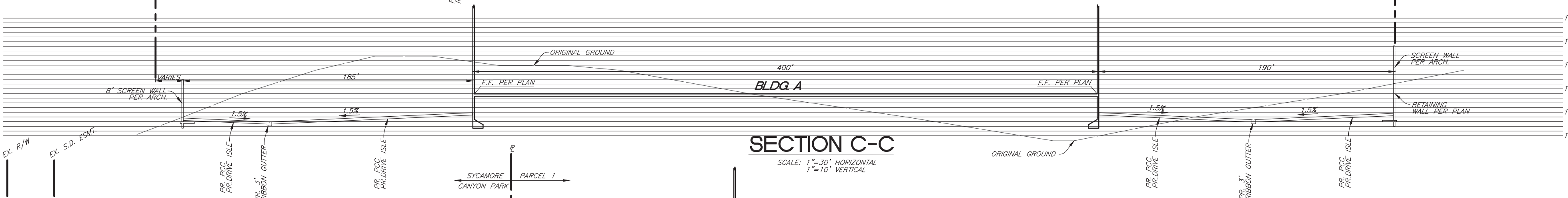
1"=10' VERTICAL



SECTION C-C

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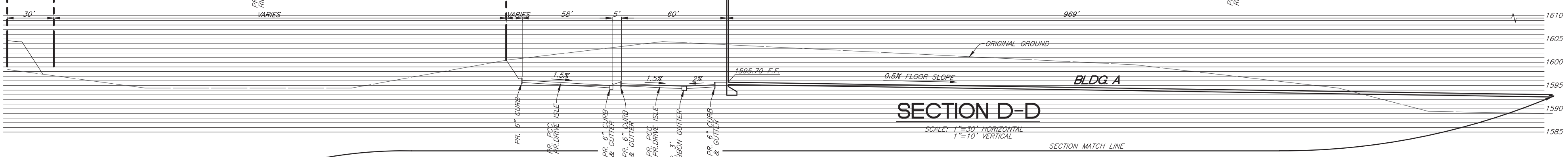
1"=10' VERTICAL



SECTION D-D

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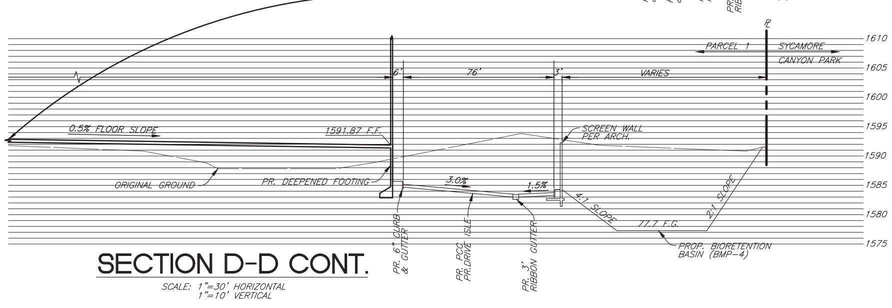
1"=10' VERTICAL



SECTION D-D CONT.

SCALE: 1"=30' HORIZONTAL
1"=10' VERTICAL

BUSINESS TAX CERTIFICATE NO. 107994 EXP. 6-30-21

SEAL:

DANE A. SOMMERS
No. 90433
Exp. 9-30-21

PREPARED BY:

SDH ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: AS SHOWN

DATE: APRIL 2020

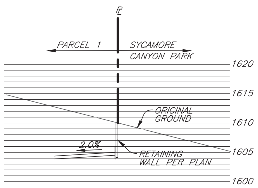
BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
ADJUSTMENT YEAR: 1996
AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

CROSS SECTIONS

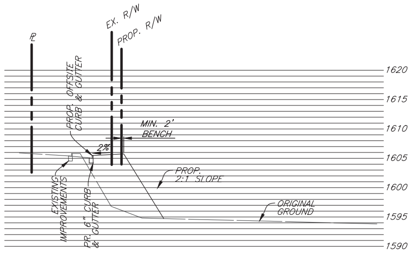
SYCAMORE HILLS
DISTRIBUTION CENTER

6
OF
7
SHEETS



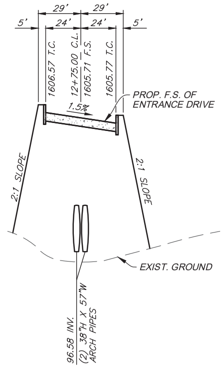
SECTION E-E

SCALE: 1"=30' HORIZONTAL
1"=10' VERTICAL



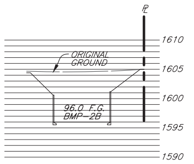
SECTION F-F

SCALE: 1"=30' HORIZONTAL
1"=10' VERTICAL



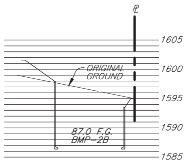
SECTION G-G

SCALE: 1"=40' HORIZONTAL
1"=4 VERTICAL



BMP 2B BASIN 1 TYPICAL SECTION

SCALE: 1"=30' HORIZONTAL
1"=10' VERTICAL



BMP 2B BASIN 2 TYPICAL SECTION

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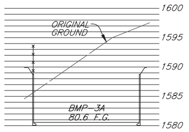
1"=10' VERTICAL



BMP 3A TYPICAL SECTION

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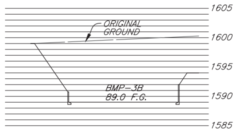
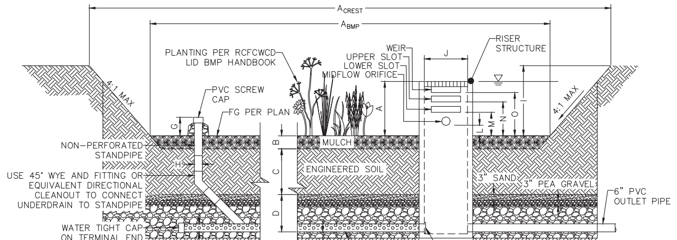
1"=10' VERTICAL



BMP 3B TYPICAL SECTION

SCALE: 1"=30' HORIZONTAL
1"=10' VERTICAL



NOTES:

1. SOIL MIX PER COUNTY OF RIVERSIDE LID HANDBOOK
2. "WELL DRAINED SOIL" SHALL BE "SANDY LOAM" SOIL MIX WITH NO MORE THAN 5% CLAY CONTENT. THE MIX SHALL CONTAIN 50–60% SAND, 20–30% COMPOST OR HARDWOOD MULCH, AND 20–30% TOPSOIL.
3. BMP 2B, 2A, 3A, AND 3B TO HAVE A WALL PER PLAN
4. BMP 2B CONSISTS OF 2 HYDRAULICALLY CONNECTED BASINS (SURFACE AND SUBSURFACE)
5. A_{BMP} IS EQUAL TO THE AREA AT THE FINISH GRADE OF THE BASIN
6. D INCLUDES 3" OF SAND AND 3" OF PEA GRAVEL

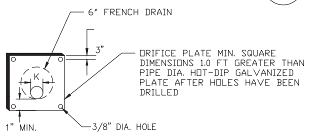
DETAIL_TITLE

DETAIL_SCALE

BIORETENTION BASIN TABULATED DATA

	BMP 2B–1	BMP 2B–2	BMP 3A	BMP 3B	BMP 4
A	2.75'	3.75'	4.25'	2.5'	4.75'
B	3"	3"	3"	3"	3"
C	33"	33"	33"	21"	33"
D	12"	12"	12"	12"	12"
E	3"	3"	3"	3"	3"
F	6"	6"	6"	6"	6"
G	3"	3"	3"	3"	3"
H	6"	6"	6"	6"	6"
I	3'	5'	4'	3.5'	6'
J	48"X48"	12"X12"	48"X48"	36"X36"	36"X36"
K	0.75"	1.65"	1.67"	1.125"	2.25"
MIDFLOW ORIFICE	–	–	0.875"	1.5"	1.75"
L	–	–	6"	6"	6"
LOWER SLOT$^{(1)}$	6" X 2"	¼" X ¼"	–	–	24" X 3"
M	6"	39.6"	–	–	36"
UPPER SLOT$^{(1)}$	–	–	0.96' X 0.167'	–	–
N	–	–	27"	–	–
WEIR	–	–	–	–	–
O	–	–	–	–	–
A_{BMP}	1,829 SF	4,912 SF	6,757 SF	10,584 SF	15,085 SF
A_{CREST}	1,829 SF	7,057 SF	6,757 SF	10,584 SF	25,275 SF
V_{CAP}	5,578 CF	28,827 CF	34,122 CF	37,044 CF	115,465 CF

(1): WIDTH X HEIGHT



FLOW CONTROL ORIFICE PLATE

NTS

BUSINESS TAX CERTIFICATE NO. 107994 EXP. 6–30–20

SEAL:
DANE A. SOMMERS
No. 90433
Exp. 9–30–21
CIVIL

PREPARED BY:
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: AS SHOWN

DATE: APRIL 2019

BENCHMARK
POINT ID: AB5569
1988 ELEVATION: 1598.410
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AN MWD DISK STAMPED "MP 106" IN CONCRETE CATCH BASIN DECK SOUTH SIDE OF ALESSANDRO BLVD, 50 FEET EAST OF ALEXANDER IN A CATCH BASIN DECK.

CITY OF RIVERSIDE

SECTIONS & LID BMP DETAILS

SYCAMORE HILLS
DISTRIBUTION CENTER

7
OF
7
SHEETS

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

Geotechnical Engineering Investigation

Proposed Industrial Warehouse Development
NEC Barton Street and Alessandro Boulevard
Riverside, California

Darrell Butler
3241 Alta Laguna Boulevard
Laguna Beach, California 92651

Project Number 21022-19
March 29, 2019

NorCal Engineering

NorCal Engineering
Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

March 29, 2019

Project Number 21022-19

Darrell Butler
3241 Alta Laguna Boulevard
Laguna Beach, California 92651

RE: **Geotechnical Engineering Investigation** - Proposed Industrial Warehouse Development - Located at the Northeast Corner of Barton Street and Alessandro Boulevard, in the City of Riverside, California

Dear Mr. Butler:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation for the above referenced project in accordance with your approval of our proposal dated February 28, 2019. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide recommendations for the proposed industrial warehouse development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) soil infiltration testing; 5) engineering analysis of field and laboratory data; 5) preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

It is proposed to construct an industrial warehouse development consisting of 203,000 and 400,000 square feet buildings as shown on the attached Site Plan by HPA Architecture, Inc. dated November 8, 2018. The proposed concrete tilt-up buildings will be supported by a conventional slab-on-grade foundation system with perimeter-spread footings and isolated interior footings. Other improvements will include asphalt and concrete pavement areas, hardscape and landscaping. It is assumed that the proposed grading for the development will include cut and fill procedures on the order of a few feet to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The 37-acre subject property is located at the northeast corner of Barton Street and Alessandro Boulevard, in the City of Riverside. The generally irregular-shaped parcel is elongated in an east to west direction with topography consisting of natural rolling terrain descending gradually from a west to east direction on the order of about 30 feet. Some outcrops of granitic rock were observed throughout the property. The site is undeveloped parcel covered with a low to moderate growth of vegetation cover consisting of natural grasses and weeds and borders the Sycamore Canyon Wilderness Park to the north.

3.0 Site Exploration

The investigation consisted of the placement of twenty-one (21) subsurface exploratory trenches by a backhoe to depths ranging between 5 and 15 feet below current ground elevations. The trenches were placed at accessible locations throughout the property. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached plan. The exploratory trenches revealed the existing earth materials to consist of fill and natural soil. Detailed descriptions of the subsurface conditions are listed on the trench logs in Appendix A.

It should be noted that the transition from one soil type to another as shown on the trench logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Fill: A fill soil classifying as a brown, fine to coarse grained, silty SAND was encountered across the site to depths ranging from 1 to 1½ feet below ground surface. These soils were noted to be loose and moist.

Natural: A natural undisturbed soil classifying as a brown, fine to coarse grained, silty SAND was encountered beneath the upper fill soils. The native soils as encountered were observed to be medium dense to dense and moist.

Bedrock: A granitic bedrock classifying as a grey brown, fine to coarse grained, silty SAND (Decomposed Granite) was encountered beneath the upper soils at a depth of 1 to 5 feet below ground surface. The bedrock was noted to be massive and observed to be slightly to highly weathered and dense to very dense.

The overall engineering characteristics of the earth material were relatively uniform with each excavation. Groundwater was not encountered to the depth of our trenches and no caving occurred.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field Moisture Content** (ASTM: D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Maximum Density tests** (ASTM: D 1557) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.3 **Expansion Index tests** (ASTM: D 4829) were performed on remolded samples of the upper soils to determine expansive characteristics. Results of these tests are provided on Table II.

4.4 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities. Test results are provided on Table III.

4.5 **R-Value test** per California Test Method 301 was performed on a representative sample, which may be anticipated to be near subgrade to determine pavement design. Results are provided within the pavement design section of the report.

4.6 **Direct Shear tests** (ASTM: D 3080) were performed on undisturbed and/or remolded samples of the subsurface soils. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plates A to C.

4.7 **Consolidation tests** (ASTM: D 2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates D to G.

5.0 Seismicity Evaluation

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered unlikely. The San Jacinto Fault is located 14 kilometers from the site and is capable of producing a Magnitude 7.0 earthquake. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults.

The following seismic design acceleration parameters are provided below and are based upon the 2016 California Building Code (CBC). The data was obtained from the American Society of Civil Engineers (ASCE) website, https://asce7hazardtool.online/.

Seismic Design Acceleration Parameters

Latitude	33.919
Longitude	-117.311
Site Class	D
Risk Category	I/II/III
Mapped Spectral Response Acceleration	$S_S = 1.500$ $S_1 = 0.600$
Adjusted Maximum Acceleration	$S_{MS} = 1.500$ $S_{M1} = 0.900$
Design Spectral Response Acceleration Parameters	$S_{DS} = 1.000$ $S_{D1} = 0.600$

6.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of the Southern California area. It is during severe shaking that loose, granular soils below the groundwater table can liquefy. Based on review of the *City of Riverside Public Safety Element – Liquefaction Zones (2006)*, the site is not situated in an area of generalized liquefaction susceptibility. Thus, the design of the proposed construction in conformance with the latest Building Code provisions for earthquake design is expected to provide mitigation of ground shaking hazards that are typical to Southern California.

7.0 Infiltration Characteristics

Infiltration tests within the site were performed to provide preliminary infiltration rates for the purpose of planning and design of an on-site water disposal system. The infiltration tests consisted of the double ring infiltration test per ASTM Method D 3385. The field infiltration rate was computed using a reduction factor – R_f based on the field measurements with our calculations given in Appendix D. Based upon the results of our testing, the soils/bedrock encountered in the planned on-site drainage disposal system area exhibit the following infiltration rates.

Test No.	Depth (ft)	Infiltration Rate
T-1	5'	0.5 in/hr
T-2	7.5'	0.16 in/hr
T-11	5'	0.28 in/hr
T-12	10'	0.08 in/hr
T-19	5'	0
T-20	5'	0.08 in/hr
T-21	10'	0.04 in/hr

The correction factors CF_t, CF_v and CF_s are given below based on soils/bedrock between 5 and 10 feet from our field tests.

a) CF_t = Rf =1.0 for our double ring infiltration test holes.

b) CF_v = 1.0 based on uniform soils encountered in two trenches for infiltration tests.

c) CF_s = 3.0 for long-term siltation, plugging and maintenance. The subsurface soils are likely to have some plugging and regular maintenance of storm water discharge devices is required.

Based on the results of our field testing, the subsurface soils/bedrock encountered in the proposed on-site drainage disposal system from 5 to 10 feet below ground surface shall utilize a design infiltration rate of 0.05 or less in/hr. This value is less than 0.3 in/hr and indicates a very low infiltration rate for the on-site material. All systems must meet the latest city and/or county specifications and the California Regional Water Quality Control Board (CRWQCB) requirements.

It is recommended that foundations shall be setback a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the geotechnical engineer.

8.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the soils engineer may be necessary based upon the conditions encountered.

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

8.1 Site Grading Recommendations

Any vegetation and/or demolition debris shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill.*

8.1.1 Removal and Recompaction Recommendations

All disturbed soils and/or fill (about 1 to 1½ feet below ground surface) shall be removed to competent native material, the exposed surface scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

It is possible that isolated areas of undiscovered fill not described in this report are present on site; if found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction.

Any imported fill material should be preferably soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

8.1.2 Fill Blanket Recommendations

Due to the potential for differential settlement of foundations placed on engineered fill and the underlying bedrock, it is recommended that all foundations including floor slab areas be underlain by a uniform compacted fill blanket at least two feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater. Otherwise all foundations for each individual building or site wall shall be embedded into bedrock.

8.2 Shrinkage/Bulking and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 5 to 15% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. The bulking of the bedrock shall be between 3 to 7%. Subsidence should be 0.2 feet die to earthwork operations.

The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements, or topographic approximations. Although these values are only approximate, they represent our best estimate of lost yardage, which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing the actual equipment and grading techniques should be conducted.

8.3 Temporary Excavations

Temporary unsurcharged excavations in the existing site materials may be made at vertical inclinations up to 4 feet in height unless cohesionless soils are encountered. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring or flatter excavations may be required. The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

8.4 Foundation Design

All foundations may be designed utilizing the following allowable bearing capacities for an embedded depth of 18 inches into approved engineered fill or bedrock with the corresponding widths:

Allowable Bearing Capacity (psf)		
Width (feet)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2075	2575
4.0	2375	2875
6.0	2500	3000

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 18-inch minimum depth, up to a maximum of 4,000 psf. A one-third increase may be used when considering short-term loading and seismic forces. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

8.5 Settlement Analysis

Resultant pressure curves for the consolidation tests are shown on Plates D to G. Computations utilizing these curves and the recommended allowable soil bearing capacities reveal that the foundations will experience settlements on the order of ¾ inch and differential settlements of less than ¼ inch.

8.6 Lateral Resistance

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.40
Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.
Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native materials.

8.7 Retaining Wall Design Parameters

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical)	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. An equivalent fluid pressure of 45 pcf may be utilized for the restrained wall condition with a level grade behind the wall.

The seismic-induced lateral soil pressure for walls greater than 6 feet may be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H where H is the height of the retained soils above the wall footing should be used in final design of retaining walls. Sliding resistance values and passive fluid pressure values may be increased by 1/3 during short-term wind and seismic loading conditions.

All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system. The granular backfill to be utilized immediately adjacent to retaining walls shall consist of an approved select granular soil with a sand equivalency greater than 30. This backfill zone of free draining material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination of no less than ¾ to 1 (horizontal to vertical).

8.8 Slab Design

All concrete slabs shall be a minimum of six inches in thickness in the proposed warehouse areas and four inches in office and hardscape and placed on approved subgrade soils. Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon soils expansion potential and proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect.

A vapor retarder (10-mil minimum thickness) should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed directly upon compacted subgrade soils conditioned to near optimum moisture levels, although one to two inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

8.9 Pavement Section Design

The table below provides a preliminary pavement design based upon an R-Value of 50 and 54 for the subgrade soils for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of site grading to assure that these soils are consistent with those assumed in this preliminary design. The recommendations are based upon estimated traffic loads. Client should submit any other anticipated traffic loadings to the geotechnical engineer, if necessary, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.

Type of Traffic	Traffic Index	Asphalt (in.)	Base Material (in.)
Automobile Parking Stalls	4.0	3.0	3.0
Light Vehicle Circulation Areas	5.5	3.5	4.5
Heavy Truck Access Areas	7.0	4.0	8.0

Any concrete slab-on-grade in pavement areas shall be a minimum of six inches in thickness and may be placed on approved subgrade soils. All pavement areas shall have positive drainage toward an approved outlet from the site. Drain lines behind curbs and/or adjacent to landscape areas should be considered by client and the appropriate design engineers to prevent water from infiltrating beneath pavement. If such infiltration occurs, damage to pavement, curbs and flow lines, especially on sites with expansive soils, may occur during the life of the project.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the City of Riverside. The base material; and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

8.10 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

8.11 Corrosion Design Criteria

Representative samples of the surficial soils, typical of the subgrade soils expected to be encountered within foundation excavations and underground utilities were tested for corrosion potential. The minimum resistivity value obtained for the samples tested is representative of an environment that may be severely corrosive to metals. The soil pH value was considered mildly alkaline and may not have a significant effect on soil corrosivity. Consideration should be given to corrosion protection systems for buried metal such as protective coatings, wrappings or the use of PVC where permitted by local building codes.

According to Table 4.3.1 of ACI 318 Building Code and Commentary, these contents revealed negligible sulfate concentrations. Therefore, a Type II cement according to latest CBC specifications may be utilized for building foundations at this time. It is recommended that additional sulfate tests be performed at the completion of site grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Corrosion test results may be found on the attached Table IV.

8.12 Expansive Soil

If expansive soils are encountered, special attention should be given to the project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

9.0 Closure

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D. Tucker

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/2020
GEOTECHNICAL
STATE OF CALIFORNIA

Scott D. Spensiero
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low-density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Geotechnical Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material for Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Geotechnical Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils

The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D 1557) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Geotechnical Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Geotechnical Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Geotechnical Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

EXPANSIVE SOIL GUIDELINES

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

*From Table 18A-I-B of California Building Code (1988)

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and "hairline" cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades should be designed to the latest building code and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any "ponding" of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

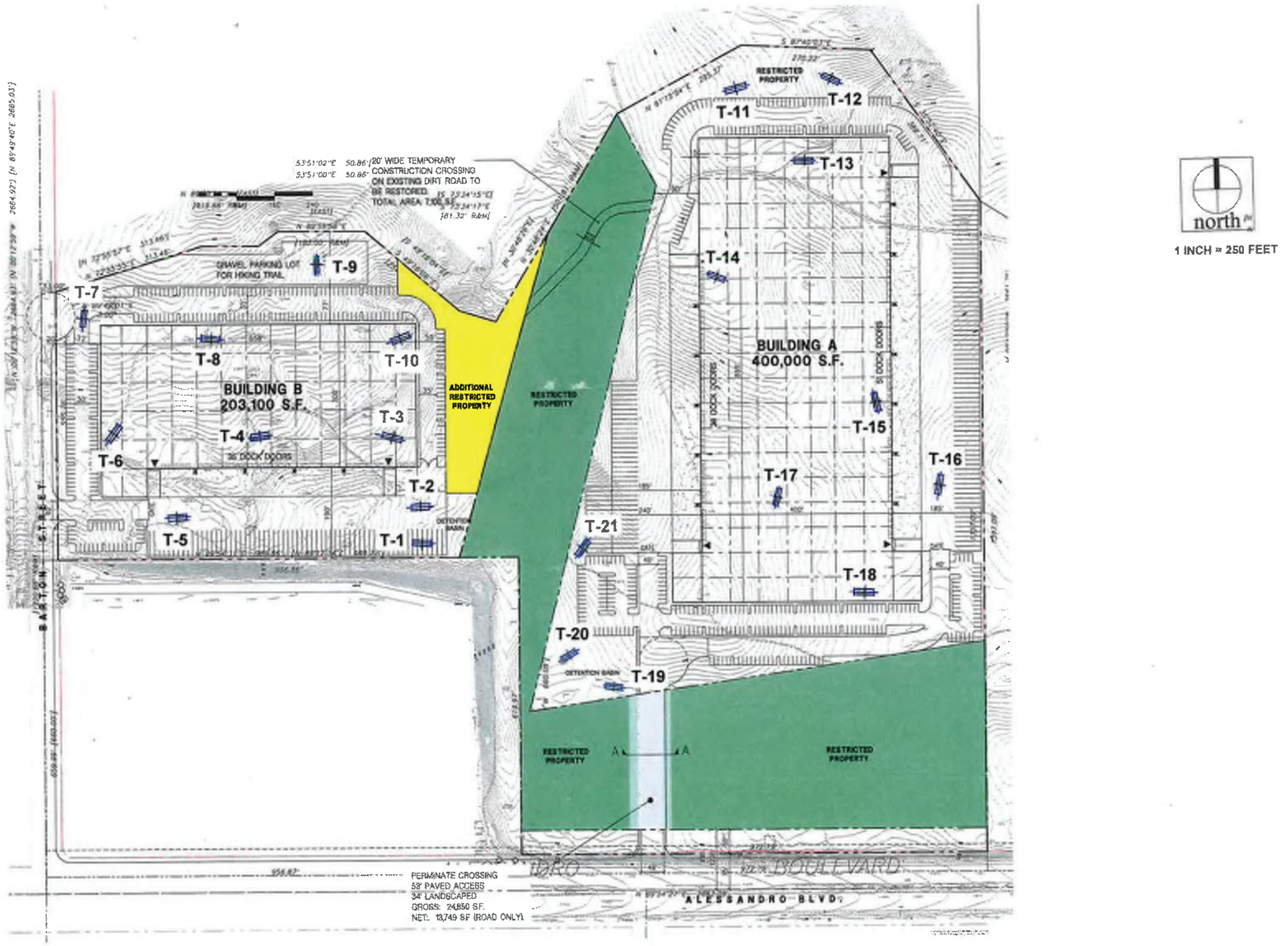
- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain a relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.



NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 21022-19 DATE MARCH 2019

SITE PLAN

List of Appendices

(in order of appearance)

Appendix A – Log of Excavations

Log of Trenches T-1 to T-21

Appendix B – Laboratory Tests

Table I – Maximum Dry Density

Table II – Expansion

Table III – Corrosion

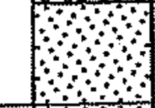
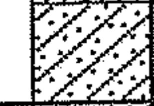
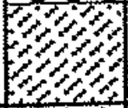
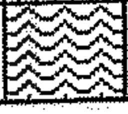
Plate A to C – Direct Shear

Plates D to G - Consolidation

Appendix C – ASCE Seismic Hazards Report

Appendix D – Soil Infiltration Data

Appendix A

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

■	Indicates 2.5-inch Inside Diameter. Ring Sample.
☒	Indicates 2-inch OD Split Spoon Sample (SPT).
⍂	Indicates Shelby Tube Sample.
◫	Indicates No Recovery.
◧	Indicates SPT with 140# Hammer 30 in. Drop.
🖂	Indicates Bulk Sample.
◩	Indicates Small Bag Sample.
◨	Indicates Non-Standard
⧗	Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

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Log of Trench T-1

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith- ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0	▥	GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
	▨		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
5			Trench completed at depth of 5'					
10								
15								
20								
25								
30								
35								

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Log of Trench T-2

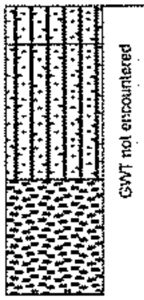
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples Type	 Blow Counts	Laboratory Moisture	 Dry Density	 Fines Content %
0		FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
		Trench completed at depth of 7.5'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-3

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		7.0	115.0	
	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		4.4	121.3	
	Refusal at depth of 8'					
10						
15						
20						
25						
30						
35						

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Log of Trench T-4

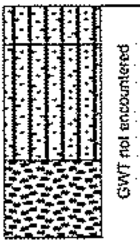
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 **Groundwater Depth: None Encountered**

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		10.5	113.7	
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist	☐				
5		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		3.8	124.2	
		Refusal at depth of 6'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-5

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

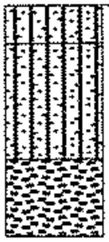
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
			NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5			BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
			Boring completed at depth of 6'					
10								
15								
20								
25								
30								
35								

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Log of Trench T-6

Boring Location: Barton & Alessandro, Riverside	
Date of Drilling: 3/11/19	**Groundwater Depth: None Encountered**
Drilling Method: Backhoe	
Hammer Weight:	**Drop:**
Surface Elevation: Not Measured	

Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		■ ▽		8.6	114.1	
	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		5.6	112.4	
10		■		5.6	125.1	
15	Trench completed at depth of 15'	■		4.2	127.7	
20						
25						
30						
35						

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21022-19

Log of Trench T-7

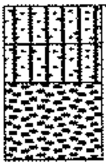
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 **Groundwater Depth: None Encountered**

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
			NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5			BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
			Trench completed at depth of 4'					
10								
15								
20								
25								
30								
35								

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Log of Trench T-8

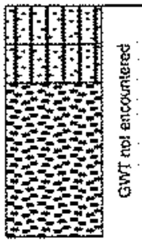
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		7.3	118.8	
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist	■		5.1	123.2	
5		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
		Trench completed at depth of 6'					
10							
15							
20							
25							
30							
35							

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21022-19

Log of Trench T-9

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
5		Trench completed at depth of 5'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-10

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

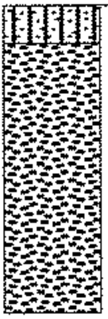
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Lith- ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		6.1	122.2	
5			BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		5.7	124.3	
			Trench completed at depth of 8'					
10								
15								
20								
25								
30								
35								

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Log of Trench T-11

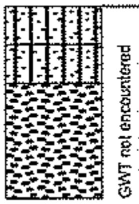
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 | **Groundwater Depth: None Encountered**

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
		Trench completed at depth of 5'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-12

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

Groundwater Depth: None Encountered

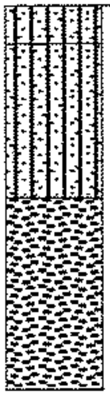
Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
			NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5			BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
10			Trench completed at depth of 10'					
15								
20								
25								
30								
35								



SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21022-19.log Date: 4/2/2019

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Log of Trench T-13

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

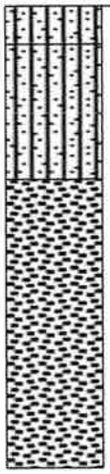
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



GWT not encountered

Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		8.2	108.5	
	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist	▽				
5	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		2.8	125.1	
10		■		4.8	130.8	
	Trench completed at depth of 12'					
15						
20						
25						
30						
35						

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21022-19.log Date: 4/2/2019

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Log of Trench T-14

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

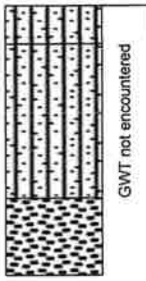
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		11.2	111.4	
	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		4.8	124.8	
	Refusal at depth of 7'					
10						
15						
20						
25						
30						
35						

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21022-19.log Date: 4/2/2019

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Log of Trench T-15

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

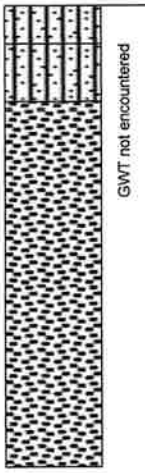
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory Fines Content %
0	FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		12.1	116.1	
	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		2.3	118.4	
10		■		5.9	125.7	
	Boring completed at depth of 12'					
15						
20						
25						
30						
35						

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\21022-19.log Date: 4/2/2019

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Log of Trench T-16

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

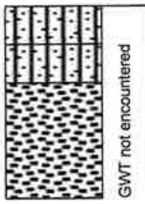
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist Refusal completed at depth of 5'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-17

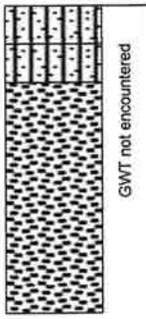
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:
Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		■		8.3	125.1	
	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist	▽				
5	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist	■		3.9	117.1	
	Refusal at depth of 8'					

Depth scale: 0, 5, 10, 15, 20, 25, 30, 35

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Log of Trench T-18

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: **Drop:**

Surface Elevation: Not Measured

Depth (feet)	Lith- ology	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory Fines Content %
0	▨ GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist	■		3.7	116.0	
	▨	NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, damp	■		2.9	122.3	
5	▨	BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, damp					
		Trench completed at depth of 7'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-19

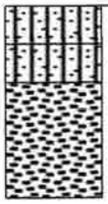
Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19 | **Groundwater Depth: None Encountered**

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation: Not Measured



GWT not encountered

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Fines Content %
0		FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
		NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5		BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
		Trench completed at depth of 5'					
10							
15							
20							
25							
30							
35							

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Log of Trench T-20

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

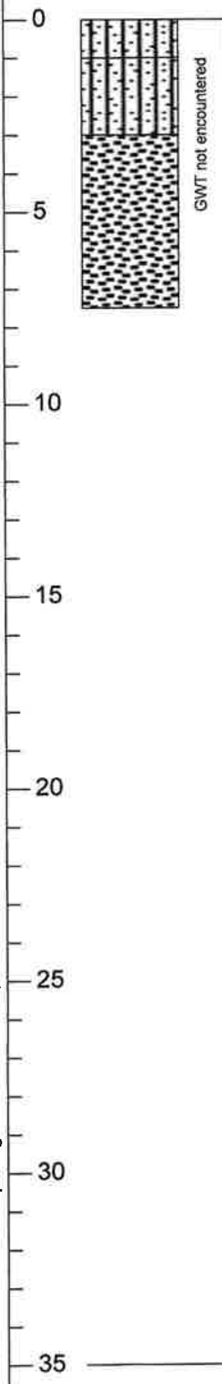
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					

Trench completed at depth of 7.5'

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Log of Trench T-21

Boring Location: Barton & Alessandro, Riverside

Date of Drilling: 3/11/19

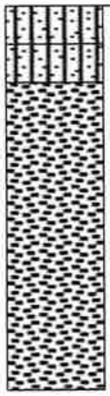
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Lith- ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		GWT not encountered	FILL Silty (fine to coarse grained) SAND Brown, loose, moist					
			NATURAL Silty (fine to coarse grained) SAND Brown, medium dense, moist					
5			BEDROCK Decomposed Granite Silty (fine to ocarse grained) SAND Grey-brown, very dense, moist					
10			Boring completed at depth of 10'					
15								
20								
25								
30								
35								

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Appendix B

TABLE I
MAXIMUM DENSITY TESTS

Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
T-4 @ 2'	Silty SAND	9.5	130.0
T-6 @ 2'	Silty SAND	9.0	131.0
T-13 @ 2'	Silty SAND	10.0	127.0
T-17 @ 2'	Silty SAND	8.5	133.0

TABLE II
EXPANSION TESTS

Sample	Classification	Expansion Index
T-4 @ 2'	Silty SAND	3
T-13 @ 2'	Silty SAND	4

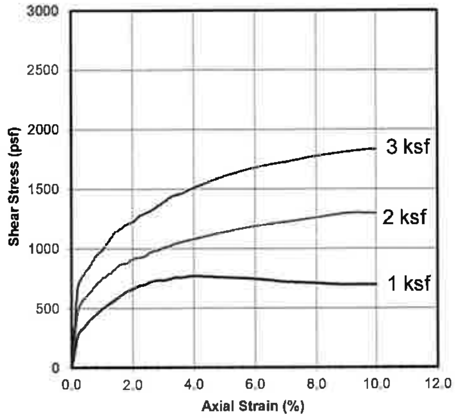
TABLE III
CORROSION TESTS

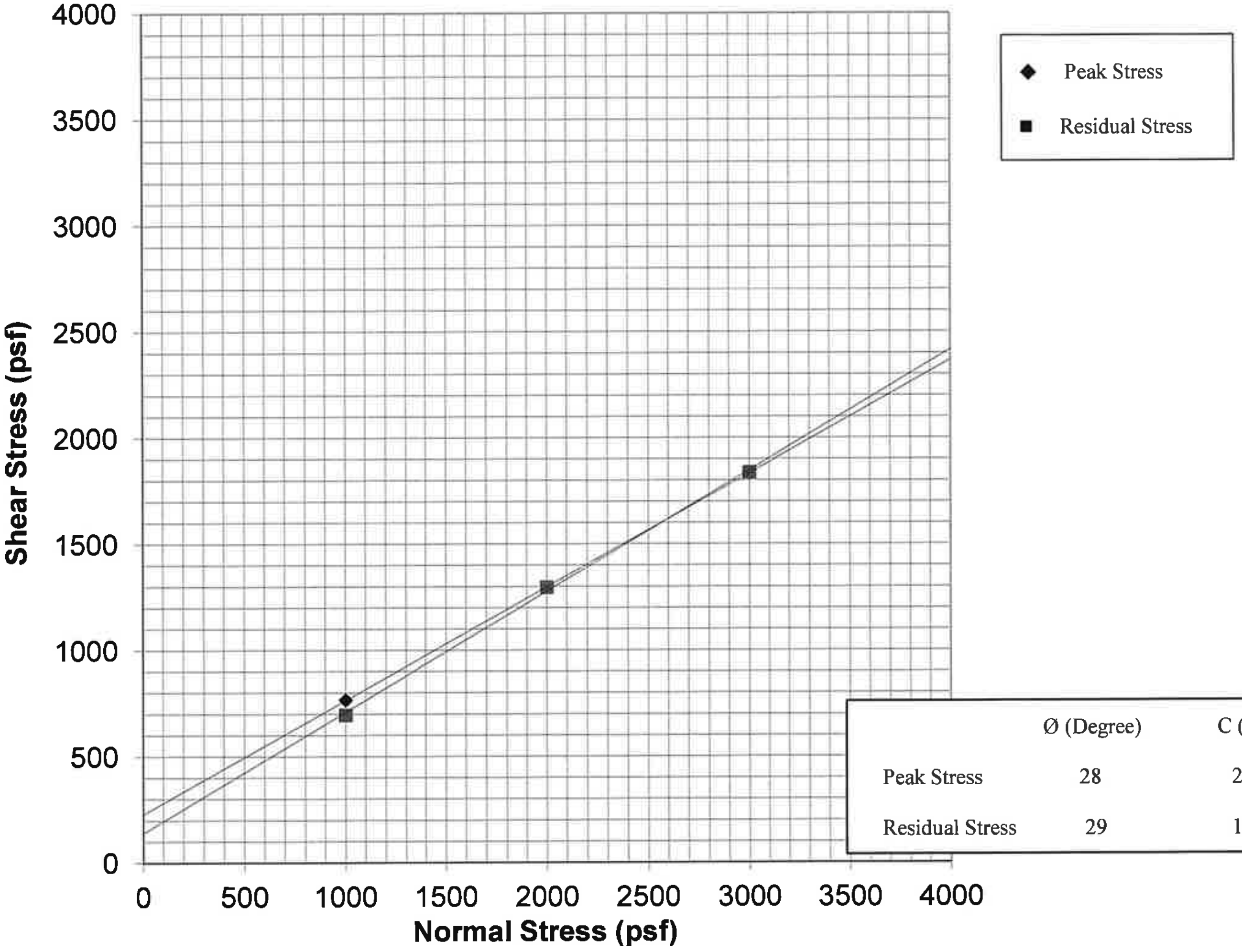
Sample	pH	Electrical Resistivity	Sulfate (%)	Chloride (ppm)
T-6 @ 2'	7.1	3,190	0.003	190
T-17 @ 4'	7.2	4,082	0.003	173

% by weight
ppm – mg/kg

Sample No. T4@2'
Sample Type: Undisturbed/Saturated
Soil Description:

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	768	1296	1836
Displacement	(in)	0.100	0.225	0.250
Residual Stress	(psf)	696	1296	1836
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	113.7	113.7	113.7
In Situ Water Content	(%)	10.5	10.5	10.5
Saturated Water Content	(%)	17.8	17.8	17.8
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	28	230
Residual Stress	29	140

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PROJECT NUMBER: 21022-19 DATE: 3/27/2019

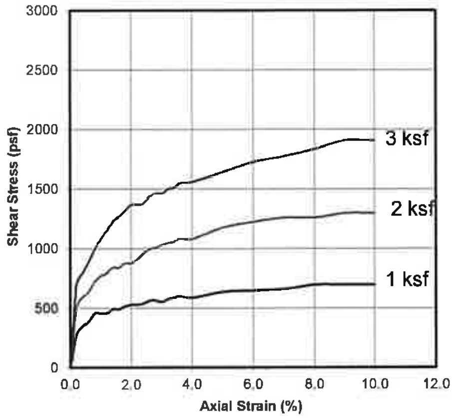
DIRECT SHEAR TEST

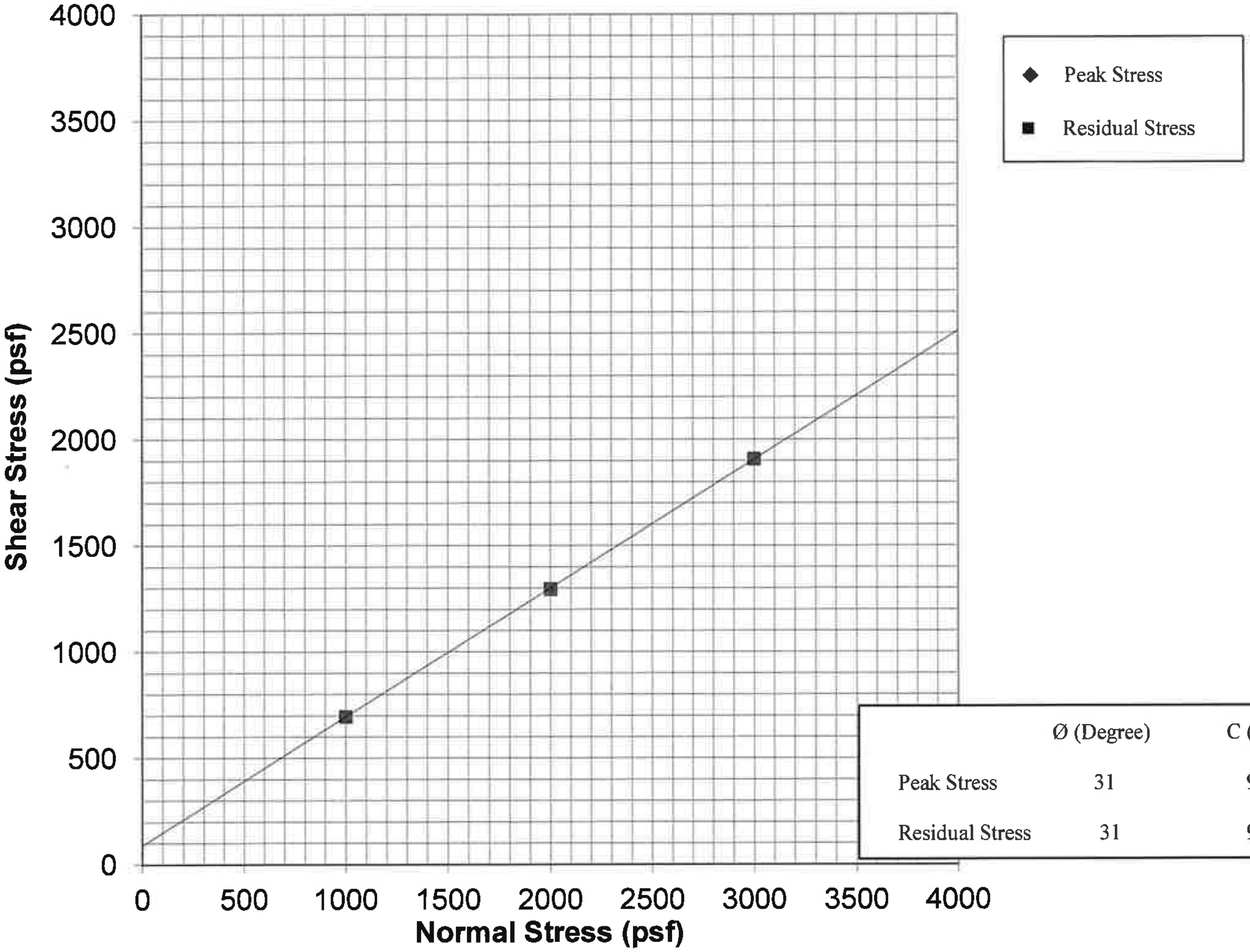
ASTM D3080

Plate A

Sample No. T13@2'
Sample Type: Undisturbed/Saturated
Soil Description:

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	696	1296	1908
Displacement	(in.)	0.200	0.225	0.225
Residual Stress	(psf)	696	1296	1908
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	108.5	108.5	108.5
In Situ Water Content	(%)	8.2	8.2	8.2
Saturated Water Content	(%)	20.4	20.4	20.4
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	31	90
Residual Stress	31	90

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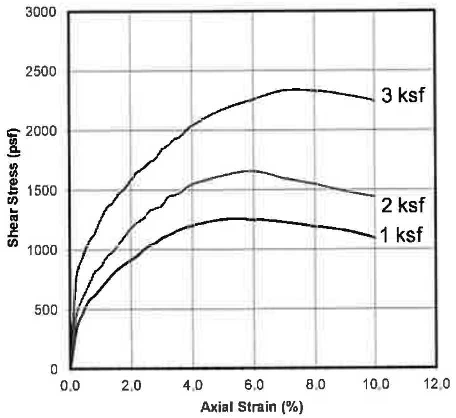
DIRECT SHEAR TEST

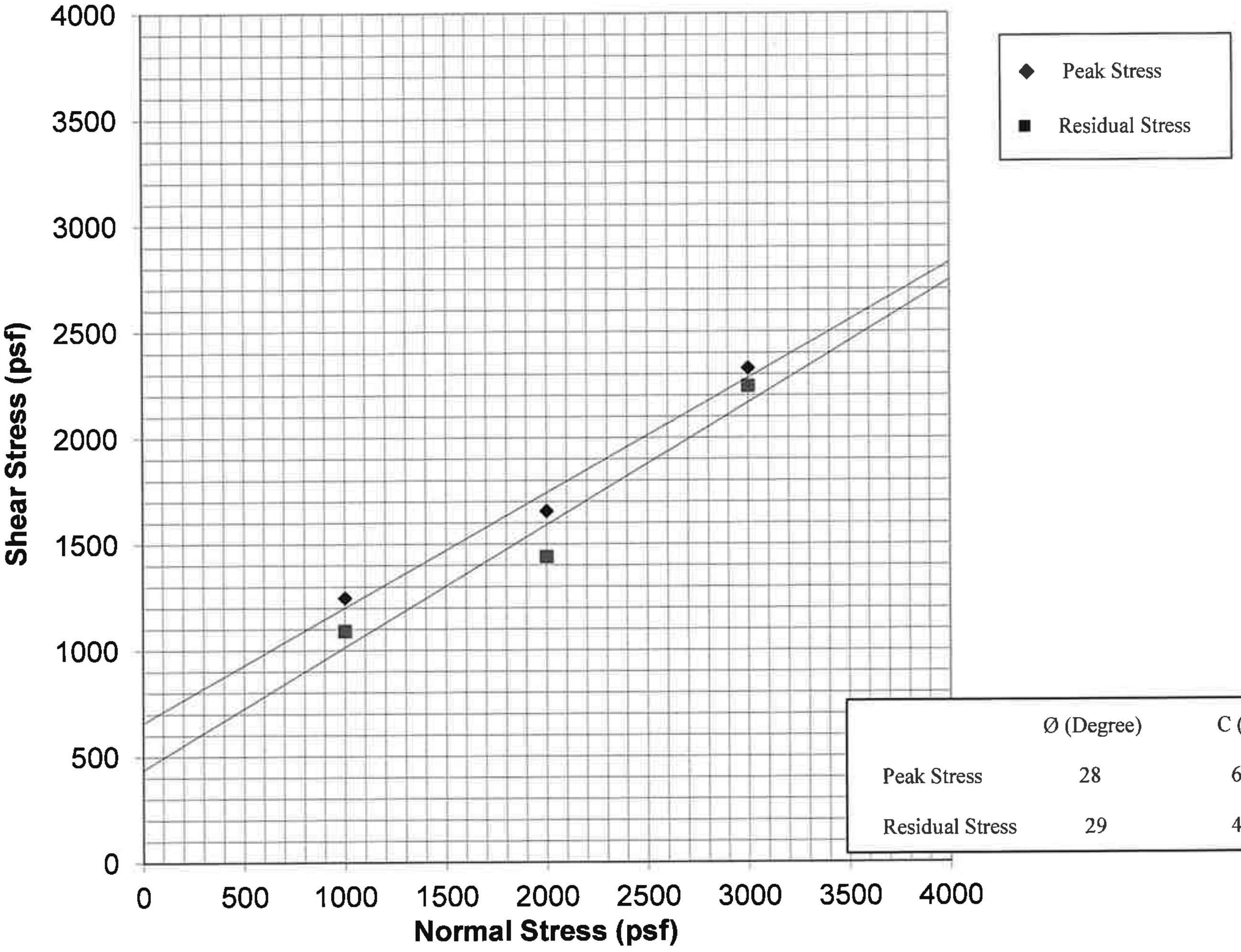
ASTM D3080

Plate B

Sample No.	T17@2'
Sample Type:	Undisturbed/Saturated
Soil Description:	Silty Fine-Coarse Grained Sand

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	1248	1656	2328
Displacement	(in)	0.125	0.150	0.175
Residual Stress	(psf)	1092	1440	2244
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	125.1	125.1	125.1
In Situ Water Content	(%)	8.3	8.3	8.3
Saturated Water Content	(%)	12.6	12.6	12.6
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	28	660
Residual Stress	29	440

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DIRECT SHEAR TEST

ASTM D3080

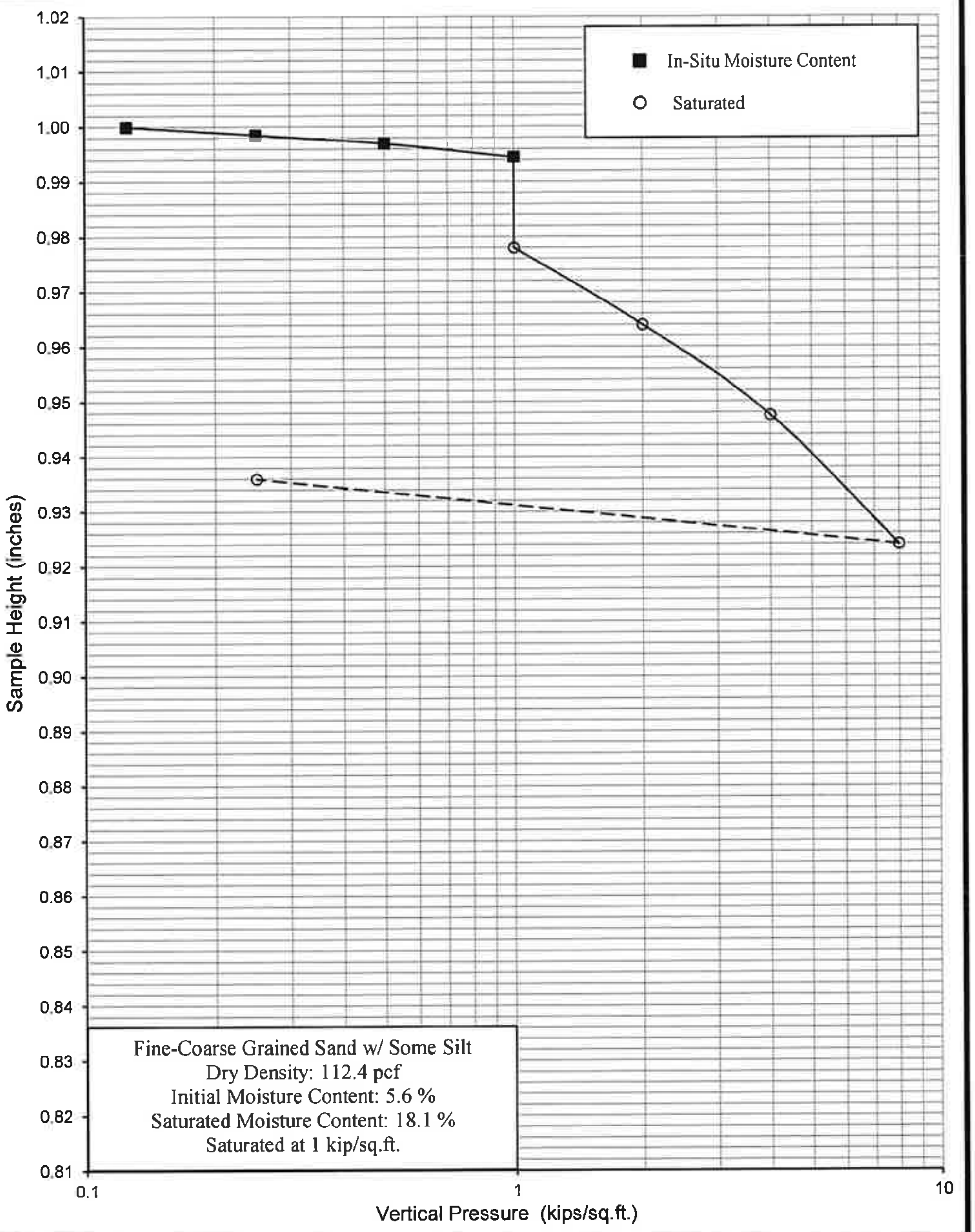
Plate C

Sample No. T6 | Depth 5' | Date 3/27/2019

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9985	0.2
0.5	0.9970	0.3
1	0.9945	0.6
1	0.9780	2.2
2	0.9640	3.6
4	0.9475	5.3
8	0.9240	7.6
0.25	0.9360	6.4

Saturated

Date Tested: 3/25/2019
Sample: T6
Depth: 5'



Fine-Coarse Grained Sand w/ Some Silt
Dry Density: 112.4 pcf
Initial Moisture Content: 5.6 %
Saturated Moisture Content: 18.1 %
Saturated at 1 kip/sq.ft.

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PROJECT NUMBER: 21022-19 DATE: 3/27/2019

CONSOLIDATION TEST

ASTM D2435

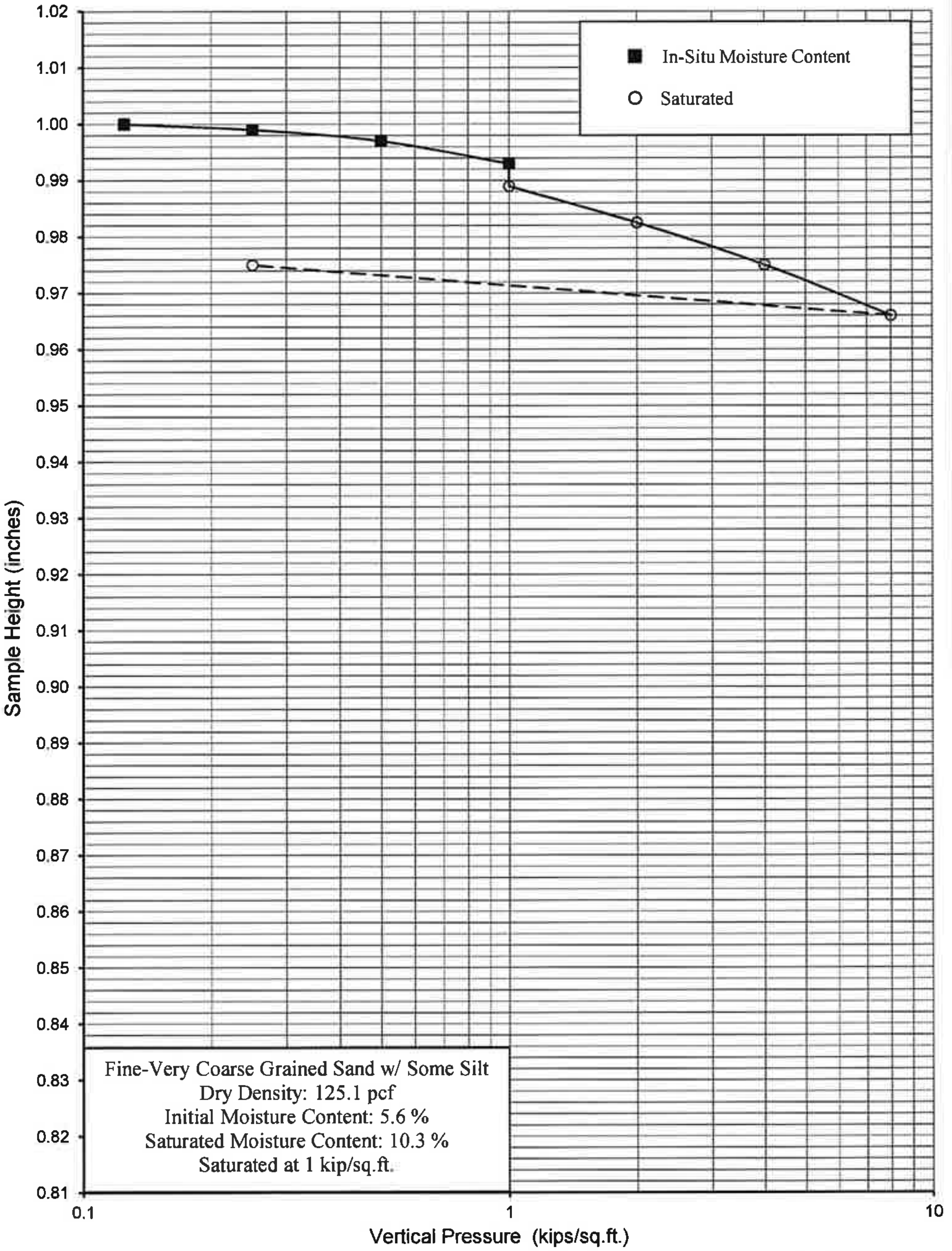
Plate D

Sample No. T6 | Depth 10' | Date 3/27/2019

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9990	0.1
0.5	0.9970	0.3
1	0.9930	0.7
1	0.9890	1.1
2	0.9825	1.8
4	0.9750	2.5
8	0.9660	3.4
0.25	0.9750	2.5

Saturated

Date Tested: 3/25/2019
Sample: T6
Depth: 10'



Fine-Very Coarse Grained Sand w/ Some Silt
Dry Density: 125.1 pcf
Initial Moisture Content: 5.6 %
Saturated Moisture Content: 10.3 %
Saturated at 1 kip/sq.ft.

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PROJECT NUMBER: 21022-19 DATE: 3/27/2019

CONSOLIDATION TEST

ASTM D2435

Plate E

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9943	0.6
0.5	0.9877	1.2
1	0.9793	2.1
1	0.9726	2.7
2	0.9586	4.1
4	0.9404	6.0
8	0.9201	8.0
0.25	0.9334	6.7

Saturated

Sample No. T13

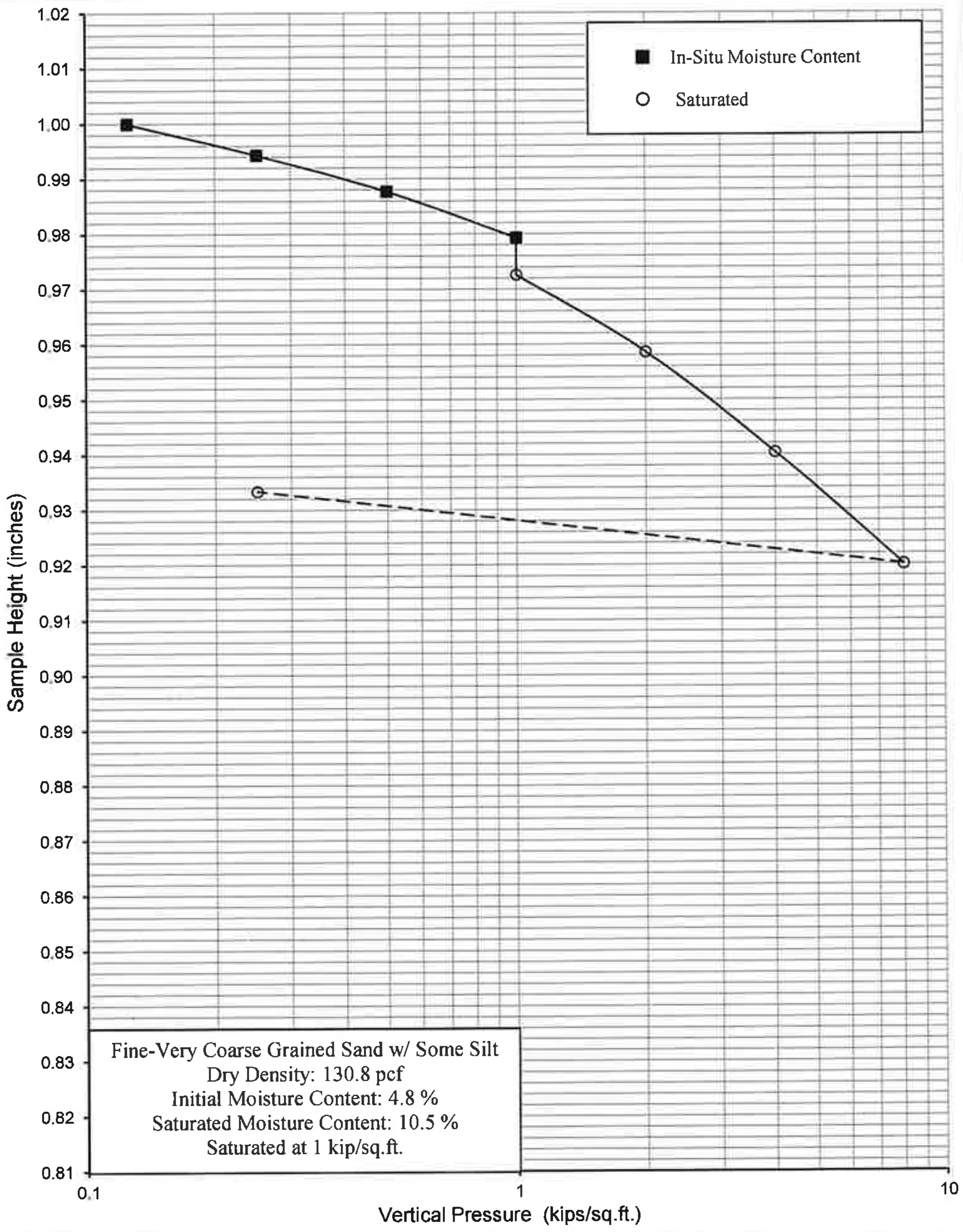
Depth 10'

Date 3/27/2019

Date Tested: 3/25/2019

Sample: T13

Depth: 10'



Fine-Very Coarse Grained Sand w/ Some Silt
Dry Density: 130.8 pcf
Initial Moisture Content: 4.8 %
Saturated Moisture Content: 10.5 %
Saturated at 1 kip/sq.ft.

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PROJECT NUMBER: 21022-19 DATE: 3/27/2019

CONSOLIDATION TEST

ASTM D2435

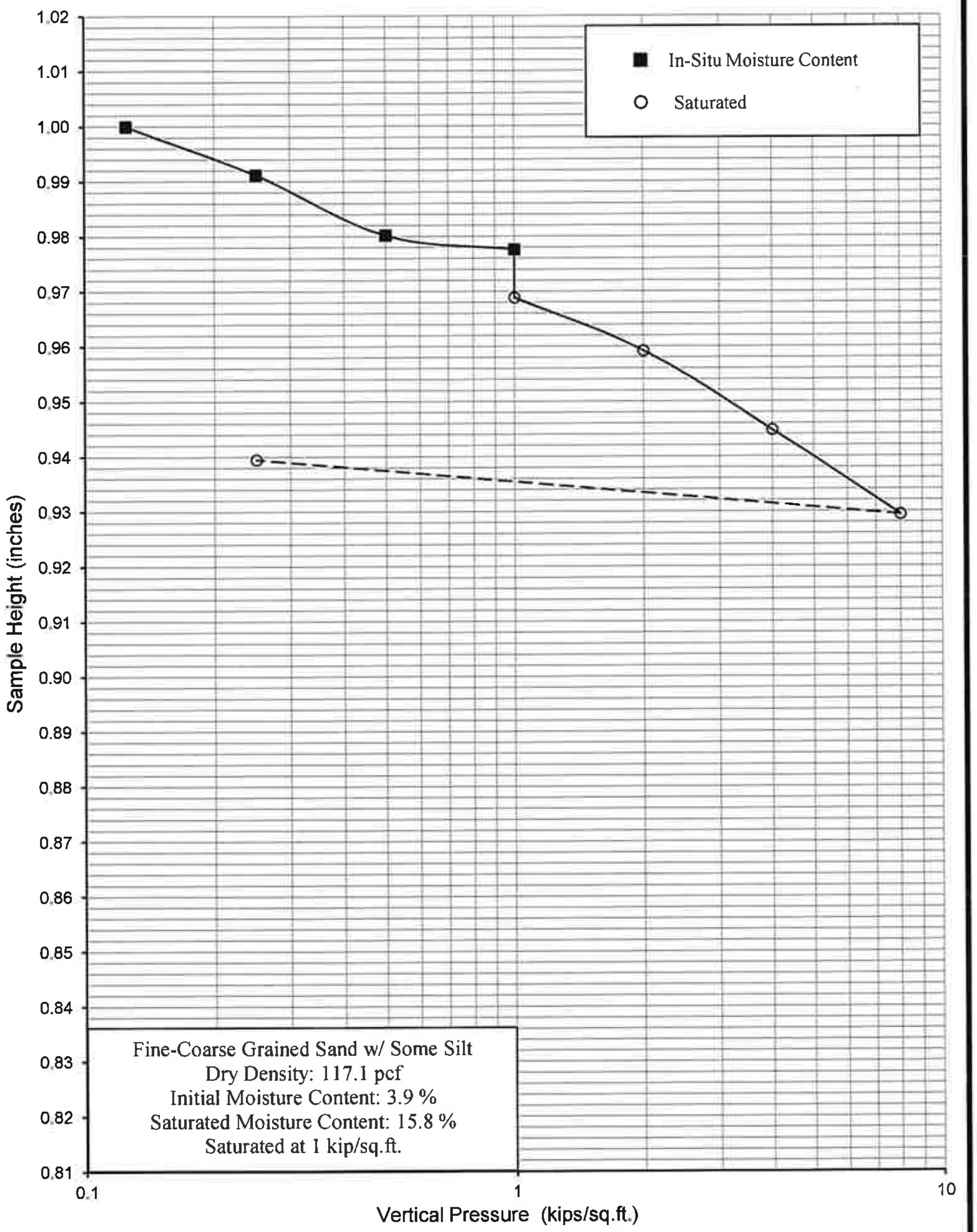
Plate F

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9912	0.9
0.5	0.9802	2.0
1	0.9776	2.2
1	0.9689	3.1
2	0.9592	4.1
4	0.9448	5.5
8	0.9294	7.1
0.25	0.9395	6.1

Saturated

Sample No. T17 | Depth 5' | Date 3/27/2019

Date Tested: 3/26/2019
Sample: T17
Depth: 5'



Fine-Coarse Grained Sand w/ Some Silt
Dry Density: 117.1 pcf
Initial Moisture Content: 3.9 %
Saturated Moisture Content: 15.8 %
Saturated at 1 kip/sq.ft.

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PROJECT NUMBER: 21022-19 DATE: 3/27/2019

CONSOLIDATION TEST

ASTM D2435

Plate G

Appendix C

U.S. Geological Survey Quaternary Faults

3/13/2019, 7:44:29 AM

Fault Areas
- ☐ Class B
- ☐ historic
- ☐ late Quaternary
- ☐ latest Quaternary
- ☐ middle and late Quaternary

U.S. Quaternary Faults
- — Undifferentiated Quaternary (< 130,000 years), well constrained location
- — Latest Quaternary (<15,000 years), well constrained location
- - - Latest Quaternary (<15,000 years), moderately constrained location
- · · · Latest Quaternary (<15,000 years), inferred location
- — Late Quaternary (< 130,000 years), well constrained location
- - - Late Quaternary (< 130,000 years), moderately constrained location
- · · · Late Quaternary (< 130,000 years), inferred location

1:144,448

0 1.5 3 6 mi

0 2.25 4.5 9 km

Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp., USGS

USGS

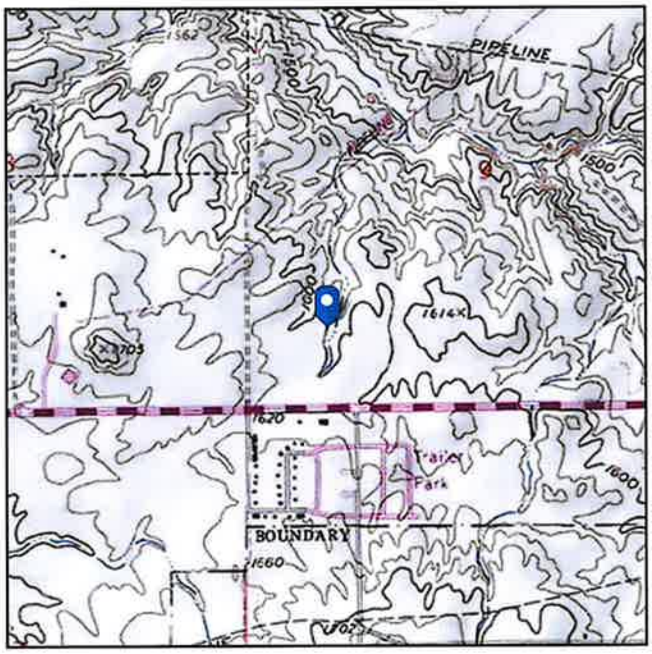
Content may not reflect National Geographic's current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp. | USGS |

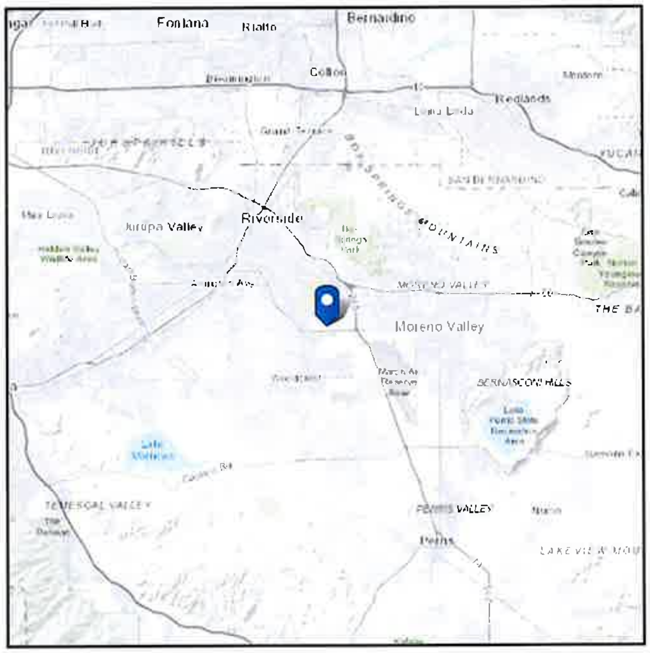
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-10
Risk Category: III
Soil Class: D - Stiff Soil

Elevation: 1602.28 ft (NAVD 88)
Latitude: 33.919008
Longitude: -117.310797





AMERICAN SOCIETY OF CIVIL ENGINEERS

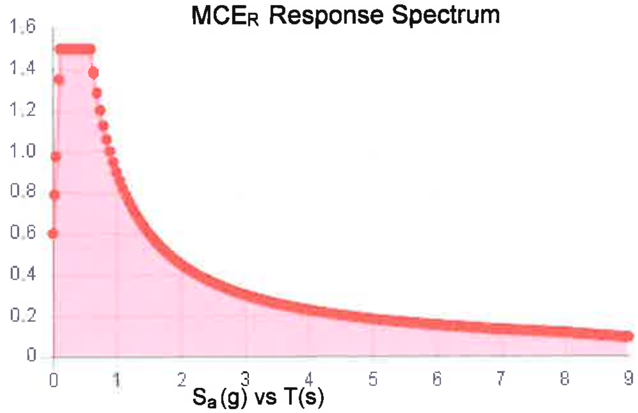
Seismic

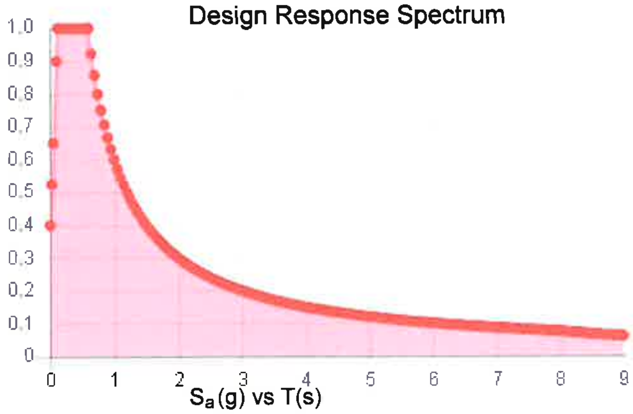
Site Soil Class: D - Stiff Soil

Results:

S_S :	1.5	S_{DS} :	1
S_1 :	0.6	S_{D1} :	0.6
F_a :	1	T_L :	8
F_v :	1.5	PGA :	0.5
S_{MS} :	1.5	PGA_M :	0.5
S_{M1} :	0.9	F_{PGA} :	1
		I_e :	1.25

Seismic Design Category D





Data Accessed: Fri Mar 22 2019

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided "as is" and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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Appendix D

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Darrell Butler
Project No.: 21022-19
Date: 3/11/19
Test No. T-1
Depth: 5'
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
8:00			78.8			46.1					
8:10	10	10	80.0	1.2		47.4	1.3				
8:10			74.0			41.6					
8:20	10	20	75.0	1.0		42.6	1.0				
8:20			75.0			42.6					
8:30	10	30	76.0	1.0		43.6	1.0				
8:30			76.0			43.6					
8:40	10	40	76.7	0.7		44.3	0.7				
8:40			76.7			44.3					
8:50	10	50	77.1	0.4		44.7	0.4				
8:50			77.1			44.7					
9:00	10	60	77.5	0.4		45.1	0.4				
9:00			77.5			45.1					
9:10	10	70	77.7	0.2		45.5	0.4		1.2	2.4	
9:10			75.6			43.2					
9:20	10	80	75.9	0.3		43.6	0.4		1.8	2.4	
9:20			75.9			43.6					
9:30	10	90	76.1	0.2		43.9	0.3		1.2	1.8	
9:30			76.1			43.9					
9:40	10	100	76.3	0.2		44.1	0.2		1.2	1.2	
9:40			76.3			44.1					
9:50	10	110	76.5	0.2		44.3	0.2		1.2	1.2	
9:50			76.5			44.3					
10:00	10	120	76.7	0.2		44.5	0.2		1.2	1.2	

Average = 1.3 / 1.7 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Darrell Butler
Project No.: 21022-19
Date: 3/11/19
Test No. T-2
Depth: 7.5’
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
8:50			109.2			47.2					
9:00	10	10	109.4	0.2		47.5	0.3				
9:00			109.4			47.5					
9:10	10	20	109.6	0.2		47.7	0.2				
9:10			109.6			47.7					
9:20	10	30	109.8	0.2		47.9	0.2				
9:20			108.1			46.3					
9:30	10	40	108.2	0.1		46.4	0.1				
9:30			108.2			46.4					
9:40	10	50	108.2	0.0		46.4	0.0				
9:40			108.2			46.4					
9:50	10	60	108.3	0.1		46.5	0.1				
9:50			108.3			46.5					
10:00	10	70	108.4	0.1		46.6	0.1		0.6	0.6	
10:00			108.4			46.6					
10:10	10	80	108.5	0.1		46.7	0.1		0.6	0.6	
10:10			108.5			46.7					
10:20	10	90	108.6	0.1		46.8	0.1		0.6	0.6	
10:20			108.6			46.8					
10:30	10	100	108.6	0.0		46.9	0.1		0.0	0.6	
10:30			108.6			46.9					
10:40	10	110	108.6	0.0		47.1	0.2		0.0	1.2	
10:40			108.6			47.1					
10:50	10	120	108.7	0.1		47.2	0.1		0.6	0.6	

Average = 0.4 / 0.7 cm/hr

NORCAL
ENGINEERING
SOILS AND GEOTECHNICAL CONSULTANTS

Project: Darrell Butler
Project No.: 21022-19
Date: 3/11/19
Test No. T-11
Depth: 5'
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
10:25			78.6			47.1					
10:35	10	10	79.1	0.7		47.6	0.5				
10:35			79.1			47.6					
10:45	10	20	79.5	0.4		48.1	0.5				
10:45			72.5			41.1					
10:55	10	30	73.0	0.5		41.5	0.4				
10:55			73.0			41.5					
11:05	10	40	73.2	0.2		41.8	0.3				
11:05			73.2			41.8					
11:15	10	50	73.5	0.3		42.0	0.2				
11:15			73.5			42.0					
11:25	10	60	73.7	0.2		42.1	0.1				
11:25			73.7			42.1					
11:35	10	70	73.9	0.2		42.5	0.4		1.2	2.4	
11:35			73.9			42.5					
11:45	10	80	74.2	0.3		42.7	0.2		1.8	1.2	
11:45			74.2			42.7					
11:55	10	90	74.4	0.2		42.9	0.2		1.2	1.2	
11:55			74.4			42.9					
12:05	10	100	74.4	0.0		42.9	0.0		0.0	0.0	
12:05			74.4			42.9					
12:15	10	110	74.4	0.0		42.9	0.0		0.0	0.0	
12:15			74.4			42.9					
12:25	10	120	74.4	0.0		42.9	0.0		0.0	0.0	

Average = 0.7 / 0.8 cm/hr

Project: Darrell Butler
Project No.: 21022-19
Date: 3/11/19
Test No. T-12
Depth: 10’
Tested By: J.S.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
11:34			109.6			50.2					
11:44	10	10	109.8	0.2		50.6	0.4				
11:44			109.8			50.6					
11:54	10	20	109.9	0.1		50.8	0.2				
11:54			109.9			50.8					
12:04	10	30	110.0	0.1		51.0	0.2				
12:04			110.0			51.0					
12:14	10	40	110.0	0.0		51.0	0.0				
12:14			110.0			51.0					
12:24	10	50	110.1	0.1		51.1	0.1				
12:24			110.1			51.1					
12:34	10	60	110.1	0.0		51.1	0.0				
12:34			110.1			51.1					
12:44	10	70	110.1	0.0		51.1	0.0		0.0	0.0	
12:44			110.1			51.1					
12:54	10	80	110.1	0.0		51.1	0.0		0.0	0.0	
12:54			110.1			51.1					
1:04	10	90	110.2	0.1		51.2	0.1		0.6	0.6	
1:04			110.2			51.2					
1:14	10	100	110.2	0.0		51.2	0.0		0.0	0.0	
1:14			110.2			51.2					
1:24	10	110	110.3	0.1		51.3	0.1		0.6	0.6	
1:24			110.3			51.3					
1:34	10	120	110.3	0.0		51.3	0.0		0.0	0.0	

Average = 0.2 / 0.2 cm/hr

Project: Darrell Butler
Project No.: 21022-19
Date: 3/12/19
Test No. T-19
Depth: 5'
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
7:30			79.9			49.5					
7:40	10	10	80.2	0.3		50.1	0.6				
7:40			80.2			50.1					
7:50	10	20	80.4	0.2		50.3	0.2				
7:50			80.4			50.3					
8:00	10	30	80.5	0.1		50.6	0.3				
8:00			80.5			50.6					
8:10	10	40	80.5	0.0		50.6	0.0				
8:10			80.5			50.6					
8:20	10	50	80.5	0.0		50.6	0.0				
8:20			80.5			50.6					
8:30	10	60	80.5	0.0		50.6	0.0				
8:30			80.5			50.6					
8:40	10	70	80.5	0.0		50.6	0.0		0.0	0.0	
8:40			80.5			50.6					
8:50	10	80	80.5	0.0		50.6	0.0		0.0	0.0	
8:50			80.5			50.6					
9:00	10	90	80.5	0.0		50.6	0.0		0.0	0.0	
9:00			80.5			50.6					
9:10	10	100	80.5	0.0		50.6	0.0		0.0	0.0	
9:10			80.5			50.6					
9:20	10	110	80.5	0.0		50.6	0.0		0.0	0.0	
9:20			80.5			50.6					
9:30	10	120	80.5	0.0		50.6	0.0		0.0	0.0	

Average = 0.0 / 0.0 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: Darrell Butler
Project No.: 21022-19
Date: 3/12/19
Test No. T-20
Depth: 5'
Tested By: J.O.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
8:06			106.3			49.0					
8:16	10	10	106.4	0.1		49.1	0.1				
8:16			106.4			49.1					
8:26	10	20	106.5	0.1		49.3	0.2				
8:26			106.5			49.3					
8:36	10	30	106.6	0.1		49.5	0.2				
8:36			106.6			49.5					
8:46	10	40	106.7	0.0		49.6	0.1				
8:46			106.7			49.6					
8:56	10	50	106.8	0.1		49.6	0.0				
8:56			106.8			49.6					
9:06	10	60	106.8	0.0		49.6	0.0				
9:06			106.8			49.6					
9:16	10	70	106.9	0.1		49.6	0.0		0.6	0.0	
9:16			106.9			49.6					
9:26	10	80	107.0	0.1		49.6	0.0		0.6	0.0	
9:26			107.0			49.6					
9:36	10	90	107.0	0.0		49.6	0.0		0.0	0.0	
9:36			107.0			49.6					
9:46	10	100	107.0	0.0		49.6	0.0		0.0	0.0	
9:46			107.0			49.6					
9:56	10	110	107.0	0.0		49.6	0.0		0.0	0.0	
9:56			107.0			49.6					
10:06	10	120	107.0	0.0		49.6	0.0		0.0	0.0	

Average = 0.2 / 0.0 cm/hr

Project: Darrell Butler	
Project No.: 21022-19	
Date: 3/12/19	
Test No. T-21	
Depth: 10'	
Tested By: J.S.	

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1:05			77.5			46.7					
1:15	10	10	78.2	0.7		47.4	0.7				
1:15			78.2			47.4					
1:25	10	20	78.6	0.4		48.1	0.7				
1:25			78.6			48.1					
1:35	10	30	79.0	0.4		48.5	0.4				
1:35			79.0			48.5					
1:45	10	40	79.0	0.0		49.0	0.5				
1:45			79.0			49.0					
1:55	10	50	79.1	0.1		49.3	0.3				
1:55			79.1			49.3					
2:05	10	60	79.1	0.0		49.5	0.2				
2:05			79.1			49.5					
2:15	10	70	79.1	0.0		49.5	0.0		0.0	0.0	
2:15			79.1			49.5					
2:25	10	80	79.1	0.0		49.5	0.0		0.0	0.0	
2:25			79.1			49.5					
2:35	10	90	79.2	0.1		49.5	0.0		0.6	0.0	
2:35			79.2			49.5					
2:45	10	100	79.2	0.0		49.6	0.1		0.0	0.6	
2:45			79.2			49.6					
2:55	10	110	79.2	0.0		49.6	0.0		0.0	0.0	
2:55			79.2			49.6					
3:05	10	120	79.2	0.0		49.6	0.0		0.0	0.0	

Average = 0.1 / 0.1 cm/hr

Appendix 4: Historical Site Conditions

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

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Section not applicable. Runoff from entire project site will be captured and treated via proposed bioretention BMPs

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

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

Company Name REC-CONSULTANTS
Date 3/10/2020
Designed by WOG
Case No
Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-2A (Filterra FTIBC0604-C)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
2A-IMP	*18,986*	*Concrete or Asphalt*	*1*	*0.89*	*16935.5*			
2A-PER	*12,340*	*Ornamental Landscaping*	*0.1*	*0.11046*	*1363.1*			
	31326	***Total***			**18298.6**	**0.20**	***0.1***	***0.1***

Notes:

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

(Rev. 10-2011)

Legend: ▭ Required Entries
▨ Calculated Cells

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

Company Name REC-CONSULTANTS
Date 3/10/2020
Designed by WOG
Case No
Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-2B (Bioretention Basin)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
2B-IMP	*227,517*	*Concrete or Asphalt*	*1*	*0.89*	*202945.2*			
2B-PER	*27,456*	*Ornamental Landscaping*	*0.1*	*0.11*	*3032.7*			
	254973		***Total***		**205977.9**	**0.60**	***10316.1***	***10449***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend:		
	▭	Required Entries
	▨	Calculated Cells

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

Company Name REC-CONSULTANTS

Date 3/10/2020

Designed by WOG

Case No

Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-2C (Filterra FTIBC1107-C)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
2C-IMP	*80,222*	*Concrete or Asphalt*	*1*	*0.89*	*71558*			
2C-PER	*6,566*	*Ornamental Landscaping*	*0.1*	*0.11046*	*725.3*			
	86788	***Total***			**72283.3**	**0.20**	***0.3***	***0.3***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▒ Calculated Cells

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

Company Name REC-CONSULTANTS
Date 3/10/2020
Designed by WOG
Case No
Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-2D (Filterra FTIBC1107-C)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

DMAs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
2D-IMP	*78,733*	*Concrete or Asphalt*	*1*	*0.89*	*70229.8*			
2D-PER	*6,028*	*Ornamental Landscaping*	*0.1*	*0.11046*	*665.8*			
	84761	***Total***			**70895.6**	**0.20**	***0.3***	***0.3***

Notes:

Santa Ana Watershed - BMP Design Flow Rate, Q_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

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

Company Name REC-CONSULTANTS

Date 3/10/2020

Designed by WOG

Case No

Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-2E (Filterra FTIBC0604-C)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

Design Rainfall Intensity I = 0.20 in/hr

Drainage Management Area Tabulation

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

	DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type (use pull-down menu)	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Rainfall Intensity (in/hr)*	*Design Flow Rate (cfs)*	*Proposed Flow Rate (cfs)*
DMAs	*2E-IMP*	*31,761*	*Concrete or Asphalt*	*1*	*0.89*	*28330.8*			
	2E-PER	*14,528*	*Ornamental Landscaping*	*0.1*	*0.11046*	*1604.7*			
		46289	***Total***			**29935.5**	**0.20**	***0.1***	***0.1***

Notes:

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

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

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

Company Name REC-CONSULTANTS
Date 3/10/2020
Designed by WOG
Case No
Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-3A (Bioretention Basin)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, **V_{BMP}** (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
3A-IMP	*187,121*	*Concrete or Asphalt*	*1*	*0.89*	*166911.9*			
3A-PER	*11,721*	*Ornamental Landscaping*	*0.1*	*0.11*	*1294.7*			
	198842	***Total***			168206.6	0.60	*8424.3*	*9273*

Notes:

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

(Rev. 10-2011)

Legend: ▭ Required Entries
▨ Calculated Cells

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

Company Name REC-CONSULTANTS
Date 3/10/2020
Designed by WOG
Case No
Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-3B (Bioretention Basin)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
3B-IMP	*113,782*	*Concrete or Asphalt*	*1*	*0.89*	*101493.5*			
3B-PER	*36,880*	*Ornamental Landscaping*	*0.1*	*0.11*	*4073.7*			
	150662	***Total***			**105567.2**	**0.60**	***5287.2***	***13528***

Notes:

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

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

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

Company Name REC-CONSULTANTS
Date 3/10/2020
Designed by WOG
Case No
Company Project Number/Name Sycamore Hills Business Center

BMP Identification

BMP NAME / ID BMP-4 (Bioretention Basin)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

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

D_{85}= 0.60 inches

Drainage Management Area Tabulation

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

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
4-IMP	*536,417*	*Concrete or Asphalt*	*1*	*0.89*	*478484*			
4-PER	*65,423*	*Ornamental Landscaping*	*0.1*	*0.11*	*7226.5*			
	601840	***Total***			**485710.5**	**0.60**	***24326***	***27027***

Notes:

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries	🟦
	BMP-2B		Calculated Cells	▨

Company Name: REC CONSULTANTS
Date: 3/10/2020
Designed by: WOG
County/City Case No.: PW19-0769

Design Volume

Enter the area tributary to this feature A_T= 5.85 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 10,449 ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

● No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 3.0 ft

Top Width of Bioretention Facility, excluding curb w_T = 50.0 ft

Total Effective Depth, d_E

$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$ d_E = 1.80 ft

Minimum Surface Area, A_m

$$A_M (ft^2) = \frac{V_{BMP} (ft^3)}{d_E (ft)}$$

A_M = 5,805 ft^2

Proposed Surface Area A= 6,181 ft^2

Minimum Required Length of Bioretention Facility, L L = 116.1 ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = - :1

Diameter of Underdrain - inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation:

Notes:

Stage-Storage for BMP-2B - Basin 1

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	1829	0.000	**BOTTOM OF GRAVEL LAYER (0.4 Voids)**
0.08	1829	61	
0.17	1829	122	
0.25	1829	183	
0.33	1829	244	
0.42	1829	305	
0.50	1829	366	
0.58	1829	427	
0.67	1829	488	
0.75	1829	549	
0.83	1829	610	
0.92	1829	671	
1.00	1829	732	**TOP OF GRAVEL LAYER**
1.08	1829	777	
1.17	1829	823	
1.25	1829	869	
1.33	1829	915	
1.42	1829	960	
1.50	1829	1006	
1.58	1829	1052	
1.67	1829	1097	
1.75	1829	1143	
1.83	1829	1189	
1.92	1829	1235	
2.00	1829	1280	
2.08	1829	1326	
2.17	1829	1372	
2.25	1829	1417	
2.33	1829	1463	
2.42	1829	1509	
2.50	1829	1555	
2.58	1829	1600	
2.67	1829	1646	
2.75	1829	1692	
2.83	1829	1738	
2.92	1829	1783	
3.00	1829	1829	
3.08	1829	1875	
3.17	1829	1920	
3.25	1829	1966	
3.33	1829	2012	
3.42	1829	2058	
3.50	1829	2103	
3.58	1829	2149	
3.67	1829	2195	
3.75	1829	2241	**TOP OF AMMENDED SOILS LAYER(0.3Voids)**
3.83	1829	2286	
3.92	1829	2332	
4.00	1829	2378	**TOP OF MULCH(1)**

4.08	1829	2530	
4.17	1829	2683	
4.25	1829	2835	
4.33	1829	2987	
4.42	1829	3140	
4.50	1829	3292	
4.58	1829	3445	
4.67	1829	3597	
4.75	1829	3749	
4.83	1829	3902	
4.92	1829	4054	
5.00	1829	4207	
5.08	1829	4359	
5.17	1829	4512	
5.25	1829	4664	
5.33	1829	4816	
5.42	1829	4969	
5.50	1829	5121	**SURFACE DISCHARGE(2) (FIRST OUTLET)**
5.58	1829	5274	
5.67	1829	5426	
5.75	1829	5578	
5.83	1829	5731	
5.92	1829	5883	
6.00	1829	6036	
6.08	1829	6188	
6.17	1829	6341	
6.25	1829	6493	
6.33	1829	6645	
6.42	1829	6798	
6.50	1829	6950	
6.58	1829	7103	
6.67	1829	7255	
6.75	1829	7407	SURFACE DISCHARGE (TOP OF RISER)
6.83	1829	7560	
6.92	1829	7712	
7.00	1829	7865	
7.08	1829	8017	
7.17	1829	8170	
7.25	1829	8322	
7.33	1829	8474	
7.42	1829	8627	
7.50	1829	8779	
7.58	1829	8932	
7.67	1829	9084	
7.75	1829	9236	
7.83	1829	9389	
7.92	1829	9541	
8.00	1829	9694	

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Stage-Storage for BMP-2B Basin 2

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	4352	**0**	**BOTTOM OF GRAVEL LAYER (0.4 Voids)**
1.00	4352	1741	**TOP OF GRAVEL LAYER**
3.00	4352	4352	
3.75	4352	5331	**TOP OF AMMENDED SOILS LAYER(0.3Voids)**
4.00	4352	5658	**TOP OF MULCH(1)**
4.08	5795	6080	
4.17	5825	6565	
4.25	5854	7051	
4.33	5884	7540	
4.42	5914	8032	
4.50	5943	8526	**SURFACE DISCHARGE(2) (FIRST OUTLET)**
4.58	5973	9022	
4.67	6002	9521	
4.75	6032	10023	
4.83	6061	10527	
4.92	6091	11033	
5.00	6120	11542	
5.08	6150	12053	
5.17	6179	12567	
5.25	6209	13083	
5.33	6239	13602	
5.42	6268	14123	
5.50	6298	14646	
5.58	6327	15172	
5.67	6357	15701	
5.75	6386	16232	
5.83	6416	16765	
5.92	6445	17301	
6.00	6475	17839	
6.08	6505	18380	
6.17	6534	18924	
6.25	6564	19469	
6.33	6593	20017	
6.42	6623	20568	
6.50	6652	21121	
6.58	6682	21677	**Surface Discharge (2nd Outlet)**
6.67	6712	22235	
6.75	6741	22795	
6.83	6771	23358	
6.92	6800	23924	
7.00	6830	24492	
7.08	6859	25062	

7.17	6889	25635	
7.25	6919	26210	
7.33	6948	26788	
7.42	6978	27368	
7.50	7007	27951	
7.58	7037	28536	
7.67	7067	29124	
7.75	7096	29714	SURFACE DISCHARGE (TOP OF RISER)
7.83	7126	30307	
7.92	7155	30902	
8.00	7185	31499	
8.08	7215	32099	
8.17	7244	32702	
8.25	7274	33307	
8.33	7303	33914	
8.42	7333	34524	
8.50	7363	35136	
8.58	7392	35751	
8.67	7422	36368	
8.75	7451	36988	
8.83	7481	37610	
8.92	7511	38235	
9.00	7540	38862	

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries	▢
	BMP-3A		Calculated Cells	▨

Company Name: REC CONSULTANTS
Date: 3/10/2020
Designed by: WOG
County/City Case No.: PW19-0769

Design Volume

Enter the area tributary to this feature A_T= 2.48 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 9,273 ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

● No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 3.0 ft

Top Width of Bioretention Facility, excluding curb w_T = 34.0 ft

Total Effective Depth, d_E

$$d_E = [(0.3) \text{ x } d_S + (0.4) \text{ x } 1] + 0.5$$

d_E = 1.80 ft

Minimum Surface Area, A_m

$$A_M\,(\text{ft}^2) = \frac{V_{BMP}\,(\text{ft}^3)}{d_E\,(\text{ft})}$$

A_M = 5,152 ft^2

Proposed Surface Area A= 6,757 ft^2

Minimum Required Length of Bioretention Facility, L L = 151.5 ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = - :1

Diameter of Underdrain - inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation:

Notes:

Stage-Storage for BMP-3A

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	6757	**0**	**BOTTOM OF GRAVEL LAYER (0.4 Voids)**
1.00	6757	2703	**TOP OF GRAVEL LAYER**
2.00	6757	4730	
3.75	6757	8277	**TOP OF AMMENDED SOILS LAYER(0.3Voids)**
4.00	6757	8784	**TOP OF MULCH(1)**
4.08	6757	9347	
4.17	6757	9910	
4.25	6757	10473	
4.33	6757	11036	
4.42	6757	11600	
4.50	6757	12163	**SURFACE DISCHARGE(2) (FIRST OUTLET)**
4.58	6757	12726	
4.67	6757	13289	
4.75	6757	13852	
4.83	6757	14415	
4.92	6757	14978	
5.00	6757	15541	
5.08	6757	16104	
5.17	6757	16667	
5.25	6757	17230	
5.33	6757	17793	
5.42	6757	18357	
5.50	6757	18920	
5.58	6757	19483	
5.67	6757	20046	
5.75	6757	20609	
5.83	6757	21172	
5.92	6757	21735	
6.00	6757	22298	
6.08	6757	22861	
6.17	6757	23424	
6.25	6757	23987	**Surface Discharge (2nd Outlet)**
6.33	6757	24550	
6.42	6757	25114	
6.50	6757	25677	
6.58	6757	26240	
6.67	6757	26803	
6.75	6757	27366	
6.83	6757	27929	
6.92	6757	28492	
7.00	6757	29055	
7.08	6757	29618	

7.17	6757	30181	
7.25	6757	30744	
7.33	6757	31307	
7.42	6757	31871	
7.50	6757	32434	
7.58	6757	32997	
7.67	6757	33560	
7.75	6757	34123	
7.83	6757	34686	
7.92	6757	35249	
8.00	6757	35812	
8.08	6757	36375	
8.17	6757	36938	
8.25	6757	37501	SURFACE DISCHARGE (TOP OF RISER)
8.33	6757	38064	
8.42	6757	38628	
8.50	6757	39191	

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Bioretention Facility - Design Procedure	BMP ID BMP-3B	Legend:	Required Entries 🟦 Calculated Cells ▨

Company Name: REC CONSULTANTS

Date: 3/10/2020

Designed by: WOG

County/City Case No.: PW19-0769

Design Volume

Enter the area tributary to this feature $A_T =$ 4.55 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook $V_{BMP} =$ 13,528 ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

● No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer $d_S =$ 1.5 ft

Top Width of Bioretention Facility, excluding curb $w_T =$ 38.0 ft

Total Effective Depth, d_E

$$d_E = [(0.3) \text{ x } d_S + (0.4) \text{ x } 1] + 0.5$$

$d_E =$ 1.35 ft

Minimum Surface Area, A_m

$$A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$$

$A_M =$ 10,021 ft^2

Proposed Surface Area $A =$ 10,584 ft^2

Minimum Required Length of Bioretention Facility, L $L =$ 263.7 ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility $z =$ - :1

Diameter of Underdrain - inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation:

Notes:

Stage-Storage for BMP-3B

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	10584	**0**	**BOTTOM OF GRAVEL LAYER (0.4 Voids)**
1.00	10584	4234	**TOP OF GRAVEL LAYER**
2.00	10584	7409	
2.75	10584	9790	**TOP OF AMMENDED SOILS LAYER(0.3Voids)**
3.00	10584	10584	**TOP OF MULCH**(1)
3.08	10584	11466	
3.17	10584	12348	
3.25	10584	13230	
3.33	10584	14112	
3.42	10584	14994	
3.50	10584	15876	**SURFACE DISCHARGE**(2) **FIRST OUTLET)**
3.58	10584	16758	
3.67	10584	17640	
3.75	10584	18522	
3.83	10584	19404	
3.92	10584	20286	
4.00	10584	21168	
4.08	10584	22050	
4.17	10584	22932	
4.25	10584	23814	
4.33	10584	24696	
4.42	10584	25578	
4.50	10584	26460	
4.58	10584	27342	
4.67	10584	28224	
4.75	10584	29106	
4.83	10584	29988	
4.92	10584	30870	
5.00	10584	31752	
5.08	10584	32634	
5.17	10584	33516	
5.25	10584	34398	
5.33	10584	35280	
5.42	10584	36162	
5.50	10584	37044	SURFACE DISCHARGE (TOP OF RISER)
5.58	10584	37926	
5.67	10584	38808	
5.75	10584	39690	
5.83	10584	40572	
5.92	10584	41454	
6.00	10584	42336	
6.08	10584	43218	
6.17	10584	44100	

6.25	10584	44982
6.33	10584	45864
6.42	10584	46746
6.50	10584	47628

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Bioretention Facility - Design Procedure

BMP ID: BMP-4

Legend: Required Entries 🟦 Calculated Cells ▨

Company Name: REC CONSULTANTS

Date: 3/10/2020

Designed by: WOG

County/City Case No.: PW19-0769

Design Volume

Enter the area tributary to this feature A_T= 13.8 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 27,027 ft^3

Type of Bioretention Facility Design

○ Side slopes required (parallel to parking spaces or adjacent to walkways)

● No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer d_S = 3.0 ft

Top Width of Bioretention Facility, excluding curb w_T = 49.0 ft

Total Effective Depth, d_E

$$d_E = [(0.3) \times d_S + (0.4) \times 1] + 0.5$$

d_E = 1.80 ft

Minimum Surface Area, A_m

$$A_M\,(ft^2) = \frac{V_{BMP}\,(ft^3)}{d_E\,(ft)}$$

A_M = 15,015 ft^2

Proposed Surface Area A= 15,085 ft^2

Minimum Required Length of Bioretention Facility, L L = 306.4 ft

Bioretention Facility Properties

Side Slopes in Bioretention Facility z = - :1

Diameter of Underdrain - inches

Longitudinal Slope of Site (3% maximum) 0 %

6" Check Dam Spacing 0 feet

Describe Vegetation:

Notes:

Stage-Storage for BMP-4

Elevation (ft)	Area (ft^2)	Volume (ft^3)	
0.00	15085	**0**	**BOTTOM OF GRAVEL LAYER (0.4 Voids)**
1.00	15085	6034	**TOP OF GRAVEL LAYER**
2.00	15085	10560	
3.75	15085	18479	**TOP OF AMMENDED SOILS LAYER(0.3Voids)**
4.00	15085	19611	**TOP OF MULCH(1)**
4.08	15368	20879	
4.17	15509	22166	
4.25	15652	23464	
4.33	15796	24775	
4.42	15942	26097	
4.50	16088	27432	**SURFACE DISCHARGE(2) (FIRST OUTLET)**
4.58	16236	28778	
4.67	16385	30138	
4.75	16535	31509	
4.83	16687	32894	
4.92	16840	34291	
5.00	16994	35700	
5.08	17149	37123	
5.17	17305	38558	
5.25	17463	40007	
5.33	17622	41469	
5.42	17782	42944	
5.50	17944	44433	
5.58	18106	45935	
5.67	18270	47451	
5.75	18436	48980	
5.83	18602	50523	
5.92	18770	52080	
6.00	18938	53652	
6.08	19109	55237	
6.17	19280	56836	
6.25	19453	58450	
6.33	19626	60079	
6.42	19801	61721	
6.50	19978	63379	
6.58	20155	65051	
6.67	20334	66738	
6.75	20514	68440	
6.83	20695	70157	
6.92	20878	71889	
7.00	21062	73637	**Surface Discharge (2nd Outlet)**
7.08	21247	75400	

7.17	21433	77178	
7.25	21620	78972	
7.33	21809	80782	
7.42	21999	82607	
7.50	22190	84448	
7.58	22383	86305	
7.67	22576	88179	
7.75	22771	90068	
7.83	22967	91974	
7.92	23165	93896	
8.00	23363	95835	
8.08	23563	97790	
8.17	23764	99762	
8.25	23967	101751	
8.33	24170	103756	
8.42	24375	105779	
8.50	24581	107819	
8.58	24788	109876	
8.67	24997	111950	
8.75	25207	114042	SURFACE DISCHARGE (TOP OF RISER)
8.83	25418	116152	
8.92	25630	118278	
9.00	25843	120423	
9.08	26058	122586	
9.17	26274	124766	
9.25	26491	126965	
9.33	26710	129182	
9.42	26929	131416	
9.50	27150	133670	
9.58	27372	135942	
9.67	27596	138232	
9.75	27820	140541	
9.83	28046	142869	
9.92	28273	145215	
10.00	28502	147581	

(1): The area at this surface elevation corresponds to the area of gravel and amended soil (Bio-filtration layer)

(2): Volume at this elevation coresponds with surface volume for WQ purposes (invert of lowest surface outlet)

Filterra Flow Based BMP Sizing

Sycamore Hills Business Center

Table 1: Maximum Treatment Flow Rate for each Filterra Model

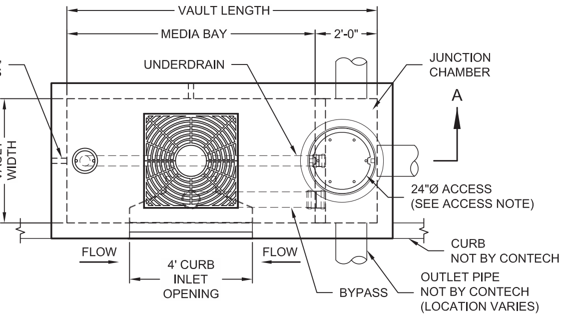
Filterra Model Name	Vault Size (ft) (LxW)	Media Bay Size (ft) (LxW)	Media Bay Area (sf)	Infiltration Rate[1] (in/hr)	Maximum Treatment Flow[2] (cfs)	Max Bypass Flow (cfs)
FTIBC0404LS-C	6 x 4	4 x 4	16.0	175	0.06	1.42
FTIBC04504-C	6.5 x 4	4.5 x 4	18.0	175	0.07	1.89
FTIBC058045-C	7.83 x 4.5	5.83 x 4.5	26.2	175	0.11	1.89
FTIBC0604-C	8 x 4	6 x 4	24.0	175	0.10	1.89
FTIBC0606LS-C	8 x 6	6 x 6	36.0	175	0.15	2.37
FTIBC0806-C	10 x 6	8 x 6	48.0	175	0.19	2.37
FTIBC1006-C	12 x 6	10 x 6	60.0	175	0.24	2.37
FTIBC1107-C	13 x 7	11 x 7	77.0	175	0.31	2.37
FTIBC1208-C	14 x 8	12 x 8	96.0	175	0.39	4.74
FTIBC1408-C	16 x 8	14 x 8	112.0	175	0.45	4.74
FTIBC1608-C	18 x 8	16 x 8	128.0	175	0.52	4.74
FTIBC1808-C	20 x 8	18 x 8	144.0	175	0.58	4.74
FTIBC2008-C	22 x 8	20 x 8	160.0	175	0.65	4.74
FTIBC2208-C	24 x 8	22 x 8	176.0	175	0.71	4.74

(1) The Infiltration Rate is from the letter titled "General Use Level Designation for Basic (tss), Enhanced, Phosphorus & Oil Treatment For CONTECH Engineered Solutions Filterra" by the Washington State Department of Ecology Dated February 2020. A copy of the letter is enclosed.

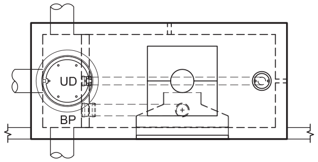
(2) Maximum Treatment Flow = Media Area x Infiltration Rate / 43,200 [conversion factor]

Table 2: Smallest Filterra for each DMA

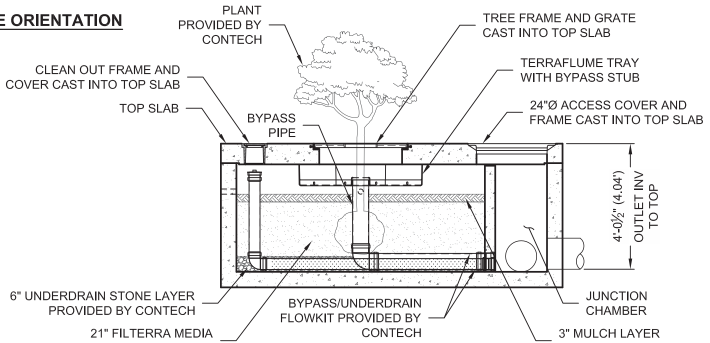
DMA Name	Water Quality Flow rate (cfs)	Smallest Filttera Model
DMA-2A	0.1	FTIBC0604-C
DMA-2C	0.3	FTIBC1107-C
DMA-2D	0.3	FTIBC1107-C
DMA-2E	0.1	FTIBC0604-C



PLAN VIEW

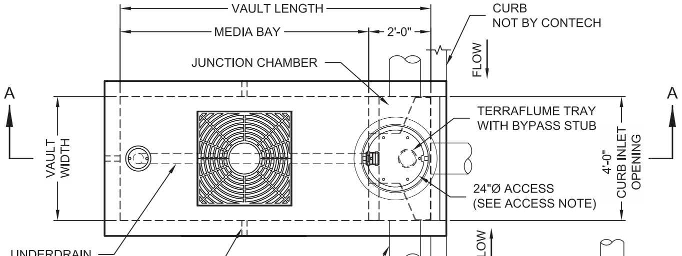


ALTERNATE ORIENTATION

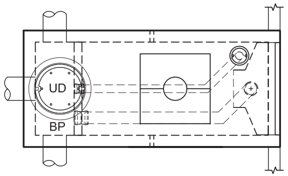


SECTION A-A

ACCESS NOTE:
JUNCTION CHAMBER TOP SLAB ACCESS WILL BE 12"Ø FOR FTIBC0404-CSS AND FTIBC0404-CLS DUE TO STRUCTURAL CONSIDERATIONS



PLAN VIEW



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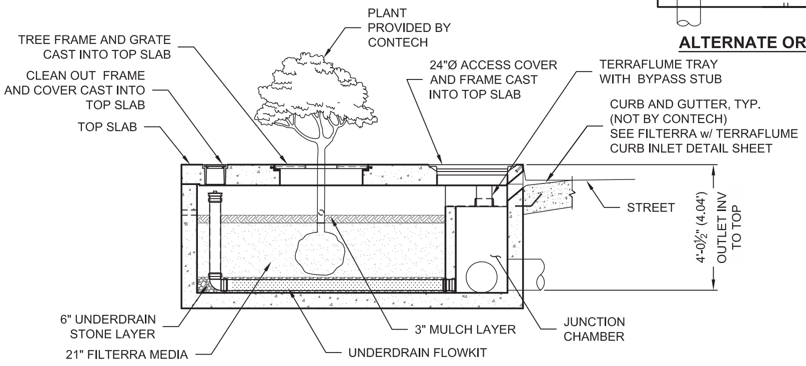

SECTION A-A

FTIBC-C LONG SIDE CURB INLET

DESIGNATION (LONG SIDE)	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	MAX. BYPASS PIPE DIA	MAX. BYPASS FLOW (CFS)	UNDERDRAIN PIPE DIA. (PERF.)	TREE GRATE QTY. & SIZE
FTIBC0404LS-C	N/A CA	4 x 4	6 x 4	6" SDR 35	1.42	4" SDR 35	(1) 3' x 3'
FTIBC04504-C	CA ONLY	4.5 x 4	6.5 x 4	8"SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC058045-C	MID-ATL ONLY	5.83 x 4.5	7.83 x 4.5	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0604-C	N/A MID-ATL	6 x 4	8 x 4	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0606LS-C	ALL	6 x 6	8 x 6	10" SDR 35	2.37	4" SDR 35	(1) 3' x 3'
FTIBC0806-C	ALL	8 x 6	10 x 6	10" SDR 35	2.37	4" SDR 35	(1) 4' x 4'
FTIBC1006-C	ALL	10 x 6	12 x 6	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
FTIBC1107-C	ALL	11 x 7	13 x 7	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
FTIBC1208-C*	CALL CONTECH	12 x 8	14 x 8	(2) 10" SDR 35	4.74	6" SDR 35	(2) 4' x 4'
FTIBC1408-C*	CALL CONTECH	14 x 8	16 x 8	(2) 10" SDR 35	4.74	6" SDR 35	(2) 4' x 4'
FTIBC1608-C*	CALL CONTECH	16 x 8	18 x 8	(2) 10" SDR 35	4.74	6" SDR 35	(2) 4' x 4'
FTIBC1808-C*	CALL CONTECH	18 x 8	20 x 8	(2) 10" SDR 35	4.74	6" SDR 35	(3) 4' x 4'
FTIBC2008-C*	CALL CONTECH	20 x 8	22 x 8	(2) 10" SDR 35	4.74	6" SDR 35	(3) 4' x 4'
FTIBC2208-C*	CALL CONTECH	22 x 8	24 x 8	(2) 10" SDR 35	4.74	6" SDR 35	(3) 4' x 4'

N/A = NOT AVAILABLE

*REQUIRES (2) TERRAFLUMES

INTERNAL PIPE CONFIGURATION MAY VARY
DEPENDING ON VAULT SIZE

FTIBC-C SHORT SIDE CURB INLET

DESIGNATION (SHORT SIDE)	AVAILABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	MAX. BYPASS PIPE DIA	MAX. BYPASS FLOW (CFS)	UNDERDRAIN PIPE DIA. (PERF.)	TREE GRATE QTY. & SIZE
FTIBC0404SS-C	N/A CA	4 x 4	4 x 6	6" SDR 35	1.42	4" SDR 35	(1) 3' x 3'
FTIBC04045-C	CA ONLY	4 x 4.5	4 x 6.5	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0406-C	N/A MID-ATL	4 x 6	4 x 8	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC045058-C	MID-ATL	4.5 x 5.83	4.5 x 7.83	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0606SS-C	ALL	6 x 6	6 x 8	10" SDR 35	2.37	4" SDR 35	(1) 3' x 3'
FTIBC0608-C	ALL	6 x 8	6 x 10	10" SDR 35	2.37	4" SDR 35	(1) 4' x 4'
FTIBC0610-C	ALL	6 x 10	6 x 12	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
FTIBC0711-C	ALL	7 x 11	7 x 13	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
FTIBC0812-C*	CALL CONTECH	8 x 12	8 x 14	(2) 10" SDR 35	4.74	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

*REQUIRES (2) TERRAFLUMES

filterra®
THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 6,277,274; 6,569,321; 7,625,485; 7,425,261; 7,833,412; RELATED FOREIGN PATENTS.

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FILTERRA INTERNAL BYPASS CURB WITH CHAMBER (FTIBC-C) CONFIGURATION DETAIL