Appendix E

Hydrology and Hydraulics Report

Euclid-Hazard 7-Eleven Service Station

Hydrology and Hydraulics Report

FOR

7-ELEVEN
DP NO. 2018-08; GP NO. P0107595
813 N EUCLID STREET, SANTA ANA, CA 92703
TRACT 841, LOT 1, APN 100-231-01

Prepared for:
ASI DEVELOPMENT
5932 Bolsa Avenue, Suite 107
Huntington Beach, CA 92649
(714) 892-8810

Prepared by:
NA & ASSOCIATES, INC.
22672 Lambert Street, Suite 606
Lake Forest, CA 92630
949-753-0600

October, 2019

1. INTRODUCTION

1.1 SCOPE AND PURPOSE

The purpose of this study is to determine the design flows for on-site drainage systems at the proposed 0.64-acre commercial property, at 813 N Euclid Street, Santa Ana, California, and to establish the sufficiency of the proposed drainage system.

1.2 SITE LOCATION AND DESCRIPTION

The existing site, which is located on the South-East corner of North Euclid Street and Hazard Avenue, in the City of Santa Ana, consists entirely of undeveloped landscaped area, and is located in the Newport Bay Watershed. Approximately 100% of the existing project site is pervious surfaces. The existing property drains storm water in a sheet flowing condition, from the site's high point in the southeast corner, to the site's low point located at the northwest portion of the property. Water flows, untreated, over the existing public sidewalk and driveway at the north property line of the site, into East South Street.

The proposed project will consist of one commercial building, asphalt paved drive aisles and parking stalls, gas fueling stations and associated pads, landscaped areas, and two concrete paved driveways. Approximately 21.8% of the proposed project site is pervious surfaces. The proposed pervious surfaces are landscaped areas to all sides of the proposed building. The proposed project will convey storm water in the northwesterly direction, through sheet flow to gutters. The water will then be collected in one proprietary biofiltration device, which will act as a catch basin, and dispatch water, via a pump and an under sidewalk drain pipe, into Euclid Street. The property is bounded on the East and South sides by walls. Run-on from the adjacent properties is not a concern for the project site. It is shown in the Proposed and Existing Hydrology Plans, as well as in the table in Section 4.3 of this report, that the proposed flows are greater than the existing flows.

2. DESIGN DISCUSSION

2.1 DRAINAGE STANDARDS

The drainage system was designed to meet or exceed the requirements of the Orange County Hydrology Manual, which was used to determine the design storm.

2.2 PROPOSED DRAINAGE

The site will drain all storm water runoff into a single proprietary biofiltration device located at the northeast end of the property. Water will be dispatched into the existing curb and gutter in Euclid Street.

3. HYDROLOGY

3.1 DESIGN STORM

The 10, 25 and 100-year rainfall events were selected as the design storm.

3.2 METHOD OF STUDY

This study was conducted in accordance with the Orange County Hydrology Manual. Flows were calculated by the modified rational method using the Advanced Engineering Software model. The computer calculation outputs are included in Appendix B.

Due to the fact that the pre-project and post-project pervious surfaces differ greatly, 97% and 21.8% respectively, different computer pervious ratios inputs were used to compare the two conditions. In the existing condition, a pervious ratio of 1.00 was used. The proposed condition computer input pervious ratio used is 0.10, which is lower than the actual pervious ratio of 0.218, to provide a conservative result, resulting in output storm water quantities being higher than actual. Both inputs were used to create a conservative output in order to compare existing to proposed storm water quantities.

Soil type 'A' was used in the model. See Soil Group Map in Appendix D of this report.

4. RESULTS AND CONCLUSIONS

4.1 STUDY OF 10, 25 AND 100-YEAR EVENTS

The 10, 25 and 100-year rainfall events have been studied in detail. Flows at critical points have been calculated by established methods.

4.2 CONSIDERATION OF THE 100-YEAR EVENT

The site is shown on FEMA Flood Insurance Rate Map 06059C0139J (Revised December 03, 2009). The site is located in shaded zone "X" which means there is a 0.2% annual chance of flood in project areas that do not have at least one foot of elevation separation between finished floor and site relief point.

The building finished floor will be graded to an elevation of 69.75 feet, which is more than one foot higher than the site's secondary emergency flood relief elevation of 67.64, within the driveway along Euclid Street.

4.3 RESULTS

Site Condition	Area Runoff by Storm Year		
	10-year (CFS)	25-year (CFS)	100-year (CFS)
Existing	1.20	1.48	1.95
Proposed	1.91	2.28	2.93

It can be seen in the above table that the post-construction flow rates will be greater than the pre-construction flow rates at the project site.

Sizing calculations for the 25-year storm event have been performed to determine that the proposed proprietary biofiltration device (acting as a catch basin) is adequately sized at a max cfs of 2.37, with the proposed development 25-year storm at 2.28 cfs. The manufacturer's specification sheet can be found in Appendix E of this report.

4.4 CONCLUSION

The drainage goals and requirements, set by the Orange County Hydrology Manual, have been met or exceeded by this design.

APPENDIX A:
REFERENCES

REFERENCES

1. "Rational Method Hydrology Computer Program Package (RATSC2);" Civil CAD Software; 1989-2005.
2. "Flood Insurance Rate Map (FIRM);" Map Number 06059C0139J (Revised December 03, 2009).
3. "Orange County Local Drainage Manual;" Orange County Environmental Management Agency.
4. Site Improvements Plans By NA & Associates, Inc.
5. County of Orange Technical Guidance Documents.

APPENDIX B:
RATIONAL METHOD HYDROLOGY

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 10/23/19 File Name: 1801e10.roc

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********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 0.000(Ft.) to Point/Station 219.000(Ft.)
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.400(In/Hr)
Max Catchment Loss (Fm) = 0.400(In/Hr)
Initial subarea data:
Initial area flow distance = 219.000(Ft.)
Top (of initial area) elevation = 69.800(Ft.)
Bottom (of initial area) elevation = 67.930(Ft.)
Difference in elevation = 1.870(Ft.)
Slope = 0.00854 s(%)= 0.85
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.751 min.
Rainfall intensity = 2.488(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.755
Subarea runoff = 1.203(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number (AMC 2) = 67.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 10/23/19 File Name: 1801e25.roc

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********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 0.000(Ft.) to Point/Station 219.000(Ft.)
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.400(In/Hr)
Max Catchment Loss (Fm) = 0.400(In/Hr)
Initial subarea data:
Initial area flow distance = 219.000(Ft.)
Top (of initial area) elevation = 69.800(Ft.)
Bottom (of initial area) elevation = 67.930(Ft.)
Difference in elevation = 1.870(Ft.)
Slope = 0.00854 s(%)= 0.85
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.751 min.
Rainfall intensity = 2.974(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.779
Subarea runoff = 1.483(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number (AMC 2) = 67.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 10/23/19 File Name: 1801e100.roc

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********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

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Process from Point/Station 0.000(Ft.) to Point/Station 219.000(Ft.)
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 67.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fp)= 0.400(In/Hr)
Max Catchment Loss (Fm) = 0.400(In/Hr)
Initial subarea data:
Initial area flow distance = 219.000(Ft.)
Top (of initial area) elevation = 69.800(Ft.)
Bottom (of initial area) elevation = 67.930(Ft.)
Difference in elevation = 1.870(Ft.)
Slope = 0.00854 s(%)= 0.85
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.751 min.
Rainfall intensity = 3.792(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.805
Subarea runoff = 1.954(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number (AMC 2) = 67.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 10/23/19 File Name: 1801p10.roc

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********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 0.000(Ft.) to Point/Station 263.000(Ft.)
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fp)= 0.400(In/Hr)
Max Catchment Loss (Fm) = 0.040(In/Hr)
Initial subarea data:
Initial area flow distance = 263.000(Ft.)
Top (of initial area) elevation = 70.000(Ft.)
Bottom (of initial area) elevation = 67.090(Ft.)
Difference in elevation = 2.910(Ft.)
Slope = 0.01106 s(%)= 1.11
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.951 min.
Rainfall intensity = 3.361(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.889
Subarea runoff = 1.913(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number (AMC 2) = 32.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 10/23/19 File Name: 1801p25.roc

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********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0

Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 0.000(Ft.) to Point/Station 263.000(Ft.)
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fp)= 0.400(In/Hr)
Max Catchment Loss (Fm) = 0.040(In/Hr)
Initial subarea data:
Initial area flow distance = 263.000(Ft.)
Top (of initial area) elevation = 70.000(Ft.)
Bottom (of initial area) elevation = 67.090(Ft.)
Difference in elevation = 2.910(Ft.)
Slope = 0.01106 s(%)= 1.11
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.951 min.
Rainfall intensity = 4.003(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.891
Subarea runoff = 2.283(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number (AMC 2) = 32.0

Orange County Rational Hydrology Program

(Hydrology Manual Date(s) October 1986 & November 1996)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2004 Version 8.0
Rational Hydrology Study, Date: 10/23/19 File Name: 1801p100.roc

---

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0

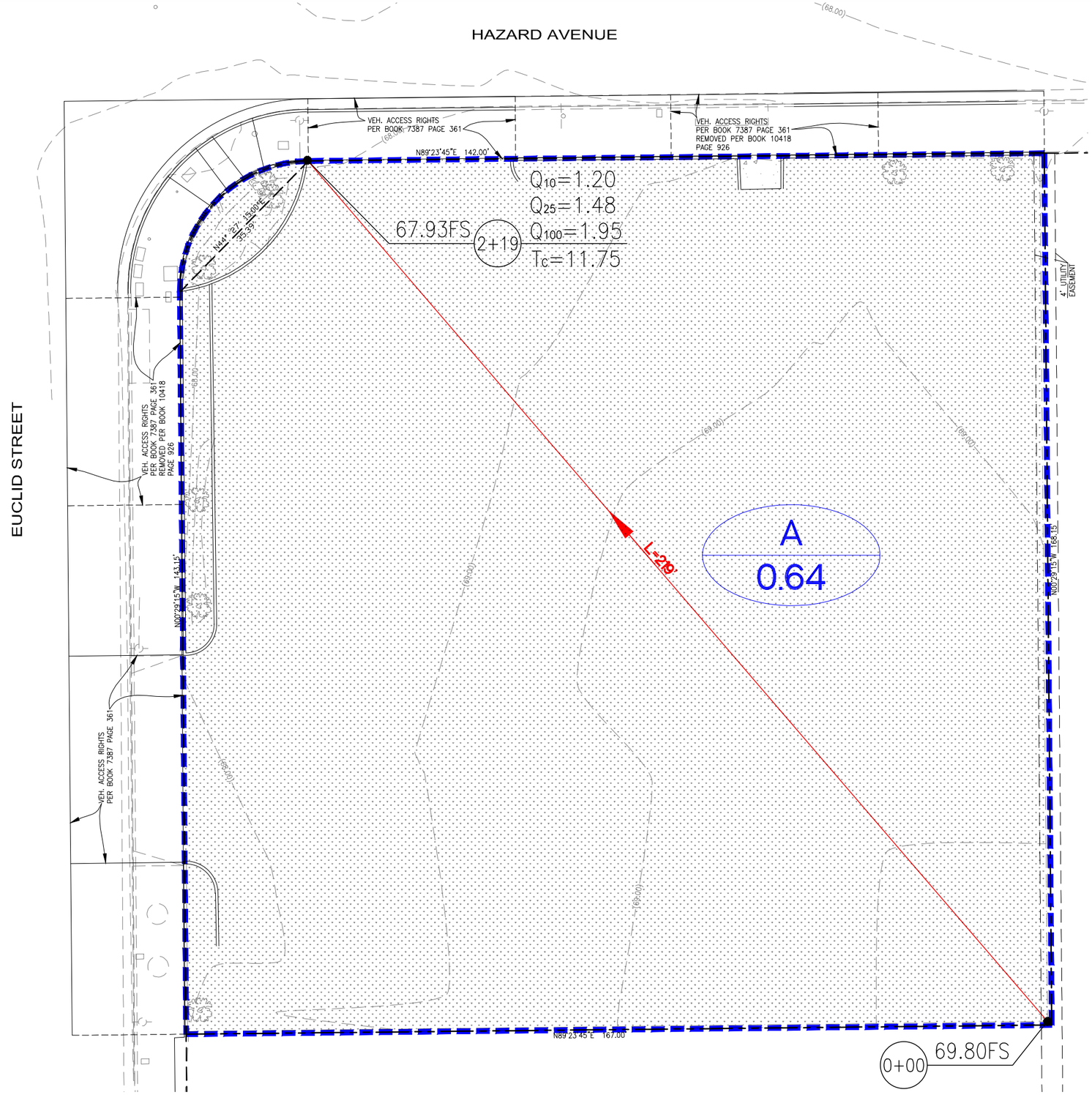
Decimal fraction of study above 2000 ft., 600M = 0.0000
English Units Used for input data

++
Process from Point/Station 0.000(Ft.) to Point/Station 263.000(Ft.)
**** INITIAL AREA EVALUATION ****

SCS curve number for soil(AMC 2) = 32.00
Pervious ratio(Ap) = 0.1000 Max loss rate(Fp)= 0.400(In/Hr)
Max Catchment Loss (Fm) = 0.040(In/Hr)
Initial subarea data:
Initial area flow distance = 263.000(Ft.)
Top (of initial area) elevation = 70.000(Ft.)
Bottom (of initial area) elevation = 67.090(Ft.)
Difference in elevation = 2.910(Ft.)
Slope = 0.01106 s(%)= 1.11
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.951 min.
Rainfall intensity = 5.123(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.893
Subarea runoff = 2.928(CFS)
Total initial stream area = 0.640(Ac.)
End of computations, total study area = 0.64 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number (AMC 2) = 32.0

APPENDIX C:
EXISTING AND PROPOSED CONDITIONS



SITE AREA: 27,948 s.f. / 0.64 ACRES

LEGEND:

- Direction of Drainage

A-X / X.XX — DRAINAGE AREA IDENTIFICATION / DRAINAGE AREA ACREAGE

LAND COVERS:

- Landscaping

Flow Runoff Rate (cfs) / Storm Event

Elevation

270.80FS 1+00 $Q_{10}=1.000$ $Q_{25}=1.500$ $Q_{100}=2.500$ $T_c=5.000$

Time of Concentration (min)

Station

ASi DEVELOPMENT
5932 Bolsa Avenue, Ste. #107
Huntington Beach, CA 92649
T: 714-892-8810
714-892-8812
F: 800-342-0507

Stamp:

ELEVEN®

Project Location:

813 North Euclid St
@ W Hazard Ave
Santa Ana, CA 92703

New Building 3,045 S.F.

No.	Date	Revision

Project No.:	1801
Scale:	1"=10'
Drawn / Checked by:	GA
Date:	10/23/19

Drawing Title:

EXISTING CONDITION

Sheet:

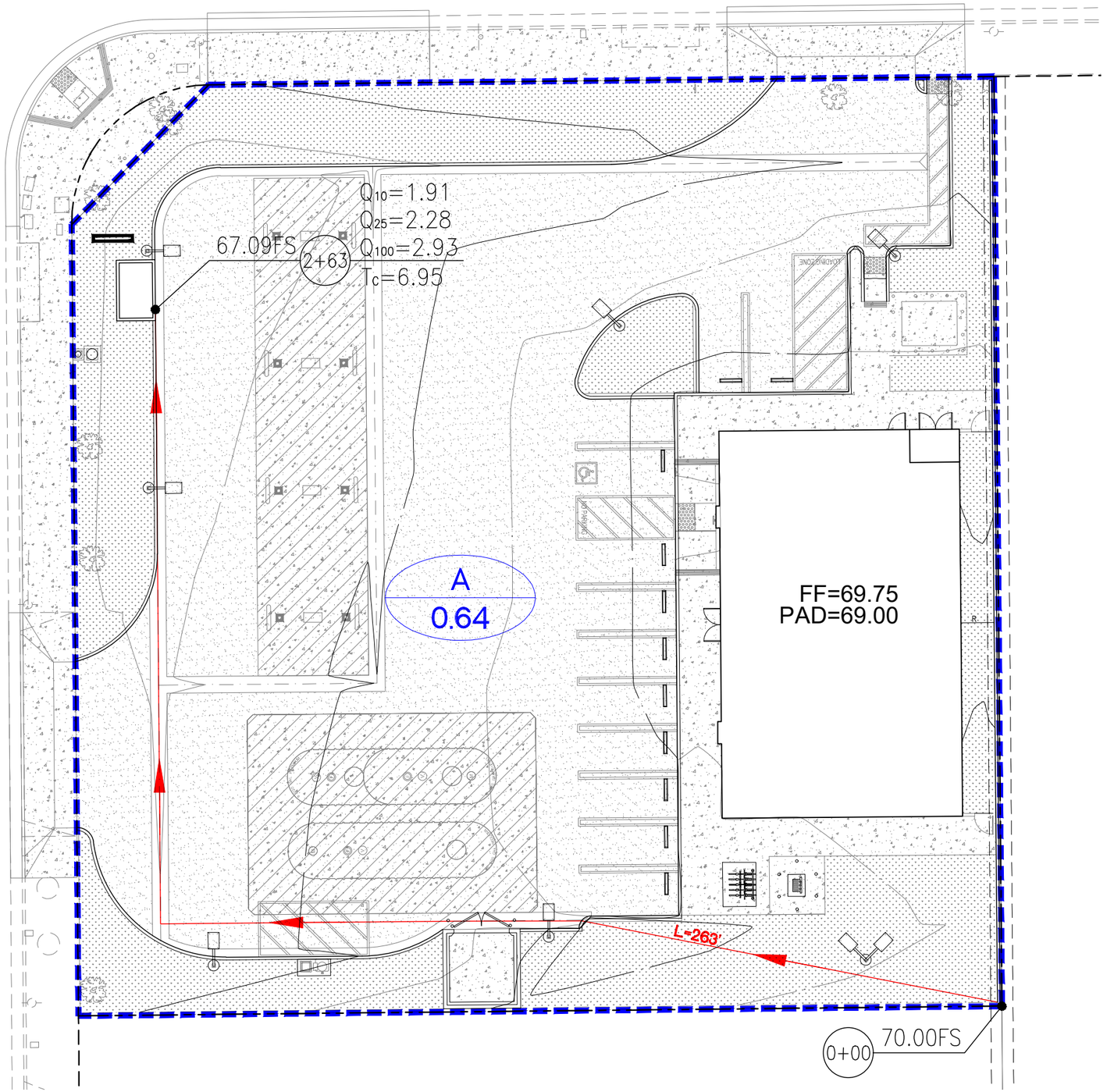
1 OF 2

DIG ALERT
DIAL TOLL FREE
1-800-422-4133
AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

NA & Associates, Inc.
22672 LAMBERT ST. #606, LAKE FOREST, CA 92630
PHONE: (949) 753-0600 FAX: (949) 600-8493

HAZARD AVENUE

EUCLID STREET



SITE AREA: 27,948 s.f. / 0.64 ACRES

LEGEND:

- Direction of Drainage

A-X / X.XX — DRAINAGE AREA IDENTIFICATION / DRAINAGE AREA ACREAGE

LAND COVERS:

- Landscaping
- Concrete
- Asphalt Paving

Flow Runoff Rate (cfs)
Storm Event
Elevation

270.80FS
1+00
Q_{10}=1.000
Q_{25}=1.500
Q_{100}=2.500
T_c=5.000
Time of Concentration (min)
Station

DIGALERT
DIAL TOLL FREE
1-800-422-4133
AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

NA & Associates, Inc.
22672 LAMBERT ST. #606, LAKE FOREST, CA 92630
PHONE: (949) 753-0600 FAX: (949) 600-8493

ASi DEVELOPMENT
5932 Bolsa Avenue, Ste. #107
Huntington Beach, CA 92649
T: 714-892-8810
714-892-8812
F: 800-342-0507

Stamp:

ELEVEN

Project Location:

813 North Euclid St
@ W Hazard Ave
Santa Ana, CA 92703

New Building 3,045 S.F.

No.	Date	Revision

Project No.:	1801
Scale:	1"=10'
Drawn / Checked by:	GA
Date:	10/23/19

Drawing Title:

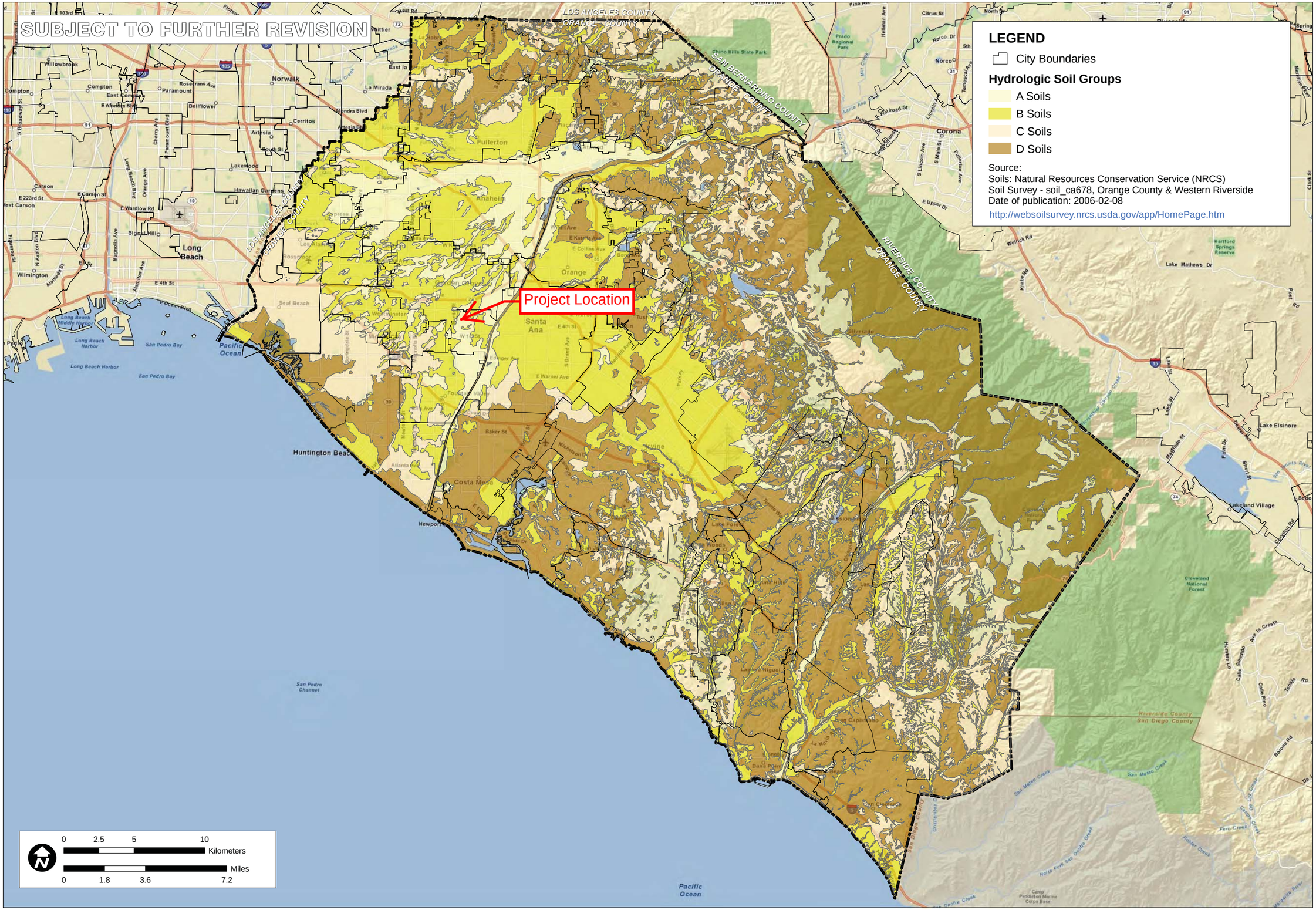
PROPOSED CONDITION

Sheet:

2 OF 2

APPENDIX D:
SOIL GROUP MAP

SUBJECT TO FURTHER REVISION



LEGEND

City Boundaries

Hydrologic Soil Groups

- A Soils
- B Soils
- C Soils
- D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

0 2.5 5 10 Kilometers

0 1.8 3.6 7.2 Miles

P:\ 9526E\ 6-GIS\ Mxds\ Reports\ InfiltrationFeasability_20110215\ 9526E_FigureXVI-2a_HydroSoils_20110215.mxd

TITLE
NRCS HYDROLOGIC SOILS GROUPS

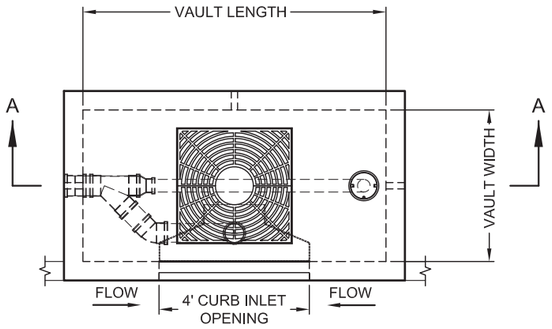
JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

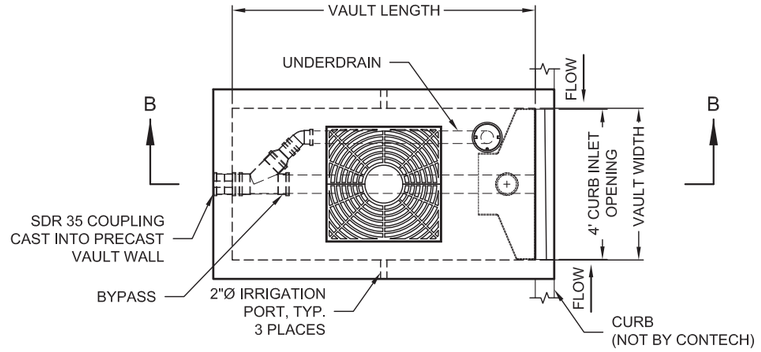
PACE
Advanced Water Engineering

FIGURE
XVI-2a

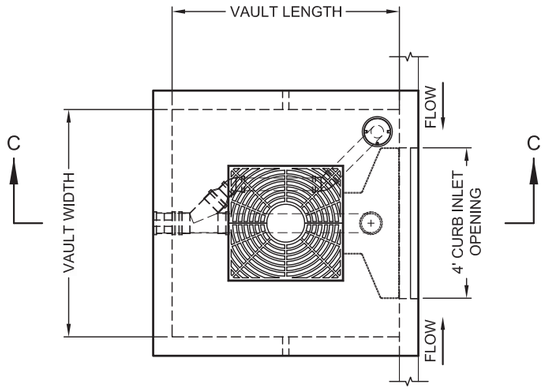
APPENDIX E:
MANUFACTURER SPECIFICATIONS



PLAN VIEW



PLAN VIEW



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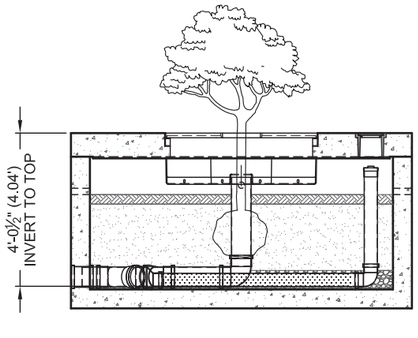
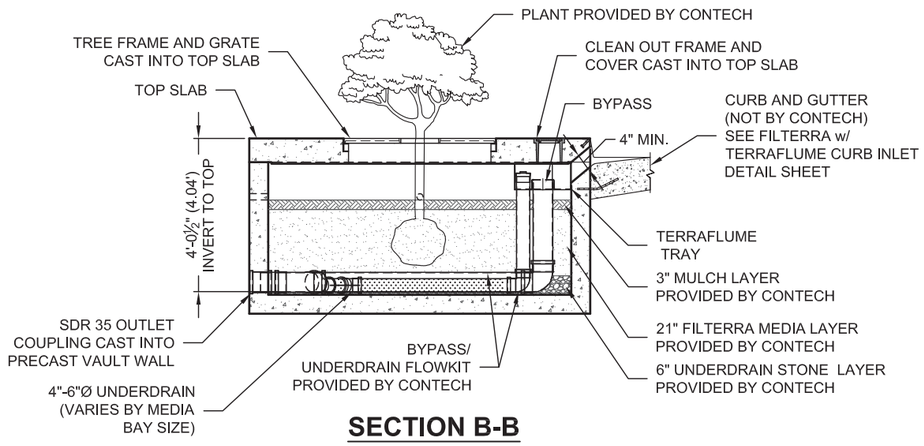
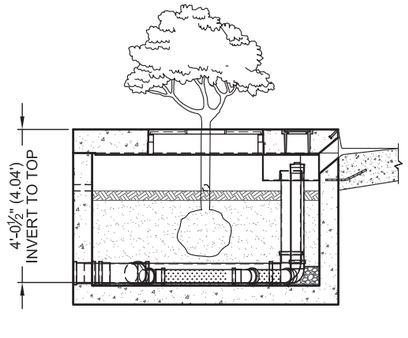


SECTION A-A



SECTION B-B



SECTION C-C

FTIBC LONG SIDE CURB INLET

DESIGNATION	AVAIL-ABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	MAX. OUTLET/ BYPASS PIPE DIA.	MAX. BYPASS FLOW (CFS)	UNDER-DRAIN PIPE DIA. (PERF)	TREE GRATE QTY. & SIZE
FTIBC0604	N/A CA	6 x 4	6 x 4	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC06504	CA ONLY	6.5 x 4	6.5 x 4	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC078045	MID-ATL ONLY	7.83 x 4.5	7.83 x 4.5	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0804	N/A MID-ATL	8 x 4	8 x 4	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0806	ALL	8 x 6	8 x 6	10" SDR 35	2.37	4" SDR 35	(1) 4' x 4'
FTIBC1006	ALL	10 x 6	10 x 6	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
FTIBC1206	ALL	12 x 6	12 x 6	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'
FTIBC1307	ALL	13 x 7	13 x 7	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

Q25 = 2.28 cubic feet per second, therefore the catch basins are adequately sized.

FTIBC SHORT SIDE CURB INLET

DESIGNATION	AVAIL-ABILITY	MEDIA BAY SIZE	VAULT SIZE (W x L)	MAX. OUTLET/ BYPASS PIPE DIA.	MAX. BYPASS FLOW (CFS)	UNDER-DRAIN PIPE DIA. (PERF)	TREE GRATE QTY. & SIZE
FTIBC0406	N/A CA	4 x 6	4 x 6	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC04065	CA ONLY	4 x 6.5	4 x 6.5	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0408	N/A MID-ATL	4 x 8	4 x 8	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC045078	MID-ATL ONLY	4.5 x 7.83	4.5 x 7.83	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'
FTIBC0608	ALL	6 x 8	6 x 8	10" SDR 35	2.37	4" SDR 35	(1) 4' x 4'
FTIBC0610	ALL	6 x 10	6 x 10	10" SDR 35	2.37	6" SDR 35	(1) 4' x 4'
FTIBC0612	ALL	6 x 12	6 x 12	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'
FTIBC0713	ALL	7 x 13	7 x 13	10" SDR 35	2.37	6" SDR 35	(2) 4' x 4'

N/A = NOT AVAILABLE

FTIBC SQUARE CURB INLET

DESIGNATION	AVAIL-ABILITY	MEDIA BAY SIZE	VAULT SIZE (L x W)	MAX. OUTLET/ BYPASS PIPE DIA.	MAX. BYPASS FLOW (CFS)	UNDER-DRAIN PIPE DIA. (PERF)	TREE GRATE QTY. & SIZE
FTIBC0404	ALL	4 x 4	4'-0"	6" SDR 35	1.42	4" SDR 35	(1) 3' x 3'
FTIBC0606	ALL	6 x 6	6'-0"	8" SDR 35	1.89	4" SDR 35	(1) 3' x 3'

N/A = NOT AVAILABLE

INTERNAL PIPE CONFIGURATION MAY VARY DEPENDING ON VAULT SIZE.

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; 7,533,412. RELATED FOREIGN PATENTS.

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FILTERRA INTERNAL BYPASS CURB (FTIBC) CONFIGURATION DETAIL