Appendix G
Conceptual Drainage Report

ESA

DRAINAGE STUDY REPORT

For

Firestone Boulevard Widening Project

Hoxie Avenue to Imperial Highway
Norwalk, California 91765

Prepared and Submitted to:

NORWALK
CALIFORNIA

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April 3, 2020

This Drainage Study Report has been prepared by or under the direction of the following registered civil engineer. The undersigned civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based:

Flora Diaz, Registered Civil Engineer	4/3/2020 Date

TABLE OF CONTENTS

ATTACHMENTS

I. INTRODUCTION

A. PROJECT DESCRIPTION AND LOCATION

The City of Norwalk (City) has identified the need to widen Firestone Boulevard between Hoxie Avenue/NB I-605 Freeway Ramps to the west and Imperial Highway to the east. The Firestone Boulevard Widening project would be located partially within the State's Right-of-way at the western limits with most of the project located within the City of Norwalk.

The existing Firestone Boulevard serves as a vital corridor to move goods and people, supporting the Norwalk economy. It provides a necessary link between the I-5 Freeway and the I-605 Freeway. Currently, this segment of Firestone Boulevard consists of 4-lanes of traffic (2 in each direction) and a landscaped raised median, in an urbanized area of the city with businesses on both sides of the road.

Previously the Cities of Norwalk and Downey, under a joint agreement, widened Firestone Boulevard to the west from the City of Downey limits to the I-605 Freeway ramps. LA Metro and Gateway Cities COG are currently planning the improvements to the I-605 Freeway/Firestone Boulevard interchange. This project has been identified as an early action project of the larger I-605 Freeway Improvements project.

The Firestone Boulevard Widening project would upgrade the existing section to be consistent with the wider section to the west and the planned 6-lane cross section under the I-605 freeway. This project widens the roadway east of the I-605 freeway to three (3) lanes in each direction including at an existing overpass of the Union Pacific Railroad (UPRR) line. The project will also provide multi-modal improvements with the installation of on-street (class II and class III) bicycle facilities. Other improvements that are part of the Firestone Boulevard Widening project include, but are not limited to, a bridge widening over a UPRR active line, traffic signal improvements, retaining walls, pavement reconstruction, landscape and irrigation improvements, and pedestrian (ADA) improvements.

The project is anticipated to be constructed within existing City Right-of-way, except the westerly 200 feet of the Project's limits, which are located within the State's Right-of-Way

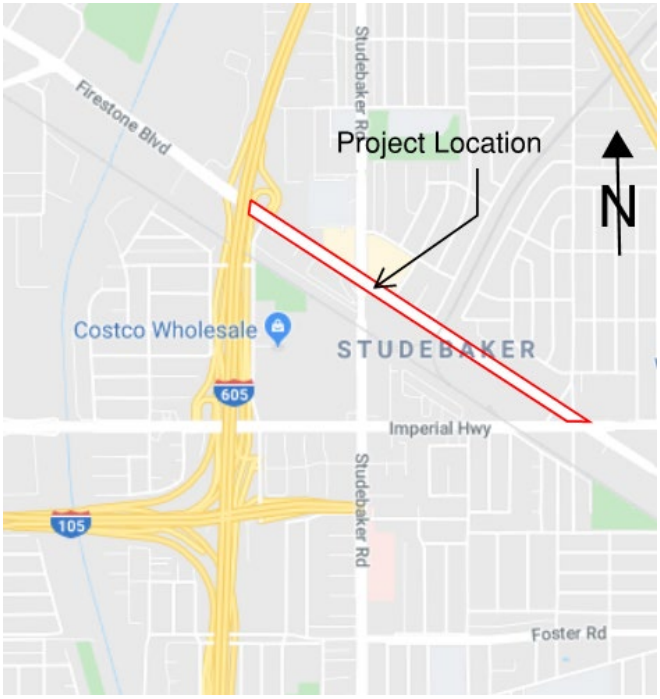


Figure 1 – Project Location Map

II. EXISTING CONDITIONS

A. EXISTING TERRAIN

The surrounding terrain generally drains in a southwesterly direction towards Los Angeles River within the project limits. Existing offsite watersheds within the project consist of developed land, with commercial and single-family residential housing.

B. EXISTING FACILITIES

The culverts within the project limits consist of City of Norwalk and Los Angeles County Flood Control District (LACFCD) existing drainage culverts and catch basins identifies in Table 1 and 2.

Table 1 – Summary of Existing Culverts

LOCATION			FACILITY	SUMMARY
NO.	**STATION**	**LINE**		
1	22+00 to 34+00	F	27" - 66" RCP	Protect-in-Place
2	22+50	F	27" RCP	Protect-in-Place
3	23+25	F	39" RCP	Protect-in-Place
4	24+00	F	24" RCP	Protect-in-Place
5	24+25 to 25+25	F	18" RCP	Protect-in-Place
6	24+25 to 29+75	F	Abn 18" RCP	Protect-in-Place
7	25+21	F	24" RCP	Protect-in-Place
8	25+45	F	33" RCP	Protect-in-Place
9	25+75	F	Abn 16”x25” CMPA	Protect-in-Place
10	28+00	F	18" RCP	Protect-in-Place
11	28+30 to 28+75	F	21" RCP	Protect-in-Place
12	28+90	F	21" RCP	Protect-in-Place
13	29+60	F	5'x2' RCB Culvert & 3'x2' RCB Culvert	Protect-in-Place
14	32+00	F	18" RCP	Protect-in-Place
15	33+20	F	9.5'x8.5' RCB	Protect-in-Place
16	33+50	F	18" RCP	Protect-in-Place
17	33+75	F	Double 9.5'x8.5' RCB	Protect-in-Place
18	34+25	F	Triple 4'x2' RCB	Protect-in-Place
19	44+85	F	4'x2' RCB	Protect-in-Place
20	52+75 to 55+00	F	30" - 33" RCP	Protect-in-Place
21	55+00	F	18" - 42" RCP	Protect-in-Place
22	55+25	F	18" RCP	Protect-in-Place
23	55+50	F	60" RCP	Protect-in-Place

Table 2 – Summary of Existing Inlets

LOCATION			CATCH BASIN	SUMMARY
NO.	STATION	LINE		
1	21+91.66	F	21’ CB	Reconstruct
2	23+20.54	F	7’ CB	Reconstruct
3	22+74.58	F	21’ CB	Reconstruct
4	22+63.10	F	14’ CB	Protect-in-place
5	23+83.20	F	21’ CB	Protect-in-place
6	24+23.70	F	3.5’ CB	Protect-in-place
7	25+15.29	F	3.5’ CB	Protect-in-place
8	25+29.35	F	3.5’ CB	Protect-in-place
9	25+66.59	F	7’ CB	Protect-in-place
10	27+19.53	F	3.5’ CB	Reconstruct
11	28+01.76	F	7’ CB	Protect-in-place
12	28+37.81	F	21’ CB	Protect-in-place
13	28+81.01	F	21’ CB	Protect-in-place
14	29+39.43	F	3.5’ CB	Reconstruct
15	29+65.75	F	3.5’ CB	Reconstruct
16	31+91.48	F	7’ CB	Protect-in-place
17	33+55.16	F	3.5’ CB	Protect-in-place
18	34+32.09	F	14’ CB	Protect-in-place
19	45+04.08	F	7’ CB	Reconstruct
20	52+71.60	F	14’ CB	Protect-in-place
21	52+74.38	F	21’ CB	Protect-in-place
22	53+26.31	F	7’ CB	Protect-in-place
23	54+81.81	F	14’ CB	Protect-in-place
24	55+14.34	F	14’ CB	Protect-in-place

The western portion of the project drains to the existing BI 1110 Hud -2- Line B 66” RCP connects to BI 1110 Hud -2- Line A Double 9.5'x8.5' RCB. The eastern portion of the project drains to the existing Longvest Drain 42” RCP connects to BI 0557 Line B Triple 12.5’x4’ RCB which both discharge to the San Gabriel River, refer to **Attachment D** for the Drainage Plans for the proposed drainage improvements.

III. HYDROLOGIC ANALYSIS

A. LOCAL CLIMATE/WATERSHED CHARACTERISTICS

Climate data was collected for the City of Norwalk with average monthly high temperatures ranging from 68.2ºF in January to 84.4ºF in August. Average monthly low temperatures range from 47.5ºF in December to 64.1ºF in August. Most precipitation in the Los Angeles County area results from winter storms with an average rainfall in the region 14.93 inches falling between the months of October and April.

Soil types in Los Angeles County are found on the soil classification maps in the Los Angeles County Hydrology Manual, see **Attachment A**- Los Angeles County Hydrology Parameters. The project watershed is defined as soil type 003, 006, and 007 shown on map 1-H1.10, included in **Attachment A**. A soil classification identifying the hydrologic characteristics of the area's surface soils, where soil types 003, 006 and 007 were based on soil classifications published by the United States Department of Agriculture, Natural Resources Conservation Service.

B. DESIGN CRITERIA

Hydrologic calculations for watersheds within the project were computed in accordance with the parameters outlined in Los Angeles County Hydrology Manual. Specifically, the rational method was used exclusively to determine all design discharges within the project. The runoff coefficient used for impervious materials such as concrete or asphalt is 1.00.

All hydrologic calculations are developed using the ONDRAIN English Version 7.5c spreadsheet (Excel format) developed and approved by Caltrans. This spreadsheet generates the peak design storm and in turn calculates the water spread width, inlet interception, and bypass flow to determine appropriate inlet placement.

C. RAINFALL INTENSITY

The rainfall intensity calculations were computed in accordance with the parameters established in the Los Angeles County Hydrology Manual. A 5-minute time of concentration was used for watersheds within the project limits to determine rainfall intensity.

The 10-year rainfall intensity value for the project limit is 3.14 in/hr. The intensity value was determined using Figure 1-H1.10 in the Los Angeles County Hydrology Manual,

which is included as **Attachment A**, and equation 5.1.2 of the Los Angeles County Hydrology Manual. The 10-year rainfall intensity calculation is shown in Figure 2.

10-Year Storm Event

$$\frac{I_t}{I_{1440}} = \left(\frac{1440}{t}\right)^{0.47}$$

$$I_t = Rainfall\ intensity\ for\ the\ duration\ given\ {}^{in}/_{hr}$$

$$t = time\ of\ concetration\ (5\ minutes)$$

$$I_{1440} = \frac{6\ in}{24\ hrs} = 0.25\ {}^{in}/_{hr}$$

$$I_t = \left(\frac{1440}{5}\right)^{0.47} \times 0.25\ {}^{in}/_{hr} = 3.58\ {}^{in}/_{hr}$$

Convert to 24-Hour Isohyet for 10-Year Storm Event using reduction factor of **0.714** (see Attachment A)

$$I_t = 3.58\ {}^{in}/_{hr} \times 0.714 = 3.14\ {}^{in}/_{hr}$$

$$I_t = \mathbf{2.56}\ {}^{\boldsymbol{in}}/_{\boldsymbol{hr}}\ (10\text{-Year Storm})$$

Figure 2 – Rainfall Intensity Calculation (T_C=5min)

IV. HYDRAULIC ANALYSIS

A. INLET DESIGN CRITERIA

The hydraulic analysis of inlets within local streets were designed to intercept runoff from a 10-year return frequency storm.

Inlet capacities were calculated using a spreadsheet generated by Caltrans using the Federal Highway Administration HEC-22 analysis. Inlet locations are based on the calculated water spread width of storm runoff conveyed within the shoulder using a modified Manning's equation for triangular flow. Concentrated flow crossing the roadway was limited to 0.10 cubic feet per second (cfs). A clogging factor of 33% was used in determining curb-opening inlet interception rates for all inlets on grade and 50% was used in sag locations. All on-site hydraulic calculations are developed using the ONDRAIN English Version 7.5c spreadsheet (Excel format) developed and approved by Caltrans.

B. STORM DRAIN DESIGN CRITERIA

The hydraulic analysis of existing and proposed storm drain systems was performed using Autodesk Hydraflow Storm Sewer computer software program. This computer software utilizes the HEC-22 methodology and adheres to City of Norwalk and Los Angeles County requirements for hydraulic analysis and head losses.

The hydraulic analysis of laterals was performed in accordance with the guidelines established in the county requirements. Laterals within the traveled way were designed to convey runoff from a 10-year frequency storm. The hydraulic analysis laterals discharging to culverts conveying off-site storm runoff were performed by establishing the controlling headwater elevation equal to the soffit of the pipe or channel at the downstream connection. Conduits are designed for full flow condition and in many instances operate under pressure. Junction losses within inlets are computed using 1.2 times the velocity head. All roughness coefficients for culverts Los Angeles County Hydrology Manual. The design slope of each pipe was checked to meet the minimum self-cleaning velocity of 3 feet per second when flowing half full. The conduits are designed with 100% runoff from develop areas, (C=1.0).

V. PROPOSED IMPROVEMENTS

The following section defines the proposed drainage design. The Hydrology Map for the proposed drainage systems is included in **Attachment B**. Also, refer to **Attachment D** for the Drainage Plans for the proposed drainage improvements.

A. DRAINAGE FACILITIES

There are several proposed drainage facilities for the project to protect the roadways from flooding and keeping the runoff within the half lane. Table 3 and 4 identifies the proposed drainage culverts and catch basins within the project limits.

Table 3 – Summary of Proposed Culverts

NO.	STATION	CULVERT	LOCATION
1	21+56.38 TO 21+80.68	24" RCP	Firestone Blvd
2	22+02.55 TO 22+36.47	27" RCP	Firestone Blvd
3	22+78.12 TO 22+83.48	27" RCP	Firestone Blvd
4	22+22.36 TO 23+06.54	24" RCP	Firestone Blvd
5	23+28.64 TO 23+30.26	39" RCP	Firestone Blvd
6	29+62.78 TO 29+67.01	18" RCP	Firestone Blvd
7	44+47.29 TO 44+52.42	48" RCP	Firestone Blvd
8	44+61.55 TO 44+93.52	18" RCP	Firestone Blvd
9	53+75.57 TO 55+82.06	24" RCP	Firestone Blvd

Table 4 – Summary of Proposed Catch Basins

NO.	STATION	CATCH BASIN	LOCATION
1	21+49.35 TO 21+56.35	7' CB	Firestone Blvd
2	21+80.68 TO 22+02.55	21' CB	Firestone Blvd
3	22+15.20 TO 22+22.19	7' CB	Firestone Blvd
4	22+68.55 TO 22+78.34	12' CB	Firestone Blvd
5	23+06.37 TO 23+32.34	21' CB	Firestone Blvd
6	27+27.18 TO 27+21.56	3.5' CB	Firestone Blvd
7	29+36.95 TO 29+41.26	3.5' CB	Firestone Blvd
8	29+54.62 TO 29+59.11	3.5' CB	Firestone Blvd
9	44+91.45 TO 45+13.31	21' CB	Firestone Blvd
10	44+99.62 TO 45+07.99	8.5' CB	Firestone Blvd
11	53+68.60 TO 53+75.60	7' CB	Firestone Blvd

The Hydrology Map for the proposed drainage systems is included in **Attachment B**. For the inlet capacity and location analysis, excel spreadsheets were used with HEC-22 methodology and these are within **Attachment C**. The sub watershed area for each inlet is shown on the hydrology maps, which correspond to the sub-areas and peak flows to each inlet within the inlet capacity spreadsheets. The hydraulic analysis for each drainage system are located in within **Attachment E**.

A. STORMWATER TREATMENT

The project proposes to add more than 10,000 square feet of impervious areas in the median. The recommended treatment control of Best Management Practices (BMP) for the street improvements are Filterra bioretention systems at two locations on Firestone Blvd. The separate Green Streets Plan lists the treatment BMPs identified for this project.

VI. REFERENCES

1. *Los Angeles County Hydrology Manual,* Los Angeles County Department of Public Works, January 2006.

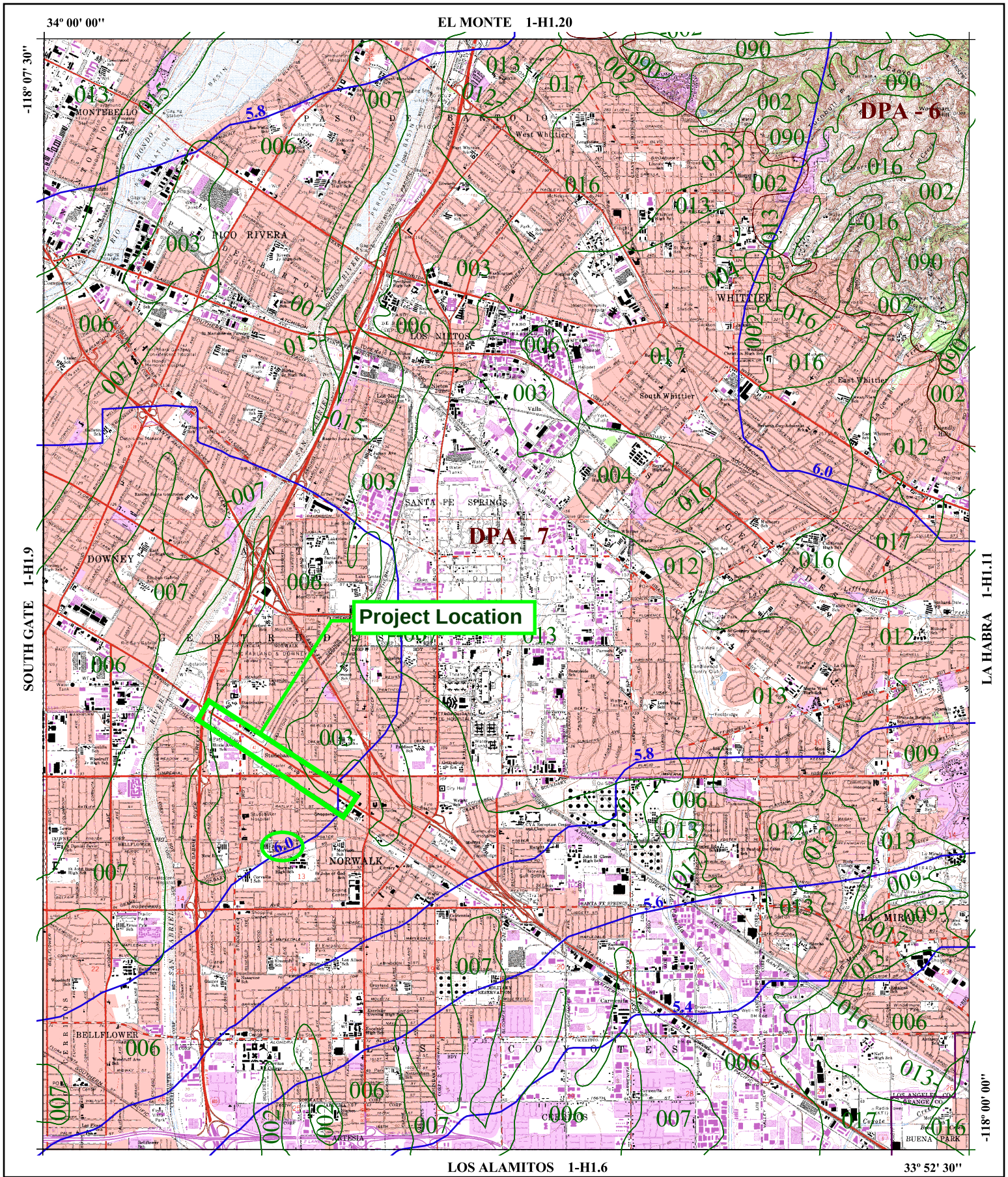
2. *Highway Design Manual, Seventh Edition;* California Department of Transportation, May, 2015.

3. *Standard Plans*; California Department of Transportation, 2015.

4. *Standard Plans;* Los Angeles County Public Works Agency

5. *Urban Drainage Design Manual, Hydraulic Engineering Circular No. 22, Third Edition;* U.S. Department of Transportation, Federal Highway Administration, September 2009.

ATTACHMENT A
LOS ANGELES COUNTY
HYDROLOGY PARAMETERS



016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

N W E S

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

W H I T T I E R
50-YEAR 24-HOUR ISOHYET

1-H1.10

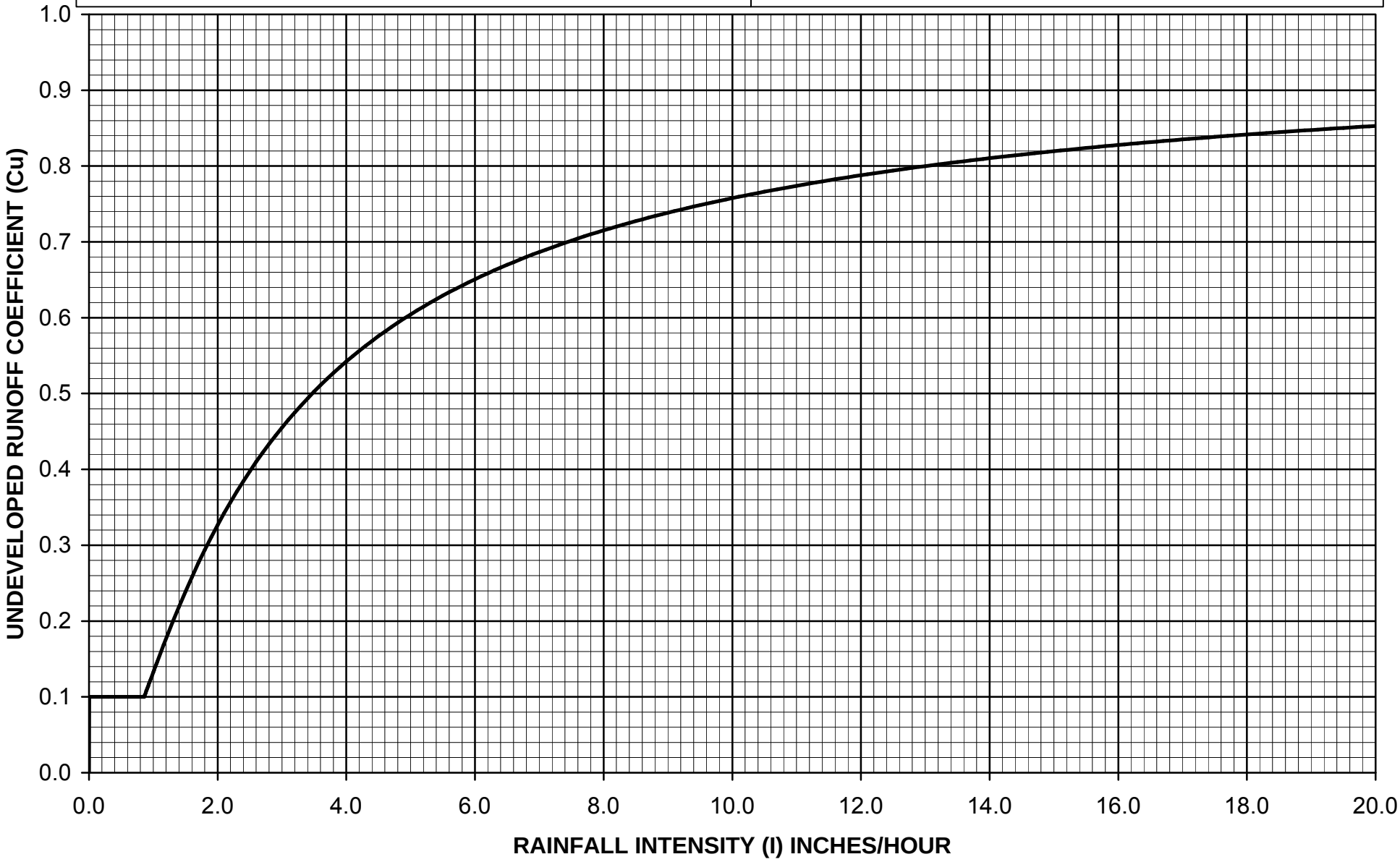
LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 003

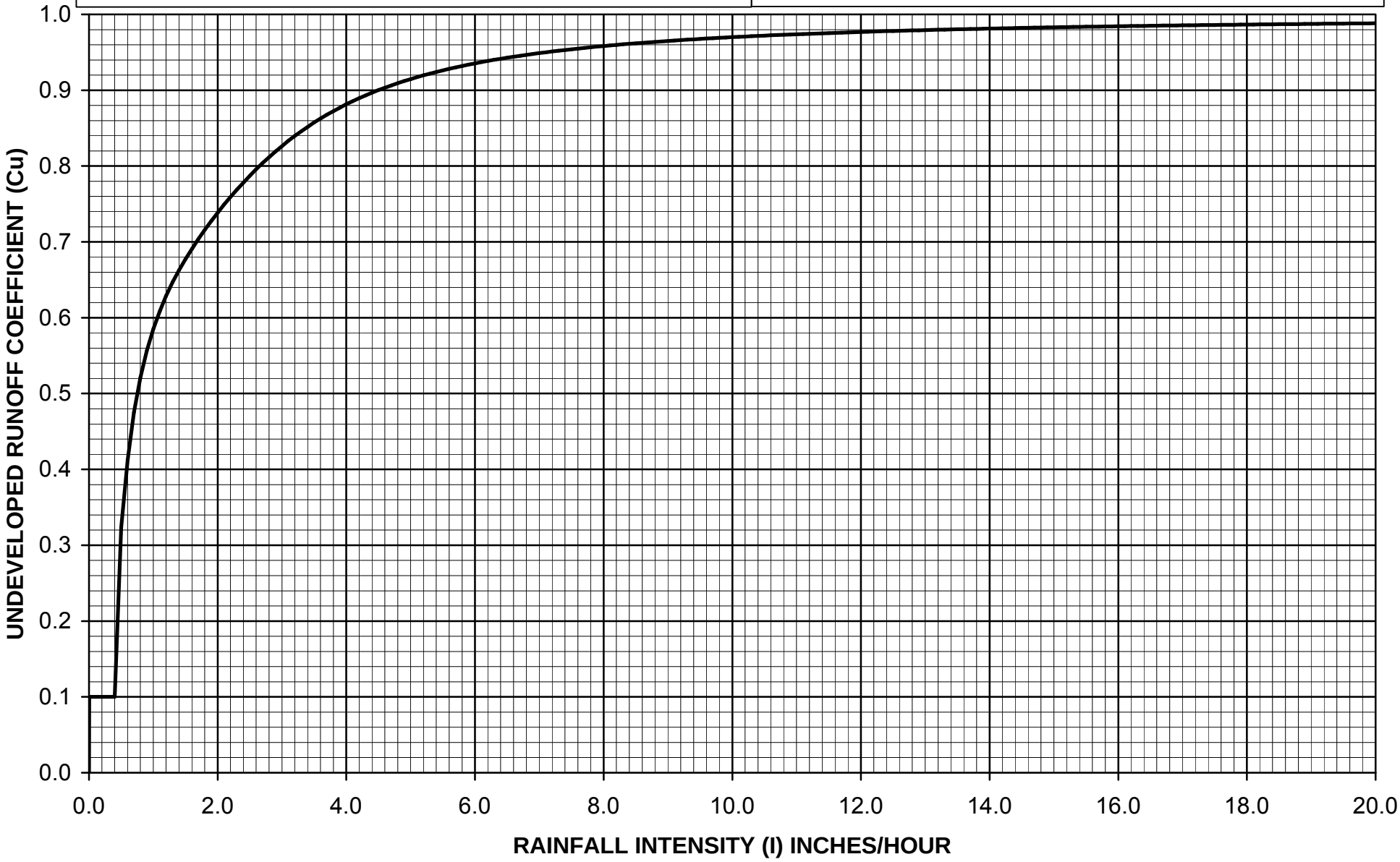


$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 006

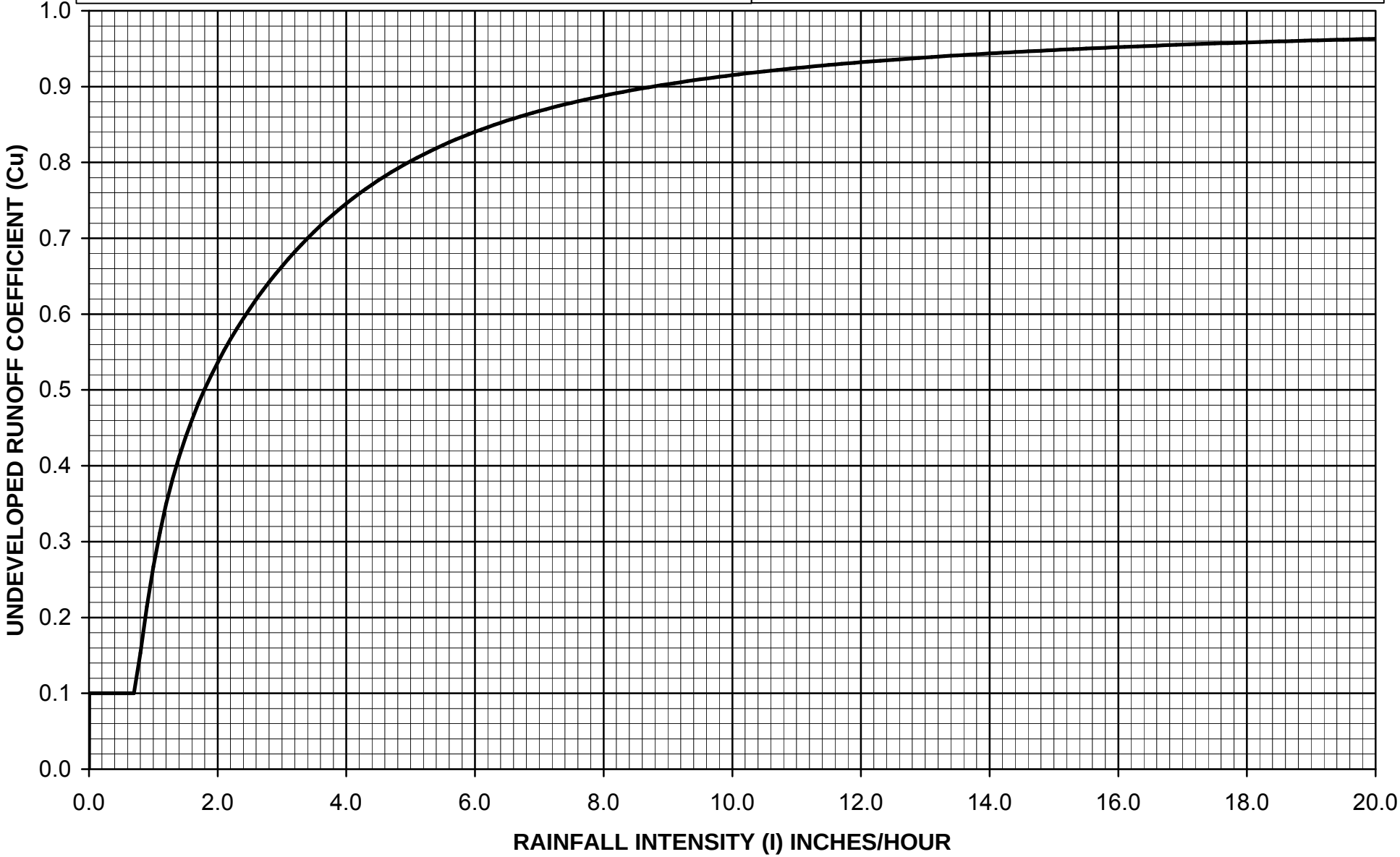


$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

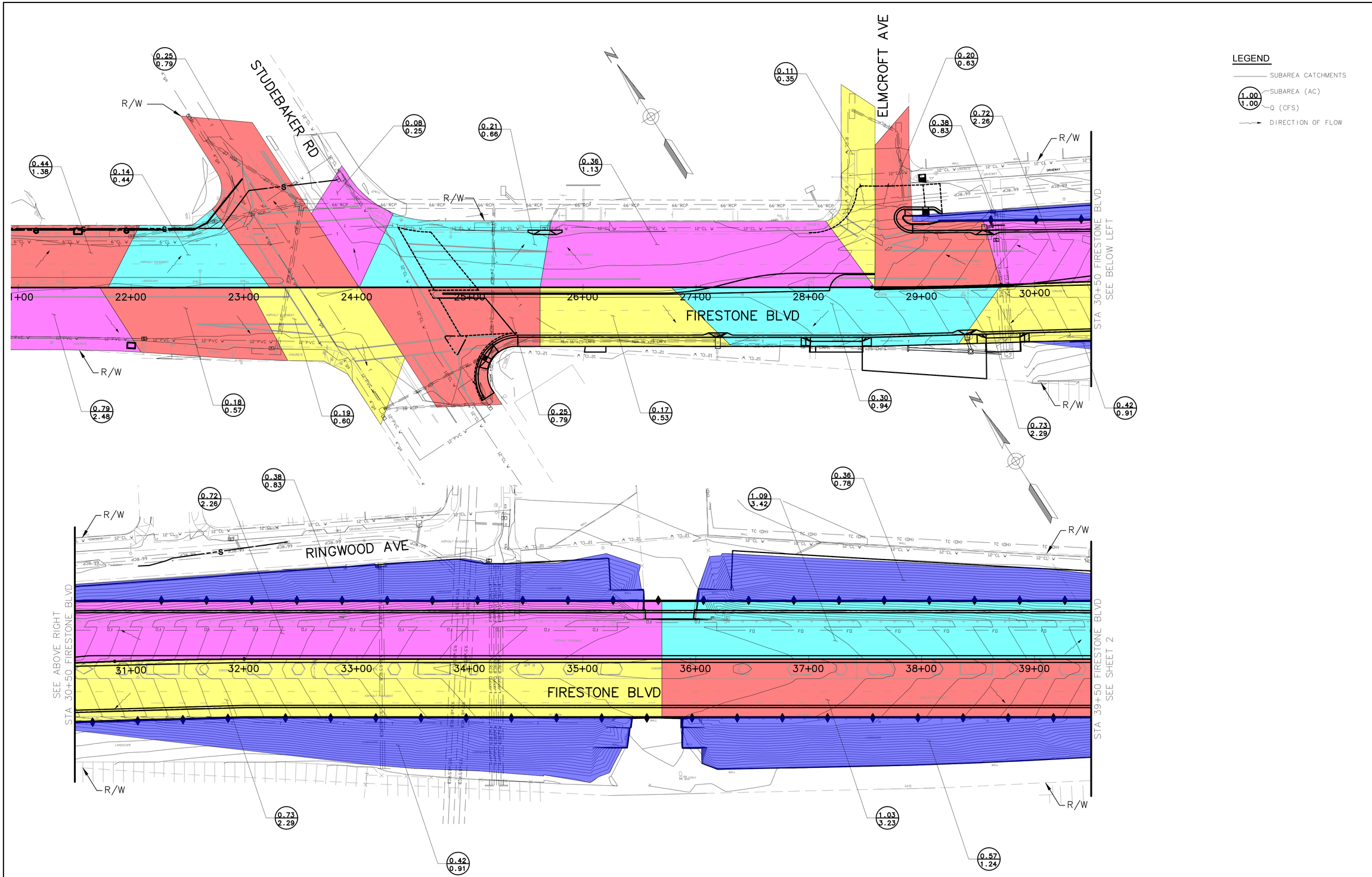
Where: C_D = Developed Runoff Coefficient
IMP = Proportion Impervious
C_U = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 007

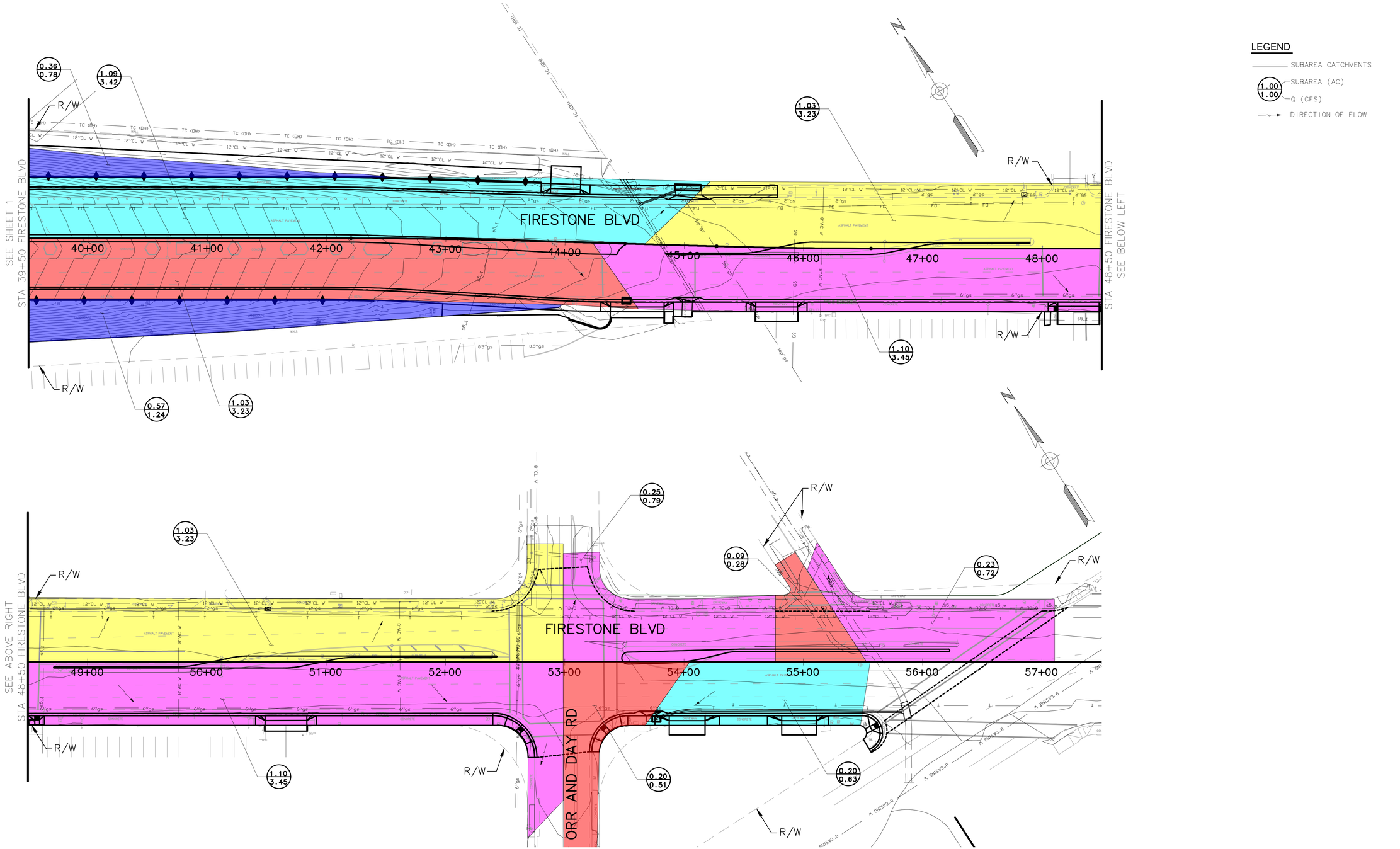


ATTACHMENT B
HYDROLOGY MAP



H-1
HYDROLOGY MAP

SCALE: 1' = 40'



H-2
HYDROLOGY MAP
SCALE: 1' = 40'

ATTACHMENT C
INLET CALCULATIONS (ONDRAIN)

HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Hoxie Ave to Studebaker Rd (Eastbound)

	Starting Point								
Location station (ft):	**10+00.0**	**11+00.0**	**16+50.0**	**18+00.0**	**22+00.0**	**23+00.0**	**23+50.0**	**24+00.0**	**24+50.0**
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade	on-grade	on-grade	on-grade	on-grade	on-grade
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		hydraulics only	hydraulics only	hydraulics only	side opening	side opening	hydraulics only	side opening	hydraulics only
Longitudinal slope, S:		0.12%	0.12%	0.12%	0.12%	0.12%	0.12%	0.12%	0.12%
Shoulder cross-slope, Sx:		2.73%	2.16%	2.35%	1.73%	2.80%	2.77%	2.24%	1.50%
Average watershed paved width (ft):		49.00	55.00	55.00	71.00	63.00	65.00	78.00	110.00
Shoulder Manning's n:		0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Inlet description (optional):					Proposed	Exist DI		Exist DI	
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Watershed paved length (ft):		100.0	550.0	150.0	550.0	100.0	150.0	100.0	100.0
Paved area contributing to this inlet (acres):		0.112	0.694	0.189	0.896	0.145	0.224	0.179	0.253
Subarea discharge Q_{sa} (cfs):		0.29	1.78	0.48	2.295	0.370	0.573	0.458	0.646
Additional discharge Area (acres):		0.000	0.000	0.000	0.000	0.720	0.000	0.000	0.000
Additional discharge (cfs):		**0.00**	**0.00**	**0.00**	**0.00**	**1.84**	**0.00**	**0.00**	**0.00**
Total discharge Q_t, including any upstream by-pass (cfs):		**0.288**	**2.066**	**2.551**	**4.361**	**2.213**	**0.573**	**0.458**	**1.219**
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.29**	**2.07**	**2.55**	**0.00**	**0.00**	**0.57**	**0.00**	**1.22**
DEPRESSION CALCULATION:					O.K., done	O.K., done		O.K., done	
Width of depression "w" (ft):					2.00	2.00		2.00	
Depression depth "a" (from flowline w/o depression) (in):					4.80	4.80		1.68	
Depression cross-slope (Sw=Sx+a/12w):					21.73%	22.80%		9.24%	
Flooded width T (assuming depression cross-slope) (ft):					3.99	3.00		2.93	
Q_w over depression (cfs):					4.360	2.212		0.457	
Fraction of flow over the depression (Eo):					1.000	1.000		0.998	
Discharge-weighted equivalent cross-slope (Se):					21.73%	22.79%		9.22%	
Flooded Width T at depression (ft):					2.43	2.42		2.52	
Ts (shoulder flooded width, excluding the depression) (ft):					0.427	0.424		0.518	
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)					0.001	0.001		0.001	
Q_s over shoulder (excluding flow over the depression) (cfs):					0.000	0.000		0.000	
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):					**4.360**	**2.213**		**0.458**	
HYDRAULIC RESULTS:									
Flooded Width Capacity (ft):		7.00	13.50	13.50	13.50	13.50	13.50	13.50	13.50
Flooded Width T for Q_t, upstream of inlet (ft):		**5.27**	**12.76**	**13.11**	**19.41**	**11.14**	**6.76**	**7.09**	**13.16**
Flooded Width T at depression (if any) (ft):		**5.27**	**12.76**	**13.11**	**2.43**	**2.42**	**6.76**	**2.52**	**13.16**
Check if Inlet is Needed		**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**
Flooded Width T for BYPASS Q downstream of inlet (ft):	**0.00**	**5.27**	**12.76**	**13.11**	**0.00**	**0.00**	**6.76**	**0.00**	**13.16**
Water depth at curb (with or without depression) (in):		1.73	3.31	3.70	5.30	5.61	2.25	2.36	2.37
Water cross-area at shoulder (without depression) (sq.ft.):		0.38	1.76	2.02	3.26	1.74	0.63	0.56	1.30
Water velocity immediately u/s from inlet (w/o depression) (fps):		0.76	1.17	1.26	1.34	1.27	0.91	0.81	0.94
Average water velocity for the segment to this inlet (fps):		0.28	0.48	0.62	0.59	0.48	0.34	0.30	0.40
Flowtime from the previous inlet to this one (min):		5.88	19.15	4.00	15.44	3.50	7.39	5.50	4.21
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):					4.79	3.50		3.11	
Length of inlet provided L (ft):					7.00	21.00		7.00	
Efficiency for length L:					100.0%	100.0%		100.0%	
Interception for length L (cfs):					4.361	2.213		0.458	
Side opening flow-through flow (cfs):					**0.000**	**0.000**		**0.000**	
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):									
Max. head at sag w/o exceeding allowable flooded width (ft):									
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):									
Capacity of curb-opening inlet in a sag (weir) (cfs):									

ONDRAIN_English Version 7.5c, developed by Fernando Manzanera, Caltrans District 1, Hydraulics Capital Support (September 2010).

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Studebaker Rd to Ringwood Ave (Eastbound)

	Starting Point								
Location station (ft):	**24+50.0**	**25+66.0**							
Longitudinal profile ("on-grade" or "sag"):		sag							
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		side opening							
Longitudinal slope, S:									
Shoulder cross-slope, Sx:		0.72%							
Average watershed paved width (ft):		110.00							
Shoulder Manning's n:									
Inlet description (optional):		Exist DI							
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56							
Runoff Coefficient for paved areas, "C_p":		1.00							
Runoff Coefficient for unpaved areas, "C_u":		0.00							
Unpaved area contributing to this inlet (acres):		0.000							
Watershed paved length (ft):		116.0							
Paved area contributing to this inlet (acres):		0.293							
Subarea discharge Q_{sa} (cfs):		0.750							
Additional discharge (cfs):		0.000							
Total discharge Q_t, including any upstream by-pass (cfs):		1.969							
By-pass Q (cfs): *Describe here source of bypass:*	**1.219**	**SAG**							
DEPRESSION CALCULATION:									
Width of depression "w" (ft):		2.00							
Depression depth "a" (from flowline w/o depression) (in):		1.80							
Depression cross-slope (Sw=Sx+a/12w):		SAG							
Flooded width T (assuming depression cross-slope) (ft):		SAG							
Q_w over depression (cfs):									
Fraction of flow over the depression (Eo):									
Discharge-weighted equivalent cross-slope (Se):									
Flooded Width T at depression (ft):									
Ts (shoulder flooded width, excluding the depression) (ft):									
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)									
Q_s over shoulder (excluding flow over the depression) (cfs):									
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):									
HYDRAULIC RESULTS:									
Flooded Width Capacity (ft):		13.50							
Flooded Width T for Q_t, upstream of inlet (ft):		SAG							
Flooded Width T at depression (if any) (ft):		SAG							
Check if Inlet is Needed		Add Inlet							
Flooded Width T for BYPASS Q downstream of inlet (ft):	**13.16**	SAG							
Water depth at curb (with or without depression) (in):									
Water cross-area at shoulder (without depression) (sq.ft.):									
Water velocity immediately u/s from inlet (w/o depression) (fps):									
Average water velocity for the segment to this inlet (fps):									
Flowtime from the previous inlet to this one (min):									
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):									
Length of inlet provided L (ft):									
Efficiency for length L:									
Interception for length L (cfs):									
Side opening flow-through flow (cfs):									
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):		**14.00**							
Max. head at sag w/o exceeding allowable flooded width (ft):		0.25							
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):		**7.00**							
Capacity of curb-opening inlet in a sag (weir) (cfs):		***2.022***							

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Ringwood Ave to Studebaker Rd (Eastbound)

	Starting Point								
Location station (ft):	**35+50.0**	**35+00.0**	**29+50.0**	**28+00.0**	**27+00.0**	**26+50.0**	**25+66.0**		
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade	on-grade	on-grade	sag		
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		hydraulics only	side opening	hydraulics only	side opening	hydraulics only	grate		
Longitudinal slope, S:		0.12%	0.12%	0.12%	0.12%	0.12%			
Shoulder cross-slope, Sx:		3.73%	2.32%	2.46%	2.37%	2.42%	0.72%		
Average watershed paved width (ft):		55.00	50.00	50.00	52.00	46.00	110.00		
Shoulder Manning's n:		0.014	0.014	0.014	0.014	0.014			
Inlet description (optional):			Exist DI		Exist DI		Exist DI		
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56	2.56	2.56	2.56		
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00	1.00	1.00	1.00		
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00	0.00	0.00	0.00		
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000	0.000	0.000	0.000		
Watershed paved length (ft):		50.0	550.0	150.0	100.0	50.0	84.0		
Paved area contributing to this inlet (acres):		0.063	0.631	0.172	0.119	0.053	0.212		
Subarea discharge Q_{sa} (cfs):		0.16	1.62	0.441	0.306	0.135	0.543		
Additional discharge (cfs):		0.000	0.000	0.000	0.000	0.000	1.000		
Total discharge Q_t, including any upstream by-pass (cfs):		**0.162**	**1.778**	**0.441**	**0.746**	**0.135**	**1.678**		
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.16**	**0.00**	**0.44**	**0.00**	**0.14**	**SAG**		
DEPRESSION CALCULATION:			O.K., done		O.K., Qs = 0				
Width of depression "w" (ft):			2.00		2.00				
Depression depth "a" (from flowline w/o depression) (in):			3.84		6.90				
Depression cross-slope (Sw=Sx+a/12w):			18.32%		31.12%				
Flooded width T (assuming depression cross-slope) (ft):			3.17		1.64				
Q_w over depression (cfs):			1.78		0.746				
Fraction of flow over the depression (Eo):			0.999		1.000				
Discharge-weighted equivalent cross-slope (Se):			18.31%		31.12%				
Flooded Width T at depression (ft):			2.45		1.64				
Ts (shoulder flooded width, excluding the depression) (ft):			0.45		0.000				
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)			0.001		0.001				
Q_s over shoulder (excluding flow over the depression) (cfs):			0.000		0.000				
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):			**1.777**		**0.746**				

HYDRAULIC RESULTS:									
Flooded Width Capacity (ft):		12.00	11.50	11.50	11.50	11.50	12.50		
Flooded Width T for Q_t, upstream of inlet (ft):		**3.49**	**11.54**	**6.59**	**8.22**	**4.28**	**SAG**		
Flooded Width T at depression (if any) (ft):		**3.49**	**2.45**	**6.59**	**1.64**	**4.28**	**SAG**		
Check if Inlet is Needed		**OK**	**OK**	**OK**	**OK**	**OK**	**Add Inlet**		
Flooded Width T for BYPASS Q downstream of inlet (ft):	**0.00**	**3.49**	**0.00**	**6.59**	**0.00**	**4.28**	**SAG**		
Water depth at curb (with or without depression) (in):		1.56	4.52	1.95	6.14	1.24			
Water cross-area at shoulder (without depression) (sq.ft.):		0.23	1.54	0.53	0.80	0.22			
Water velocity immediately u/s from inlet (w/o depression) (fps):		0.71	1.15	0.82	0.93	0.61			
Average water velocity for the segment to this inlet (fps):		0.27	0.45	0.31	0.43	0.23			
Flowtime from the previous inlet to this one (min):		3.14	20.21	8.14	3.84	3.67			
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):			3.64		1.84				
Length of inlet provided L (ft):			7.00		2.80				
Efficiency for length L:			100.0%		100.0%				
Interception for length L (cfs):			1.78		0.746				
Side opening flow-through flow (cfs):			**0.00**		**0.000**				
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):							**21.00**		
Max. head at sag w/o exceeding allowable flooded width (ft):							0.15		
Capacity of grate in a sag (3-sided weir) (cfs):							***0.000***		
Length provided of curb-opening inlet at sag (ft):							**14.00**		
Capacity of curb-opening inlet in a sag (weir) (cfs):							***1.893***		

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Ringwood Ave to Orr & Day Rd (Eastbound)

	Starting Point								
Location station (ft):	**35+50.0**	**44+50.0**	**46+00.0**	**52+75.0**					
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade					
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		side opening	hydraulics only	side opening					
Longitudinal slope, S:		0.10%	0.10%	0.10%					
Shoulder cross-slope, Sx:		1.97%	2.50%	2.02%					
Average watershed paved width (ft):		52.00	58.00	93.00					
Shoulder Manning's n:		0.014	0.014	0.014					
Inlet description (optional):		Proposed		Exist DI					
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56					
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00					
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00					
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000					
Watershed paved length (ft):		900.0	150.0	675.0					
Paved area contributing to this inlet (acres):		1.074	0.200	1.441					
Subarea discharge Q_{sa} (cfs):		2.75	0.511	3.689					
Additional discharge (cfs):		0.000	0.000	0.000					
Total discharge Q_t, including any upstream by-pass (cfs):		**2.750**	**0.511**	**4.201**					
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.00**	**0.51**	**0.00**					
DEPRESSION CALCULATION:		O.K., done		O.K., done					
Width of depression "w" (ft):		2.00		2.00					
Depression depth "a" (from flowline w/o depression) (in):		2.64		2.64					
Depression cross-slope (Sw=Sx+a/12w):		12.97%		13.02%					
Flooded width T (assuming depression cross-slope) (ft):		4.80		5.61					
Q_w over depression (cfs):		2.75		4.200					
Fraction of flow over the depression (Eo):		1.000		1.000					
Discharge-weighted equivalent cross-slope (Se):		12.97%		13.02%					
Flooded Width T at depression (ft):		2.34		2.29					
Ts (shoulder flooded width, excluding the depression) (ft):		0.34		0.287					
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)		0.001		0.001					
Q_s over shoulder (excluding flow over the depression) (cfs):		0.000		0.000					
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):		**2.750**		**4.200**					
HYDRAULIC RESULTS:									
Flooded Width Capacity (ft):		12.00	12.00	12.00					
Flooded Width T for Q_t, upstream of inlet (ft):		**15.58**	**7.14**	**17.97**					
Flooded Width T at depression (if any) (ft):		**2.34**	**7.14**	**2.29**					
Check if Inlet is Needed		**OK**	**OK**	**OK**					
Flooded Width T for BYPASS Q downstream of inlet (ft):	**0.00**	**0.00**	**7.14**	**0.00**					
Water depth at curb (with or without depression) (in):		3.19	2.14	3.19					
Water cross-area at shoulder (without depression) (sq.ft.):		2.39	0.64	3.26					
Water velocity immediately u/s from inlet (w/o depression) (fps):		1.15	0.80	1.29					
Average water velocity for the segment to this inlet (fps):		0.43	0.30	0.52					
Flowtime from the previous inlet to this one (min):		34.89	8.36	21.52					
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):		5.10		6.08					
Length of inlet provided L (ft):		7.00		21.00					
Efficiency for length L:		100.0%		100.0%					
Interception for length L (cfs):		2.75		4.201					
Side opening flow-through flow (cfs):		**0.00**		**0.000**					
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):									
Max. head at sag w/o exceeding allowable flooded width (ft):									
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):									
Capacity of curb-opening inlet in a sag (weir) (cfs):									

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Orr & Day Rd to Imperial (Eastbound)

	Starting Point								
Location station (ft):	**56+00.0**	**55+75.0**	**53+00.0**	**52+75.0**					
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade					
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		side opening	hydraulics only	side opening					
Longitudinal slope, S:		0.10%	0.10%	0.10%					
Shoulder cross-slope, Sx:		12.89%	1.96%	2.02%					
Average watershed paved width (ft):		67.00	80.00	93.00					
Shoulder Manning's n:		0.014	0.014	0.014					
Inlet description (optional):		Proposed		Exist DI					
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56					
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00					
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00					
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000					
Watershed paved length (ft):		25.0	275.0	300.0					
Paved area contributing to this inlet (acres):		0.038	0.505	0.640					
Subarea discharge Q_{sa} (cfs):		0.098	1.293	1.640					
Additional discharge (acres):		0.140	0.000	0.000					
Additional discharge (cfs):		**0.36**	**0.00**	**0.00**					
Total discharge Q_t, including any upstream by-pass (cfs):		**0.457**	**1.293**	**1.640**					
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.00**	**1.29**	**0.00**					
DEPRESSION CALCULATION:		O.K., Qs = 0	O.K., done	O.K., done					
Width of depression "w" (ft):		2.00	2.00	2.00					
Depression depth "a" (from flowline w/o depression) (in):		2.64	2.64	2.64					
Depression cross-slope (Sw=Sx+a/12w):		23.89%	12.96%	13.02%					
Flooded width T (assuming depression cross-slope) (ft):		1.67	3.62	3.94					
Q_w over depression (cfs):		0.457	1.292	1.639					
Fraction of flow over the depression (Eo):		1.000	0.999	0.999					
Discharge-weighted equivalent cross-slope (Se):		23.89%	12.95%	13.01%					
Flooded Width T at depression (ft):		1.67	2.46	2.41					
Ts (shoulder flooded width, excluding the depression) (ft):		0.000	0.459	0.412					
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)		0.001	0.001	0.001					
Q_s over shoulder (excluding flow over the depression) (cfs):		0.000	0.000	0.000					
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):		**0.457**	**1.292**	**1.639**					
HYDRAULIC RESULTS:									
Flooded Width Capacity (ft):		6.00	12.00	12.00					
Flooded Width T for Q_t, upstream of inlet (ft):		**2.46**	**11.77**	**12.63**					
Flooded Width T at depression (if any) (ft):		**1.67**	**2.46**	**2.41**					
Check if Inlet is Needed		**OK**	**OK**	**OK**					
Flooded Width T for BYPASS Q downstream of inlet (ft):	**0.00**	**0.00**	**11.77**	**0.00**					
Water depth at curb (with or without depression) (in):		4.79	3.22	3.22					
Water cross-area at shoulder (without depression) (sq.ft.):		0.39	1.36	1.61					
Water velocity immediately u/s from inlet (w/o depression) (fps):		1.18	0.95	1.02					
Average water velocity for the segment to this inlet (fps):		0.44	0.36	0.38					
Flowtime from the previous inlet to this one (min):		0.95	12.90	13.16					
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):		1.66		4.09					
Length of inlet provided L (ft):		7.00		21.00					
Efficiency for length L:		100.0%		100.0%					
Interception for length L (cfs):		0.457		1.640					
Side opening flow-through flow (cfs):		**0.000**		**0.000**					
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):									
Max. head at sag w/o exceeding allowable flooded width (ft):									
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):									
Capacity of curb-opening inlet in a sag (weir) (cfs):									

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Hoxie Ave to Studebaker Rd (Westbound)

	Starting Point									
Location station (ft):	**10+00.0**	**11+00.0**	**21+50.0**	**21+75.0**	**22+25.0**	**22+75.0**	**23+00.0**	**24+25.0**	**25+00.0**	
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade	on-grade	on-grade	on-grade	on-grade	on-grade	
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		hydraulics only	side opening	side opening	hydraulics only	side opening	hydraulics only	side opening	hydraulics only	
Longitudinal slope, S:		0.12%	0.12%	0.12%	0.12%	0.12%	0.12%	0.12%	0.12%	
Shoulder cross-slope, Sx:		2.25%	2.25%	2.25%	2.25%	2.21%	2.11%	2.19%	2.23%	
Average watershed paved width (ft):		52.00	60.00	57.00	45.00	55.00	69.00	87.00	58.00	
Shoulder Manning's n:		0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	
Inlet description (optional):				Exist DI		Exist DI		Exist DI		
Clogging factor for on-grade grates:										
Grate width (ft):										
Grate length (ft):										
Precipitation intensity (in/hr):		2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Watershed paved length (ft):		100.0	1050.0	25.0	75.0	100.0	75.0	125.0	75.0	
Paved area contributing to this inlet (acres):		0.119	1.446	0.033	0.077	0.126	0.119	0.250	0.100	
Subarea discharge Q_{sa} (cfs):		0.31	3.702	0.084	0.198	0.323	0.304	0.64	0.26	
Additional discharge area (acres):		0.000	0.000	1.880	0.000	0.000	0.000	0.000	0.000	
Additional discharge (cfs):		0.000	0.000	4.813	0.000	0.000	0.000	0.000	0.000	
Total discharge Q_t, including any upstream by-pass (cfs):		**0.306**	**4.008**	**4.989**	**0.291**	**0.323**	**0.595**	**1.234**	**0.256**	
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.31**	**0.09**	**0.00**	**0.29**	**0.00**	**0.60**	**0.00**	**0.26**	
DEPRESSION CALCULATION:			O.K., done	O.K., done		O.K., done		O.K., done		
Width of depression "w" (ft):			2.00	2.00		2.00		2.00		
Depression depth "a" (from flowline w/o depression) (in):			1.56	4.90		1.56		1.56		
Depression cross-slope (Sw=Sx+a/12w):			8.75%	22.67%		8.71%		8.69%		
Flooded width T (assuming depression cross-slope) (ft):			6.83	4.09		2.66		4.41		
Q_w over depression (cfs):			4.007	4.988		0.322		1.23		
Fraction of flow over the depression (Eo):			1.000	1.000		0.997		0.999		
Discharge-weighted equivalent cross-slope (Se):			8.75%	22.66%		8.69%		8.68%		
Flooded Width T at depression (ft):			2.21	2.35		2.58		2.34		
Ts (shoulder flooded width, excluding the depression) (ft):			0.214	0.354		0.580		0.34		
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)			0.00100	0.00100		0.00100		0.00100		
Q_s over shoulder (excluding flow over the depression) (cfs):			0.00004	0.0002		0.00056		0.00013		
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):			**4.00710**	**4.98847**		**0.32279**		**1.23350**		

HYDRAULIC RESULTS:									
Actual Flooded Width (ft):	7.00	13.50	7.50	8.50	8.50	8.50	8.50	8.50	
Flooded Width T for Q_t, upstream of inlet (ft):	**6.08**	**15.95**	**17.32**	**5.97**	**6.28**	**8.12**	**10.43**	**5.72**	
Flooded Width T at depression (if any) (ft):	**6.08**	**2.21**	**2.35**	**5.97**	**2.58**	**8.12**	**2.34**	**5.72**	
Check if Inlet is Needed:	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**	
Flooded Width T for BYPASS Q downstream of inlet (ft): **0.00**	**6.08**	**3.89**	**0.00**	**5.97**	**0.00**	**8.12**	**0.00**	**5.72**	
Water depth at curb (with or without depression) (in):	1.64	2.16	5.54	1.61	2.24	2.06	2.18	1.53	
Water cross-area at shoulder (without depression) (sq.ft.):	0.42	2.86	3.37	0.40	0.44	0.70	1.19	0.36	
Water velocity immediately u/s from inlet (w/o depression) (fps):	0.74	1.40	1.48	0.73	0.74	0.86	1.04	0.70	
Average water velocity for the segment to this inlet (fps):	0.27	0.57	0.57	0.32	0.28	0.39	0.48	0.26	
Flowtime from the previous inlet to this one (min):	6.08	30.95	0.73	3.90	6.02	3.22	4.36	4.78	
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):		7.99	4.95		2.78		4.89		
Length of inlet provided L (ft):		7.00	21.00	14.00	7.00		7.00		
Efficiency for length L:		97.7%	100.0%		100.0%		100.0%		
Interception for length L (cfs):		3.915	4.989		0.323		1.23		
Side opening flow-through flow (cfs):		**0.093**	**0.000**		**0.000**		**0.00**		
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):									
Max. head at sag w/o exceeding allowable flooded width (ft):									
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):									
Capacity of curb-opening inlet in a sag (weir) (cfs):									

ONDRAIN_English Version 7.5c, developed by Fernando Manzanera, Caltrans District 1, Hydraulics Capital Support (September 2010).

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Ringwood Ave to Studebaker Rd (Westbound)

	Starting Point								
Location station (ft):	**36+50.0**	**35+00.0**	**29+75.0**	**26+50.0**	**25+50.0**	**25+00.0**			
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade	on-grade	on-grade			
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		hydraulics only	side opening	hydraulics only	side opening	hydraulics only			
Longitudinal slope, S:		4.92%	4.92%	0.12%	0.12%	0.12%			
Shoulder cross-slope, Sx:		4.28%	2.24%	2.35%	2.24%	2.23%			
Average watershed paved width (ft):		53.00	50.00	65.00	59.00	58.00			
Shoulder Manning's n:		0.014	0.014	0.014	0.014	0.014			
Inlet description (optional):			Exist DI		Exist DI				
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56	2.56	2.56			
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00	1.00	1.00			
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00	0.00	0.00			
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000	0.000	0.000			
Watershed paved length (ft):		150.0	525.0	325.0	100.0	50.0			
Paved area contributing to this inlet (acres):		0.183	0.603	0.485	0.135	0.067			
Subarea discharge Q_{sa} (cfs):		0.47	1.543	1.242	0.347	0.170			
Additional discharge (cfs):		0.000	0.000	0.000	0.000	0.000			
Total discharge Q_t, including any upstream by-pass (cfs):		**0.467**	**2.010**	**1.766**	**2.113**	**0.170**			
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.47**	**0.52**	**1.77**	**0.00**	**0.17**			
DEPRESSION CALCULATION:			O.K., Qs = 0		O.K., done				
Width of depression "w" (ft):			2.00		2.00				
Depression depth "a" (from flowline w/o depression) (in):			3.00		3.00				
Depression cross-slope (Sw=Sx+a/12w):			14.74%		14.74%				
Flooded width T (assuming depression cross-slope) (ft):			1.90		3.88				
Q_w over depression (cfs):			2.010		2.112				
Fraction of flow over the depression (Eo):			1.000		1.000				
Discharge-weighted equivalent cross-slope (Se):			14.74%		14.73%				
Flooded Width T at depression (ft):			1.90		2.38				
Ts (shoulder flooded width, excluding the depression) (ft):			0.000		0.378				
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)			0.001		0.001				
Q_s over shoulder (excluding flow over the depression) (cfs):			0.000		0.000				
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):			**2.010**		**2.112**				
HYDRAULIC RESULTS:									
Actual Flooded Width (ft):		12.00	11.50	11.50	8.50	8.50			
Flooded Width T for Q_t, upstream of inlet (ft):		**2.38**	**6.16**	**11.42**	**12.58**	**4.91**			
Flooded Width T at depression (if any) (ft):		**2.38**	**1.90**	**11.42**	**2.38**	**4.91**			
Check if Inlet is Needed		**OK**	**OK**	**OK**	**OK**	**OK**			
Flooded Width T for BYPASS Q downstream of inlet (ft):	**0.00**	**2.38**	**3.72**	**11.42**	**0.00**	**4.91**			
Water depth at curb (with or without depression) (in):		1.22	3.35	3.22	3.64	1.31			
Water cross-area at shoulder (without depression) (sq.ft.):		0.12	0.42	1.53	1.77	0.27			
Water velocity immediately u/s from inlet (w/o depression) (fps):		3.87	4.74	1.15	1.19	0.63			
Average water velocity for the segment to this inlet (fps):		1.44	1.91	0.46	0.58	0.24			
Flowtime from the previous inlet to this one (min):		1.74	4.58	11.84	2.90	3.53			
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):			13.31		4.46				
Length of inlet provided L (ft):			7.00		7.00				
Efficiency for length L:			73.9%		100.0%				
Interception for length L (cfs):			1.485		2.113				
Side opening flow-through flow (cfs):			**0.525**		**0.000**				
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):									
Max. head at sag w/o exceeding allowable flooded width (ft):									
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):									
Capacity of curb-opening inlet in a sag (weir) (cfs):									

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Ringwood Ave to Orr & Day Rd (Westbound)

	Starting Point								
Location station (ft):	**36+50.0**	**40+00.0**	**45+00.0**	**47+50.0**	**52+75.0**	**53+00.0**			
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade	on-grade	on-grade			
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		hydraulics only	side opening	hydraulics only	side opening	hydraulics only			
Longitudinal slope, S:		4.92%	0.10%	0.10%	0.10%	0.10%			
Shoulder cross-slope, Sx:		3.89%	1.81%	1.66%	2.53%	2.22%			
Average watershed paved width (ft):		53.00	53.00	53.00	80.00	80.00			
Shoulder Manning's n:		0.014	0.014	0.014	0.014	0.014			
Inlet description (optional):			p		Exist DI				
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56	2.56	2.56			
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00	1.00	1.00			
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00	0.00	0.00			
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000	0.000	0.000			
Watershed paved length (ft):		350.0	500.0	250.0	525.0	25.0			
Paved area contributing to this inlet (acres):		0.426	0.608	0.304	0.964	0.046			
Subarea discharge Q_{sa} (cfs):		1.09	1.557	0.779	2.468	0.118			
Additional discharge (acres):		0.000	0.000	0.000	0.720	0.000			
Additional discharge (cfs):		**0.00**	**0.00**	**0.00**	**1.84**	**0.00**			
Total discharge Q_t, including any upstream by-pass (cfs):		**1.090**	**2.648**	**0.779**	**5.090**	**0.118**			
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**1.09**	**0.00**	**0.78**	**0.00**	**0.12**			
DEPRESSION CALCULATION:			O.K., done		O.K., done				
Width of depression "w" (ft):			2.00		2.00				
Depression depth "a" (from flowline w/o depression) (in):			5.28		5.28				
Depression cross-slope (Sw=Sx+a/12w):			23.81%		24.53%				
Flooded width T (assuming depression cross-slope) (ft):			3.23		4.06				
Q_w over depression (cfs):			2.647		5.089				
Fraction of flow over the depression (Eo):			1.000		1.000				
Discharge-weighted equivalent cross-slope (Se):			23.80%		24.53%				
Flooded Width T at depression (ft):			2.53		2.34				
Ts (shoulder flooded width, excluding the depression) (ft):			0.532		0.343				
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)			0.001		0.001				
Q_s over shoulder (excluding flow over the depression) (cfs):			0.000		0.000				
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):			**2.647**		**5.089**				

HYDRAULIC RESULTS:									
Actual Flooded Width (ft):		12	12	12	12	12			
Flooded Width T for Q_t, upstream of inlet (ft):		**3.47**	**16.19**	**10.80**	**16.78**	**4.43**			
Flooded Width T at depression (if any) (ft):		**3.47**	**2.53**	**10.80**	**2.34**	**4.43**			
Check if Inlet is Needed		**OK**	**OK**	**OK**	**OK**	**OK**			
Flooded Width T for BYPASS Q downstream of inlet (ft):	**0.00**	**3.47**	**0.00**	**10.80**	**0.00**	**4.43**			
Water depth at curb (with or without depression) (in):		1.62	5.83	2.15	5.99	1.18			
Water cross-area at shoulder (without depression) (sq.ft.):		0.23	2.37	0.97	3.56	0.22			
Water velocity immediately u/s from inlet (w/o depression) (fps):		4.67	1.12	0.80	1.43	0.54			
Average water velocity for the segment to this inlet (fps):		1.74	0.43	0.30	0.63	0.20			
Flowtime from the previous inlet to this one (min):		3.36	19.39	13.89	13.87	2.08			
GRATE INLETS ON-GRADE:									
Splash-over V for effective length of grate (type P-1 3/8) (fps):									
Effective length of grate considering clogging factor (ft):									
Ratio of grate frontal flow to total flow:									
Frontal flow (m^3/s), (Qw):									
Side flow (m^3/s), (Qs):									
Fraction of frontal flow intercepted (Rf):									
Fraction of side flow interception (Rs):									
Total flow intercepted (cfs):									
Grate Efficiency (E):									
Grate flow-through flow (cfs):									
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:									
Length required for total interception (ft):			3.48		4.50				
Length of inlet provided L (ft):			14.00		14.00				
Efficiency for length L:			100.0%		100.0%				
Interception for length L (cfs):			2.648		5.090				
Side opening flow-through flow (cfs):			**0.000**		**0.000**				
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:									
Maximum allowable flooded width (including the depression) (ft):									
Max. head at sag w/o exceeding allowable flooded width (ft):									
Capacity of grate in a sag (3-sided weir) (cfs):									
Length provided of curb-opening inlet at sag (ft):									
Capacity of curb-opening inlet in a sag (weir) (cfs):									

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HYDRAULIC CALCULATOR FOR ONSITE DRAINAGE (English Units)

Date: 04/03/20

Orr & Day Rd to Imperial (Westbound)

	Starting Point								
Location station (ft):	**56+50.0**	**55+25.0**	**55+00.0**	**54+75.0**	**54+50.0**	**53+25.0**	**53+00.0**		
Longitudinal profile ("on-grade" or "sag"):		on-grade	on-grade	on-grade	on-grade	on-grade	on-grade		
Calculation Type ("grate", "side opening", or "shoulder hydraulics only"):		side opening	hydraulics only	side opening	hydraulics only	side opening	hydraulics only		
Longitudinal slope, S:		0.10%	0.10%	0.10%	0.10%	0.10%	0.10%		
Shoulder cross-slope, Sx:		4.64%	3.88%	6.24%	6.02%	2.47%	2.22%		
Average watershed paved width (ft):		40.00	65.00	65.00	42.00	80.00	80.00		
Shoulder Manning's n:		0.014	0.014	0.014	0.014	0.014	0.014		
Inlet description (optional):		Exist DI		Exist DI		Exist DI			
Clogging factor for on-grade grates:									
Grate width (ft):									
Grate length (ft):									
Precipitation intensity (in/hr):		2.56	2.56	2.56	2.56	2.56	2.56		
Runoff Coefficient for paved areas, "C_p":		1.00	1.00	1.00	1.00	1.00	1.00		
Runoff Coefficient for unpaved areas, "C_u":		0.00	0.00	0.00	0.00	0.00	0.00		
Unpaved area contributing to this inlet (acres):		0.000	0.000	0.000	0.000	0.000	0.000		
Watershed paved length (ft):		125.0	150.0	25.0	25.0	125.0	25.0		
Paved area contributing to this inlet (acres):		0.115	0.224	0.037	0.024	0.230	0.046		
Subarea discharge Q_{sa} (cfs):		0.29	0.57	0.10	0.06	0.59	0.118		
Additional discharge area (acres):		0.000	0.000	0.000	0.137	0.000	0.000		
Additional discharge (cfs):		**0.00**	**0.00**	**0.00**	**0.35**	**0.00**	**0.00**		
Total discharge Q_t, including any upstream by-pass (cfs):		**0.294**	**0.573**	**0.096**	**0.985**	**0.588**	**0.118**		
By-pass Q (cfs): *Describe here source of bypass:*	**0.000**	**0.00**	**0.57**	**0.00**	**0.98**	**0.00**	**0.12**		
DEPRESSION CALCULATION:		O.K., Qs = 0		O.K., Qs = 0		O.K., Qs = 0			
Width of depression "w" (ft):		2.00		2.00		2.00			
Depression depth "a" (from flowline w/o depression) (in):		7.32		3.96		5.64			
Depression cross-slope (Sw=Sx+a/12w):		35.14%		22.74%		25.97%			
Flooded width T (assuming depression cross-slope) (ft):		1.11		0.96		1.74			
Q_w over depression (cfs):		0.29		0.10		0.59			
Fraction of flow over the depression (Eo):		1.000		1.000		1.000			
Discharge-weighted equivalent cross-slope (Se):		35.14%		22.74%		25.97%			
Flooded Width T at depression (ft):		1.11		0.96		1.74			
Ts (shoulder flooded width, excluding the depression) (ft):		0.00		0.00		0.00			
Q_s (first guess: **Qt - 0.001**, after iteration should be same as next line)		0.001		0.001		0.001			
Q_s over shoulder (excluding flow over the depression) (cfs):		0.000		0.000		0.000			
Q=Q_w+Q_s (cfs) (after iterations must match **Q_t** value):		**0.294**		**0.096**		**0.588**			

HYDRAULIC RESULTS:								
Actual Flooded Width (ft):	6.00	6.00	6.00	6.00	12.00	12.00		
Flooded Width T for Q_t, upstream of inlet (ft):	**3.94**	**5.66**	**2.15**	**5.27**	**7.58**	**4.43**		
Flooded Width T at depression (if any) (ft):	**1.11**	**5.66**	**0.96**	**5.27**	**1.74**	**4.43**		
Check if Inlet is Needed	**OK**	**OK**	**OK**	**OK**	**OK**	**OK**		
Flooded Width T for BYPASS Q downstream of inlet (ft): **0.00**	**0.00**	**5.66**	**0.00**	**5.27**	**0.00**	**4.43**		
Water depth at curb (with or without depression) (in):	4.69	2.64	2.61	3.81	5.43	1.18		
Water cross-area at shoulder (without depression) (sq.ft.):	0.36	0.62	0.14	0.84	0.71	0.22		
Water velocity immediately u/s from inlet (w/o depression) (fps):	0.82	0.92	0.66	1.18	0.83	0.54		
Average water velocity for the segment to this inlet (fps):	0.30	0.34	0.25	0.60	0.31	0.20		
Flowtime from the previous inlet to this one (min):	6.85	7.27	1.69	0.69	6.75	2.08		
GRATE INLETS ON-GRADE:								
Splash-over V for effective length of grate (type P-1 3/8) (fps):								
Effective length of grate considering clogging factor (ft):								
Ratio of grate frontal flow to total flow:								
Frontal flow (m^3/s), (Qw):								
Side flow (m^3/s), (Qs):								
Fraction of frontal flow intercepted (Rf):								
Fraction of side flow interception (Rs):								
Total flow intercepted (cfs):								
Grate Efficiency (E):								
Grate flow-through flow (cfs):								
SLOTTED DRAINS & SIDE-OPENING INLETS ON-GRADE:								
Length required for total interception (ft):	1.10		0.89		1.76			
Length of inlet provided L (ft):	14.00		14.00		14.00			
Efficiency for length L:	100.0%		100.0%					
Interception for length L (cfs):	0.29		0.10					
Side opening flow-through flow (cfs):	**0.00**		**0.00**					
INTERCEPTION CAPACITY OF INLETS IN SAG LOCATION:								
Maximum allowable flooded width (including the depression) (ft):								
Max. head at sag w/o exceeding allowable flooded width (ft):								
Capacity of grate in a sag (3-sided weir) (cfs):								
Length provided of curb-opening inlet at sag (ft):								
Capacity of curb-opening inlet in a sag (weir) (cfs):								

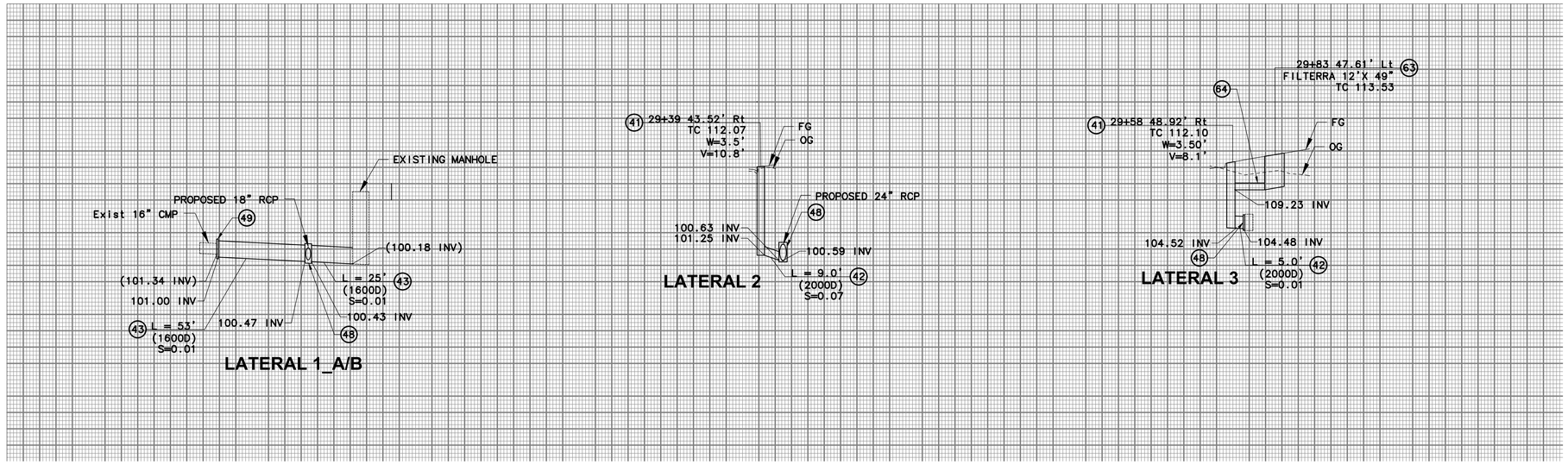
ONDRAIN_English Version 7.5c, developed by Fernando Manzanera, Caltrans District 1, Hydraulics Capital Support (September 2010).

Notes: -This program utilizes the equations presented in the FHA Hydraulic Engineering Circular 22 (HEC-22), FHWA-NHI-10-009.

- Underlined values are calculated by the program, the others are input by the user.

ATTACHMENT D
DRAINAGE PLANS

PROFILE
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1"=8'



DISPOSITION NOTES:

A	PROTECT-IN-PLACE (ITEM AS NOTED)
B	REMOVE (ITEM AS NOTED)

CONSTRUCTION NOTES:

(41) CONSTRUCT CURB OPENING CATCH BASIN PER CITY OF NORWALK STD. PLAN NO. 300A.

(42) INSTALL 18" RCP.

(43) INSTALL 24" RCP.

(44) INSTALL 27" RCP.

(45) INSTALL 39" RCP.

(47) REMOVE AND RECONSTRUCT CATCH BASIN PER DETAIL ON SHEET 25.

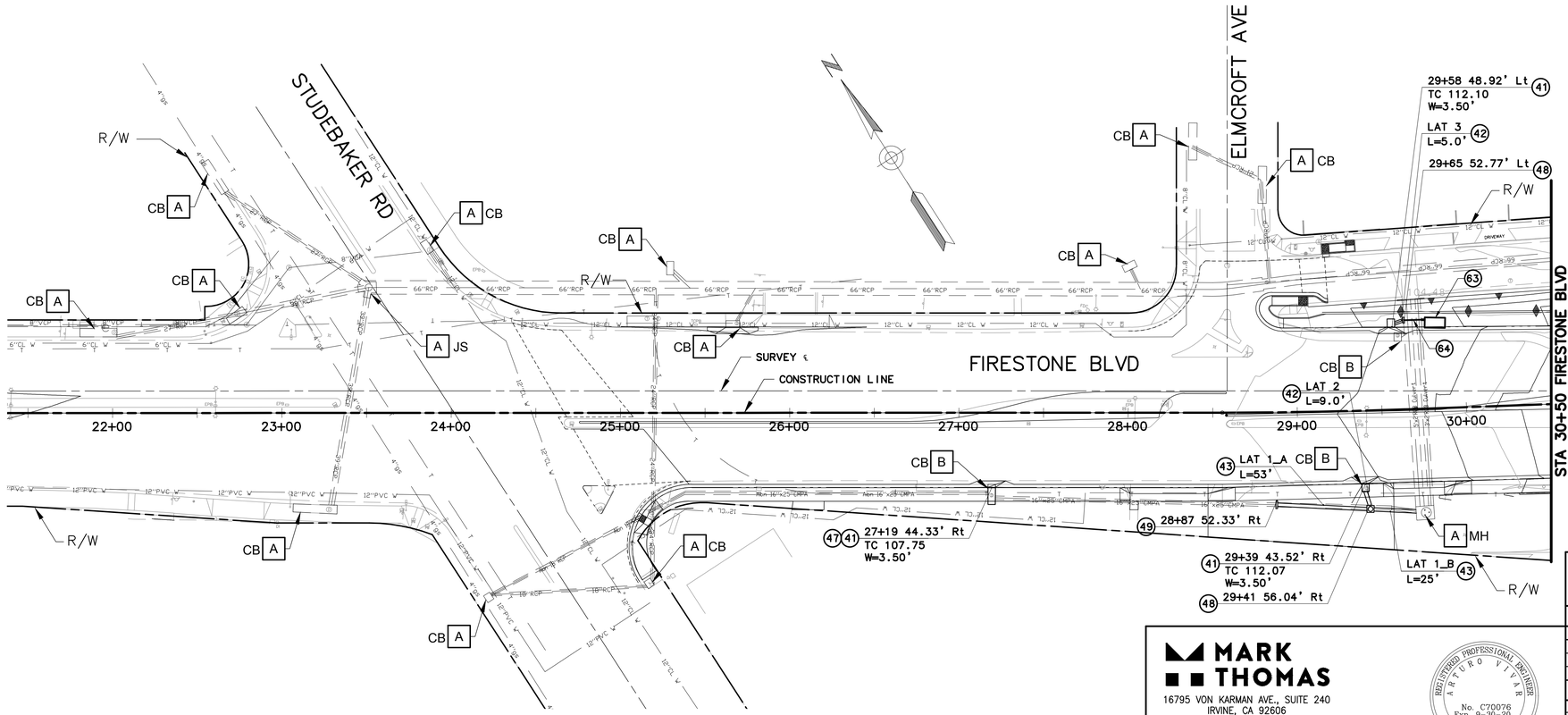
(48) CONSTRUCT JUNCTION STRUCTURE PER CITY OF NORWALK STD. PLAN NO. 309A.

(49) CONSTRUCT CONCRETE COLLAR PER CITY OF NORWALK STD. PLAN NO. 308.

(63) CONSTRUCT FILTERRA PER DETAIL ON SHEET 26.

(64) CONSTRUCT 10" PLASTIC PIPE

LINE TABLE	
LINE #	DIRECTION
L1_A	N54°19'41"W
L1_B	N54°19'41"W
L2	S14°54'00"W
L3	S77°17'23"E



engineering division

REVISIONS

DATE	BY	
		AS BUILT

FIELD BOOK REF.

PLAN REF.

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IRVINE, CA 92606
(949) 477-9000

REGISTERED PROFESSIONAL ENGINEER
ARTURO VIVAR
No. C70076
Exp. 9-30-20
CIVIL
STATE OF CALIFORNIA

CITY OF NORWALK

TITLE:
GRADING AND DRAINAGE PLAN
FIRESTONE BOULEVARD WIDENING
FROM STUDEBAKER ROAD TO IMPERIAL HIGHWAY (PHASE 1)

Approved
CITY ENGINEER RCE 20568 DATE

Recommended
DATE

PROJECT NO.
7196.1

DRAWING NO.

Drawn By P.B. Checked By A.V.

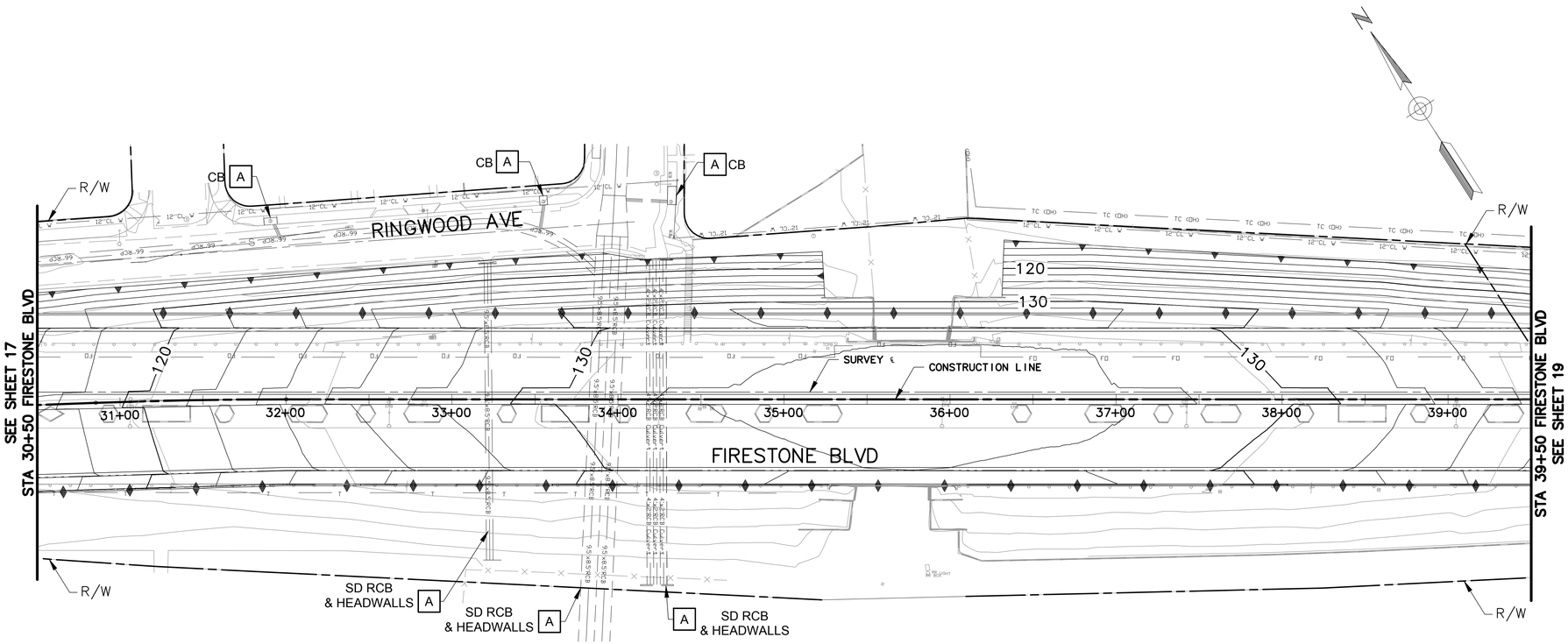
SHEET 17 OF 62

S:\FIRESTONE\CALTRANS.DWG REV. 07-15-97

DWG: J:\City of Norwalk-IR-19101-Firestone Blvd\CADD_2018\Sheets\IR-19101_D-PPH1.dwg USER: msoriano
DATE: Apr 02, 2020 11:46am

DISPOSITION NOTES:

A PROTECT-IN-PLACE (ITEM AS NOTED)



SCALE

0 20 10 40

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		AS BUILT

FIELD BOOK REF.

PLAN REF.

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Approved
CITY ENGINEER RCE 20568 DATE

Recommended
DATE

PROJECT NO. 7196.1

DRAWING NO.

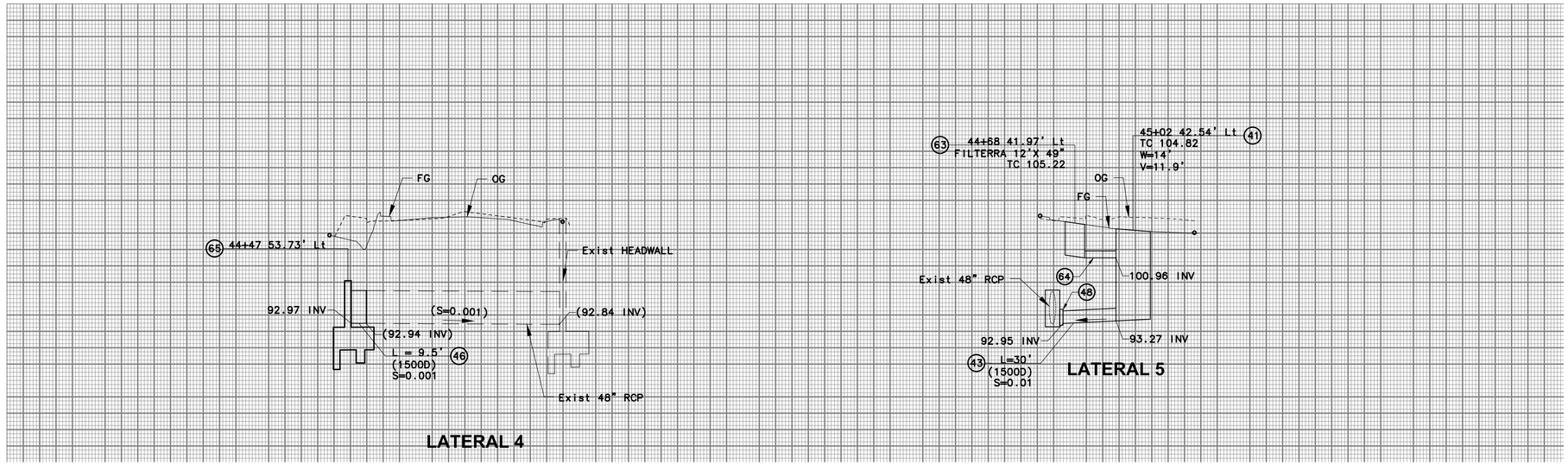
Drawn By P.B. Checked By A.V.

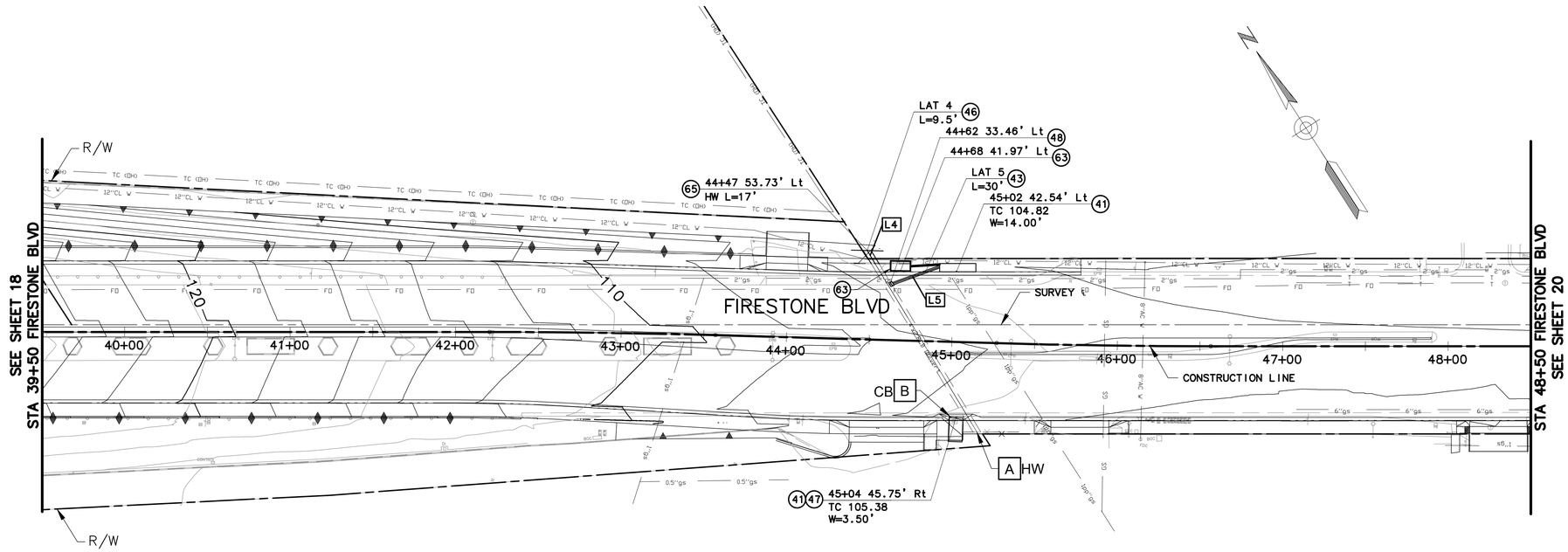
SHEET 18 OF 62

S:\FIRESTONE\CALTRANS.DWG REV. 07-15-97

DWG: J:\City of Norwalk-IR-19101-Firestone Blvd\CADD_2018\Sheets\IR-19101_D-PPM1.dwg USER: msoriano
DATE: Apr 02, 2020 11:46am

PROFILE
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1"=8'





DISPOSITION NOTES:

A PROTECT-IN-PLACE (ITEM AS NOTED)

B REMOVE (ITEM AS NOTED)

CONSTRUCTION NOTES:

(41) CONSTRUCT CURB OPENING CATCH BASIN PER CITY OF NORWALK STD. PLAN NO. 300A.

(43) INSTALL 24" RCP.

(46) INSTALL 48" RCP.

(47) REMOVE AND RECONSTRUCT CATCH BASIN PER DETAIL ON SHEET 16.

(48) CONSTRUCT JUNCTION STRUCTURE PER CITY OF NORWALK STD. PLAN NO. 309A.

(49) CONSTRUCT CONCRETE COLLAR PER CITY OF NORWALK STD. PLAN NO. 308.

(63) CONSTRUCT FILTERA PER DETAIL ON SHEET 26.

(64) CONSTRUCT 10" PLASTIC PIPE.

(65) CONSTRUCT HEADWALL PER DETAIL ON SHEET 25.

LINE TABLE	
LINE #	DIRECTION
L4	S1°46'48"W
L5	S76°53'45"E

SCALE
0 20
10 40

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engineering division

REVISIONS

DATE	BY	
		AS BUILT

FIELD BOOK REF.

PLAN REF.

CITY OF NORWALK

TITLE:
GRADING AND DRAINAGE PLAN
FIRESTONE BOULEVARD WIDENING
FROM STUDEBAKER ROAD TO IMPERIAL HIGHWAY (PHASE 1)

Approved
CITY ENGINEER RCE 20568 DATE

Recommended
DATE

PROJECT NO. 7196.1

DRAWING NO.

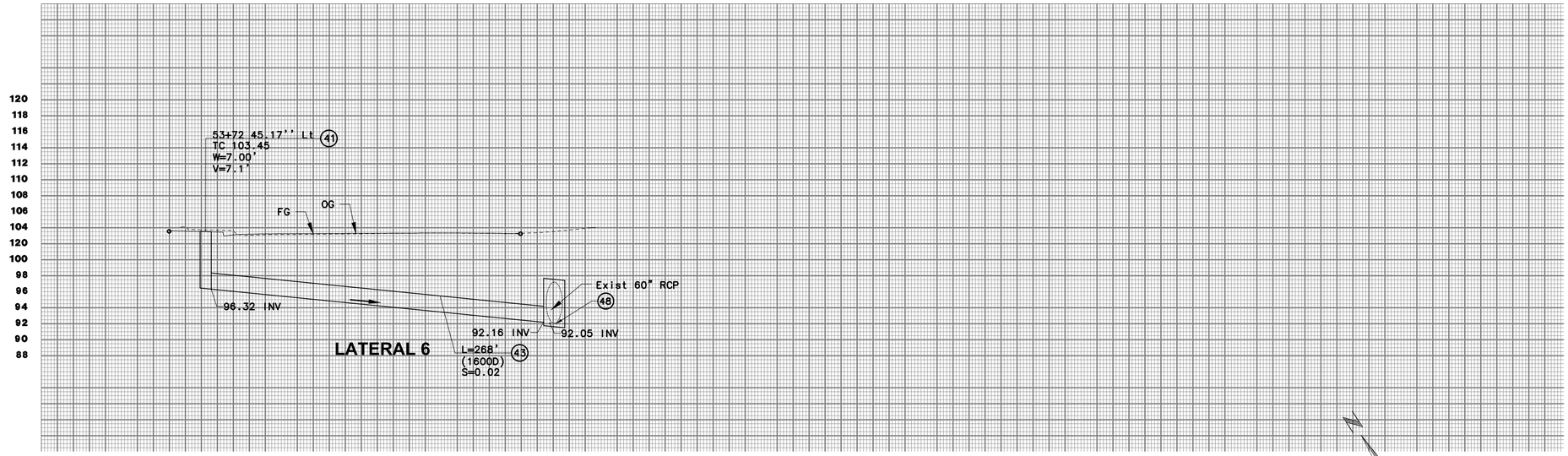
Drawn By P.B. Checked By A.V.

SHEET 19 OF 62

S:\FIRESTONE\CALTRANS.DWG REV. 07-15-97

DWG: J:\City of Norwalk-IR-19101-Firestone Blvd\CADD_2018\Sheets\IR-19101_D-PPM1.dwg USER: msoriano
DATE: Apr 02, 2020 11:46am

PROFILE
HORIZ. SCALE: 1"=40'
VERT. SCALE: 1"=8'



DISPOSITION NOTES:

A	PROTECT-IN-PLACE (ITEM AS NOTED)
B	REMOVE (ITEM AS NOTED)

CONSTRUCTION NOTES:

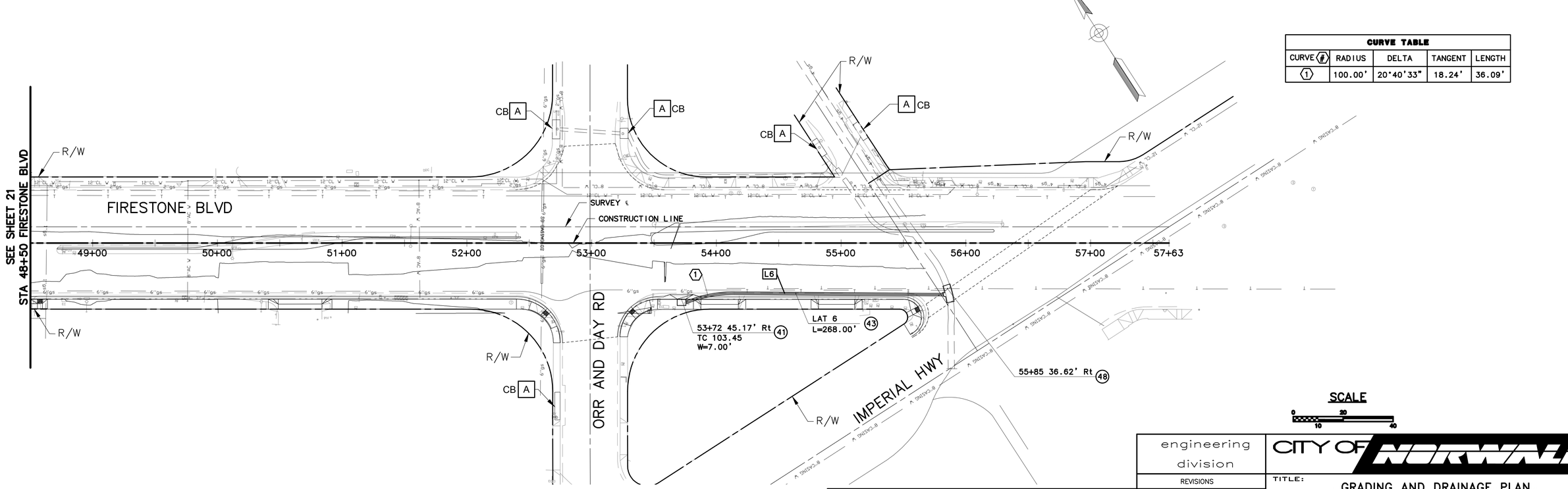
(41) CONSTRUCT CURB OPENING CATCH BASIN PER CITY OF NORWALK STD. PLAN NO. 300A.

(43) INSTALL 24" RCP.

(48) CONSTRUCT JUNCTION STRUCTURE PER CITY OF NORWALK STD. PLAN NO. 309A.

LINE TABLE	
LINE #	DIRECTION
L6	S56°38'14"E

CURVE TABLE				
CURVE #	RADIUS	DELTA	TANGENT	LENGTH
1	100.00'	20°40'33"	18.24'	36.09'



SCALE
0 20
10 40

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engineering division

REVISIONS

DATE	BY	
		AS BUILT

FIELD BOOK REF.

PLAN REF.

CITY OF NORWALK

TITLE:
GRADING AND DRAINAGE PLAN
FIRESTONE BOULEVARD WIDENING
FROM STUDEBAKER ROAD TO IMPERIAL HIGHWAY (PHASE 1)

Approved
CITY ENGINEER RCE 20568 DATE

Recommended
DATE

PROJECT NO.
7196.1

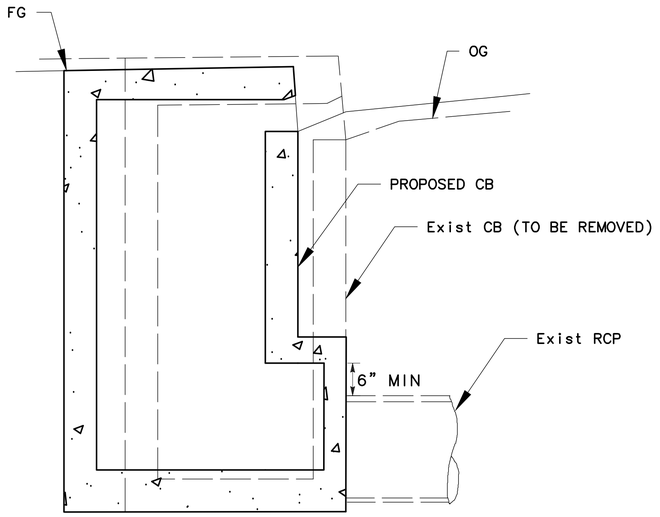
DRAWING NO.

Drawn By P.B. Checked By A.V.

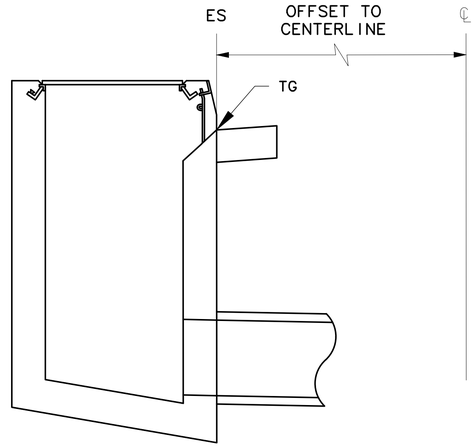
SHEET 20 OF 62

S:\FIRESTONE\CALTRANS.DWG REV. 07-15-97

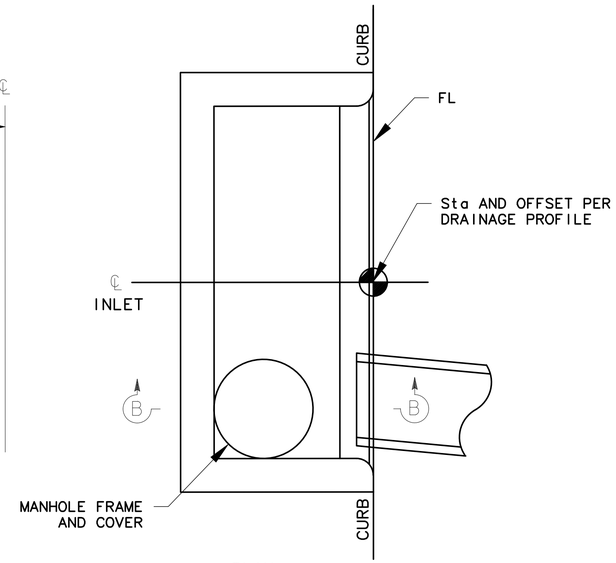
DWG: J:\City of Norwalk-IR-19101-Firestone Blvd\CADD_2018\Sheets\IR-19101_D-PPM1.dwg USER: msoriano
DATE: Apr 02, 2020 11:46am



REMOVE AND RECONSTRUCT CATCH BASIN

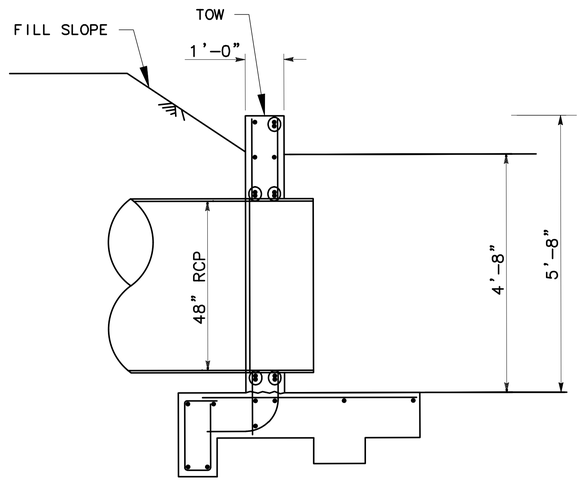


SECTION B–B



PLAN

CURB OPENING INLET LAYOUT CONTROL POINT



HEADWALL

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CIVIL
STATE OF CALIFORNIA

engineering division

REVISIONS

DATE	BY	
		AS BUILT

FIELD BOOK REF.

PLAN REF.

CITY OF NORWALK

TITLE: DRAINAGE DETAILS
FIRESTONE BOULEVARD WIDENING
FROM STUDEBAKER ROAD TO IMPERIAL HIGHWAY (PHASE 1)

Approved
CITY ENGINEER RCE 20568 DATE

Recommended
DATE

PROJECT NO. 7196.1

DRAWING NO.

Drawn By P.B. Checked By A.V.

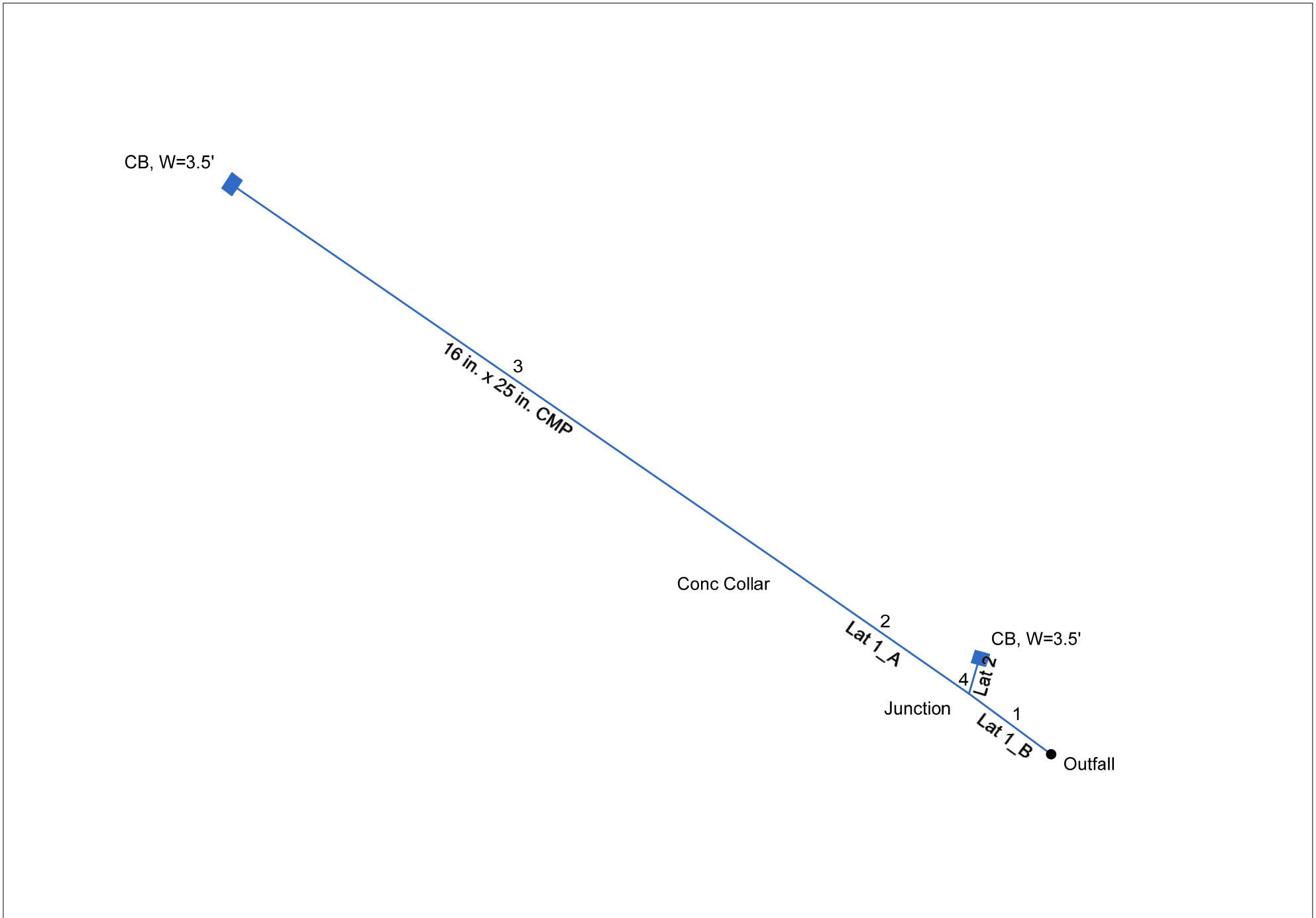
SHEET 25 OF 62

S:\FIRESTONE\CAL TRANS.DWG REV. 07-15-97

DWG: J:\City of Norwalk-IR-19101-Firestone Blvd\CADD_2018\Sheets\IR-19101_DD-PH1.dwg USER: msoriano
DATE: Apr 02, 2020 10:46am

ATTACHMENT E
HYDRAULIC CALCULATIONS

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Lat 1-2.stm	Number of lines: 4	Date: 4/2/2020

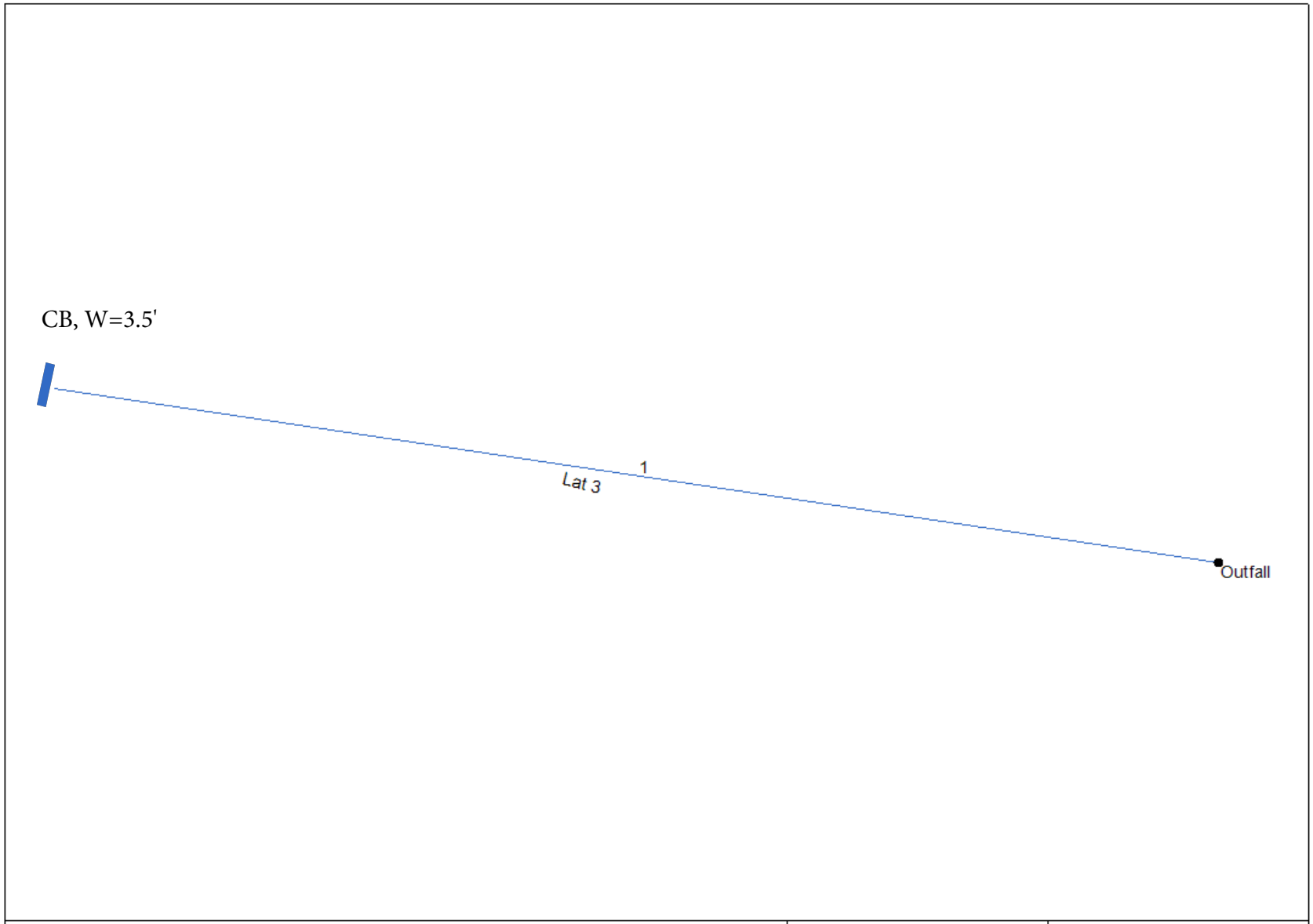
HGL Calc

Line No.	Line ID	Line Length (ft)	Line Size (in)	Inlet ID	Invert Dn (ft)	Invert Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	HGL Dn (ft)	HGL Up (ft)	EGL Dn (ft)	EGL Up (ft)	Flow Rate (cfs)	Vel Dn (ft/s)	
1	Lat 1_B	25.000	24	Junction	100.18	100.43	109.00	110.00	102.18	102.18	102.20	102.21	3.82	1.22	
2	Lat 1_A	53.000	24	Conc Collar	100.47	101.00	110.00	106.00	102.21	101.48	102.38	101.65	1.90	0.66	
3	16 in. x 25 in. CMP	165.609	18	CB, W=3.5'	101.34	103.00	106.00	110.00	101.76	103.50	101.94	103.68	1.76	4.41	
4	Lat 2	9.000	18	CB, W=3.5'	100.63	101.25	110.00	112.05	102.21	102.19	102.22	102.23	1.77	1.00	

Project File: Lat 1-2.stm | Number of lines: 4 | Date: 4/2/2020

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: System Lat 3.stm	Number of lines: 1	Date: 4/2/2020

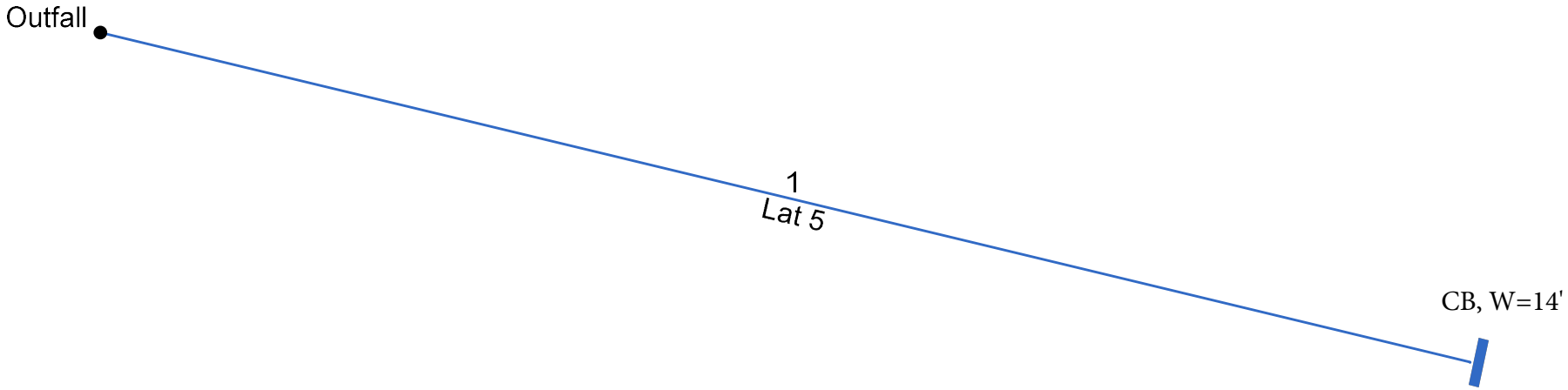
HGL Calc

Line No.	Line ID	Line Length (ft)	Line Size (in)	Inlet ID	Invert Dn (ft)	Invert Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	HGL Dn (ft)	HGL Up (ft)	EGL Dn (ft)	EGL Up (ft)	Flow Rate (cfs)	Vel Dn (ft/s)	
1	Lat 3	5.000	18	CB, W=3.5'	104.48	104.53	112.88	112.62	106.48	106.48	106.48	106.48	0.01	0.01	

Project File: Lat 3.stm | Number of lines: 1 | Date: 4/2/2020

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Lat 5 Results.stm	Number of lines: 1	Date: 4/2/2020

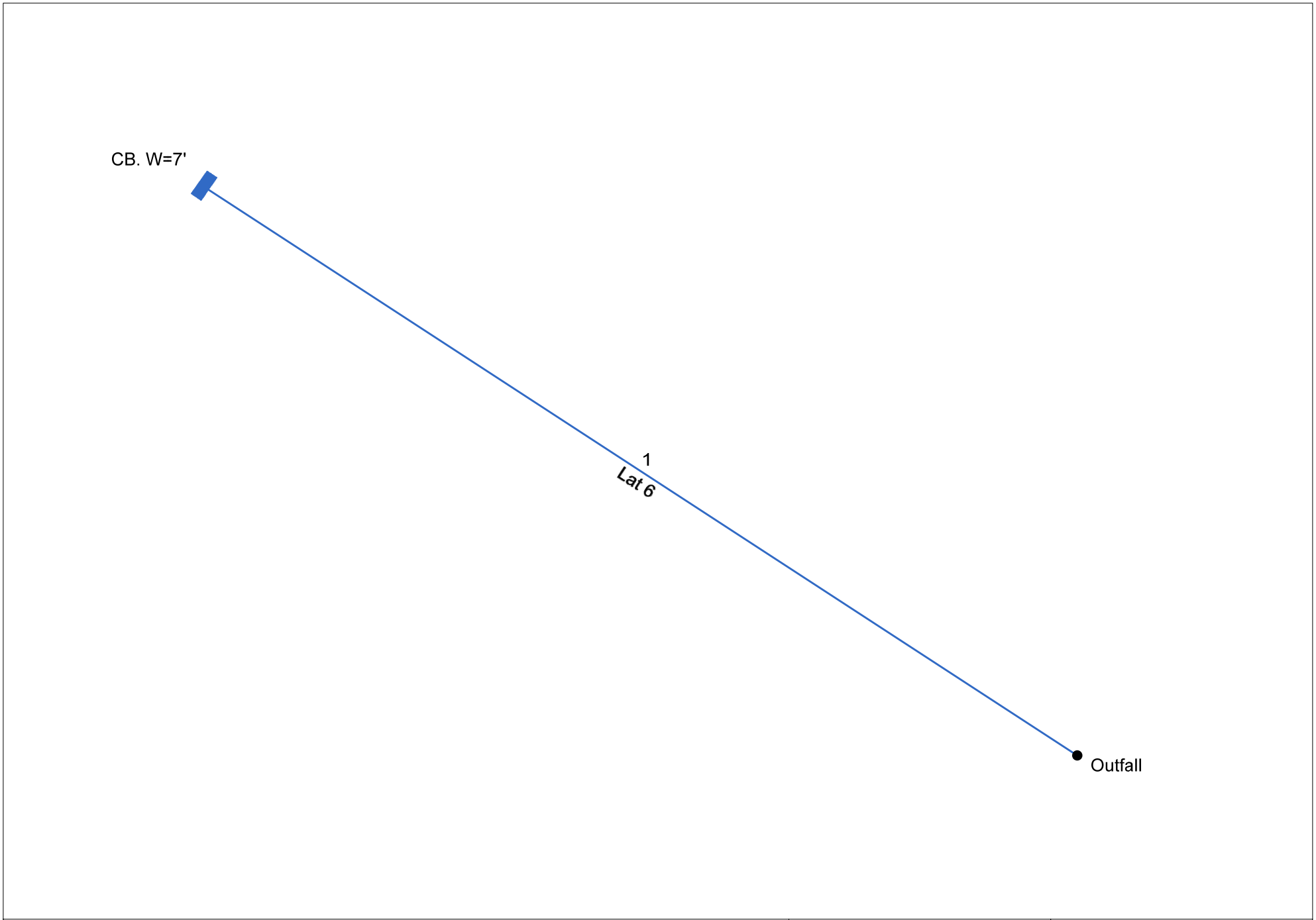
HGL Calc

Line No.	Line ID	Line Length (ft)	Line Size (in)	Inlet ID	Invert Dn (ft)	Invert Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	HGL Dn (ft)	HGL Up (ft)	EGL Dn (ft)	EGL Up (ft)	Flow Rate (cfs)	Vel Dn (ft/s)	
1	Lat 5	30.000	24	Inlet	92.95	93.27	105.22	104.82	94.95	94.95	94.96	94.97	2.75	0.88	

Project File: Lat 5 Results.stm | Number of lines: 1 | Date: 4/2/2020

NOTES: ** Critical depth

Hydraflow Storm Sewers Extension for Autodesk® AutoCAD® Civil 3D® Plan



Project File: Lat 6 Results.stm	Number of lines: 1	Date: 4/2/2020

HGL Calc

Line No.	Line ID	Line Length (ft)	Line Size (in)	Inlet ID	Invert Dn (ft)	Invert Up (ft)	Gnd/Rim El Dn (ft)	Gnd/Rim El Up (ft)	HGL Dn (ft)	HGL Up (ft)	EGL Dn (ft)	EGL Up (ft)	Flow Rate (cfs)	Vel Dn (ft/s)	
1	Lat 6	268.000	24	CB. W=7'	92.16	96.32	103.42	103.42	94.16	96.58 j	94.16	96.67	0.59	0.19	

Project File: Lat 6 Results.stm | Number of lines: 1 | Date: 4/2/2020

NOTES: ** Critical depth