Bradley Avenue Convalescent Home

Hydrology & Hydraulics Report

El Cajon, CA

June 10, 2024

Prepared for:
Generations Healthcare
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KHA Project # 194306001

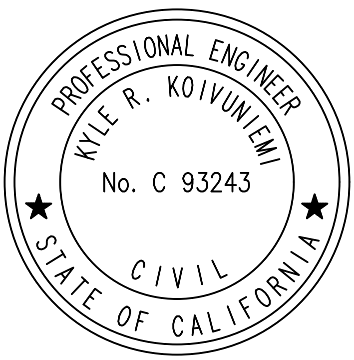
Declaration of Responsible Charge

I hereby declare that I am the Engineer of Work for this project. That I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

06/10/2024

Kyle R. Koivuniemi, P.E. # 58449 Date



Contents

1. PROJECT DESCRIPTION 5
a. Purpose of Study 5
b. Project Description 5
2. VICINITY MAP 6
3. DESCRIPTION OF WATERSHED 7
a. Pre-Developed Topography and Drainage Patterns 7
b. Post-Development Topography and Drainage Patterns 7
c. Hydrologic Unit Contribution 8
4. METHODOLOGY 8
a. Hydrology Software 9
b. Soils Type Determination 9
c. Isopluvial Value Determination 9
d. CEQA Requirements 9
e. Existing Public Storm Drain Flow Rates 10
5. CALCULATIONS 10
a. Determination of Drainage Area Parameters 10
b. Runoff Coefficient 11
c. Manning Roughness Coefficient 11
d. Rational Method Calculation Summary 11
e. Post-Developed Impact on Storm Drain Pipe in Bradley Avenue 13
6. FEMA FLOODPLAIN DATA 14
7. CONCLUSION 14
8. REFERENCES 15

Attachments:

Attachment 1: Figures & Tables

Attachment 2: Watershed Information

Hydrologic Basin Map

Rainfall Isopluvial Maps

Soil Group Map

Pre-Developed Drainage Map

Post Development Drainage Map

Attachment 3: Modified Rational Method Runoff Calculations

3a. AES Pre Development Calculations

3b. AES Post Development Calculations

Attachment 4: Hydraulics

4a. WSPG Calculations

Attachment 5: FEMA Floodplains/Floodways

Attachment 6: Off-site References

6a. Sheets Plans for Construction of Bradley Avenue Widening, City of El Cajon Drawing No. 14608, dated August 9, 2023.

6b. Bradley Avenue Widening Drainage Report references (Proposed On-Site Hydrology Map, Table D-1, Table D-1a, Stormcad exhibit, Stormcad profile reports) dated November 2019 completed by Dokken Engineering.

1. PROJECT DESCRIPTION

a. Purpose of Study

The purpose of this study is to support the site redevelopment plans for an existing commercial property located in the jurisdictional boundary of the County of San Diego. This study will demonstrate that the post-development 100-year peak runoff will not exceed existing peak runoff rates.

b. Project Description

The existing site composed of two skilled nursing facilities, a provided parking lot, and landscape area. The project fronts onto East Bradley Avenue and Sams Hill Road.

The project proposes to retain the two existing buildings and add two new healthcare buildings at the northern and southern portion of the site. The proposed sitework will include 73 new parking spaces, and a new fire lane access road allowing access to the rear of existing Building 2 and the new Building 3. A new driveway approach along Bradley Avenue will be placed for full fire truck access. New sewer, domestic water, and fire water (including one additional fire hydrant) will be provided with the sitework. Two trash enclosures for refuse and recycled goods will be provided. Along with new landscaping throughout the facility, site lighting will be installed to provide a minimum of 1.0 FC of lighting along all egress paths to the public way. The current facility is served by an existing emergency generator, a new generator will be provided to meet all air quality requirements. All work outside of the building envelops falls under local jurisdiction, with joint review and oversight by HCAi on some items such as Building Pad Certification, Fire Service Installation, etc. All necessary utilities (storm, sewer, etc.) will be installed as part of the project.

Normal uses of such a development will generate storm water runoff with the potential to carry pollutants to off-site tributaries. Biofiltration basins are planned to be incorporated throughout the site to treat and detain runoff from impervious and landscaped areas.

2. VICINITY MAP

The project is located at the East Bradley Avenue just southeast of the intersection of Sams Hill Road and East Bradley Avenue, in the county of San Diego, California.

3. DESCRIPTION OF WATERSHED

a. Pre-Developed Topography and Drainage Patterns

The site is an existing low-density commercial site composed of two skilled nursing facilities, a provided parking lot, and landscape area. The project fronts onto East Bradley Avenue. The project is bounded by onto East Bradley Avenue and Sams Hill Road to the southeast site. The property drains primarily by overland flow to two existing curb inlets located near the northeast corner of the site and northwest of the site along East Bradley Avenue. The project area can be split into 2 major drainage areas P6 and P9. These drainage areas are also reflected in the Drainage Report from the Bradley Ave Widening Project included in Attachment 6.

Drainage area P6 discharges to the existing catch basin near the northeast corner of the sites. This existing public curb inlet accepts runoff from drainage area P6. Drainage area P6 consists of the easter perimeter of the project site, neighboring properties to the east and the southern half of E Bradley Ave. Once the runoff enters the existing curb inlet, it is then piped to north via dual 18” storm drain pipes to the existing 66” pipe that runs within East Bradley Ave. Drainage area P9 makes up most of the project site and sheet flows to E Bradley Avenue. Drainage area P9 also includes the southern half of E Bradley Avenue as shown on the Existing Development Drainage Map. Runoff is collected in an existing curb inlet northwest of the site. This curb inlet also accepts runoff from drainage area P10 as shown in Attachment 6. Once the runoff enters the existing curb inlet, it is then piped to north via a 24” storm drain pipe to the existing 66” pipe.

The Point of Compliance, POC, will be at the connection between the existing 24” and existing 66” storm drain pipes, as described above. The soil type of the entire project site is Soil Type D.

The impervious square footage of the site was estimated based on aerial photography and detailed aerial topographic mapping to be approximately 22% of the site. The runoff coefficient is selected based on soil type and %IMPER. From table 3-1 “RUNOFF COEFFICIENTS FOR URBAN AREA”, the runoff coefficient of 25% imperviousness and Soil Type D will be used in the pre-development runoff calculations.

A pre-developed drainage map can be found as Attachment 2 in this report.

b. Post-Development Topography and Drainage Patterns

The project proposes to retain the two existing buildings and add two new healthcare buildings at the northern and southern portion of the site. Along with the additional new buildings the project proposes to add reconfigured parking spaces, drive isles, various patio areas and walkways throughout the site. As part of this project, associated improvements will include the south, the west, and the east parking lot with three bio-filtration basins BMP-A, BMP-B, BMP-C. BMP C will be used only for pollution control and flow control, while BMPs-A&B will used for pollution control and hydromodification control. All runoff from the existing and proposed areas sheet flow to a bio-filtration basin or to a curb and gutter where it then enters a bio-filtration basin by curb inlet curb-cut. Post-developed onsite runoff that was collected by the bio-filtration basins will be piped via a proposed 18" storm drain to the existing 66" pipe along East Bradley Ave at what is identified as the discharge point and continues downstream where it will confluence with the 24" storm drain pipe from the existing curb inlet northeast of the site, otherwise known as the POC. Offsite runoff will continue to sheetflow to their existing discharge points as described in the section above.

The total impervious area of the proposed onsite design is 101,263 sf over a site tributary area of 144,890 sf which results in a percent imperviousness of the site of 69%. The runoff coefficient is selected based on soil type and %IMPER. From table 3-1 "RUNOFF COEFFICIENTS FOR URBAN AREA", the runoff coefficient of 65% imperviousness and Soil Type D will be used in the post- development runoff calculations.

A post-developed drainage map can be found as Attachment 2 in this report.

c. Hydrologic Unit Contribution

The project site is located in the El Cajon Hydrologic Sub Area of the Lower San Diego Hydrologic Area of the San Diego Hydrologic Unit (907.13). The project is tributary to a public storm drain system that discharges to the San Diego River.

A map showing the project location with respect to the hydrologic basin areas can be found in Attachment 2 in this report.

4. METHODOLOGY

This report is prepared in accordance with the 2003 San Diego County Hydrology Manual (Hydrology Manual). Based on the overall tributary study area, calculations are based on the Rational Method. This report also refers to the calculations included in the "Bradley Avenue Widening Drainage Report" dated November 2019. This report was used to determined the additional runoff being conveyed to the existing public catch basins and pipes that impact the hydraulics of the underground storm drain system. The report was also used to determine a peak flow rate per acre for drainage area P9. This allowable peak flow rate is used to confirm the project proposed conditions does not exceed the peak flow rates utilized to design the public storm drain system along East Bradley Avenue.

a. Hydrology Software

The "San Diego County Rational Hydrology Program" by Hydrosoft AES Engineering Software, Version 18.0, refereed hereafter as "AES", was used to develop the rational method calculations. This program specifically utilizes the methods prescribed in the County of San Diego Hydrology Manual and is one of the approved programs for the use in the San Diego County area.

b. Soils Type Determination

The soils type for the project was assumed as soil type D.

c. Isopluvial Value Determination

The isopluvial values for the 100-year 6 hour and 24-hour storm events were determined by plotting the project's location on the respective exhibits from Appendix B of the Hydrology Manual.

d. CEQA Requirements

- The proposed project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site. No significant alteration of any stream or river will occur on this site due to grading operations. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes. The development of the site will help mitigate further erosion downstream.

- The proposed project does not create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. The flows from the project leave the site at less than predeveloped rates per the mitigated flow rates shown.

- The proposed project does not place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps. No housing is proposed and no FIRM-identified flood hazard areas are located on the parcel.

- The proposed project does not place structures within a 100-year flood hazard area which would impede or redirect flood flows. No FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam. No levees or dams are proposed and all runoff is being mitigated in properly designed flow control basins with redundancies. This will be noted in the conclusion.

e. Existing Public Storm Drain Flow Rates

The calculation was completed in Water Surface Pressure Gradient for Windowns (WSPGW) software to compare impacts to the hydraulic gradeline in the existing 66” RCP. The flow rates used in the WSPG analysis were obtained from the Dokken Bradley Avenue Widening Project report and adjusted based on the flows calculated in Section 5. Table 1 below provides a summary of the flow rate sources and references. Refer to Attachment 6 for a visual representation of these flow rates and reference pages from the Bradley Avenue Widening Project report.

Summary of Bradley Avenue Widening Project Flow Data

Table 1: Bradley Ave Widening Project Flow Data

Lateral	Station	Flow (cfs)	Source Page	Notes
66” RCP	86+54.32	302.05	Stormcad Profile Report - C28a – C31 – c32	Total flow from StormCAD pipe model
66” RCP	85+89.80 North	7.51	Table D-1	Runoff for watershed P5b nodes 81 to 38
66” RCP	85+89.80 South	9.52	Table D-1	Runoff for watershed P6e nodes 89 to 40
66” RCP	83+85.95 South	13.80	Table D-1	Runoff for watershed P7-P8 node 41 to 90
66” RCP	82+99.95 south	15.24	Table D-1b	Runoff for junction at node 46

5. CALCULATIONS

a. Determination of Drainage Area Parameters

The drainage area parameters are determined by delineating the extents and flow direction of runoff from each of the pre and post development drainage areas and measuring the respective changes in elevation, flow length and drainage area acreage. Proposed drainage areas were delineated for the worst-case scenario and assumes that 100-year flows bypass the low flow catch basins on grade located upstream of the biofiltration basin. See Attachments 1 and 2 of this report for the respective drainage area exhibits.

b. Runoff Coefficient

The runoff coefficients for each of the drainage areas are determined by AES by comparing the drainage area imperviousness and soil type to Table 3-1 of the Hydrology Manual. For this project, the land use is based on the average %IMPER, which is between 0% to 80%. Undisturbed Natural Terrain (Natural), Low Density Residential (2.0 DU/Acre or less), Medium Density Residential (7.3 DU/Acre or less), and Medium Density Residential (14.5 DU/Acre or less) are assumed for the pre- and the post-development conditions and the values for the respective soil types are used. Table 3-1 is included in the AES software and the values are chosen based on the program input parameters.

c. Manning Roughness Coefficient

Four values for the Manning Roughness Coefficient are used in the hydrology calculations. One for the overland flow travel time calculations, second for the pipe flow friction factor, and fourth for gutter flow calculations.

For fairly regular sections, the value for the roughness coefficient is taken from the Hydraulic Design Manual Table A-5. It is assumed that minor streams in this classification are some grass and weeds, light brush. The Manning's n factor for these classes of streams is 0.04.

For the closed conduit calculations, the value for the roughness coefficient is taken from the Hydraulic Design Manual Table A-2. It is assumed that pipe material of Smooth Plastic Pipe (HPDE and PVC), Spiral Rib Pipe, Reinforced Concrete Pipe (RCP), or a similar material will be used on the project. The Manning's n factor for this class of pipe material is 0.013.

For the gutter flow calculations, a value of 0.04 is used for existing conditions and 0.015 is used for proposed conditions. This is taken from the hydraulic design manual, Table A-1. It is conservatively assumed that the gutter sections are bare soil/grass for existing conditions and concrete for proposed conditions.

d. Rational Method Calculation Summary

The peak runoff values for the 100-year storm are calculated according to the Hydrology Manual rational method. The calculations are performed using the AES software. These calculations were completed for the runoff the discharges at the project's property lines. A summary of the calculations are summarized in the table below:

Summary Pre and Post Peak 100-Year Runoff

Table 2: Q100 Analysis Results

Pre-Developed				Post-Developed			
Node #	Area (Acres)	Tc (Min)	Q100 (cfs)	Node #	Area (Acres)	Tc (Min)	Q100 (cfs)
101	0.06	5.0	0.15	101	0	-	0
104	0.17	11.92	0.24	104	0.05	8.63	0.09
Subarea 6 Subtotal	*0.23*	-	*0.39*	*Subarea 6 Subtotal*	*0.05*	-	*0.09*
202	3.22	8.90	7.74	202	1.32	8.23	2.38
				206	0.48	6.48	1.01
				209	1.59	14.57	1.99
				401	0.01	5.05	0.03
Subarea 9 Subtotal	*3.22*	-	*7.74*	*Subarea 9 Subtotal*	*3.40*	-	*5.41*

*Note 1: Drainage Area runoff calculations included above only include the onsite areas and offsite areas that confluence with onsite areas prior to runoff discharging at the property line.

The onsite project area is part of drainage areas 6 and 9 as shown in the Bradley Avenue Widening Drainage Report excerpts included in Attachment 6. Most of the onsite project lies within drainage area 9 in existing conditions. Since the project is proposing to isolate the onsite area and discharge directly tot the existing 66” pipe along East Bradley Avenue, the peak flow rates at the discharge points for drainage area 6 and 9 as shown in the Bradley Avenue Drainage Report were also completed. The existing conditions peak flow rates are obtained from the Bradley Avenue Drainage Report. The proposed conditions peak flow rates for the portions of runoff from drainage areas 6 and 9 that extend beyond the project’s property lines were calculated by subtracting the existing peak flow rates in table 1 above from the Bradley Avenue Drainage Report peak flow rates. Table 3 below summarizes these calculations.

Table 3: Peak Flow Rate Comparison to Bradley Avenue Widening Road Drainage Report Analysis

<table>
<tr><th rowspan="2">Drainage Area</th><th colspan="2">Bradley Report</th><th colspan="2">Updated Bradley Report Post-Developed</th></tr>
<tr><th>Discharge Node</th><th>Q100 (cfs)</th><th>Discharge Node</th><th>Q100 (cfs)</th></tr>
<tr><td>6</td><td>40</td><td>9.50</td><td>40</td><td>9.22</td></tr>
<tr><td rowspan="2">9, 10</td><td rowspan="2">46</td><td rowspan="2">15.24</td><td>301</td><td>5.41</td></tr>
<tr><td>46</td><td>7.53</td></tr>
</table>

The analysis summarized in Table 1 shows that the proposed peak flow rates are less than pre-development flows. In addition, Table 2 shows that the updated proposed peak flow rates from the project site will not exceed that which was planned and shown in the Bradley Drainage Report included in Attachment 6. Both of these analyses show that the project is able to meet pre-development conditions requirements and thus does not require additional detention. The project is required to meet hydromodification requirements as shown in the project specific Stormwater Quality Management Plan prepared by Kimley-Horn. AES data and output files can be found in Attachment 3 of this report.

e. Post-Developed Impact on Storm Drain Pipe in Bradley Avenue

The point of discharge for the post-developed condition is where a proposed 18-inch storm drain line, which is carrying stormwater from the proposed site, connects with the existing 66-inch storm drain in Bradley Avenue. This point of discharge lies approximately 148 feet upstream along the 66-inch storm drain pipe from the project Point of Comparison (POC). The pre-developed POC is a specific point where stormwater flows that are generated from the subject property confluences with the existing 66-inch storm drain line and provides a common point when comparing pre- versus post- development.

The re-direction on-site flows upstream to the point of discharge adds this flow in the 66-inch storm drain along this 148-foot stretch of pipe. A hydraulic analysis to study the impact of this additional flow on the existing 66-inch pipe was performed using the WSPGW (Water Surface Pressure Gradient for Windows). WSPGW is a program that computes and plots uniform and non-uniform steady flow water surface profiles and pressure gradients in open channels or closed conduits with regular or irregular cross-sections. The Bradley Widening Drainage Report excerpts and plans are included in Attachment 6. The WSPGW calculations are included in Attachment 4. The additional runoff causes the 100-year HGL to rise by approximately 0.18 feet. The overall impact for a 100-year storm scenario is very minimal as the pipe continues to be in an open flow condition for a 100-year storm. Therefore, the diversion of the onsite flow upstream from the POC a distance of 148-feet is acceptable.

6. FEMA FLOODPLAIN DATA

The proposed site lies within a Flood Zone "X', which defines the area determined to be outside the 500-year flood and protected by levee from 100- year flood. FEMA Firmette is in Attachment 5.

7. CONCLUSION

Based on the results of this report, the project does not increase the 100-year peak flow rate of the mitigated stormwater discharge from the site as post-developed flows are lower than those of pre-development flows. The project meets the County of San Diego standards for peak flow control and therefore can be concluded that this project will not negatively impact the existing downstream storm drainage facilities.

This project does not sit within a 100-year flood hazard zone as mapped on the federal Flood Insurance Rate maps for this area.

- Although the project reroutes much of the surface flow from Bradley Ave that would be collected by the existing curb inlet northwest of the site to being directly piped to the existing 66" pipe. The proposed project does not substantially alter the existing drainage pattern of the site and area discharging to the existing 66" pipe. The minor alteration of the runoff does not substantially increase the rate or amount of runoff in a manner which would result in flooding on- or off-site. No significant alteration of any stream or river will occur on this site due to this project. All defined drainage channels are due to erosive effects of high velocity runoff from the uphill slopes.

- The proposed project does not create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems. The flows from the project leave the site at less than predeveloped rates shown above.

- The proposed project does not place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map, including County Floodplain Maps. No housing is proposed and no FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not place structures within a 100-year flood hazard area which would impede or redirect flood flows. No FIRM identified flood hazard areas are located on the parcel.

- The proposed project does not expose people or structures to a significant risk of loss, injury or death involving flooding as a result of the failure of a levee or dam. No levees or dams are proposed and all runoff is being mitigated in properly designed flow control basins with redundancies. This will be noted in the conclusion.

8. REFERENCES

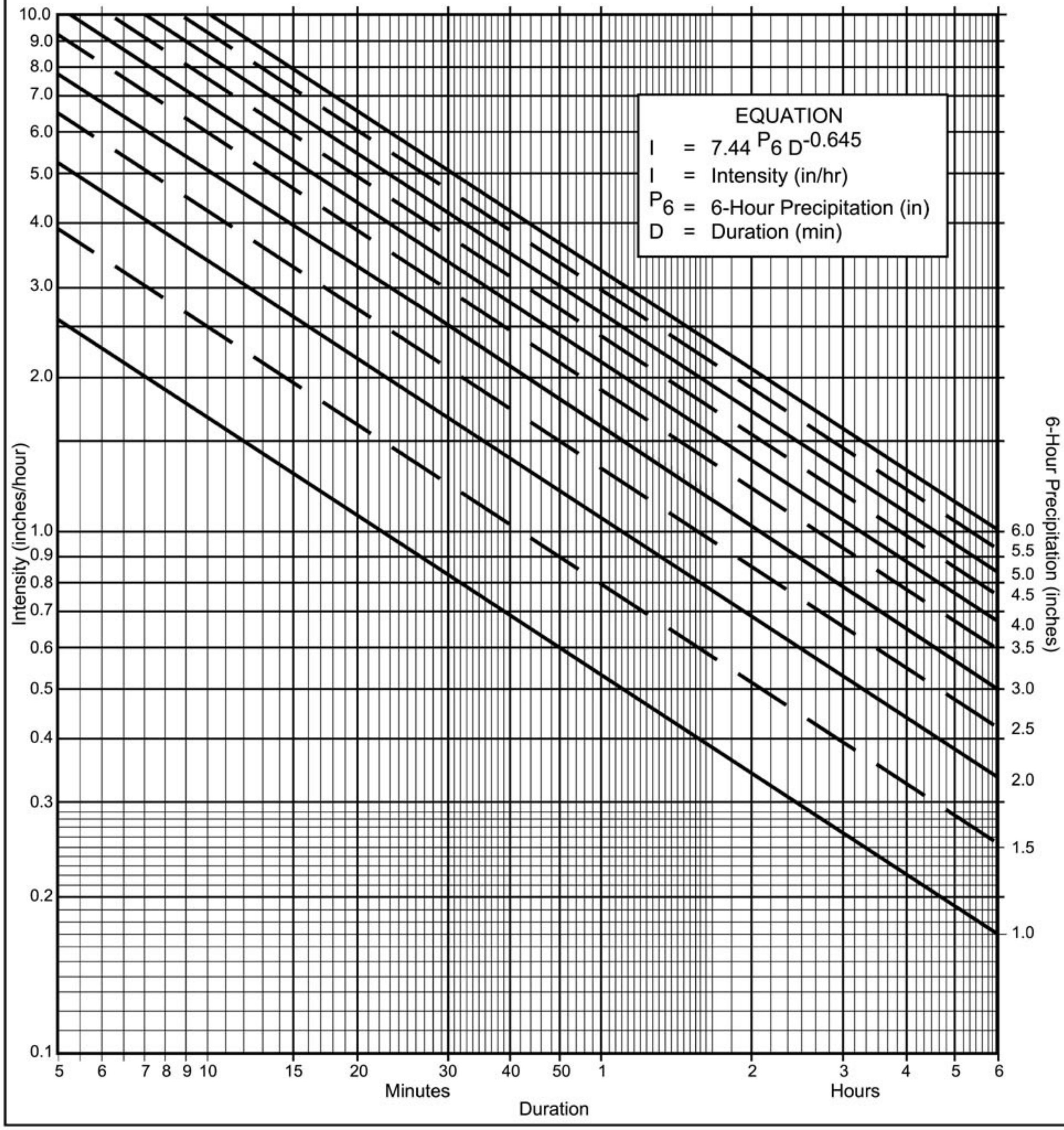
County of San Diego Hydrology Manual, June 2003

San Diego County Hydraulic Design Manual, September 2014

Bradley Avenue Widening, City of El Cajon Drawing No. 14608, August 9, 2023

Bradley Avenue Widening Drainage Report, November 2019

ATTACHMENT 1: Figures & Tables



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency ______ year

(b) P_6 = ______ in., P_{24} = ______ , $\frac{P_6}{P_{24}}$ = ______ %(2)

(c) Adjusted $P_6^{(2)}$ = ______ in.

(d) t_x = ______ min.

(e) I = ______ in./hr.

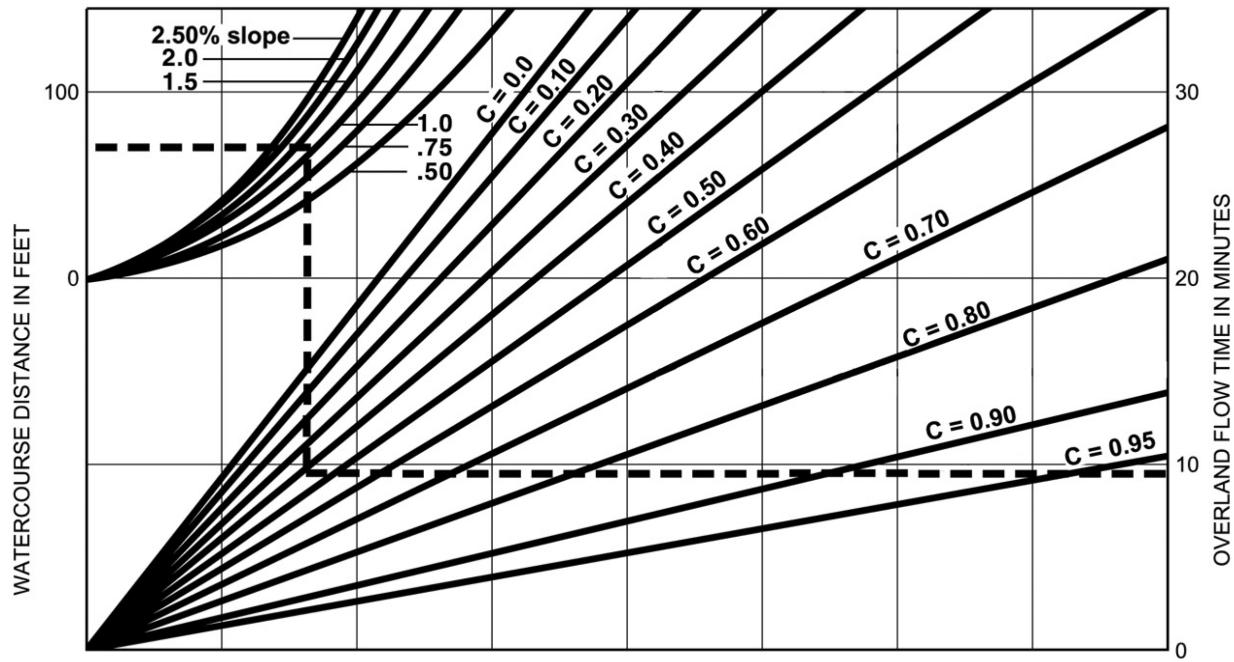
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet

Slope (s) = 1.3%

Runoff Coefficient (C) = 0.41

Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

Rational Formula - Overland Time of Flow Nomograph

FIGURE

3-3

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description

Table A-1

Table A-1 Average Manning Roughness Coefficients for Pavement and Gutters[1]

Concrete Gutter[2]	0.015
Concrete Pavement	
Float Finish	0.014
Broom Finish	0.016
Concrete Gutter with Asphalt Pavement	
Smooth Finish	0.013
Rough Texture	0.015
Asphalt Pavement	
Smooth Finish	0.013
Rough Texture	0.016

Based on FHWA HEC-22.

[1] Based on materials and workmanship required by standard specifications.
[2] Increase roughness coefficient in gutters with mild slopes where sediment might accumulate by 0.020.

Table A-2 Average Manning Roughness Coefficients for Closed Conduits[3]

Reinforced Concrete Pipe (RCP)	0.013
Corrugated Metal Pipe and Pipe Arch	
2-3/8 x 1/2 inch Corrugations	
Unlined	0.024
Half Lined	
Full Flow	0.018
d/D>=0.60	0.016
d/D<0.60	0.013
Fully Lined	0.013
3 x 1 inch Corrugations	0.027
6 x 2 inch Corrugations	0.032
Spiral Rib Pipe	0.013
Helically Wound Pipe	
18-inch	0.015
24-inch	0.017
30-inch	0.019
36-inch	0.021
42-inch	0.022
48-inch	0.023
Plastic Pipe (HPDE and PVC)	
Smooth	0.013
Corrugated	0.024
Vitrified Clay Pipe	0.014
Cast-Iron Pipe (Uncoated)	0.013
Steel Pipe	0.011
Brick	0.017
Cast-In-Place Concrete Pipe	
Rough Wood Forms	0.017
Smooth Wood or Steel Forms	0.014

[3] Based on materials and workmanship required by standard specifications.

Table A-5

Table A-5 Average Manning Roughness Coefficients for Natural Channels

Minor Streams (Surface Width at Flood Stage < 100 ft)

Fairly Regular Section

- (A) Some Grass and Weeds, Little or No Brush 0.030
- (B) Dense Growth of Weeds, Depth of Flow Materially Greater Than Weed Height 0.040
- (C) Some Weeds, Light Brush on Banks 0.040
- (D) Some Weeds, Heavy Brush on Banks 0.060
- (E) For Trees within Channel with Branches Submerged at High Stage, Increase All Above Values By 0.015

Irregular Section, with Pools, Slight Channel Meander

- Channels (A) to (E) Above, Increase All Values By 0.015

Mountain Streams; No Vegetation in Channel, Banks Usually Steep, Trees and Brush along Banks Submerged at High Stage

- (A) Bottom, Gravel, Cobbles and Few Boulders 0.050
- (B) Bottom, Cobbles with Large Boulders 0.060

Flood Plains (Adjacent To Natural Streams)

Pasture, No Brush

- (A) Short Grass 0.030
- (B) High Grass 0.040

Cultivated Areas

- (A) No Crop 0.040
- (B) Mature Row Crops 0.040
- (C) Mature Field Crops 0.050

Heavy Weeds, Scattered Brush 0.050

Light Brush and Trees 0.060

Medium To Dense Brush 0.090

Dense Willows 0.170

Cleared Land with Tree Stumps, 100-150 Per Acre 0.060

Heavy Stand of Timber, Little Undergrowth

- (A) Flood Depth below Branches 0.110
- (B) Flood Depth Reaches Branches 0.140

ATTACHMENT 2: Watershed Information

LEGEND

— — —	INDICATES DMA BOUNDARY
←·—·←	FLOW LINE
DX.X / X.XX	DRAINAGE AREA ID
	SUB AREA (AC)
——>	SD PIPE PATH
90	BRADLEY AVE WIDENING PROJECT REFERENCE NODE
100	EXISTING ONSITE NODE

NOTES

DRAINAGE AREA 9.E IS INCLUDED AS REFERENCE ONLY TO DETERMINE AN ALLOWABLE FLOW RATE FOR THE ONSITE PORTIONS OF DRAIANGE AREA 9.

NORTH

GRAPHIC SCALE IN FEET
0 10 20 40

COUNTY APPROVED CHANGES

DESCRIPTION:	APPROVED BY:	DATE:

PRIVATE CONTRACT

SHEET | COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS | SHEETS

GRADING PLAN FOR:

BRADLEY AVENUE CONVALESCENT HOME
PRE-DEVELOPMENT HYDROLOGY MAP

CALIFORNIA COORDINATE INDEX

APPROVED DIRECTOR OF PUBLIC WORKS BY:

ENGINEER OF WORK R.C.E.

GRADING PERMIT NO:

811
Know what's below. Call before you dig.
DIAL TOLL FREE
8 1 1
AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

REV.	SYMBOL	DESCRIPTION OF CHANGE	R.C.E.	DATE	P.D.E.	DATE

DESIGNED BY: LAC DATE
DRAWN BY: LAC DATE
CHECKED BY: KK DATE

ENGINEER'S SEAL

PREPARED BY:

KYLE KOIVUNIEMI, PE
REGISTERED ENGINEER

58449
RCE NUMBER

DATE REVISED:

ATTACHMENT 3: Modified Rational Method Runoff Calculations

3a. AES Pre Development Calculations

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
         (c) Copyright 1982-2011 Advanced Engineering Software (aes)
             Ver. 18.0 Release Date: 07/01/2011  License ID 1499

                           Analysis prepared by:

                      Kimley-Horn and Associates, Inc.
                             765 The City Drive
                                 Suite 200
                              Orange, CA 92868

 ************************** DESCRIPTION OF STUDY **************************
* Bradley Apartments                                                        *
* 100-Year Existing Conditions                                              *
* Kimley-Horn                                                               *
 **************************************************************************

  FILE NAME: BRADE.DAT
  TIME/DATE OF STUDY: 16:36 04/03/2024
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   8.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  LAWNS, GOLF COURSES, ETC. GOOD COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  80
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    52.00
  UPSTREAM ELEVATION(FEET) =    481.70
  DOWNSTREAM ELEVATION(FEET) =    467.00
  ELEVATION DIFFERENCE(FEET) =     14.70
```

```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.519
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.114
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.15
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.15

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  LAWNS, GOLF COURSES, ETC. GOOD COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  80
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    469.91
  DOWNSTREAM ELEVATION(FEET) =    453.61
  ELEVATION DIFFERENCE(FEET) =     16.30
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.150
  SUBAREA RUNOFF(CFS) =      0.13
  TOTAL AREA(ACRES) =      0.06   TOTAL RUNOFF(CFS) =      0.13

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    453.61
  DOWNSTREAM NODE ELEVATION(FEET) =    448.16
  CHANNEL LENGTH THRU SUBAREA(FEET) =   225.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0450
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.061
  LAWNS, GOLF COURSES, ETC. GOOD COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  80
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.66
  AVERAGE FLOW DEPTH(FEET) =   0.08   FLOOD WIDTH(FEET) =    8.98
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   5.66   Tc(MIN.) =   11.92
  SUBAREA AREA(ACRES) =    0.11       SUBAREA RUNOFF(CFS) =    0.16
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =       0.2         PEAK FLOW RATE(CFS) =       0.24

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.08   FLOOD WIDTH(FEET) =    9.70
  FLOW VELOCITY(FEET/SEC.) =   0.69   DEPTH*VELOCITY(FT*FT/SEC) =   0.06
  LONGEST FLOWPATH FROM NODE    102.00 TO NODE    104.00 =     325.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (2.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .4900
  SOIL CLASSIFICATION IS "D"
```

```
  S.C.S. CURVE NUMBER (AMC II) =  85
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    470.00
  DOWNSTREAM ELEVATION(FEET) =    466.38
  ELEVATION DIFFERENCE(FEET) =      3.62
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    7.027
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    96.55
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.712
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.16   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    466.38
  DOWNSTREAM NODE ELEVATION(FEET) =    439.25
  CHANNEL LENGTH THRU SUBAREA(FEET) =   497.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.904
  RESIDENTIAL (2.9 DU/AC OR LESS) RUNOFF COEFFICIENT = .4900
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  85
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.13
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.42
  AVERAGE FLOW DEPTH(FEET) =   0.13   FLOOD WIDTH(FEET) =   18.15
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.87   Tc(MIN.) =    8.90
  SUBAREA AREA(ACRES) =    3.06       SUBAREA RUNOFF(CFS) =    7.35
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.490
  TOTAL AREA(ACRES) =        3.2         PEAK FLOW RATE(CFS) =       7.74

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.16   FLOOD WIDTH(FEET) =   24.18
  FLOW VELOCITY(FEET/SEC.) =   4.92   DEPTH*VELOCITY(FT*FT/SEC) =   0.77
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     597.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        3.2  TC(MIN.) =      8.90
  PEAK FLOW RATE(CFS)   =       7.74
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

ATTACHMENT 3: Modified Rational Method Runoff Calculations

3b. AES Post Development Calculations

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

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
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             Ver. 18.0 Release Date: 07/01/2011  License ID 1499

                           Analysis prepared by:

                      Kimley-Horn and Associates, Inc.
                             765 The City Drive
                                 Suite 200
                              Orange, CA 92868

 ************************** DESCRIPTION OF STUDY **************************
* BRADLEY                                                                  *
* PROPOSED CONDITIONS 100-YEAR                                             *
* KIMLEY-HORN                                                              *
 **************************************************************************

  FILE NAME: BRADP.DAT
  TIME/DATE OF STUDY: 17:59 04/03/2024
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   2.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   8.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    104.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  LAWNS, GOLF COURSES, ETC. GOOD COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  80
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   305.00
  UPSTREAM ELEVATION(FEET) =    459.84
  DOWNSTREAM ELEVATION(FEET) =    448.16
  ELEVATION DIFFERENCE(FEET) =     11.68
```

```
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.629
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =   100.00
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.003
  SUBAREA RUNOFF(CFS) =      0.09
  TOTAL AREA(ACRES) =      0.05   TOTAL RUNOFF(CFS) =      0.09

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  LAWNS, GOLF COURSES, ETC. POOR COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    470.20
  DOWNSTREAM ELEVATION(FEET) =    460.74
  ELEVATION DIFFERENCE(FEET) =      9.46
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.384
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.077
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    460.74
  DOWNSTREAM NODE ELEVATION(FEET) =    441.59
  CHANNEL LENGTH THRU SUBAREA(FEET) =   359.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.158
  LAWNS, GOLF COURSES, ETC. POOR COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.24
  AVERAGE FLOW DEPTH(FEET) =   0.09   FLOOD WIDTH(FEET) =   10.91
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.85   Tc(MIN.) =    8.23
  SUBAREA AREA(ACRES) =    1.21       SUBAREA RUNOFF(CFS) =    2.18
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        1.3         PEAK FLOW RATE(CFS) =       2.38

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.11   FLOOD WIDTH(FEET) =   15.01
  FLOW VELOCITY(FEET/SEC.) =   3.53   DEPTH*VELOCITY(FT*FT/SEC) =   0.39
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     459.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  LAWNS, GOLF COURSES, ETC. POOR COVER RUNOFF COEFFICIENT = .3500
```

```
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  USER SPECIFIED Tc(MIN.) =    5.000
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.114
  SUBAREA RUNOFF(CFS) =      0.17
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.17

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    457.10
  DOWNSTREAM NODE ELEVATION(FEET) =    454.90
  CHANNEL LENGTH THRU SUBAREA(FEET) =   145.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.019
  LAWNS, GOLF COURSES, ETC. POOR COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      0.61
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.63
  AVERAGE FLOW DEPTH(FEET) =   0.09   FLOOD WIDTH(FEET) =   10.19
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.48   Tc(MIN.) =    6.48
  SUBAREA AREA(ACRES) =    0.41       SUBAREA RUNOFF(CFS) =    0.86
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =       0.5         PEAK FLOW RATE(CFS) =      1.01

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.10   FLOOD WIDTH(FEET) =   13.32
  FLOW VELOCITY(FEET/SEC.) =   1.82   DEPTH*VELOCITY(FT*FT/SEC) =   0.18
  LONGEST FLOWPATH FROM NODE    204.00 TO NODE    206.00 =     504.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  LAWNS, GOLF COURSES, ETC. POOR COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   124.00
  UPSTREAM ELEVATION(FEET) =    469.51
  DOWNSTREAM ELEVATION(FEET) =    468.41
  ELEVATION DIFFERENCE(FEET) =      1.10
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =   11.370
  WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
           THE MAXIMUM OVERLAND FLOW LENGTH =    65.48
           (Reference: Table 3-1B of Hydrology Manual)
           THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.188
  SUBAREA RUNOFF(CFS) =      0.10
  TOTAL AREA(ACRES) =      0.07   TOTAL RUNOFF(CFS) =      0.10

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    468.41
  DOWNSTREAM NODE ELEVATION(FEET) =    439.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   625.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.050
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0130
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   5.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.568
  LAWNS, GOLF COURSES, ETC. POOR COVER RUNOFF COEFFICIENT = .3500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  89
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.06
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.25
  AVERAGE FLOW DEPTH(FEET) =   0.08   FLOOD WIDTH(FEET) =    9.22
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.20   Tc(MIN.) =   14.57
  SUBAREA AREA(ACRES) =    1.52       SUBAREA RUNOFF(CFS) =    1.90
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        1.6         PEAK FLOW RATE(CFS) =       1.99

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.10   FLOOD WIDTH(FEET) =   13.32
  FLOW VELOCITY(FEET/SEC.) =   3.57   DEPTH*VELOCITY(FT*FT/SEC) =   0.36
  LONGEST FLOWPATH FROM NODE    207.00 TO NODE    209.00 =     749.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RESIDENTIAL (1. DU/AC OR LESS) RUNOFF COEFFICIENT = .4100
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  82
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    14.00
  UPSTREAM ELEVATION(FEET) =    442.00
  DOWNSTREAM ELEVATION(FEET) =    439.47
  ELEVATION DIFFERENCE(FEET) =      2.53
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.157
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.114
  NOTE: RAINFALL INTENSITY IS BASED ON Tc = 5-MINUTE.
  SUBAREA RUNOFF(CFS) =      0.03
  TOTAL AREA(ACRES) =      0.01   TOTAL RUNOFF(CFS) =      0.03
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        0.0  TC(MIN.) =      2.16
  PEAK FLOW RATE(CFS)   =       0.03
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

ATTACHMENT 4: Hydraulics

4a. WSPG Calculations

```
T1 Bradley Terraces                                                        0
T2 Existing Conditions 100-Yr
T3 Kimley-Horn
SO   7923.680 419.930  1                           424.888
R    8298.950 426.600  1      .013                                  .000    .000 0
JX   8300.950 426.610  1  2   .013   15.240          426.610         90.0         .000
R    8384.950 427.530  1      .013                                  .000    .000 0
JX   8386.950 427.550  1  2   .013   13.800          429.650         90.0         .000
R    8588.300 432.830  1      .013                                  .000    .000 0
JX   8591.300 432.840  1  3  3.013    7.510    9.520 432.840 432.840-90.0 90.0    .000
R    8654.320 433.840  1      .013                                  .000    .000 0
SH   8654.320 433.840  1                           433.840
CD   1  4   1    .000   5.500     .000  .000  .000   .00
CD   2  4   1    .000   2.000     .000  .000  .000   .00
CD   3  4   2    .000   1.500     .000  .000  .000   .00
Q          302.050   .0
```

```
 FILE: BradleyE.WSW                             W S P G W - CIVILDESIGN Version 14.08                                  PAGE    1
                                          Program Package Serial Number: 7152
                                                             WATER SURFACE PROFILE LISTING                    Date: 6-10-2024  Time: 3:32:15
                                    Bradley Terraces
                                      Existing Conditions 100-Yr
                                        Kimley-Horn
 ************************************************************************************************************************ ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy  | Super  |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.|  Elev  | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |         SF Ave|    HF    |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
 *********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |               |          |        |        |        |       |       |      |
 7923.681   419.930   3.737   423.667    348.12   20.25     6.37   430.04      .00     5.01     5.13    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
  153.945    .0178                                        .0160     2.46     3.74     1.95     3.65    .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8077.626   422.666   3.842   426.508    348.12   19.64     5.99   432.50      .00     5.01     5.05    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
  116.530    .0178                                        .0146     1.70     3.84     1.85     3.65    .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8194.156   424.737   4.016   428.754    348.12   18.73     5.45   434.20      .00     5.01     4.88    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
   64.883    .0178                                        .0131      .85     4.02     1.69     3.65    .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8259.039   425.891   4.206   430.097    348.12   17.86     4.95   435.05      .00     5.01     4.67    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
   39.911    .0178                                        .0118      .47     4.21     1.54     3.65    .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8298.950   426.600   4.416   431.016    348.12   17.03     4.50   435.52      .00     5.01     4.38    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
JUNCT STR   .0050                                         .0128      .03     4.42     1.39              .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8300.950   426.610   3.812   430.422    332.88   18.94     5.57   435.99      .00     4.95     5.07    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
   84.000    .0110                                        .0152     1.28     3.81     1.79     4.27    .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8384.950   427.530   3.668   431.198    332.88   19.78     6.07   437.27      .00     4.95     5.18    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
JUNCT STR   .0100                                         .0177      .04     3.67     1.93              .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8386.949   427.550   3.331   430.881    319.08   21.20     6.98   437.86      .00     4.88     5.38    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
   15.991    .0262                                        .0192      .31     3.33     2.23     3.03    .013      .00    .00  PIPE
         |         |        |         |         |               |          |        |        |        |       |       |      |
 8402.940   427.969   3.360   431.329    319.08   20.98     6.84   438.17      .00     4.88     5.36    5.500     .000    .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-     -|-     -|-    |-
```

57.664	.0262					.0179	1.03	3.36	2.20	3.03	.013	.00	.00	PIPE

Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING Date: 6-10-2024 Time: 3:32:15

Bradley Terraces

Existing Conditions 100-Yr

Kimley-Horn

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
8460.604	429.481	3.499	432.981	319.08	20.01	6.22	439.20	.00	4.88	5.29	5.500	.000	.00	1 .0
40.158	.0262					.0158	.64	3.50	2.03	3.03	.013	.00	.00	PIPE
8500.763	430.534	3.648	434.182	319.08	19.08	5.65	439.83	.00	4.88	5.20	5.500	.000	.00	1 .0
29.237	.0262					.0141	.41	3.65	1.87	3.03	.013	.00	.00	PIPE
8530.000	431.301	3.807	435.108	319.08	18.19	5.14	440.24	.00	4.88	5.08	5.500	.000	.00	1 .0
21.656	.0262					.0126	.27	3.81	1.72	3.03	.013	.00	.00	PIPE
8551.656	431.869	3.978	435.847	319.08	17.34	4.67	440.52	.00	4.88	4.92	5.500	.000	.00	1 .0
15.896	.0262					.0112	.18	3.98	1.58	3.03	.013	.00	.00	PIPE
8567.553	432.286	4.164	436.450	319.08	16.53	4.25	440.69	.00	4.88	4.72	5.500	.000	.00	1 .0
11.199	.0262					.0101	.11	4.16	1.44	3.03	.013	.00	.00	PIPE
8578.752	432.580	4.369	436.949	319.08	15.76	3.86	440.81	.00	4.88	4.45	5.500	.000	.00	1 .0
6.978	.0262					.0091	.06	4.37	1.30	3.03	.013	.00	.00	PIPE
8585.729	432.763	4.601	437.364	319.08	15.03	3.51	440.87	.00	4.88	4.07	5.500	.000	.00	1 .0
2.570	.0262					.0084	.02	4.60	1.16	3.03	.013	.00	.00	PIPE
8588.300	432.830	4.875	437.705	319.08	14.33	3.19	440.89	.00	4.88	3.49	5.500	.000	.00	1 .0
JUNCT STR	.0033					.0081	.02	4.88	1.00		.013	.00	.00	PIPE
8591.300	432.840	5.877	438.717	302.05	12.71	2.51	441.23	.00	4.78	.00	5.500	.000	.00	1 .0

```
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
   48.520    .0159                                        .0080      .39     5.88     .00    3.44    .013       .00    .00  PIPE
↑ FILE: BradleyE.WSW                          W S P G W - CIVILDESIGN Version 14.08                                         PAGE    3
                               Program Package Serial Number: 7152
                                              WATER SURFACE PROFILE LISTING                   Date: 6-10-2024  Time: 3:32:15
                          Bradley Terraces
                            Existing Conditions 100-Yr
                              Kimley-Horn
************************************************************************************************************************** ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|     |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)   Head  | Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |       SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|*****  |*******
         |         |        |         |         |              |         |       |        |        |       |       |      |
 8639.819   433.610    5.500   439.110    302.05   12.71    2.51   441.62     .00    4.78      .00    5.500     .000   .00   1    .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
   14.501    .0159                                        .0076      .11     5.50     .00    3.44    .013       .00    .00  PIPE
         |         |        |         |         |              |         |       |        |        |       |       |      |
 8654.320   433.840    5.334   439.174    302.05   12.83    2.55   441.73     .00    4.78     1.88    5.500     .000   .00   1    .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
↑
```

```
T1 Bradley Terraces                                                        0
T2 Proposed Conditions 100-Yr
T3 Kimley-Horn
SO   7923.680 419.930  1                           424.888
R    8298.950 426.600  1      .013                                  .000    .000 0
JX   8300.950 426.610  1  2   .013    7.530          426.610         90.0        .000
R    8384.950 427.530  1      .013                                  .000    .000 0

JX   8386.950 427.550  1  2   .013   13.800          429.650         90.0        .000
R    8447.620 429.170  1      .013                                  .000    .000 0

JX   8449.120 429.180  1  4   .013    8.340          431.260         90.0        .000
R    8588.300 432.830  1      .013                                  .000    .000 0
JX   8591.300 432.840  1  3  3.013    7.510    9.220 432.840 432.840-90.0 90.0    .000
R    8654.320 433.840  1      .013                                  .000    .000 0
SH   8654.320 433.840  1                           433.840
CD   1  4   1    .000   5.500     .000  .000  .000   .00
CD   2  4   1    .000   2.000     .000  .000  .000   .00
CD   3  4   2    .000   1.500     .000  .000  .000   .00
CD   4  4   1    .000   1.500     .000  .000  .000   .00
Q          302.050   .0
```

Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING Date: 6-10-2024 Time: 3:34: 0

Bradley Terraces

Proposed Conditions 100-Yr

Kimley-Horn

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
7923.680	419.930	3.728	423.658	348.45	20.32	6.41	430.07	.00	5.02	5.14	5.500	.000	.00	1 .0
26.785	.0178					.0167	.45	3.73	1.96	3.65	.013	.00	.00	PIPE
7950.465	420.406	3.738	424.144	348.45	20.26	6.38	430.52	.00	5.02	5.13	5.500	.000	.00	1 .0
201.030	.0178					.0157	3.16	3.74	1.95	3.65	.013	.00	.00	PIPE
8151.495	423.979	3.904	427.883	348.45	19.32	5.80	433.68	.00	5.02	4.99	5.500	.000	.00	1 .0
92.982	.0178					.0140	1.31	3.90	1.79	3.65	.013	.00	.00	PIPE
8244.478	425.632	4.084	429.715	348.45	18.42	5.27	434.98	.00	5.02	4.81	5.500	.000	.00	1 .0
54.473	.0178					.0126	.69	4.08	1.64	3.65	.013	.00	.00	PIPE
8298.950	426.600	4.280	430.880	348.45	17.56	4.79	435.67	.00	5.02	4.57	5.500	.000	.00	1 .0
JUNCT STR	.0050					.0127	.03	4.28	1.49		.013	.00	.00	PIPE
8300.950	426.610	3.978	430.588	340.92	18.53	5.33	435.92	.00	4.98	4.92	5.500	.000	.00	1 .0
84.000	.0110					.0141	1.19	3.98	1.69	4.37	.013	.00	.00	PIPE
8384.950	427.530	3.848	431.378	340.92	19.21	5.73	437.10	.00	4.98	5.04	5.500	.000	.00	1 .0
JUNCT STR	.0100					.0163	.03	3.85	1.80		.013	.00	.00	PIPE
8386.950	427.550	3.480	431.030	327.12	20.64	6.62	437.65	.00	4.92	5.30	5.500	.000	.00	1 .0
19.875	.0267					.0175	.35	3.48	2.10	3.06	.013	.00	.00	PIPE
8406.825	428.081	3.535	431.615	327.12	20.27	6.38	438.00	.00	4.92	5.27	5.500	.000	.00	1 .0

40.795	.0267					.0162	.66	3.53	2.04	3.06	.013	.00	.00	PIPE

Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING Date: 6-10-2024 Time: 3:34: 0

Bradley Terraces

Proposed Conditions 100-Yr

Kimley-Horn

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
8447.620	429.170	3.686	432.856	327.12	19.33	5.80	438.66	.00	4.92	5.17	5.500	.000	.00	1 .0
JUNCT STR	.0067					.0162	.02	3.69	1.88		.013	.00	.00	PIPE
8449.121	429.180	3.464	432.644	318.78	20.22	6.35	438.99	.00	4.87	5.31	5.500	.000	.00	1 .0
12.020	.0262					.0170	.20	3.46	2.07	3.03	.013	.00	.00	PIPE
8461.141	429.495	3.499	432.994	318.78	19.99	6.21	439.20	.00	4.87	5.29	5.500	.000	.00	1 .0
39.969	.0262					.0158	.63	3.50	2.03	3.03	.013	.00	.00	PIPE
8501.109	430.543	3.647	434.190	318.78	19.06	5.64	439.83	.00	4.87	5.20	5.500	.000	.00	1 .0
29.126	.0262					.0141	.41	3.65	1.87	3.03	.013	.00	.00	PIPE
8530.235	431.307	3.806	435.113	318.78	18.17	5.13	440.24	.00	4.87	5.08	5.500	.000	.00	1 .0
21.571	.0262					.0125	.27	3.81	1.72	3.03	.013	.00	.00	PIPE
8551.807	431.873	3.977	435.850	318.78	17.33	4.66	440.51	.00	4.87	4.92	5.500	.000	.00	1 .0
15.840	.0262					.0112	.18	3.98	1.58	3.03	.013	.00	.00	PIPE
8567.646	432.288	4.163	436.452	318.78	16.52	4.24	440.69	.00	4.87	4.72	5.500	.000	.00	1 .0
11.156	.0262					.0101	.11	4.16	1.44	3.03	.013	.00	.00	PIPE
8578.803	432.581	4.369	436.949	318.78	15.75	3.85	440.80	.00	4.87	4.45	5.500	.000	.00	1 .0
6.945	.0262					.0091	.06	4.37	1.30	3.03	.013	.00	.00	PIPE
8585.748	432.763	4.600	437.363	318.78	15.02	3.50	440.87	.00	4.87	4.07	5.500	.000	.00	1 .0

```
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-      -|-      -|-      |-
    2.552    .0262                                        .0084      .02     4.60    1.16    3.03    .013       .00   .00  PIPE
 FILE: BradleyP.WSW                         W S P G W - CIVILDESIGN Version 14.08                                           PAGE    3
                               Program Package Serial Number: 7152
                                            WATER SURFACE PROFILE LISTING                    Date: 6-10-2024  Time: 3:34: 0
                          Bradley Terraces
                            Proposed Conditions 100-Yr
                             Kimley-Horn
**************************************************************************************************************************** ********
          | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super  |Critical|Flow Top|Height/|Base Wt|      |No Wth
  Station | Elev    |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head |  Grd.El.| Elev   | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-      -|-      -|-     -|
  L/Elem  |Ch Slope |        |         |         |       SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
          |         |        |         |         |              |         |        |        |        |       |       |      |
 8588.300  432.830   4.874  437.704    318.78  14.32    3.18  440.89     .00    4.87     3.49    5.500     .000   .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-      -|-      -|-      |-
JUNCT STR   .0033                                         .0081      .02    4.87    1.00            .013       .00   .00  PIPE
          |         |        |         |         |              |         |        |        |        |       |       |      |
 8591.300  432.840   5.866  438.706    302.05  12.71    2.51  441.22     .00    4.78      .00    5.500     .000   .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-      -|-      -|-      |-
   47.031    .0159                                        .0080      .38    5.87     .00    3.44    .013       .00   .00  PIPE
          |         |        |         |         |              |         |        |        |        |       |       |      |
 8638.331  433.586   5.500  439.086    302.05  12.71    2.51  441.60     .00    4.78      .00    5.500     .000   .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-      -|-      -|-      |-
   15.989    .0159                                        .0075      .12    5.50     .00    3.44    .013       .00   .00  PIPE
          |         |        |         |         |              |         |        |        |        |       |       |      |
 8654.320  433.840   5.312  439.152    302.05  12.85    2.56  441.72     .00    4.78     2.00    5.500     .000   .00   1   .0
        -|-       -|-      -|-       -|-       -|-      -|-      -|-       -|-      -|-      -|-      -|-      -|-      -|-      |-
```

```
T1 Bradley Terraces                                                       0
T2 Node 206-300, 100-Year
T3 Kimley-Horn
SO       .000 434.730  1                           436.253
R      51.280 437.498  1      .013                                  .000 -45.000 0
JX     52.690 437.574  1  1   .013     .001          437.574           .0         .000
R     135.790 442.059  1      .013                                  .000 -22.000 0
R     170.380 443.926  1      .013                                  .000 -68.000 0
JX    172.110 444.020  1  1   .013     .010          444.020         22.0         .000
R     318.000 452.650  1      .013                                  .000    .000 0
SH    318.000 452.650  1                           452.650
CD   1  4   1    .000   1.000     .000  .000  .000   .00
Q             1.010   .0
```

FILE: Bradley206.WSW W S P G W - CIVILDESIGN Version 14.08 PAGE 1

Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING Date: 6-10-2024 Time: 3:41: 1

Bradley Terraces

Node 206-300, 100-Year

Kimley-Horn

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
.000	434.730	1.523	436.253	1.02	1.30	.03	436.28	.00	.42	.00	1.000	.000	.00	1 .0
9.912	.0540					.0008	.01	1.52	.00	.24	.013	.00	.00	PIPE
9.912	435.265	1.000	436.265	1.02	1.30	.03	436.29	.00	.42	.00	1.000	.000	.00	1 .0
1.675	.0540					.0008	.00	1.00	.00	.24	.013	.00	.00	PIPE
11.587	435.355	.907	436.263	1.02	1.36	.03	436.29	.00	.42	.58	1.000	.000	.00	1 .0
.956	.0540					.0007	.00	.91	.21	.24	.013	.00	.00	PIPE
12.544	435.407	.853	436.260	1.02	1.43	.03	436.29	.00	.42	.71	1.000	.000	.00	1 .0
.775	.0540					.0008	.00	.85	.25	.24	.013	.00	.00	PIPE
13.319	435.449	.809	436.258	1.02	1.50	.03	436.29	.00	.42	.79	1.000	.000	.00	1 .0
.667	.0540					.0009	.00	.81	.28	.24	.013	.00	.00	PIPE
13.986	435.485	.770	436.255	1.02	1.57	.04	436.29	.00	.42	.84	1.000	.000	.00	1 .0
.588	.0540					.0010	.00	.77	.32	.24	.013	.00	.00	PIPE
14.574	435.517	.735	436.252	1.02	1.65	.04	436.29	.00	.42	.88	1.000	.000	.00	1 .0
.441	.0540					.0011	.00	.74	.35	.24	.013	.00	.00	PIPE
15.015	435.540	.703	436.243	1.02	1.73	.05	436.29	.00	.42	.91	1.000	.000	.00	1 .0
HYDRAULIC JUMP														
15.015	435.540	.237	435.778	1.02	7.16	.80	436.57	.00	.42	.85	1.000	.000	.00	1 .0

36.265	.0540					.0540	1.96	.24	3.08	.24	.013	.00	.00	PIPE

Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING Date: 6-10-2024 Time: 3:41: 1

Bradley Terraces
Node 206-300, 100-Year
Kimley-Horn

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
51.280	437.498	.237	437.735	1.02	7.16	.80	438.53	.00	.42	.85	1.000	.000	.00	1 .0
JUNCT STR	.0539					.0540	.08	.24	3.08		.013	.00	.00	PIPE
52.690	437.574	.237	437.811	1.02	7.16	.80	438.61	.00	.42	.85	1.000	.000	.00	1 .0
54.138	.0540					.0540	2.92	.24	3.08	.24	.013	.00	.00	PIPE
106.828	440.496	.237	440.733	1.02	7.16	.80	441.53	.00	.42	.85	1.000	.000	.00	1 .0
28.962	.0540					.0540	1.56	.24	3.08	.24	.013	.00	.00	PIPE
135.790	442.059	.237	442.296	1.02	7.16	.80	443.09	.00	.42	.85	1.000	.000	.00	1 .0
15.940	.0540					.0540	.86	.24	3.08	.24	.013	.00	.00	PIPE
151.730	442.919	.237	443.156	1.02	7.16	.80	443.95	.00	.42	.85	1.000	.000	.00	1 .0
18.650	.0540					.0551	1.03	.24	3.08	.24	.013	.00	.00	PIPE
170.380	443.926	.235	444.161	1.02	7.27	.82	444.98	.00	.42	.85	1.000	.000	.00	1 .0
JUNCT STR	.0543					.0577	.10	.23	3.15		.013	.00	.00	PIPE
172.110	444.020	.231	444.251	1.01	7.38	.85	445.10	.00	.42	.84	1.000	.000	.00	1 .0
102.296	.0592					.0592	6.05	.23	3.22	.23	.013	.00	.00	PIPE
274.406	450.071	.231	450.302	1.01	7.38	.85	451.15	.00	.42	.84	1.000	.000	.00	1 .0
18.456	.0592					.0575	1.06	.23	3.22	.23	.013	.00	.00	PIPE
292.862	451.163	.234	451.397	1.01	7.23	.81	452.21	.00	.42	.85	1.000	.000	.00	1 .0

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          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
    9.642    .0592                                                 .0523      .50      .23    3.14     .23    .013       .00    .00  PIPE
↑ FILE: Bradley206.WSW                        W S P G W - CIVILDESIGN Version 14.08                                       PAGE    3
                                   Program Package Serial Number: 7152
                                                      WATER SURFACE PROFILE LISTING                   Date: 6-10-2024  Time: 3:41: 1
                             Bradley Terraces
                               Node 206-300, 100-Year
                                 Kimley-Horn
************************************************************************************************************************** ********
          | Invert   |  Depth |  Water   |    Q     |  Vel     Vel  |  Energy  | Super  |Critical|Flow Top|Height/|Base Wt|       |No Wth
  Station |  Elev    |  (FT)  |  Elev    |  (CFS)   | (FPS)   Head  | Grd.El.|  Elev  | Depth  | Width  |Dia.-FT|or I.D.|  ZL   |Prs/Pip
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-     -|
  L/Elem  |Ch Slope |        |          |          |         SF Ave|    HF    |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR   |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|*****  |*******
          |         |        |          |          |               |          |        |        |        |       |       |       |
  302.504   451.733     .242   451.975      1.01    6.89      .74   452.71      .00      .42      .86   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
    4.387    .0592                                                 .0458      .20      .24    2.94     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  306.891   451.993     .250   452.243      1.01    6.57      .67   452.91      .00      .42      .87   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
    2.737    .0592                                                 .0400      .11      .25    2.75     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  309.628   452.155     .259   452.413      1.01    6.27      .61   453.02      .00      .42      .88   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
    1.923    .0592                                                 .0350      .07      .26    2.57     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  311.551   452.269     .268   452.536      1.01    5.97      .55   453.09      .00      .42      .89   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
    1.444    .0592                                                 .0306      .04      .27    2.41     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  312.994   452.354     .277   452.631      1.01    5.70      .50   453.13      .00      .42      .89   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
    1.116    .0592                                                 .0268      .03      .28    2.25     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  314.110   452.420     .287   452.707      1.01    5.43      .46   453.16      .00      .42      .90   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
     .889    .0592                                                 .0235      .02      .29    2.11     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  314.999   452.473     .297   452.769      1.01    5.18      .42   453.19      .00      .42      .91   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
     .711    .0592                                                 .0205      .01      .30    1.97     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
  315.710   452.515     .307   452.821      1.01    4.94      .38   453.20      .00      .42      .92   1.000     .000    .00   1   .0
          -|-        -|-       -|-        -|-        -|-      -|-      -|-        -|-      -|-        -|-       -|-      -|-      -|-      |-
     .573    .0592                                                 .0180      .01      .31    1.85     .23    .013       .00    .00  PIPE
          |         |        |          |          |               |          |        |        |        |       |       |       |
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 316.283   452.548     .318   452.866      1.01    4.71     .34   453.21     .00     .42      .93   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .463    .0592                                        .0157      .01     .32    1.73     .23    .013       .00   .00  PIPE
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                           Program Package Serial Number: 7152
                                         WATER SURFACE PROFILE LISTING                   Date: 6-10-2024  Time: 3:41: 1
                       Bradley Terraces
                        Node 206-300, 100-Year
                          Kimley-Horn
************************************************************************************************************************** ********
         | Invert   |  Depth  |  Water   |    Q     |  Vel     Vel   |  Energy  | Super  |Critical|Flow Top|Height/|Base Wt|     |No Wth
 Station |  Elev    |  (FT)   |  Elev    |  (CFS)   | (FPS)    Head  | Grd.El.|  Elev  | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     -|
 L/Elem  |Ch Slope |         |          |          |         SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|*****  |*******
         |         |        |         |         |                |         |        |        |        |       |       |       |
 316.746   452.576     .329   452.905      1.01    4.49     .31   453.22     .00     .42      .94   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .371    .0592                                        .0138      .01     .33    1.62     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 317.117   452.598     .341   452.938      1.01    4.28     .28   453.22     .00     .42      .95   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .292    .0592                                        .0121      .00     .34    1.51     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 317.409   452.615     .353   452.968      1.01    4.08     .26   453.23     .00     .42      .96   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .224    .0592                                        .0106      .00     .35    1.41     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 317.634   452.628     .365   452.994      1.01    3.89     .24   453.23     .00     .42      .96   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .166    .0592                                        .0093      .00     .37    1.32     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 317.800   452.638     .378   453.016      1.01    3.71     .21   453.23     .00     .42      .97   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .112    .0592                                        .0082      .00     .38    1.23     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 317.912   452.645     .392   453.037      1.01    3.54     .19   453.23     .00     .42      .98   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .066    .0592                                        .0072      .00     .39    1.15     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 317.978   452.649     .406   453.055      1.01    3.37     .18   453.23     .00     .42      .98   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    .022    .0592                                        .0063      .00     .41    1.08     .23    .013       .00   .00  PIPE
         |         |        |         |         |                |         |        |        |        |       |       |       |
 318.000   452.650     .422   453.072      1.01    3.21     .16   453.23     .00     .42      .99   1.000     .000   .00  1   .0
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
```

```
T1 Bradley Terraces                                                     0
T2 Proposed Node 202-301
T3 Kimley-Horn
SO       .000 431.260  1                           432.856
R      89.500 434.720  1      .013                                  .000 -90.000 0
JX     93.500 434.730  2  1  0.013    1.010    1.990 434.730 434.730 45.0   .0    .000
R     199.000 437.350  2      .013                                  .000    .000 1
SH    199.000 437.350  2                           437.350
CD   1  4   1    .000   1.500     .000  .000  .000   .00
CD   2  4   1    .000   1.000     .000  .000  .000   .00
Q            2.380   .0
```

Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING Date: 6-10-2024 Time: 3:37:36

Bradley Terraces
Proposed Node 202-301
Kimley-Horn

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
.000	431.260	1.596	432.856	5.38	3.04	.14	433.00	.00	.89	.00	1.500	.000	.00	1 .0
3.850	.0387					.0026	.01	1.60	.00	.52	.013	.00	.00	PIPE
3.850	431.409	1.500	432.909	5.38	3.04	.14	433.05	.00	.89	.00	1.500	.000	.00	1 .0
1.364	.0387					.0024	.00	1.50	.00	.52	.013	.00	.00	PIPE
5.214	431.462	1.447	432.909	5.38	3.08	.15	433.06	.00	.89	.55	1.500	.000	.00	1 .0
HYDRAULIC JUMP														
5.214	431.462	.525	431.986	5.38	9.77	1.48	433.47	.00	.89	1.43	1.500	.000	.00	1 .0
26.555	.0387					.0370	.98	.52	2.78	.52	.013	.00	.00	PIPE
31.768	432.488	.533	433.021	5.38	9.56	1.42	434.44	.00	.89	1.44	1.500	.000	.00	1 .0
21.989	.0387					.0337	.74	.53	2.69	.52	.013	.00	.00	PIPE
53.758	433.338	.552	433.890	5.38	9.12	1.29	435.18	.00	.89	1.45	1.500	.000	.00	1 .0
10.669	.0387					.0295	.31	.55	2.52	.52	.013	.00	.00	PIPE
64.427	433.751	.572	434.322	5.38	8.69	1.17	435.50	.00	.89	1.46	1.500	.000	.00	1 .0
6.735	.0387					.0259	.17	.57	2.35	.52	.013	.00	.00	PIPE
71.162	434.011	.592	434.603	5.38	8.29	1.07	435.67	.00	.89	1.47	1.500	.000	.00	1 .0
4.737	.0387					.0227	.11	.59	2.20	.52	.013	.00	.00	PIPE
75.899	434.194	.614	434.808	5.38	7.90	.97	435.78	.00	.89	1.48	1.500	.000	.00	1 .0

3.510	.0387					.0199	.07	.61	2.05	.52	.013	.00	.00	PIPE

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
79.410	434.330	.636	434.966	5.38	7.54	.88	435.85	.00	.89	1.48	1.500	.000	.00	1 .0
2.685	.0387					.0175	.05	.64	1.91	.52	.013	.00	.00	PIPE
82.095	434.434	.660	435.094	5.38	7.19	.80	435.90	.00	.89	1.49	1.500	.000	.00	1 .0
2.080	.0387					.0154	.03	.66	1.79	.52	.013	.00	.00	PIPE
84.175	434.514	.684	435.198	5.38	6.85	.73	435.93	.00	.89	1.49	1.500	.000	.00	1 .0
1.618	.0387					.0135	.02	.68	1.67	.52	.013	.00	.00	PIPE
85.793	434.577	.710	435.287	5.38	6.53	.66	435.95	.00	.89	1.50	1.500	.000	.00	1 .0
1.246	.0387					.0119	.01	.71	1.55	.52	.013	.00	.00	PIPE
87.039	434.625	.737	435.362	5.38	6.23	.60	435.96	.00	.89	1.50	1.500	.000	.00	1 .0
.946	.0387					.0105	.01	.74	1.45	.52	.013	.00	.00	PIPE
87.985	434.661	.765	435.426	5.38	5.94	.55	435.97	.00	.89	1.50	1.500	.000	.00	1 .0
.689	.0387					.0092	.01	.76	1.35	.52	.013	.00	.00	PIPE
88.675	434.688	.794	435.482	5.38	5.66	.50	435.98	.00	.89	1.50	1.500	.000	.00	1 .0
.467	.0387					.0081	.00	.79	1.25	.52	.013	.00	.00	PIPE
89.142	434.706	.825	435.532	5.38	5.40	.45	435.98	.00	.89	1.49	1.500	.000	.00	1 .0
.268	.0387					.0072	.00	.83	1.16	.52	.013	.00	.00	PIPE
89.410	434.717	.858	435.575	5.38	5.15	.41	435.99	.00	.89	1.48	1.500	.000	.00	1 .0

```
          -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
      .090    .0387                                         .0063      .00      .86    1.08     .52    .013       .00    .00  PIPE
 FILE: Bradley18.WSW                        W S P G W - CIVILDESIGN Version 14.08                                         PAGE    3
                           Program Package Serial Number: 7152
                                                    WATER SURFACE PROFILE LISTING                 Date: 6-10-2024  Time: 3:37:36
                        Bradley Terraces
                          Proposed Node 202-301
                            Kimley-Horn
************************************************************************************************************************ ********
         | Invert  |  Depth |  Water  |    Q    |  Vel     Vel  |  Energy | Super |Critical|Flow Top|Height/|Base Wt|     |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)    Head | Grd.El.|  Elev | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-    -|
 L/Elem  |Ch Slope |        |         |         |        SF Ave|   HF    |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|*****  |*******
         |         |        |         |         |               |         |       |        |        |       |       |       |
  89.500  434.720     .894  435.614      5.38    4.90      .37  435.99      .00      .89     1.47    1.500     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
JUNCT STR   .0025                                          .0052      .02      .89    1.00             .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
  93.500  434.730    1.523  436.253      2.38    3.03      .14  436.40      .00      .66      .00    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
  25.750    .0248                                          .0044      .11     1.52      .00      .45    .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
 119.250  435.369    1.000  436.369      2.38    3.03      .14  436.51      .00      .66      .00    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
   2.695    .0248                                          .0041      .01     1.00      .00      .45    .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
 121.945  435.436     .907  436.344      2.38    3.18      .16  436.50      .00      .66      .58    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
HYDRAULIC JUMP
         |         |        |         |         |               |         |       |        |        |       |       |       |
 121.945  435.436     .454  435.891      2.38    6.85      .73  436.62      .00      .66     1.00    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
  12.745    .0248                                          .0248      .32      .45     2.05      .45    .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
 134.690  435.753     .454  436.207      2.38    6.85      .73  436.94      .00      .66     1.00    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
  33.052    .0248                                          .0239      .79      .45     2.05      .45    .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
 167.742  436.574     .465  437.039      2.38    6.65      .69  437.73      .00      .66     1.00    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
  13.670    .0248                                          .0215      .29      .46     1.96      .45    .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
 181.412  436.913     .482  437.396      2.38    6.34      .62  438.02      .00      .66     1.00    1.000     .000    .00   1    .0
        -|-       -|-      -|-       -|-       -|-      -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-      |-
   6.555    .0248                                          .0190      .12      .48     1.82      .45    .013       .00    .00  PIPE
         |         |        |         |         |               |         |       |        |        |       |       |       |
```

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  187.966   437.076     .501   437.577      2.38    6.05     .57   438.14     .00     .66    1.00    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    3.987   .0248                                             .0167     .07     .50    1.70     .45    .013      .00   .00  PIPE
```


Program Package Serial Number: 7152

WATER SURFACE PROFILE LISTING   Date: 6-10-2024 Time: 3:37:36

Bradley Terraces
Proposed Node 202-301
Kimley-Horn

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********************************************************************************************************************** ********
         | Invert  |  Depth |  Water  |    Q    |  Vel    Vel  |  Energy | Super  |Critical|Flow Top|Height/|Base Wt|      |No Wth
 Station |  Elev   |  (FT)  |  Elev   |  (CFS)  | (FPS)   Head |  Grd.El.|  Elev  | Depth  | Width  |Dia.-FT|or I.D.|  ZL  |Prs/Pip
        -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     -|
 L/Elem  |Ch Slope |        |         |         |       SF Ave|    HF   |SE Dpth|Froude N|Norm Dp |  "N"  | X-Fall|  ZR  |Type Ch
*********|*********|********|*********|*********|*******|*******|*********|*******|********|********|*******|*******|***** |*******
         |         |        |         |         |              |         |        |        |        |       |       |      |
  191.953   437.175     .520   437.695      2.38    5.77     .52   438.21     .00     .66    1.00    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    2.644   .0248                                             .0147     .04     .52    1.58     .45    .013      .00   .00  PIPE
         |         |        |         |         |              |         |        |        |        |       |       |      |
  194.597   437.241     .540   437.781      2.38    5.50     .47   438.25     .00     .66    1.00    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    1.804   .0248                                             .0130     .02     .54    1.47     .45    .013      .00   .00  PIPE
         |         |        |         |         |              |         |        |        |        |       |       |      |
  196.401   437.285     .561   437.847      2.38    5.24     .43   438.27     .00     .66     .99    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
    1.227   .0248                                             .0115     .01     .56    1.37     .45    .013      .00   .00  PIPE
         |         |        |         |         |              |         |        |        |        |       |       |      |
  197.628   437.316     .584   437.900      2.38    5.00     .39   438.29     .00     .66     .99    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
     .794   .0248                                             .0101     .01     .58    1.27     .45    .013      .00   .00  PIPE
         |         |        |         |         |              |         |        |        |        |       |       |      |
  198.422   437.336     .607   437.943      2.38    4.77     .35   438.30     .00     .66     .98    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
     .439   .0248                                             .0090     .00     .61    1.17     .45    .013      .00   .00  PIPE
         |         |        |         |         |              |         |        |        |        |       |       |      |
  198.862   437.347     .633   437.979      2.38    4.54     .32   438.30     .00     .66     .96    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
     .138   .0248                                             .0079     .00     .63    1.09     .45    .013      .00   .00  PIPE
         |         |        |         |         |              |         |        |        |        |       |       |      |
  199.000   437.350     .660   438.010      2.38    4.33     .29   438.30     .00     .66     .95    1.000     .000   .00   1   .0
         -|-       -|-      -|-       -|-       -|-     -|-     -|-       -|-     -|-      -|-      -|-     -|-     -|-     |-
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ATTACHMENT 5: FEMA Floodplains/Floodways

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). this information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

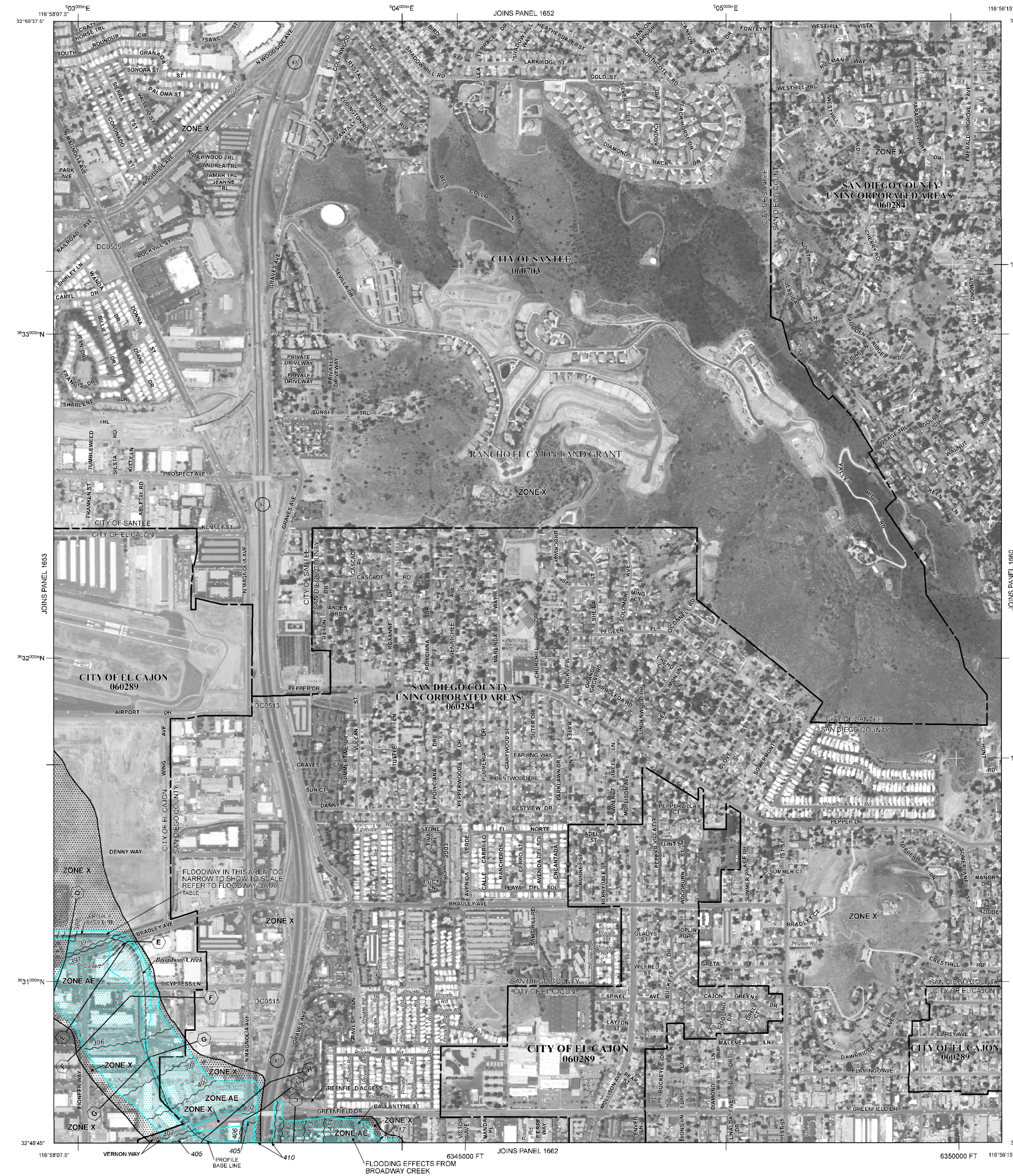
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-877-FEMA MAP (1-877-336-2627) for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip/.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

(A)——(A)	Cross section line
(23)- - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{42}75^{000m}$E	1000-meter Universal Transverse Mercator grid ticks, zone 11
6000000 FT	5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
May 16, 2012 – to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to update map elevations to North American Vertical Datum of 1988.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 250 500 750 1,000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1654G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 1654 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL CAJON, CITY OF	060289	1654	G
SAN DIEGO COUNTY	060284	1654	G
SANTEE, CITY OF	060703	1654	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1654G

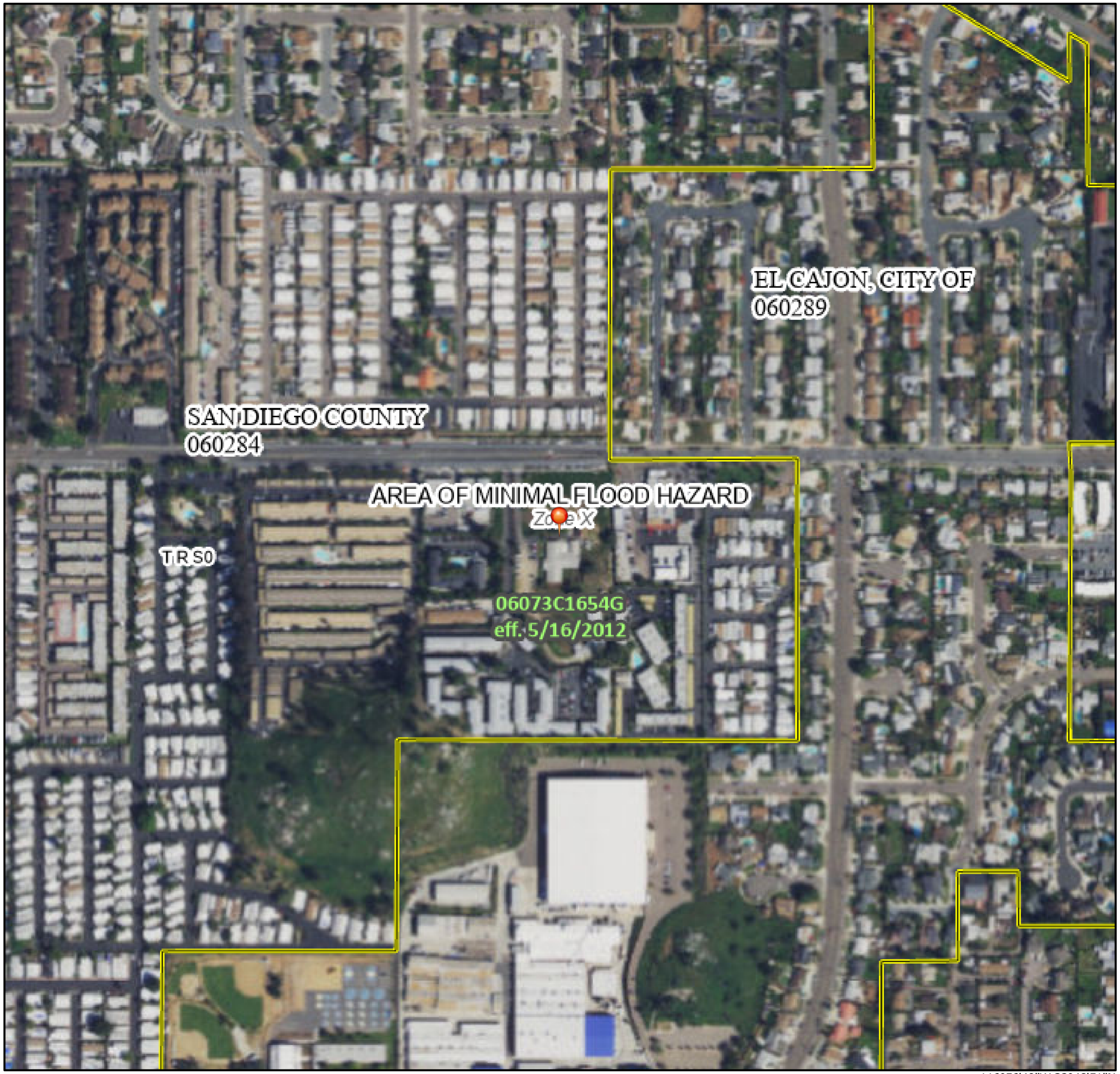
MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

116°57'27"W 32°49'22"N



Feet

0 250 500 1,000 1,500 2,000

1:6,000

116°56'49"W 32°48'51"N

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) *Zone A, V, A99*
		With BFE or Depth *Zone AE, AO, AH, VE, AR*
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
		Future Conditions 1% Annual Chance Flood Hazard *Zone X*
		Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
		Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN	Area of Minimal Flood Hazard *Zone X*
		Effective LOMRs
		Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES	B 20.2 / 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	8	Coastal Transect
	513	Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/26/2021 at 2:50 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT 6: Off-site Hydraulic Calculations

6a. Sheets Plans for Construction of Bradley Avenue Widening, City of El Cajon Drawing No. 14608, dated August 9, 2023.

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

PLANS	BY	DATE
DESIGNED	A. NADERHOFF	3/24/20
CHECKED	R. TORRES	3/24/20

REGISTERED PROFESSIONAL ENGINEER
Robert J Torres
No. C71378
Exp. 12-31-2023
STATE OF CALIFORNIA

REGISTERED ENGINEER 8/9/2023 DATE

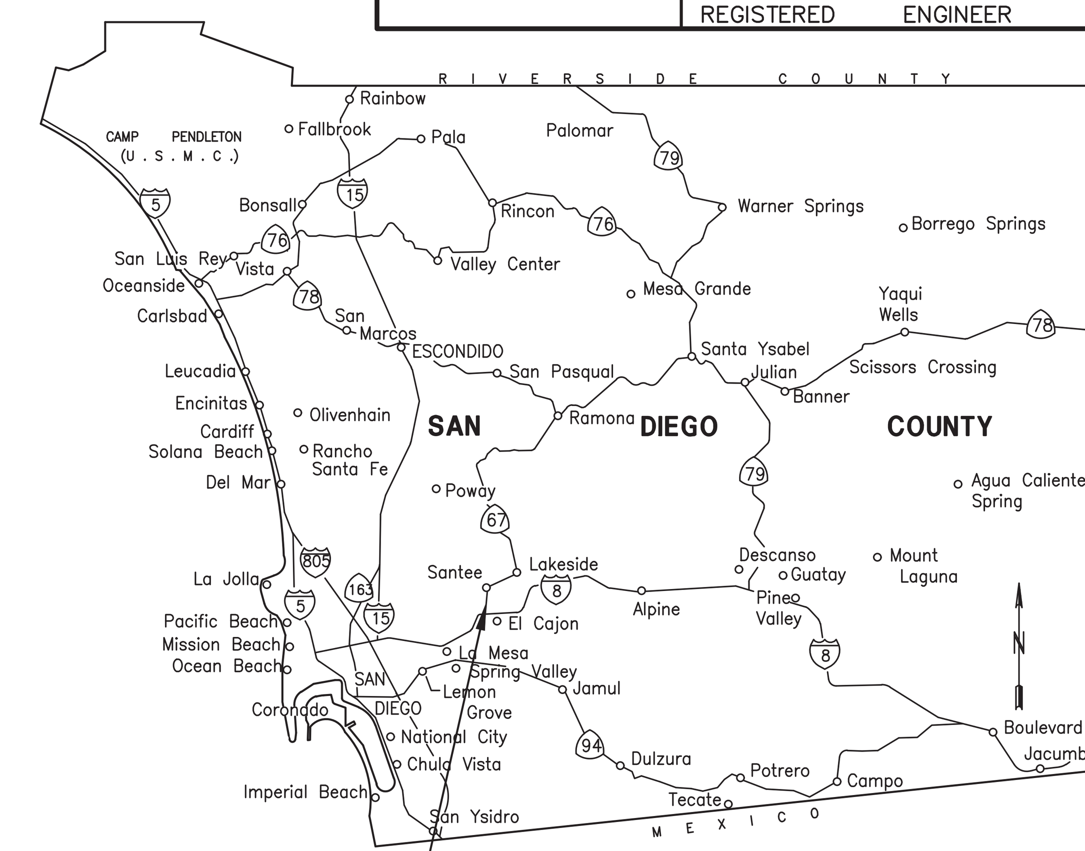
INDEX OF SHEETS

No.	Description
01	TITLE SHEET
02	NOTES, LEGEND, AND PLAN OVERVIEW
03–05	TYPICAL SECTIONS
06–10	DEMOLITION PLAN
11–20	PLAN AND PROFILE SHEET
21–23	PROFILE–DRIVEWAY
24	TRAFFIC SIGNAL PLAN SHEET
25–27	STREET LIGHTING PLAN SHEET
28–50	CONSTRUCTION DETAILS
51–58	PLAN AND PROFILE – STORM DRAIN
59–62	DETAILS – STORM DRAIN
63–70	SIGNING AND STRIPING PLAN
71	SIGNING AND STRIPING DETAILS
72–92	TRAFFIC CONTROL
93	TRAFFIC CONTROL – DETOUR PLAN
94–95	WATER POLLUTION CONTROL PLAN
96–97	WATER POLLUTION CONTROL DETAILS
98–104	IRRIGATION
105–110	PLANTING
111–116	SOUNDWALL GENERAL PLAN

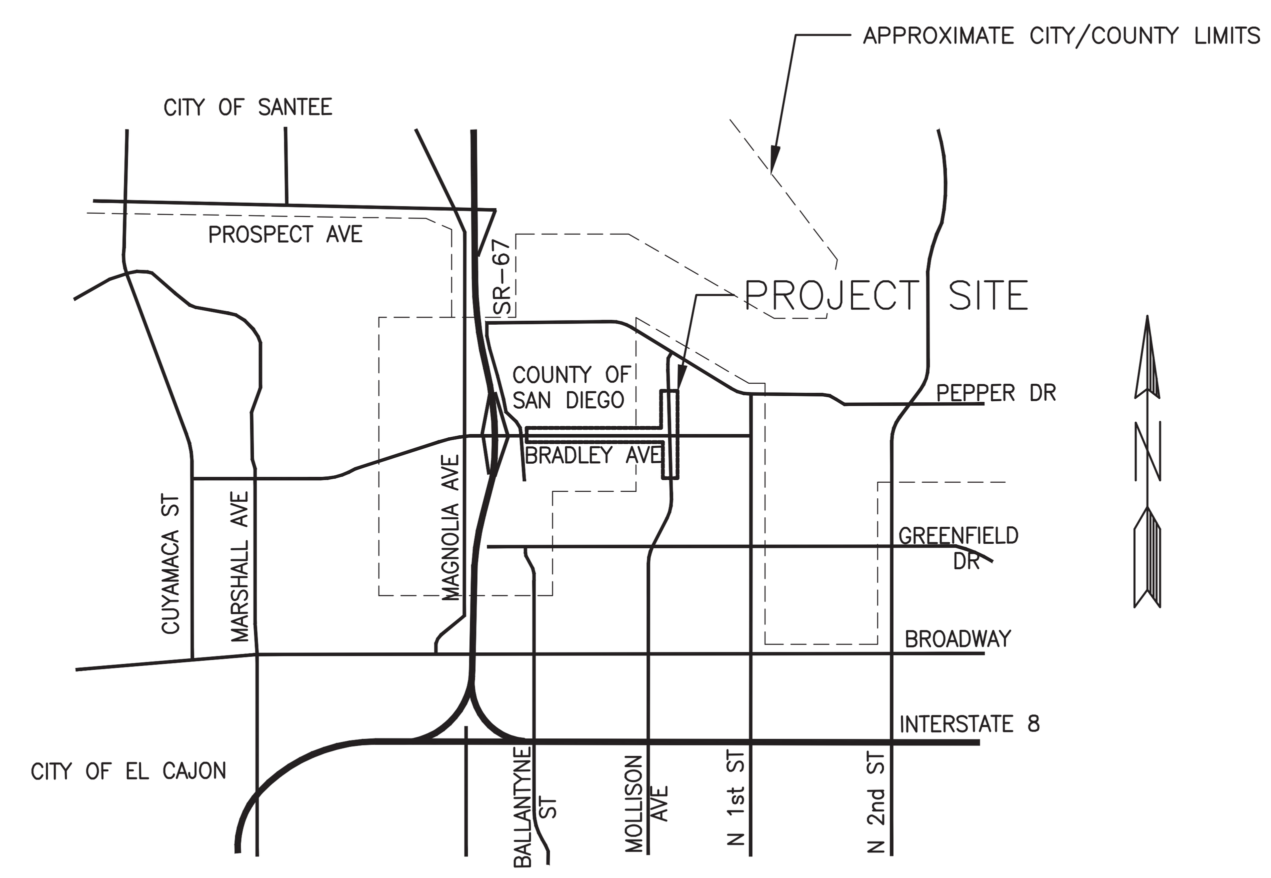
COUNTY OF SAN DIEGO, CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

PLANS FOR CONSTRUCTION OF BRADLEY AVENUE WIDENING RS 1171

In The Vicinity of El Cajon
LENGTH = 0.50 MILES



PROJECT LOCATION



VICINITY MAP

NO SCALE

THE CITY OF EL CAJON MUST BE NOTIFIED PRIOR TO THE START OF ANY TRAFFIC CONTROL, DEMOLITION OR CONSTRUCTION ACTIVITIES WITHIN ITS JURISDICTION. CALL THE CITY PUBLIC WORKS DEPARTMENT AT 619-441-1653 AT REQUEST TO BE CONNECTED WITH THE CITY PUBLIC WORKS INSPECTOR AND THE CITY STORM WATER INSPECTOR. NOTIFICATION VIA E-MAIL IS ACCEPTABLE AT:
STORMWATER@CITYOFELCAJON.US
PWINSPECTION@CITYOFELCAJON.US

GENERAL NOTES:

ATTENTION IS DIRECTED TO THE POSSIBLE EXISTENCE OF UNDERGROUND UTILITY FACILITIES NOT KNOWN OR IN A LOCATION DIFFERENT FROM THAT WHICH IS SHOWN ON THE PLANS OR IN THE SPECIAL PROVISIONS. THE CONTRACTOR SHALL TAKE STEPS TO ASCERTAIN THE EXACT LOCATION OF ALL UNDERGROUND FACILITIES PRIOR TO PERFORMING WORK THAT MAY DAMAGE SUCH FACILITIES OR INTERFERE WITH THEIR SERVICE. FORTY-EIGHT HOURS BEFORE EXCAVATING, THE CONTRACTOR SHALL VERIFY THE LOCATION OF UNDERGROUND FACILITIES BY CONTACTING UNDERGROUND SERVICE ALERT AT TELEPHONE 1-800-422-4133.

OPERATORS OF GRAVITY SEWER SYSTEMS AND CERTAIN OTHER UTILITIES, WHO ARE NOT MEMBERS OF UNDERGROUND SERVICE ALERT, MUST BE INDIVIDUALLY CONTACTED.

COUNTY OF SAN DIEGO DPW DESIGN SECTION

DATE

REVIEWED BY:

CITY OF EL CAJON JOB NO. 3417
CITY OF EL CAJON DRAWING NO. 14608

CITY OF EL CAJON
ENGINEERING DEPARTMENT
Mario Sanchez Digitally signed by Mario Sanchez Date: 2023.08.10 07:42:35 -07'00' DATE
CITY ENGINEER

RECOMMENDED BY: Jim Bolz Digitally signed by Jim Bolz Date: 2023.08.10 12:18:26 -07'00' DATE
Hanger, Christopher Digitally signed by Hanger, Christopher Date: 2023.08.14 09:51:14 -07'00' DATE

APPROVED BY: William Morgan Digitally signed by William Morgan Date: 2023.08.29 15:28:57 -07'00' DATE
William P. Morgan, County Engineer

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
5500 OVERLAND AVENUE, SAN DIEGO, CA 92123-1295

REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX
238 N. 1779 E.
CONST. COMPL.
FIELD REVISIONS

BRADLEY AVENUE WIDENING
In The Vicinity of EL CAJON
TITLE SHEET

SCALE: HOR. NONE VERT. NONE
W.A. 1003030 R.S. RS 1171
SHEET 01 OF 116 SHEETS

N:\Projects\1C1005\ED_Plans\C-SH01-T01.dwg Thursday, Aug. 10 2023 6:08am anaderho

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

-1 0 1 2 3 4 5 6 7 8 9 10

PLANS	BY	DATE
DESIGNED	A. NADERHOFF	3/24/20
CHECKED	R. TORRES	3/24/20

REGISTERED PROFESSIONAL ENGINEER
Robert J Torres
No. C71378
Exp. 12-31-2023
STATE OF CALIFORNIA

REGISTERED ENGINEER 8/9/2023 DATE

PROJECT STANDARD SPECIFICATIONS

STATE OF CALIFORNIA STANDARD SPECIFICATIONS, 2015

PROJECT STANDARD PLANS

SAN DIEGO COUNTY DESIGN STANDARDS (SDCDS), October 2012

DS-07, DS-10, DS-12, DS-13A, DS-13D, DS-13G, DS-21(A-F), DS-22

SAN DIEGO REGIONAL STANDARD DRAWINGS (SDRSD), December 2015

C-1, D-1, D-2, D-7, D-8, D-9, D-11A, D-11B, D-12, D-13, D-22, D-25, D-60, D-61, D-62, D-63, D-75, E-1, E-2, G-1, G-2, G-5, G-6, G-7, G-9, G-10, G-12, G-13, G-14A, G-14B, G-14D, G-14E (Mod), G-14G, G-30, L-3, M-1, M-2, M-45, SP-3, SP-9, TC-4, TC-21

CALTRANS STANDARD PLANS (CTSP), 2018

A3A, A3B, A3C, A10A, RSP A10B, A20A, A20B, A20C, A20D, A24A, A24D, A24E, A73B, A81A, A81B, RSP A85, B0-3, B2-3, B3-9, B15-2, B15-3, B15-5, B15-10, D73B, D73F, D73G, D77A, D77B, D-80, D-82, ES-1A, ES-1B, RSP ES-1C, ES-3A, RSP ES-3C, ES-4A, ES-4B, ES-4C, ES-4D, ES-4E, RSP ES-5A, RSP ES-5B, ES-5C, ES-5D, RSP ES-7F, ES-70, T2, T13, T56, T57, T58, T62

CITY OF EL CAJON IMPROVEMENT STANDARDS, 1987

FS-10

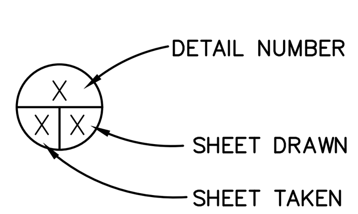
WATER AGENCIES' STANDARDS (WAS), 2014

WF-01, WI-02, WI-03, WP-08, WS-01, WS-02, WS-03, WS-05

STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION (SPPWC), 2012

225-2

DETAIL DRAWING



SURVEY NOTES

HORIZONTAL CONTROL

ALL BEARINGS, DISTANCES, STATIONS AND COORDINATES ARE GRID AND BASED ON CALIFORNIA COORDINATE SYSTEM, ZONE 6, NAD 83 (1991.35) DATUM. 1SR ORDER PROJECT CONTROL POINT '151WCCS1' PER ROS 16959 AND PROJECT POINTS 'BA XP3', 'PDC FP2'. 'BA FP35', AND 'PDC FP1' PER FIELDBOOK R1792 WERE USED TO CONTROL THE SURVEY HORIZONTALLY.

AT STATION '151WCCS1':
N = 1878415.8738
E = 6349217.4362
ELEV = 787.28
λ = -0°22'47.99" AT THE COMBINATION FACTOR = 0.99996187

$$\text{GROUND DISTANCE} = \frac{\text{GRID DISTANCE}}{\text{COMBINATION FACTOR}}$$

BENCH MARKS

DESIGNATION: EL CAJON #88

DESCRIPTION: STANDARD 3" BRASS DISC

LOCATION: STD BM T/C SOUTH END OF CURB RETURN AT SOUTHWEST CORNER OF MOLLISON & BRADLEY AVE

ELEVATION: 458.135

DATUM: NAVD 88

MONUMENTS

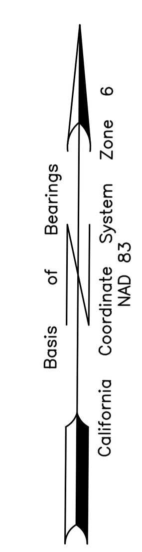
PRIOR TO CONSTRUCTION, THE COUNTY OF SAN DIEGO FIELD SURVEYS SECTION SHALL BE NOTIFIED REGARDING ANY CONTROL, MONUMENTS, OR BENCHMARKS THAT MAY BE DESTROYED BY CONSTRUCTION.

NOTE:

ALL DS-21(A-D) CURB RAMPS MUST HAVE 3'x4' TRUNCATED DOMES, PER DS-21F

PERMANENT WATER POLLUTION CONTROL BMP'S

1. SITE DESIGN BMP'S — SEE SHEETS 6-15, 44-50
2. SOURCE CONTROL BMP'S — SEE SHEETS 44-50
3. TREATMENT CONTROL BMP'S — SEE SHEETS 6-15, 44-50



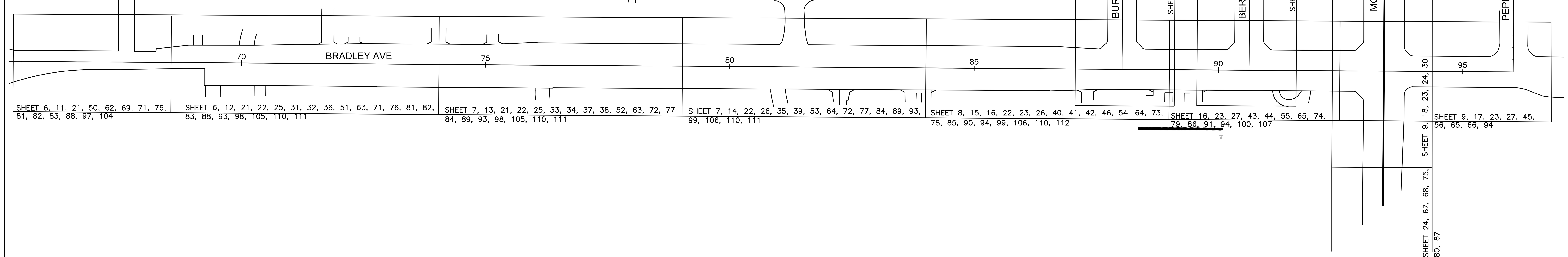
LEGEND OF IMPROVEMENTS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	CENTERLINE		EXIST CITY STREET LIGHT
	DWY CENTERLINE		EXIST POWER POLE LIGHT
	SAWCUT LINE		EXIST CURB INLET
	RIGHT OF WAY		EXIST RCP
	TCE		REMOVE EXIST UTILITY
	CUT/FILL LINE	TV	EXIST TELEVISION LINE
	SOUNDWALL	T	EXIST TELEPHONE LINE
	RETAINING CURB	E	EXIST ELECTRICAL LINE
	ESA	W	EXIST WATER LINE
	CONCRETE	G	EXIST GAS LINE
	AC ON AB	S	EXIST SEWER LINE
	PLANE AC PAVEMENT,AC PAVEMENT (ROADWAY)	WV	EXIST WATER VALVE
	PLANE AC PAVEMENT,AC PAVEMENT (DRIVEWAY)	GV	EXIST GAS VALVE
	PAVEMENT REMOVAL		EXIST WATER METER
	CELLULAR BLOCK (PRECAST)		EXIST DRAINAGE/SEWER MANHOLE
	BIOSWALE/RAIN GARDEN		EXIST SDGE POWER POLE/CABLE
	TRAFFIC PLASTIC DRUM		EXIST FIRE HYDRANT
	TYPE III BARRICADE		PROPOSED RCP
	SIGN	FR	TEMPORARY FIBER ROLL
	TYPE G CURB AND GUTTER	GBB	TEMPORARY GRAVEL BAG
	TYPE A CURB RAMPS		WOOD FENCE
	CITY STREET LIGHT		TEMPORARY INLET PROTECTION
	CURB INLET TYPE A-1		TEMPORARY DROP INLET PROTECTION
	CURB INLET TYPE B-1		TEMPORARY CONCRETE WASHOUT
	CURB INLET TYPE B		
	CURB INLET TYPE B-2		
	CLEANOUT TYPE A-4, A-7, A-8		
	HGL		
	EXIST CURB AND GUTTER		
	EXIST CURB RAMP		

ABBREVIATIONS

ABBREVIATION	DESCRIPTION	ABBREVIATION	DESCRIPTION
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS	P#	STORM DRAIN PIPE IDENTIFICATION NUMBER
APN	ASSESOR'S PARCEL NUMBER	RC	RELATIVE COMPACTION
BSW	BACK OF SIDEWALK	RG	RAIN GARDEN
CFS	CUBIC FEET PER SECOND	RS	ROAD SURVEY
C&G	CURB & GUTTER	SDCDS	SAN DIEGO COUNTY DESIGN STANDARD
CL	CENTERLINE	SDRSD	SAN DIEGO REGIONAL STANDARD DRAWING
CMPA	CORRUGATED METAL PIPE ARM	SPPWC	STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION
CTSP	CALTRANS STANDARD PLAN	T	TANGENT
EDGE	EDGE OF CONCRETE	TC	TOP OF CURB
FPS	FEET PER SECOND	TD	TOP OF DIKE
FT	FOOT	TPD	TEMPORARY PLASTIC DRUM
GB	GRADE BREAK	WAS	WATER AGENCIES' STANDARDS
HGL	HYDRAULIC GRADE LINE	WPC	WATER POLLUTION CONTROL
IE	INVERT ELEVATION		
NTS	NOT TO SCALE		
PVC	POLYVINYL CHLORIDE		
PVI	POINT OF VERTICAL INTERSECTION PAVEMENT		

KEY MAP
1"=100'



	REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX
238 N. 1779 E.
CONST. COMPL.
FIELD REVISIONS

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
5500 OVERLAND AVENUE, SAN DIEGO, CA 92123-1295

BRADLEY AVENUE WIDENING
In The Vicinity of EL CAJON
NOTES, LEGEND, AND PLAN OVERVIEW

SCALE: HOR. NONE VERT. NONE
W.A. 1003030 R.S. RS 1171
SHEET 02 OF 116 SHEETS

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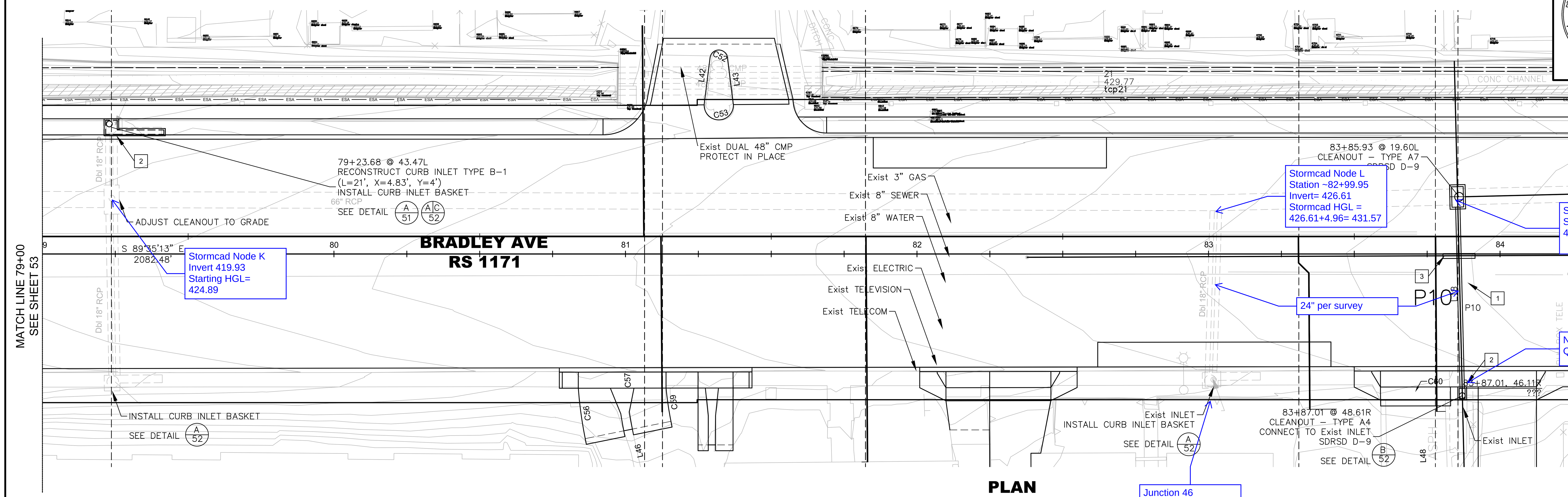
FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES

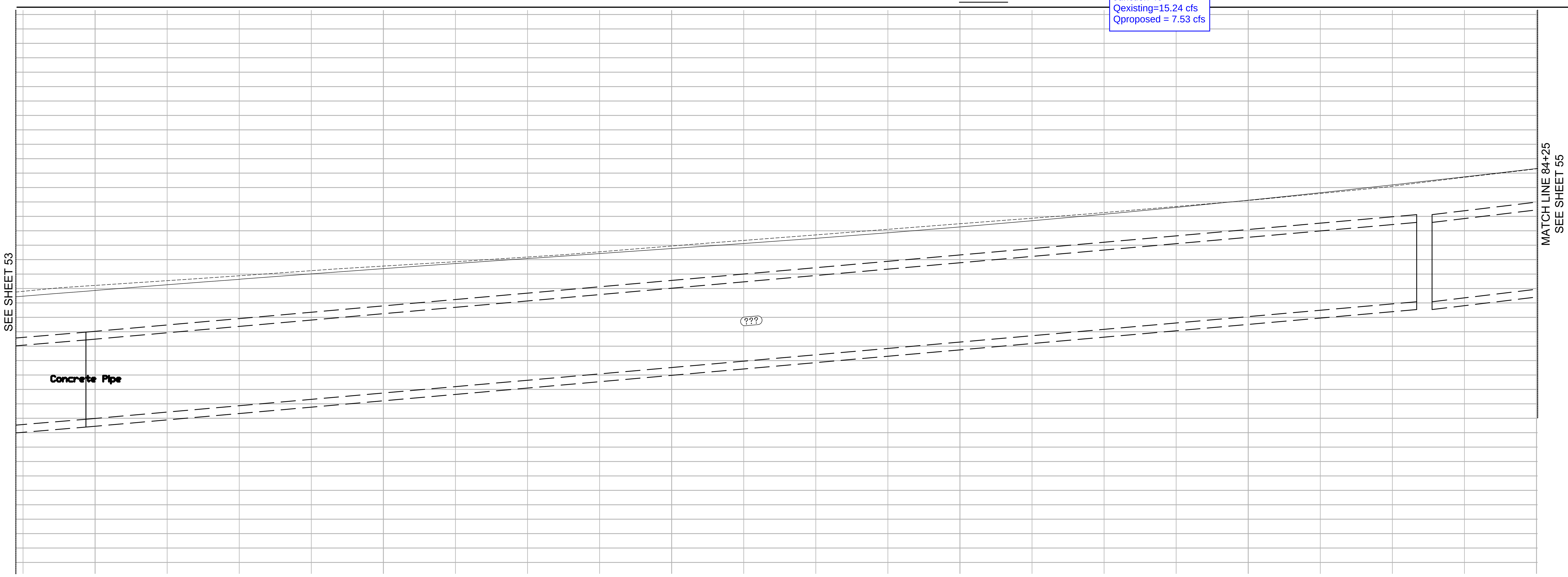
PLANS	BY	DATE
DESIGNED	A. NADERHOFF	3/24/20
CHECKED	R. TORRES	3/24/20

REGISTERED PROFESSIONAL ENGINEER
Robert J Torres
No. C71378
Exp. 12-31-2023
STATE OF CALIFORNIA

REGISTERED ENGINEER 8/9/2023 DATE



PLAN



NOTES:

1. WATER MAIN TO BE ENCASED PER WAS WP-08.
2. STENCIL "NO DUMPING! DRAWS TO WATERWAYS" PER COUNTY OF SAN DIEGO BMP MANUAL APPENDIX I.4 STRUCTURAL BMP LABEL TEMPLATE. TO BE STENCILED BY OTHERS.
3. PROVIDE CONCRETE BLANKET PROTECTION ON SEWER PER SPPWC 225-2

STORM DRAIN DATA

NUMBER	BEARING/DELTA	RADIUS	LENGTH	REMARKS
L18	N00°57'35"W	–	62.21'	24" RCP (1350-D)

Basis of Bearings
California Coordinate System Zone 6
NAD 83

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
5500 OVERLAND AVENUE, SAN DIEGO, CA 92123-1295

REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX
238 N. 1779 E.
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BRADLEY AVENUE WIDENING
In The Vicinity of EL CAJON
PLAN AND PROFILE - STORM DRAIN

SCALE: HOR. 1"=20' VERT. 1"=4'
W.A. 1003030 R.S. RS 1171
SHEET 54 OF 116 SHEETS

N:\Projects\C1005\ED_Plans\C-SH53-PPRS004.dwg Monday, Nov. 20 2023 9:48pm anaderho

NOTES:

2. STENCIL "NO DUMPING! DRAWS TO WATERWAYS" PER COUNTY OF SAN DIEGO BMP MANUAL APPENDIX I.4 STRUCTURAL BMP LABEL TEMPLATE. TO BE STENCILED BY OTHERS.
4. SEWER MAIN TO BE ENCASED BY OTHERS
5. SUPPORT VCP SEWER PIPE WHILE TRENCHING FOR DRAINAGE PIPE
6. CAUTION: FORMER HAZARDOUS WASTE SITE PER SDRSD SP-09

STORM DRAIN DATA

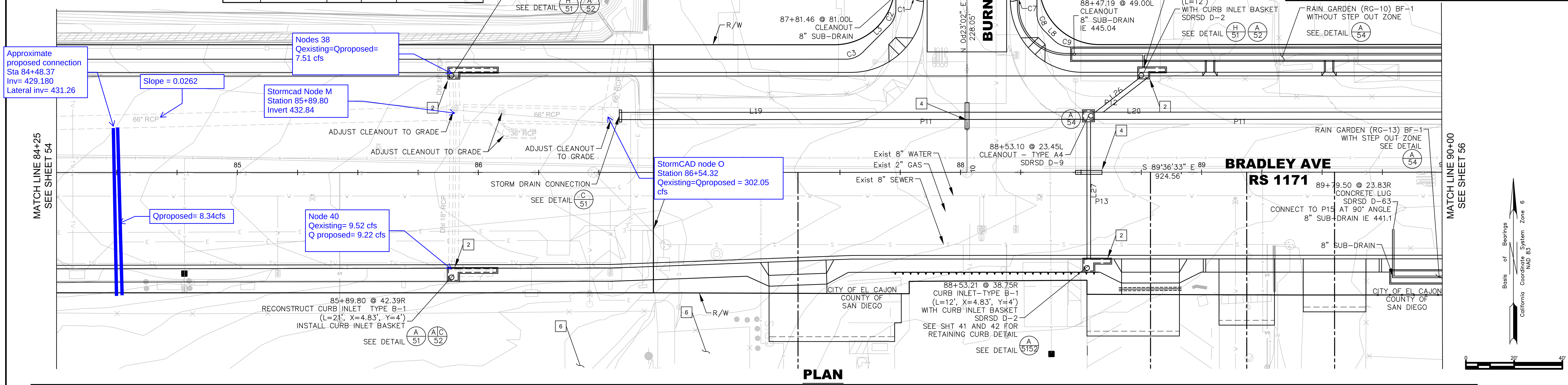
NUMBER	BEARING/DELTA	RADIUS	LENGTH	REMARKS
L19	S89°36'33"E	–	192.65'	36" RCP (1350-D)
L20	S89°36'33"E	–	144.74'	36" RCP (1350-D)
L26	N52°37'37"E	–	25.80'	18" RCP (1350-D)
L27	S00°23'27"W	–	57.12'	18" RCP (1350-D)

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES

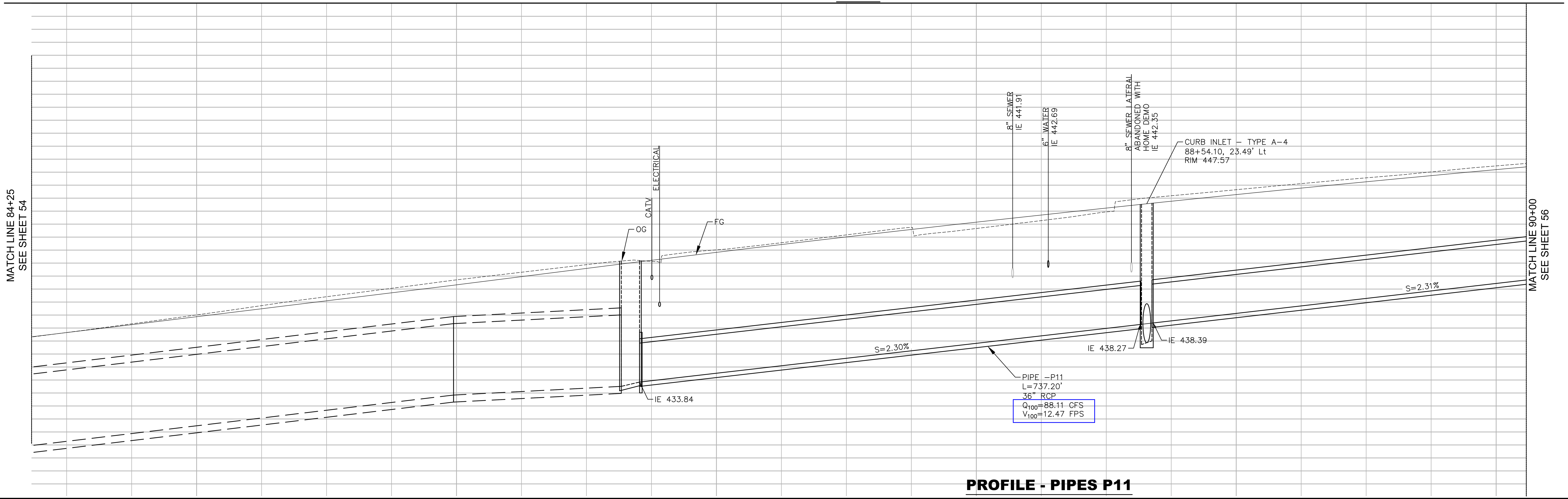
REGISTERED PROFESSIONAL ENGINEER Robert J Torres No. C71378 Exp. 12-31-2023 STATE OF CALIFORNIA

PLANS	BY	DATE
DESIGNED	A. NADERHOFF	3/24/20
CHECKED	R. TORRES	3/24/20

REGISTERED ENGINEER 8/9/2023 DATE



PLAN



PROFILE - PIPES P11

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
5500 OVERLAND AVENUE, SAN DIEGO, CA 92123-1295

REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX 238 N. 1779 E
CONST. COMPL.
FIELD REVISIONS

BRADLEY AVENUE WIDENING
In The Vicinity of EL CAJON
PLAN AND PROFILE - STORM DRAIN

SCALE: HOR. 1"=20' VERT. 1"=4'
W.A. 1003030 R.S. RS 1171
SHEET 55 OF 116 SHEETS

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FOR REDUCED PLANS
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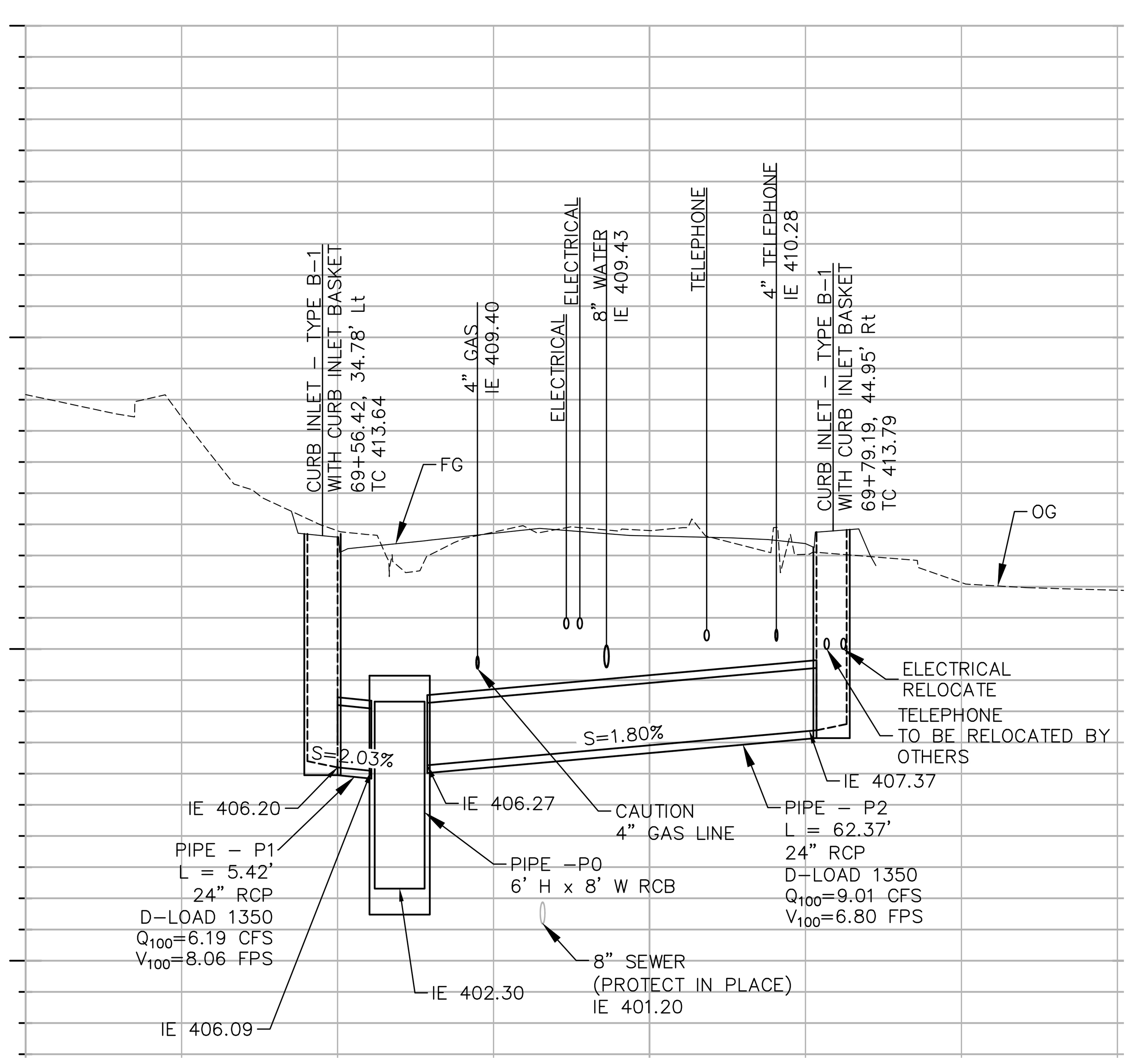
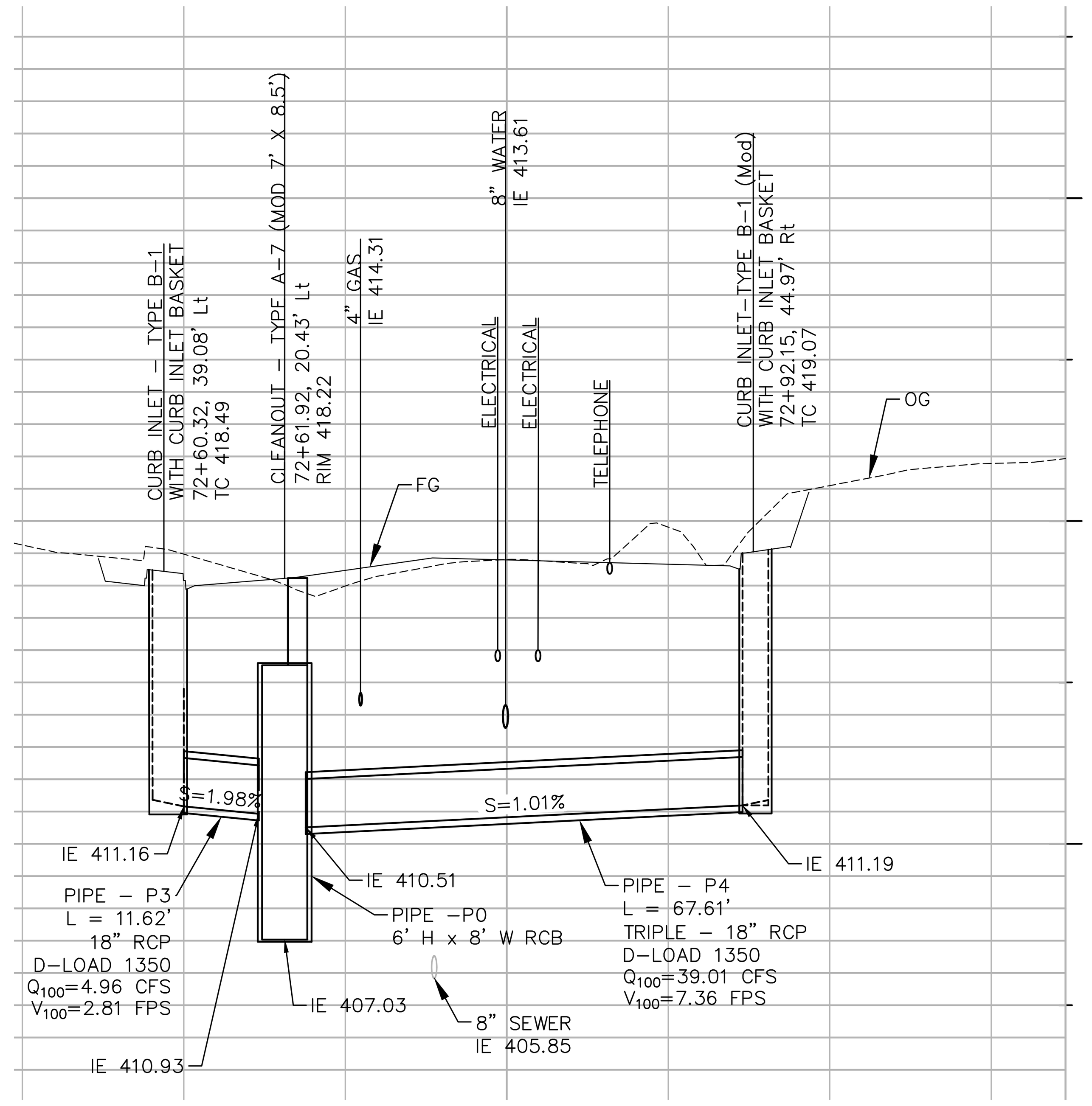
PLANS	BY	DATE
DESIGNED	A. NADERHOFF	3/24/20
CHECKED	R. TORRES	3/24/20

REGISTERED PROFESSIONAL ENGINEER Robert J Torres No. C71378 Exp. 12-31-2023 STATE OF CALIFORNIA

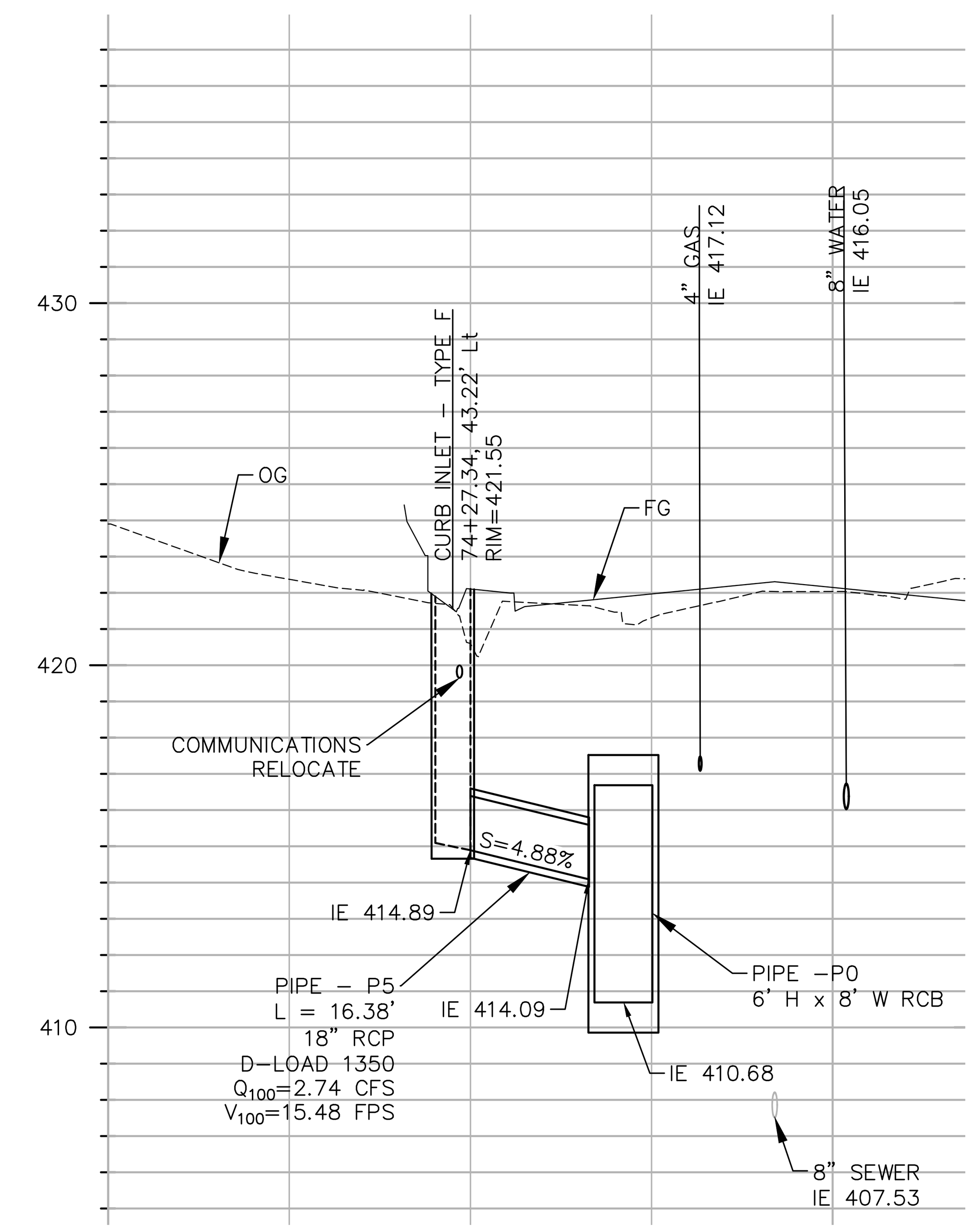
REGISTERED ENGINEER 8/9/2023 DATE



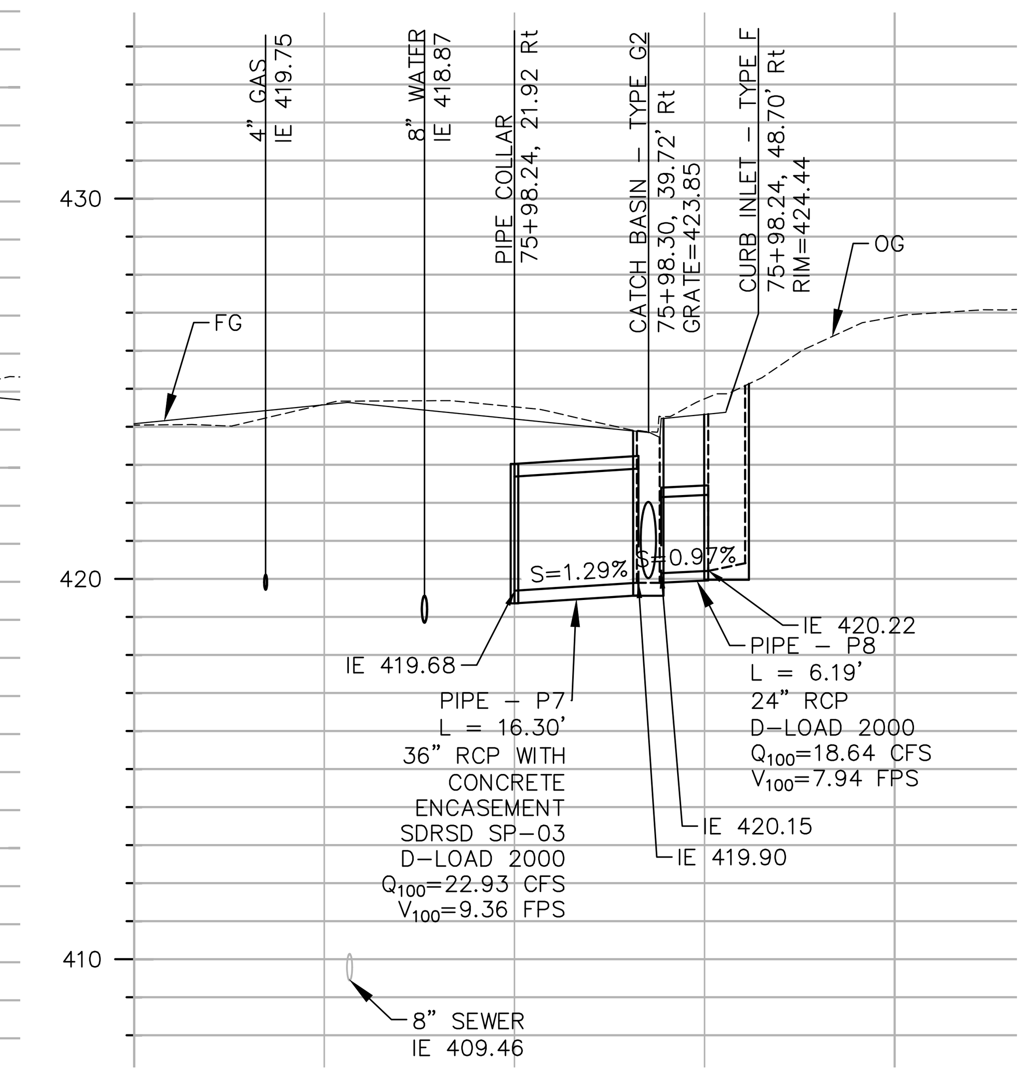
PROFILE - PIPE P1 & P2



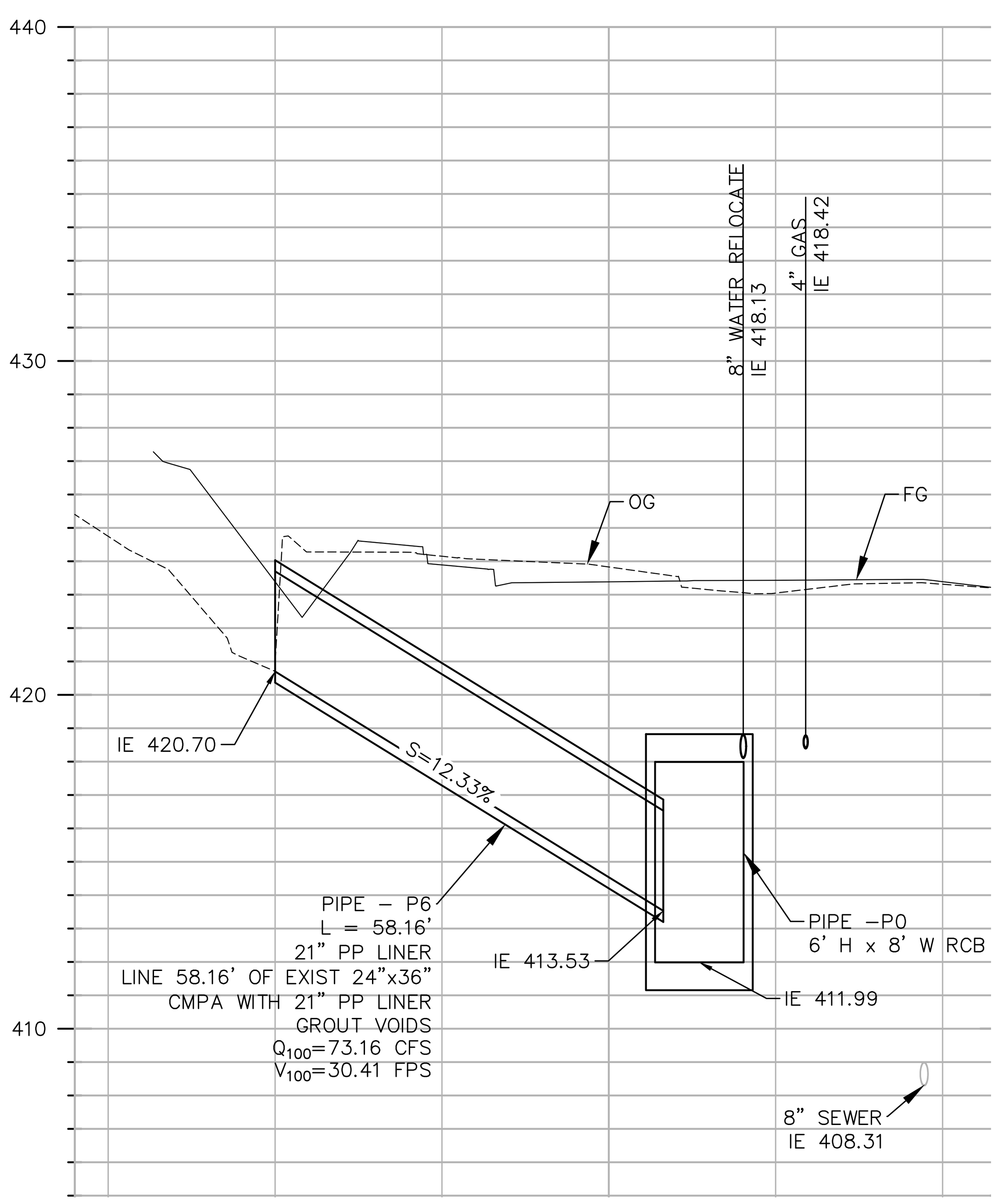
PROFILE - PIPE P3 & P4



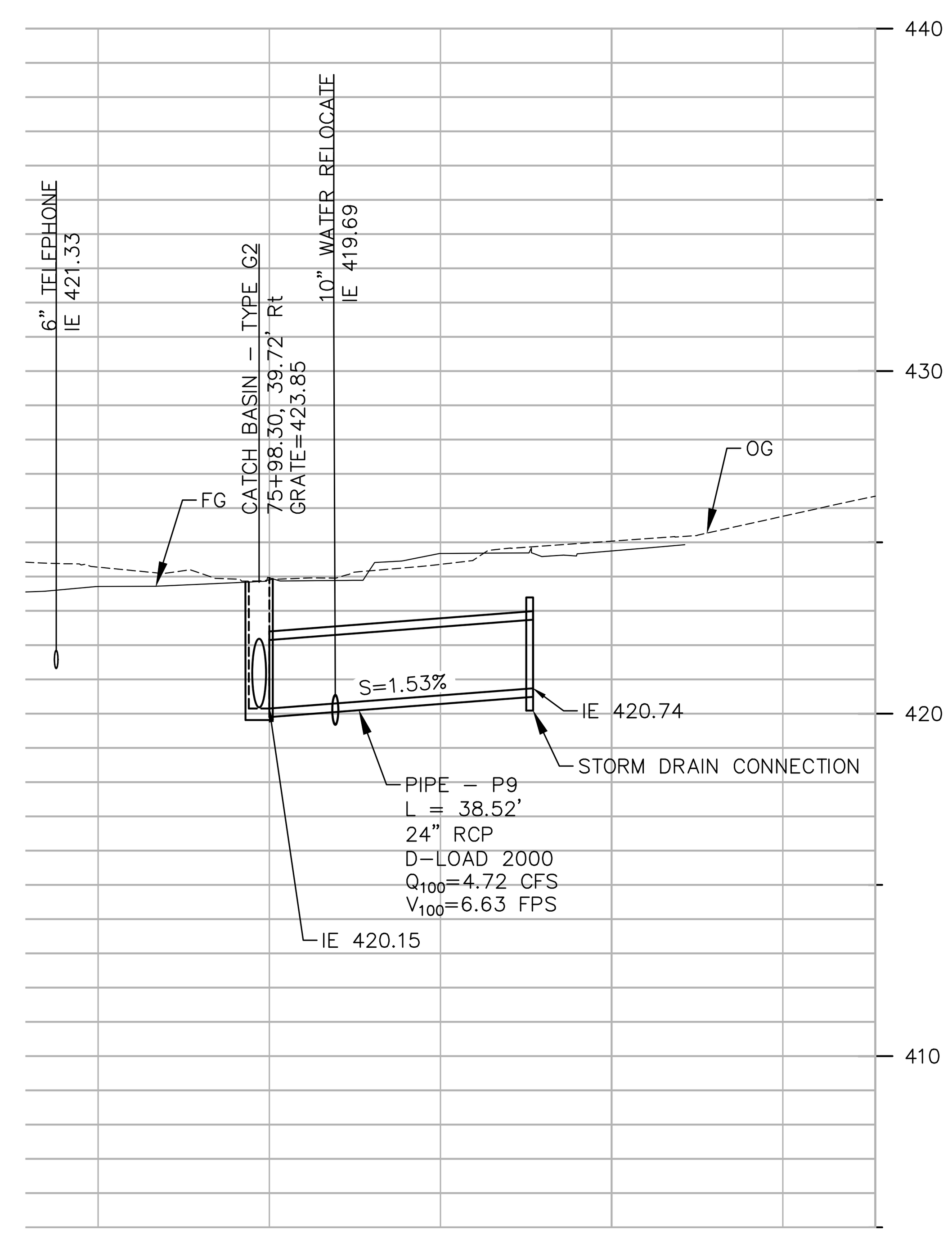
PROFILE - PIPE P5



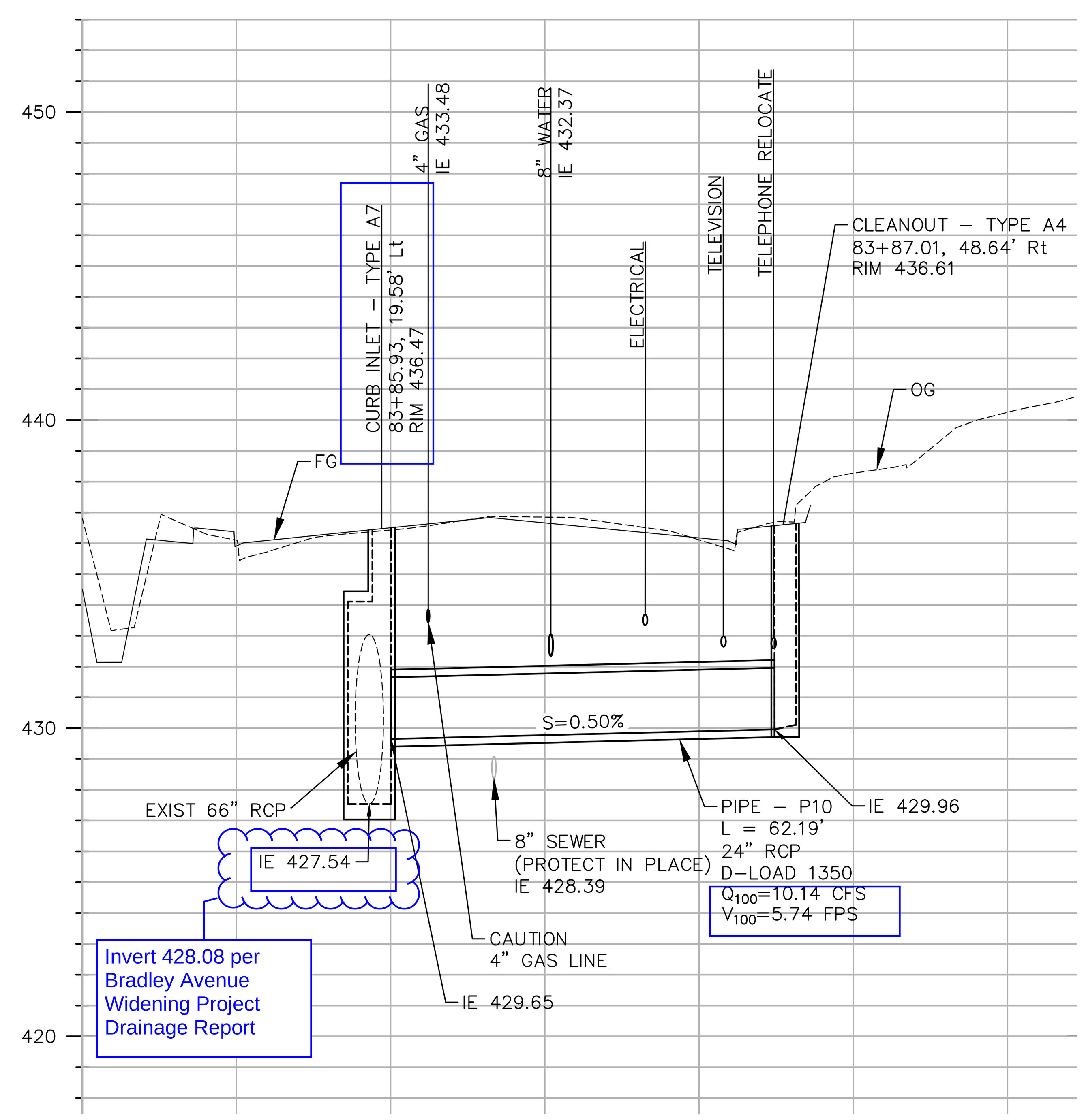
PROFILE - PIPE P7, P8



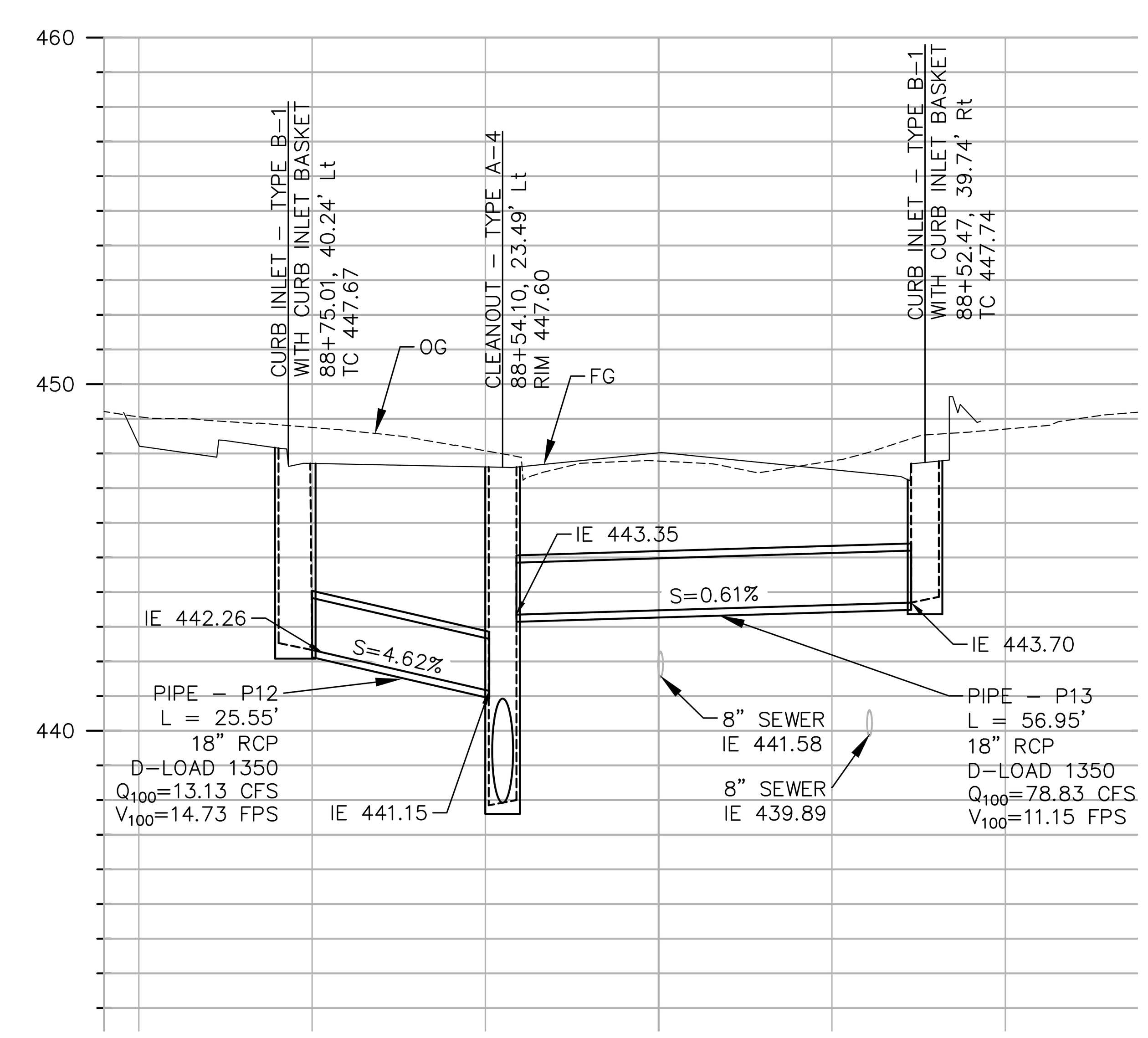
PROFILE - PIPE P6



PROFILE - PIPE P9



PROFILE - PIPE P10



PROFILES - PIPES P12, P13

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
5500 OVERLAND AVENUE, SAN DIEGO, CA 92123-1295

REVISIONS	BY	APPROVED	DATE

COORDINATE INDEX 238 N. 1779 E.
CONST. COMPL.
FIELD REVISIONS

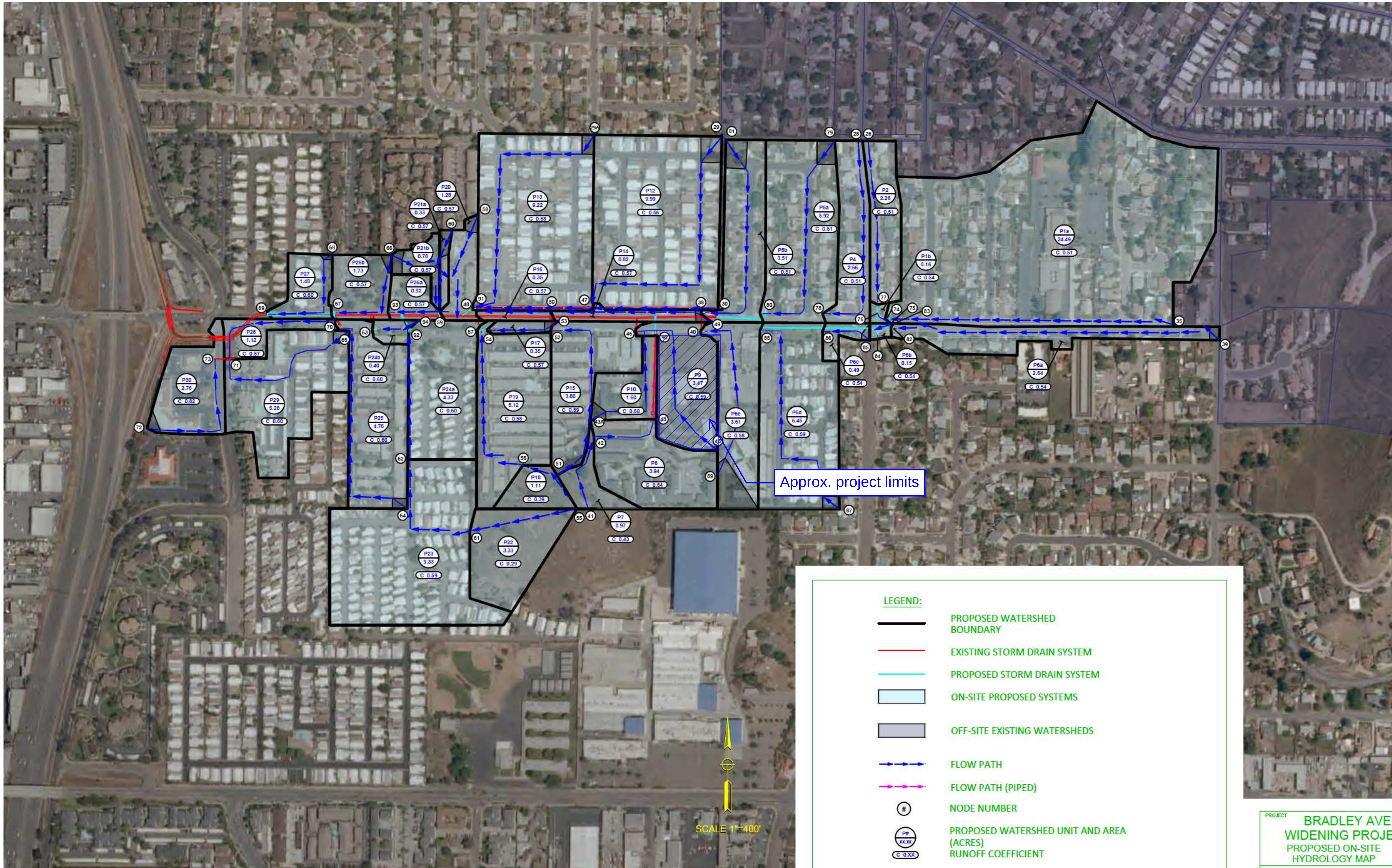
BRADLEY AVENUE WIDENING
In The Vicinity of EL CAJON
PLAN AND PROFILE - STORM DRAIN

SCALE: HOR. 1"=20' VERT. 1"=4'
W.A. 1003030 R.S. RS 1171
SHEET 58 OF 116 SHEETS

N:\Projects\1C1005\ED_Plans\C-SH57-PPRSD08.dwg Monday, Nov. 20 2023 10:08pm onaderho

ATTACHMENT 6: Off-site Hydrologic References

6b. Bradley Avenue Widening Drainage Report references (Proposed On-Site Hydrology Map, Table D-1, Table D-1a, Stormcad exhibit, Stormcad profile reports) dated November 2019 completed by Dokken Engineering.



LEGEND:

- PROPOSED WATERSHED BOUNDARY
- EXISTING STORM DRAIN SYSTEM
- PROPOSED STORM DRAIN SYSTEM
- ON-SITE PROPOSED SYSTEMS
- OFF-SITE EXISTING WATERSHEDS
- FLOW PATH
- FLOW PATH (PIPED)
- NODE NUMBER
- PROPOSED WATERSHED UNIT AND AREA (ACRES) RUNOFF COEFFICIENT

PROJECT

BRADLEY AVE WIDENING PROJECT

PROPOSED ON-SITE HYDROLOGY MAP

NOVEMBER 2019

TABLE D-1 : FLOW RATES FOR PROPOSED ON-SITE WATERSHEDS

Major Watershed	Drainage Sub-area	Drainage System	Drainage Area (ft^2)	Drainage Area (acres)	Initial Flow L (ft)	Initial Flow D (ft)	Initial Flow ΔE (ft)	Initial Flow S %	Initial Flow Ti (min)	Travel Time L (ft)	Travel Time S (ft/ft)	Travel Time V (50)	Travel Time V (100)	Travel Time Tt (50)	Travel Time Tt (100)	Tc(50) (min)	Tc(100) (min)	50-yr P6	100-Yr P_6 (in)	50-yr Intensity	100-Yr Intensity (in/hr)	Runoff Coefficient C	CA	∑(CA)	Q(50-yr) cfs	Q(100-yr) cfs
P1a	35 to 74	Street Flow - Gutter	1,066,852	24.49	-	-	40.0	-	-	1272	0.031	9.10	9.49	2 33	2 23	12.21	12.04	2.25	2.65	3 33	3 96	0.51	12.37	20.06	**66.83**	**79.43**
P1b	75 to 76	Street Flow - Gutter	6 912	0.16	75	75	1 0	1 33	7.95	-	-	-	-	-	-	7 95	7 95	2.25	2.65	4.40	5.18	0.54	0.09	0 09	**0.38**	**0.44**
P2	26 to 77	Street Flow - Gutter	99,183	2.28	-	-	14.0	-	-	719	0.019	4 36	4.53	2.75	2 65	14.15	13.95	2.25	2.65	3 03	3 60	0.51	1.15	2 03	**6.14**	**7.30**
P4	28 to 78	Street Flow - Gutter	115,849	2.66	-	-	15.0	-	-	926	0.016	4 34	4.53	3 56	3.41	17.82	17.48	2.25	2.65	2 61	3.11	0.51	1.35	2 91	**7.60**	**9.06**
P5a-initial	79 to 80	Initial sub-area	8,498	0.20	130	75	-	1 83	7.57	-	-	-	-	-	-	7 57	7 57	2.25	2.65	4 54	5 34	0.51	0.10	0.10	0.45	0.53
P5a	79 to 80	Street Flow - Gutter	249,340	5.72	982	-	18.0	1 83	-	907	0.018	4.47	4.62	3 38	3 27	10.95	10.84	2.25	2.65	3 57	4 24	0.51	2.90	3 00	**10.72**	**12.71**
P5b-initial	81 to 38	Initial sub-area	11,988	0.28	158	75	-	1 86	7.54	-	-	-	-	-	-	7 54	7 54	2.25	2.65	4 55	5 36	0.51	0.14	0.14	0.64	0.75
P5b	81 to 38	Street Flow - Gutter	140,758	3.23	968	-	18.0	1 86	-	893	0.019	4.10	4.28	3 63	3.48	11.17	11.02	2.25	2.65	3.53	4.19	0.51	1.65	1.79	**6.32**	**7.51**
P6a-initial	39 to 82	Initial sub-area	2 583	0.06	58	-	-	2 81	7.59	-	-	-	-	-	-	7 59	7 59	2.25	2.65	4 53	5 33	0.58	0.03	0 03	0.15	0.18
P6a	39 to 82	Street Flow - Gutter	112,373	2.58	1468	-	28.0	1 91	-	1410	0.019	3.78	3.90	6 22	6 03	13.81	13.62	2.25	2.65	3 08	3 66	0.54	1.38	1.42	**4.36**	**5.18**
P6b	83 to 84	Street Flow - Gutter	6,429	0.15	102	95	3 5	3.44	6.25	7	0.034	-	-	0 04	0 04	6 29	6 29	2.25	2.65	5.11	6 02	0.54	0.08	0 08	**0.41**	**0.48**
P6c-initial	85 to 86	Initial sub-area	1,849	0.04	45	45	-	2 53	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.54	0.02	0 02	0.14	0.16
P6c	85 to 86	Street Flow - Gutter	19,444	0.45	217	-	5 5	2 53	-	172	0.025	3 65	3.71	0.79	0.77	5.79	5.77	2.25	2.65	5.40	6 36	0.54	0.24	0 26	**1.42**	**1.68**
P6d-initial	87 to 88	Initial sub-area	4,055	0.09	92	92	-	2 82	6.49	-	-	-	-	-	-	6.49	6.49	2.25	2.65	5 01	5 90	0.59	0.06	0 06	0.28	0.33
P6d	87 to 88	Street Flow - street	276,999	6.36	1064	-	30.0	2 82	-	972	0.028	3 35	3.49	4 84	4 64	11.33	11.13	2.25	2.65	3 50	4.17	0.59	3.77	3 83	**13.39**	**15.95**
P6e-initial	89 to 40	Initial sub-area	23,791	0.55	86	86	-	3 22	6.29	-	-	-	-	-	-	6 29	6 29	2.25	2.65	5.11	6 02	0.58	0.32	0 32	1.62	1.90
P6e	89 to 40	Street Flow - street	133,496	3.06	776	-	25.0	3 22	-	690	0.032	3 22	3.39	3 57	3 39	9 86	9 68	2.25	2.65	3 83	4 56	0.58	1.77	2 09	**7.99**	**9.52**
P7	41 to 42	Natural Hillside	42 050	0.97	358	100	80.0	22.35	5.00	258	0.223	-	-	0 88	0 88	5 88	5 88	2.25	2.65	5 34	6 29	0.43	0.42	0.40	2.15	2.54
P8	42 to 43	Street Flow - Gutter	171,559	3.94	-	-	10.0	-	-	303	0.033	5.19	5.36	0 97	0 94	6 86	6 82	2.25	2.65	4 84	5.71	0.54	2.13	2 53	12 25	14.47
P8-A	43 to 90	Pipe Flow	-	-	-	-	20.0	-	-	411	0.049	12.55	13.15	0 55	0 52	7.40	7 34	2.25	2.65	4 60	5.45	-	-	2 53	**11.66**	**13.80**
P9	45 to 46	Overland Flow - Sheet	150,986	3.47	757	100	30.0	3 96	5.92	657	0.040	-	-	3.79	3.79	9.71	9.71	2.25	2.65	3 86	4 55	0.59	2.03	2 03	**7.85**	**9.25**
P10-initial	43A to 46	Initial sub-area	4,047	0.09	79	79	-	3 24	6.28	-	-	-	-	-	-	6 28	6 28	2.25	2.65	5.12	6 03	0.60	0.06	0 06	0.29	0.34
P10	43A to 46	Street Flow - Gutter	65,499	1.50	617	-	20.0	3 24	15.10	538	0.032	4 66	4.81	1 92	1 86	8 20	8.14	2.25	2.65	4 31	5.10	0.60	0.90	0 96	**4.13**	**4.88**
Junction at Node 46 - See Tables D-1a and D-1b																**9.71**	**9.71**			**3.86**	**4.55**			**2.99**	**12.75**	**15.24**
P12-initial	29 to 47	Initial sub-area	10,498	0.24	147	65	-	1.19	7.71	-	-	-	-	-	-	7.71	7.71	2.25	2.65	4.48	5 28	0.56	0.13	0.13	0.60	0.71
P12	29 to 47	Street Flow - Gutter	424 724	9.75	1263	-	15.0	1.19	-	1198	0.012	3 80	3.99	5 25	5 00	12.96	12.71	2.25	2.65	3 21	3 82	0.56	5.41	5 55	**17.78**	**21.21**
P13-initial	29A to 91	Initial sub-area	4,593	0.11	101	101	-	0 82	8.19	-	-	-	-	-	-	8.19	8.19	2.25	2.65	4 31	5 08	0.58	0.06	0 06	0.27	0.31
P13	29A to 91	Street Flow - Gutter	396,889	9.11	1221	-	10.0	0 82	-	1120	0.008	3.18	3.34	5 87	5 59	14.06	13.78	2.25	2.65	3 04	3 63	0.58	5.31	5 37	**16.35**	**19.51**
P14-initial	49 to 50	Initial sub-area	2,173	0.08	87	75	-	1.13	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.57	0.05	0 05	0.27	0.32
P14	49 to 50	Street Flow - Gutter	33,585	0.77	707	-	8 0	1.13	-	632	0.011	2 68	2.75	3 93	3 83	8 93	8 83	2.25	2.65	4 08	4 84	0.57	0.44	0.49	**1.98**	**2.35**
P15-initial	51 to 52	Initial sub-area	5,807	0.13	150	-	-	7 35	5.44	-	-	-	-	-	-	5.44	5.44	2.25	2.65	5 61	6 61	0.59	0.08	0 08	0.44	0.52
P15	51 to 52	Street Flow - Brow Ditch	159,678 36	3.67	859	-	65.0	7 56	-	709	0.076	7 22	7.53	1 64	1 57	7 08	7 01	2.25	2.65	4.74	5 61	0.59	2.16	2 23	**10.59**	**12.55**
P16-initial	53 to 48	Initial sub-area	836	0.02	53	53	-	1 34	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.57	0.01	0 01	0.06	0.08
P16	53 to 48	Street Flow - Gutter	15,256	0.35	318	-	5 0	1 57	-	265	0.016	2 89	2.93	1 53	1 51	6 53	6 51	2.25	2.65	4 99	5 89	0.57	0.20	0 21	**1.05**	**1.24**
P17-initial	53 to 54	Initial sub-area	1,666	0.04	69	69	-	1 96	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.57	0.02	0 02	0.13	0.15
P17	53 to 54	Street Flow - Gutter	15,191	0.35	324	-	5 0	1 54	-	255	0.015	2 84	2.88	1 50	1.48	6 50	6.48	2.25	2.65	5 01	5 91	0.57	0.20	0 22	**1.10**	**1.30**
P18	55 to 56	Natural Hillside	48,196	1.11	325	100	80.0	24.64	5.00	225	0.246	-	-	0.75	0.75	5.75	5.75	2.25	2.65	5.42	6 38	0.39	0.43	0.43	2.33	2.74
P19	56 to 57	Street Flow - Brow Ditch	223,199	5.12	-	-	45.0	-	-	780	0.058	7 36	7.69	1.77	1 69	7 52	7.44	2.25	2.65	4 56	5.40	0.58	2.98	3.41	**15.54**	**18.42**
P20-initial	58 to 59	Initial sub-area	3,952	0.09	87	-	-	0 90	8.56	-	-	-	-	-	-	8 56	8 56	2.25	2.65	4.19	4 94	0.57	0.05	0 05	0.22	0.26
P20	58 to 59	Street Flow - Gutter	51,814	1.19	527	-	5 0	0 95	-	440	0.009	2 26	2.32	3 25	3.16	11.81	11.72	2.25	2.65	3.41	4 03	0.57	0.68	0.73	**2.49**	**2.94**
P21a-initial	60 to 59	Initial sub-area	5,310	0.12	134	70	-	1 35	8.05	64	-	-	-	0 51	0 51	8 56	8 56	2.25	2.65	4.19	4 93	0.57	0.07	0 07	0.29	0.34
P21a	60 to 59	Earthen Swale	9 144	0.21	364	-	5 0	1 37	-	294	0.014	1 09	1.14	4.49	4 30	13.06	12.86	2.25	2.65	3.19	3 80	0.57	0.12	0.19	**0.60**	**0.72**
P21b-initial	66 to 59	Initial sub-area	5,023	0.12	52	52	-	1 21	8.19	-	-	-	-	-	-	8.19	8.19	2.25	2.65	4 31	5 08	0.57	0.07	0 07	0.28	0.33
P21b	66 to 59	Street Flow - Gutter	34,166	0.78	414	-	5 0	1 21	-	362	0.012	2.44	2.51	2.47	2.40	10.66	10.59	2.25	2.65	3 64	4 30	0.57	0.45	0 51	**1.87**	**2.21**
Junction at Node 59 - See Tables D-1c and D-1d																**11.81**	**11.72**			**3.41**	**4.03**			**1.24**	**4.23**	**5.01**
P22	55 to 61	Natural Hillside	145,222	3.33	487	100	116 0	23.81	5.07	387	0.238	-	-	1 22	1 22	6 29	6 29	2.25	2.65	5.11	6 02	0.29	0.97	0 97	4.95	5.83
P23	61 to 62	Street Flow - Gutter	406,367	9.33	-	-	10.0	-	-	574	0.017	5 00	5.22	1 91	1 83	8 20	8.12	2.25	2.65	4 31	5.11	0.59	5.54	6 51	28 05	33 25
P24a	62 to 93	Open Channel Flow	188 700	4.33	-	-	8 0	-	-	573	0.014	8 95	9.38	1 07	1 02	9 27	9.14	2.25	2.65	3 98	4.73	0.60	2.60	9.11	**36.27**	**43.11**
P24b-initial	94 to 63	Initial sub-area	1,441	0.03	63	63	-	2 00	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.60	0.02	0 02	0.12	0.14
P24b	94 to 63	Street Flow - Gutter	16 000	0.37	183	-	-	2 00	-	120	0.022	3.42	3.48	0 59	0 58	5 59	5 58	2.25	2.65	5 52	6 51	0.60	0.22	0 24	**1.33**	**1.56**
P25-initial	64 to 65	Initial sub-area	3,054	0.07	81	81	-	0.77	8.27	-	-	-	-	-	-	8 27	8 27	2.25	2.65	4 29	5 05	0.60	0.04	0 04	0.18	0.21
P25	64 to 65	Street Flow - Brow Ditch	204,230	4.69	985	-	8 0	0 81	-	904	0.008	2 95	3.10	5.11	4 86	13.38	13.13	2.25	2.65	3.14	3.75	0.60	2.81	2 86	**8.97**	**10.69**
P26a	59 to 93	Street Flow - Gutter	39,891	0.92	-	-	-	2 20	-	219	0.022	4.71	4.90	0.78	0.75	12.58	12.47	2.25	2.65	3 27	3 87	0.57	0.52	1.76	**5.77**	**6.83**
P26b-initial	66 to 67	Initial sub-area	2,540	0.06	75	75	-	5.14	5.97	-	-	-	-	-	-	5 97	5 97	2.25	2.65	5 29	6 23	0.57	0.03	0 03	0.18	0.21
P26b	66 to 67	Street Flow - Gutter	72,842	1.67	459	-	25.0	5.45	-	384	0.054	5 91	6.08	1 08	1 05	7 05	7 02	2.25	2.65	4.75	5 61	0.57	0.95	0 99	4.68	5.53
P27-initial	68 to 69	Initial sub-area	1,031	0.02	43	43	-	1 52	7.38	-	-	-	-	-	-	7 38	7 38	2.25	2.65	4 61	5.43	0.60	0.01	0 01	0.07	0.08
P27	68 to 69	Street Flow - Brow Ditch	59 910	1.38	525	0	8 0	1 52	-	482	0.015	2 89	3.02	2.78	2 66	10.16	10.04	2.25	2.65	3.75	4.45	0.60	0.83	0 84	**3.15**	**3.74**
P28-initial	70 to 71	Initial sub-area	2,199	0.05	44	44	-	1 00	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.57	0.03	0 03	0.17	0.20
P28	70 to 71	Street Flow - Gutter	46,678	1.07	601	-	6 0	1 00	-	557	0.010	2 36	2.45	3 93	3.79	8 93	8.79	2.25	2.65	4 08	4 85	0.57	0.61	0 64	**2.61**	**3.10**
P29-initial	65 to 71	Initial sub-area	3,875	0.09	88	88	-	0 83	8.17	-	-	-	-	-	-	8.17	8.17	2.25	2.65	4 32	5 09	0.60	0.05	0 05	0.23	0.27
P29	65 to 71	Street Flow - Brow Ditch	226,190	5.19	724	-	6 0	0 83	-	636	0.008	3.15	3.30	3 36	3 21	11.53	11.38	2.25	2.65	3.46	4.11	0.60	3.12	3.17	**10.96**	**13.02**
Junction at Node 71 - See Existing On-site Tables C-1k and C-1l																**11.53**	**11.38**			**3.46**	**4.11**			**3.81**	**13.17**	**15.64**
P30-initial	72 to 73	Initial sub-area	2,941	0.07	59	59	-	0 62	5.00	-	-	-	-	-	-	5 00	5 00	2.25	2.65	5 93	6 98	0.82	0.06	0 06	0.33	0.39
P30	72 to 73	Street Flow - Gutter	117,333	2.69	646	-	4 0	0 62	-	587	0.006	2 55	2.65	3 84	3 69	8 84	8 69	2.25	2.65	4.11	4 89	0.82	2.21	2 26	**9.30**	**11.07**

TABLE D-1a : Junction at node 46 - 50-Year

System	Q (cfs)	Tc (min)	I (in/hr)	Q_{T1} (cfs)	Q_{T2} (cfs)	Q (cfs)
P10	4.13	8 20	4 31	10.76	12.75	12.75
P9	7.85	9.71	5.12			

TABLE D-1b : Junction at node 46 - 100-Year

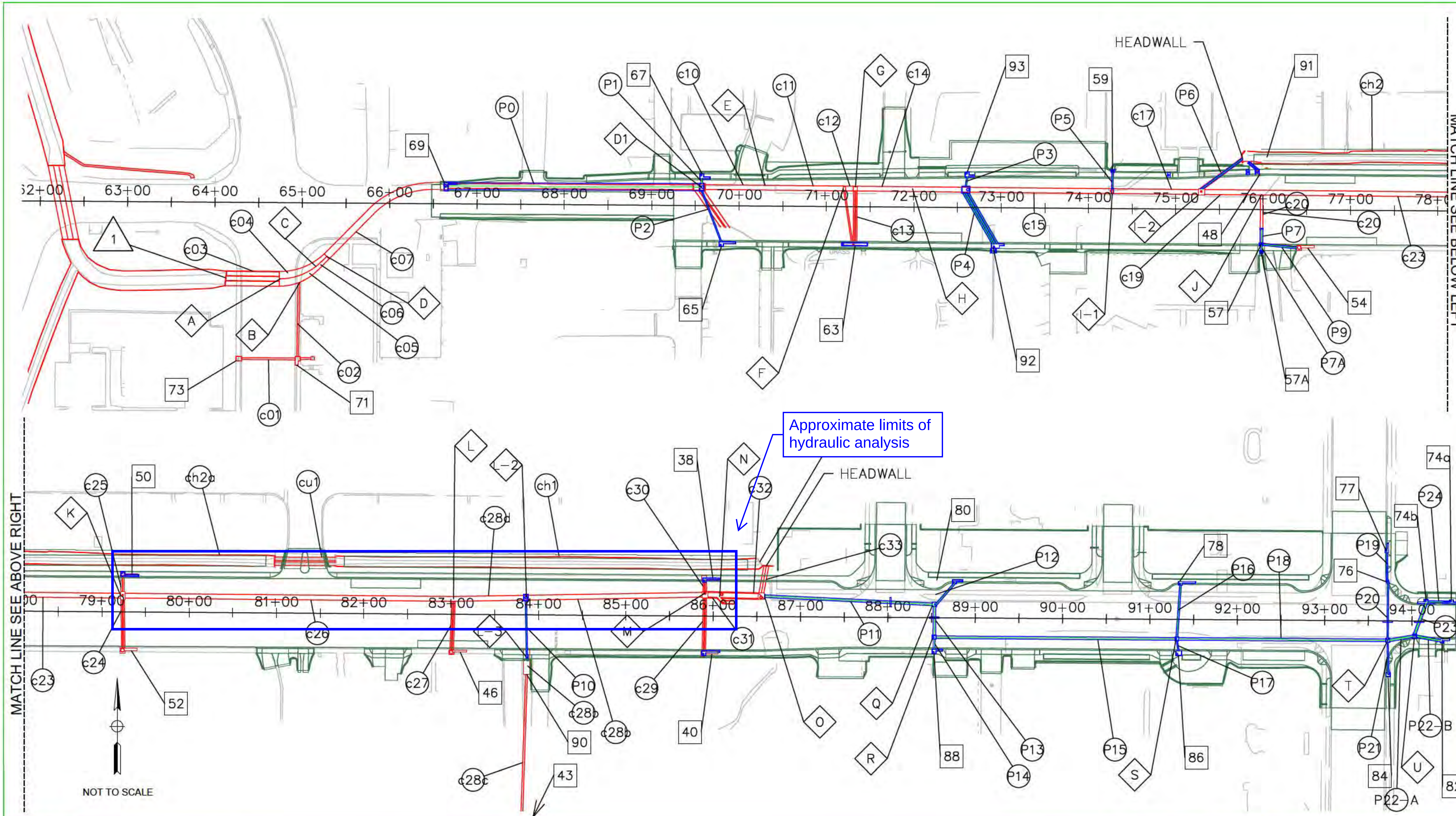
System	Q (cfs)	Tc (min)	I (in/hr)	Q_{T1} (cfs)	Q_{T2} (cfs)	Q (cfs)
P10	9.25	9.71	4 55	15.07	15.24	15.24
P9	4.88	8.14	5.10			

TABLE D-1c : Junction at node 59 - 50-Year

System	Q (cfs)	Tc (min)	I (in/hr)	Q_{T1} (cfs)	Q_{T2} (cfs)	Q (cfs)
P21b	1.87	10.66	3 64	4.11	4.23	4.23
P20	2.49	11.81	3.41			

TABLE D-1d : Junction at node 59 - 100-Year

System	Q (cfs)	Tc (min)	I (in/hr)	Q_{T1} (cfs)	Q_{T2} (cfs)	Q (cfs)
P21b	2.21	10.59	4 30	4.86	5.01	5.01
P20	2.94	11.72	4 03			



LEGEND:

CONDUIT/CHANNEL

TRANSITION/MANHOLE

INLET

PROJECT OUTFALL

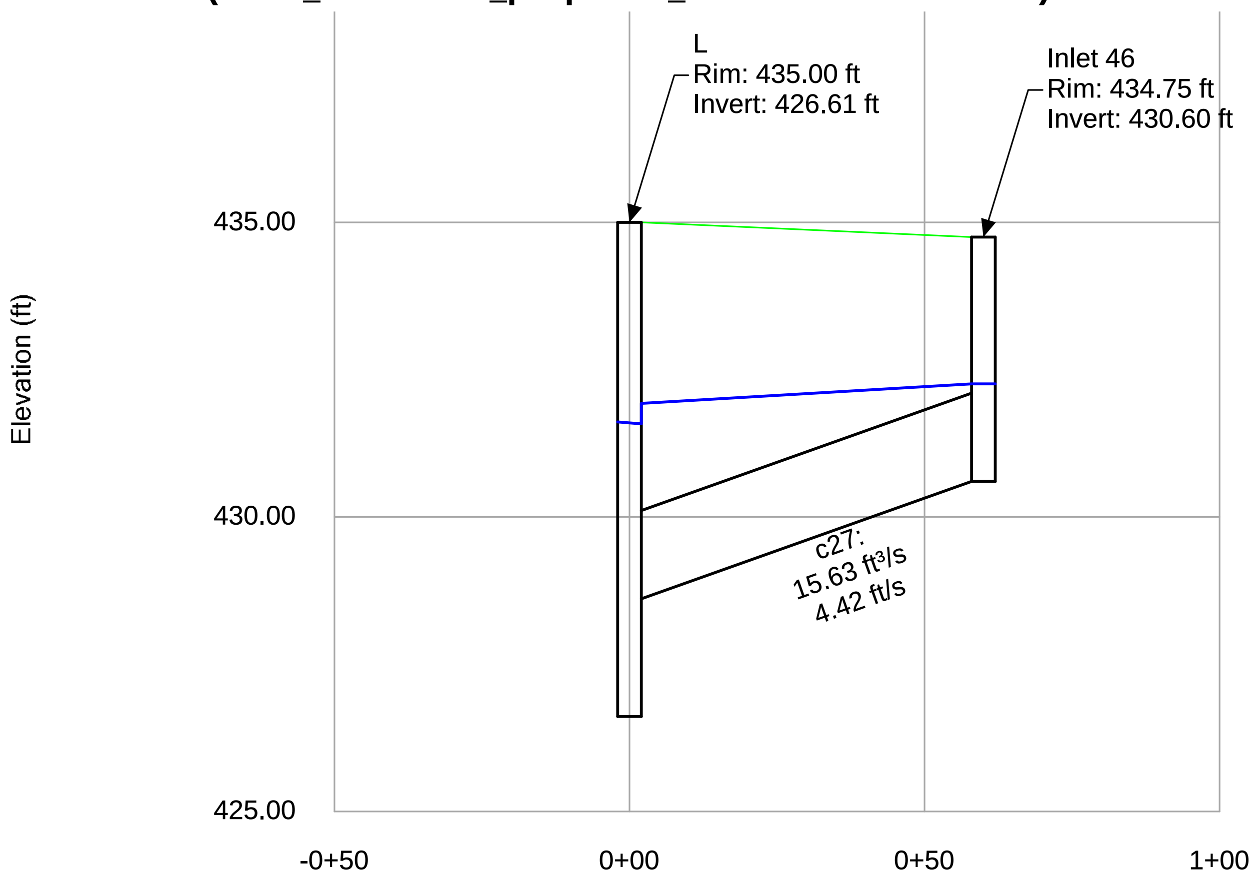
DOKKEN ENGINEERING

BRADLEY AVE WIDENING PROJECT

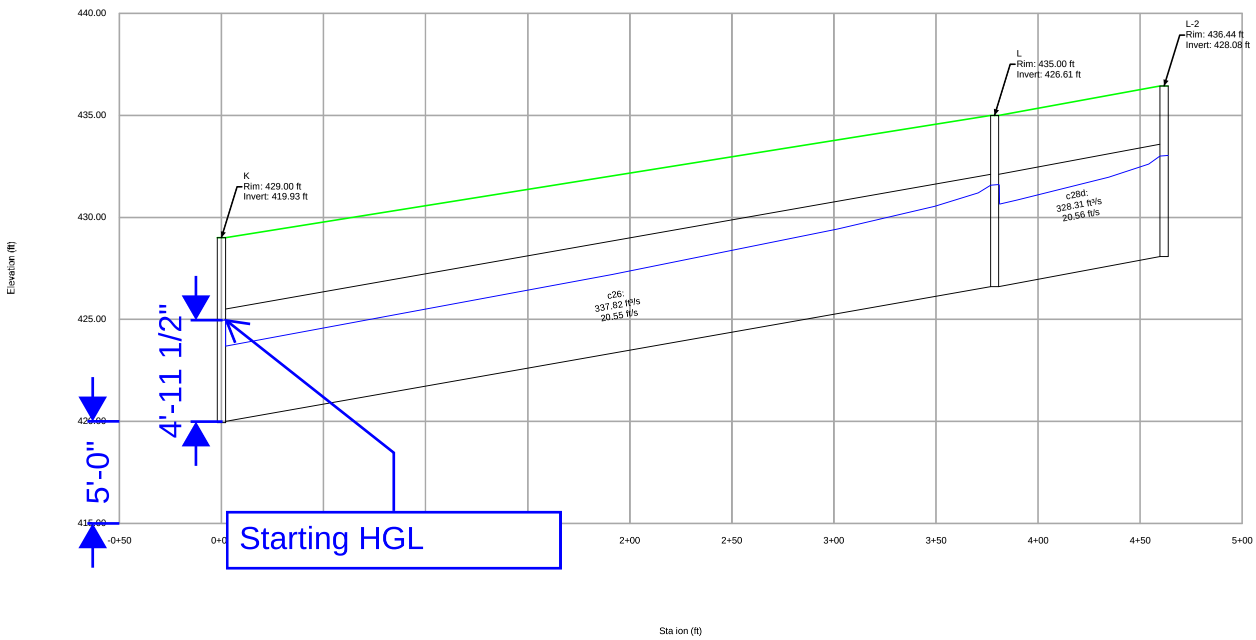
STORMCAD EXHIBIT

PROPOSED STORM DRAIN

Profile Report
Engineering Profile - Profile - c27
(1841_Stormcad_proposed_November2019.stsw)



Profile Report
Engineering Profile - Profile - c26 - c28d
(1841_Stormcad_proposed_November2019.stsw)



Profile Report
Engineering Profile - Profile - c28a - c31 - c32
(1841_Stormcad_proposed_November2019.stsw)