Drainage Report for:

Blossom Ridge

APN: 223-0091-002

Prepared by CNA Engineering Inc.

Vertical Datum NAVD 88

(Conversion factor to NGVD 29 = -2.549'

Per VertCon for BM #15-61)

Introduction and background

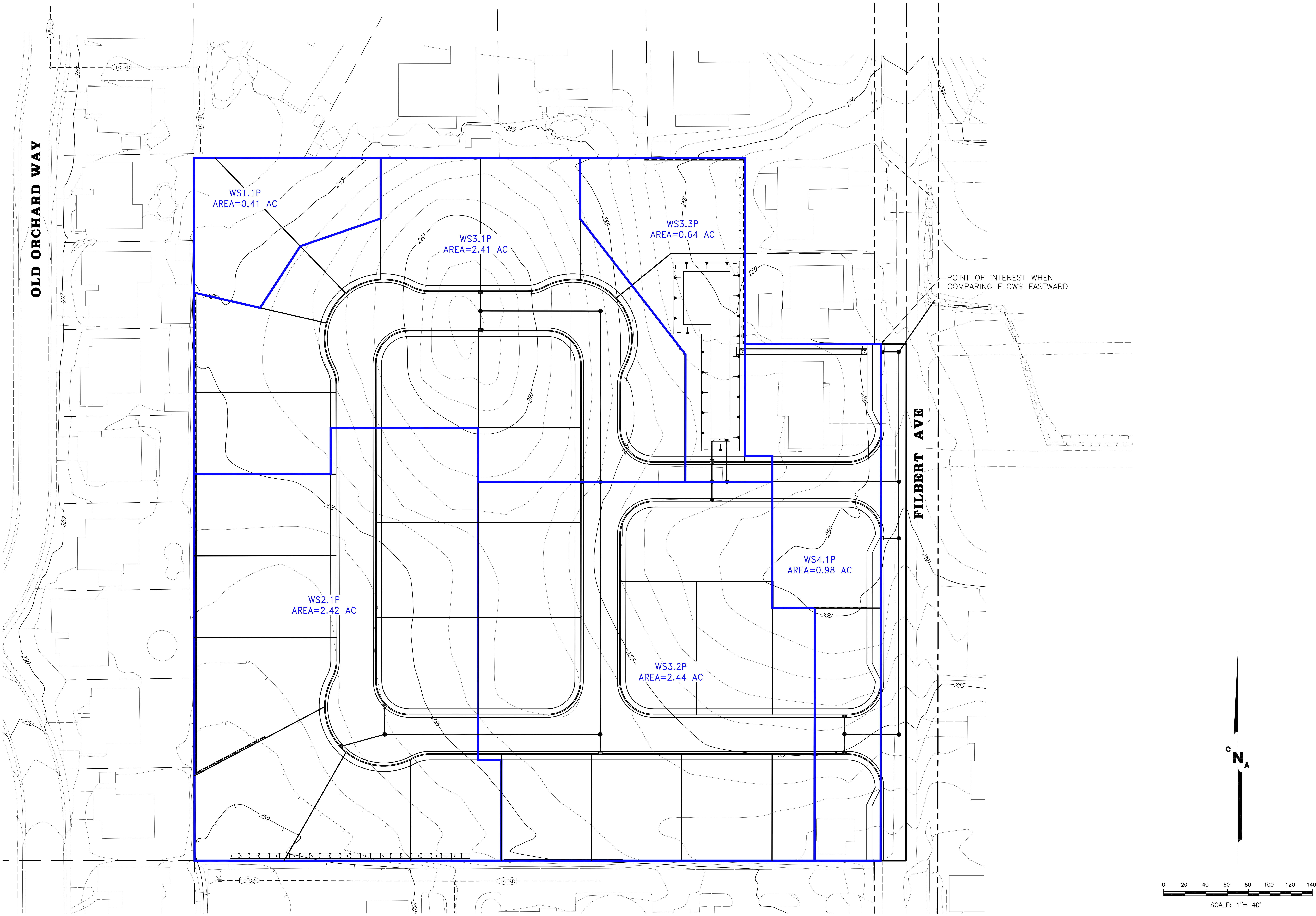
Project site is located on Filbert Avenue, north of the intersection with Greenback Lane.

The project drains to three directions. Each drainage direction is discussed separately in the following chapters.

The scope of this study includes:

- 100-, 10- and 2-year post-development peak control to the pre- development level;
- Design public pipe system;
- Preliminary design Low Impact Development facilities.

OLD ORCHARD WAY
FILBERT AVE
PUBLIC SD SYSTEM
MH 1.1
MH 1.2
WS1.2
AREA=0.22 AC
DI 1.1 FOR WS1.1E(P) & WS1.2
WS1.1E
AREA=0.96 AC
WS3.1E
AREA=1.40 AC
BERM AT PL PER FIELD SURVEY
WS2.1E
AREA=3.72 AC
WS4.1E
AREA=3.14 AC
SWALE PER FIELD SURVEY
SWALE JUNCTION PER FIELD SURVEY
WS2.1E(P) OUTFALL
DI FOR WS2.1E(P)
PRIVATE SD SYSTEM
SCALE: 1"= 40'
NO.
DESCRIPTION
APPROVED BY
DATE
REVISIONS
CNA ENGINEERING INC.
CIVIL ENGINEERING; LAND SURVEYING
PLANNING; STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com
PREPARED BY
DRAFTED BY: VAL T.
DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.
SCALE
HORIZ.: 1"= 40'
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002
PRE-WATERSHED ON-SITE MAP FOR:
BLOSSOM RIDGE
COUNTY OF SACRAMENTO
STATE OF CALIFORNIA
DATE : 6/7/2021
FN.:19144_10.DWG
SHEET
X OF X
SHEETS



NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

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SCALE
HORIZ.: 1"= 40'
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002

POST-WATERSHED ON-SITE MAP FOR:
BLOSSOM RIDGE
COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021
FN.:19144_10.DWG
SHEET X OF X SHEETS

1. North-West Direction of Drainage

Watershed WS1.1E currently drains northwest to the backyard of the single-family residence. There is a public inlet located in the backyard that collects drainage and conveys it to Old Orchard Way. Per discussion with the Sacramento County Water Resources the proposed design should meet 2 criteria:

- Do not increase the 2-, 10- and 100-year flows in the historical direction;
- Make sure the existing pipe system is capable of conveying Nolte flows in the post-development conditions. The system needs to be checked up to the Manhole MH13 (MH1.1) per DWR.

1.1 Watersheds Descriptions

Watershed WS1.1E conditions are:

Total shed area = 0.96 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 299 ft;

Length along longest watercourse to centroid – 156 ft;

Existing basin slope is 3.8%;

Hydrologic Soils group B per USDA GIS Map.

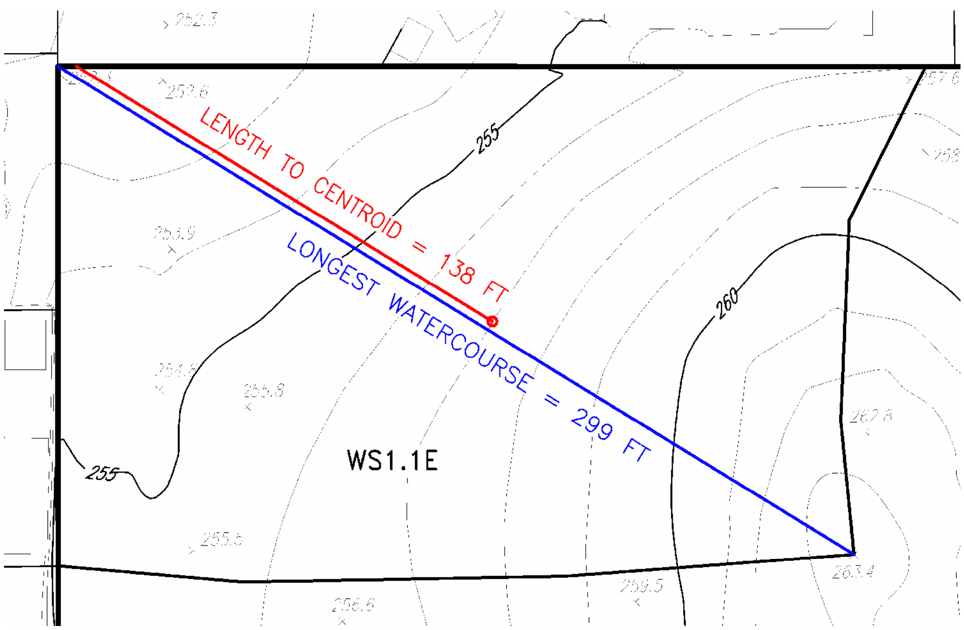


Figure 1 – WS1.1E Lengths.

Watershed WS1.1P conditions are:

Total shed area = 0.41 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-3;

Length of longest watercourse – 176 ft;

Length along longest watercourse to centroid – 71 ft;

Basin slope is 3.8%;

Hydrologic Soils group B per USDA GIS Map.

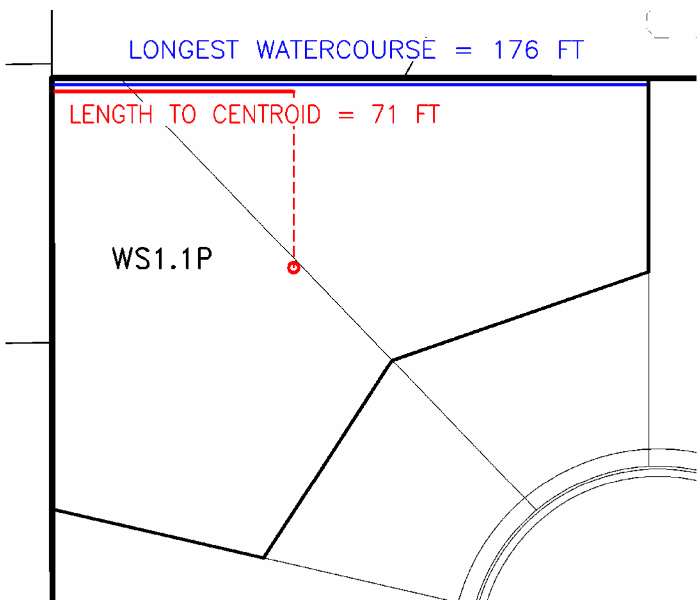


Figure 2 – WS1.1P Lengths.

Watershed WS1.2 – offsite (collected by the existing Type DI):

Total shed area = 0.22 acres;

Existing imperviousness = 50%.

1.2 SacCalc Analysis

Results are presented below.

Sacramento method results
(Project: Blossom Ridge)
(100-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
WS1-1E	2.6	12:05	.00			
WS2-1E	8.4	12:09	.01			
WS1-1P	1.5	12:02	.00			
WS3-1E	4.1	12:05	.00			
WS4-1E	6.9	12:09	.00			
PRE	10.	12:08	.01			
WS4-1P	3.2	12:03	.00			
WS3-1P	6.1	12:07	.00			
WS3-2P	6.7	12:06	.00			
WS2-1P	6.9	12:05	.00			
DV001	3.2	12:11	.00			.05
WS3-3P	2.3	12:02	.00			
JNC001	18.	12:06	.01			
POND	7.4	12:25	.01	2.9	.4	.00
POST	8.1	12:24	.01			
WSC-1	35.	12:09	.02			

(10-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
WS1-1E	1.5	12:05	.00			
WS2-1E	4.8	12:09	.01			
WS1-1P	.8	12:02	.00			
WS3-1E	2.3	12:05	.00			
WS4-1E	3.9	12:09	.00			
PRE	5.8	12:08	.01			
WS4-1P	2.0	12:02	.00			
WS3-1P	4.0	12:05	.00			
WS3-2P	4.3	12:04	.00			
WS2-1P	4.4	12:04	.00			
DV001	3.2	12:01	.00			.01
WS3-3P	1.3	12:02	.00			
JNC001	13.	12:04	.01			
POND	3.0	12:34	.01	2.2	.3	
POST	4.2	12:03	.01			
WSC-1	23.	12:07	.02			

(2-year, 1-day rainfall)

ID	Peak flow (cfs)	Time of peak (hours)	Basin area (sq. mi)	Peak stage (feet)	Peak storage (ac-ft)	Diversion volume (ac-ft)
WS1-1E	.7	12:05	.00			
WS2-1E	2.3	12:09	.01			
WS1-1P	.4	12:02	.00			
WS3-1E	1.1	12:05	.00			
WS4-1E	1.9	12:09	.00			
PRE	2.8	12:08	.01			
WS4-1P	1.0	12:02	.00			
WS3-1P	2.0	12:05	.00			
WS3-2P	2.2	12:04	.00			
WS2-1P	2.3	12:04	.00			
DV001	2.3	12:04	.00			.00
WS3-3P	.7	12:02	.00			
JNC001	7.1	12:04	.01			
POND	2.2	12:24	.01	1.2	.1	.00
POST	2.6	12:07	.01			
WSC-1	12.	12:07	.02			

Figure 3 – SacCalc Results for 2-, 10-, and 100-year 24 hour storm events.

Nolte method results
(Project: Blossom Ridge_Nolte)
(Hydrologic zone 1)

ID	Drainage area (acres)	Impervious area (%)	Design Q (cfs)
WS1-1E	0.96	20.00	0.27
WS1-2	0.22	50.00	0.06
WS2-1E	3.82	20.00	1.07
WS2-1P	2.39	38.60	0.67
WS1-1P	0.41	30.00	0.11
WS-211	0.76	40.00	0.21
WS-212	1.23	30.00	0.34
WS-311	1.14	30.00	0.32
WS-312	0.40	40.00	0.11
WS-313	0.64	25.00	0.18
WS-314	0.56	40.00	0.16
WS-321	0.94	40.00	0.26
WS-322	0.82	40.00	0.23
WS-323	0.99	40.00	0.28
WS-411	0.44	30.00	0.12
WS-412	0.50	30.00	0.14
WS-413	0.08	30.00	0.02
WS-414	0.24	30.00	0.07

Figure 4 – SacCalc Results Nolte flows.

As can be seen from the results above, the development will not increase runoff offsite in the North-West Direction during 2-, 10- and 100-year events and for Nolte flows.

1.3 Hydraflow Pipe Analysis – Existing Off-site System

Flows from WS1.1P and WS1.2 are entered in the DI1.1 (Node #3) located offsite of the project.

Total flow entered is 0.22 + 0.41 = 0.63 cfs. (See Figure 4 above).

Pipes and nodes information is as follows (refer to the WS Map above). Existing SD facilities have been surveyed:

Structure #	*Structure ID*	*Rim Elevation*	*Invert (FL)*	*Pipe size and material (downstream)*	*Slope downstream*	*n-value*
1	MH 1.1	248.50	244.30 (out)	15”, PVC	0.0100 (assumed)	0.015
2	MH 1.2	249.72	246.98 (out)	10”, PVC	0.0192	0.015
3	DI 1.1 (WS1.1P & WS1.2)	252.35	249.63	10”, PVC	0.0310	0.015

Table 1 – Existing Storm Drain System Information.

As can be seen from the results below, HGL_{Nolte} for the system northwest of the project does not get closer than 12” below the rims of manholes and 6” below the rims of drop inlets. The system is considered to have sufficient capacity.

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan

Project File: North Pipe System_Proposed Flows.stm	Number of lines: 3	Date: 10-29-2020

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	9.141	89.850	MH	0.00	0.00	0.00	0.0	242.50	1.09	242.60	15	Cir	0.015	1.00	248.50	
2	1	139.424	-90.028	MH	0.00	0.00	0.00	0.0	244.30	1.92	246.98	10	Cir	0.015	1.00	249.72	
3	2	81.000	88.765	DrGrt	0.63	0.00	0.00	0.0	247.12	3.10	249.63	10	Cir	0.015	1.00	252.35	

Project File: North Pipe System_Proposed Flows.stm	Number of lines: 3	Date: 10-29-2020

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev. (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1		Manhole	248.50	Cir	4.00	4.00	15	Cir	242.60	10	Cir	244.30
2		Manhole	249.72	Cir	4.00	4.00	10	Cir	246.98	10	Cir	247.12
3		DropGrate	252.35	Rect	2.00	2.00	10	Cir	249.63			

Project File: North Pipe System_Proposed Flows.stm	Number of Structures: 3	Run Date: 10-29-2020

Storm Sewer Summary Report

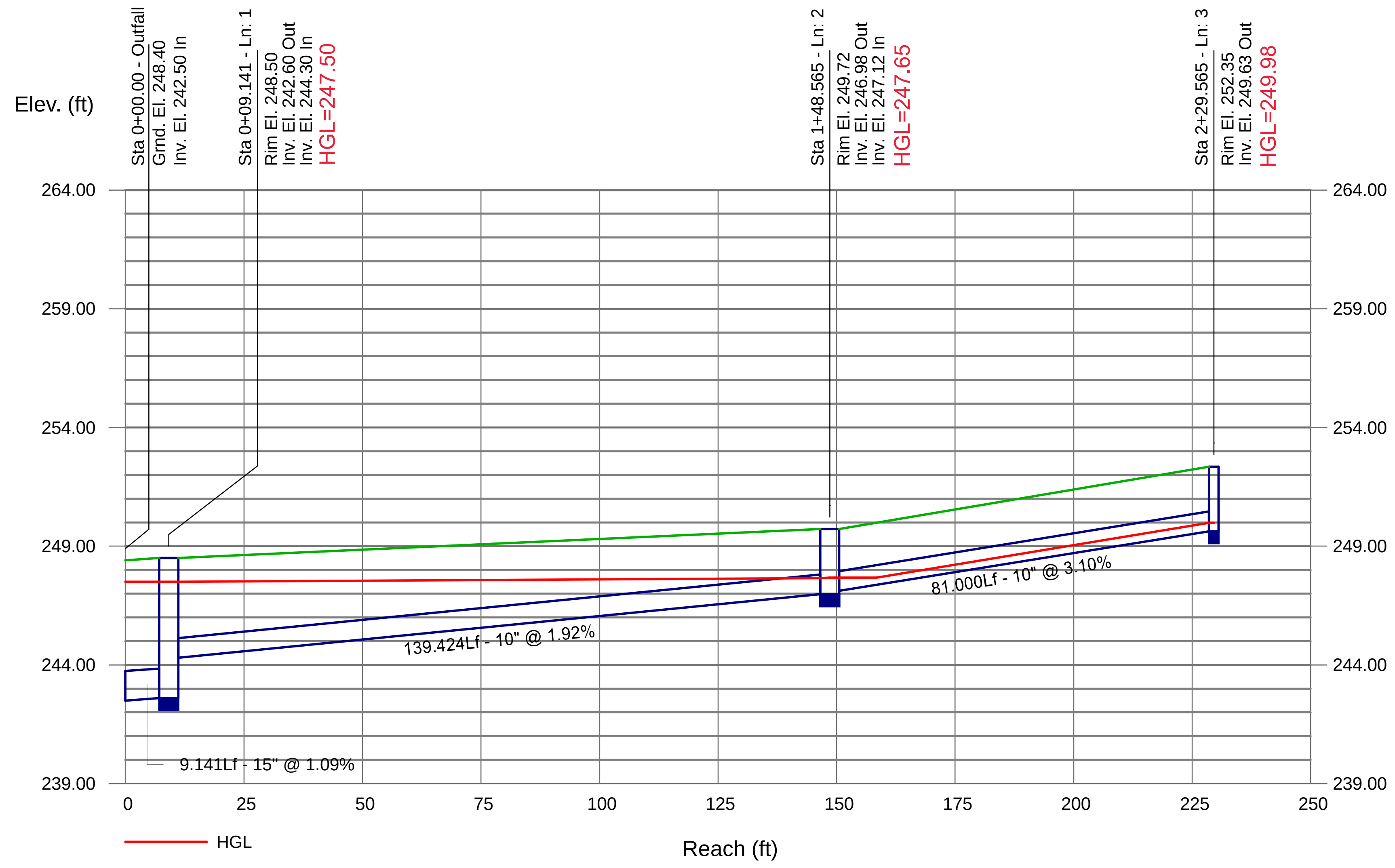
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1		0.63	15	Cir	9.141	242.50	242.60	1.094	247.50*	247.50*	0.00	247.51	End	Manhole
2		0.63	10	Cir	139.424	244.30	246.98	1.922	247.51	247.65	0.03	247.68	1	Manhole
3		0.63	10	Cir	81.000	247.12	249.63	3.099	247.68	249.98	n/a	249.98 j	2	DropGrate

Project File: North Pipe System_Proposed Flows.stm	Number of lines: 3	Run Date: 10-29-2020

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Profile

Proj. file: North Pipe System_Proposed Flows.stm



Hydraflow Storm Sewers Extension

2. South-West Direction of Drainage

Watershed WS2.1E currently drains southwest to the church property. The most of the watershed drainage is designed to be collected into the proposed pipe drainage system. The system will convey the flows to the detention basin and later off-site in the easterly direction. Per discussion with the Sacramento County Water Resources the proposed design should meet this criteria:

- Do not increase the 2-, 10- and 100-year flows in the historical direction. This direction is considered overland release path for this watershed.

2.1 Watersheds Descriptions

Watershed WS2.1E conditions are:

Total shed area = 3.82 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 565 ft;

Length along longest watercourse to centroid – 252 ft;

Existing basin slope is 2.5%;

Hydrologic Soils group B per USDA GIS Map.

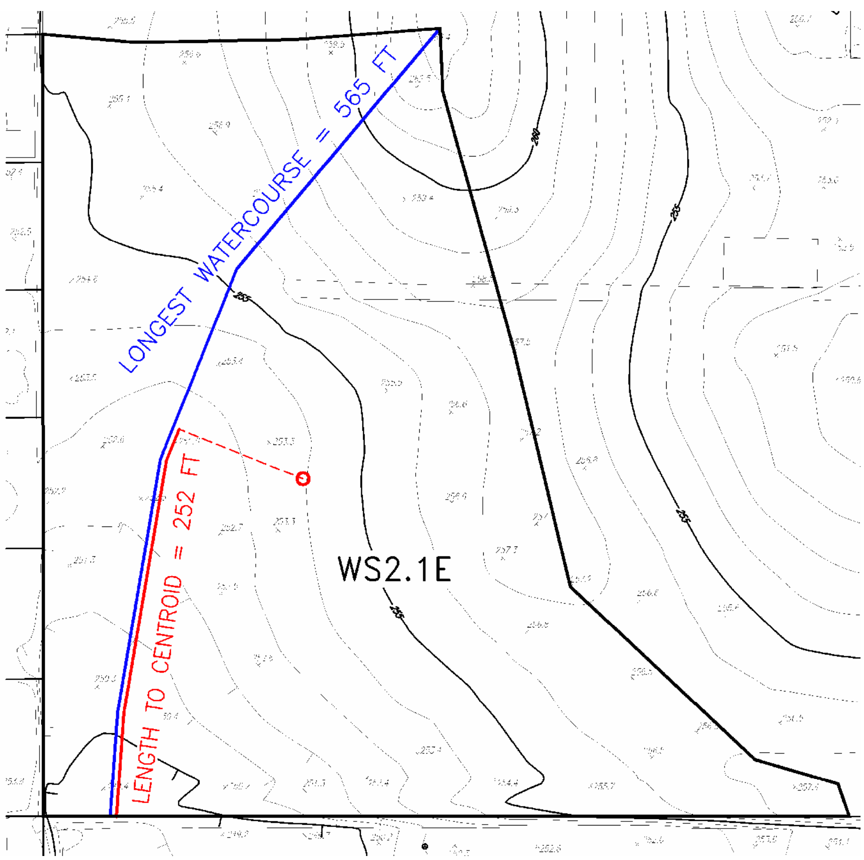


Figure 5 – WS2.1E Lengths.

Watershed WS2.1P conditions are:

Total shed area = 2.42 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

RD-3 = 1.21 acres – 50%;

RD-4 = 1.21 acres – 50%.

Length of longest watercourse – 602 ft;

Length along longest watercourse to centroid – 291 ft;

Proposed basin slope is 1.0%;

Hydrologic Soils group B per USDA GIS Map.

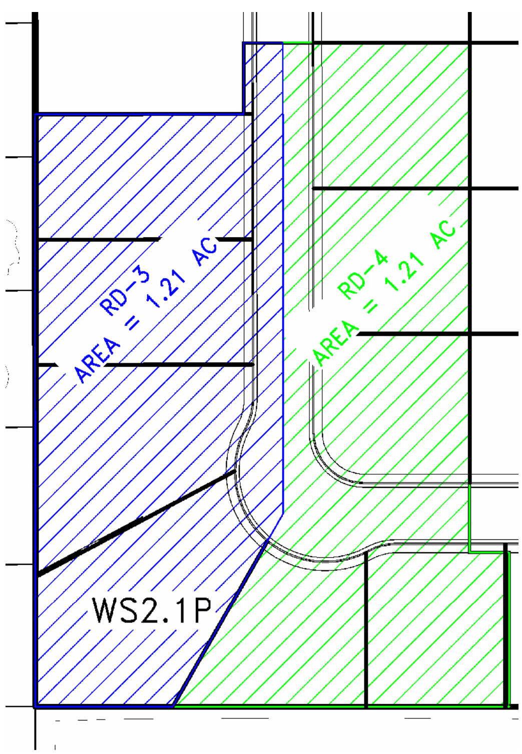


Figure 6 – WS2.1P Zoning.

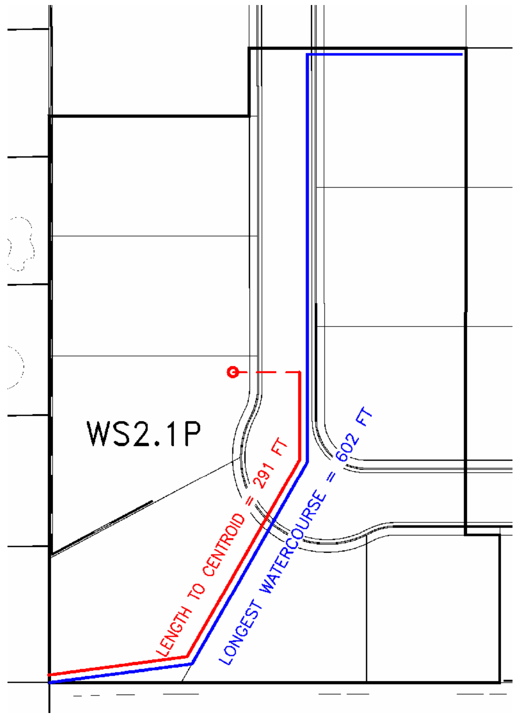


Figure 7 – WS2.1P Lengths.

2.2 SacCalc Analysis

As can be seen from the results in the Figure 3, the development will not increase runoff offsite in the South-West Direction during 2-, 10- and 100-year events.

3. East Direction of Drainage

Watershed WS3.1E currently drains northeast to the backyards of the single-family residences located on Filbert Avenue. Drainage fills up the front yards and finds its way across Filbert Avenue either via existing cross culvert or spilling over the sag of the roadway. Similarly, Watershed WS4.1E currently drains east towards Filbert Avenue, follows along the road and finds release in the same location. There is a drainage swale across Filbert Avenue that receives the drainage form the project site. This swale runs east towards the junction with another swale coming from the north direction. The swale junction has been surveyed and is located approximately 340 feet east of the Filbert centerline. Per discussion with the Sacramento County Water Resources the proposed design should meet the following criteria:

- Do not increase the 2-, 10- and 100-year flows in the historical direction;
- Design the pipe system that outfalls into the existing swale. If the tie-in location is in the Right-of-Way, no easement would be necessary;
- Design the proposed pipe system to be capable to convey Nolte flows in the post-development conditions;
- Analyze downstream conditions.

3.1 Watersheds Descriptions

Watershed WS3.1E conditions are:

Total shed area = 1.40 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 289 ft;

Length along longest watercourse to centroid – 130 ft;

Existing basin slope is 5.5%;

Hydrologic Soils group B per USDA GIS Map.

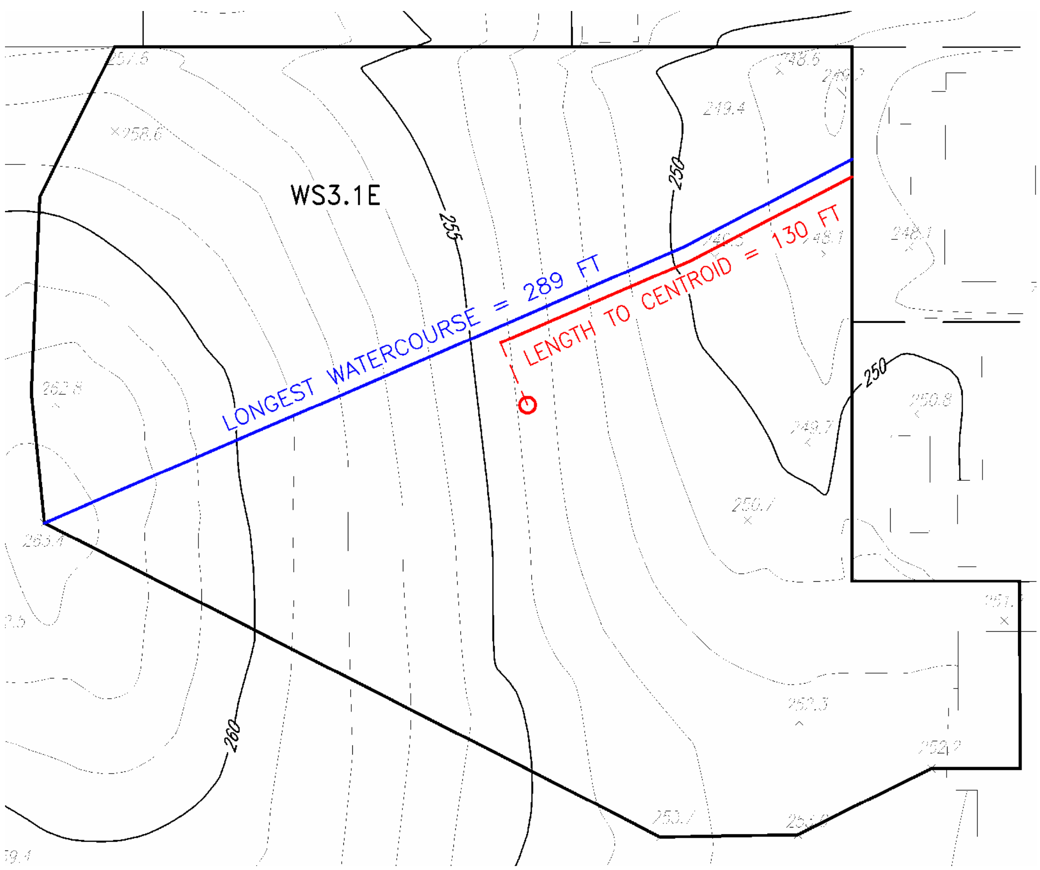


Figure 8 – WS3.1E Lengths.

Watershed WS4.1E conditions are:

Total shed area = 3.14 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 2% - open space grassland;

Length of longest watercourse – 514 ft;

Length along longest watercourse to centroid – 291 ft;

Existing basin slope is 2.5%;

Hydrologic Soils group B per USDA GIS Map.

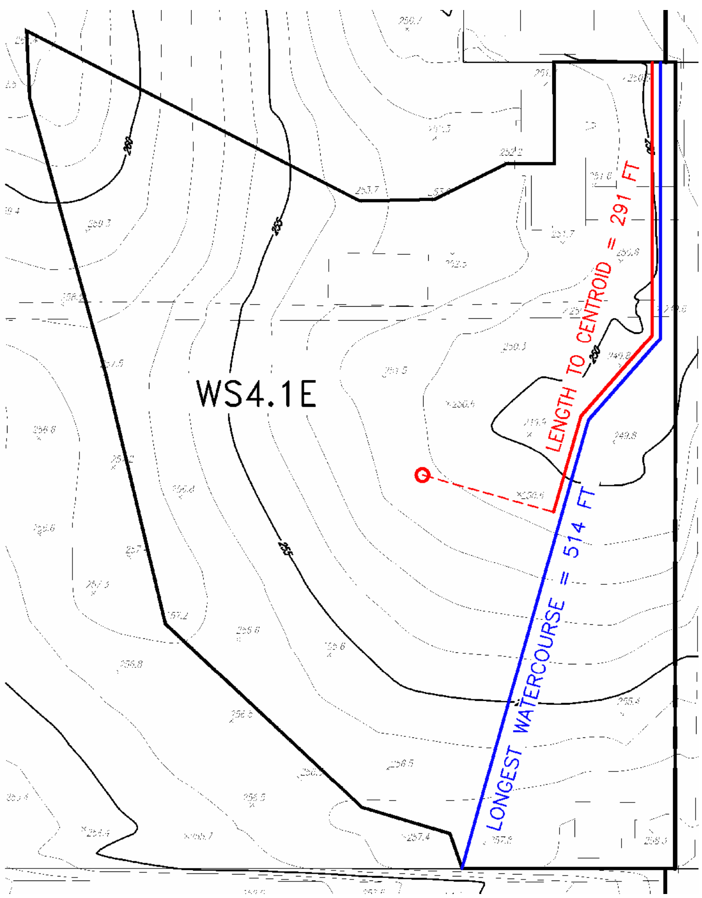


Figure 9 – WS4.1E Lengths.

Watershed WS3.1P conditions are:

Total shed area = 2.41 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

RD-2 = 0.32 acres;

RD-3 = 1.37 acres ;

RD-4 = 0.72 acres.

Length of longest watercourse – 776 ft;

Length along longest watercourse to centroid – 322 ft;

Proposed average basin slope is 0.5%;

Hydrologic Soils group B per USDA GIS Map.

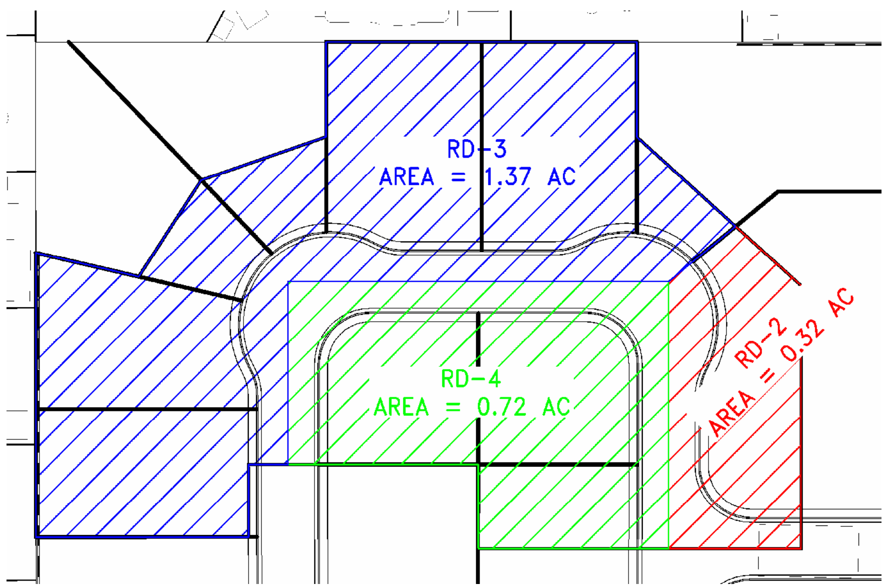


Figure 10 – WS3.1P Zoning.

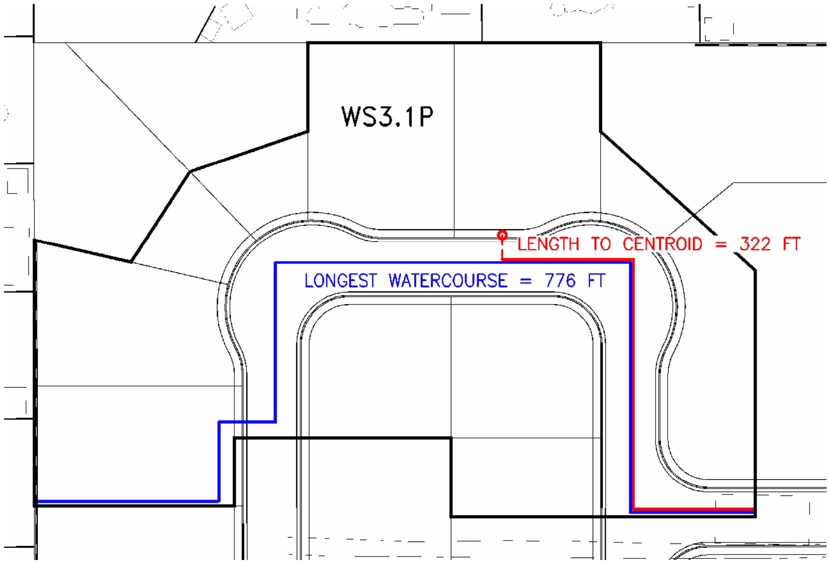


Figure 11 – WS3.1P Lengths.

Watershed WS3.2P conditions are:

Total shed area = 2.44 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

RD-3 = 0.57acres – 23%;

RD-4 = 1.87 acres – 77%.

Length of longest watercourse – 646 ft;

Length along longest watercourse to centroid – 283 ft;

Proposed average basin slope is 0.5%;

Hydrologic Soils group B per USDA GIS Map.

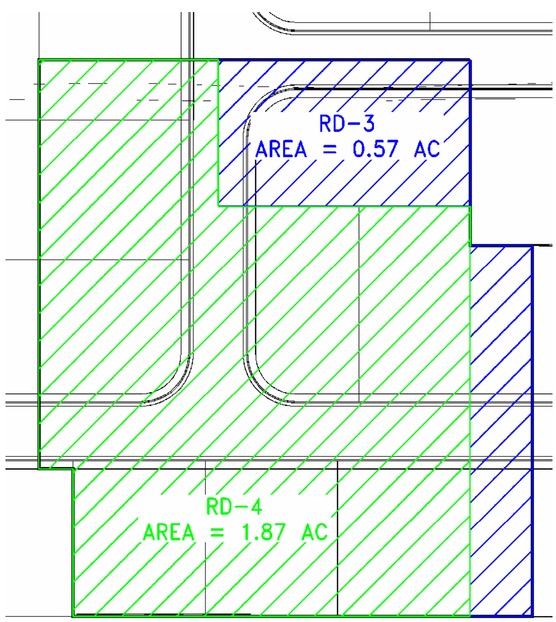


Figure 12 – WS3.2P Zoning.

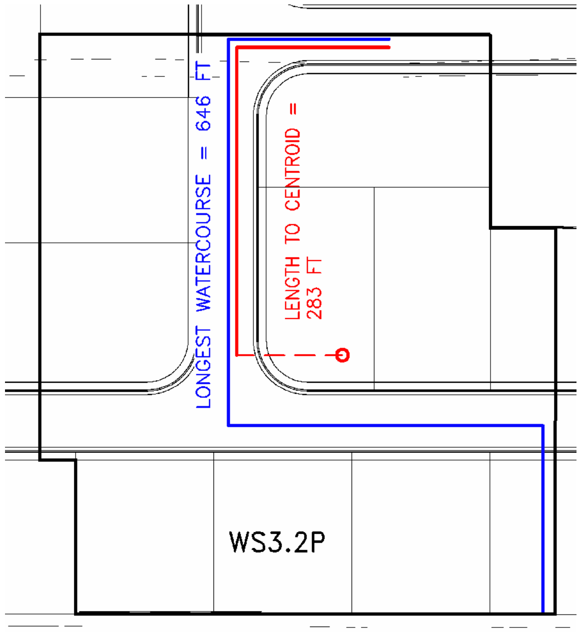


Figure 13 – WS3.2P Lengths.

Watershed WS3.3P conditions are:

Total shed area = 0.64 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on proposed zoning area:

RD-3 = 0.34 acres;

RD-4 = 0.30 acres.

Length of longest watercourse – 186 ft;

Length along longest watercourse to centroid – 41 ft;

Proposed average basin slope is 1.0%;

Hydrologic Soils group B per USDA GIS Map.

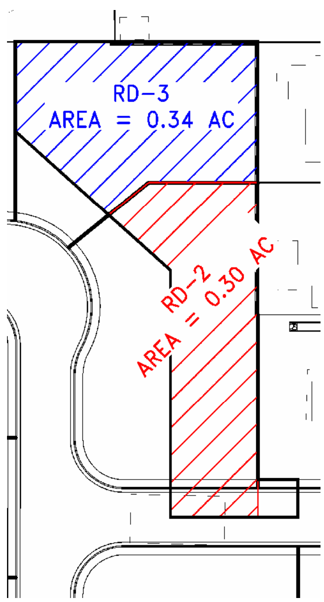


Figure 14 – WS3.2P Zoning.

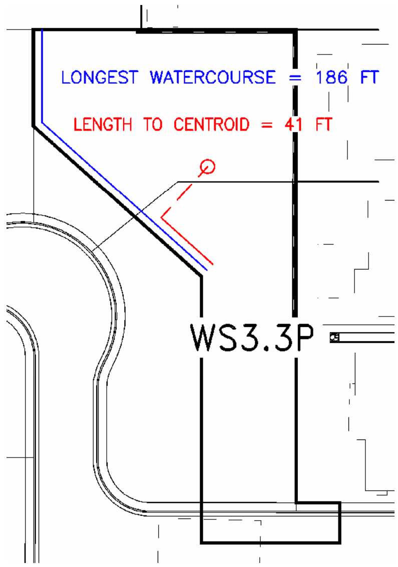


Figure 15 – WS3.2P Lengths.

Watershed WS4.1P conditions are:

Total shed area = 0.98 acres;

Mean Elevation – 255 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-3.

Length of longest watercourse – 533 ft;

Length along longest watercourse to centroid – 167 ft;

Proposed average basin slope is 2.0%;

Hydrologic Soils group B per USDA GIS Map.

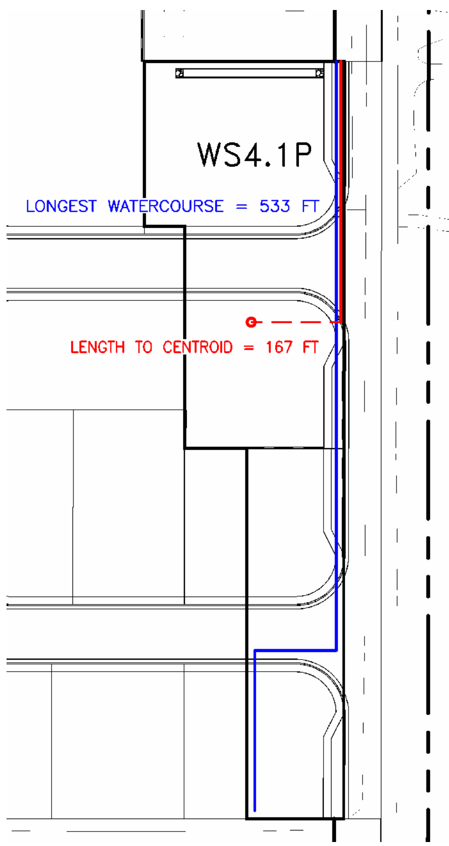


Figure 16 – WS4.1P Lengths.

3.2 Peak Control

Due to the drainage issues downstream of the proposed development, the project is required not to increase the peak flows during 24 hour 2-, 10- and 100-year events. In order to satisfy this requirement the detention in the back of Lot 2 basin is proposed. On-site grades are design to allow the drainage to enter the basin by both: pipe system and overland flows. Flow restriction in the detention basin is proposed per detail in the Preliminary Grading Plan. Total depth of the basin is 3' with 3:1 side slopes. Watershed WS2.1P is connected to the basin via the drainage pipe system, but overland release of it follows the historical path south of the development.

3.3 SacCalc Analysis

As can be seen from the results in the Figure 3 – PRE and POST, the development will not increase runoff offsite in the East Direction during 2-, 10- and 100-year events. Watershed WS2.1P is connected to the basin using Diversion function. Inlet capacity as calculated below is used as a diverted flow.

Inlet capacity per HEC- 22 (USDOT, FHWA, September 2009):

$Q_{cap} = K\ D^{5/3}$, where

D – depth of flow at curb = 0.38 ft – difference between FL and TBW per Preliminary Grading Plan;

K - coefficient of inlet capacity based on transverse and longitudinal gutter slopes. See figure below.

S_L - longitudinal gutter slope – ranges from 0.75% to 1.50% for WS2.1P. Average of 1.2% is taken.

S_T - transverse gutter slope = 6.2% per Sacramento County 4-30 detail for type 1A gutter.

K = 16 for the above values per the graph below.

$Q_{cap} = K\ D^{5/3} = 16 \times 0.38^{5/3} = 3.19$ cfs.

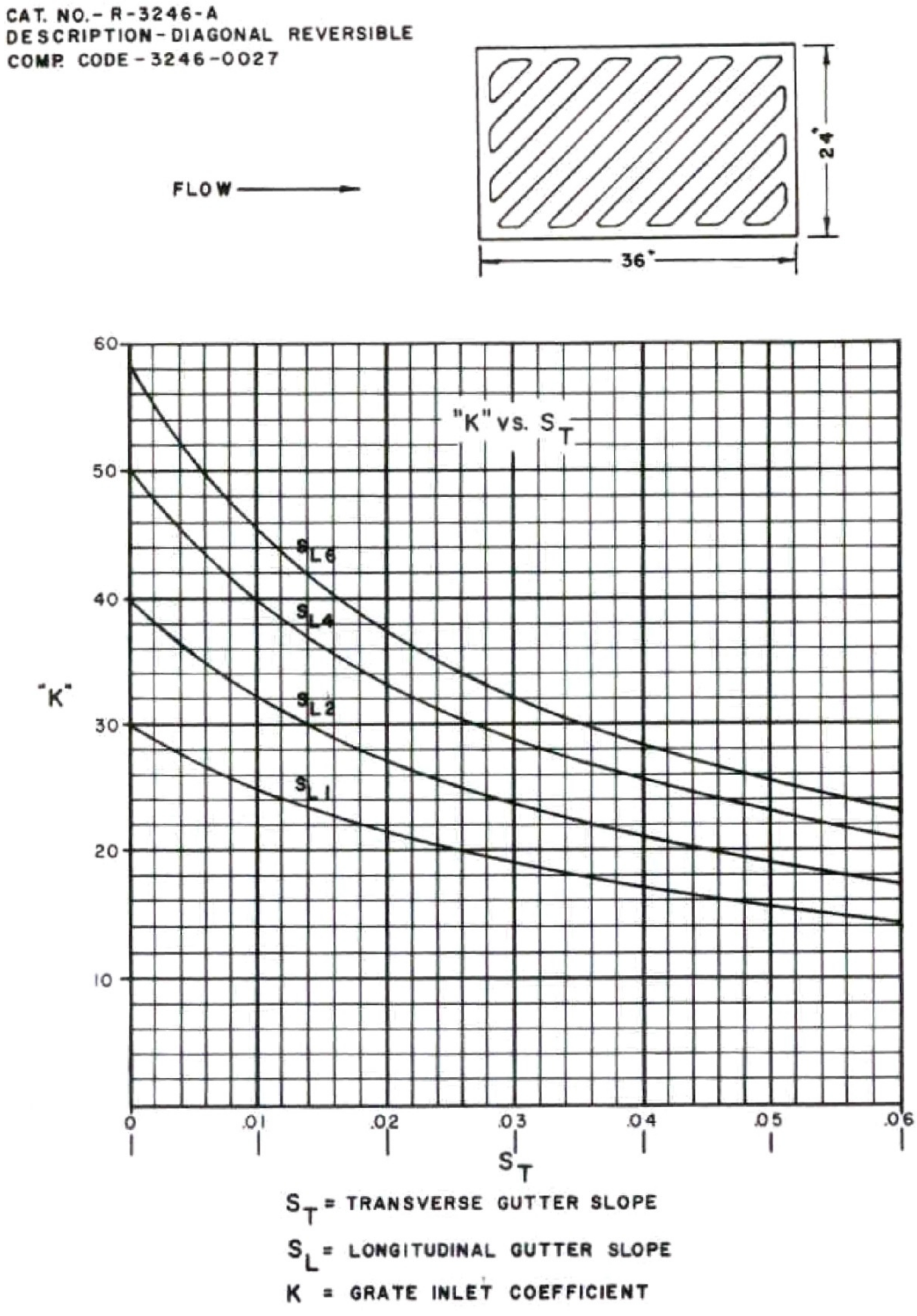


Figure 17 – Inlet Capacity.

3.4 Overland Release

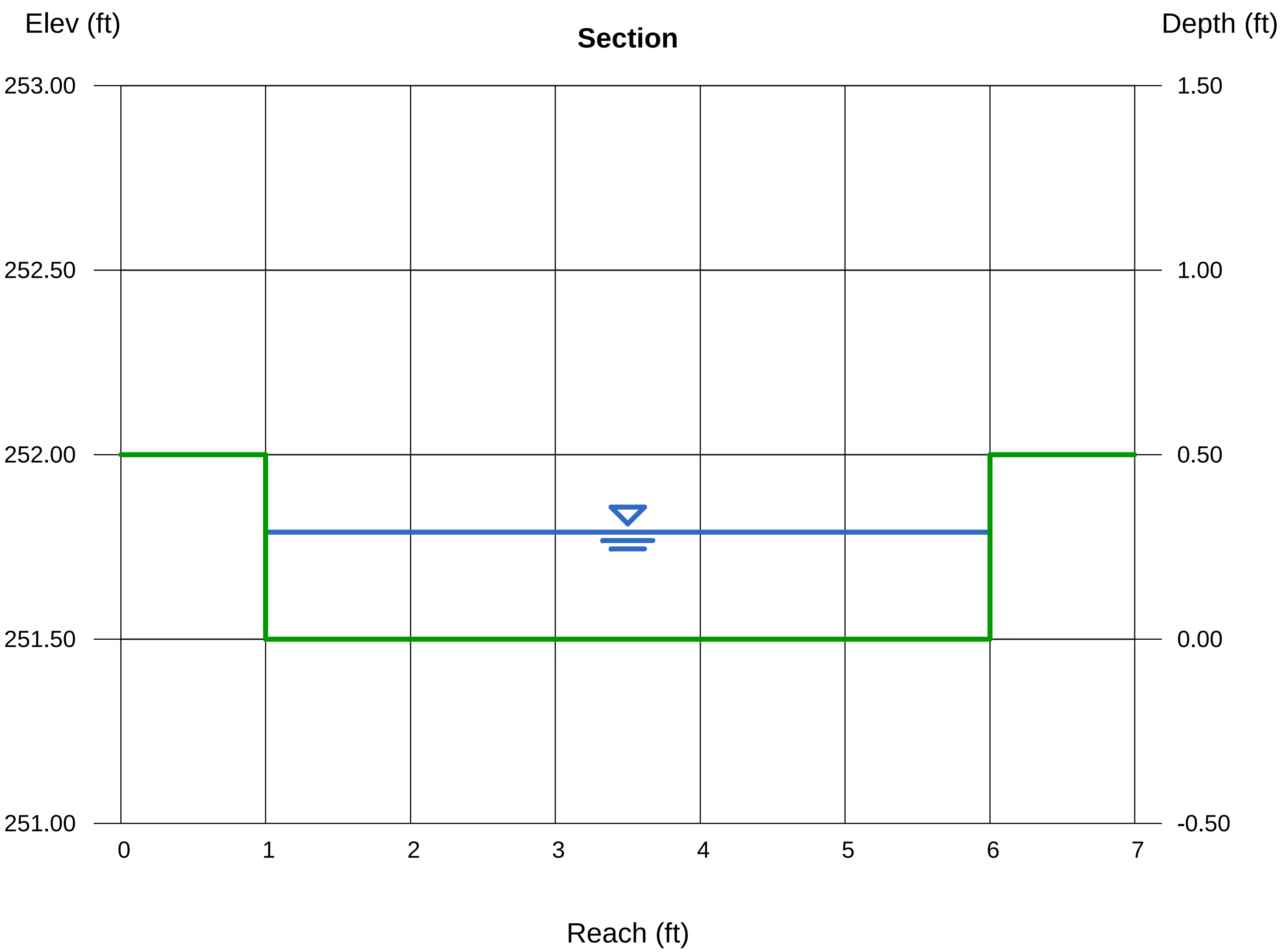
Elevation of the sidewalk low point on the north access road adjacent to the basin is designed to be lower than the gutter flow line east of the basin in order to direct the overland flow into the basin. 5 foot wide weir and concrete spillway is proposed on the north side of the existing house on lot 1. Flow of 8.1 cfs as a post-developed condition downstream of the pond is used for the calculation.

The Report for the spillway is presented below. The detail is provided in the Preliminary Grading Plan.

Channel Report

Overland Release

Rectangular		**Highlighted**	
Bottom Width (ft)	= 5.00	Depth (ft)	= 0.29
Total Depth (ft)	= 0.50	Q (cfs)	= 8.100
		Area (sqft)	= 1.45
Invert Elev (ft)	= 251.50	Velocity (ft/s)	= 5.59
Slope (%)	= 2.35	Wetted Perim (ft)	= 5.58
N-Value	= 0.016	Crit Depth, Yc (ft)	= 0.44
		Top Width (ft)	= 5.00
Calculations		EGL (ft)	= 0.78
Compute by:	Known Q		
Known Q (cfs)	= 8.10		



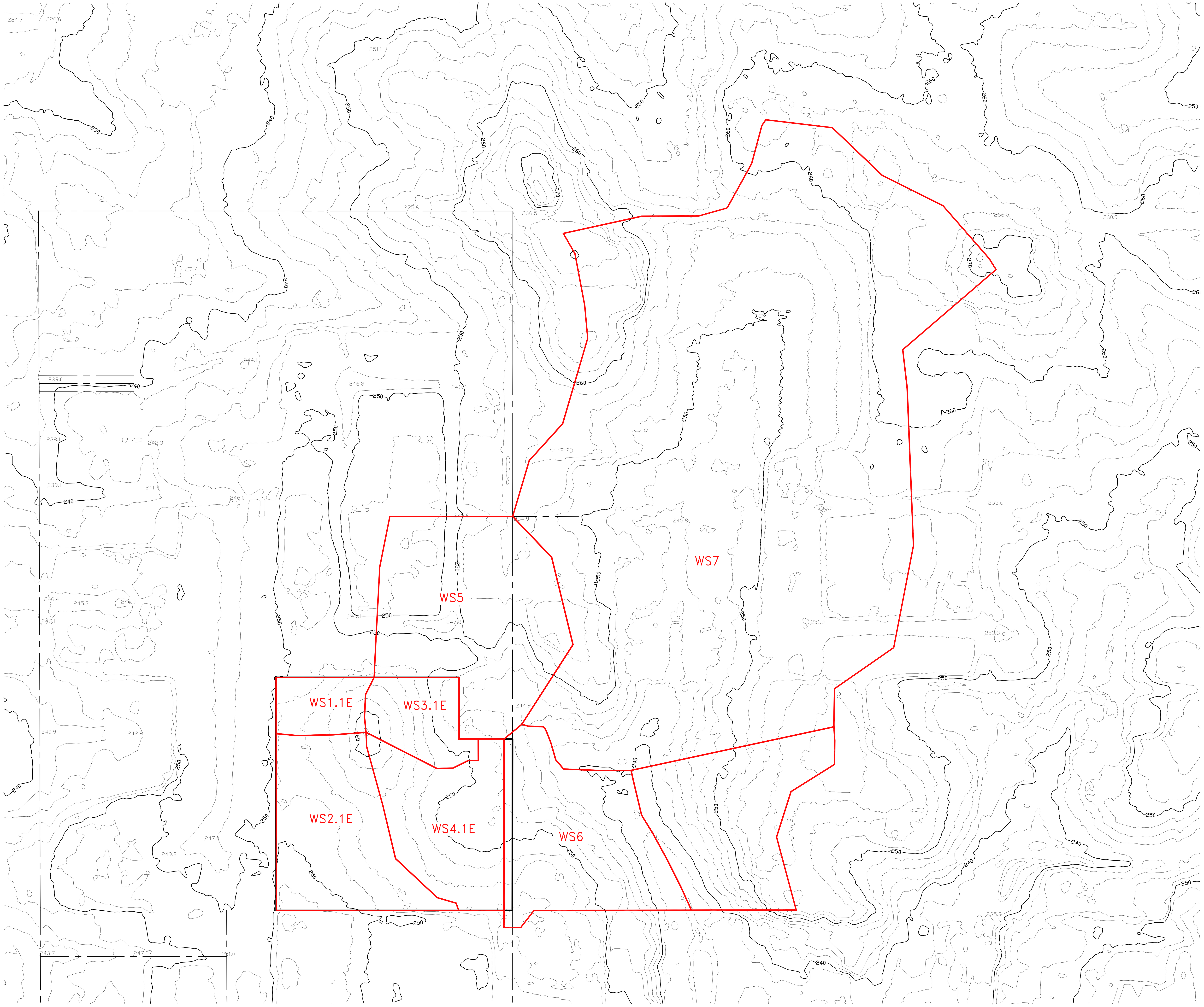
3.5 Downstream Analysis

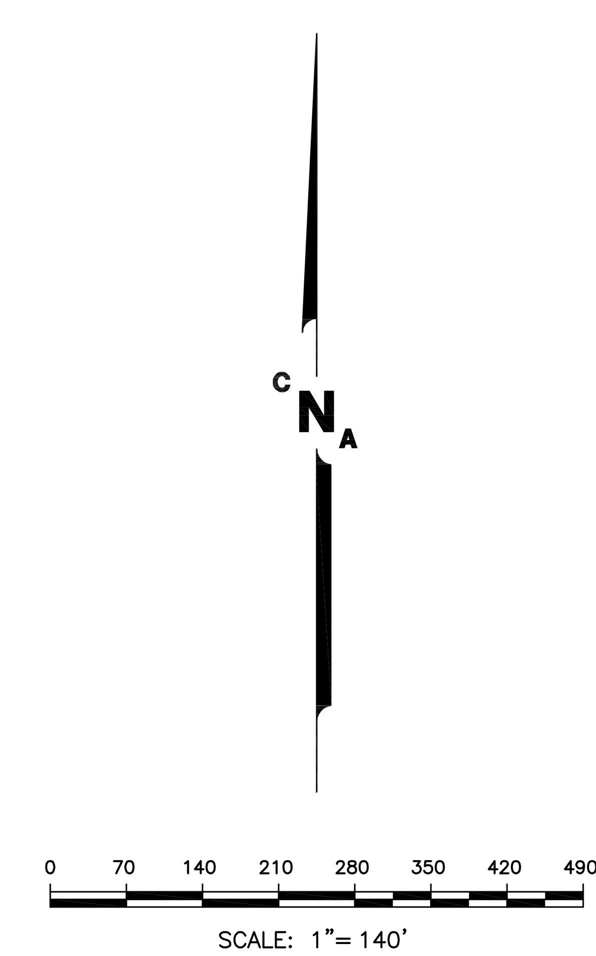
In order to evaluate the effect of the development downstream of the project Hec-Ras analysis has been performed. The goal of this analysis is to analyze the impact of the proposed development on the existing downstream developments and make sure that no adverse effect appear due to the development.

Exisitng conditions are as follows: onsite flows from WS3.1E & WS4.1E cross Filbert Avenue and fall into the swale. This swale alos conveys flows from WS5 as shonw on the Watershed Map. Further down flows from WS7 enter at the swales merging point. Flows from WS6 and WS7 enter the swale along its length. The Hec-Ras model is extended inside the subdivision to establish the proper downstream boundary conditions with a normal depth. At the Palms Subdivision northern boundary there is a CMP round inlet with 30” pipe that extends inside the subdivision pipe drain system. This pipe is disregarded in this floodplain analysis for simplicity of computations.

All drainage facilities and grades have been surveyed.

On-site watersheds have been described previously. Off-site watersheds are described below.





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cnaeng.com

SCALE	PREPARED BY
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VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.

ASSESSOR'S PARCEL NO.: 223-0091-002

EXISTING WATERSHED MAP:

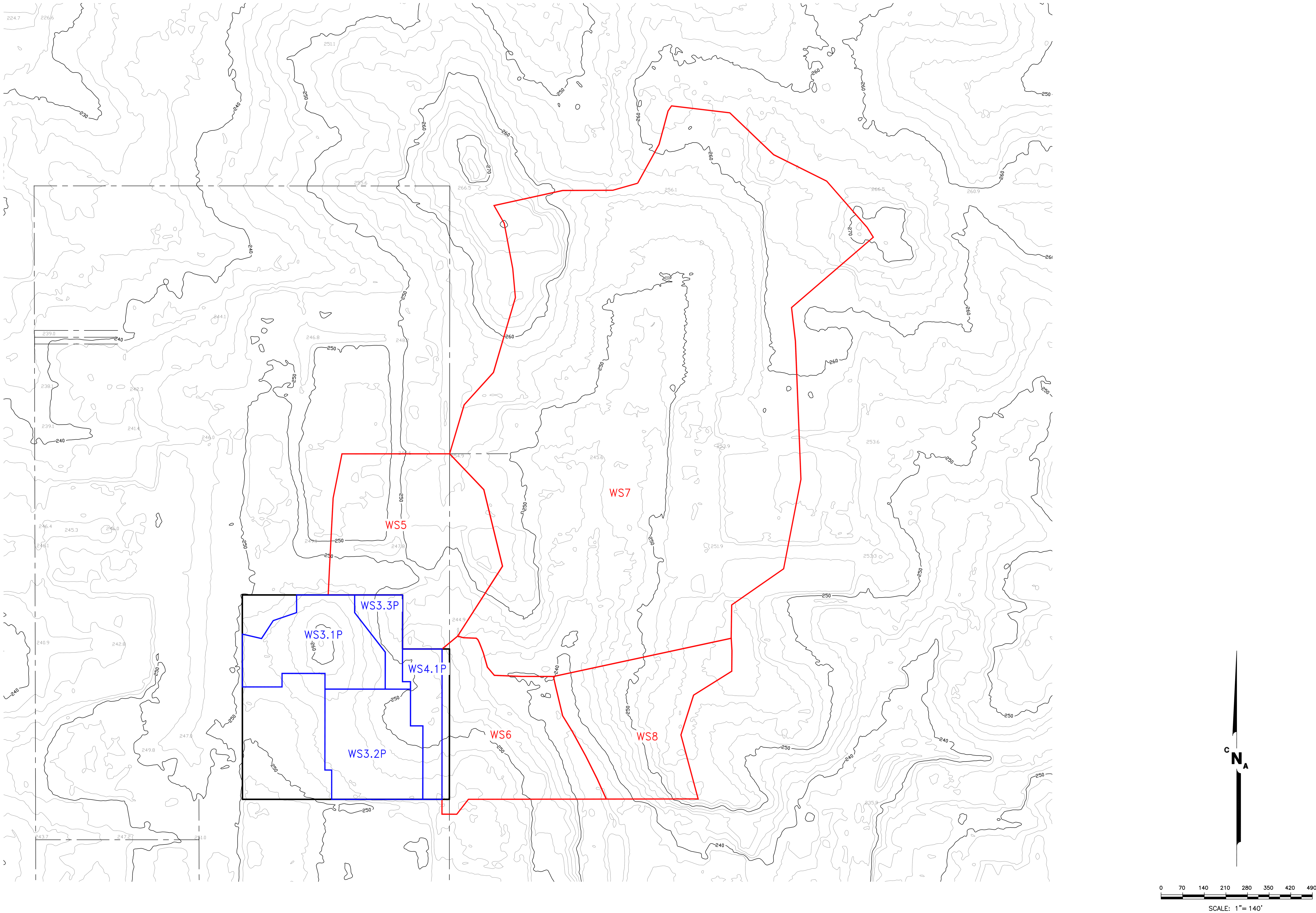
BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021

FN.:NAD 27 GRID.DWG

SHEET X OF X SHEETS



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ASSESSOR'S PARCEL NO.: 223-0091-002

PROPOSED WATERSHED MAP:

BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021

FN.:NAD 27 GRID.DWG

SHEET X OF X SHEETS

3.5.1 Off-site Watersheds Descriptions

Watershed WS5 conditions are:

Total shed area = 6.04 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 816 ft;

Length along longest watercourse to centroid – 468 ft;

Existing basin slope is 1.0%;

Hydrologic Soils group B per USDA GIS Map.

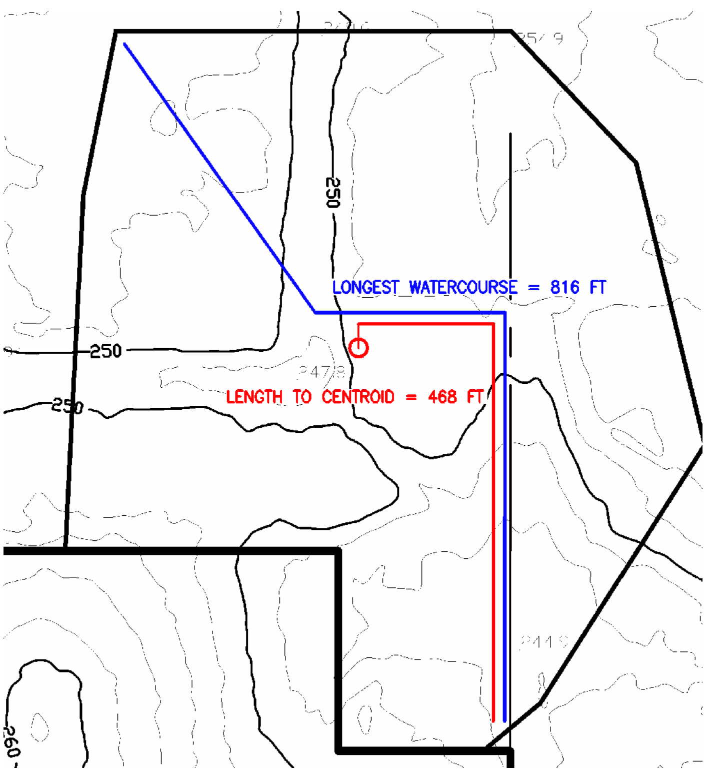


Figure 18 – WS5 Lengths.

Watershed WS6 conditions are:

Total shed area = 4.44 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 506 ft;

Length along longest watercourse to centroid – 215 ft;

Existing basin slope is 3.0%;

Hydrologic Soils group B per USDA GIS Map.

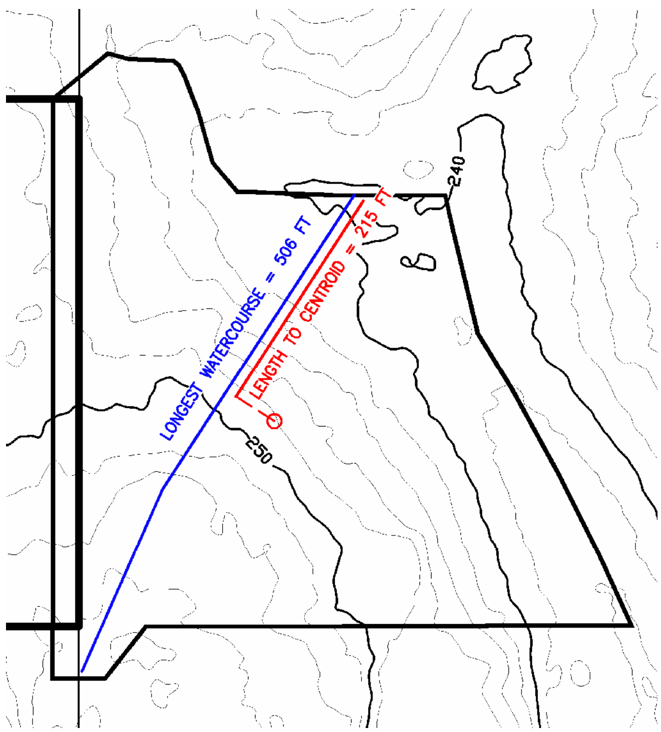


Figure 19 – WS6 Lengths.

Watershed WS7 conditions are:

Total shed area = 37.21 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 1,897 ft;

Length along longest watercourse to centroid – 894 ft;

Existing basin slope is 1.0%;

Hydrologic Soils group B per USDA GIS Map.

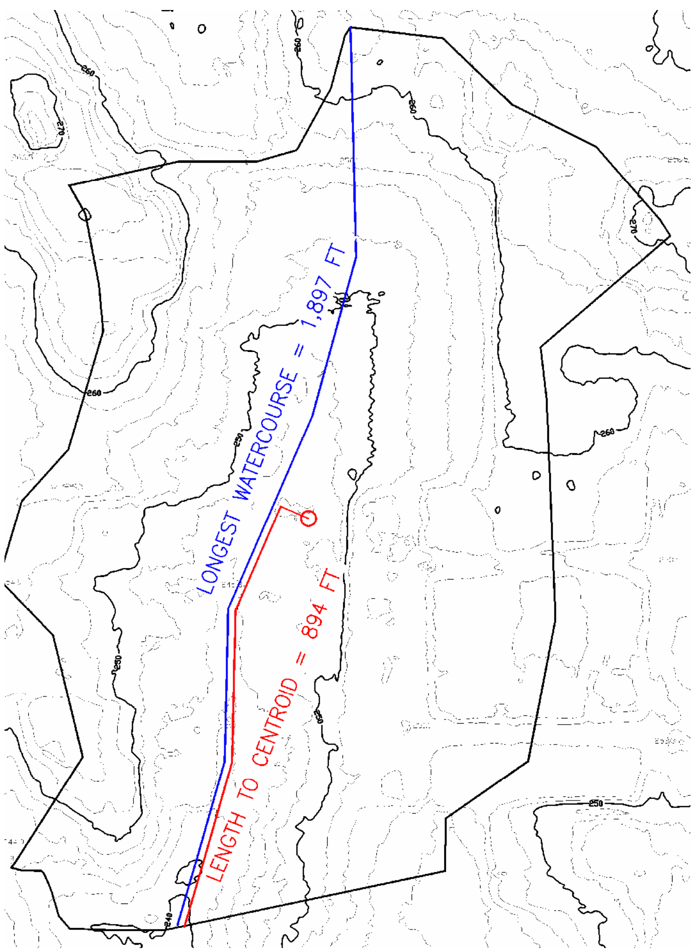


Figure 21 – WS7 Lengths.

Watershed WS8 conditions are:

Total shed area = 4.20 acres;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – 30% - RD-2;

Length of longest watercourse – 573 ft;

Length along longest watercourse to centroid – 210 ft;

Existing basin slope is 3.0%;

Hydrologic Soils group B per USDA GIS Map.

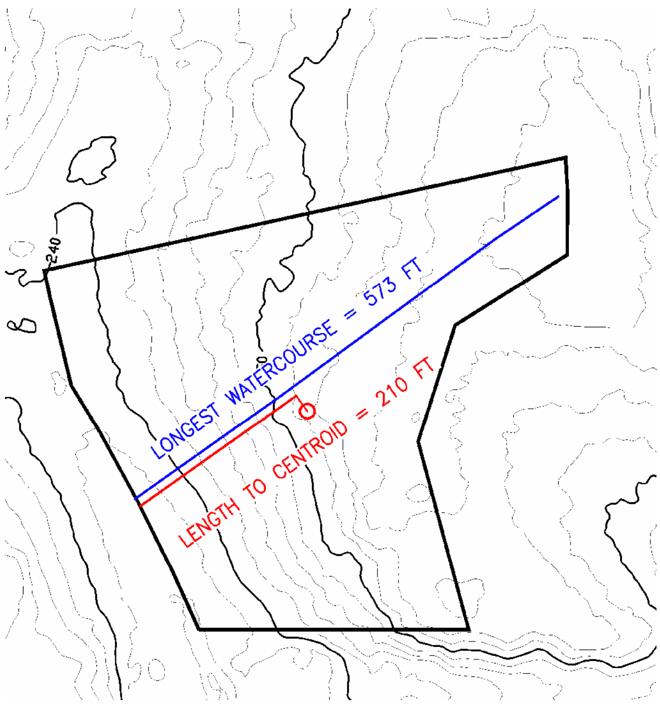


Figure 22 – WS8 Lengths.

3.5.2 HEC-RAS Analysis

Pre-Project conditions are analyzed in HEC-RAS.

1. Unsteady Flow Analysis has been performed in HEC-RAS. SacCalc results have been imported into HEC-RAS in the following locations for the Pre-Project conditions:
    - WS5 flow at section 1000;
    - WS3.1E & WS4.1 combined (PRE) flow at section 968;
    - WS6 flow between sections 350 and 770;
    - WS8 flow between sections 250 and 450;
    - WS7 flow at section 571.
2. Post-Project conditions:
    - WS5 flow at section 1000;
    - Mitigated combined (POST) flow at section 968;
    - WS6 flow between sections 350 and 770;
    - WS8 flow between sections 250 and 450;
    - WS7 flow at section 571.

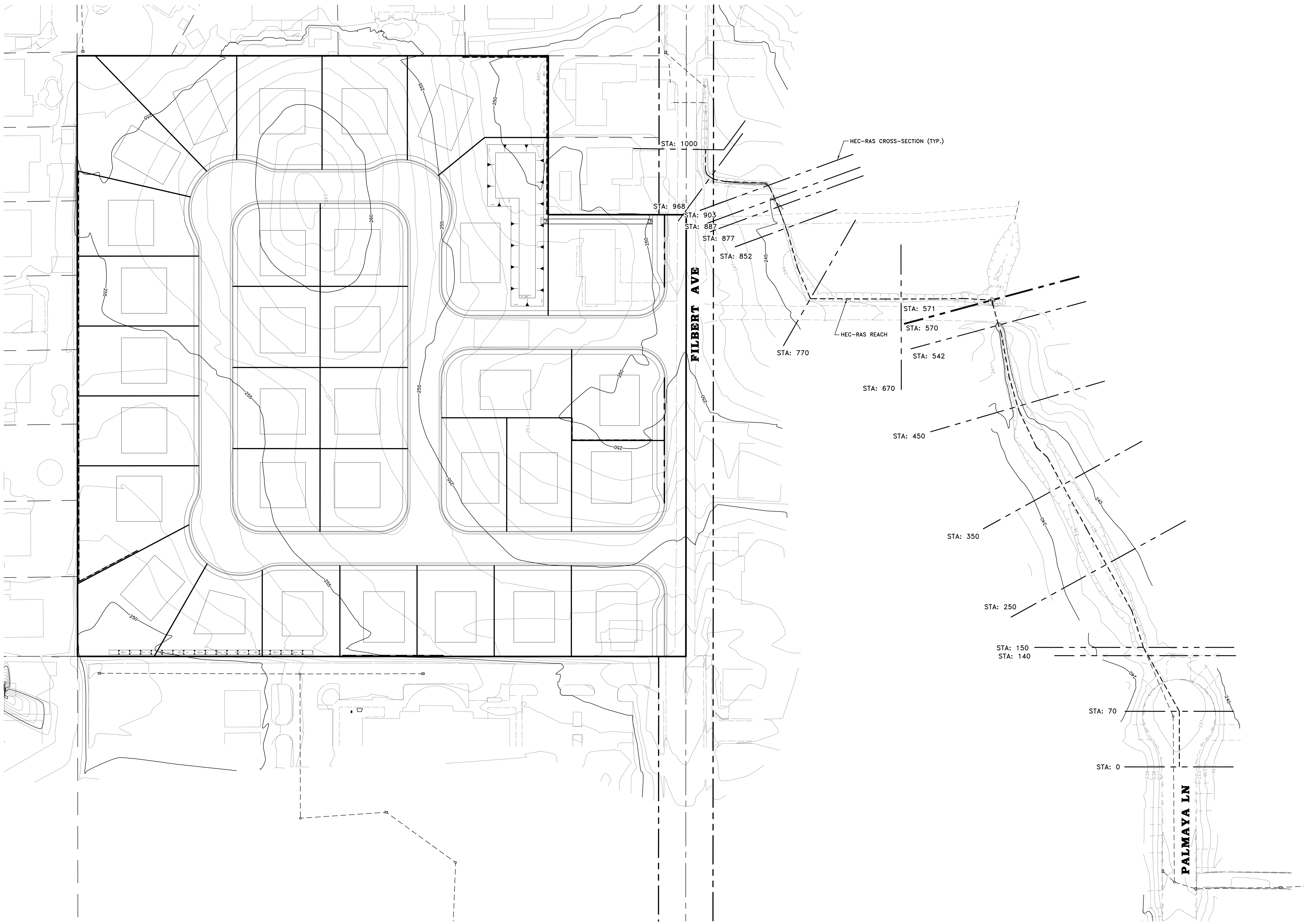
3 culverts have been in locations per field survey.

At the end of the river normal depth of 0.007 has been applied to account for the slope of the private road as per field survey.

Manning's n-value of 0.045 as for main channels with tall weeds and stones as well as flood plains with high grass has been used for the swale cross sections in HEC-RAS. Manning's n-value of 0.016 has been used for pavement in sections 0 and 70.

All the channel's bed sections were surveyed and LiDar information has been used to fill the gaps in field shots for some of the overbank data.

Simulation time of 10 seconds has been utilized in the HEC-RAS model provided attached for review.



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SCALE
HORIZ.: N/A
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002

HEC-RAS PLAN FOR:
BLOSSOM RIDGE
COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021
FN.:19144_10.DWG
SHEET X OF X SHEETS

3.5.3 Analysis of the Results

As a result of the development flow rate and water surface elevations during 100-, 10-, & 2- year storm events do not increase.

4. Proposed Pipe Systems Analysis

The tie-in point for the System in Filbert Avenue is an existing swale in the Right-of-Way as described in Section 3 and shown in the Preliminary Grading Plan. Starting elevation for the HGL_{pipe} will is established as a 10-year HGL in the swale per Sacramento County Standards.

4.1 Initial HGL for Pipe System Analysis

Initial 10-year HGL in the pipe system is obtained from the downstream channel calculation.

4.1.1 Watershed Description

Watershed WSC.1 conditions are:

Total shed area = 15.60 acres – all the project area has been conservatively included as the most of the site will be collected by the proposed pipe system;

Mean Elevation – 250 ft;

Precipitation Zone – 3;

Imperviousness – combined, based on existing zoning areas:

RD-2 + AR-2 = 6.65 acres;

RD-3 = 5.15 acres;

RD-4 = 3.80 acres.

Length of longest watercourse – 1,066 ft;

Length along longest watercourse to centroid – 412 ft;

Basin slope is 0.5%;

Hydrologic Soils group B per USDA GIS Map.

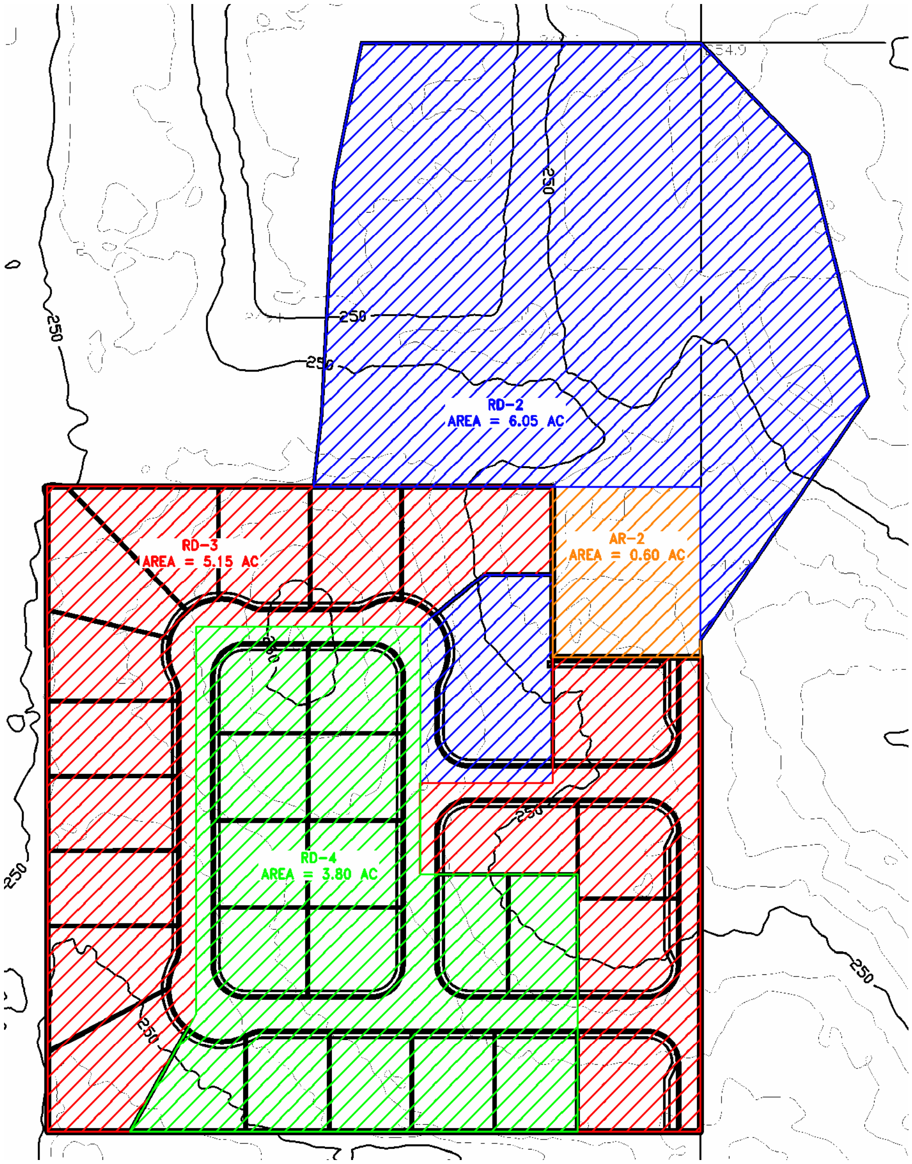


Figure 18 – WSC.1 Zoning.

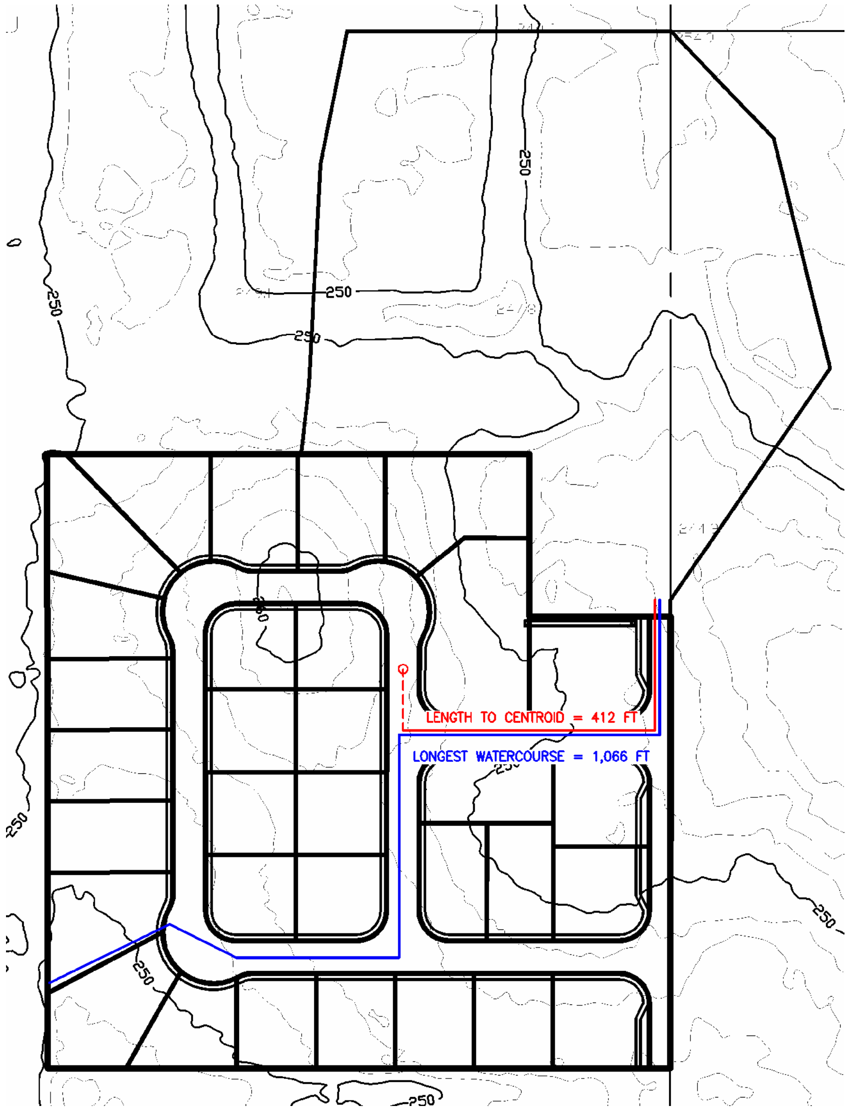
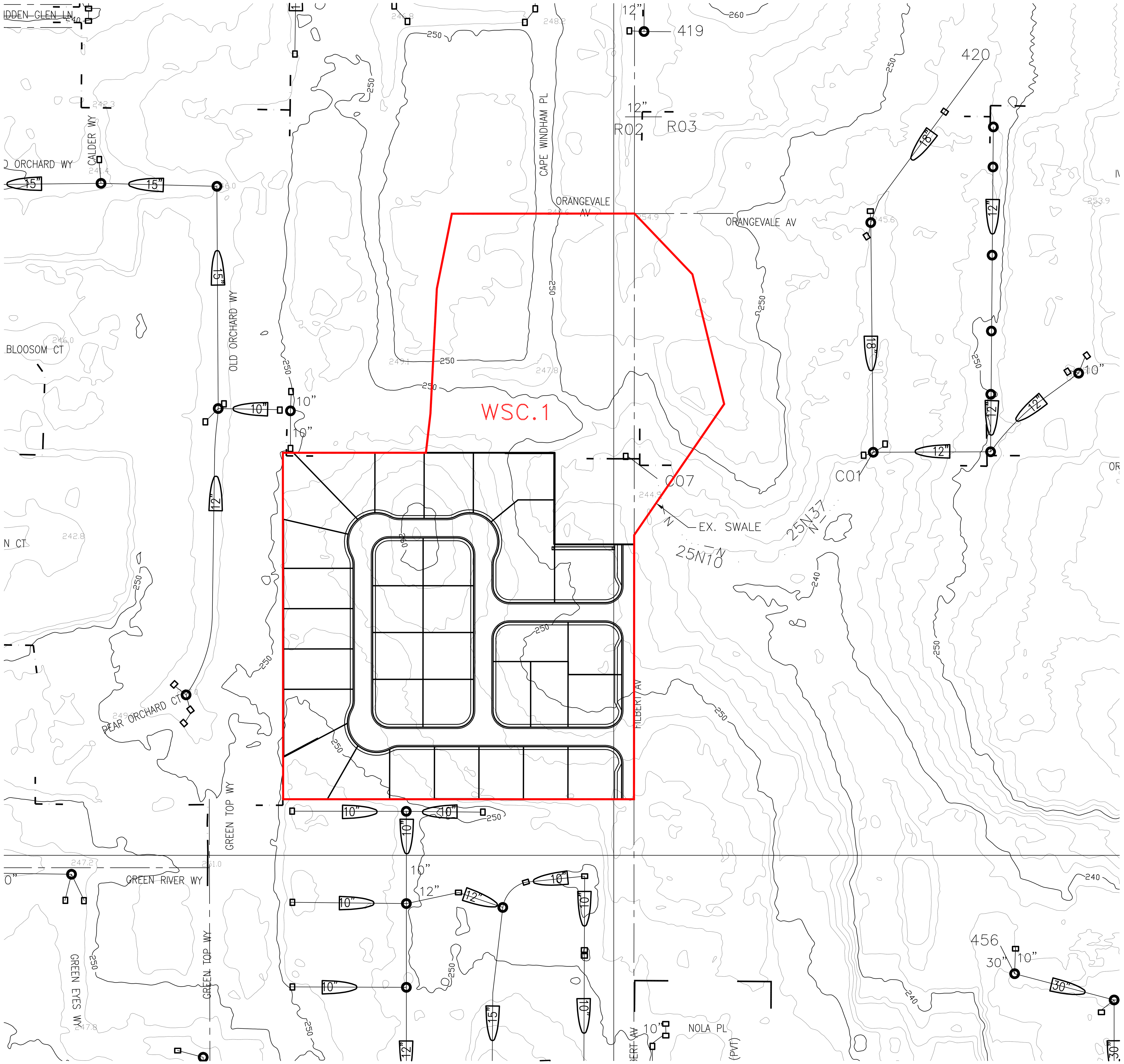


Figure 19 – WSC.1 Lengths.



0 50 100 150 200 250 300 350

SCALE: 1"= 100'

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DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.

SCALE
HORIZ.: 1"= 100'
VERT.: N/A
FLD BK.: N/A
ASSESSOR'S PARCEL NO.: 223-0091-002

WATERSHED MAP FOR CREEK HGL.

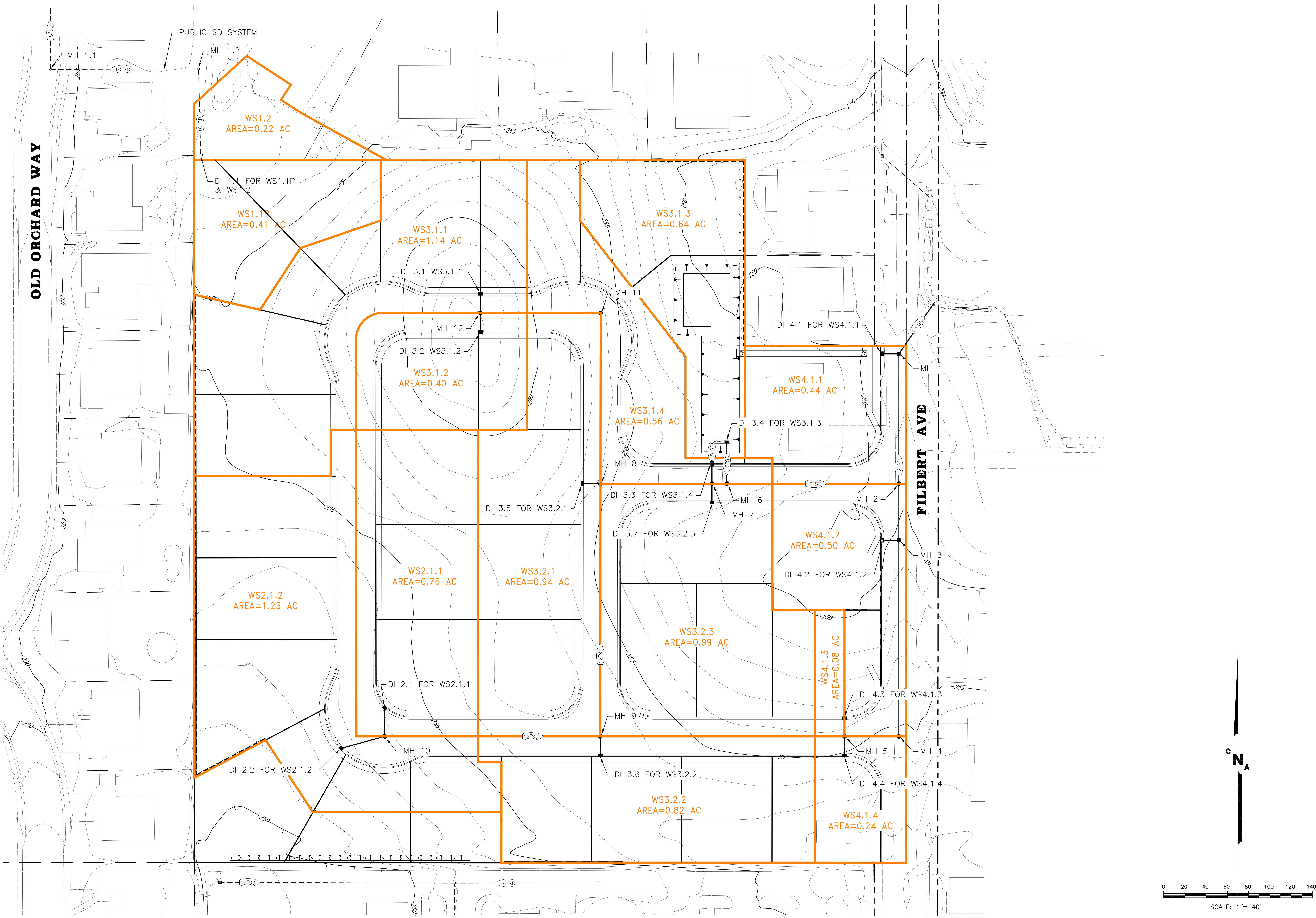
BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021

FN.:NAD 27 GRID.DWG

SHEET X OF X SHEETS



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ASSESSOR'S PARCEL NO.: 223-0091-002

SCALE
HORIZ.: 1"= 40'
VERT.: N/A
FLD BK.: N/A

WATERSHED MAP FOR PIPES FOR:

BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021

FN.:19144_10.DWG

SHEET X OF X SHEETS

4.1.2 SacCalc Analysis

Per SacCalc results for WSC.1 for 10-year event, peak flow is 23.0 cfs.

4.1.3 Hydraflow Channel Analysis

10-year 24-hour flow as calculated above for the watershed WSC.1 (23 cfs) has been run through the channel calculator. See report below. The geometry of the section has been obtained from the field work. N-value of 0.040 has been used for the earth channel with some weeds.

Water depth in the channel reaches 1.66' above the flow line which results in the WSE of 246.78'. This elevation is taken as a boundary condition for the pipe system at the last node of the system.

4.2 Pipe Analysis

4.2.1 Watersheds Description

Areas and conditions for the purpose of calculations are assumed to be as follows:

- *WS2.1.1* (collected by the proposed type B DI):

Total shed area = 0.76 acres;

Proposed imperviousness = 40% - RD-4;

- *WS2.1.2* (collected by the proposed type B DI):

Total shed area = 1.23 acres;

Proposed imperviousness = 30% - RD-3;

- *WS3.1.1* (collected by the proposed type B DI):

Total shed area = 1.14 acres;

Proposed imperviousness = 30% - RD-3;

- *WS3.1.2* (collected by the proposed type B DI):

Total shed area = 0.40 acres;

Proposed imperviousness = 40% - RD-4;

- *WS3.1.3* (collected by the proposed type F DI in the pond):

Total shed area = 0.64 acres;

Proposed imperviousness = 25% - RD-2;

- *WS3.1.4* (collected by the proposed type J DI):

Total shed area = 0.56 acres;

Proposed imperviousness = 40% - RD-4;

- *WS3.2.1* (collected by the proposed type B DI):

Total shed area = 0.94 acres;

Proposed imperviousness = 40% - RD-4;

- *WS3.2.2* (collected by the proposed type B DI):

Total shed area = 0.82 acres;

Proposed imperviousness = 40% - RD-4;

- *WS3.2.3* (collected by the proposed type B DI):

Total shed area = 0.99 acres;

Proposed imperviousness = 40% - RD-4;

- *WS4.1.1* (collected by the proposed type B DI):

Total shed area = 0.44 acres;

Proposed imperviousness = 30% - RD-3;

- *WS4.1.2* (collected by the proposed type B DI):

Total shed area = 0.50 acres;

Proposed imperviousness = 30% - RD-3;

- *WS4.1.3* (collected by the proposed type B DI):

Total shed area = 0.08 acres;

Proposed imperviousness = 30% - RD-3;

- *WS4.1.4* (collected by the proposed type B DI):

Total shed area = 0.24 acres;

Proposed imperviousness = 30% - RD-3;

4.2.2 SacCalc Analysis

Nolte method results
(Project: Blossom Ridge_Nolte)
(Hydrologic zone 1)

ID	Drainage area (acres)	Impervious area (%)	Design Q (cfs)
WS1-1E	0.96	20.00	0.27
WS1-2	0.22	50.00	0.06
WS2-1E	3.82	20.00	1.07
WS2-1P	2.39	38.60	0.67
WS1-1P	0.41	30.00	0.11
WS-211	0.76	40.00	0.21
WS-212	1.23	30.00	0.34
WS-311	1.14	30.00	0.32
WS-312	0.40	40.00	0.11
WS-313	0.64	25.00	0.18
WS-314	0.56	40.00	0.16
WS-321	0.94	40.00	0.26
WS-322	0.82	40.00	0.23
WS-323	0.99	40.00	0.28
WS-411	0.44	30.00	0.12
WS-412	0.50	30.00	0.14
WS-413	0.08	30.00	0.02
WS-414	0.24	30.00	0.07

Figure 20 – SacCalc Nolte Results.

4.2.3 Hydraflow Analysis

Pipes and nodes information is as follows (refer to the WS Map above).

There is a concrete V-gutter between nodes 5 and 6 in the detention basin. This connection has been modeled as a 15” pipe (as upstream) in order to analyze the system capacity for conveyance of Nolte flows.

Structure #	*Structure ID*	*Rim Elevation*	*Invert (FL)*	*Pipe size and material (downstream)*	*Slope downstream*	*n-value*
1	MH 1	248.35	245.33	12”, RCP	0.0035	0.015

2	MH 2	249.80	245.76	12”, RCP	0.0035	0.015
3	MH 6	253.21	246.57	12”, PVC	0.0050	0.015
4	DI 3.4 (WS3.1.3)	249.79	246.76	10”, PVC	0.0050	0.015
5	FES	N/A	249.00	15”, PVC (assumed connection for purpose of SD design)	0.0029 (actual gutter – assumed as pipe)	0.015
6	DI 3.3 (WS3.1.4)	252.65	249.09	15”, PVC	0.0050	0.015
7	MH 7	253.14	249.19	15”, PVC	0.0050	0.015
8	MH 8	254.53	249.51	12”, PVC	0.0030	0.015
9	MH 9	255.74	250.23	12”, PVC	0.0030	0.015
10	MH 10	254.88	250.84	12”, PVC	0.0030	0.015
11	DI 2.2 (WS2.1.2)	253.57	250.97	12”, PVC	0.0030	0.015
12	DI 4.1 (WS4.1.1)	247.97	245.39	12”, PVC	0.0035	0.015
13	MH 3	250.39	245.95	12”, PVC	0.0035	0.015
14	DI 3.7 (WS3.2.3)	252.65	249.28	12”, PVC	0.0050	0.015
15	DI 3.5 (WS3.2.1)	254.04	246.60	12”, PVC	0.0050	0.015
16	DI 3.6 (WS3.2.2)	255.24	250.32	12”, PVC	0.0050	0.015
17	DI 2.1 (WS2.1.1)	253.88	250.92	12”, PVC	0.0030	0.015
18	MH 4	255.30	249.65	12”, PVC	0.0200	0.015
19	MH 5	255.85	250.17	12”, PVC	0.0250	0.015

20	DI 4.3 (WS4.1.3)	255.36	250.34	12”, PVC	0.0100	0.015
21	MH 11	254.91	250.00	12”, PVC	0.0030	0.015
22	DI 4.2 (WS4.1.2)	249.94	246.03	12”, PVC	0.0050	0.015
23	DI 4.4 (WS4.1.4)	255.36	250.34	12”, PVC	0.0100	0.015
24	MH 12	255.10	250.34	12”, PVC	0.0030	0.015
25	DI 3.1 (WS3.1.1)	254.61	250.43	12”, PVC	0.0050	0.015
26	DI 3.2 (WS3.1.2)	254.61	250.43	12”, PVC	0.0050	0.015

Table 2 – Proposed Storm Drain System Information.

246.78’ is used as downstream boundary condition as determined above.

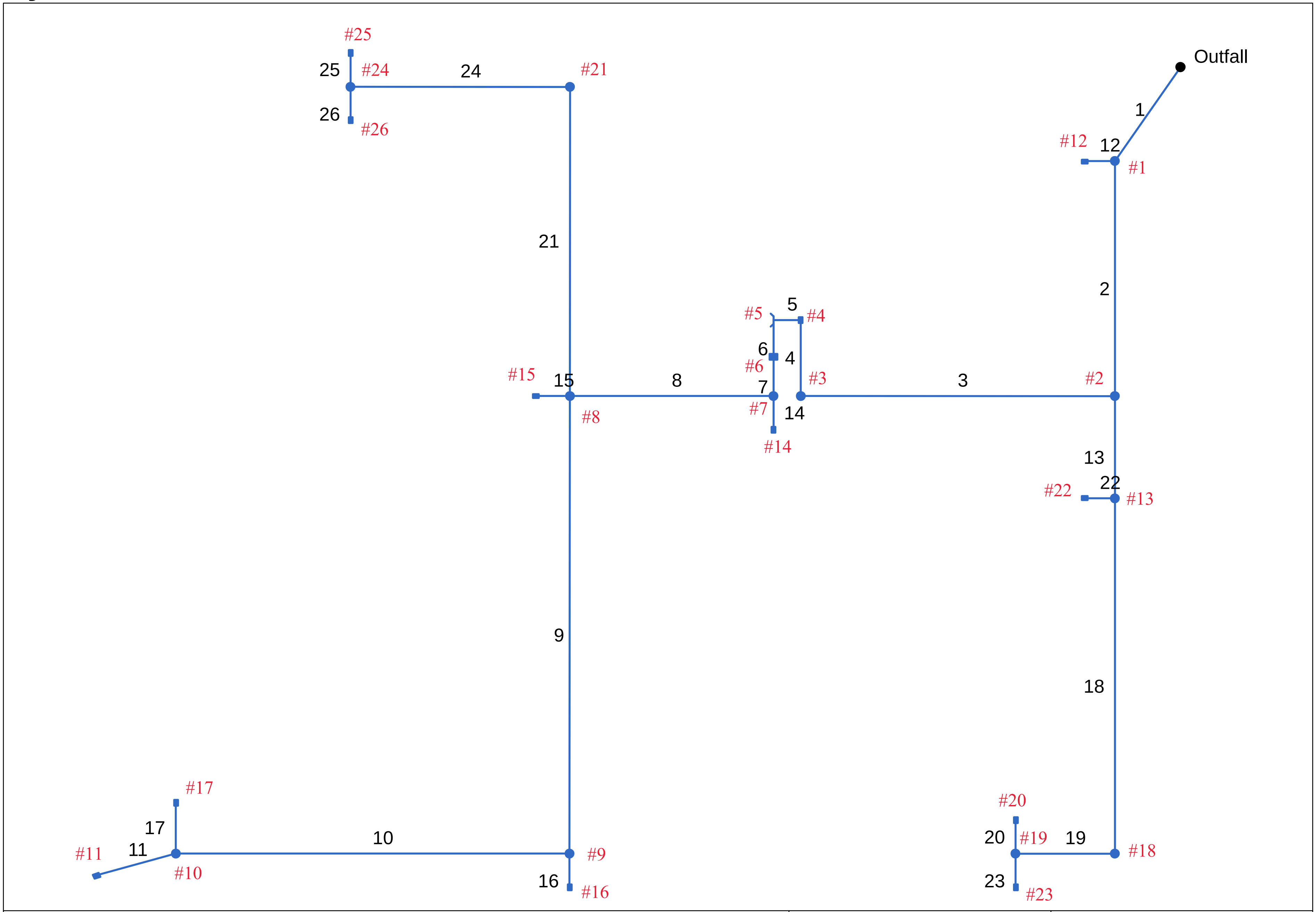
Structure #	*Structure ID*	*Rim Elevation*	*HGL*	*Rim – HGL*
1	MH 1	248.35	247.28	1.07
2	MH 2	249.80	248.11	1.69
3	MH 6	253.21	248.96	4.25
4	DI 3.4	249.79	249.78	0.01
5	FES	N/A	249.93	N/A
6	DI 3.3	252.65	249.98	2.67
7	MH 7	253.14	250.07	3.07
8	MH 8	254.53	250.37	4.16
9	MH 9	255.74	250.79	4.95
10	MH 10	254.88	251.28	3.60
11	DI 2.2	253.57	251.34	2.23

12	DI 4.1	247.97	247.28	0.69
13	MH 3	250.39	248.11	2.28
14	DI 3.7	252.65	250.07	2.58
15	DI 3.5	254.04	250.37	3.67
16	DI 3.6	255.24	250.79	4.45
17	DI 2.1	253.88	251.29	2.59
18	MH 4	255.30	249.78	5.52
19	MH 5	255.85	250.30	5.55
20	DI 4.3	255.36	250.42	4.94
21	MH 11	254.91	250.48	4.43
22	DI 4.2	249.94	248.11	1.83
23	DI 4.4	255.36	250.45	4.91
24	MH 12	255.10	250.73	4.37
25	DI 3.1	254.61	250.78	3.83
26	DI 3.2	254.61	250.74	3.87

Table 3 – Summary of Nolte Results.

As can be seen from the results below, HGL_{Nolte} for the system does not get closer than 12” below the rims of manholes and 6” below the rims of drop inlets except for DI 3.4. This DI is placed in the detention area to collect the drainage and restrict the higher flows, so its opening is set at the elevation of the pond. The system is considered to have sufficient capacity to convey Nolte flows.

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2009 Plan



Project File: Main SD Pipe System.stm	Number of lines: 26	Date: 05-28-2021

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
1	End	59.377	124.661	MH	0.00	0.00	0.00	0.0	245.12	0.35	245.33	12	Cir	0.015	0.85	248.35	
2	1	122.261	-34.657	MH	0.00	0.00	0.00	0.0	245.33	0.35	245.76	12	Cir	0.015	1.00	249.80	
3	2	162.049	90.000	MH	0.00	0.00	0.00	0.0	245.76	0.50	246.57	12	Cir	0.015	1.00	253.21	
4	3	39.500	89.996	Grate	0.18	0.00	0.00	0.0	246.57	0.48	246.76	10	Cir	0.015	1.50	249.79	
5	4	13.969	-90.000	Hdwl	0.00	0.00	0.00	0.0	248.96	0.29	249.00	15	Cir	0.015	1.50	252.00	
6	5	19.334	-89.901	Curb	0.16	0.00	0.00	0.0	249.00	0.47	249.09	15	Cir	0.015	0.50	252.65	
7	6	20.164	-0.099	MH	0.00	0.00	0.00	0.0	249.09	0.50	249.19	15	Cir	0.015	1.00	253.14	
8	7	105.022	90.004	MH	0.00	0.00	0.00	0.0	249.19	0.30	249.51	12	Cir	0.015	1.00	254.53	
9	8	238.000	-89.967	MH	0.00	0.00	0.00	0.0	249.51	0.30	250.23	12	Cir	0.015	1.00	255.74	
10	9	203.020	89.967	MH	0.00	0.00	0.00	0.0	250.23	0.30	250.84	12	Cir	0.015	1.00	254.88	
11	10	42.548	-15.436	Comb	0.34	0.00	0.00	0.0	250.84	0.31	250.97	12	Cir	0.013	1.00	0.00	
12	1	15.832	55.344	Comb	0.12	0.00	0.00	0.0	245.33	0.38	245.39	12	Cir	0.015	1.00	247.97	
13	2	53.200	0.000	MH	0.00	0.00	0.00	0.0	245.76	0.36	245.95	12	Cir	0.015	1.00	250.39	
14	7	17.830	-0.003	Comb	0.28	0.00	0.00	0.0	249.19	0.50	249.28	12	Cir	0.015	1.00	252.65	
15	8	17.033	-0.006	Comb	0.26	0.00	0.00	0.0	249.51	0.53	249.60	12	Cir	0.015	1.00	254.04	
16	9	17.830	0.000	Comb	0.23	0.00	0.00	0.0	250.23	0.50	250.32	12	Cir	0.015	1.00	255.24	
17	10	26.686	89.996	Comb	0.21	0.00	0.00	0.0	250.84	0.30	250.92	12	Cir	0.013	1.00	0.00	
18	13	184.800	0.000	MH	0.00	0.00	0.00	0.0	245.95	2.00	249.65	12	Cir	0.015	1.00	255.30	
19	18	51.241	90.000	MH	0.00	0.00	0.00	0.0	249.65	1.01	250.17	12	Cir	0.015	1.00	255.85	
20	19	17.000	90.000	Comb	0.02	0.00	0.00	0.0	250.17	1.00	250.34	12	Cir	0.015	1.00	255.36	
21	8	160.784	90.033	MH	0.00	0.00	0.00	0.0	249.51	0.30	250.00	12	Cir	0.015	1.00	254.91	
22	13	15.689	90.000	Comb	0.14	0.00	0.00	0.0	245.95	0.51	246.03	12	Cir	0.015	1.00	249.94	

Project File: Main SD Pipe System.stm	Number of lines: 26	Date: 05-28-2021

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr line No.	Line length (ft)	Defl angle (deg)	Junc type	Known Q (cfs)	Drng area (ac)	Runoff coeff (C)	Inlet time (min)	Invert El Dn (ft)	Line slope (%)	Invert El Up (ft)	Line size (in)	Line shape	N value (n)	J-loss coeff (K)	Inlet/ Rim El (ft)	
23	19	17.830	-90.001	Comb	0.07	0.00	0.00	0.0	250.17	0.95	250.34	12	Cir	0.015	1.00	255.36	
24	21	113.175	-90.028	MH	0.00	0.00	0.00	0.0	250.00	0.30	250.34	12	Cir	0.015	1.00	255.10	
25	24	17.830	90.000	Comb	0.32	0.00	0.00	0.0	250.34	0.50	250.43	12	Cir	0.015	1.00	254.61	
26	24	17.830	-90.000	Comb	0.11	0.00	0.00	0.0	250.34	0.50	250.43	12	Cir	0.015	1.00	254.61	

Project File: Main SD Pipe System.stm	Number of lines: 26	Date: 05-28-2021

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev. (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1		Manhole	248.35	Cir	4.00	4.00	12	Cir	245.33	12 12	Cir Cir	245.33 245.33
2		Manhole	249.80	Cir	4.00	4.00	12	Cir	245.76	12 12	Cir Cir	245.76 245.76
3		Manhole	253.21	Cir	4.00	4.00	12	Cir	246.57	10	Cir	246.57
4		Grate	249.79	Rect	3.00	2.00	10	Cir	246.76	15	Cir	248.96
5		OpenHeadwall	252.00	n/a	n/a	n/a	15	Cir	249.00	15	Cir	249.00
6		Curb-Horiz	252.65	Rect	3.00	4.00	15	Cir	249.09	15	Cir	249.09
7		Manhole	253.14	Cir	4.00	4.00	15	Cir	249.19	12 12	Cir Cir	249.19 249.19
8		Manhole	254.53	Cir	4.00	4.00	12	Cir	249.51	12 12 12	Cir Cir Cir	249.51 249.51 249.51
9		Manhole	255.74	Cir	4.00	4.00	12	Cir	250.23	12 12	Cir Cir	250.23 250.23
10		Manhole	254.88	Cir	4.00	4.00	12	Cir	250.84	12 12	Cir Cir	250.84 250.84
11		Combination	0.00	Rect	3.00	2.00	12	Cir	250.97			
12		Combination	247.97	Rect	3.00	2.00	12	Cir	245.39			
13		Manhole	250.39	Cir	4.00	4.00	12	Cir	245.95	12 12	Cir Cir	245.95 245.95
14		Combination	252.65	Rect	3.00	2.00	12	Cir	249.28			
15		Combination	254.04	Rect	3.00	2.00	12	Cir	249.60			
16		Combination	255.24	Rect	3.00	2.00	12	Cir	250.32			
17		Combination	0.00	Rect	3.00	2.00	12	Cir	250.92			
18		Manhole	255.30	Cir	4.00	4.00	12	Cir	249.65	12	Cir	249.65

Project File: Main SD Pipe System.stm	Number of Structures: 26	Run Date: 05-28-2021

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev. (ft)	Structure Shape	Structure Length (ft)	Structure Width (ft)	Line Out Size (in)	Line Out Shape	Line Out Invert (ft)	Line In Size (in)	Line In Shape	Line In Invert (ft)
19		Manhole	255.85	Cir	4.00	4.00	12	Cir	250.17	12 12	Cir Cir	250.17 250.17
20		Combination	255.36	Rect	3.00	2.00	12	Cir	250.34			
21		Manhole	254.91	Cir	4.00	4.00	12	Cir	250.00	12	Cir	250.00
22		Combination	249.94	Rect	3.00	2.00	12	Cir	246.03			
23		Combination	255.36	Rect	3.00	2.00	12	Cir	250.34			
24		Manhole	255.10	Cir	4.00	4.00	12	Cir	250.34	12 12	Cir Cir	250.34 250.34
25		Combination	254.61	Rect	3.00	2.00	12	Cir	250.43			
26		Combination	254.61	Rect	3.00	2.00	12	Cir	250.43			

Project File: Main SD Pipe System.stm	Number of Structures: 26	Run Date: 05-28-2021

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
1		2.44	12	Cir	59.377	245.12	245.33	0.354	246.78*	247.15*	0.13	247.28	End	Manhole
2		2.32	12	Cir	122.261	245.33	245.76	0.352	247.28*	247.97*	0.14	248.11	1	Manhole
3		2.09	12	Cir	162.049	245.76	246.57	0.500	248.11*	248.85*	0.11	248.96	2	Manhole
4		2.09	10	Cir	39.500	246.57	246.76	0.481	248.96*	249.44*	0.34	249.78	3	Grate
5		1.91	15	Cir	13.969	248.96	249.00	0.286	249.78	249.81	0.12	249.93	4	OpenHeadwall
6		1.91	15	Cir	19.334	249.00	249.09	0.465	249.93	249.95	0.04	249.98	5	Curb-Horiz
7		1.75	15	Cir	20.164	249.09	249.19	0.496	249.98	250.00	0.07	250.07	6	Manhole
8		1.47	12	Cir	105.022	249.19	249.51	0.305	250.07	250.29	0.08	250.37	7	Manhole
9		0.78	12	Cir	238.000	249.51	250.23	0.303	250.37	250.72	0.06	250.79	8	Manhole
10		0.55	12	Cir	203.020	250.23	250.84	0.300	250.79	251.21	0.07	251.28	9	Manhole
11		0.34	12	Cir	42.548	250.84	250.97	0.306	251.28	251.31	0.03	251.34	10	Combination
12		0.12	12	Cir	15.832	245.33	245.39	0.379	247.28*	247.28*	0.00	247.28	1	Combination
13		0.23	12	Cir	53.200	245.76	245.95	0.357	248.11*	248.11*	0.00	248.11	2	Manhole
14		0.28	12	Cir	17.830	249.19	249.28	0.505	250.07	250.07	0.00	250.07	7	Combination
15		0.26	12	Cir	17.033	249.51	249.60	0.528	250.37	250.37	0.00	250.37	8	Combination
16		0.23	12	Cir	17.830	250.23	250.32	0.505	250.79	250.79	0.01	250.79	9	Combination
17		0.21	12	Cir	26.686	250.84	250.92	0.300	251.28	251.28	0.01	251.29	10	Combination
18		0.09	12	Cir	184.800	245.95	249.65	2.002	248.11	249.78	n/a	249.78 j	13	Manhole
19		0.09	12	Cir	51.241	249.65	250.17	1.015	249.78	250.30	0.04	250.30	18	Manhole
20		0.02	12	Cir	17.000	250.17	250.34	1.000	250.30	250.40	n/a	250.42 j	19	Combination
21		0.43	12	Cir	160.784	249.51	250.00	0.305	250.37	250.45	0.02	250.48	8	Manhole
22		0.14	12	Cir	15.689	245.95	246.03	0.510	248.11*	248.11*	0.00	248.11	13	Combination
23		0.07	12	Cir	17.830	250.17	250.34	0.953	250.30	250.45	n/a	250.45 j	19	Combination

Project File: Main SD Pipe System.stm	Number of lines: 26	Run Date: 05-28-2021

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

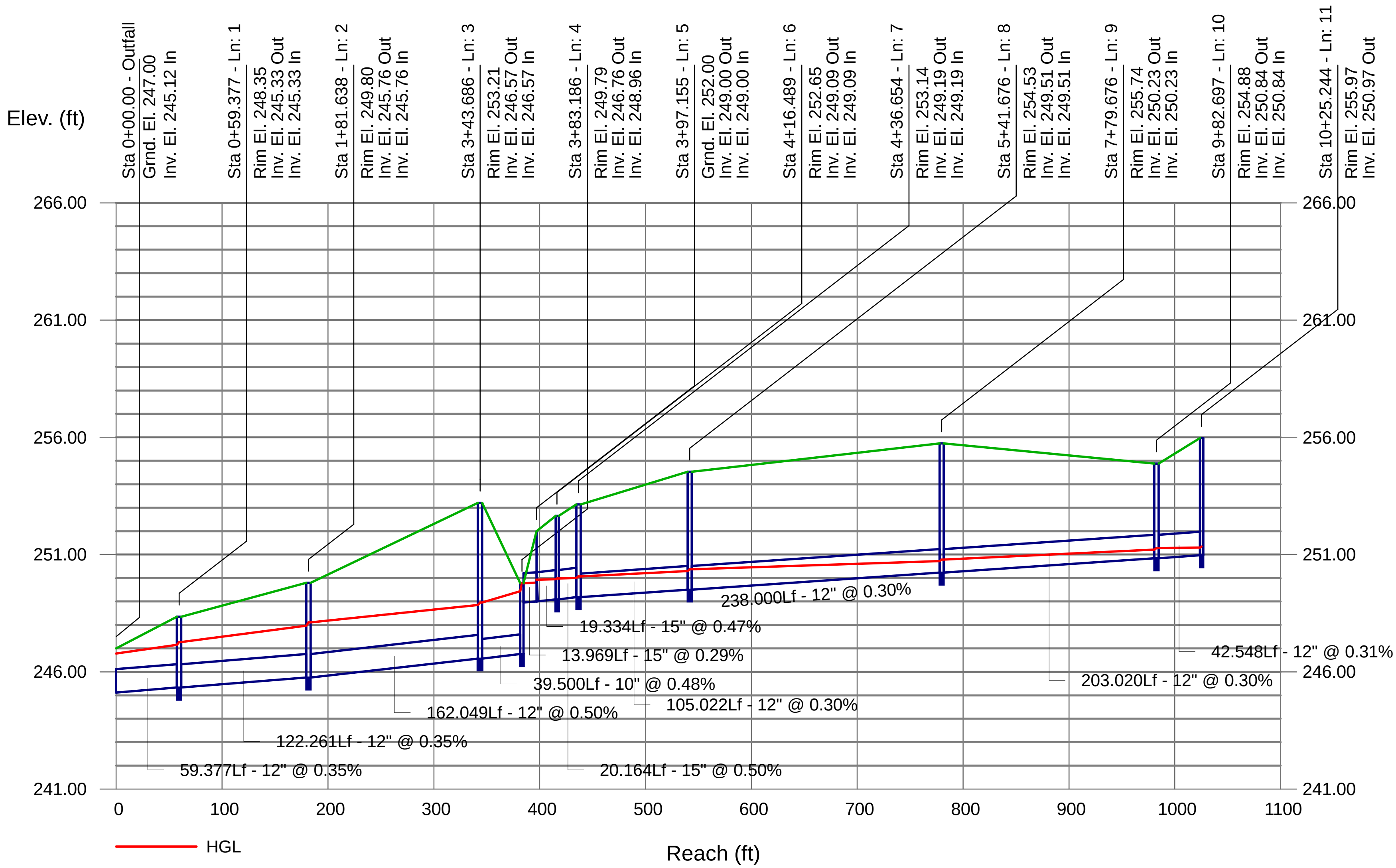
Line No.	Line ID	Flow rate (cfs)	Line size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line slope (%)	HGL down (ft)	HGL up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns line No.	Junction Type
24		0.43	12	Cir	113.175	250.00	250.34	0.300	250.48	250.68	0.05	250.73	21	Manhole
25		0.32	12	Cir	17.830	250.34	250.43	0.505	250.73	250.75	0.04	250.78	24	Combination
26		0.11	12	Cir	17.830	250.34	250.43	0.505	250.73	250.73	0.00	250.74	24	Combination

Project File: Main SD Pipe System.stm	Number of lines: 26	Run Date: 05-28-2021

NOTES: Known Qs only ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Profile

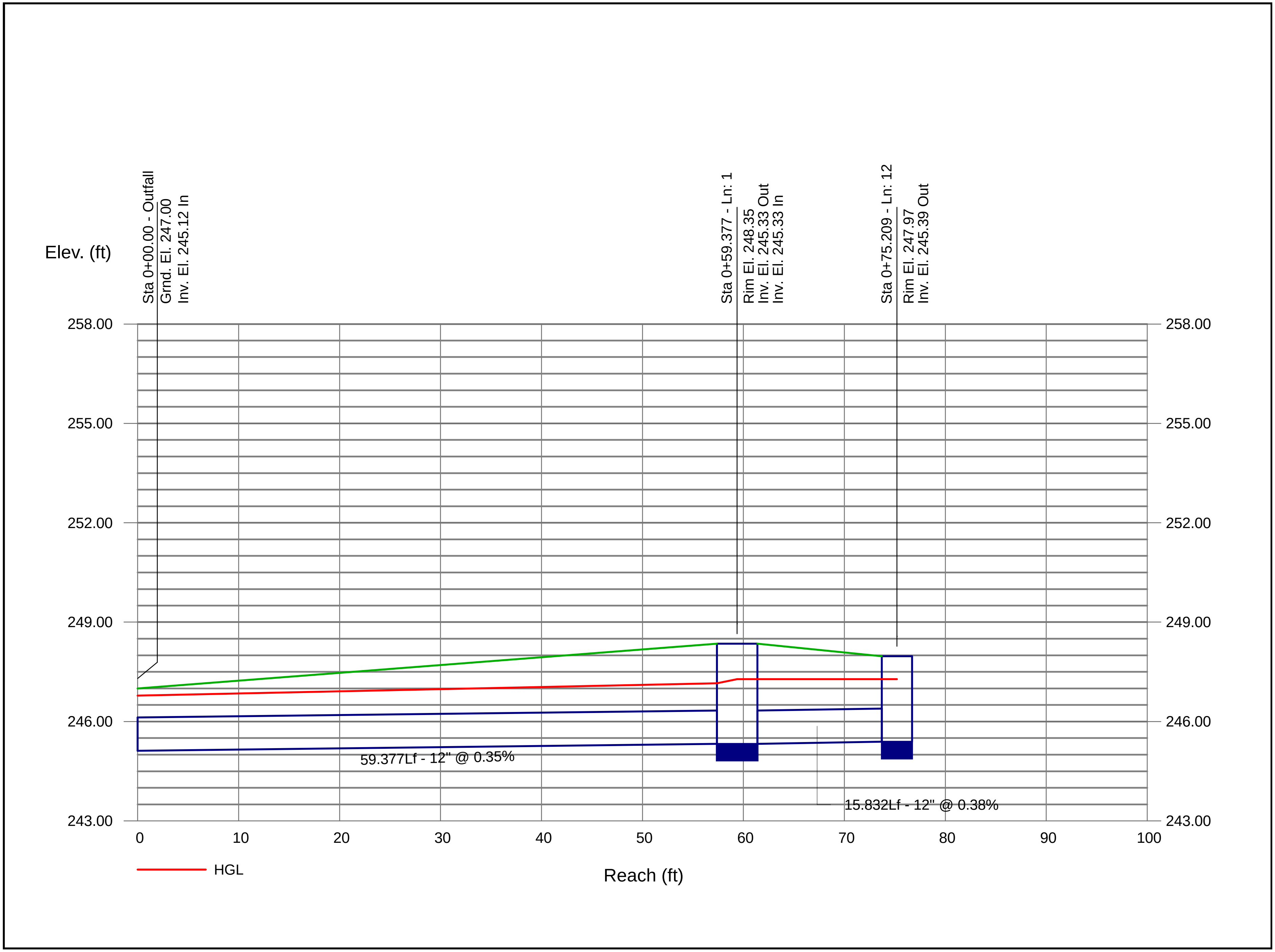
Proj. file: Main SD Pipe System.stm



Hydraflow Storm Sewers Extension

Storm Sewer Profile

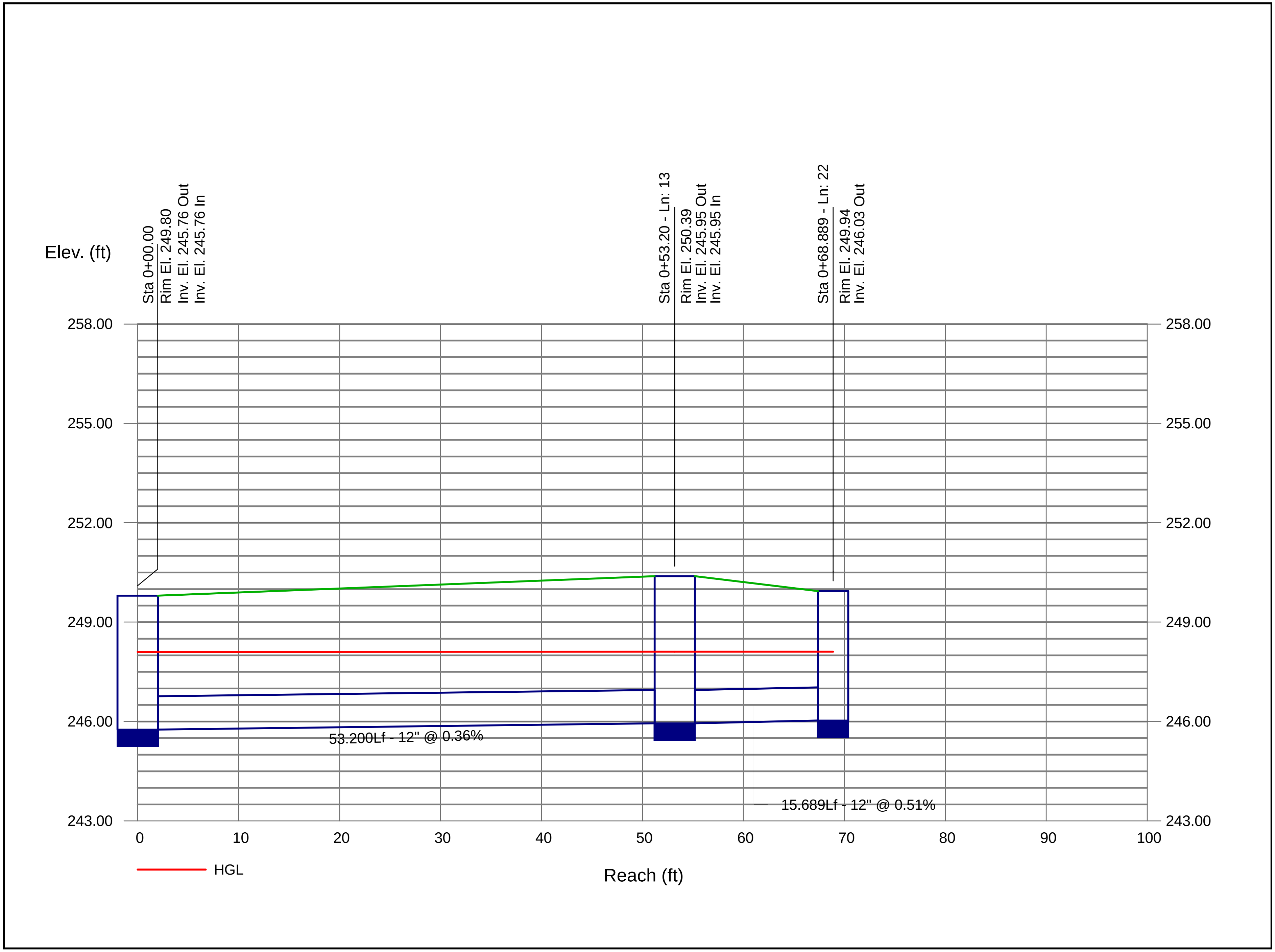
Proj. file: Main SD Pipe System.stm



Hydraflow Storm Sewers Extension

Storm Sewer Profile

Proj. file: Main SD Pipe System.stm



Storm Sewer Profile

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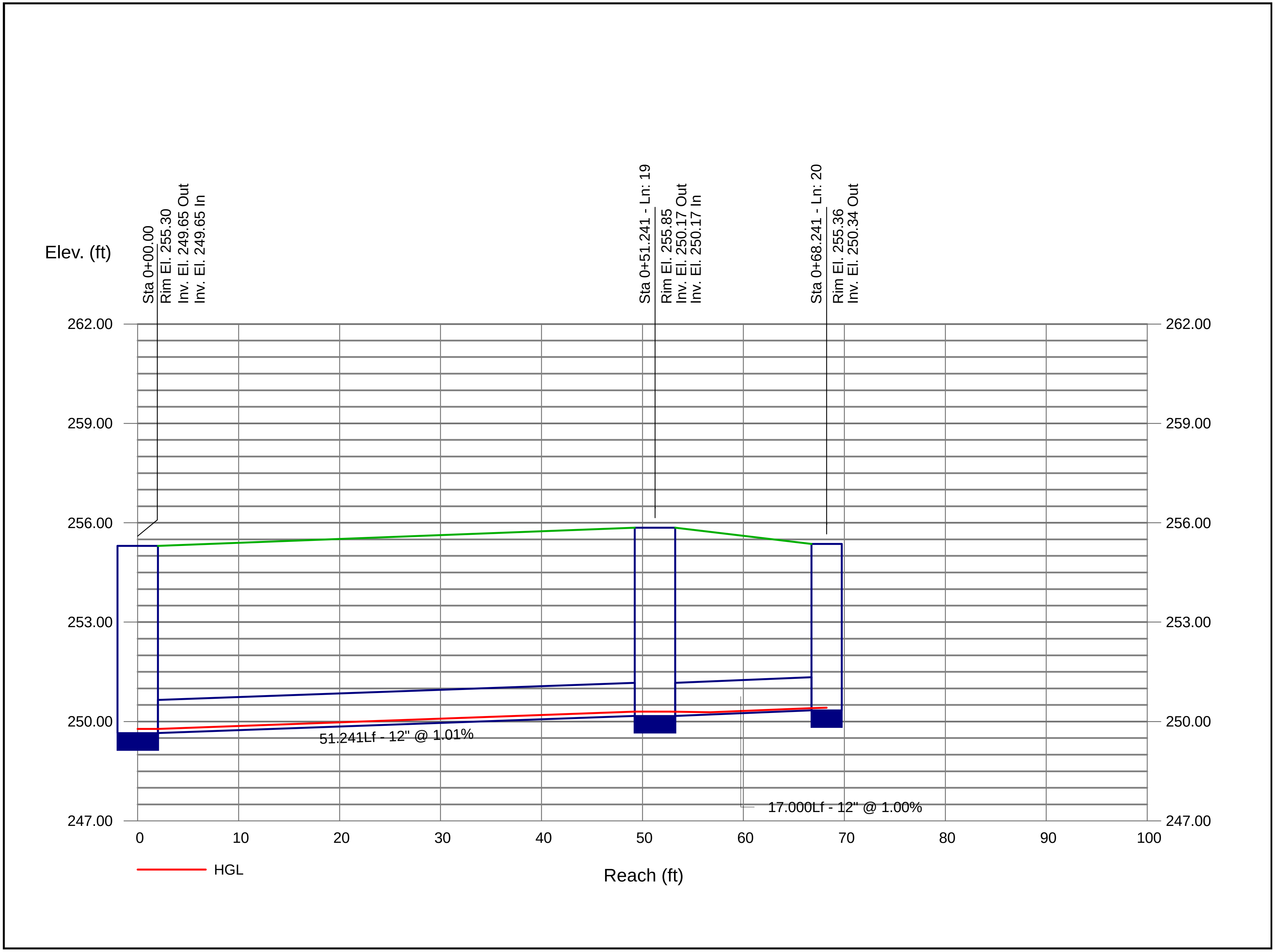

Storm Sewer Profile

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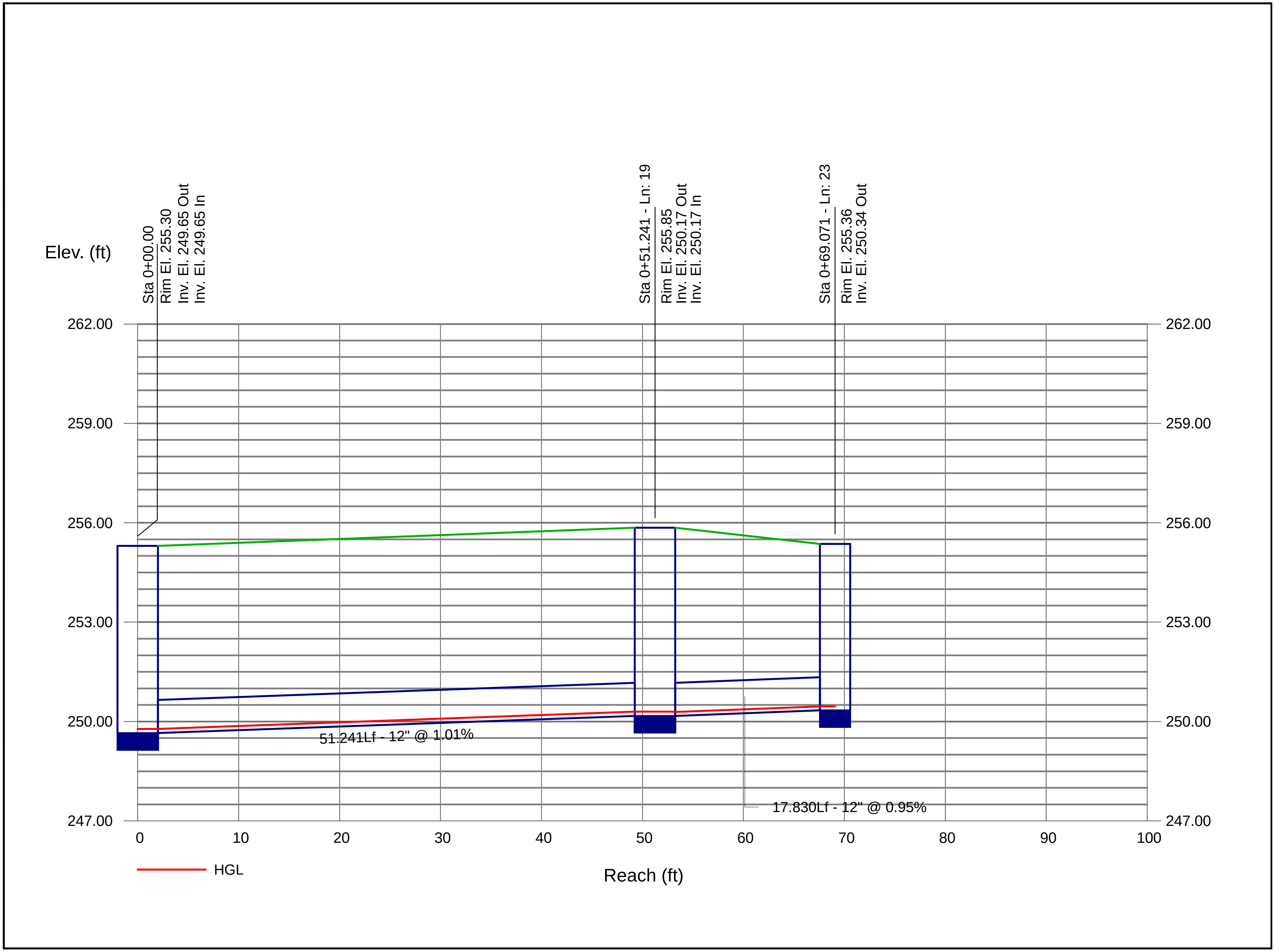
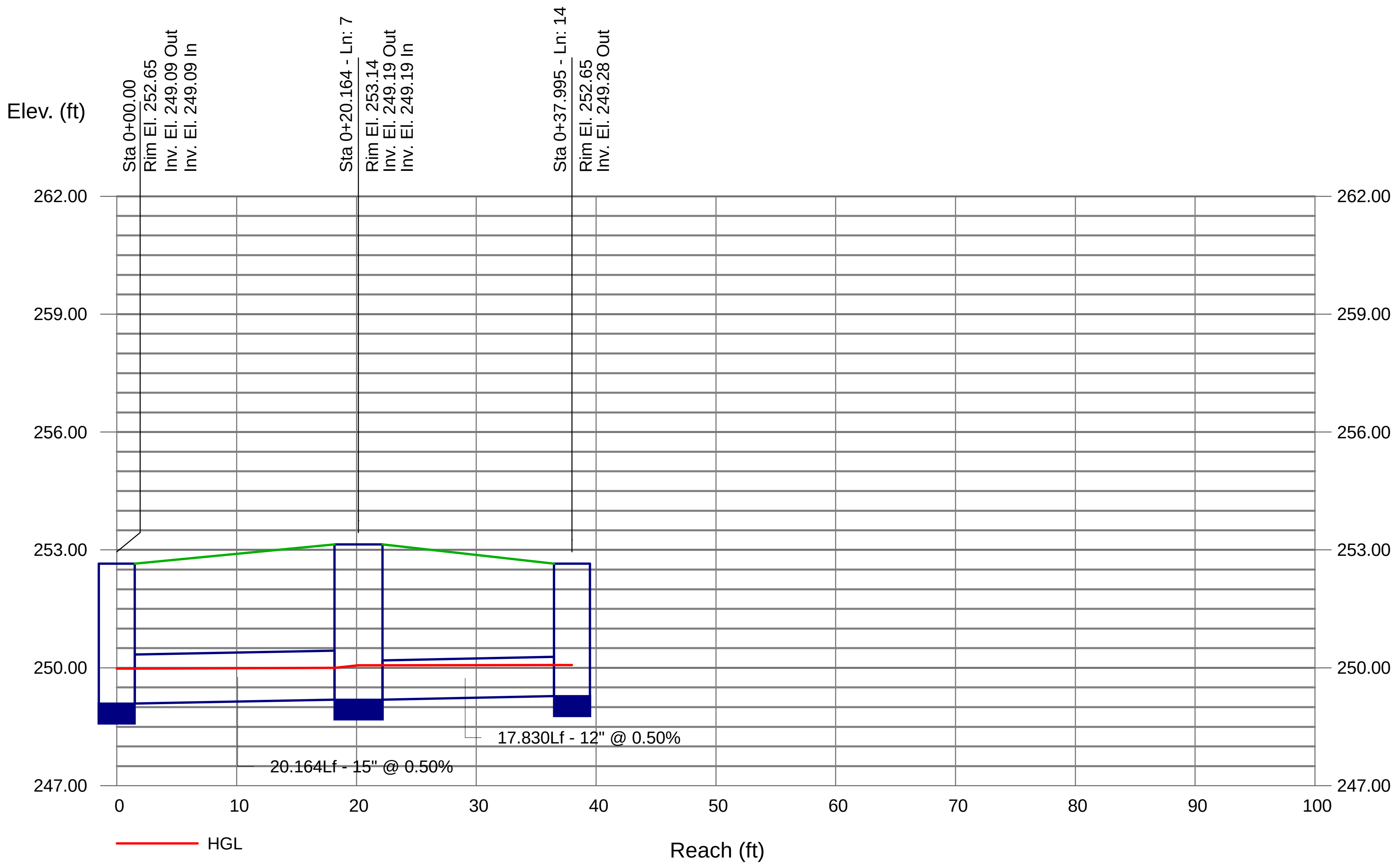


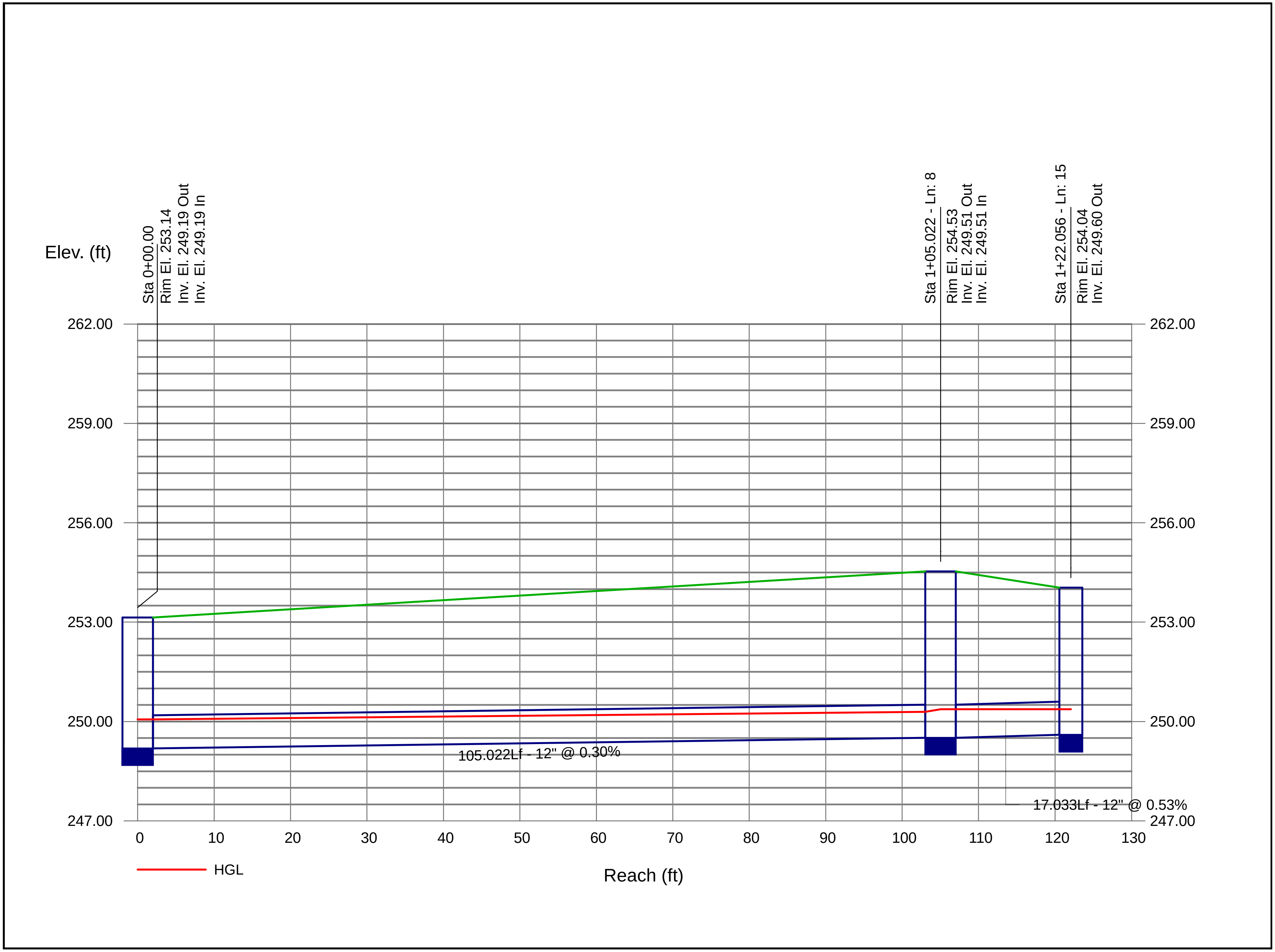
Storm Sewer Profile

Proj. file: Main SD Pipe System.stm



Storm Sewer Profile

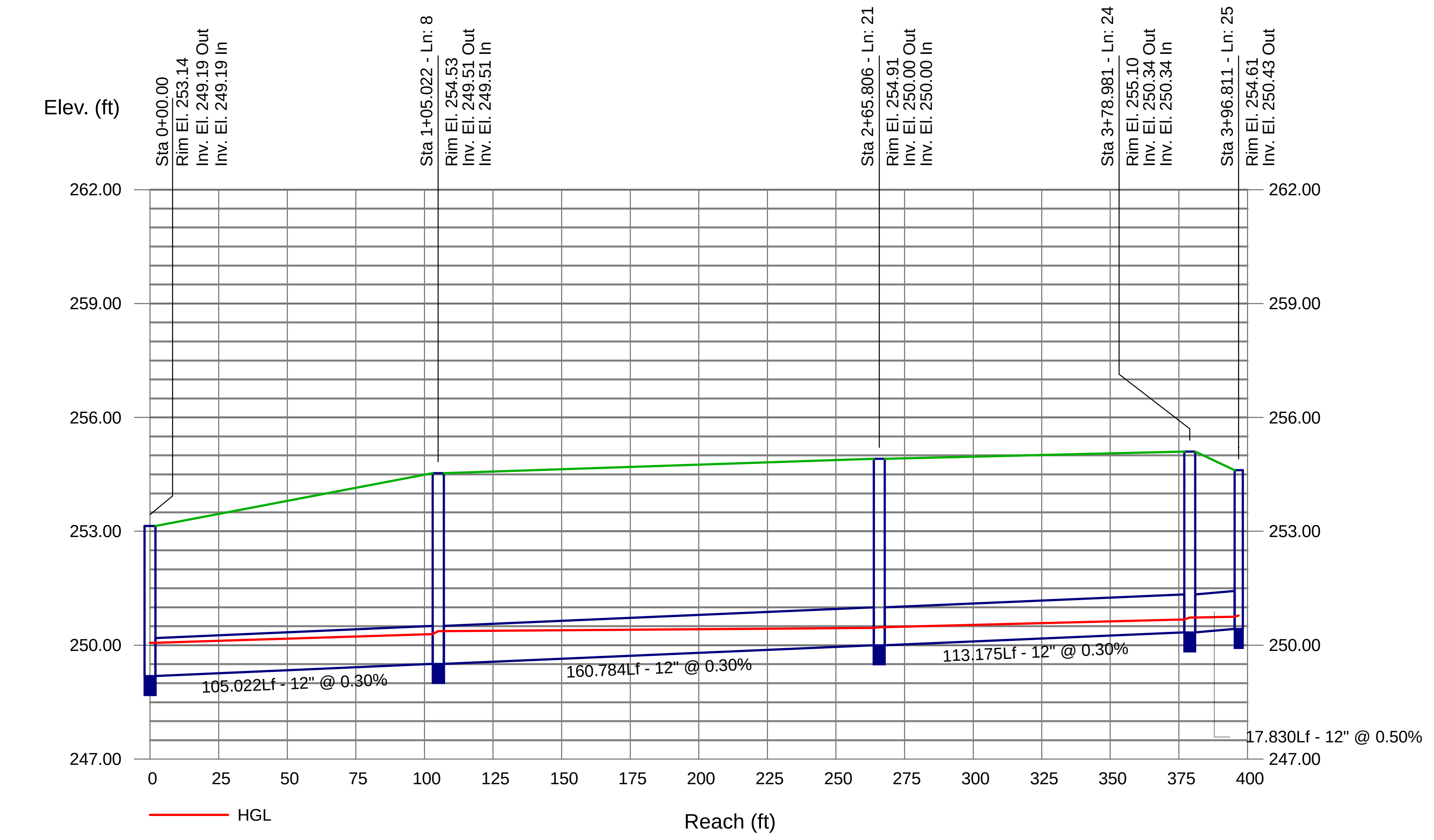
Proj. file: Main SD Pipe System.stm



Hydraflow Storm Sewers Extension

Storm Sewer Profile

Proj. file: Main SD Pipe System.stm



Storm Sewer Profile

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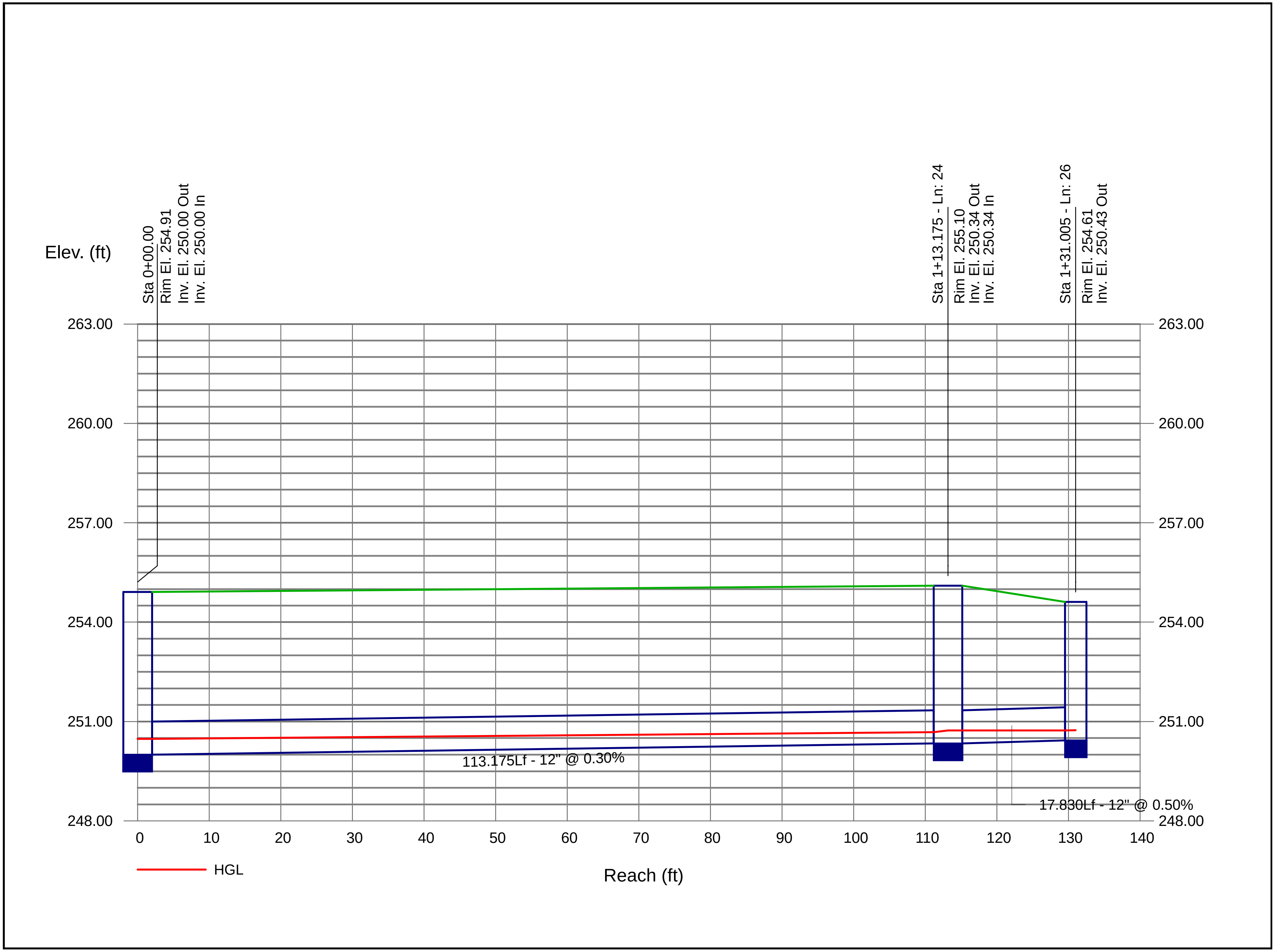
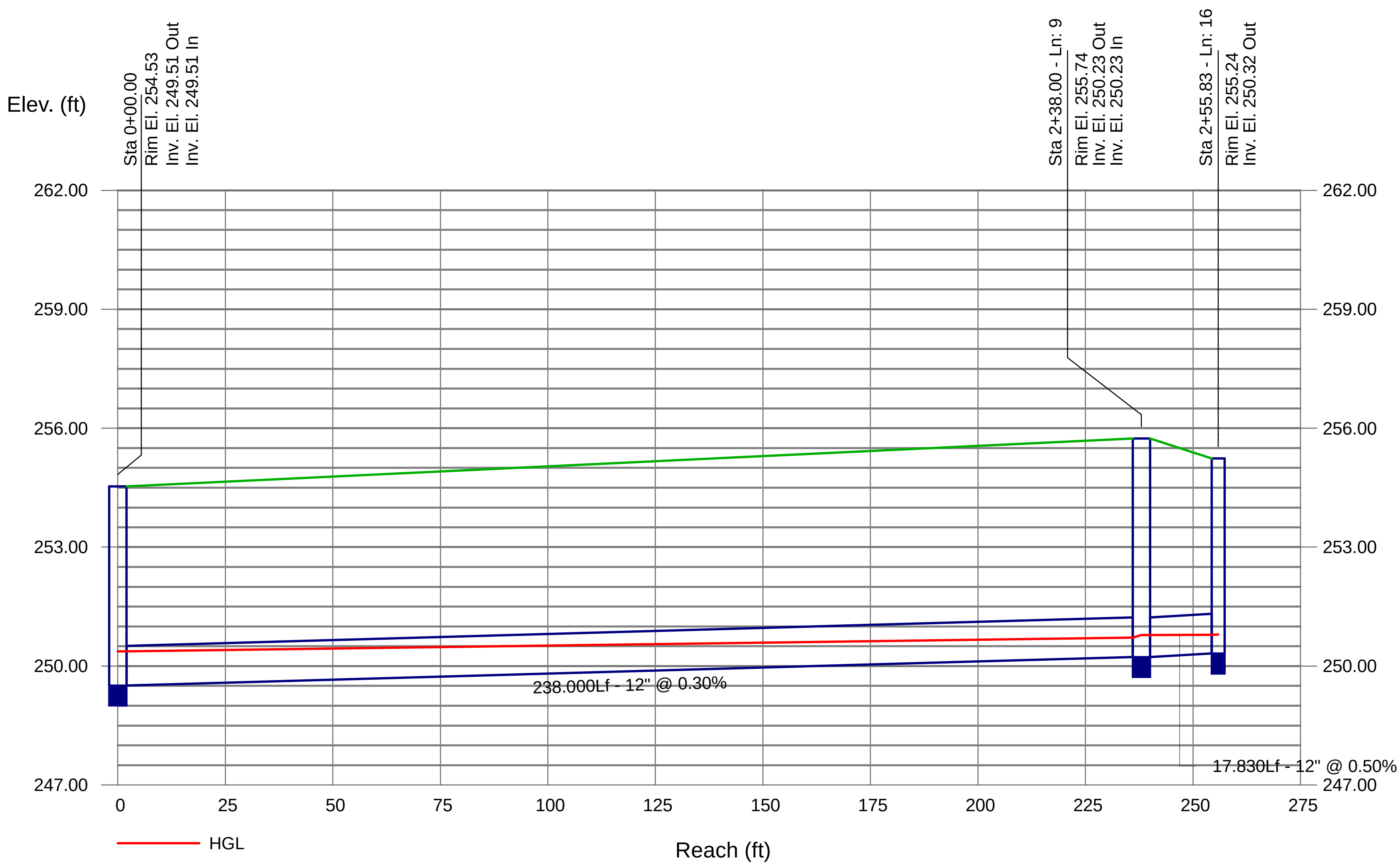


Storm Sewer Profile

Proj. file: Main SD Pipe System.stm



Storm Sewer Profile

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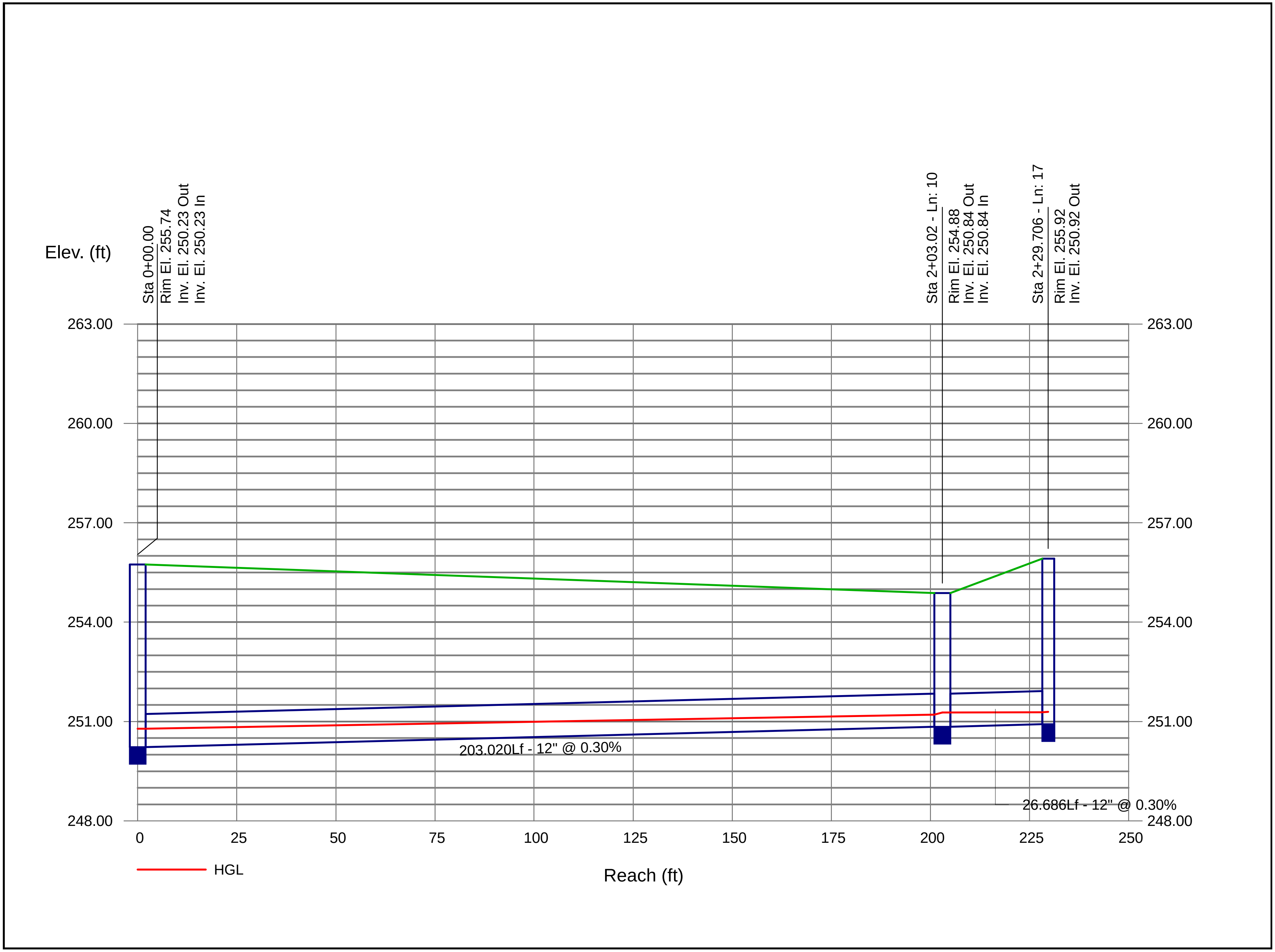
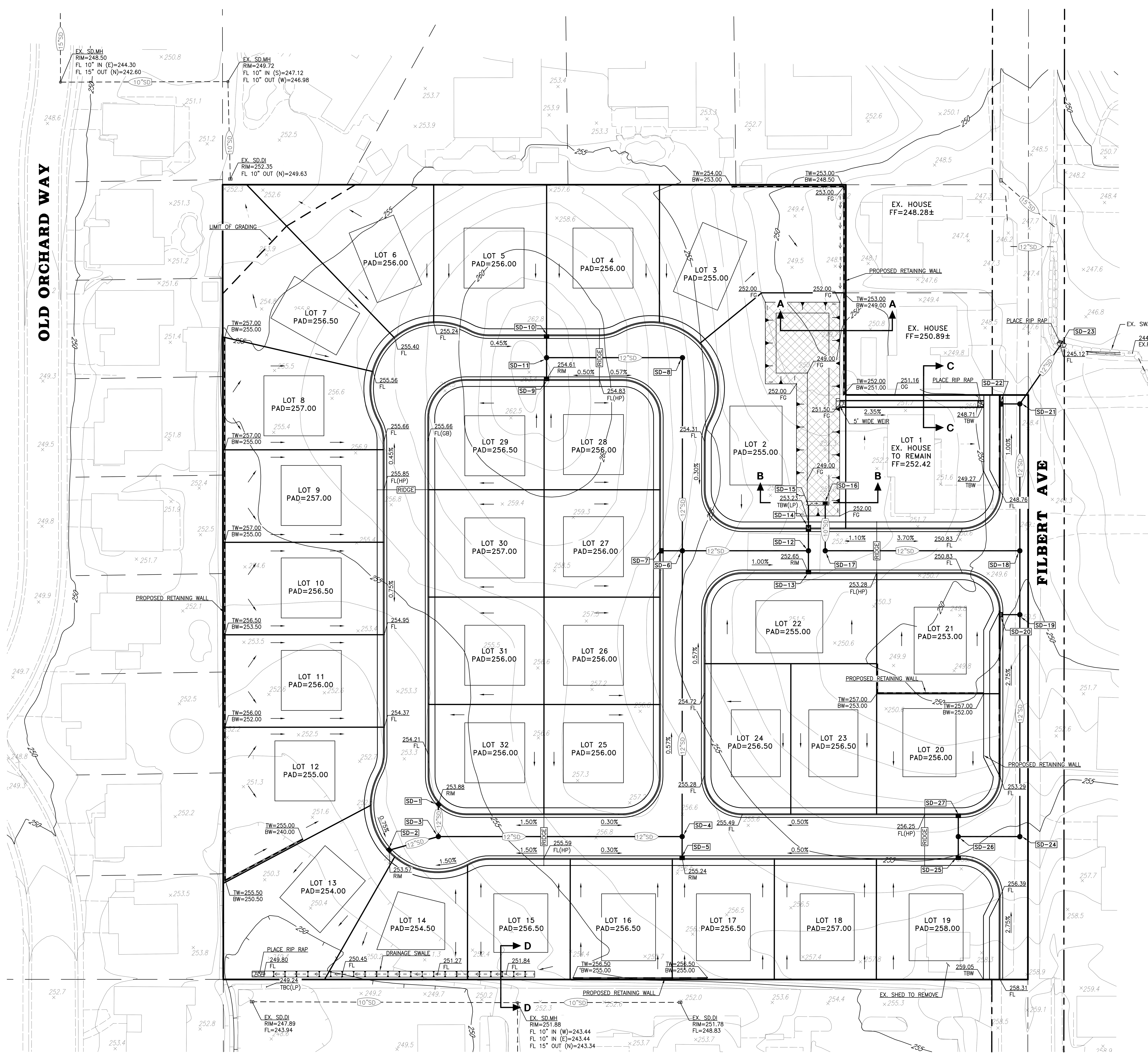
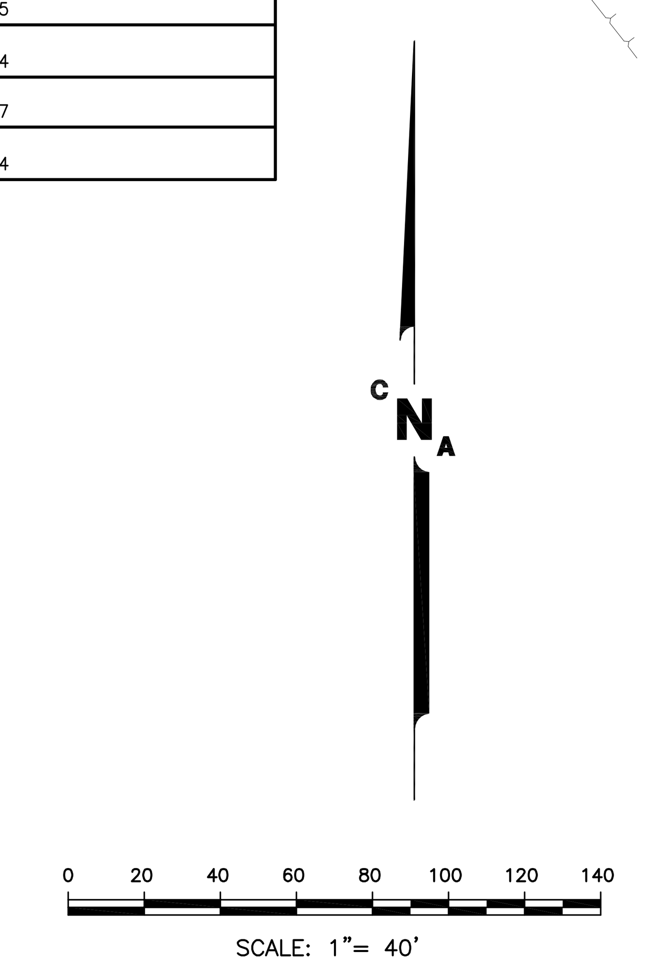


Hydraflow Storm Sewers Extension





HATCH LEGEND:

[hatch]	DETENTION BASIN

STORM DRAIN KEYNOTES:

SD-1	PROP. TYPE "B" SD.DI RIM=253.88, FL=250.92
SD-2	PROP. TYPE "B" SD.DI RIM=253.57, FL=250.97
SD-3	PROP. SD.MH RIM=254.88, FL=250.84
SD-4	PROP. SD.MH RIM=255.74, FL=250.23
SD-5	PROP. TYPE "B" SD.DI RIM=255.24, FL=250.32
SD-6	PROP. SD.MH RIM=254.53, FL=249.51
SD-7	PROP. TYPE "B" SD.DI RIM=254.04, FL=249.60
SD-8	PROP. SD.MH RIM=254.91, FL=250.00
SD-9	PROP. TYPE "B" SD.DI RIM=254.61, FL=250.43
SD-10	PROP. TYPE "B" SD.DI RIM=254.61, FL=250.43
SD-11	PROP. SD.MH RIM=255.10, FL=250.34
SD-12	PROP. SD.MH RIM=253.14, FL=249.19
SD-13	PROP. TYPE "B" SD.DI RIM=252.65, FL=249.28
SD-14	PROP. TYPE "J" SD.DI RIM=252.65, FL=249.09

SD-15	PROP. PIPE SYSTEM OUTFALL TO THE BASIN FL=249.00
SD-16	PROP. TYPE "F" SD.DI RIM=249.79, OPENING=248.96, FL=246.76
SD-17	PROP. SD.MH RIM=253.29, FL=246.57
SD-18	PROP. SD.MH RIM=249.80, FL=245.76
SD-19	PROP. SD.MH RIM=250.39, FL=245.95
SD-20	PROP. TYPE "B" SD.DI RIM=249.94, FL=246.03
SD-21	PROP. SD.MH RIM=248.35, FL=245.33
SD-22	PROP. TYPE "B" SD.DI RIM=247.97, FL=245.39
SD-23	PROP. PIPE SYSTEM OUTFALL FL=245.12
SD-24	PROP. SD.MH RIM=255.30, FL=249.65
SD-25	PROP. TYPE "B" SD.DI RIM=255.36, FL=250.34
SD-26	PROP. SD.MH RIM=255.85, FL=250.17
SD-27	PROP. TYPE "B" SD.DI RIM=255.36, FL=250.34

NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
PLANNING: STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

SCALE	PREPARED BY
HORIZ.: 1"= 40'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223-0091-002	

PRELIMINARY GRADING PLAN FOR:

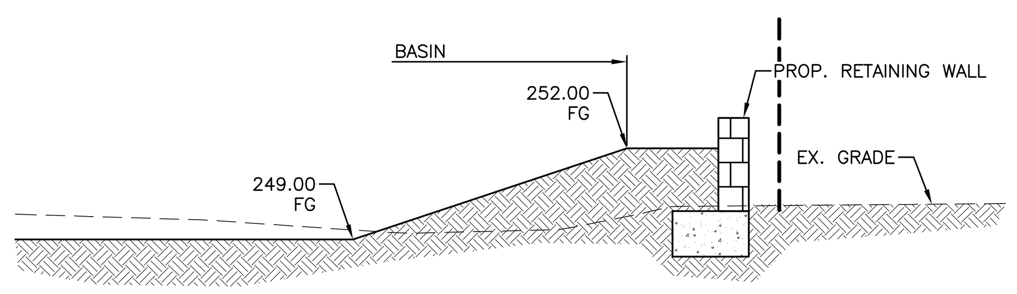
BLOSSOM RIDGE

COUNTY OF SACRAMENTO STATE OF CALIFORNIA

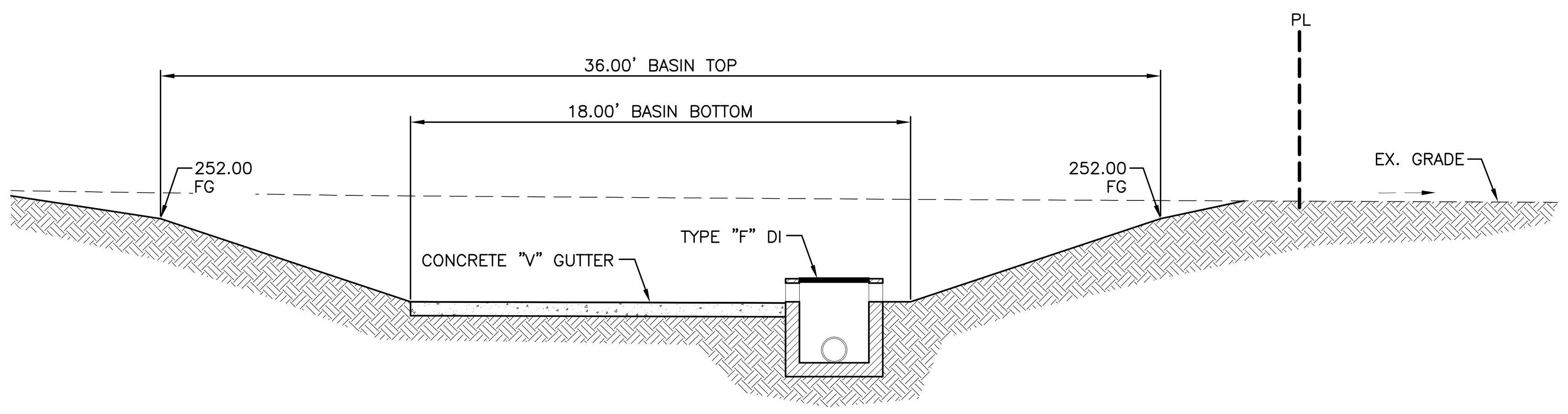
DATE : 6/7/2021

FN.:19144_10.DWG

SHEET X OF X SHEETS



SECTION A–A
SCALE: NTS



SECTION B–B
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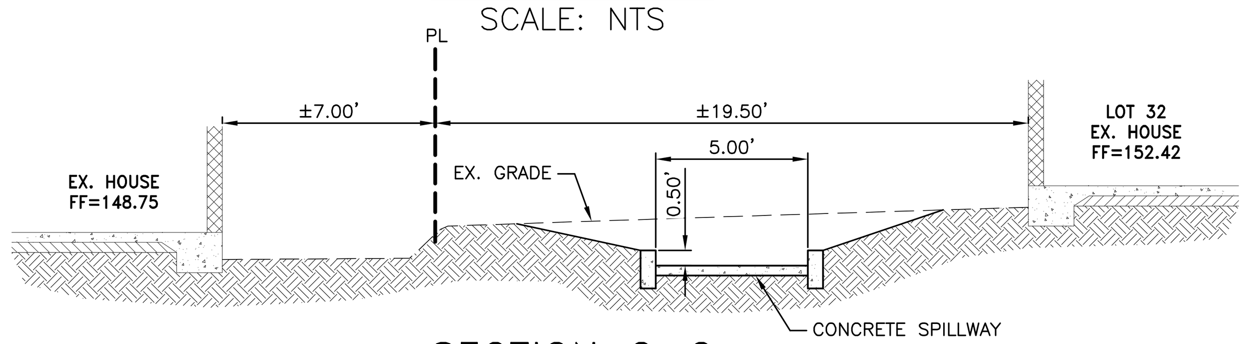
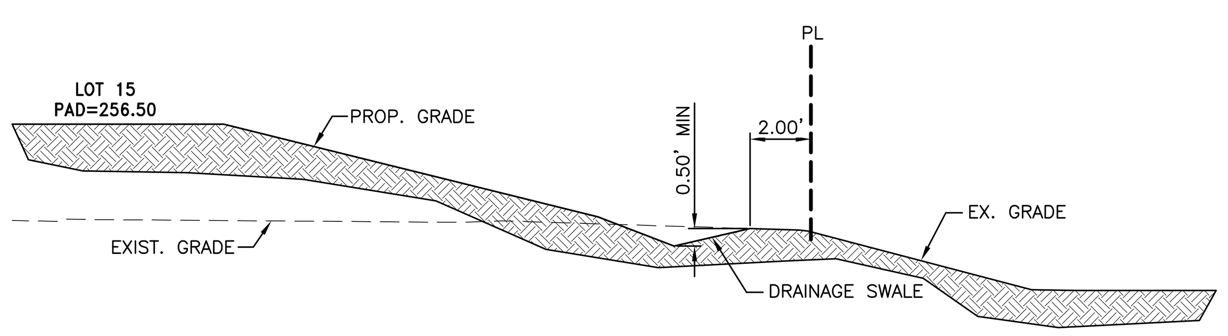


SECTION C–C
SCALE: NTS



SECTION D–D
SCALE: NTS

NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

CNA ENGINEERING INC.
CIVIL ENGINEERING; LAND SURVEYING
PLANNING; STRUCTURAL DESIGN
PHONE: (916) 485–3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

PREPARED BY
DRAFTED BY: VAL T.
DESIGNED BY: STEVE N.
CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223–0091–002

SCALE
HORIZ.: N/A
VERT.: N/A
FLD BK.: N/A

CROSS SECTIONS FOR:
BLOSSOM RIDGE
COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021
FN.:19144_10.DWG
SHEET X OF X SHEETS

Low Impact Development Design

Residential LID Credits Worksheets are used to calculate the points for the project (see below). The required minimum for the project is 100 points. Information used is described below.

Total area = 9.31 acres to the Filbert Right-of Way;

Drainage Basin = 0.19 acres.

Number of Units = 32.

No new trees are counted in the calculations.

There are 3 discharges and, therefore, 3 points of compliance.

LID features will be constructed with building permits. Feasibility analysis is provided below with preliminary design and calculations. Final design will be provided at the time of building permit with each lot design or final Improvement plans.

Northwest POC

Watershed WS1.1P constitutes the point of compliance. It consists of portions of lots 6 and 7.

To show future ability to comply with LID standards a sample lot has been reviewed. Lot 7 has been thoroughly reviewed and calculations are provided below.

Lot 7

30% Imperviousness is taken into account for proposed zoning RD-3.

Area of Lot 7 sloping northwest = ±9,300 ft^2 = 0.21 acres.

Mulch bed is proposed as LID feature for Lot 7. Depth of amended soil:

$D_{BMP} = (D_{DR} * R_V) / (\text{Ø} * A_{BMP} / [A_{BMP} + A_i]) = (0.64 * 0.89) / (0.35 * 1{,}150 / [1{,}150 + 1{,}500])$ = 3.75” => 4” is proposed.

D_{DR} = 0.64’ for impervious area;

Ø = 0.35 - amended soil porosity;

R_V = 0.89 – Volumetric Runoff coefficient for 100% imperviousness per Stormwater Quality Design Manual;

A_{BMP} = 375 ft^2 - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 1,150 ft^2.

A_i = 1,500 ft^2 – assumed portion of total impervious area sloping northwest – lot is split in two drainage directions.

Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment BMP Sizing Calculations

Name of Drainage Shed: Blossom Ridge Lot 7

Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

Is your project within the drainage area of a common drainage plan that includes open space? If not, skip to 1 b.

1 a. Common Drainage Plan Area		acres	A_{CDP}
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}
a. Natural storage reservoirs and drainage corridors	0	acres	
b. Buffer zones for natural water bodies	0	acres	
c. Natural areas including existing trees, other vegetation, and soil	0	acres	
d. Common landscape area/park	0	acres	
e. Regional Flood Control/Drainage basins	0	acres	

see area example below

1 b. Project Drainage Shed Area (Total)	0.21	acres	A
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}
a. Natural storage reservoirs and drainage corridors	0.00	acres	
b. Buffer zones for natural water bodies	0.00	acres	
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres	
d. Landscape area/park	0.00	acres	
e. Flood Control/Drainage basins	0.00	acres	

see area example below

** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

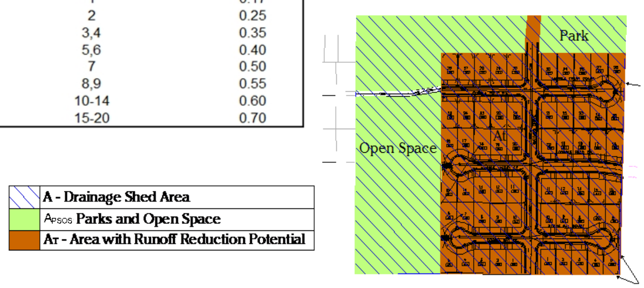
Area with Runoff Reduction Potential	$A - A_{PSOS}$ =	0.21	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	DU/A_T =	5		DUA
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.4		I

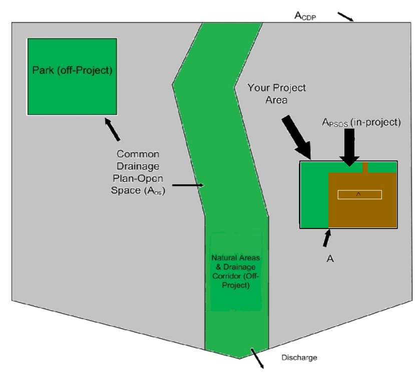
Open Space & Pervious Area LID Credit (Step 1)

$(A_{OS}/A_{CDP}+A_{PSOS}/A)\times100$ = 0 pts

Table D-1a

Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70





Step 2 - Runoff Reduction Credits

Runoff Reduction Measures		Effective Area Managed (A_C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits	0.00	acres
Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits	0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits	0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits	0.00	acres
Total Effective Area Managed (Credit Area)	A_C	0.00	acres EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100$ = 0 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only) 1.00

Runoff is directed across landscaping, determine setback

25 ft +	Use multiplier of	1.00
$\geq$ 20 and < 25 ft	Use multiplier of	0.90
$\geq$ 15 and < 20 ft	Use multiplier of	0.70
$\geq$ 10 and < 15 ft	Use multiplier of	0.45
$\geq$ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → [ ] Box J1

2. Determine percentage of roof drains disconnected → [ ] Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → 0.23 Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4 — 0.0 acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J — 0.0 acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks — [ ] Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K — 0.00 acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. — [ ] trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2 — 0 sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. — [ ] trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4 — 0 sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. — [ ] sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6 — 0 sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7 — 0 sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed and enter the result in Box L8 — 0.00 acres Box L8

This is the amount of area credit to enter into the "Interceptor Trees" Box of Form D-1

Form D-1d: Alternative Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block F	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement Porous Gravel	0.75
Not Directly-connected	1.00

[ ] Box M1

2. Determine percentage of units with Alternative Driveways: — [ ] Box M2

4. Multiply Boxes M1, M2, A_T and 0.04, and enter the result in Box M — 0.00 acres

This is the amount of area credit to enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) ______ enter gallons, for simple rain barrels | 0.00 | acres

Automated-Control Capture and Use System

(see Fact Sheet, then enter impervious area managed by the system) | 0.00 | acres

Bioretention/Infiltration Credits

Impervious Area Managed by Bioretention BMPs

(see Fact Sheet)

Bioretention Area ______ sq ft
Subdrain Elevation ______ inches
Ponding Depth, inches ______ inches | 0.00 | acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs ______ drawdown_hrs_inf
Soil Infiltration Rate, in/hr ______ soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft ______ capture_vol_inf | 0.00 | acres

Sizing Option 2: Infiltration BMP surface area, sq ft ______ soil_surface_area | 0.00 | acres

Basin or trench? Basin approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) Mulched Infiltration Area, sq ft 1,150 mulch_area | 0.11 | acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs | 0.11 | A_{LIDc}

Runoff Management Credit (Step 3) $A_{LIDC}/A_T*200 =$ 100.6 pts

Total LID Credits (Step 1+2+3)

LID compliant, check for treatment sizing in Step 4 100.6

Does project require hydromodification management? If yes, proceed to using SacHM.

Adjusted Area for Flow-Based, Non-LID Treatment $A_T - A_C - A_{LIDC} =$ 0.10 A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment $(A_T*I-A_C-A_{LIDC}) / A =$ 0.000 I_A

STOP: No additional treatment needed

Step 4a Treatment - Flow-Based (Rational Method)

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b ______ C

Determine i using Table D-1c (Rainfall Intensity) 0.18 i

A_{AT} from Step 2 0.10 A_{AT}

Flow = C * i * A_{AT} 0.00 cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity			
Roseville	i =	0.20	in/hr
Sacramento	i =	0.18	in/hr
Folsom	i =	0.20	in/hr

Step 4b Treatment - Volume-Based (ASCE-WEF)

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

Obtain A from Step 1 0.21 A ______ hrs Specified Draw Down time

Obtain P_0: Maximized Detention Volume from figures E-1 to 4 in Appendix E of this manual using I_A from Step 2. E- 0.00 P_0

Calculate treatment volume (acre-ft):
Treatment volume = A x (P_0 / 12) 0.00 Acre-Feet

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Southwest POC

Southwest portion of Watershed WS2.1P constitutes the point of compliance. It consists of portions of lots 13, 14 & 15.

Lot 14 has been thoroughly reviewed and calculations are provided below.

Lot 14

40% Imperviousness is taken into account for proposed zoning RD-4.

Area of Lot 14 sloping southwest = ±5,000 ft^2 = 0.11 acres.

Mulch bed is proposed as LID feature for Lot 14. Depth of amended soil:

$D_{BMP} = (D_{DR} * R_V) / (\emptyset * A_{BMP} / [A_{BMP} + A_i]) = (0.64 * 0.89) / (0.35 * 600 / [600 + 1,200]) =$ 4.88” => 6” is proposed.

D_{DR} = 0.64’ for impervious area;

$\emptyset$ = 0.35 - amended soil porosity;

R_V = 0.89 – Volumetric Runoff coefficient for 100% imperviousness per Stormwater Quality Design Manual;

A_{BMP} = 300 ft^2 - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 600 ft^2.

A_i = 1,200 ft^2 – assumed portion of total impervious area sloping southwest – lot is split in two drainage directions.

Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment BMP Sizing Calculations

Name of Drainage Shed: Blossom Ridge Lot 14

Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

Is your project within the drainage area of a common drainage plan that includes open space? If not, skip to 1 b.

1 a. Common Drainage Plan Area		acres	A_{CDP}
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}
a. Natural storage reservoirs and drainage corridors	0	acres	
b. Buffer zones for natural water bodies	0	acres	
c. Natural areas including existing trees, other vegetation, and soil	0	acres	
d. Common landscape area/park	0	acres	
e. Regional Flood Control/Drainage basins	0	acres	

see area example below

1 b. Project Drainage Shed Area (Total)	0.11	acres	A
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}
a. Natural storage reservoirs and drainage corridors	0.00	acres	
b. Buffer zones for natural water bodies	0.00	acres	
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres	
d. Landscape area/park	0.00	acres	
e. Flood Control/Drainage basins	0.00	acres	

see area example below

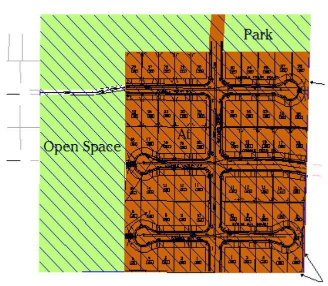
** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

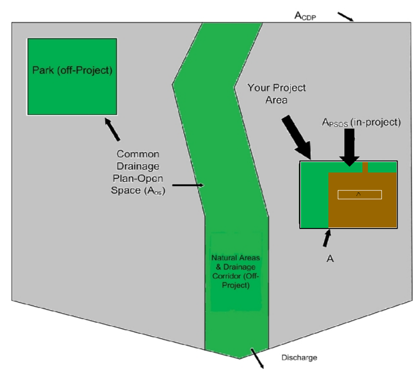
Area with Runoff Reduction Potential	$A - A_{PSOS} =$	0.11	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	$DU/A_T =$	10		DUA
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.6		I

Open Space & Pervious Area LID Credit (Step 1)

$(A_{OS}/A_{CDP}+A_{PSOS}/A)\times100 =$ 0 pts

Table D-1a	
Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70





Step 2 - Runoff Reduction Credits

Runoff Reduction Measures		Effective Area Managed (A_C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits	0.00	acres
Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits	0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits	0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits	0.00	acres
Total Effective Area Managed (Credit Area)	A_C	0.00	acres EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100 =$ 0 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only)		1.00
Runoff is directed across landscaping, determine setback		
25 ft +	Use multiplier of	1.00
≥ 20 and < 25 ft	Use multiplier of	0.90
≥ 15 and < 20 ft	Use multiplier of	0.70
≥ 10 and < 15 ft	Use multiplier of	0.45
≥ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → [ ] Box J1

2. Determine percentage of roof drains disconnected → [ ] Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → 0.37 Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4 — 0.0 acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J — 0.0 acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks — [ ] Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K — 0.00 acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. — [ ] trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2 — 0 sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. — [ ] trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4 — 0 sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. — [ ] sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6 — 0 sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7 — 0 sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed and enter the result in Box L8 — 0.00 acres Box L8

This is the amount of area credit to enter into the "Interceptor Trees" Box of Form D-1

Form D-1d: Alternative Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block F	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement Porous Gravel	0.75
Not Directly-connected	1.00

[ ] Box M1

2. Determine percentage of units with Alternative Driveways: — [ ] Box M2

4. Multiply Boxes M1, M2, A_T and 0.04, and enter the result in Box M — 0.00 acres

This is the amount of area credit to enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) ____ enter gallons, for simple rain barrels — 0.00 acres

Automated-Control Capture and Use System

(see Fact Sheet, then enter impervious area managed by the system) — 0.00 acres

Bioretention/Infiltration Credits

Impervious Area Managed by Bioretention BMPs

(see Fact Sheet)

Bioretention Area ____ sq ft

Subdrain Elevation ____ inches

Ponding Depth, inches ____ inches — 0.00 acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs ____ drawdown_hrs_inf

Soil Infiltration Rate, in/hr ____ soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft ____ capture_vol_inf — 0.00 acres

Sizing Option 2: Infiltration BMP surface area, sq ft ____ soil_surface_area — 0.00 acres

Basin or trench? Basin — approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) Mulched Infiltration Area, sq ft 600 mulch_area — 0.06 acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs — 0.06 A_{LIDc}

Runoff Management Credit (Step 3) $A_{LIDC}/A_T*200 =$ 100.2 pts

Total LID Credits (Step 1+2+3)

LID compliant, check for treatment sizing in Step 4 — 100.2

Does project require hydromodification management? If yes, proceed to using SacHM.

Adjusted Area for Flow-Based, Non-LID Treatment $A_T - A_C - A_{LIDC} =$ 0.05 A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment $(A_T*I-A_C-A_{LIDC}) / A =$ 0.099 I_A

Further treatment is required, see choose flow-based or volume-based sizing in Step 4

Step 4a Treatment - Flow-Based (Rational Method)

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b ____ C

Determine i using Table D-1c (Rainfall Intensity) 0.18 i

A_{AT} from Step 2 — 0.05 A_{AT}

Flow = C * i * A_{AT} 0.00 cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity			
Roseville	i =	0.20	in/hr
Sacramento	i =	0.18	in/hr
Folsom	i =	0.20	in/hr

Step 4b Treatment - Volume-Based (ASCE-WEF)

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

Obtain A from Step 1 — 0.11 A — ____ hrs Specified Draw Down time

Obtain P_0: Maximized Detention Volume from figures E-1 to 4 in Appendix E of this manual using I_A from Step 2. E- 0.11 P_0

Calculate treatment volume (acre-ft):

Treatment volume = A x (P_0 / 12) 0.00 Acre-Feet

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East POC

The rest of the proposed lots contribute to the east point of compluiance. Proposed frontage improvements are also added to the impervious area.

Lot 26 has been thoroughly reviewed and calculations are provided below.

Lot 26

40% Imperviousness is taken into account for proposed zoning RD-4.

Area of Lot 26 = ±10,300 ft^2 = 0.24 acres to the CL of proposed road.

Mulch bed is proposed as LID feature for Lot 26. Depth of amended soil:

$D_{BMP} = (D_{DR} * R_V) / (\emptyset * A_{BMP} / [A_{BMP} + A_i]) = (0.64 * 0.89) / (0.35 * 1{,}350 / [1{,}350 + 5{,}100])$ = 7.77” => 8” is proposed.

D_{DR} = 0.64’ for impervious area;

$\emptyset$ = 0.35 - amended soil porosity;

R_V = 0.89 – Volumetric Runoff coefficient for 100% imperviousness per Stormwater Quality Design Manual;

A_{BMP} = 1,275 ft^2 - 25% of contributing impervious area – minimum BMP area; per LID calculator in order to achieve 100 points, Area of mulch bed is 1,350 ft^2.

A_i = 5,100 ft^2 – assumed portion of total impervious area including a prtion of the proposed road to the centerline.

Appendix D-1: Residential Sites: Low Impact Development (LID) Credits and Treatment BMP Sizing Calculations

Name of Drainage Shed: Blossom Ridge Lot 26

Location of project: Sacramento

Fill in Blue Highlighted boxes

Step 1 - Open Space and Pervious Area Credits

Is your project within the drainage area of a common drainage plan that includes open space? If not, skip to 1 b.

1 a. Common Drainage Plan Area		acres	A_{CDP}
Common Drainage Plan Open Space (Off-project)	0	acres	A_{OS}
a. Natural storage reservoirs and drainage corridors	0	acres	
b. Buffer zones for natural water bodies	0	acres	
c. Natural areas including existing trees, other vegetation, and soil	0	acres	
d. Common landscape area/park	0	acres	
e. Regional Flood Control/Drainage basins	0	acres	

see area example below

1 b. Project Drainage Shed Area (Total)	0.24	acres	A
Project-Specific Open Space (In-project, communal)**	0.00	acres	A_{PSOS}
a. Natural storage reservoirs and drainage corridors	0.00	acres	
b. Buffer zones for natural water bodies	0.00	acres	
c. Natural areas including existing trees, other vegetation, and soil	0.00	acres	
d. Landscape area/park	0.00	acres	
e. Flood Control/Drainage basins	0.00	acres	

see area example below

** Doesn't include impervious areas within individual lots and surrounding individual units. That is accounted for below using Form D-1a in Step 2.

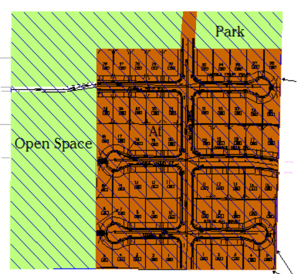
Area with Runoff Reduction Potential	$A - A_{PSOS} =$	0.24	acres	A_T
Number of Units in A_T		1		
Number of units per acre in A_T	$DU/A_T =$	5		DUA
Assumed Initial Impervious Fraction of A_T (determined using Table D-1a)		0.4		I

Open Space & Pervious Area LID Credit (Step 1)

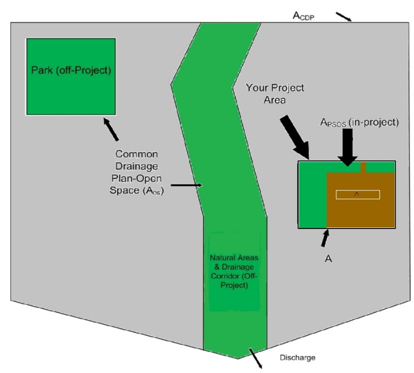
$(A_{OS}/A_{CDP}+A_{PSOS}/A)\times 100 =$ 0 pts

Table D-1a

Dwelling units per acre	Imperviousness
1	0.17
2	0.25
3,4	0.35
5,6	0.40
7	0.50
8,9	0.55
10-14	0.60
15-20	0.70



A - Drainage Shed Area
A_{PSOS} Parks and Open Space
A_T - Area with Runoff Reduction Potential



Step 2 - Runoff Reduction Credits

Runoff Reduction Measures		Effective Area Managed (A_C)	
Disconnected Roof Drains (see Fact Sheet)	use Form D-1a for credits	0.00	acres
Disconnected Pavement (see Fact Sheet)	use Form D-1b for credits	0.00	acres
Interceptor Trees (see Fact Sheet)	use Form D-1c for credits	0.00	acres
Alternative Driveway Design (see Fact Sheet)	use Form D-1d for credits	0.00	acres
Total Effective Area Managed (Credit Area)	A_C	0.00	acres EAM

Runoff Reduction Credit (Step 2) $(A_C / A_T)*100 =$ 0 pts

Form D-1a: Disconnected Roof Drains Worksheet

See Fact Sheet for more information regarding Disconnected Roof Drain credit guidelines

Effective Area Managed (A_C)

1. Determine efficiency Multiplier

Runoff is directed to a dispersal trench or dry well (Type A and B soils only)		1.00
Runoff is directed across landscaping, determine setback		
25 ft +	Use multiplier of	1.00
$\geq$ 20 and < 25 ft	Use multiplier of	0.90
$\geq$ 15 and < 20 ft	Use multiplier of	0.70
$\geq$ 10 and < 15 ft	Use multiplier of	0.45
$\geq$ 5 and < 10 ft	Use multiplier of	0.25

Efficiency Multiplier → [ ] Box J1

2. Determine percentage of roof drains disconnected → [ ] Box J2

3. Select project density in dwelling units per acre:

1	Use reduction factor of	0.08
2	Use reduction factor of	0.13
3,4	Use reduction factor of	0.19
5,6	Use reduction factor of	0.23
7	Use reduction factor of	0.29
8,9	Use reduction factor of	0.33
10-14	Use reduction factor of	0.37
15-20	Use reduction factor of	0.44

Reduction Factor → 0.23 Box J3

4. Determine Area Managed

Multiply Box J3 by A_T, and enter the result in Box J4 — 0.1 acres Box J4

5. Multiply Boxes J1, J2 and J4, and enter 60% of the Result in Box J — 0.0 acres Box J

This is the amount of area credit to enter into the "Disconnected Roof Drains" Box of Form D-1

Form D-1b: Disconnected Pavement Worksheet

See Fact Sheet for more information regarding NDC Pavement credit guidelines

Effective Area Managed (A_C)

Divided Sidewalks

1. Determine percentage of units with divided Sidewalks — [ ] Box K1

Multiply Box K1, A_T, and 0.04 and enter 60% of the result in Box K — 0.00 acres Box K

This is the amount of area credit to enter into the "Disconnected Pavement" Box of Form D-1

Form D-1c: Interceptor Tree Worksheet

See Fact Sheet for more information regarding Interceptor Tree credit guidelines

Effective Area Managed (A_C)

New Evergreen Trees

1. Enter number of new evergreen trees that qualify as Interceptor Trees in Box L1. — [ ] trees Box L1

2. Multiply Box L1 by 200 and enter result in Box L2 — 0 sq. ft. Box L2

New Deciduous Trees

3. Enter number of new deciduous trees that qualify as Interceptor Trees in Box L3. — [ ] trees Box L3

4. Multiply Box L3 by 100 and enter result in Box L4 — 0 sq. ft. Box L4

Existing Tree Canopy

5. Enter square footage of existing tree canopy that qualifies as Existing Tree canopy in Box L5. — [ ] sq. ft. Box L5

6. Multiply Box L5 by 0.5 and enter the result in Box L6 — 0 sq. ft. Box L6

Total Interceptor Tree Credits

Add Boxes L2, L4, and L6 and enter it into Box L7 — 0 sq. ft. Box L7

Divide Box L7 by 43,560 and multiply by 20% to get effective area managed and enter the result in Box L8 — 0.00 acres Box L8

This is the amount of area credit to enter into the "Interceptor Trees" Box of Form D-1

Form D-1d: Alternative Driveway Design

See Fact Sheet for more information regarding Alternative Driveway Design credit guidelines

1. Select type of driveway

Pervious Driveway:	Multiplier:
Cobblestone Block F	0.40
Pervious Concrete/A	0.60
Modular Block Porous Pavement Porous Gravel	0.75
Not Directly-connected	1.00

[ ] Box M1

2. Determine percentage of units with Alternative Driveways: — [ ] Box M2

4. Multiply Boxes M1, M2, A_T and 0.04, and enter the result in Box M — 0.00 acres

This is the amount of area credit to enter into the "Alternative Driveway Design" Box of Form D-1

Step 3 - Runoff Management Credits

Capture and Use Credits

Impervious Area Managed by Rain barrels, Cisterns, and automatically-emptied systems

(see Fact Sheet) | enter gallons, for simple rain barrels | 0.00 | acres

Automated-Control Capture and Use System

(see Fact Sheet, then enter impervious area managed by the system) | 0.00 | acres

Bioretention/Infiltration Credits

Impervious Area Managed by Bioretention BMPs

(see Fact Sheet)

Bioretention Area | sq ft

Subdrain Elevation | inches

Ponding Depth, inches | inches | 0.00 | acres

Impervious Area Managed by Infiltration BMPs

(see Fact Sheet)

Drawdown Time, hrs | drawdown_hrs_inf

Soil Infiltration Rate, in/hr | soil_inf_rate

Sizing Option 1: Capture Volume, acre-ft | capture_vol_inf | 0.00 | acres

Sizing Option 2: Infiltration BMP surface area, sq ft | soil_surface_area | 0.00 | acres

Basin or trench? Basin | approximate BMP depth 0.00 ft

Impervious Area Managed by Amended Soil or Mulch Beds

(see Fact Sheet) | Mulched Infiltration Area, sq ft 1,350 mulch_area | 0.12 | acres

Total Effective Area Managed by Capture-and-Use/Bioretention/Infiltration BMPs | 0.12 | A_{LIDc}

Runoff Management Credit (Step 3) | $A_{LIDC}/A_T*200 =$ 103.3 | pts

Total LID Credits (Step 1+2+3)

LID compliant, check for treatment sizing in Step 4 | 103.3

Does project require hydromodification management? If yes, proceed to using SacHM.

Adjusted Area for Flow-Based, Non-LID Treatment | $A_T - A_C - A_{LIDC} =$ 0.12 | A_{AT}

Adjusted Impervious Fraction of A for Volume-Based, Non-LID Treatment | $(A_T*I-A_C-A_{LIDC}) / A =$ 0.000 | I_A

STOP: No additional treatment needed

Step 4a Treatment - Flow-Based (Rational Method)

Form D-1e

Calculate treatment flow (cfs): Flow = Runoff Coefficient x Rainfall Intensity x Adjusted Treatment Area

Determine C Factor using Table D-1b | | C

Determine i using Table D-1c (Rainfall Intensity) | 0.18 | i

A_{AT} from Step 2 | 0.12 | A_{AT}

Flow = C * i * A_{AT} | 0.00 | cfs

TABLE D-1b

Development Type	Runoff Coefficient (Rational), C
Single-family areas	0.50
Multi-units, detached	0.60
Apartment dwelling areas	0.70
Multi-units, attached	0.75
User Specified	0.00

Table D-1c

Rainfall Intensity			
Roseville	i =	0.20	in/hr
Sacramento	i =	0.18	in/hr
Folsom	i =	0.20	in/hr

Step 4b Treatment - Volume-Based (ASCE-WEF)

Calculate water quality volume (Acre-Feet): WQV = Area x Maximized Detention Volume (P_0)

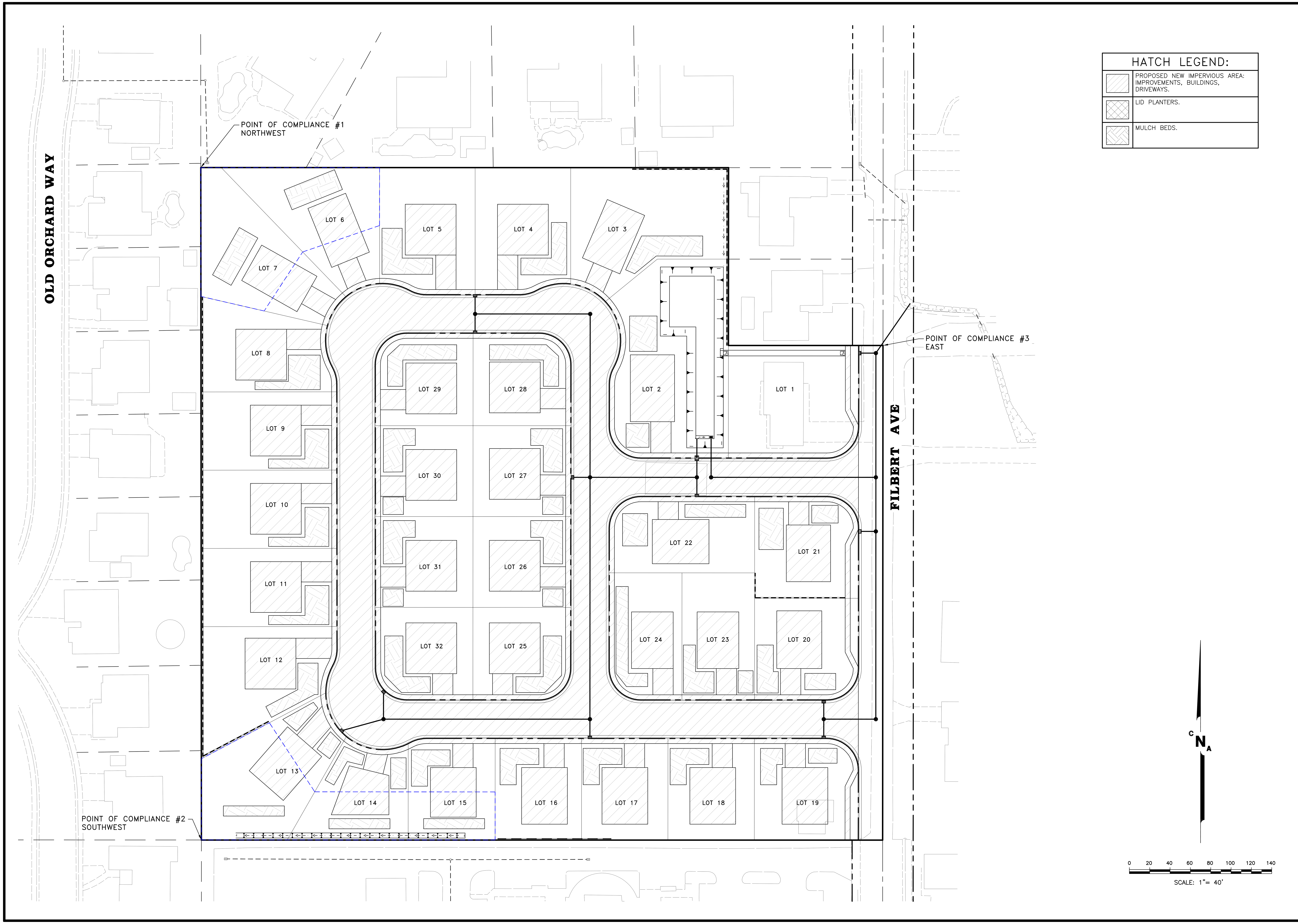
Obtain A from Step 1 | 0.24 | A | hrs Specified Draw Down time

Obtain P_0: Maximized Detention Volume from figures E-1 to 4 in Appendix E of this manual using I_A from Step 2. | E- 0.00 | P_0

Calculate treatment volume (acre-ft):

Treatment volume = A x (P_0 / 12) | 0.00 | Acre-Feet

v06232012



NO.	DESCRIPTION	APPROVED BY	DATE
1			
2			
3			
4			

REVISIONS

CNA ENGINEERING INC.
CIVIL ENGINEERING: LAND SURVEYING
PLANNING: STRUCTURAL DESIGN
PHONE: (916) 485-3746
2575 VALLEY ROAD
SACRAMENTO, CA 95821
cnaeng.com

SCALE	PREPARED BY
HORIZ.: 1"= 40'	DRAFTED BY: VAL T.
VERT.: N/A	DESIGNED BY: STEVE N.
FLD BK.: N/A	CHECKED BY: CHRIS O.
ASSESSOR'S PARCEL NO.: 223-0091-002	

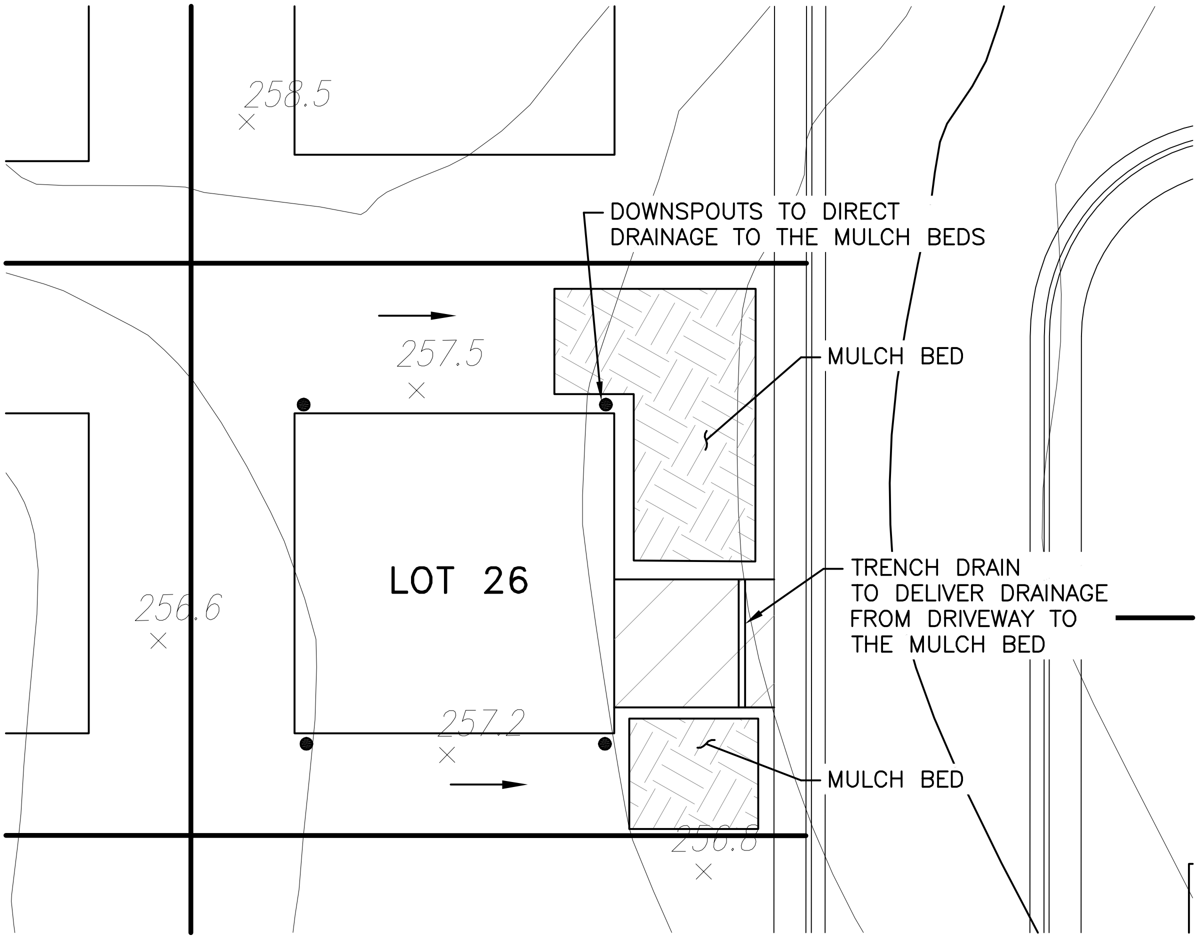
PRELIMINARY LID PLAN FOR:
BLOSSOM RIDGE

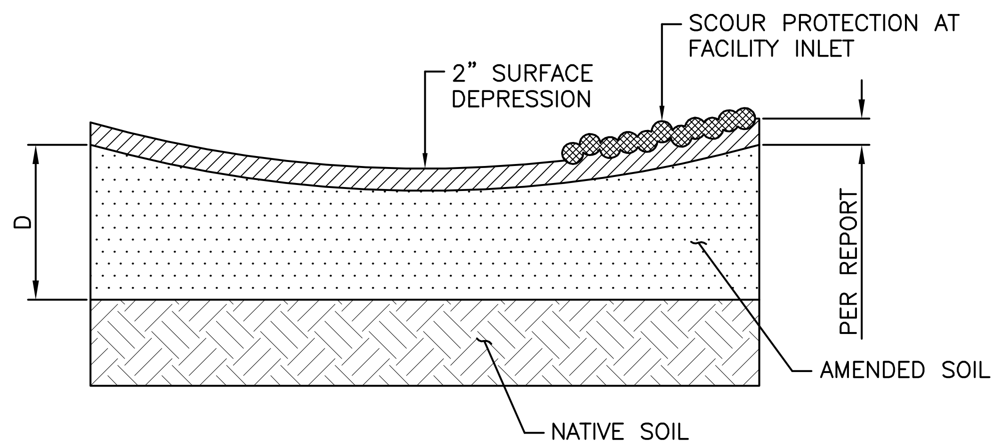
COUNTY OF SACRAMENTO STATE OF CALIFORNIA

DATE : 6/7/2021

FN.:19144_10.DWG

SHEET X OF X SHEETS





AMENDED SOIL WITH MULCH BED

N.T.S.

CNA ENGINEERING INC.
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PHONE: (916) 485-3746
2575 VALLEY ROAD, SACRAMENTO, CA 95821
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LOT 26 LID

SCALE: 1:30

DATE: 12/03/2020

FILE: 19144.DWG

Conclusions

1. The subdivision has been designed not to increase the peak flows during 100-, 10- and 2-year 24-hour events. Proposed design has incorporated the required grading to mitigate the increase of the flow during these storm events.
2. Proposed on-site and off-site public storm drain systems have been designed to suffice for the purpose of conveying drainage considering Nolte flow.
3. Low Impact Development standards have been preliminary incorporated into the design of the subdivision.