



TOP ENGINEERING INC.

CIVIL ENGINEERING, LAND SURVEYING
PLANNING, GENERAL ENGINEERING CONSTRUCTION

Preliminary Drainage Report for: Orange Meadow Estates

PLNP2021-00221

Level 2

Datum - NAVD88

Prepared by Top Engineering Inc.



DATE: 02-15-2021

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1. Introduction

1.1 Site description:

The project site is located in Orangevale on Santa Juanita Avenue north of its intersection with Central Avenue. Project area is 3 acres, which are currently vacant and cover with grass. Project proponent proposes to split the site into 6 residential lots and construct an access road to serve them. It is an infill project with the surrounding area mostly developed in a similar manner with the same zoning and land use. The site conveys the flows from north and west to the southeast corner, where it leaves the property and after crossing Santa Juanita Avenue, releases to the creek approximately 700 feet southeast from the project. Upstream watersheds consist of about 8.2 acres is located to the north and 1.1 acres located to the west of the site.

Channelization of the site is proposed in order to convey the flows and reduce the 100-year floodplain in order to facilitate the construction.

This Drainage Report covers:

- Existing 100-year flood conveyance and floodplain;
- Proposed 100-year flood conveyance and floodplain;
- Proposed 10-year crossing of the access road.

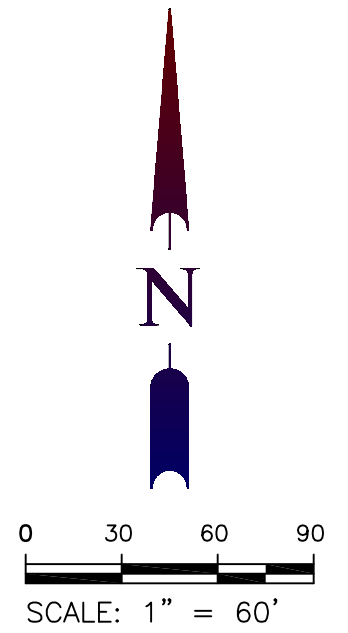
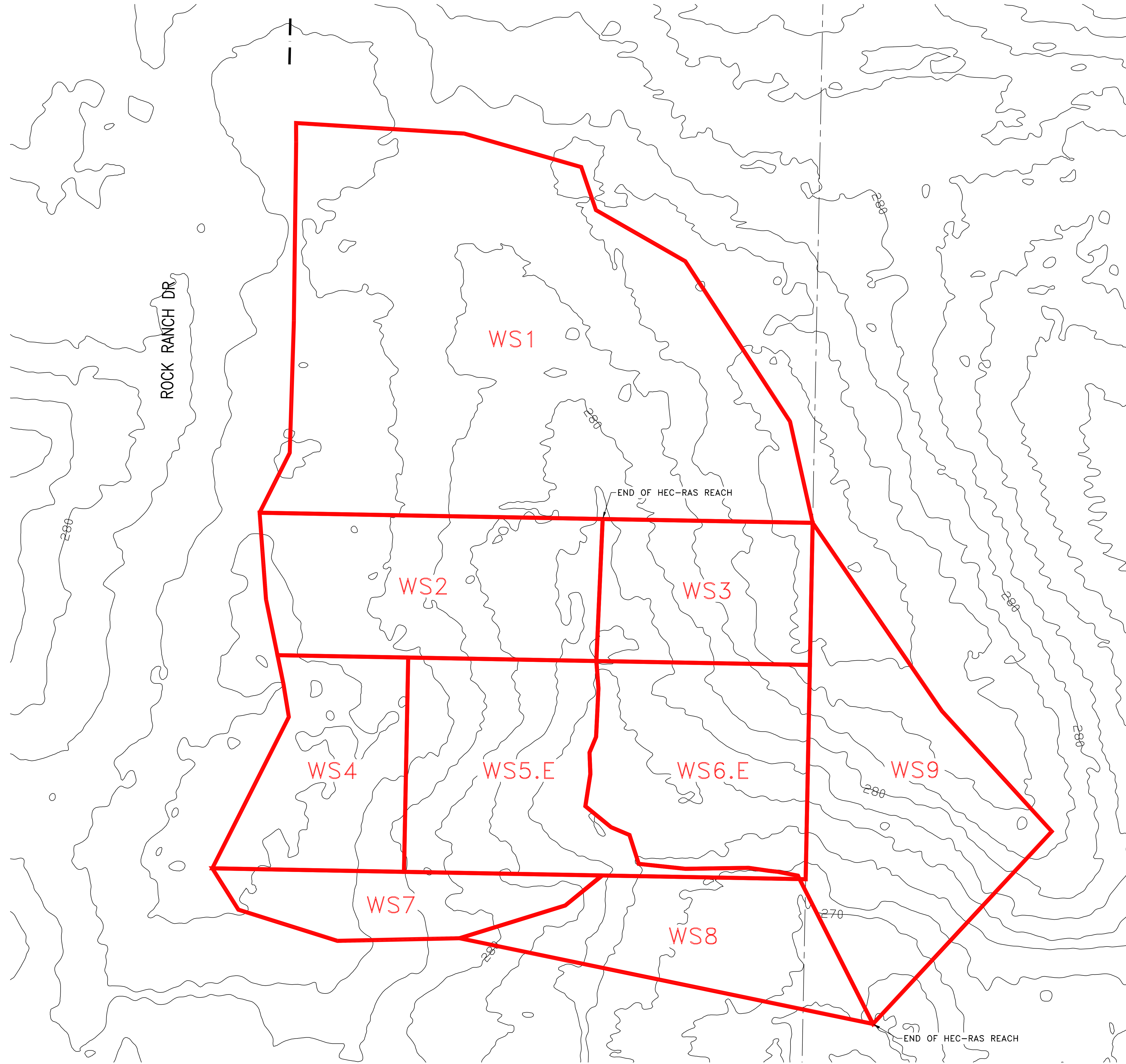
The subdivision is not required to implement Stormwater Quality measures because the site is 3.0 acres gross of single-family residential RD-2 and the assumed impervious area for RD-2 is 0.25 (Table D-1a of the Sacramento County Residential LID worksheets). The total impervious area criteria for implementing Stormwater Quality measures is 1.0 acre, and the site is assumed to propose 0.75 acres impervious (3.0 acres x 0.25 impervious ratio for RD-2).

Calculations

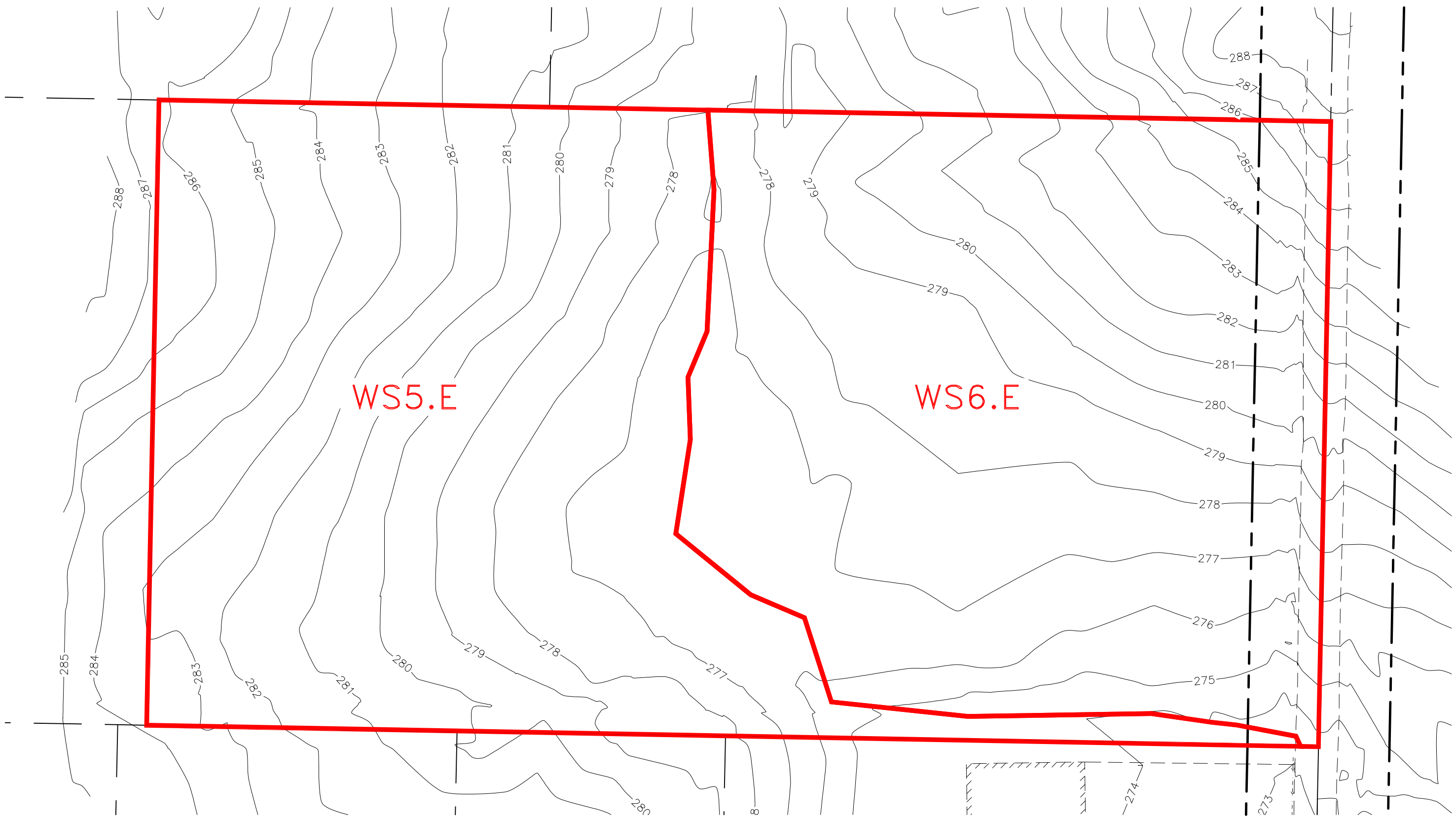
1.2 Design narrative

Existing conditions are such that the flow is being conveyed from north south via the valley on the project site. The intent of the design is to channelize the flow, increasing the buildable area and implementing the improvements for the adjacent property to the south – 6713 Santa Juanita Ave. Refer to the Preliminary Grading Plan below.

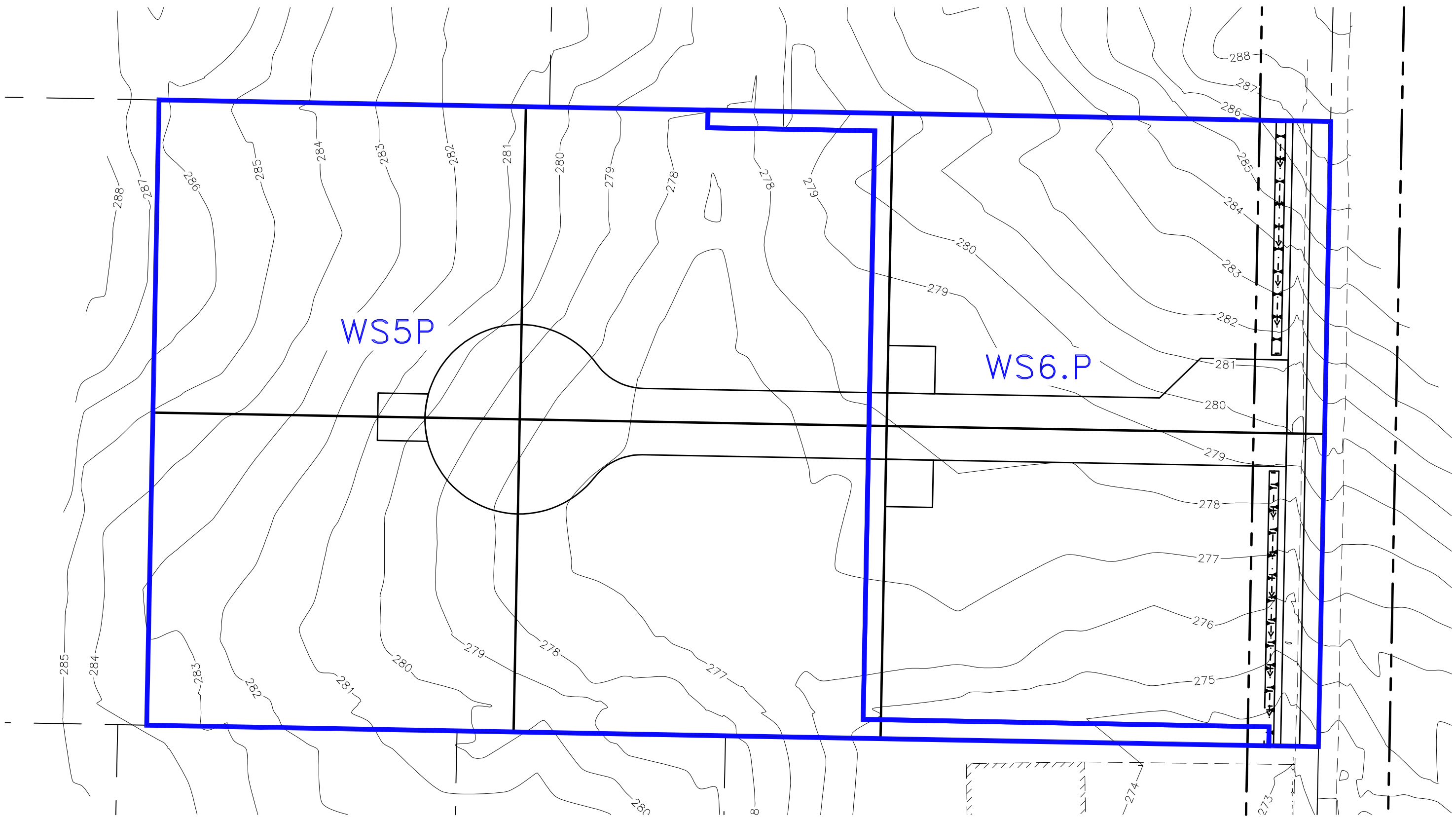
Per Sacramento County standards, SacCalc has been used to estimate the flow rates and HEC-RAS has been used to route the flow through the existing swale and proposed Channel.



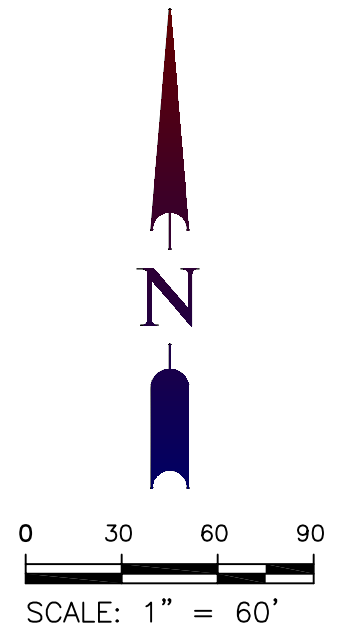
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EXISTING ON-SITE WATERSHED
SCALE: 1" = 40'



PROPOSED ON-SITE WATERSHED
SCALE: 1" = 40'



DATE : 2/15/2022		COUNTY OF CALIFORNIA	
FN.: 21031.DWG		STATE OF CALIFORNIA	
SHEET		COUNTY OF SACRAMENTO	
2 OF 5 SHEETS		ON-SITE WATERSHED MAP FOR: ORANGE MEADOW ESTATES	
SCALE		VERT. N/A	
HORIZ. 1"=60'		PREPARED BY	
DRAFTED BY: VT		DESIGNED BY: VF	
CHECKED BY: VT		TOP ENGINEERING INC. CIVIL ENGINEERING, LAND SURVEYING PLANNING, GENERAL ENGINEERING CONSTRUCTION PHONE: (916) 342-3657 main@topcivileng.com	
DESCRIPTION		ENGR. INT.	
NO.		COUNTY APPROVED BY	
REVISIONS		DATE	

2.2 Design Calculations

2.2.1 100-year flood conveyance

2.2.1.1 Watersheds Descriptions

a) Watershed WS1

Watershed WS1 conditions are:

Total shed area $A_0 = 5.58$ acres;

Mean Elevation – 282 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 638 feet; (90% = 574.2' – for use in SacCalc)

Length along longest watercourse to centroid – 244 ft;

Existing basin slope is 1.25%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

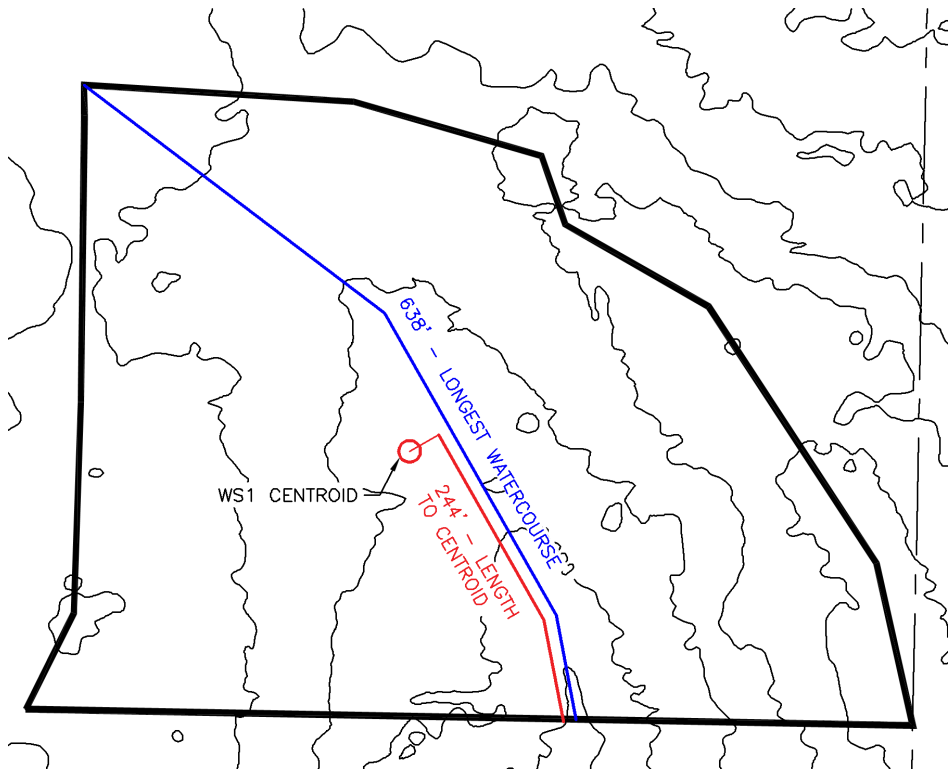


Figure 1 – WS1 Watercourse Lengths.

b) Watershed WS2

Watershed WS2 conditions are:

Total shed area $A_0 = 1.65$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 446 feet; (90% = 401.4' – for use in SacCalc)

Length along longest watercourse to centroid – 204 ft;

Existing basin slope is 2.5%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

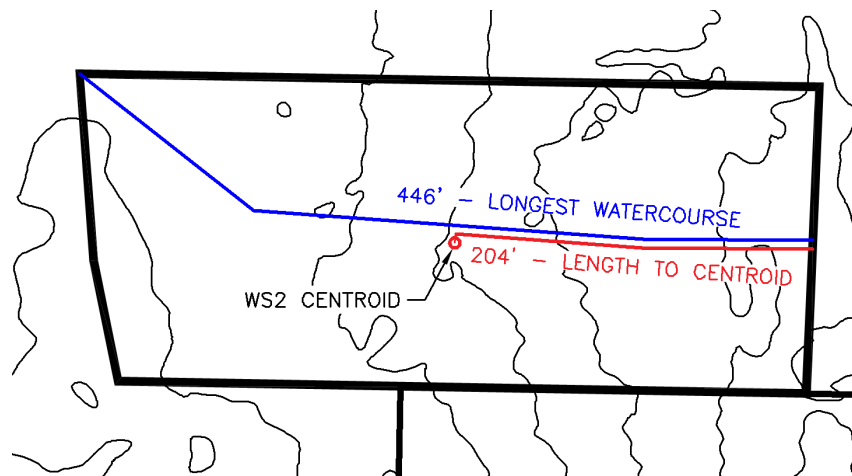


Figure 2 – WS2 Watercourse Lengths.

c) *Watershed WS3*

Watershed WS3 conditions are:

Total shed area $A_0 = 1.05$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 294 feet; (90% = 264.6' – for use in SacCalc)

Length along longest watercourse to centroid – 130 ft;

Existing basin slope is 3.5%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

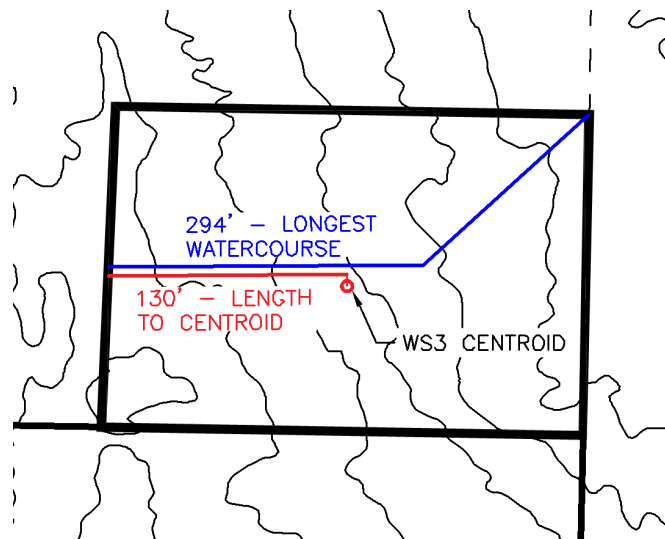


Figure 3 – WS3 Watercourse Lengths.

d) Watershed WS4

Watershed WS4 conditions are:

Total shed area $A_0 = 1.09$ acres;

Mean Elevation – 284 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 453 feet; (90% = 407.7' – for use in SacCalc)

Length along longest watercourse to centroid – 353 ft;

Existing basin slope is 3.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

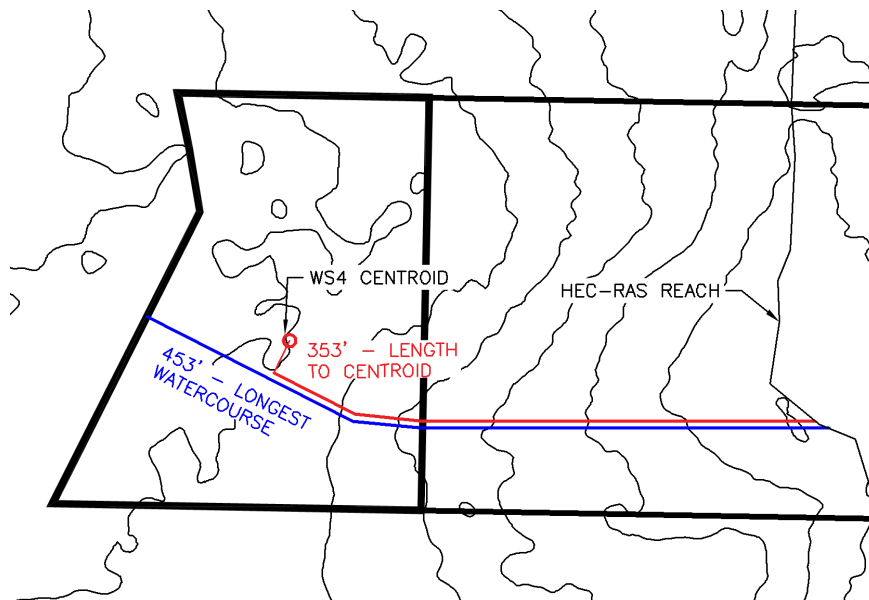


Figure 4 – WS4 Watercourse Lengths.

e) Watershed WS5.E

Watershed WS5.E conditions are:

Total shed area $A_0 = 1.52$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

Open Space - 2% impervious;

Length of longest watercourse – 226 feet; (90% = 203.4' – for use in SacCalc)

Length along longest watercourse to centroid – 106 ft;

Existing basin slope is 4.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

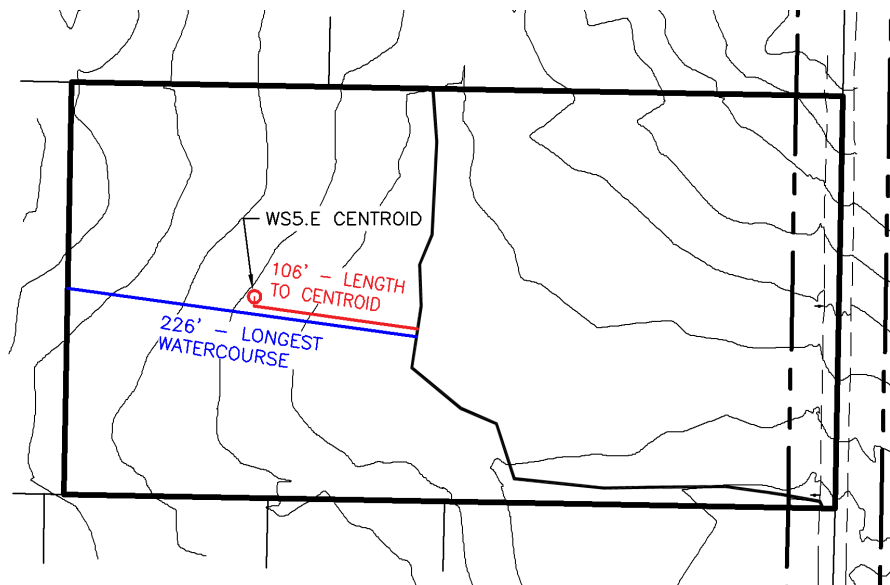


Figure 5 – WS5.E Watercourse Lengths.

f) Watershed WS6.E

Watershed WS6.E conditions are:

Total shed area $A_0 = 1.48$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

Open Space - 2% impervious;

Length of longest watercourse – 305 feet; (90% = 274.5' – for use in SacCalc)

Length along longest watercourse to centroid – 136 ft;

Existing basin slope is 3.5%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

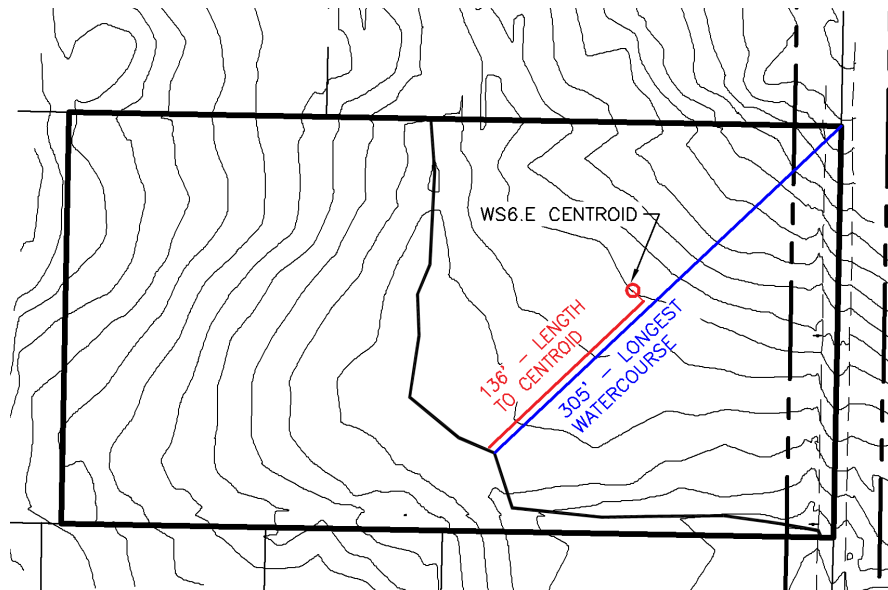


Figure 6 – WS6.E Watercourse Lengths.

g) Watershed WS7

Watershed WS7 conditions are:

Total shed area $A_0 = 0.70$ acres;

Mean Elevation – 282 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 455 feet; (90% = 409.5' – for use in SacCalc)

Length along longest watercourse to centroid – 238 ft;

Existing basin slope is 2.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

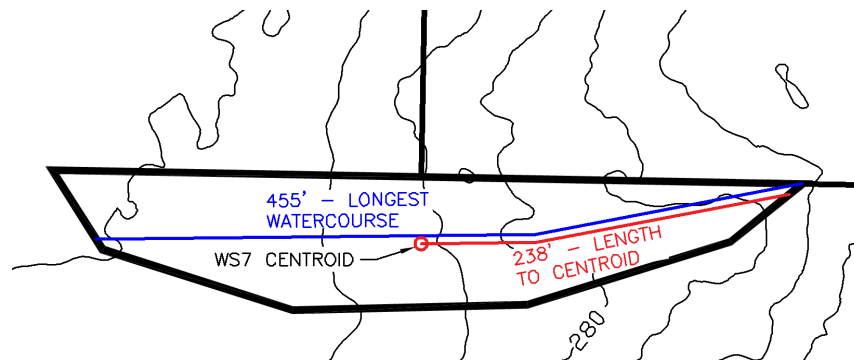


Figure 7 – WS7 Watercourse Lengths.

h) Watershed WS8

Watershed WS8 conditions are:

Total shed area $A_0 = 1.12$ acres;

Mean Elevation – 278 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 483 feet; (90% = 434.7' – for use in SacCalc)

Length along longest watercourse to centroid – 188 ft;

Existing basin slope is 3.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

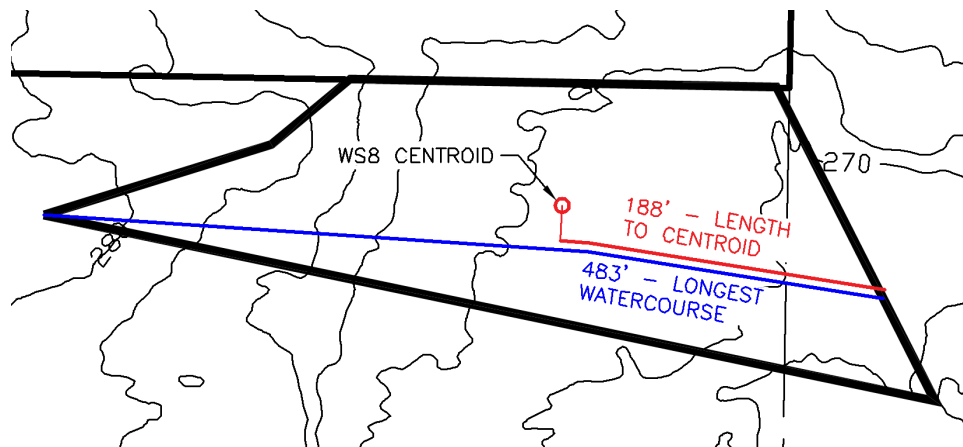


Figure 8 – WS8 Watercourse Lengths.

i) Watershed WS9

Watershed WS9 conditions are:

Total shed area $A_0 = 2.12$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 430 feet; (90% = 387.0' – for use in SacCalc)

Length along longest watercourse to centroid – 189 ft;

Existing basin slope is 5.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

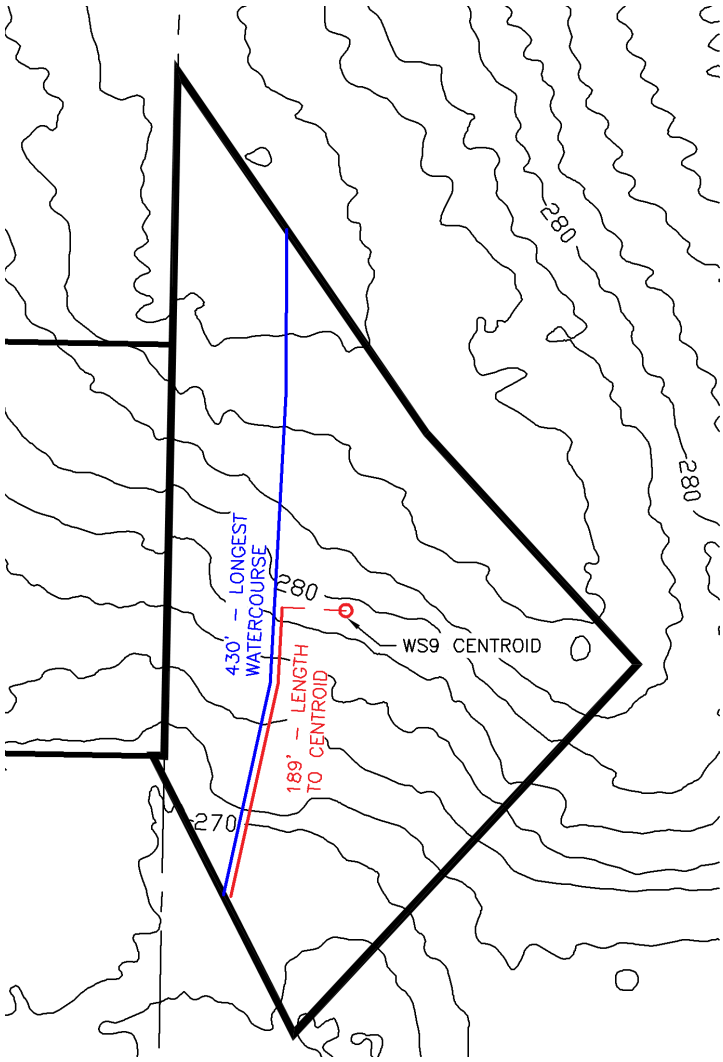


Figure 9 – WS9 Watercourse Lengths.

j) Watershed WS5.P

Watershed WS5.P conditions are:

Total shed area $A_0 = 1.85$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 313 feet; (90% = 281.7' – for use in SacCalc)

Length along longest watercourse to centroid – 143 ft;

Proposed basin slope is 3.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

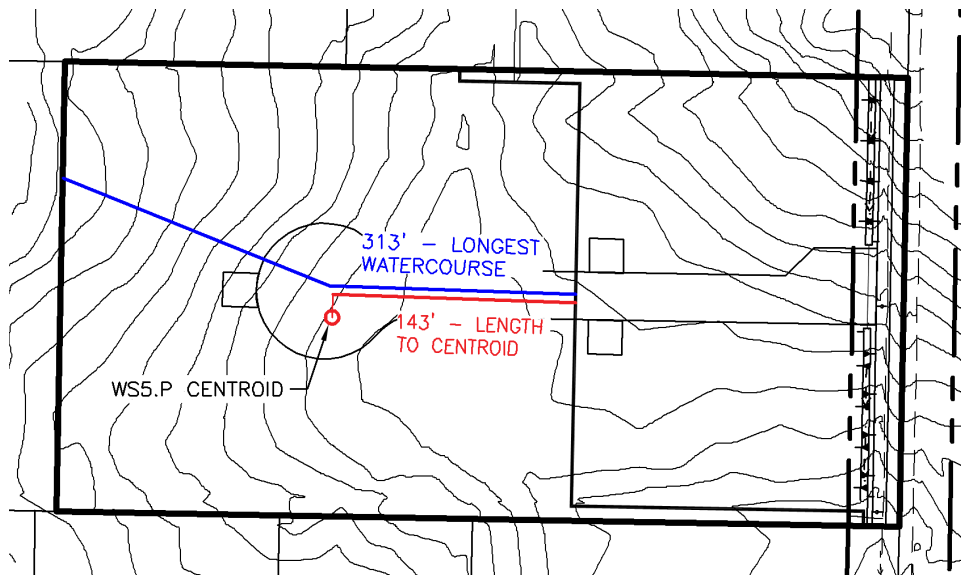


Figure 10 – WS5.P Watercourse Lengths.

k) Watershed WS6.P

Watershed WS6.P conditions are:

Total shed area $A_0 = 1.15$ acres;

Mean Elevation – 280 ft;

Precipitation Zone – 3;

Imperviousness based on the zoning (land use):

RD-2 - 25% impervious;

Length of longest watercourse – 232 feet; (90% = 208.8' – for use in SacCalc)

Length along longest watercourse to centroid – 93 ft;

Proposed basin slope is 2.0%;

Hydrologic Soils group B per USDA GIS Map. Orangevale coarse sandy loam.

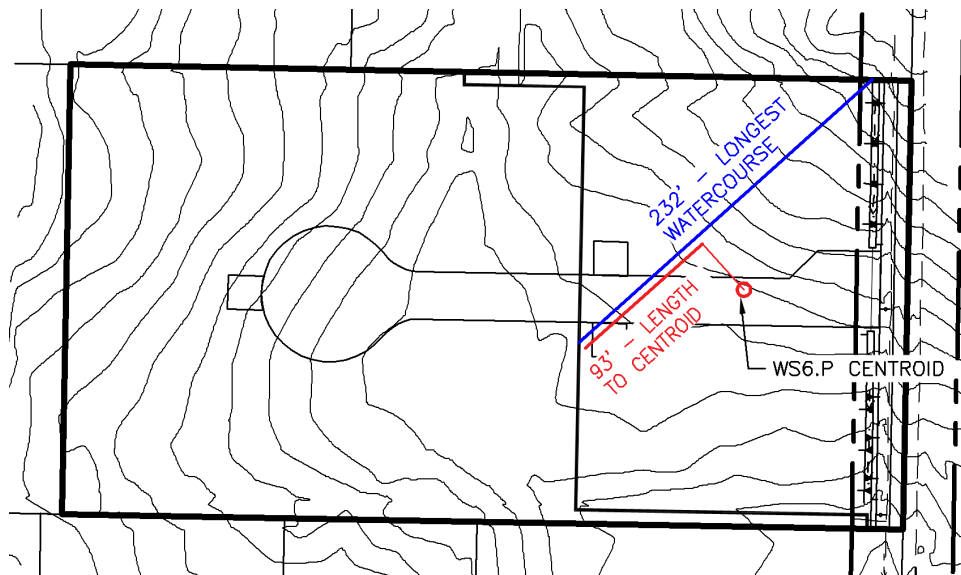


Figure 11 – WS6.P Watercourse Lengths.

2.2.1.2 Peak Control

Development proposes to increase the imperviousness of the site which leads to increase of the flows leaving the property. In order to mitigate this effect a detention facility is proposed. It consists of 2 flat channel-type basins in the front yards of Lots 2 and 5, hydraulically connected with 12" RCP pipe as show on the Preliminary Grading Plan. 10" connection to the channel is proposed. Driveway areas of crossing have been deducted from the volumes provided by this detention facility. The ponds are 1.5' deep, 3.0' wide at the bottom and 9.0' wide at the top. The detention node is modeled as one facility in SacCalc due to its hydraulic connectivity and one point of outfall.

2.2.1.3 SacCalc Analysis

Analysis is done based on 100-year 24-hour storm event.

Sacramento Hydrologic Calculator results are shown in figure below.

Sacramento method results (Project: Orange Meadow) (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	15.	12:06	.01			
WS2	5.1	12:04	.00			
WS3	3.7	12:02	.00			
WS4	3.2	12:05	.00			
WS5E	4.7	12:04	.00			
WS6E	4.2	12:05	.00			
WS7	2.1	12:05	.00			
WS8	3.5	12:04	.00			
WS9	7.0	12:03	.00			
WS6P	4.1	12:02	.00			
WS5P	6.3	12:03	.00			
DE001	3.0	12:11	.00	1.4	.0	

(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	9.5	12:05	.01			
WS2	3.2	12:03	.00			
WS3	2.1	12:02	.00			
WS4	2.0	12:04	.00			
WS5E	2.7	12:04	.00			
WS6E	2.4	12:05	.00			
WS7	1.3	12:03	.00			
WS8	2.2	12:03	.00			
WS9	4.3	12:02	.00			
WS6P	2.3	12:02	.00			
WS5P	3.8	12:02	.00			
DE001	2.4	12:08	.00	1.0	.0	

Figure 12 - Sacramento Hydrologic Calculator Results.

2.2.1.3 HEC-RAS Analysis

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:

- WS1 flow at section 860;
- WS2 flow between sections 685 and 770;
- WS3 flow between sections 685 and 770;
- WS4 flow between sections 440 and 620;
- WS5.E flow between sections 380 and 620;
- WS6.E flow between sections 260 and 560;
- WS7 flow at section 440;
- WS8 flow between sections 200 and 100;
- WS9 flow between sections 200 and 100.

2. Post-Project conditions:

- WS1 flow at section 890;
- WS2 flow between sections 715 and 800;
- WS3 flow between sections 715 and 800;
- WS4 flow between sections 408 and 617;
- DE001 flow at section 473;
- WS6.P flow between sections 268 and 572;
- WS7 flow at section 368;
- WS8 flow between sections 200 and 100;
- WS9 flow between sections 200 and 100.

At the end of the river normal depth of 0.025 has been applied to account for the slope of the ground as per LiDar.

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. 0.070 has been used to account for sharp channel turns and rip-rap at these locations.

All the on-site swale's bed sections were surveyed and LiDar information has been used to fill the gaps in field shots for some of the overbank data and off-site conditions.

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

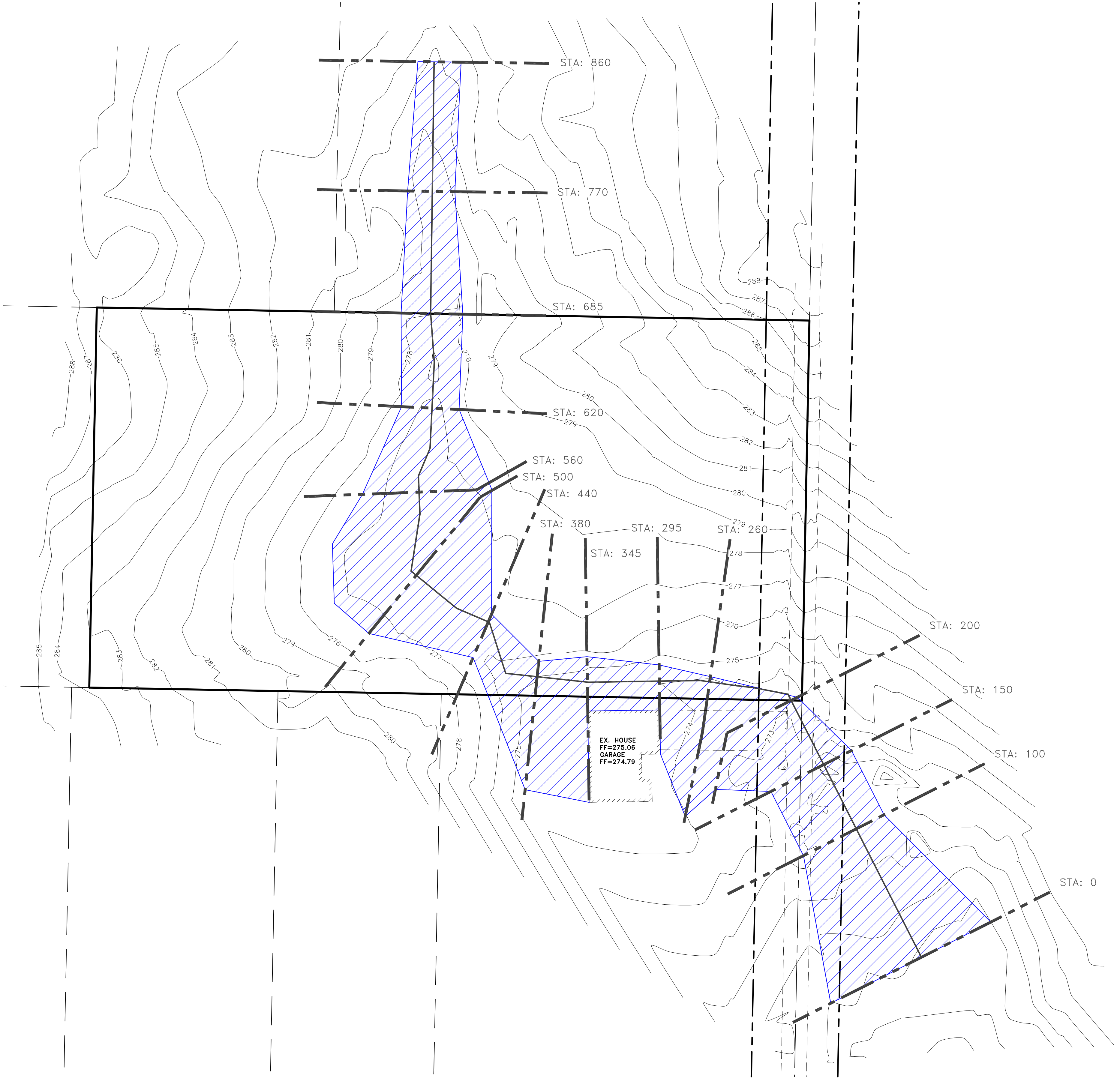
Proposed culvert has been inserted at the road crossing. (2) 18" RCP with headwalls are proposed. The 100-year flow overtops the road with less than 12" of depth, following the County standards. Calculation was done for 10-year event to prove that this flow will be contained in the culvert at the crossing.

Results are presented in the table below. As can be seen, increase of WSE by 0.01' and 0.02' have been noticed in a few sections upstream of the project. These slight increases have been found safe and acceptable. There is historic flooding downstream of the project. No WSE rise is proposed with the development and the peak flow rate during 100-year 24 hour design storm event is proposed to be reduced in the proposed conditions.

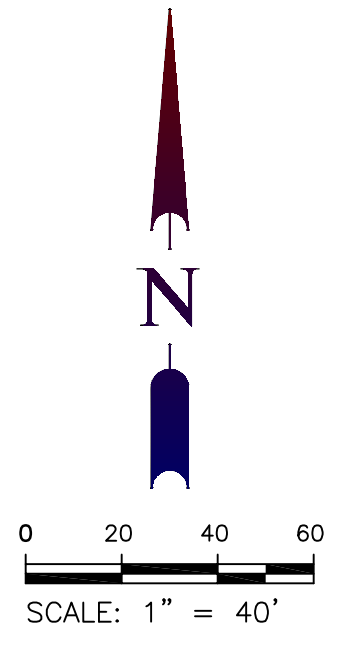
Existing house at 6713 Santa Juanita Ave has been found to be constructed at low grades. Obstruction has been inserted in the existing HEC-RAS model to account for it. The wall is proposed to be constructed along the south property line to allow 1' of freeboard over the 100-year Water Surface Elevation and the top of the wall. House Finished floor is at 275.06'. Top of the channel elevations range from 255.20 to 275.95'. WSE along the property line ranges from 274.77' to 275.44'. The flow is designed to be contained with the channel. Top of the wall along the property line is proposed at 277.00 in order to give 1' of freeboard as required and protect the existing structure.

Section	WSE Pre, ft	WSE Post, ft	Q Pre, cfs	Q Post, cfs
<i>Upstream</i>				
860 (890)	280.41	280.42	15.31	15.31
770 (800)	279.17	279.17	15.22	15.23
685 (715)	278.23	278.25	22.57	22.57
<i>Downstream</i>				
200	273.58	273.58	33.49	32.16
150	272.76	272.76	36.78	35.86
100	271.69	271.68	40.10	39.58
0	269.01	269.01	40.06	39.53

Table 1 – Pre- and Post-developed 100-year Water Surface Elevations.



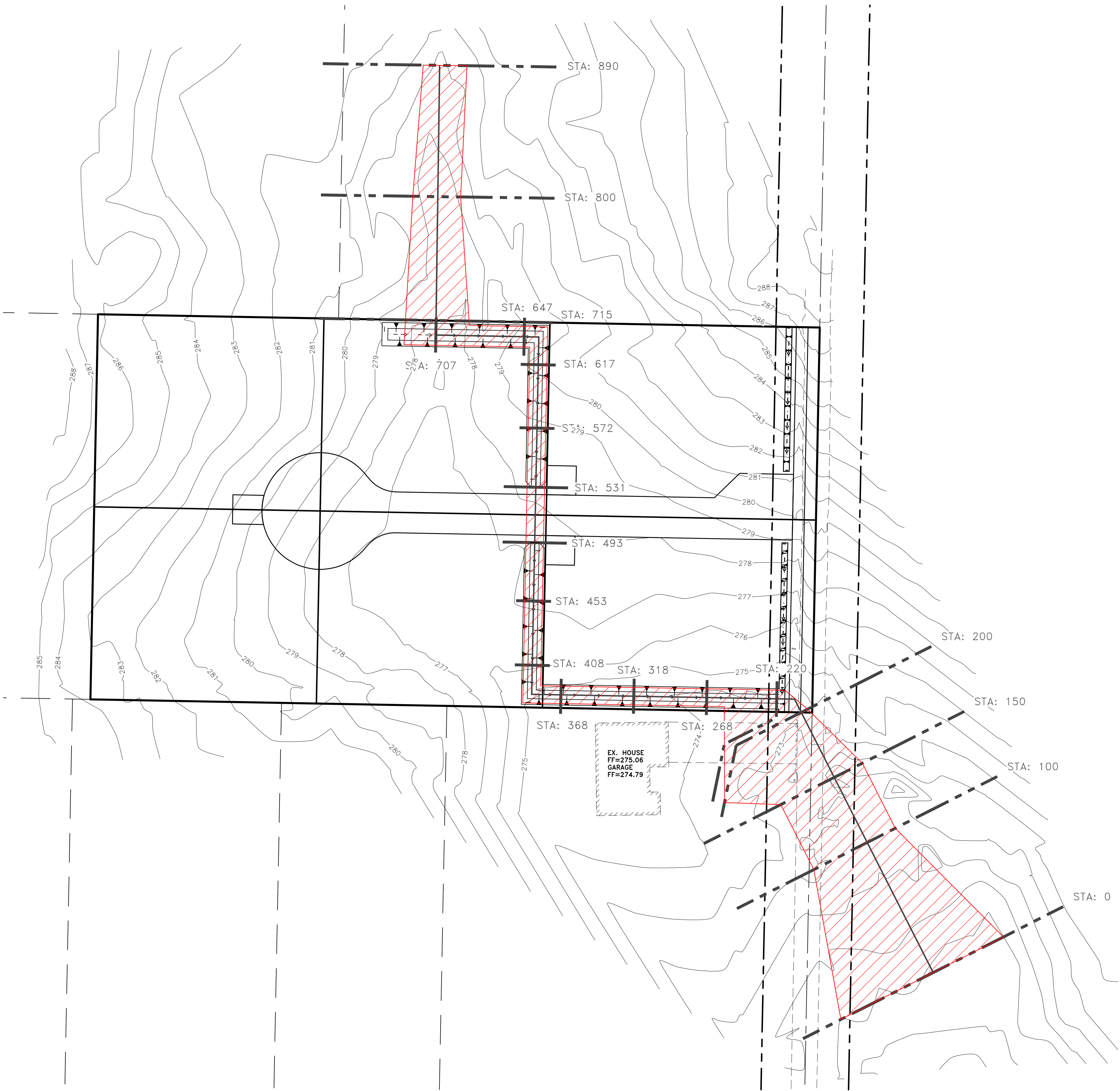
EXISTING 100-YEAR FLOODPLAIN
SCALE: 1" = 40'



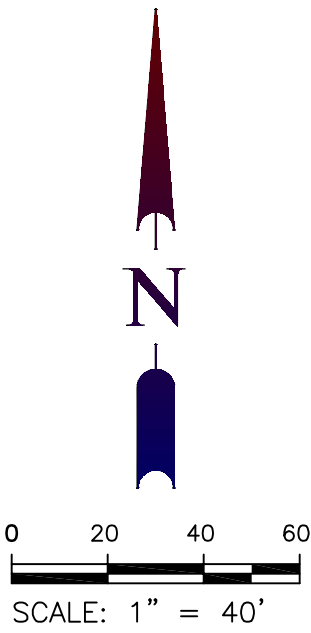
EXISTING 100-YEAR FLOODPLAIN FOR: ORANGE MEADOW ESTATES		COUNTY OF SACRAMENTO		STATE OF CALIFORNIA	
DATE : 2/15/2022		COUNTY APPROVED BY		DATE	
FN.: 21031.DWG		ENGR. INT.		APPROVED BY	
SHEET		NO.		REVISIONS	
3 OF 5		△		△	
SHEETS		△		△	

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SCALE	VERT. N/A
HORIZ. 1"=40'	PREPARED BY
DRAFTED BY: VT	DESIGNED BY: VF
CHECKED BY: VT	



PROPOSED 100-YEAR FLOODPLAIN
SCALE: 1"= 40'



DATE : 2/15/2022		COUNTY OF CALIFORNIA		NO.		DESCRIPTION		ENGR. INT.		COUNTY APPROVED BY		DATE	
FN.: 21031.DWG		COUNTY OF SACRAMENTO		4		OF		5		SHEETS		SHEETS	
SHEET		STATE OF CALIFORNIA		DRAFTED BY: VT		DESIGNED BY: VF		PREPARED BY		VERT. N/A		SCALE	
PROPOSED 100-YEAR FLOODPLAIN FOR: ORANGE MEADOW ESTATES		TOP ENGINEERING INC.		CIVIL ENGINEERING, LAND SURVEYING		PLANNING, GENERAL ENGINEERING CONSTRUCTION		PHONE: (916) 342-3657		main@topcivileng.com		REVISIONS	

2.2.2 Drainage Conveyance

Upstream drainage from the offsite watersheds WS4 and WS7 is proposed to be conveyed through the site unimpeded. Drainage from WS4 will sheet flow through proposed lots 3 and 4, and enter the proposed channel. Drainage from WS7 will be conveyed along the southern boundary line in a swale. Swale has been shown on the Preliminary Grading Plan and the report for it has been provided below.

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Wednesday, Dec 15 2021

Swale for WS7

Triangular

Side Slopes (z:1) = 2.00, 2.00
Total Depth (ft) = 1.00

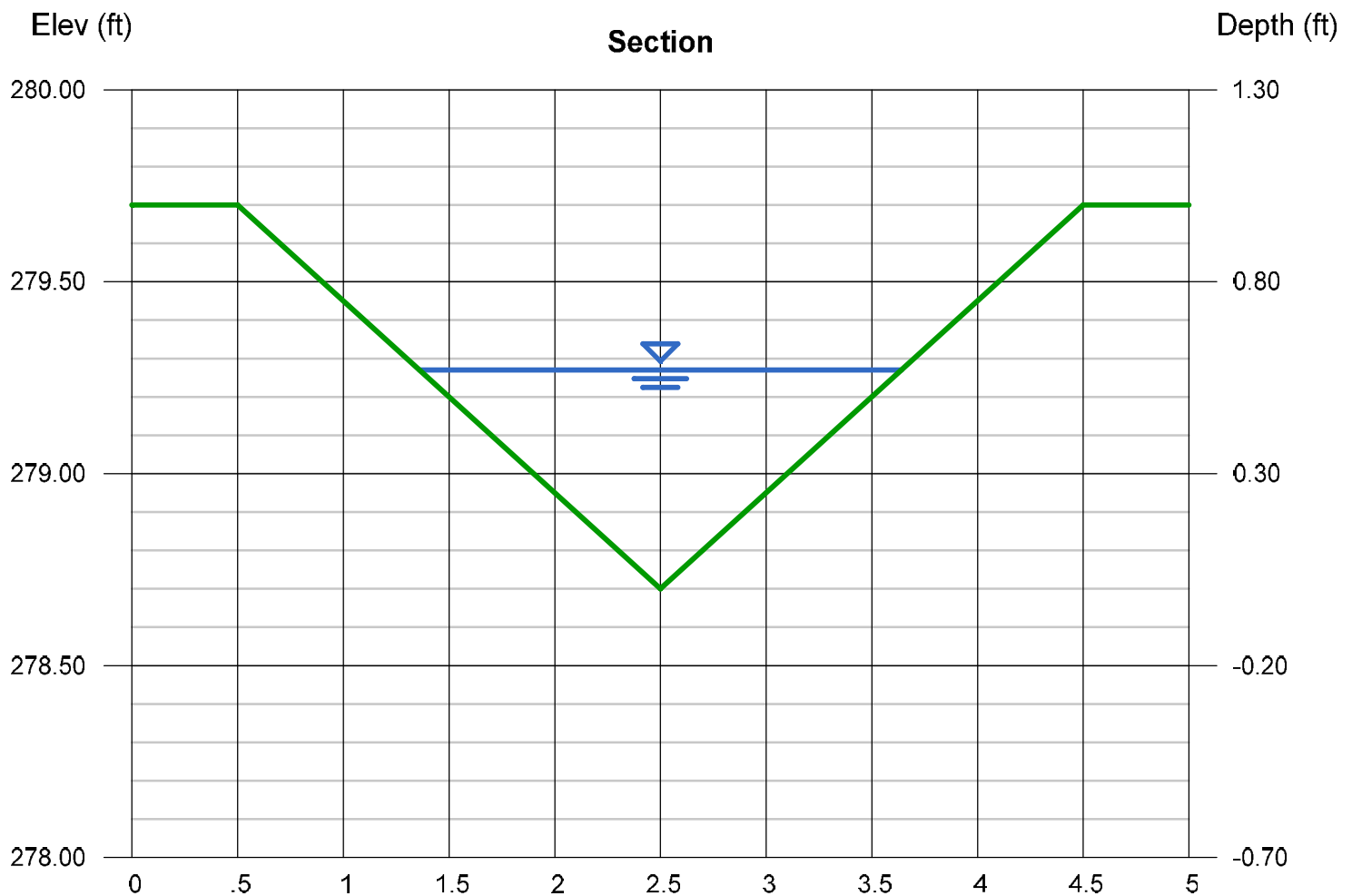
Invert Elev (ft) = 278.70
Slope (%) = 2.00
N-Value = 0.025

Calculations

Compute by: Known Q
Known Q (cfs) = 2.10

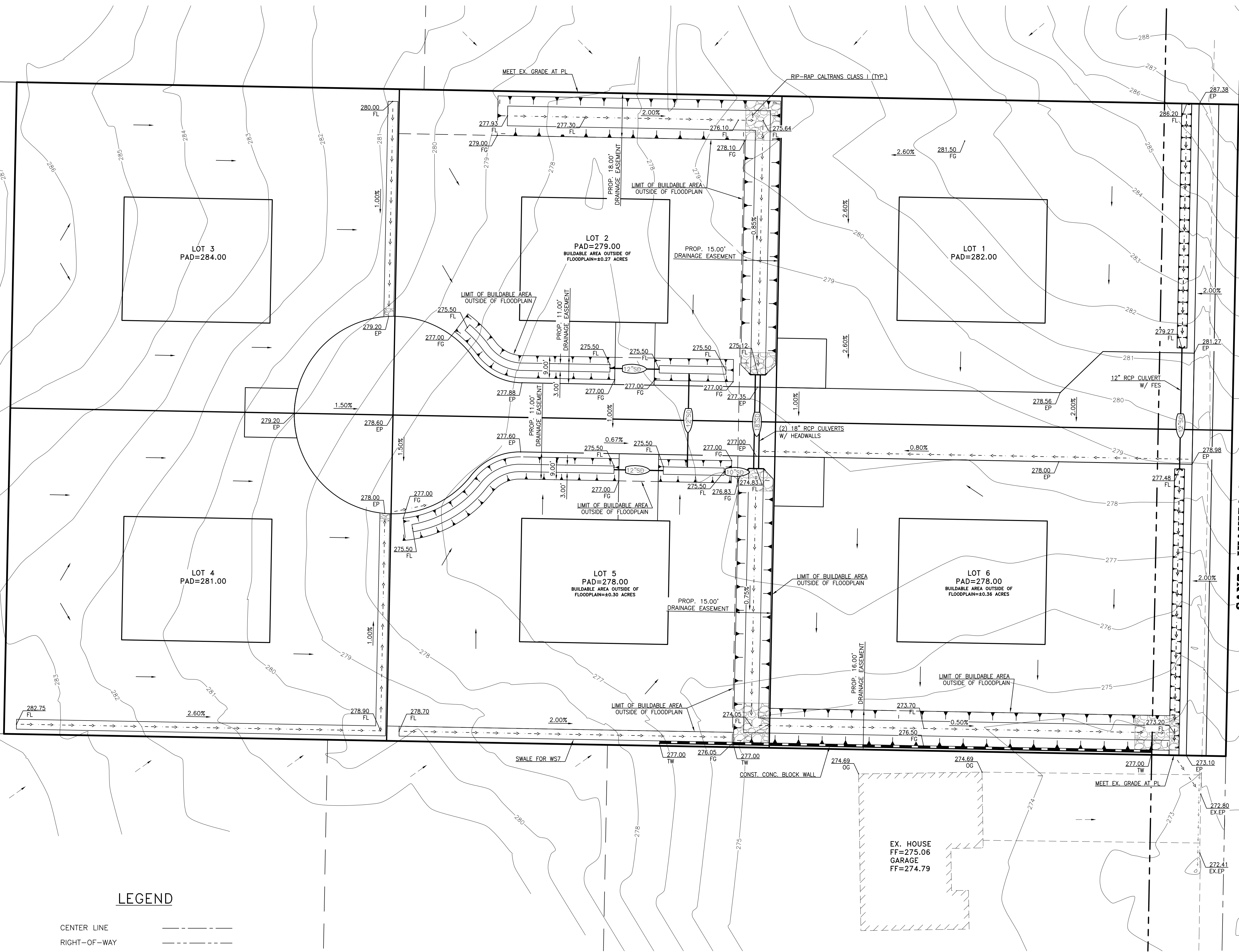
Highlighted

Depth (ft) = 0.57
Q (cfs) = 2.100
Area (sqft) = 0.65
Velocity (ft/s) = 3.23
Wetted Perim (ft) = 2.55
Crit Depth, Yc (ft) = 0.59
Top Width (ft) = 2.28
EGL (ft) = 0.73



Reach (ft)

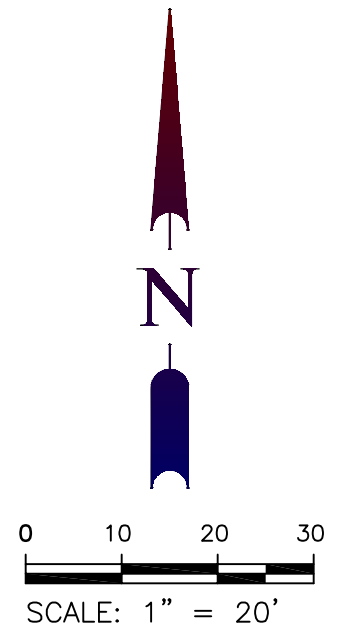
A - 26



LEGEND

CENTER LINE	---
RIGHT-OF-WAY	---
RETAINING WALL	---
SLOPE	---
FENCE	---
DITCH FLOW DIRECTION	---
FLOW DIRECTION	---
ELEVATION	×
CONTOUR	---

DRAINAGE EASEMENT NOTE:
DRAINAGE EASEMENT WILL BE DEDICATED BY A SEPARATE
DOCUMENT DURING THE DESIGN OF FINAL IMPROVEMENT PLANS.



PRELIMINARY GRADING PLAN FOR: ORANGE MEADOW ESTATES		STATE OF CALIFORNIA	
COUNTY OF SACRAMENTO		DATE : 2/15/2022	
SHEET		FN.: 21031.DWG	
5 OF 5 SHEETS		ENC. INT. COUNTY APPROVED BY	
NO. REVISIONS		DESCRIPTION	
TOP ENGINEERING INC.		CIVIL ENGINEERING, LAND SURVEYING	
PLANNING, GENERAL ENGINEERING CONSTRUCTION		PHONE: (916) 342-3657	
main@topcivileng.com			

3. Discussion of Results

It has been found that the proposed development will not significantly impact upstream or downstream properties during 100-year 24-hour storm events. Downstream areas, where historic flooding has been reported, no negative effect as a part of the development is proposed. Moreover, adjacent property at 6713 Santa Juanita Ave will only benefit from the channelization of the flow. This will protect said property from the direct inflow from the north as compared to the existing conditions. CMU wall is proposed along said property line to protect this property from any direct flow from the project site and to allow 1.0' of freeboard over the 100-year Water surface elevation to the top of the wall. Peak flows during 100-year event downstream of the project will be reduced as compared with the existing conditions.

Flow from 10-year event will not overtop the proposed road as required by the Sacramento County standards.

Building areas will meet and significantly exceed the minimum buildable area outside of the flood plain as required by the Sacramento County standards.

4. Conclusions:

- Channel has been designed in order to convey the 100-year flood in the matter similar to the existing conditions.
- It has been found that the proposed development will not significantly impact upstream or downstream properties during 100-year 24-hour storm events. Downstream areas, where historic flooding has been reported, no negative effect as a part of the development is proposed. Downstream of the project site Water Surface Elevations and peak flow during 100-year event will not increase as compared to the pre-developed conditions. Adjacent property at 6713 Santa Juanita Ave will benefit from the channelization of the flow which is proposed by the project. This will protect said property from the direct inflow from the north as compared to the existing conditions. CMU wall is proposed along said property line to protect this property from any direct flow from the project site and to allow 1.0' of freeboard over the 100-year Water surface elevation to the top of the wall.
- Flow from 10-year event will not overtop the proposed road as required by the Sacramento County standards.
- LID requirements are not applicable to this project due to the proposed impervious area being less than 1 acre.