

Preliminary Drainage Study

For

Walnut Ave. TPM

Level 3

PLNP2022-00298

Orangevale, CA

Watershed: Fair Oaks Stream Group

March 27, 2023



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1. Introduction

Walnut Ave. Tentative Parcel Map is a proposed project located at 5644 Walnut Avenue (project site) in Orangevale, California, within the unincorporated County of Sacramento. This study shall provide a drainage analysis of the project site during the preliminary phase of the project and shall be reviewed by Sacramento County Department of Water Resources (SCDWR).

a. Existing Conditions

The 0.78-acre lot has an assessor's parcel number of 235-0382-022 and is located between Walnut Avenue and Mist Court, approximately 850-feet to the north of the Blue Oak Drive and Walnut Avenue intersection in Orangevale, California as shown on **Exhibit A**.

The project site parcel is partially developed with a single-family dwelling unit, a concrete driveway and two sheds in the rear. The majority of the site is covered with grassy vegetation.

b. Project Description

The subject parcel will be subdivided into four separate parcels with a private roadway and utility easement along the north of the project site for access to the new parcels. The existing dwelling unit and driveway will be partially demolished. Three dwelling units with garages and driveways are anticipated for the project.

c. Applicable Standards

- i. Sacramento County Drainage Study Requirements
- ii. Sacramento County Floodplain Management Ordinance
- iii. Sacramento City/County Drainage Manual Volume 2: Hydrology Standards
- iv. Sacramento County Improvement Standards – Section 9
- v. Stormwater Quality Design Manual for the Sacramento Region.

d. Previous Studies: No previous drainage studies were referenced to complete this study.

e. Objectives of Analysis

The purpose of this study is to address the following items:

1. Develop and evaluate a hydrologic model for the watersheds affecting the project site. The 100-year, 24-hour storm shall be analyzed in existing and with-project conditions.
2. Calculate the 100-year, 24-hour peak water surface elevation (WSEL) for overland release points of the project site.

3. Analyze the public storm drain network during a Nolte storm event, which is SCDWR's design storm for underground facilities.

2. Baseline (Existing Conditions):

- a. **Historical Land-use:** As previously discussed, the parcel has been partially developed for residential purposes.
- b. **Topographic Sources:** Topographic data of the subject parcel is based on an on-ground field survey. Existing elevations within property line of the site range from 255-feet to 261-feet per the North American Vertical Datum of 1988 (NAVD88). Offsite topographic data relied on 2-foot light-detecting and ranging (LiDAR) generated contours from the Sacramento County Open Data website based on the North American Vertical Datum of 1988 (NAVD88). All elevations within this report reference NAVD88.
- c. **Offsite Drainage:** The general direction of runoff flows in a northerly direction towards a creek to the north of Madison Avenue.
- d. **Onsite Drainage**

The project site drains in a northerly direction towards an existing inlet located near the northeast corner of the existing parcel. The inlet is connected to a 10-inch drain line that continues north.

- e. **Hydrologic Modeling Assumptions**

Sacramento County Hydrologic Calculator version 1.1.0.25 (SacCalc) was used to complete the hydrological analysis of existing watersheds affecting the project site. The Sacramento Method was used to analyze the 100-year, 24-hour design storm. As shown on the Existing Watershed Map (**Exhibit B**), four separate watersheds were delineated, which include the project site as well as any upstream area potentially flowing to or adjacent to the project site.

Soil data was obtained from the United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) Web Soil Survey website. Xerarents-Urban land-San Joaquin complex, 0 to 5 percents slopes was identified within the database. The identified soil is not set within the database, however, is interpreted with a hydrologic soil group of 'C', which denotes a high runoff classification. See **Exhibit C** for Soil Map.

Impervious areas of the project site were delineated per the field survey and impervious areas of the adjacent watersheds were assumed based on existing land usage as shown on **Exhibit D**.

The basin ‘n’ method was used for the lag transformation of each watershed. Input parameters, such as the longest water course, distance to centroid and impervious percentage can be seen on **Table 1** below. For conservative results, and aligned with SCDWR standards, 90% of the longest watercourse was input into the model. Impervious areas and land usage can be seen on **Table 2** below. Peak runoff can be seen on **Table 3**.

See the attached electronic file of SacCalc model denoted “**Existing Hydrology Model**” for reference.

Table 1 – Existing Watershed Parameters

Watershed Name	Watershed Area (acres)	Mean Elev. (ft)	Lag Method	Longest Water Course (ft)	90% of Longest Water Course (ft)	Longest Water Course to Centroid (ft)	U/S Elev.	D/S Elev.	Slope (ft/ft)
WS001	0.83	264	Basin n	342	308	162	268	260	0.0234
WS002	0.79	264	Basin n	230	207	82	268	260	0.0348
WS003	0.96	260	Basin n	260	234	112	264	258	0.0231
WS004	0.78	258	Basin n	169	152	86	260	258	0.0118

Table 2 – Existing Impervious Areas and Land Use

Watershed Name	Roadways	RD-5	RD-1
	(95% Imp.)	(40% Imp.)	(15% Imp.)
WS001	0.22	0.61	-
WS002	0.00	0.78	-
WS003	0.22	0.74	-
WS004	0.00	0.00	0.78

Table 3 – Existing 100-Year, 24-hour Peak Watershed Runoff

Watershed Name	Peak Flowrate
	(cfs)
WS001	3.10
WS002	2.90
WS003	3.50
WS004	2.60
JNC001 (WS001, WS002, WS003, & WS004)	12

f. Hydraulic Modeling Assumptions

Hydraflow Express Extension for Autodesk Civil 3D was used to calculate the 100-year water surface elevation along the northerly property line of the project site. Although an existing fence is present along said property line, the fence was ignored from all hydraulic calculations.

The peak flowrate of the junction between all four modeled watersheds (WS001, WS002, WS003, & WS004) was routed through a cross-section of the northerly property line based on field surveyed elevations. As shown on **Exhibit E**, a water surface elevation (WSEL) of approximately 255.27-feet was computed, which partially inundates the project site.

g. Profiles

No water surface profiles were created or referenced for the existing condition.

h. Floodplain Extents

The Federal Emergency Management Agency's (FEMA) Flood Insurance Study (FIS) Flood Insurance Rate Map (FIRM) encompassing the project site was observed to analyze the existing 100-year floodplain. The project site is within the FIRM 06067C0112H, dated August 16, 2012. The project site is located within Zone X, or an unaffected area of the 100-year floodplain. (**Exhibit F**)

3. Mitigated Project (Proposed Condition):

a. Proposed Land Use

As previously stated, the proposed land-use of the subject property shall be for single-family residential units within each of the four proposed lots. The existing dwelling units within the farthest westerly lot shall remain.

b. Grading Plan

See **Exhibit G** for the Preliminary Grading and Drainage Plan of the project site.

c. Offsite Channel Drainage Improvements: No channel improvements are proposed with the project.

d. Onsite Improvements

As shown on **Exhibit G**, lots shall be graded to promote positive drainage to the private drive aisle to the north of the project site. Stormwater will be collected within a inlet and

connect to the existing inlet near the northeast corner of the project site through an underground drain line. Due to potential impacts to downstream adjacent development, underground detention facilities are proposed for the project site to be placed within the proposed drive aisle.

e. Hydrologic Model Assumptions:

The hydrologic model from the baseline section of this report was modified to incorporate the proposed development. Off-site watersheds remained the same as the existing model. Watershed WS004 was modified to incorporate the grading plan and impervious areas as shown on **Exhibit H**. Modified parameters of watershed WS004 can be seen on **Table 4** below. Computed peak flowrates can be seen on **Table 5** below.

Table 4 – Proposed Watershed Parameters

Watershed Name	Watershed Area (acres)	Mean Elev. (ft)	Lag Method	Longest Water Course (ft)	90% of Longest Water Course (ft)	Longest Water Course to Centroid (ft)	U/S Elev.	D/S Elev.	Slope (ft/ft)	Impervious %
WS004	0.78	258	Basin n	313	282	133	258.5	255	0.0112	47%

Table 5 – Proposed 100-Year, 24-hour Peak Watershed Runoff

Watershed Name	Peak Flowrate
	(cfs)
WS001	3.10
WS002	2.90
WS003	3.50
WS004	2.90
JNC001 (WS001, WS002, WS003, & WS004)	12

See the attached SacCalc electronic file denoted “**Proposed Hydrology Model**” within **Appendix A** for reference.

f. Hydraulic Model Assumptions

Hydraflow Express Extension for Autodesk Civil 3D was used to calculate the 100-year water surface elevation along the northerly property line of the project site with proposed grading.

The peak flowrate of the junction between all four modeled watersheds (WS001, WS002, WS003, & WS004) was routed through a cross-section of the northerly property line. As shown on **Exhibit I**, a water surface elevation (WSEL) of approximately 255.24-feet was computed, which partially inundates the project site.

g. Mitigation

Although peak runoff from the proposed hydrology model does not increase from the existing model, due to the overland release of the project site along the northerly property line, which abuts existing development, we believe mitigation should be implemented in order to ensure no impacts to the adjacent lots.

The volumetric difference between existing and proposed hydrographs of the project site was computed and shall be stored in underground detention pipes to detain excess stormwater generated from the project site. The storm water shall be release from the project site with a weir and orifice structure. The weir shall be elevated to utilize the entire volume within the pipes. The orifice shall be sized to discharge the flow to the Nolte Flowrate of the project site, which shall be completed in a subsequent submittal. As shown on **Figure 1**, the volume between the existing and proposed hydrographs was computed to 2,321 cubic-feet, which shall be stored in 330 lineal feet of 36-inch storm drain pipe or equivalent.

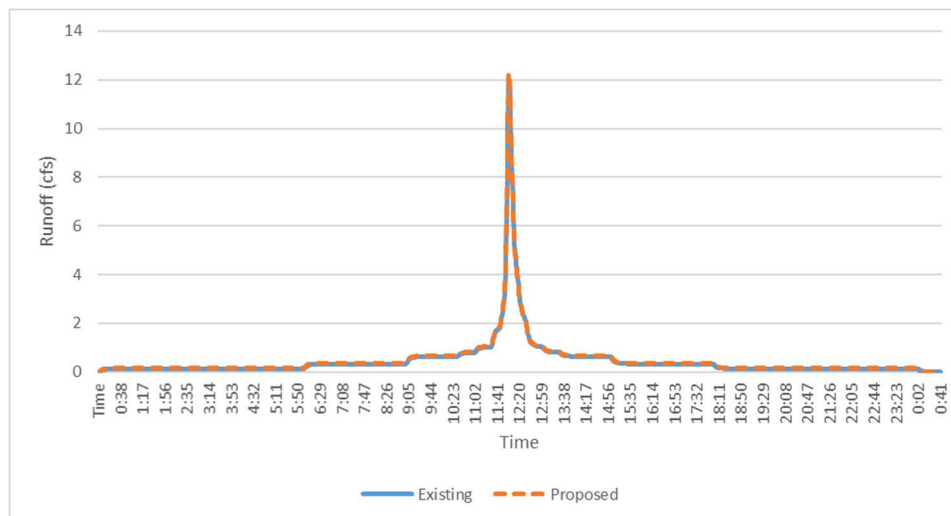


Figure 1 – Existing and Proposed Hydrographs of JNC001

h. Storm Drainage

As previously stated, the proposed project site storm drain system shall connect to a proposed drain inlet within the private road, which shall connect to the existing drain inlet near the project site property line, which drains through a 10-inch storm drain line to the existing system to the north, ultimately discharging through a channel to the north of Madison Ave.

Due to limited facility data, the analysis was extended downstream to the nearest manhole within the public roadway and assuming a subcritical flow condition, the tail-water surface elevation was assumed 1-foot below the top of the manhole lid.

Per SCDWR standards, the public storm drain system is designed to convey the Nolte storm event. SacCalc was used to complete a hydrologic model of the watershed map as seen on **Exhibit I**. Impervious areas were delineated based on the proposed site design as well land-usage.

Hydraulic analysis of pipe network can also be seen on **Exhibit J**. The analysis was completed in order to ensure standard freeboard from drainage facility structures. Per SCDWR standards, drain inlets and manholes shall have a minimum of 0.5-feet and 1-foot, respectively, of freeboard from the top of the structure.

Based on the hydrologic and hydraulic analysis, the pipe network shall be adequately sized for the proposed development.

i. Stormwater Quality

The Stormwater Quality Design Manual for the Sacramento Region (SQDMSR) was used as a reference for all storm water quality design measures. The proposed single-family residential project is approximately 0.78-acres. Per Table 3-2 of the SQDMSR, single-family residential projects less than one acre are not required to provide low impact development, hydro-modification, or treatment control. The density of dwelling units per acre is approximately 5 dwelling units per acre, thus full trash capture control is not required for the project site. Source control measures shall be determined prior to issuance of construction permits.

4. Summary of Findings:

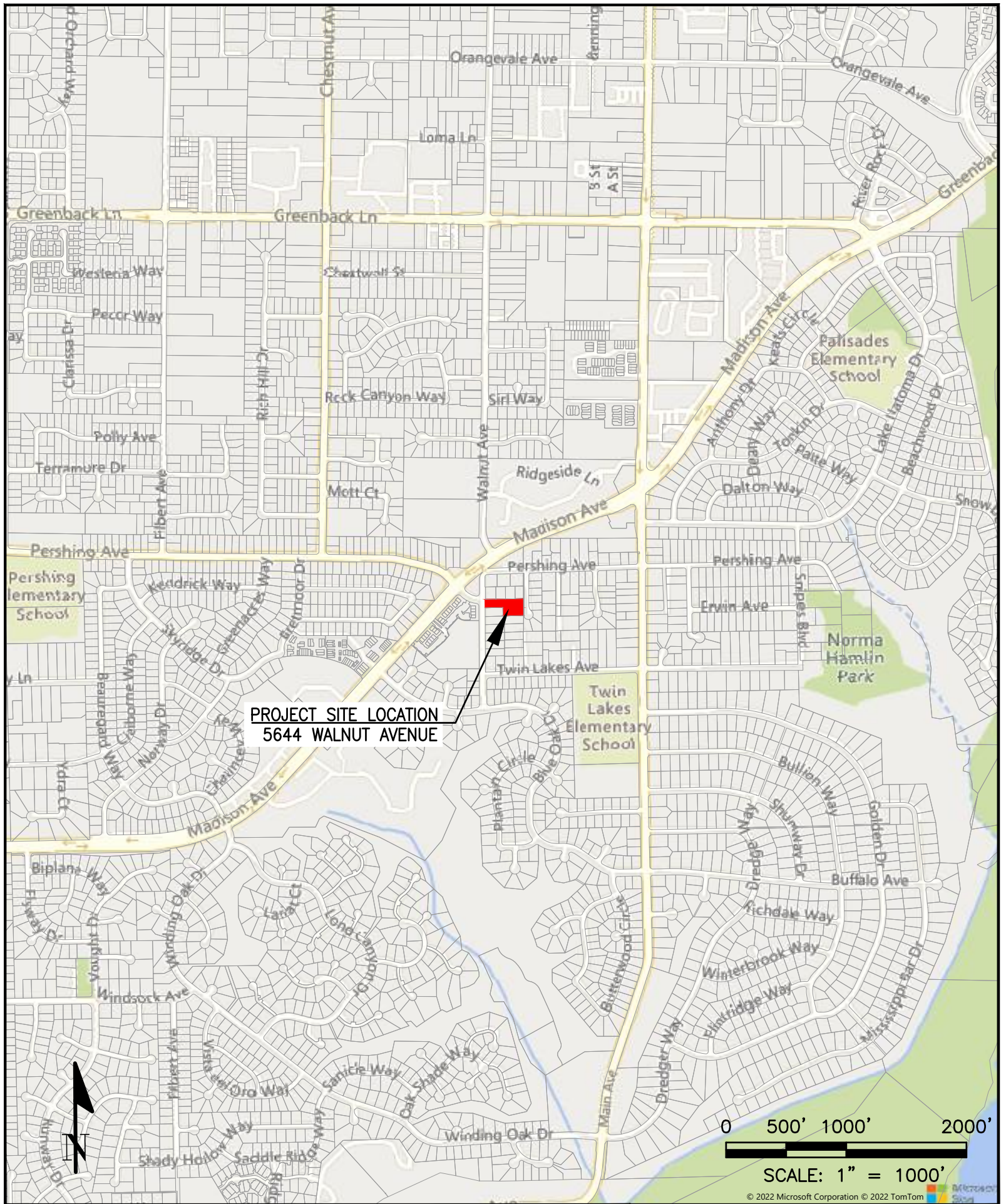
Based on the existing and proposed hydrology models presented within this report, the runoff discharge point of the project site, along the northerly property line yields equivalent peak flows in both analyzed conditions for the 100-year, 24-hour storm event.

Hydraulic computations indicate that proposed grading will lower the water surface elevation at the discharge point by approximately 0.03-feet.

Due to close proximity to the adjacent development, underground detention pipes are proposed within the project site private drive aisle. Weir and orifice design shall be analyzed within the design-level drainage study submittal of the project.

5. Conclusion:

This document is intended to serve as preliminary drainage study for the tentative parcel map at 5644 Walnut Avenue. A design-level drainage study shall be submitted and approved by SCDWR prior to issuance of construction permits for the project. Based on the findings within this study, we believe that the proposed project will not adversely impact adjacent development and adhere to the applicable standards outlined within this report.



PROJECT SITE LOCATION
5644 WALNUT AVENUE

EXHIBIT A
VICINITY MAP
WALNUT AVE. TPM

JTS ENGINEERING
CONSULTANTS, INC.
 1808 J STREET SACRAMENTO, CA 95811





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EXHIBIT B
EXISTING WATERSHED MAP

WALNUT AVE. TPM
ORANGEVALE, CA

MARCH 2023

LEGEND

-  **WATERSHED BOUNDARY**
-  **LONGEST WATER LINE**
-  **CENTROID**
-  **LONGEST WATER LINE TO CENTROID**

NOTES

1. ELEVATIONS REFERENCE NAVD88

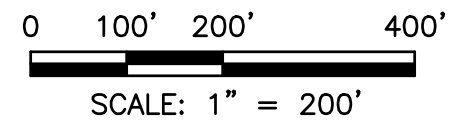


EXHIBIT C
EXISTING SOIL MAP









WALNUT AVE. TPM
ORANGEVALE, CA

MARCH 2023

LEGEND

-  Project Site
-  Watershed Boundary

Soil Data

-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
- 

Bing Virtual Earth

NOTES

1. SOIL DATA OBTAINED FROM USDA NRCS WEBSITE (<https://websoilsurvey.sc.egov.usda.gov>)
2. HYDROLOGIC SOIL GROUP OF PROJECT WATERSHEDS NOT CLASSIFIED WITHIN DATABASE, HOWEVER, IS INTERPRETED AS GROUP 'C'.

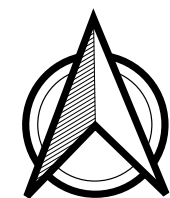






EXHIBIT D
EXISTING LAND-USE MAP

WALNUT AVE. TPM
ORANGEVALE, CA

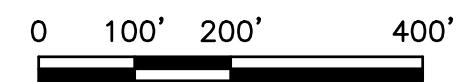
MARCH 2023

LEGEND

-  ROADWAYS (95% IMP)
-  RD-5 (40% IMP)
-  PROJECT SITE (15% IMP)
-  WATERSHED BOUNDARY

NOTES

1. PARCELS AND STREET RIGHT-OF-WAYS
DATA DOWNLOADED FROM SACRAMENTO
COUNTY OPEN DATA, SEPTEMBER 2022.



SCALE: 1" = 200'

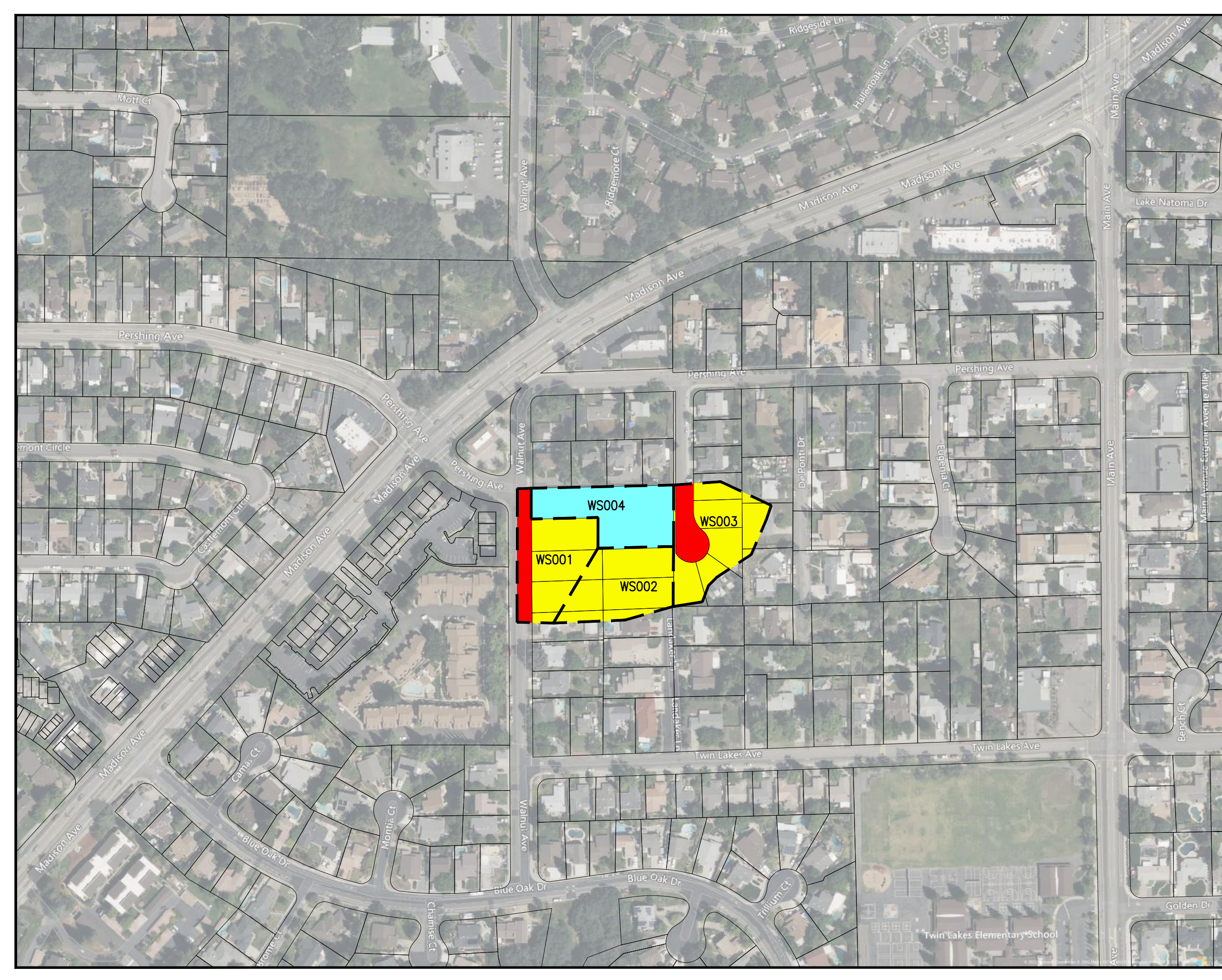


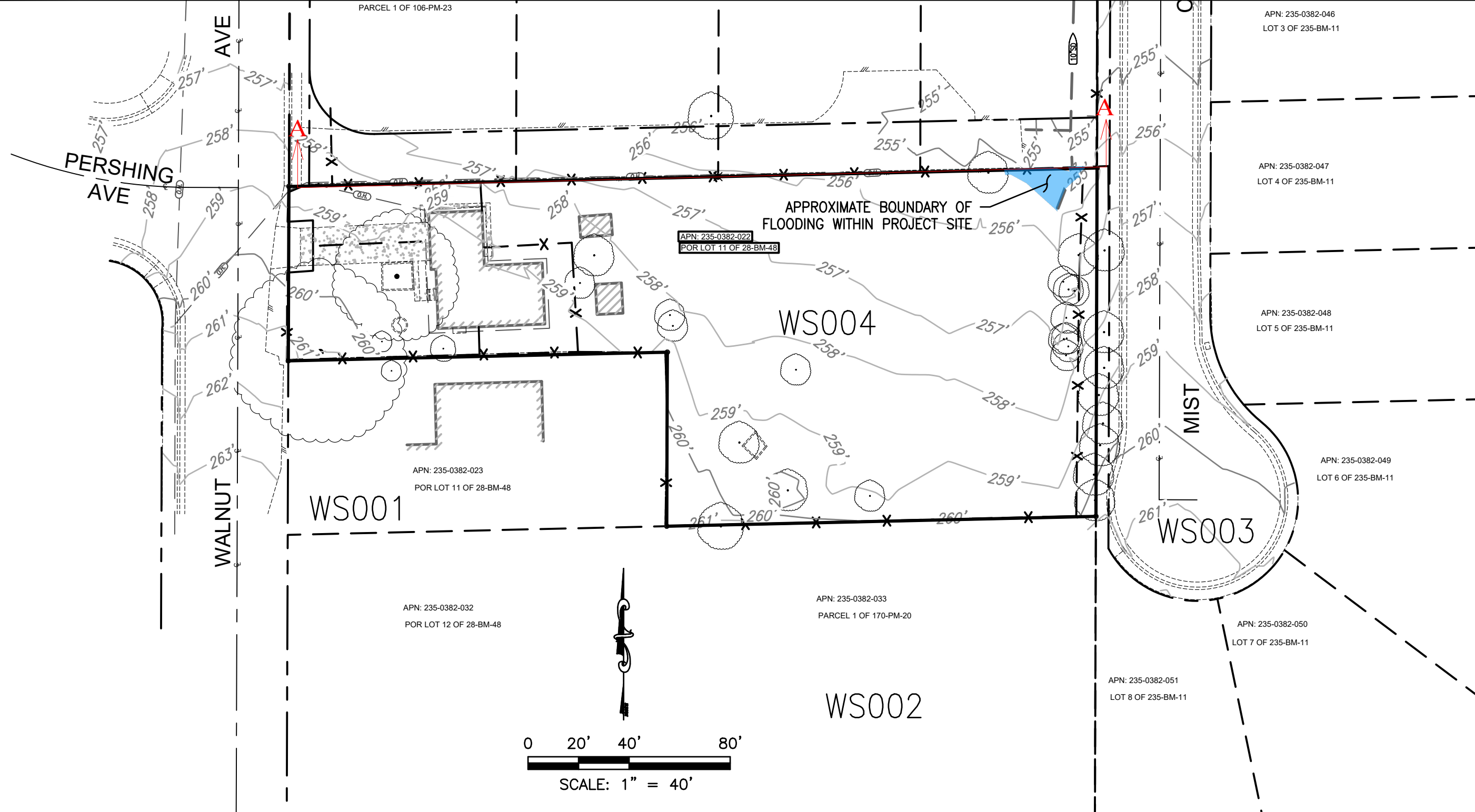
EXHIBIT E
EXISTING HYDRAULIC ROUTING MAP

WALNUT AVE. TPM
ORANGEVALE, CA

MARCH 2023

NOTES

1. ELEVATIONS REFERENCE NAVD88
2. SEE EXHIBIT B FOR OFF-SITE CONTRIBUTING WATERSHEDS



Channel Report CROSS-SECTION A-A

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 27 2023

Existing Project Site Overland Release

User-defined		Highlighted	
Invert Elev (ft)	= 255.00	Depth (ft)	= 0.27
Slope (%)	= 5.00	Q (cfs)	= 12.00
N-Value	= 0.032	Area (sqft)	= 5.84
		Velocity (ft/s)	= 2.05
Calculations		Wetted Perim (ft)	= 61.51
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.29
Known Q (cfs)	= 12.00	Top Width (ft)	= 61.50
		EGL (ft)	= 0.34

(Sta, El, n)-(Sta, El, n)...
(0.00, 258.66)-(25.00, 257.98, 0.016)-(49.00, 257.54, 0.016)-(73.00, 256.71, 0.016)-(122.00, 256.22, 0.016)-(145.00, 256.22, 0.016)-(165.00, 256.10, 0.016)
(189.00, 255.83, 0.016)-(200.00, 255.70, 0.016)-(215.00, 255.56, 0.016)-(234.00, 255.18, 0.016)-(273.00, 255.18, 0.016)-(279.00, 255.00, 0.060)-(285.00, 255.23, 0.060)
(297.00, 255.31, 0.060)-(308.00, 255.56, 0.060)-(312.00, 256.75, 0.060)

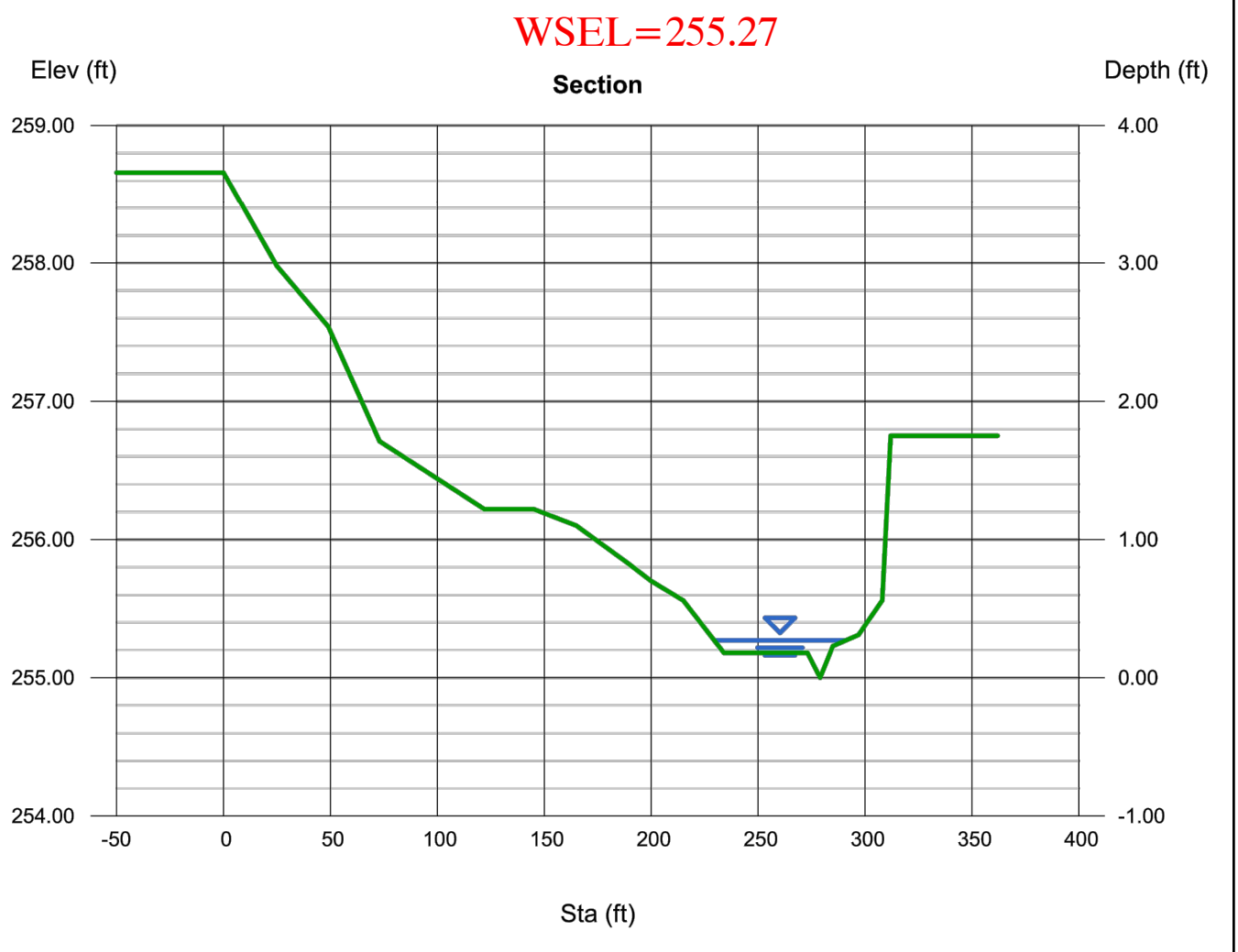


EXHIBIT F
FEMA FLOOD MAP

WALNUT AVE. TPM
ORANGEVALE, CA

MARCH 2023

LEGEND

-  Project Site
-  Watershed Boundary

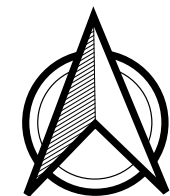
FEMA Flood Zone

-  A
-  A99
-  AE
-  AH
-  AO
-  X
- 

Bing Virtual Earth

NOTES

1. FLOOD DATA OBTAINED FROM FEMA FLOOD MAP SERVICE CENTER
2. PROJECT SITE LOCATED WITHIN FEMA FIRM 06067C0112H, DATED AUGUST 16, 2012.







0 250 500 ft


EXHIBIT H
PROPOSED WATERSHED MAP

WALNUT AVE. TPM
 ORANGEVALE, CA

MARCH 2023

LEGEND

-  WATERSHED BOUNDARY
-  LONGEST WATER LINE
-  CENTROID
-  LONGEST WATER LINE TO CENTROID

NOTES

1. ELEVATIONS REFERENCE NAVD88

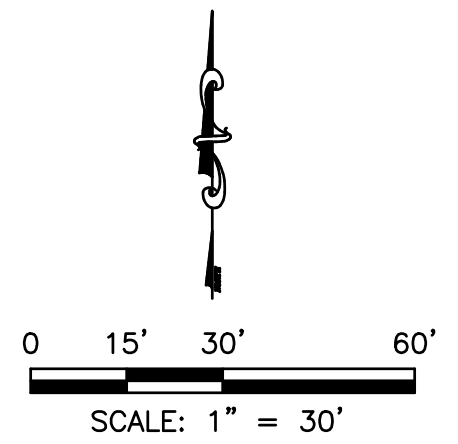
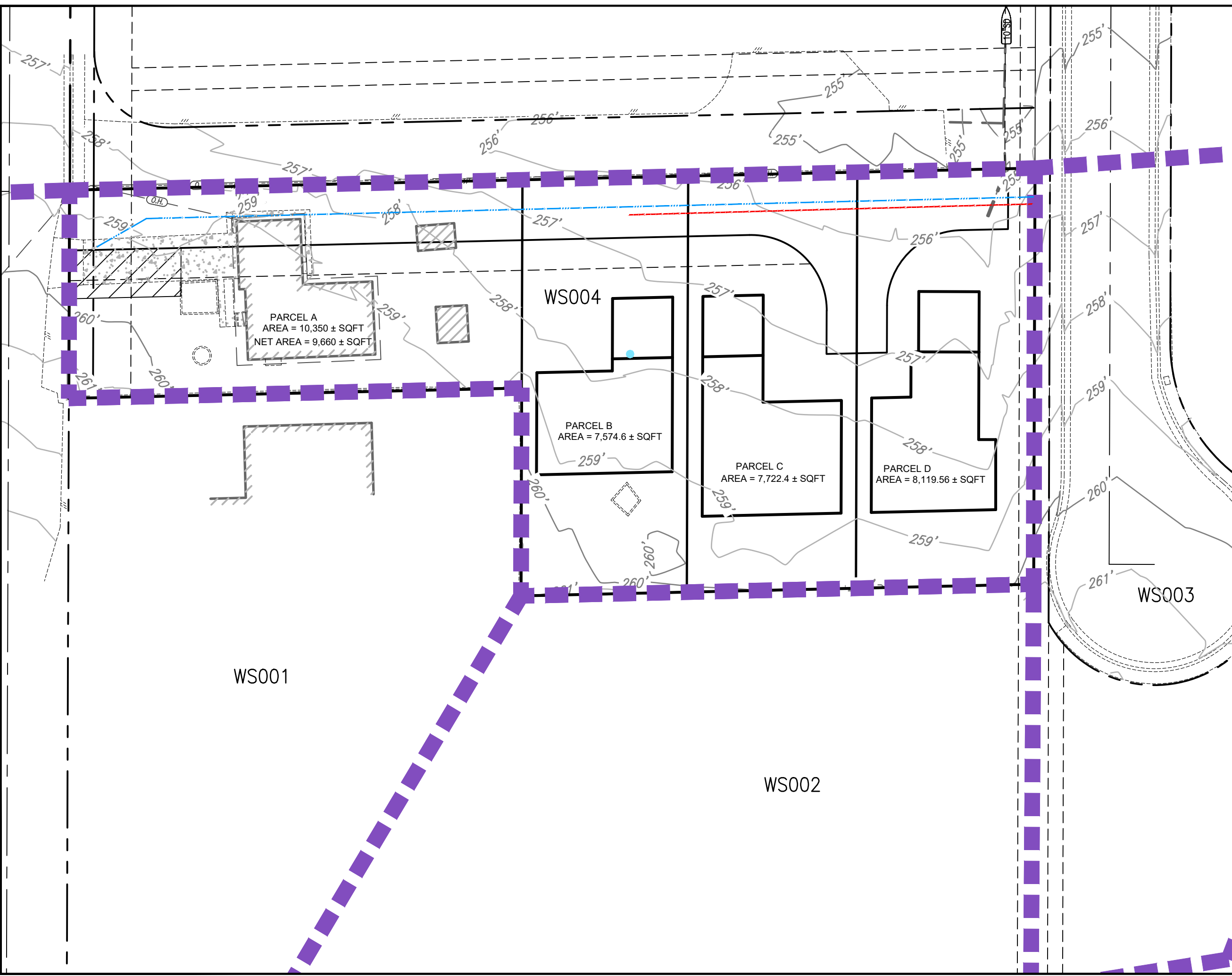
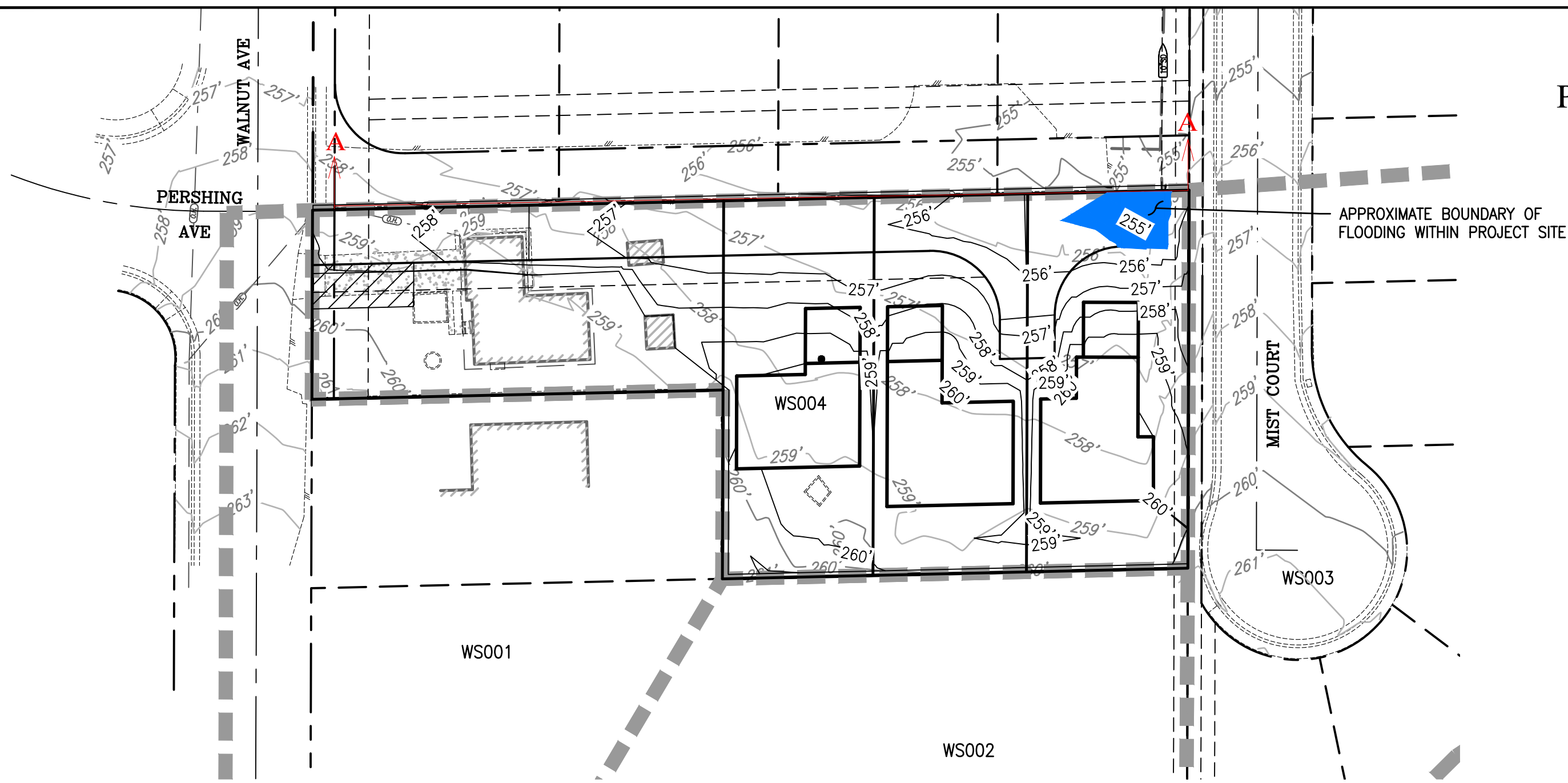


EXHIBIT I PROPOSED HYDRAULIC ROUTING MAP

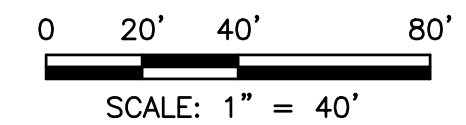
WALNUT AVE. TPM
ORANGEVALE, CA

MARCH 2023



NOTES

1. ELEVATIONS REFERENCE NAVD88
2. SEE EXHIBIT B FOR OFF-SITE CONTRIBUTING WATERSHEDS



Channel Report CROSS-SECTION A-A

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Mar 27 2023

Existing Project Site Overland Release

User-defined		Highlighted	
Invert Elev (ft)	= 255.00	Depth (ft)	= 0.24
Slope (%)	= 5.00	Q (cfs)	= 12.00
N-Value	= 0.021	Area (sqft)	= 3.06
		Velocity (ft/s)	= 3.92
Calculations		Wetted Perim (ft)	= 24.50
Compute by:	Known Q	Crit Depth, Yc (ft)	= 0.32
Known Q (cfs)	= 12.00	Top Width (ft)	= 24.49
		EGL (ft)	= 0.48

(Sta, El, n)-(Sta, El, n)...
(0.00, 258.66)-(71.00, 257.50, 0.016)-(142.00, 256.50, 0.016)-(197.00, 256.23, 0.016)-(252.00, 255.59, 0.016)-(287.00, 255.16, 0.016)-(303.00, 255.00, 0.016)
(-317.00, 256.70, 0.060)

WSEL=255.24

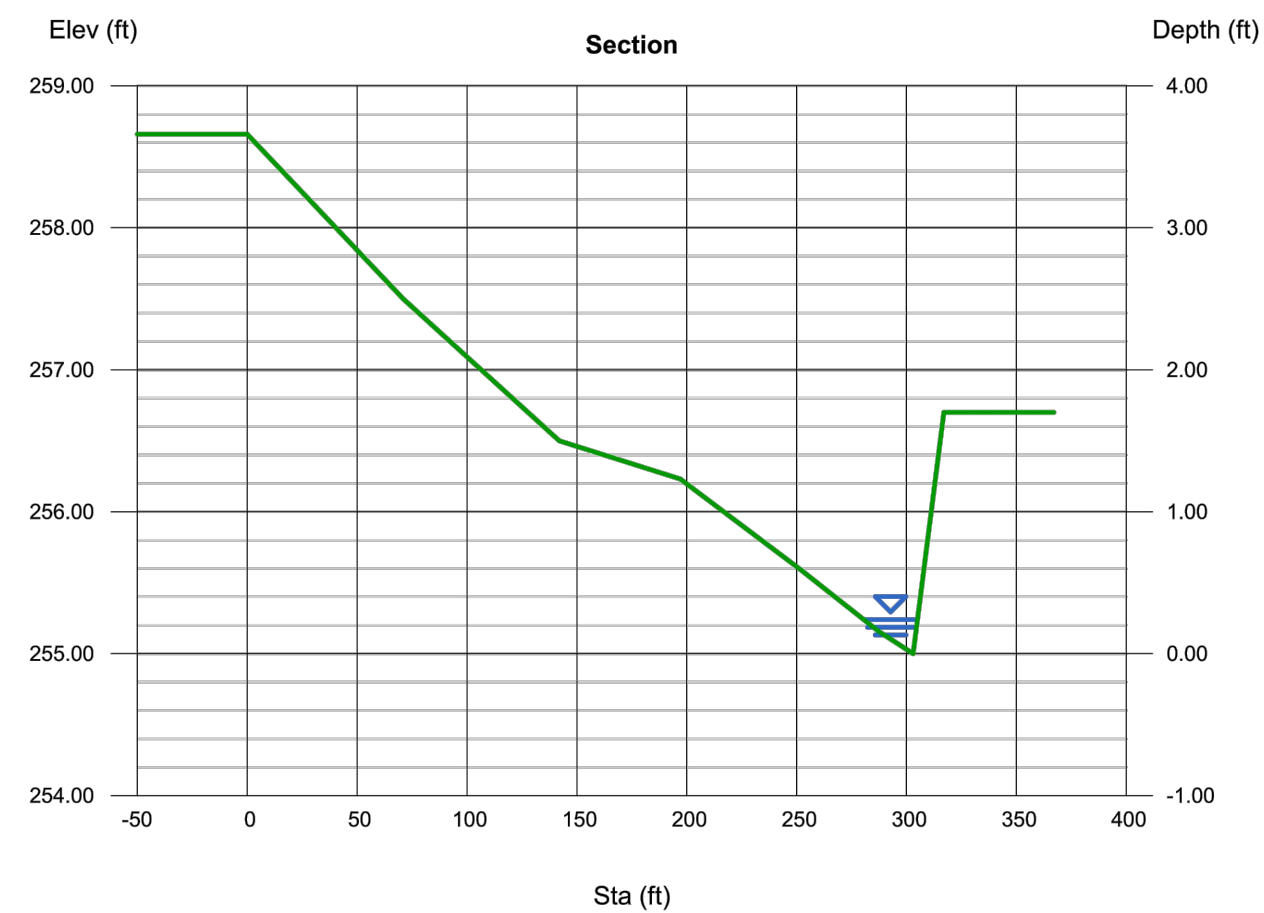


EXHIBIT J NOLTE SHED MAP

WALNUT AVE. TPM
ORANGEVALE, CA

MARCH 2023

ID	Drainage area (acres)	Impervious area (%)	Design Q (cfs)
WS00A3	0.53	50	0.15
WS00A1	2.14	50	0.6
WS00A2	1.02	50	0.29
JNC001	3.16	50	0.88
JNC002	3.69	50	1.03

Node	Design Flowrate Q _{node} (cfs)	Rim/Grate Elev. (ft)	Invert Elev. (ft)	Pipe Size (in)	Pipe Length (ft)	Pipe Slope (ft/ft)	Pipe Manning's n	Pipe Design Q (cfs)	Headloss _s (ft)	Friction Slope _s (ft/ft)	HGL (ft)	Freeboard (ft)
Pr. DI	0.60	254.83	251.70								252.01	2.82
				10	10	0.003	0.015	1.04	0.0100	0.000998422		
366-224-468	0.88	254.07	251.67	10	183	0.021	0.015	2.74	0.3930	0.002147717	252.00	2.07
366-224-458	1.03	249.22	247.87	10	27	0.034	0.015	3.49	0.0794	0.002942295	248.36	0.86
366-227-M59	-	249.28	246.96								248.28	1.00

CALCULATION NOTES

- EXISTING INVERT ELEVATIONS OBTAINED FROM AVAILABLE FIELD DATA. RECORD DRAWINGS WERE USED AS SECONDARY REFERENCE.
- HYDROLOGY WAS COMPUTED PER SAC-CALC MODEL WITHIN THIS REPORT.
- HYDRAULIC GRADE LINE COMPUTED AS HEADLOSS ADDED TO HGL AT THE DOWNSTREAM NODE. IF HGL BELOW INVERT ELEVATION OF PIPE, OPEN CHANNEL CALCULATIONS WERE PERFORMED FOR THE DEPTH OF FLOW.
- ELEVATIONS REFERENCE NAVD88.

