Floodplain

The purpose of the Floodplain Study was to determine the precise location of the Vasa Creek floodplain. Updating floodplain maps is important because it provides property owners, lenders, and insurance companies information on flood risk.

The following information applies only to residents who live in the following areas whose properties are located within a regulated floodplain:

- Lower Vasa Creek – Downstream of 163rd Avenue SE to Lake Sammamish, see Attachment A.
- Upper Vasa Creek – 1000 feet upstream of SE 37th Street to the outlet culvert downstream of 152nd Avenue SE (Eastgate Elementary School) and along the East Branch of Vasa Creek from its confluence with the main stem to SE Newport Way. See Attachment B.

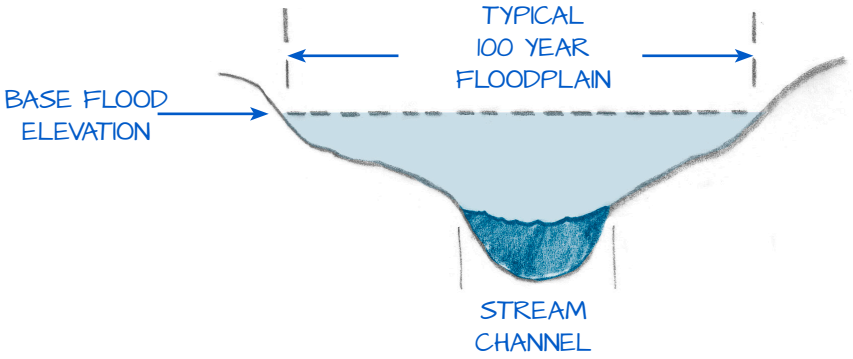
The existing floodplain is based on 1978 FEMA-developed Flood Insurance Maps that only approximated the floodplain. These floodplain maps depict some parts of the floodplain extending to areas far beyond the stream banks where it is actually contained. Attachments A and B show the areas proposed to be added and/or removed from the existing floodplain maps. The areas being added are all contained within the current stream channel.

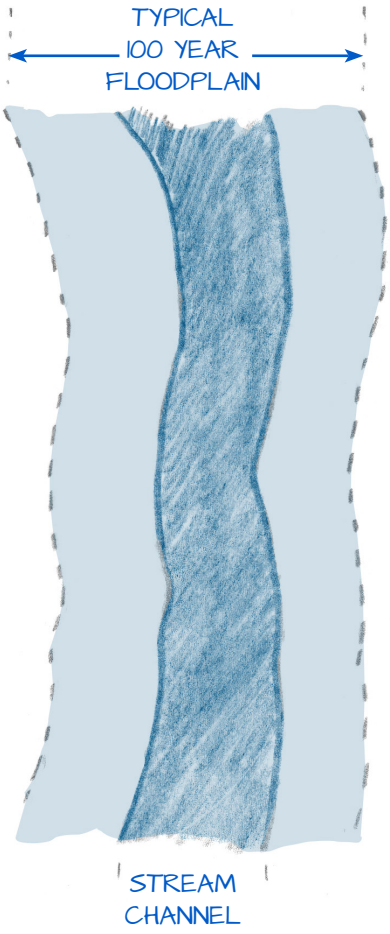
Key Findings

- The hydraulic analysis confirmed that no buildings are located in the floodplain in either upper or lower Vasa Creek.
- The floodplain in both lower and upper Vasa Creek is contained within the stream banks.
- The engineering analysis showed that a high flow bypass pipe diverts approximately 90% of the flows from the 100-year flood from upper Vasa Creek directly to Lake Sammamish. The high flow bypass restricts the flows to lower Vasa Creek to protect the downstream properties. (A high flow bypass is a pipe line that diverts water when it reaches a certain level, like the overflow drain on your bathtub.)
- In upper Vasa Creek the flows are contained within the existing stream banks.

The results of the analysis show the updated 100-year floodplain of lower Vasa Creek (Attachment A) and upper Vasa Creek (Attachment B). Within the 100-year floodplain, also known as the base flood elevation, there is a 1-in-100 chance that a flood that size might happen during any year. This concept is illustrated on the next page.

Floodplain


TYPICAL
100 YEAR
FLOODPLAIN
BASE FLOOD
ELEVATION
STREAM
CHANNEL


TYPICAL
100 YEAR
FLOODPLAIN
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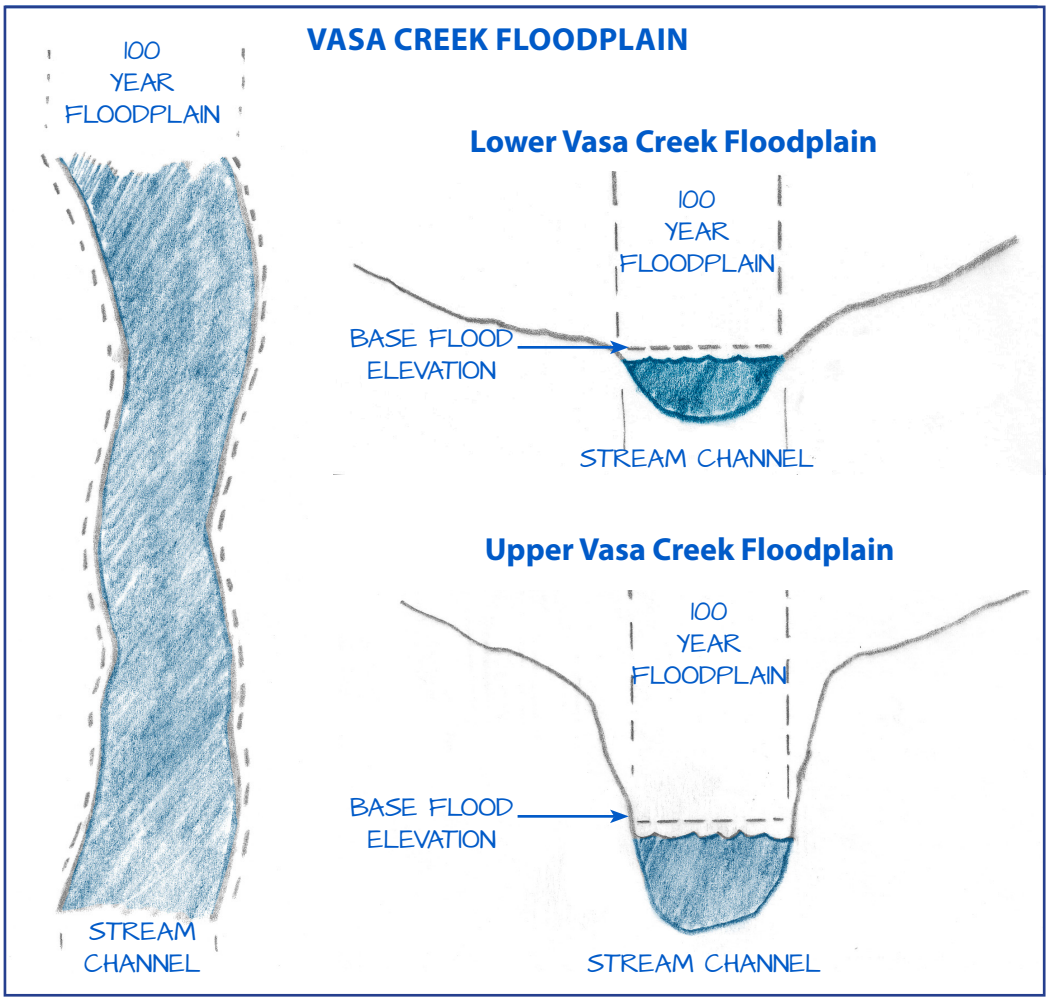

VASA CREEK FLOODPLAIN
100
YEAR
FLOODPLAIN
STREAM
CHANNEL
Lower Vasa Creek Floodplain
100
YEAR
FLOODPLAIN
BASE FLOOD
ELEVATION
STREAM CHANNEL
Upper Vasa Creek Floodplain
100
YEAR
FLOODPLAIN
BASE FLOOD
ELEVATION
STREAM CHANNEL

Floodplain

What will Bellevue Utilities do with this information?

- The city has asked the Federal Emergency Management Agency (FEMA) to remove the current floodplain designation for Vasa Creek as the 100-year flows remain within the stream channel banks. If FEMA removes the current floodplain designation, property owners would not be required to purchase flood insurance if they have a mortgage from a federally regulated, supervised, or insured financial institution. However, if property owners want to purchase flood insurance it would be at the same low rate due to our overall community rating with FEMA.
- If FEMA removes the current floodplain designation, the city will use the updated floodplain map to administer Bellevue's floodplain regulations. Accurate mapping of the floodplain is important because Bellevue's floodplain regulations prevent construction in floodplains.
- If FEMA does not remove the floodplain designation, the city will pursue a formal letter of Map Revision (LOMR) from FEMA, to accurately portray the floodplain area within the stream banks.

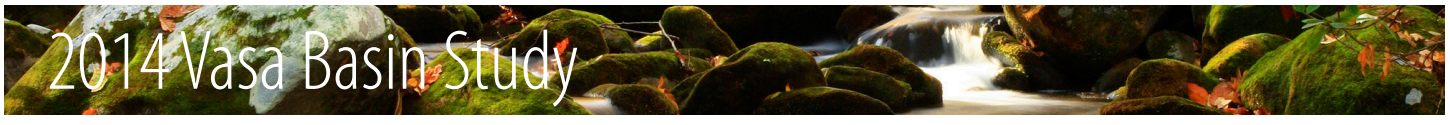
For Additional Information

Website with hydrologic technical memo http://bellevuewa.gov/pdf/Utilities/Vasa_Creek_Hydrologic_Modeling_and_Analysis.pdf

Website with hydraulic technical memo http://bellevuewa.gov/pdf/Utilities/Vasa_Creek_Hydraulic_Modeling_and_Mapping.pdf

Critical areas link Critical Areas (http://bellevuewa.gov/critical-areas.htm)

Questions? Rick Watson 425-452-4896



Memorandum

To: Rick Watson, City of Bellevue

From: Chris Frei and Larry Karpack, Watershed Science & Engineering

Date: October 29, 2014

Re: Vasa Creek Hydraulic Modeling and Analysis

1.0 INTRODUCTION

Watershed Science & Engineering (WSE) was retained by the City of Bellevue (City) to construct a hydraulic model of Vasa Creek and apply the model to simulate the current 2-, 10-, 25-, 50-, 100-, and 500-year flood events. Model results were used to produce the data needed to update existing FEMA floodplain mapping of Vasa Creek.

The project area includes two separate reaches of Vasa Creek - the "upper reach" extending from the WSDOT sediment pond south of Interstate 90 to 152nd Ave SE, and the "lower reach" extending from Lake Sammamish to a point about 500 feet upstream of 163rd Ave SE (see Figure 1). This project will include preparation of applications for Letters of Map Revision (LOMRs) to update existing FEMA Flood Insurance Rate Maps (FIRMs) for both the upper and lower reaches.

2.0 HYDRAULIC MODELING AND ANALYSIS

WSE developed and applied steady state HEC-RAS computer models of the upper and lower reaches of Vasa Creek. Model development included the following steps:

1. Developing model cross section layout and geometry data within ArcGIS 10.1 using HEC-GeoRAS.
2. Incorporating in-channel survey data, where available, to cross sections within the lower reach.
3. Incorporating bridge, culvert, and roadway data.
4. Refining the model by updating model bank stations, ineffective flow areas, and Manning's 'n' roughness values.
5. Applying peak flow hydrology determined through WSE's hydrologic (HSPF) modeling (WSE, 2014) in order to determine peak flood elevations.

2.1 MODEL DEVELOPMENT

The City provided WSE with topographic data for use in model development including 2-foot contour mapping of the basin (MapCon 2007) and stream channel survey of the lower reach. Channel survey of the lower reach was collected by the City in 2014 and includes channel thalweg elevations spaced every 25 feet, channel cross sections spaced every 100 feet, and survey of water crossing structures and road profiles (see Figure 2). WSE visited each water crossing structure to observe hydraulic conditions and collect additional measurements during site visits on December 17, 2013 and April 29, 2014. WSE used the 2-foot contour mapping to create a Triangulated Irregular Network (TIN) surface Digital Elevation Model (DEM) for use in GIS based model development, water surface projection, and mapping, as described below.

2.1.1 Model Cross Section Layout

Initial HEC-RAS cross sections were created using ArcGIS 10.1 and HEC-GeoRAS. Model cross sections were spaced at 100 foot intervals throughout the lower reach, corresponding to the location of in-channel surveys (Figure 2). Model cross sections in the upper reach were spaced at approximately 200 foot intervals (Figure 3). Cross section elevation data for both reaches were extracted from the DEM using HEC-GeoRAS.

In-channel survey elevations were then incorporated within the lower reach. No survey data was available from West Lake Sammamish Parkway to a location approximately 400 feet upstream. Representation of the low flow channel in that reach was based on average channel dimensions surveyed at nearby cross sections.

Bridges and culvert crossings were then input into the model based on structure survey provided by the City and field measurements collected by WSE.

2.1.3 Model Calibration

Historical high water marks and corresponding flows were not available to calibrate the model. WSE set Manning's 'n' values and ineffective flow limits in the model based on site observations and engineering judgment. Typical 'n' values used in the model ranged from 0.04 to 0.055 in-channel, and from 0.06 to 0.075 in overbank areas.

2.1.4 Flow Data

New peak flows were determined for this analysis based on HSPF hydrologic modeling of the Vasa Creek basin (WSE, 2014). Peak flows are shown in Table 1, along with flow values from the effective Flood Insurance Study (FEMA 2013). Flow entering the lower reach of Vasa Creek is controlled by a flow splitter that routes the majority of flow away from the creek and into a high flow bypass pipe. Additional detail on peak flow determination for this analysis can be found in the corresponding hydrologic technical memorandum (WSE, 2014).

As seen in Table 1, the peak flows developed by WSE for the lower reach of Vasa Creek are significantly lower than the peak flows reported in the effective FIS. Supporting documentation describing the methods used to develop the FIS hydrologic data is not available. It is also not clear if any detailed hydrologic analysis was done or if the reported values are simply coarse estimates. Regardless, the current hydrologic analysis by WSE noted that there is a hydraulic structure (flow splitter) a short distance upstream of 163rd Avenue SE and that the splitter controls discharges in Vasa Creek to less than 15 cfs in all conditions up to and including the 100-year event. The bulk of the flow that reaches the flow splitter is diverted into a high flow bypass pipe which runs along SE 35th Place. This bypass pipe carries high flows from Vasa Creek directly to Lake Sammamish without any opportunity for discharge back to Vasa Creek. The basin area tributary to Vasa Creek downstream of the flow splitter is only 0.29 square miles (184 acres) thus the estimated increase in 100-year peak flow between the splitter and the mouth (34 cfs or 117 cfs per sq mile) appears reasonable given the low density development in this portion of the basin.

Table 1. Peak Flow Discharges for Vasa Creek Hydraulic Analysis

Return Interval (Years)	Annual Instantaneous Peak Discharge (cfs)							
	Upper Reach			Lower Reach				
	LOMR[1]			LOMR[1]			FIS	
	East Branch	West Branch	Main	Splitter	West Lake Sammamish Parkway	Mouth	163rd Ave SE[2]	Mouth[3]
2	13	33	52	5	21	21	N/A	N/A
10	26	63	95	7	32	32	24	55
25	34	82	120	9	38	38	N/A	N/A
50	40	97	140	12	43	43	38	81
100	47	113	161	15	48	49	44	93
500	64	157	217	31	62	63	60	123

[1]LOMR flows based on WSE Hydrologic Analysis (2014)
[2]Flows at "cross section R" (FEMA, 2013), Location is near 163rd PL SE, based on the Effective Workmap
[3]Flows at Lake Sammamish (FEMA, 2013)

2.2 HYDRAULIC ANALYSIS

The HEC-RAS models were configured and run for the six flow quantiles (2-, 10-, 25-, 50-, 100-, 500-year events) shown in Table 1. A fixed downstream boundary condition of 34.5 feet (NAVD88) was specified for the lower reach. This elevation corresponds to the FEMA 10-year flood water surface elevation for Lake Sammamish (FEMA, 2013). A rating curve was specified for the downstream boundary of the upper reach. The rating curve was based on the relationship between water surface elevation and outflow at the WSDOT detention pond determined by the hydrologic analysis (WSE, 2014).

Model simulations were performed using the subcritical flow regime option. Sensitivity of the models to flow regime was tested by running the models in a mixed flow regime, which allows supercritical flow conditions to be simulated. Using the mixed flow option, flow at most cross sections was found to be supercritical; however, the change in water surface elevation relative to the subcritical run was small - typically less than 0.1 ft. The subcritical flow results were selected for mapping because they provide slightly more conservative (higher) water surface elevations in all areas.

2.2.1 MODEL RESULTS

Model results for the 100- and 500-year event on the upper and lower reach are shown in Table 2 and Table 3, respectively. Flood profiles for the 10-, 25-, 50-, 100-, and 500-year event are provided at the end of this memorandum as 01P through 07P – formatted according to FEMA FIS profile guidelines and specifications.

Steep channel slopes throughout Vasa Creek result in high velocities and flow conditions near critical depth. Flooding in the upper reach is typically contained within the channel or the adjacent narrow floodplain terrace. Flooding in the lower reach is completely contained within the channel banks. This is primarily due to limited peak flow inputs, which are controlled by the flow splitter and high flow bypass pipe that divert most of the upstream peak flows out of the creek, as described above.

Model results are consistent with flood observations along Vasa Creek, including residential reports of flooding problems compiled by the City since 1984. Over 30 years, reports included a total of 3 complaints affecting the project reach of Vasa Creek, including observations of bank erosion and flooding near bankfull depth.

Table 2. HEC-RAS Model Results for Vasa Creek Upper Reach

Cross Section		100 Yr Results				500 Year Results			
		Flow	Mean Velocity	Water Surface Elevation	Top Width	Flow	Mean Velocity	Water Surface Elevation	Top Width
Letter	Number	cfs	(ft/s)	(ft*)	(ft)	cfs	(ft/s)	(ft*)	(ft)
A	5446	161	0.2	304.4	209.3	217	0.2	305.6	214.8
B	5657	161	1.1	304.4	71.0	217	1.1	305.6	81.8
C	5859	161	0.6	304.4	97.9	217	0.6	305.6	101.8
D	6061	161	4.8	308.7	50.9	217	5.3	308.8	52.2
E	6251	161	5.7	312.0	19.7	217	6.7	312.2	21.0
F	6449	161	7.3	322.2	14.9	217	8.0	322.6	16.5
G	6650	161	7.3	334.2	14.4	217	7.9	334.6	15.8
H	6884	161	5.4	345.0	33.2	217	6.0	345.2	34.2
I	7115	161	6.8	352.1	17.1	217	7.4	352.4	19.1
J	7295	161	7.4	358.9	13.9	217	8.0	359.3	15.5
K	7474	161	6.4	367.8	24.3	217	6.9	368.1	26.9
L	7599	113	5.9	377.6	18.1	157	6.5	377.8	19.9
M	7713	113	8.6	395.5	5.7	157	9.5	396.1	6.0
N	7854	113	1.2	410.3	53.4	157	0.5	415.5	80.5
O	8031	113	1.7	410.4	52.8	157	0.5	415.5	101.6
P	8150	113	4.9	412.8	31.7	157	1.3	415.5	46.7
Q	8321	113	6.2	419.9	16.0	157	6.9	420.2	17.4
R	8399	113	6.4	426.2	16.5	157	7.0	426.5	19.2
S	8507	113	6.8	437.2	11.7	157	7.5	437.6	13.6
T	8604	113	4.6	445.9	15.9	157	2.3	448.2	45.7
U	8696	113	5.2	448.8	26.3	157	5.8	449.0	28.5
V	8758	113	6.1	452.4	18.2	157	6.7	452.7	19.5
East Branch									
A	88	47	5.2	379.3	10.8	64	5.6	379.5	12.1
B	215	47	4.0	391.3	24.7	64	4.4	391.4	26.5
C	347	47	3.7	401.7	30.4	64	4.1	401.8	32.3
D	486	47	2.7	403.2	17.7	64	3.0	403.4	18.8
E	572	47	4.2	403.8	8.3	64	4.8	404.0	8.8

*All elevations reference the NAVD88 vertical datum

Table 2. HEC-RAS Model Results for Vasa Creek Lower Reach

Cross Section		100 Yr Results				500 Year Results			
		Flow	Mean Velocity	Water Surface Elevation	Top Width	Flow	Mean Velocity	Water Surface Elevation	Top Width
Letter	Number	cfs	(ft/s)	(ft*)	(ft)	cfs	(ft/s)	(ft*)	(ft)
A	66	49	1.4	34.5	25.5	63	1.8	34.5	25.5
B	163	49	4.7	36.8	15.8	63	5.0	37.0	16.8
C	260	49	6.4	40.3	6.0	63	6.9	40.5	6.2
D	281	49	2.9	42.5	8.1	63	3.0	43.0	8.7
E	373	49	5.9	43.1	7.6	63	6.4	43.3	8.0
F	477	49	4.5	45.4	9.6	63	4.9	45.6	10.1
G	560	49	5.8	48.6	7.9	63	6.2	48.8	8.3
H	652	48	4.5	49.2	13.4	62	4.8	49.5	14.6
I	731	48	5.9	51.3	7.6	62	6.3	51.5	8.1
J	800	48	5.9	53.2	7.6	62	6.3	53.5	8.1
K	858	48	5.8	54.9	9.2	62	5.8	55.2	13.2
L	950	48	5.9	57.4	7.6	62	6.3	57.7	8.1
M	1024	48	5.9	59.5	7.6	62	6.3	59.7	8.1
N	1076	48	5.3	60.8	7.8	62	5.8	61.0	8.3
O	1174	48	5.8	63.0	8.7	62	6.1	63.2	11.6
P	1261	48	4.1	65.1	14.6	62	4.5	65.2	15.3
Q	1355	48	6.2	67.1	7.3	62	6.6	67.3	8.2
R	1445	48	5.1	69.2	12.8	62	5.5	69.4	15.3
S	1545	48	5.5	71.0	8.1	62	6.1	71.2	9.1
T	1649	48	4.7	74.9	15.7	62	5.1	75.0	16.8
U	1727	48	5.3	76.9	10.8	62	5.6	77.1	11.3
V	1815	48	5.7	80.2	8.5	62	6.0	80.4	9.3
W	1915	48	6.0	83.2	7.4	62	6.4	83.4	7.9
X	2014	48	5.0	87.3	13.3	62	5.3	87.5	14.0
Y	2108	48	5.0	90.5	12.9	62	5.4	90.7	13.4
Z	2206	48	5.7	96.1	12.7	62	5.8	96.3	17.0
AA	2305	48	4.1	99.4	24.1	62	4.5	99.5	24.4
AB	2413	48	5.0	103.7	13.6	62	5.3	103.8	15.9
AC	2514	48	4.7	108.2	14.5	62	5.1	108.4	15.6
AD	2584	48	4.7	111.2	14.5	62	5.1	111.4	15.5
AE	2640	48	4.4	112.9	10.6	62	4.9	113.1	11.1
AF	2690	15	1.8	113.1	11.0	31	2.5	113.5	12.7
AG	2777	15	4.1	115.9	6.9	31	5.0	116.2	8.1
AH	2814	15	4.3	117.9	6.1	31	5.2	118.3	12.5
AI	2834	15	1.8	119.2	19.9	31	2.6	119.8	28.4
AJ	2870	15	4.2	119.7	7.6	31	4.9	120.1	9.8
AK	2977	15	3.4	123.8	8.0	31	4.3	124.1	9.8
AL	3068	15	4.9	128.1	4.0	31	6.0	128.6	4.6
AM	3128	15	4.3	133.6	10.2	31	5.5	134.0	11.5
AN	3182	15	4.8	136.6	4.4	31	5.7	137.0	8.7
AO	3288	15	4.0	141.1	5.5	31	5.2	141.5	8.8
AP	3382	15	3.7	144.7	8.7	31	4.7	145.0	11.9
AQ	3477	15	4.4	149.1	5.9	31	5.2	149.5	8.1
AR	3582	15	4.4	153.8	4.8	31	5.5	154.2	6.7
AS	3674	15	3.7	158.4	9.5	31	4.5	158.7	11.5

*All elevations reference the NAVD88 vertical datum

2.2.2 FLOODWAY MODELING

The "regulatory floodway" means the channel of the creek and the adjacent land that must be reserved in order to discharge the 100 year flood without increasing the water surface elevation more than a designation height (typically 1-ft). Floodway modeling was not required for Vasa Creek because the 100-year flood is completely contained within the channel banks, and flow is near critical depth. FEMA regulations do not allow encroaching within the channel banks for the floodway, therefore, the floodway was mapped coincident with the 100 year floodplain.

3.0 MAPPING

WSE completed floodplain mapping for the 100 and 500-year events based on hydraulic modeling results. This new mapping will replace current "effective" FEMA mapping of the upper and lower reaches of Vasa Creek that are shown on FIRM panels 53033C0659F and 53033C0680F, respectively. The effective studies of Vasa Creek used "approximate" methods in most locations and therefore are mapped using the approximate "Zone A" designation. Detailed methods were apparently used to map the 250-ft reach between 163rd Ave SE and 164th PL SE, which is mapped as a "Zone AE". WSE acquired the corresponding hydraulic model of this reach; however, a detailed description of model development or analysis was not available. BFEs shown on the effective maps are not reasonable in this location based on a comparison to ground elevations surveyed in 2014.

3.0.1 Floodplain Mapping Upper Reach

Floodplain mapping within the upper reach is shown in Exhibit 1. The automated floodplain mapping feature of HEC-GeoRAS was used to generate water surface elevations and initial flood extents based on HEC-RAS model output and the DEM. Because the upper reach is steep (4-6%) and confined within a ravine, the DEM (which was based on photogrammetry) did not contain sufficient channel detail to accurately map in the areas between cross sections. Consequently, this resulted in "dry" creek sections, where the projected water surface elevation was less than the channel bottom elevation in the DEM. In these regions, WSE delineated the floodplain based on channel width at the bounding cross sections.

Floodplain extents were then widened to encompass creek channel extents visible in 2009 and 2012 aerial photography provided by the City. This resulted in areas where the mapped floodplain extents are wider than modeled widths, but provides a more appropriate and conservative depiction of flood risk. Floodplain extents near cross section N, shown on Exhibit 1, were also adjusted to accurately place the residential structure located at 15425 SE 42nd Street above the predicted floodplain. This was done based on an existing LOMA to the effective maps (FEMA, 2009). The LOMA lists the lowest adjacent grade elevation as 412.0-ft NGVD (~415.6-ft NAVD) which is well above the predicted 100-year flood elevation of 410.4-ft NAVD determined at that location in this study.

Base Flood Elevation (BFE) contours were created to represent the final 100-year water surface elevation. BFEs were generated based on the modeled 100 year water surface elevation and then trimmed to the edge of the final floodplain polygon.

3.1.2 Floodplain Mapping Lower Reach

Floodplain mapping within the Lower Reach is shown in Exhibit 2. WSE delineated floodplain extents by hand based on the in-channel survey provided by the City. In the areas between surveyed cross

sections, flood extents were delineated based on the surveyed channel thalweg location and channel top widths at the bounding cross sections.

Survey data was not available for two reaches of Vasa Creek, from Lake Sammamish to a driveway bridge approximately 200 feet upstream, and from West Lake Sammamish Parkway to a location approximately 400 feet upstream. Within these areas, the floodplain was delineated based on average channel widths upstream and downstream of the non-surveyed reaches, and the channel location visible in the aerial photography. A wetland area with an intermittent high flow connection to the Creek was also identified approximately 500 feet upstream of West Lake Sammamish Parkway. WSE conducted an additional field visit on July 31, 2014 to confirm the hydraulic connection between the pond and the creek, and the pond was added to the floodplain.

BFE contours for the lower reach were generated based on the modeled 100-year water surface elevation, and then trimmed to the edge of the final floodplain polygon.

4.0 SUMMARY

WSE developed HEC-RAS hydraulic models for the upper and lower reaches of Vasa Creek and applied those models together with new peak flow hydrology to determine peak flood elevations and areas of inundation. Model results were used to produce the information necessary to update floodplain mapping, including the workmaps and flood profiles provided.

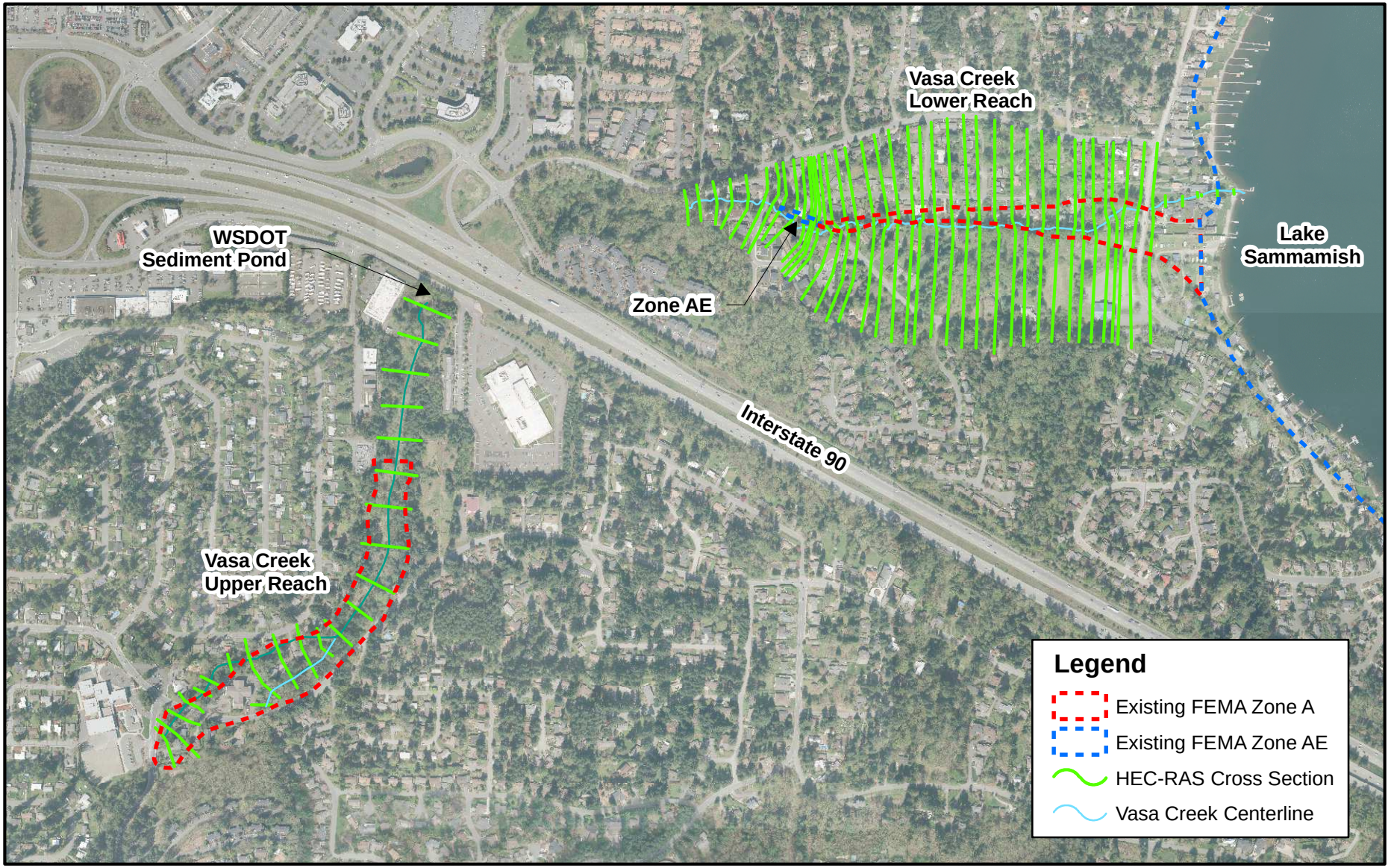
REFERENCES

WSE (2014) "Vasa Creek Hydrologic Modeling and Analysis" Watershed Science and Engineering, Technical Memorandum, September 18, 2014.

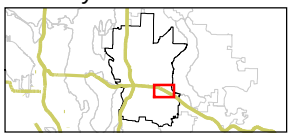
MapCon (2007) "Contours2FT" GIS Shapefile, 2 foot contour data for the City of Bellevue based on 2007 orthophoto project.

FEMA (2013) "Flood Insurance Study, King County, Washington and Incorporated Areas" Preliminary, Federal Emergency Management Agency, FIS No. 53033CV001B

FEMA (2009) "Letter of Map Amendment Determination Document (Removal), Case No. 09-10-0386A", City of Bellevue, King County WA



City of Bellevue



Vasa Creek
Hydraulic Model Location Map

0 500 1,000 Feet

N

Scale: 1:10,000

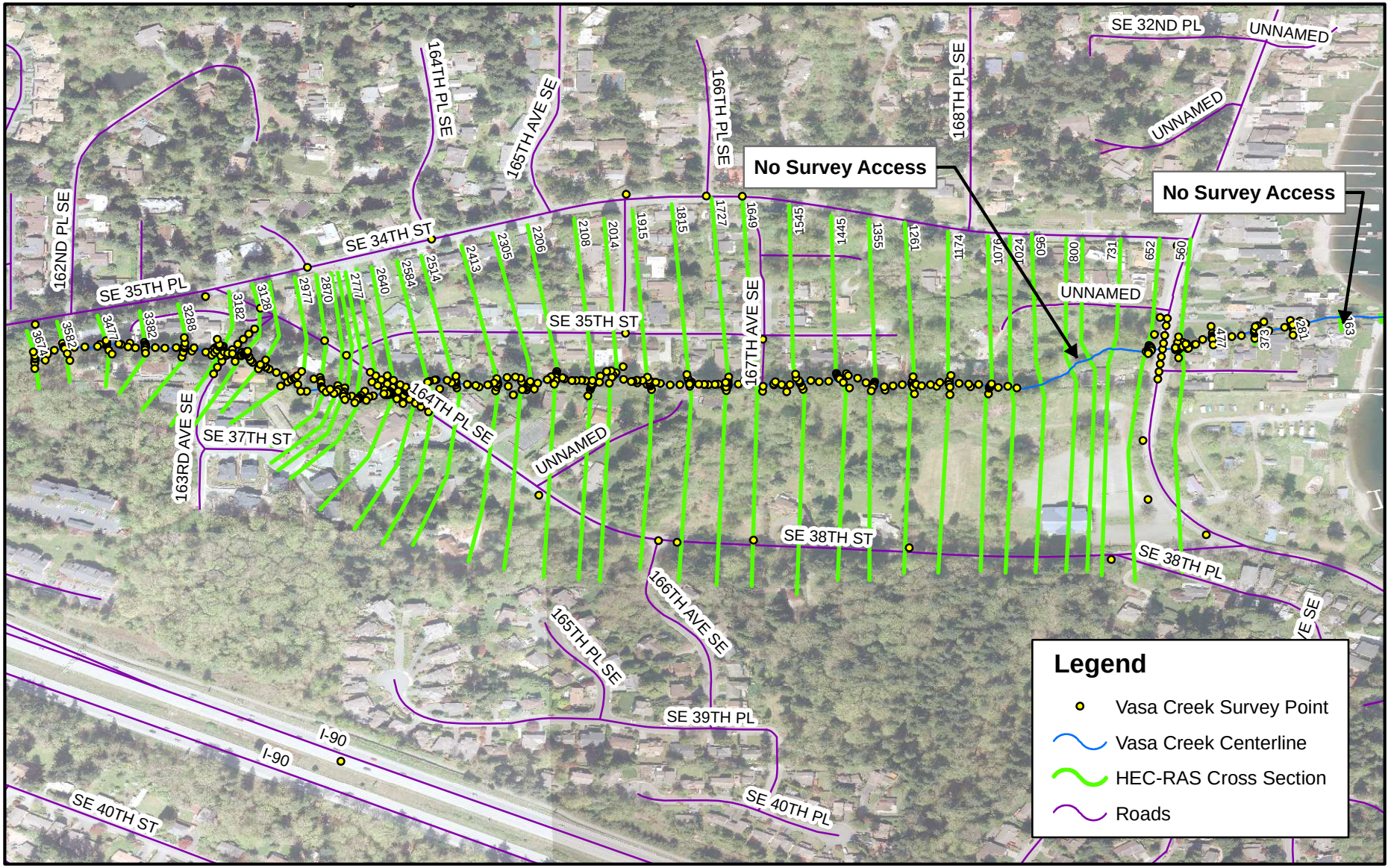
05 Aug 2014

WATERSHED SCIENCE & ENGINEERING

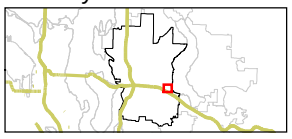
F:\13-029 Vasa Creek\GIS\Figure1.mxd 7/22/2014 2:45:19 PM

Background Image: 2012 Orthophoto provided by the City

Figure 1



City of Bellevue



Vasa Creek
HEC-RAS Model Layout
and Survey Location for Lower Reach

0 250 500 Feet

N

Scale: 1:6,000

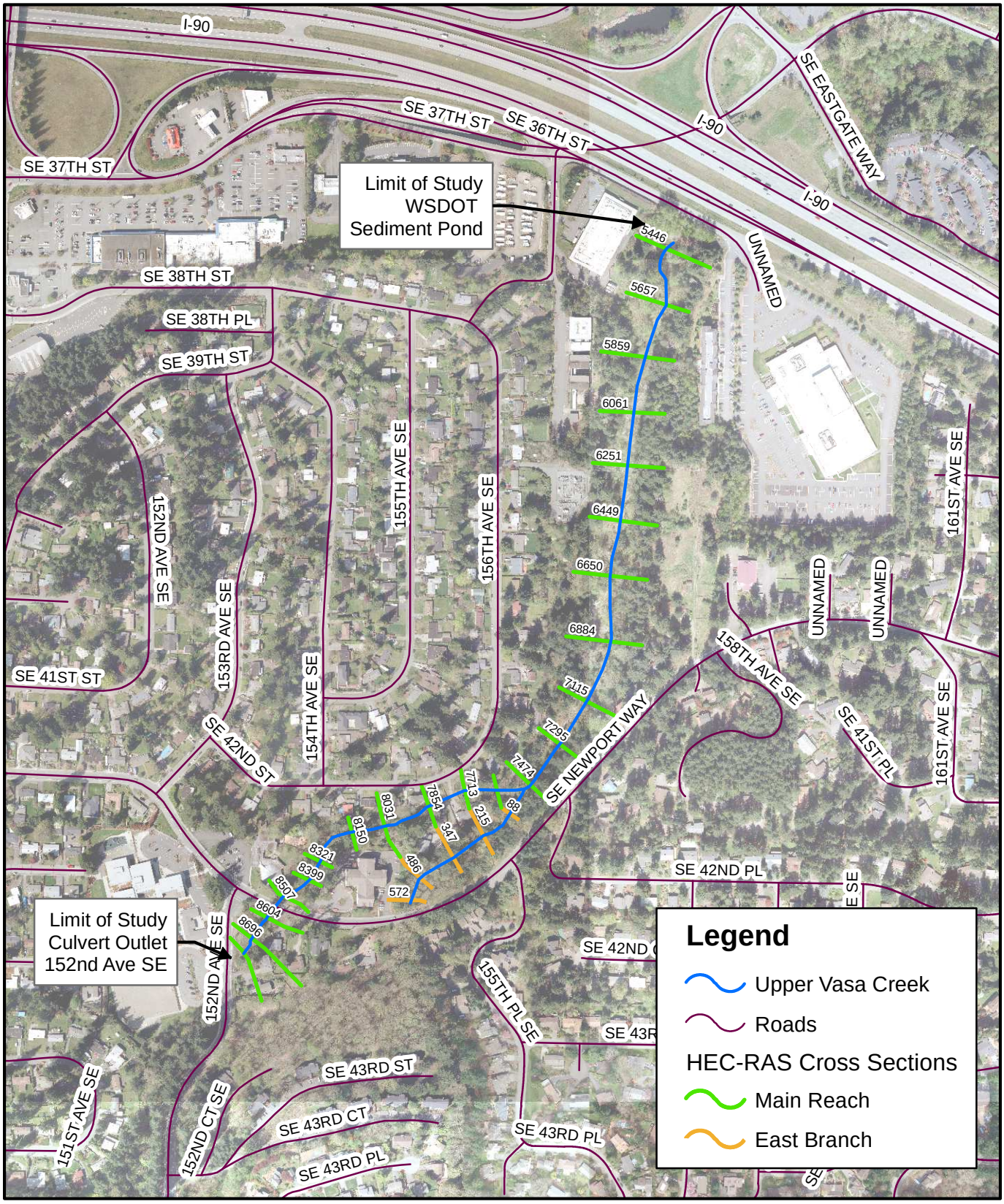
05 Aug 2014

WATERSHED SCIENCE & ENGINEERING

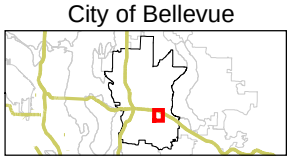
F:\13-029 Vasa Creek\GIS\Figure2.mxd 7/31/2014 11:14:18 AM

Background Image: 2012 Orthophoto provided by the City

Figure 2



City of Bellevue



Vasa Creek
HEC-RAS Model Layout
Upper Reach

0 250 500 Feet

Scale: 1:6,000

N

05 Aug 2014

WATERSHED SCIENCE & ENGINEERING

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Background Image: 2012 Orthophoto provided by the City

Figure 3

Limit of Detailed Study
WSDOT Sediment Pond

Existing FEMA Zone A Boundary

100 and 500 yr Flooding
Contained in Culvert

100- and 500-year Flooding Limits Adjusted
Based on Low Lot Elevation (415.6 ft)
Listed in Existing LOMR.

Below this Point Floodplain Limits Were Adjusted in Many Locations to Encompass Visible Channel Extents in 2009 and 2012 Orthophotos Provided by the City.

100 yr Flooding
Contained in Culvert

East Branch
Upper Vasa Creek

Limit of Detailed Study
(Outlet of Culvert)

I-90
SE 37TH ST
SE 38TH ST
SE 38TH PL
SE 39TH ST
SE 42ND ST
SE 42ND PL
SE 42ND CT
SE 43RD ST
SE NEWPORT WAY
UNNAMED
152ND AVE SE
153RD AVE SE
154TH
155TH AVE SE
156TH AVE SE
156TH LN SE
155TH PL SE
158TH AVE SE
159TH AVE SE
160TH AVE SE
158TH PL SE

304 A
B
304 305 C
308 D
312 E
317
322 324 F
329
334 G
340
345 H
348
352 354 I
359 J
363 366
K
L
M
N
O
P
Q
R
S
T
U
V
381 376 373
410
411 410
413
421
426
431
436
446
449
391
396
401
403

Legend

- 410 Base Flood Elevation (BFE)
- Roads
- Vasa Creek
- Proposed ZoneAE (Floodway is Coincident)
- Proposed ZoneX
- Effective Zone A

HEC-RAS Cross Sections

- Main Reach
- East Branch

UPPER VASA CREEK
CITY OF BELLEVUE, WA
LOMR WORKMAP

Effective FIRM Panel:
53033C0659F

0 125 250 500 Feet

N

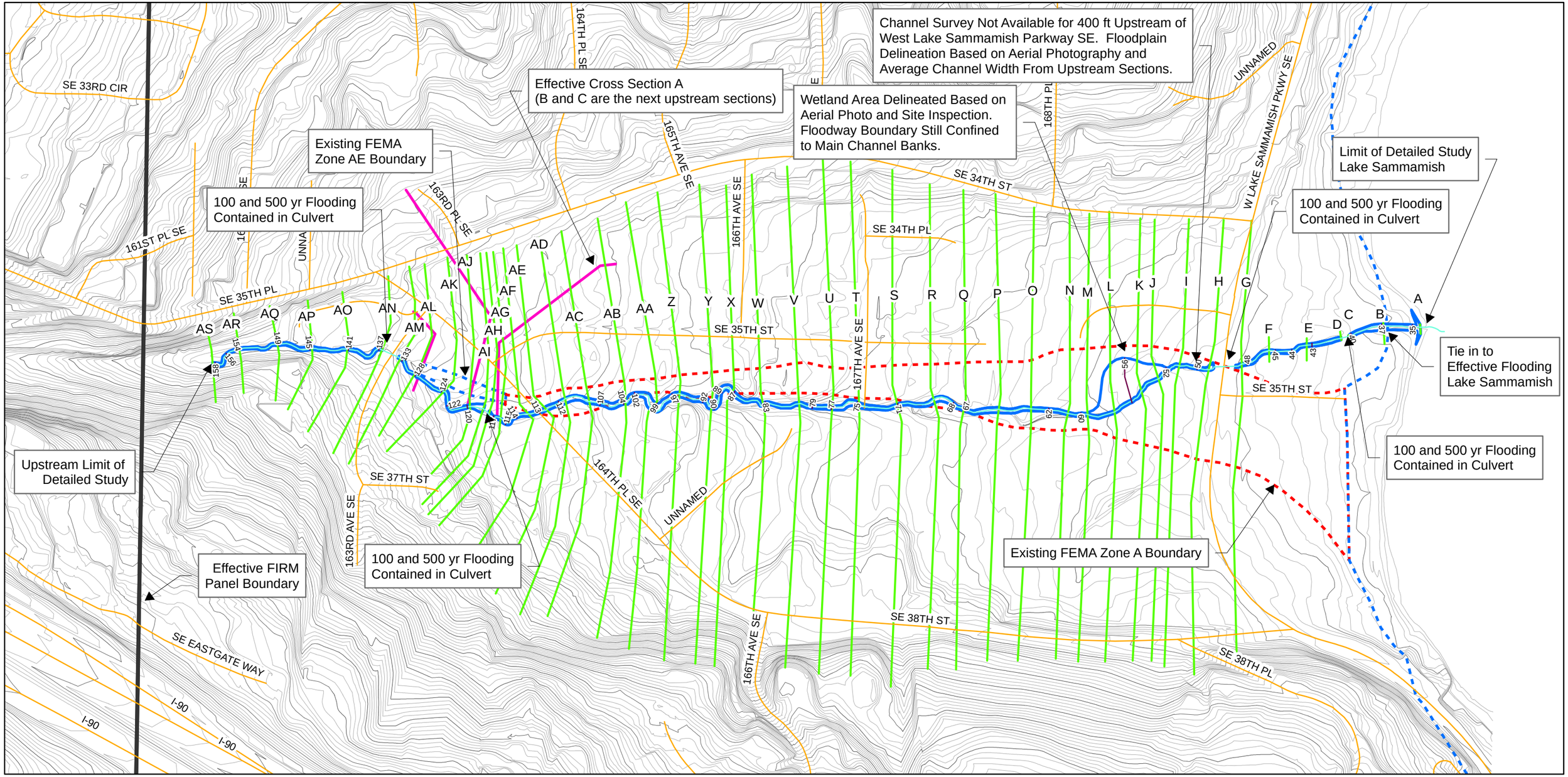
1 inch = 250 feet Vertical Datum: NAVD 88

Notes:
Effective data was taken from the King County Preliminary DFIRM.

For floodplain hazard lines, effective boundaries are shown as dashed lines and proposed LOMR revisions as solid lines. Only one flood hazard line is shown where these boundaries are coincident.

Background Topography shows 2-ft Contours Provided by the City

EXHIBIT 1



Legend

- Base Flood Elevation (BFE)
- Vasa Creek Centerline
- HEC-RAS Cross Section
- Proposed Zone AE (Floodway and Zone X are Coincident Unless Noted)
- Effective Cross Section
- Effective Zone A
- Effective Zone AE
- Roads

LOWER VASA CREEK
CITY OF BELLEVUE, WA
LOMR WORKMAP

Effective FIRM Panel:
53033C0680F

0 250 500 1,000 Feet

1 inch = 250 feet

Vertical Datum: NAVD 88

N

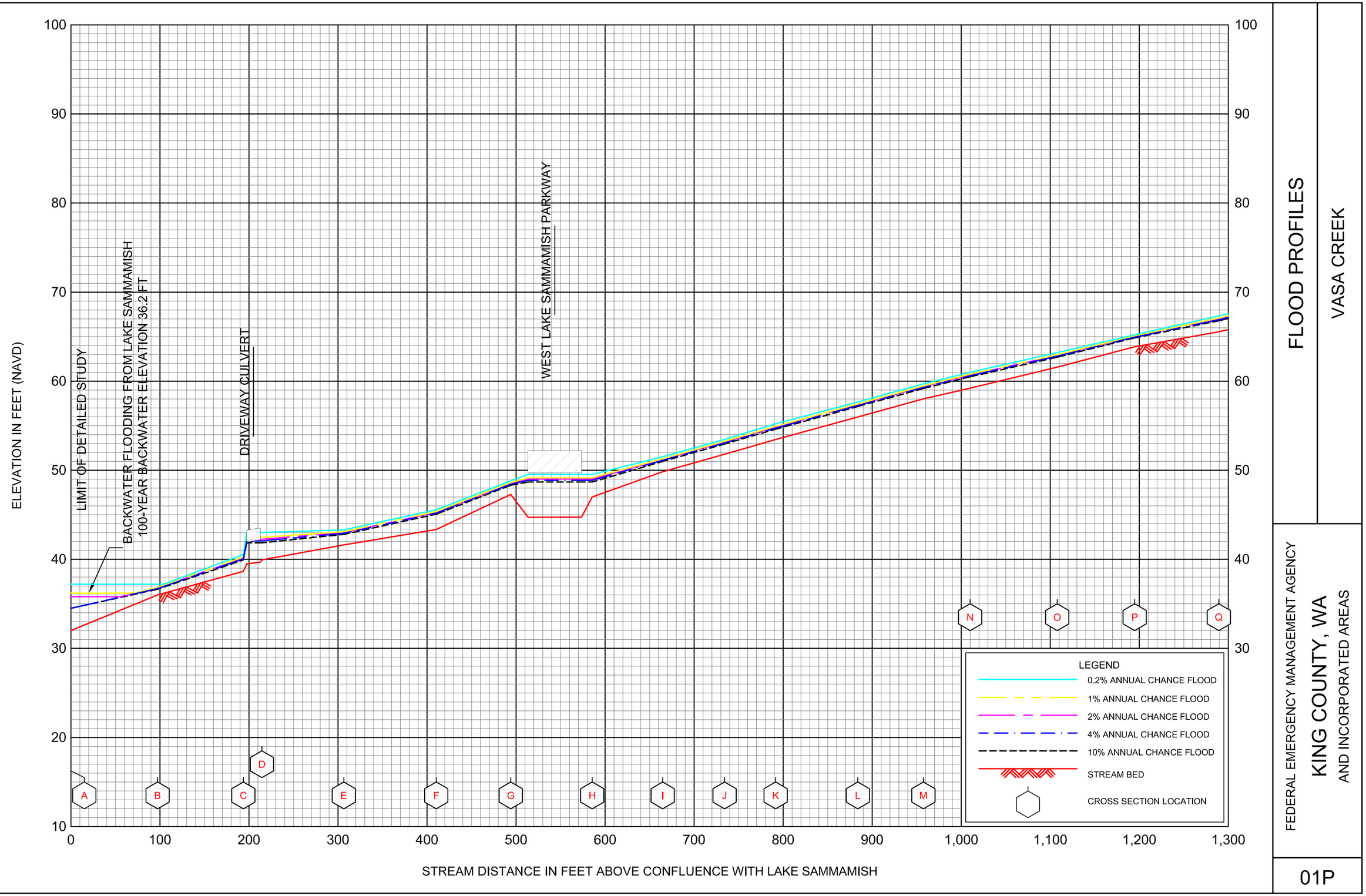
Notes: Effective data was taken from the King County Preliminary DFIRM.

Effective flood hazard boundaries are shown as dashed lines and proposed LOMR revisions as solid lines. Only one flood hazard line is shown where these boundaries are coincident.

This LOMR replaces effective Zone A completely, and no upstream tie-in is required. Downstream limit is Lake Sammamish.

Background Topography shows 2-ft Contours Provided by the City.

EXHIBIT 2



FLOOD PROFILES

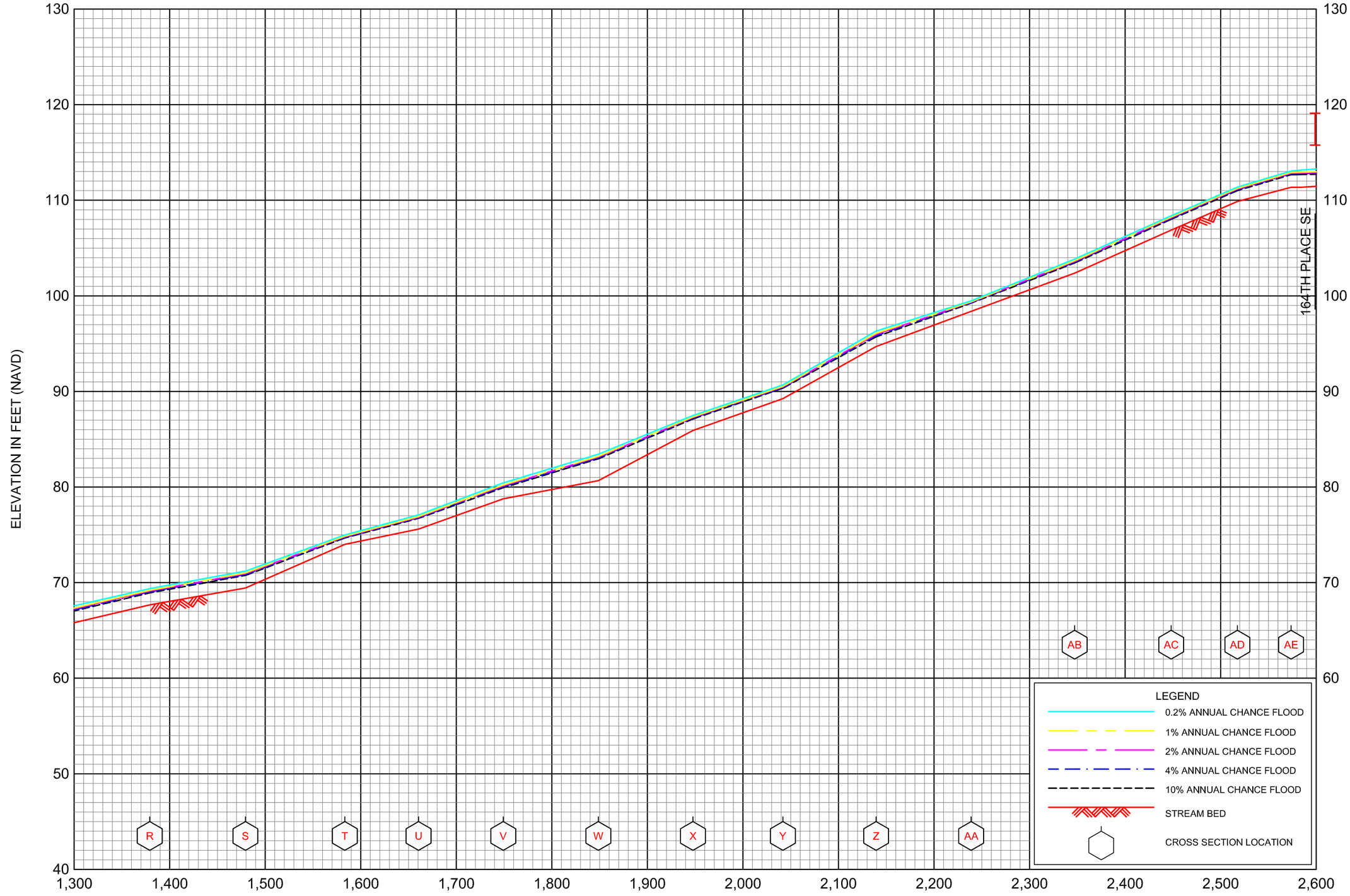
VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

01P



FLOOD PROFILES

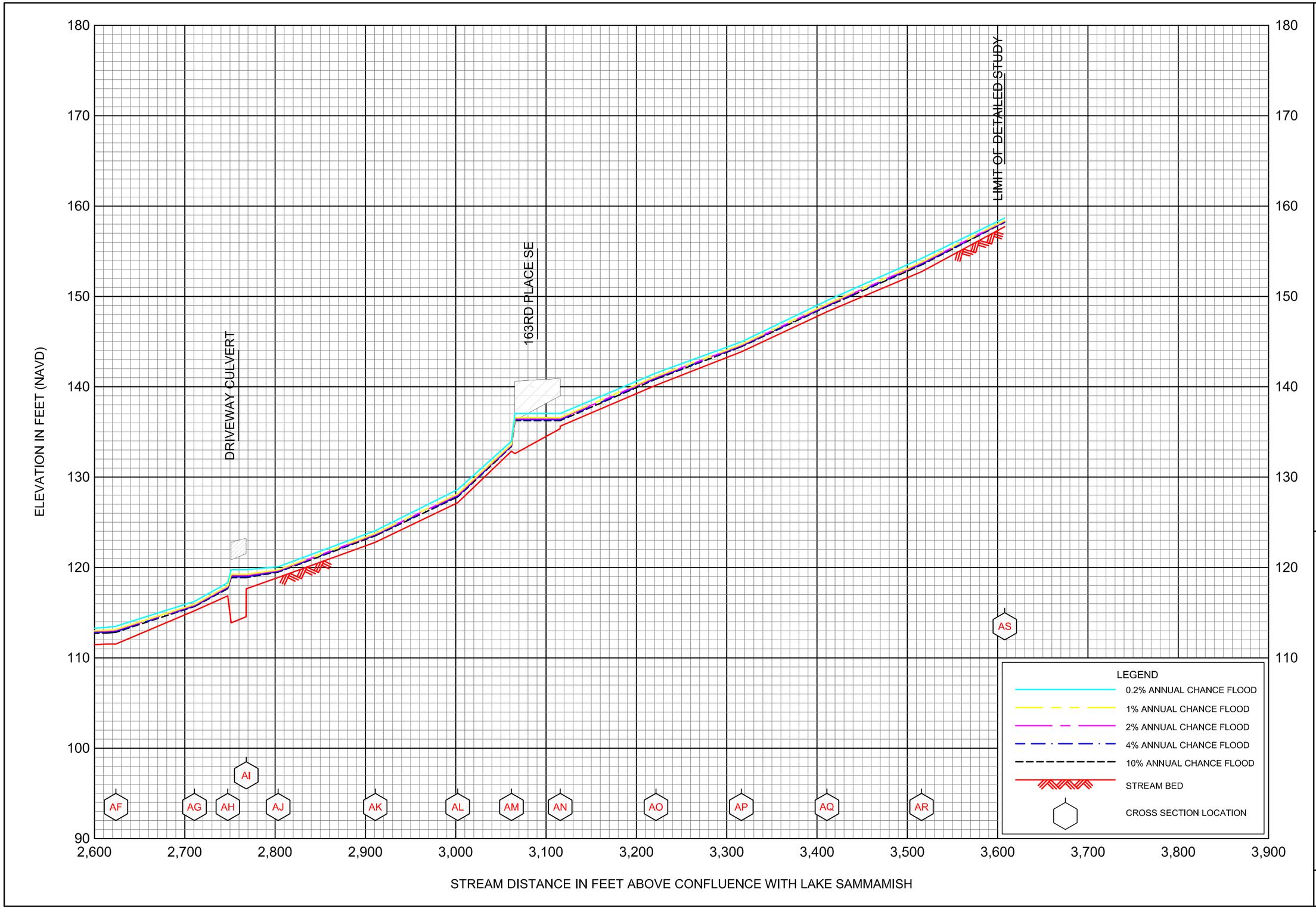
VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

02P



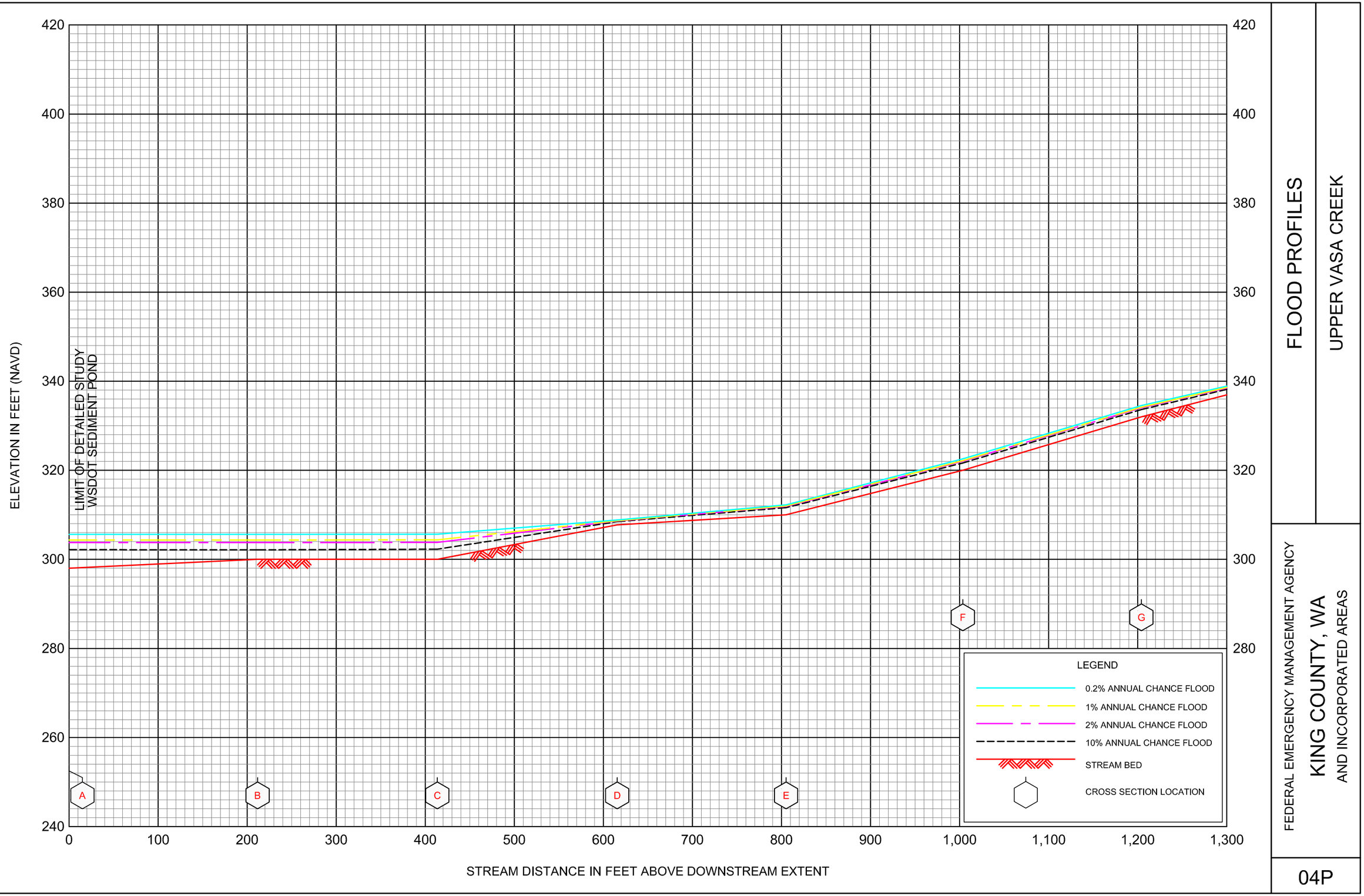
FLOOD PROFILES

VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS



FLOOD PROFILES

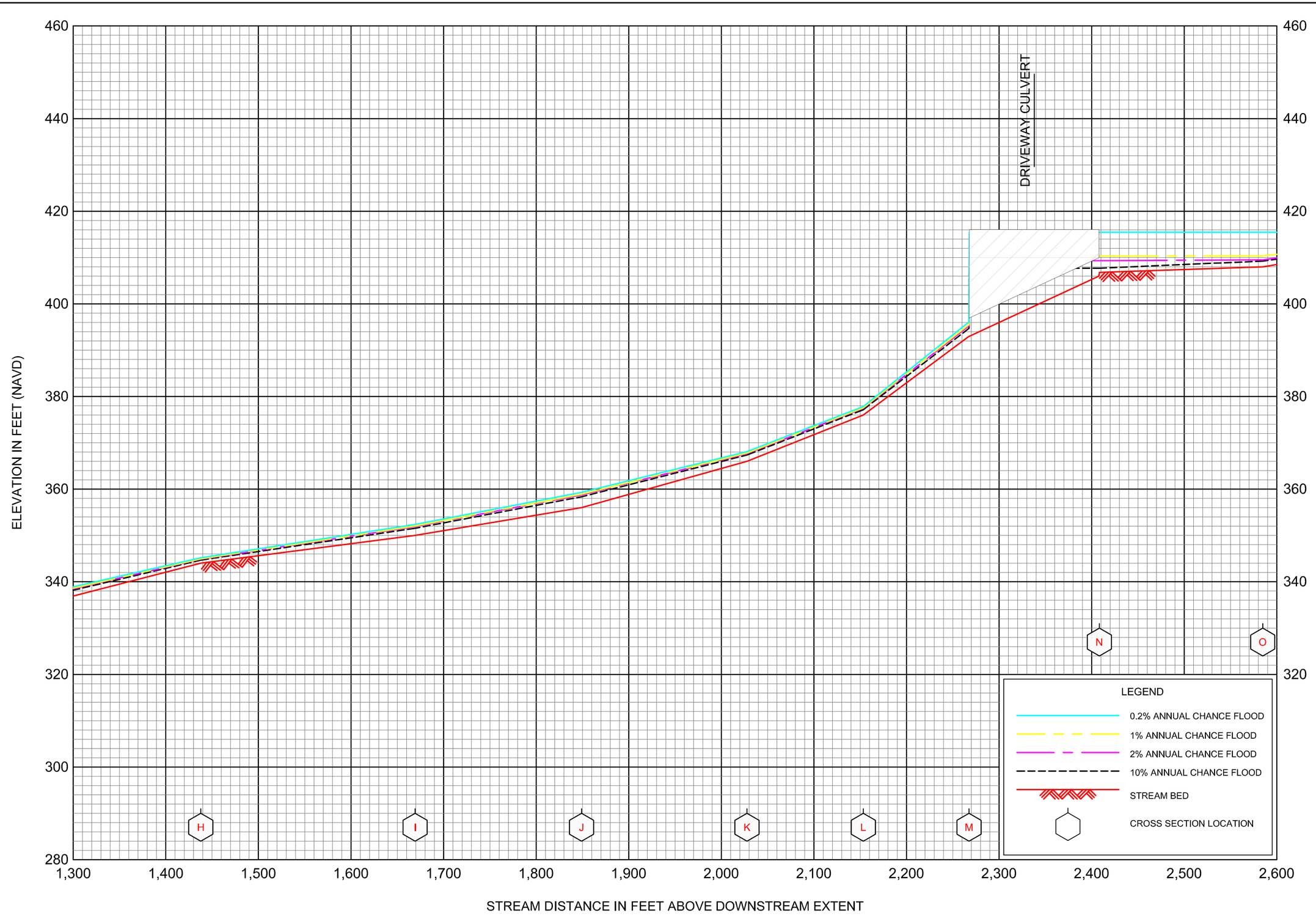
UPPER VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

04P



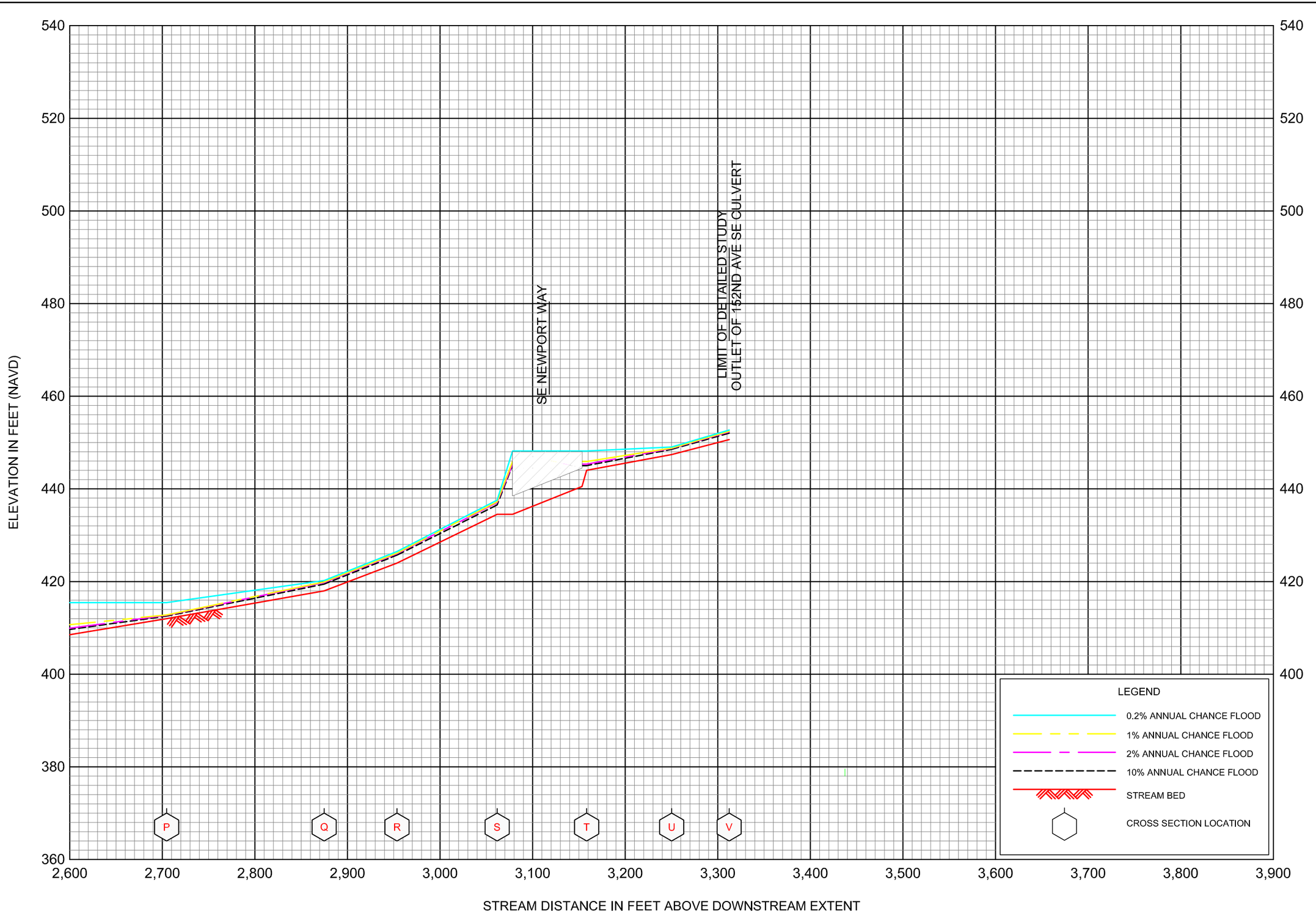
FLOOD PROFILES

UPPER VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS



FLOOD PROFILES

UPPER VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA

AND INCORPORATED AREAS

06P

ELEVATION IN FEET (NAVD)

520
500
480
460
440
420
400
380
360
340

0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300

STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH MAIN STEM

LIMIT OF DETAILED STUDY
OUTLET OF SE NEWPORT WAY CULVERT

A
B
C
D
E

LEGEND

- 0.2% ANNUAL CHANCE FLOOD
- 1% ANNUAL CHANCE FLOOD
- 2% ANNUAL CHANCE FLOOD
- 10% ANNUAL CHANCE FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

EAST BRANCH UPPER VASA CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
AND INCORPORATED AREAS