PRELIMINARY HYDRAULIC INVESTIGATION

April 6, 2017

Prepared for the City of Wilsonville

Prepared By

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OBEC CONSULTING ENGINEERS
PROJECT TECHNICAL MEMORANDUM

OBEC Job No.: 19-363 Date: 4/6/17

Reviewed: Amy Jones, PE
Prepared: Ben Wewerka, PE

Project: French Prairie Bridge: Boones Ferry Rd – Butteville Rd

REGISTERED PROFESSIONAL ENGINEER
79131
OREGON
JUNE 14, 2007
BENJAMIN P. WEWERKA
EXPIRES: 06/30/18

RE: Existing Condition Hydraulic Analysis

To: Zach Weigel, City of Wilsonville

This memorandum is prepared to document the preliminary hydraulic investigation performed for the French Prairie bike-pedestrian-emergency bridge over the Willamette River in the City of Wilsonville and Clackamas County, Oregon. The study area is located west of Interstate 5 (I-5) between the I-5 Boone Bridge and the upstream railroad bridge. Three potential bridge alignments are being evaluated within this study area, but will fall within this river reach, between river miles 38.52 and 38.86 on the Willamette River as shown in Figure 1. The crossing is located within both a Federal Emergency Management Agency (FEMA) regulatory floodplain and floodway as shown in Figure 2. All elevations in the memorandum are referenced to the North American Vertical Datum of 1988 (NAVD) unless otherwise noted.

The scope of the preliminary hydraulic investigation includes the analysis of a duplicate model of the FEMA Flood Insurance Study (FIS) along with a corrected model updated with site specific topographic data. This topographic data is a composite of cross sections through the Willamette River using an echo sounder and LiDAR data for the areas above the water surface. This data is used to make preliminary recommendations on the general approach to achieving a No Rise certification for the project which is required due to work performed within the regulated floodway.

The final hydraulic analysis will be reviewed by the City of Wilsonville and will require a floodplain development permit from the City. In the potential case of a Letter of Map Revision being issued by FEMA, FEMA Region X would also review and approve the hydraulic design. If mitigation measures are constructed on other Agency properties, such as the Oregon Department of Transportation right of way, then these agencies would also have the chance to review and approve the design as proposed on their property.

The hydrologic data for the preliminary analysis is taken from the FIS at the downstream side of the Wilsonville corporate limits and are summarized in Table 1 below. These flows are applicable in the FIS from river mile 37.07 to the Clackamas County line at river mile 43.32. The drainage area for the Willamette River listed in the FIS for the project site is 8,400 square miles.

Table 1: Willamette River Flows at French Prairie Bridge Site

Recurrence Interval	FIS Flows (cfs)
10-year	178,000
50-year	250,000
100-year	287,000
500-year	420,000

As noted above the project site is in between the I-5 Boone Bridge and the railroad bridge. The limits of the preliminary hydraulic analysis are set upstream of the railroad bridge and downstream of the I-5 bridge to encapsulate any potential impacts to these adjacent structures once the proposed bridge location and type are determined. The limits of the hydraulic analysis are shown on Figure 2. Both of the existing bridges have piers within the Willamette River with the railroad bridge having three and the I-5 bridge having four.

There were two HEC-RAS models created for this analysis. The first HEC-RAS model created is a duplicate of the current FEMA FIS model that was originally performed in HEC-2. Input data from the original model is input into HEC-RAS and a comparison is made to the FIS published elevations. This duplicate model is created in the National Geodetic Vertical Datum of 1929 to match the datum used in the HEC-2 model. This model is then converted to the NAVD datum for comparison with the published FEMA flood elevations. A comparison is shown below in Table 2.

The second model as previously mentioned is based upon current topographic data from river surveys performed by OBEC and LiDAR data obtained for overbank areas. This model serves as a baseline against which the no-rise analysis will be performed. A couple differences between the duplicate and corrected models are as follows:

- Cross section locations have been added in the corrected model downstream of the I-5 bridge west of FEMA cross section AE.
- The original FIS model didn't model the bridges as bridges within the software but as regular channel cross sections with a lid placed on them. The lid is an obstruction at the top of the cross section that is meant to mimic the bridge deck but doesn't account for hydraulic losses through the structure like a modeled bridge would. These bridge cross sections were updated and modeled as bridges with piers in the corrected model.

Water surface elevations for the corrected model are presented in Table 2 below. Cross section locations for the FIS cross sections AE, AF and AG are shown on Figure 2 and section views are shown on Figures 3-5 respectively.

Table 2: Willamette River 100-Year Water Surface Elevations (NAVD)

River Station[1]	Water Surface Elevations			
	Duplicate		FIS	Corrected
	(NVGD)	(NAVD)	(NAVD)	(NAVD)
37.917(AE)	90.16	93.60	93.6	93.60
38.086				93.68
38.337				93.94
38.495	90.60	94.04		94.15
38.497/ I-5 Br. Down	90.55	93.99		94.11
38.519/ I-5 Br. Up	90.58	94.02		94.09
38.521	90.68	94.12		94.20
38.641(AF)	90.72	94.16	94.2	94.25
38.865	90.77	94.21		94.44
38.866/ RR Br. Down	90.73	94.17		94.38
38.871/ RR Br. Up	90.74	94.18		94.47
38.873	90.80	94.24		94.57
39.009 (AG)	91.09	94.53	94.5	94.72

1. FEMA FIS cross sections are shown in parentheses, e.g. (AE) and the upstream and downstream faces of the existing bridges are labeled at their locations.

It is anticipated that the French Prairie Bridge piers may need to be placed within the river, which will have impact on the water surface elevations. If this is the case, the project will require mitigation measures in order to obtain a no-rise condition or will have to obtain a Letter of Map Revision (LOMR) from FEMA.

Two typical mitigation measures proposed are excavation to increase conveyance capacity or modification of the surface roughness along the channel/overbanks. The most likely potential approach to mitigation measures for the crossing if piers are placed within the Willamette River is excavation within/along the channel to increase conveyance capacity. The other potential mitigation approach could include measures to reduce the surface roughness along the channel/overbanks, but this will likely not prove as feasible since it would require large changes to the riparian corridor vegetation.

The best location for the excavation approach to floodway mitigation is beneath the selected bridge crossing location and extending upstream and downstream a short distance. However, one challenge for the excavation approach is the numerous properties with frontage on the river. Depending upon the crossing location selected mitigation measures may need to be located downstream from the crossing in order to minimize the impacts to adjacent properties. This downstream mitigation would best be achieved between FEMA cross section AF and I-5 Boone Bridge as shown on Figure 2.

Any mitigation measure within the river riparian corridor will be permitted as part of the project's other riparian impacts. There are no expected NEPA strategy impacts as a result of

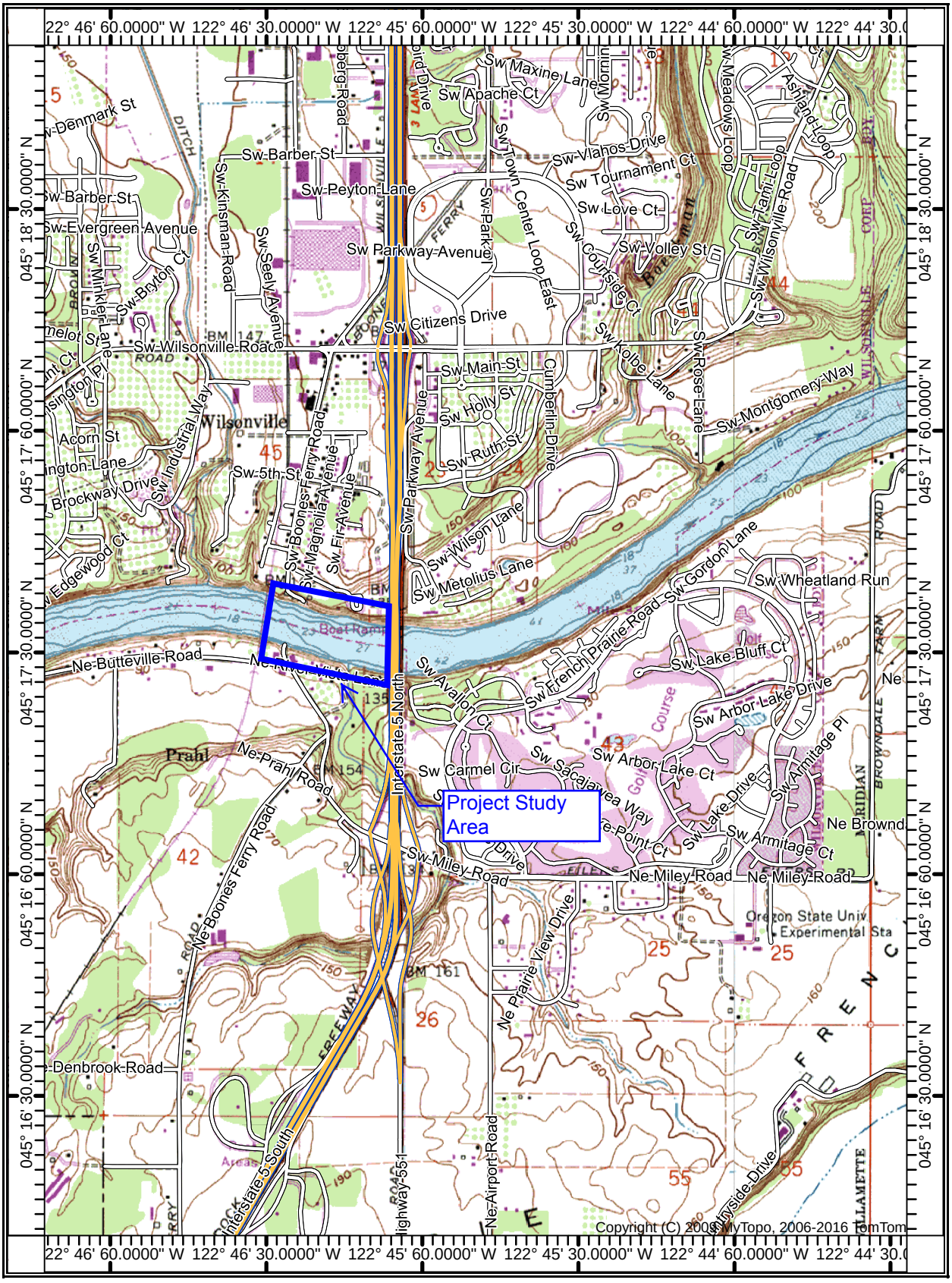
the potential mitigation measures. The extent and location of the floodway mitigation will be determined once the bridge location and type are decided.

Another option to address any increase in the water surface elevation is to obtain a LOMR from FEMA. This would redefine the floodplain and floodway elevations in the location of the proposed bridge and a no-rise analysis would not be required. Approval for this would need to be obtained from the City of Wilsonville and FEMA.

Construction of a bridge that keeps the piers outside the floodway will avoid the necessity of the no-rise analysis and potential mitigation or changes to the mapped floodplain/floodway. A structure type that spans the floodway may be considered among the bridge type alternatives, depending on the preferred alignment.

In summary, the corrected effective model shows the baseline elevations for the future hydraulic and potential no-rise analyses. The anticipated impacts of the bridge upon the waterway are minimal and any of the three options presented above are expected to adequately address the hydraulic considerations of the selected crossing.

Hydraulic Memorandum – Figures



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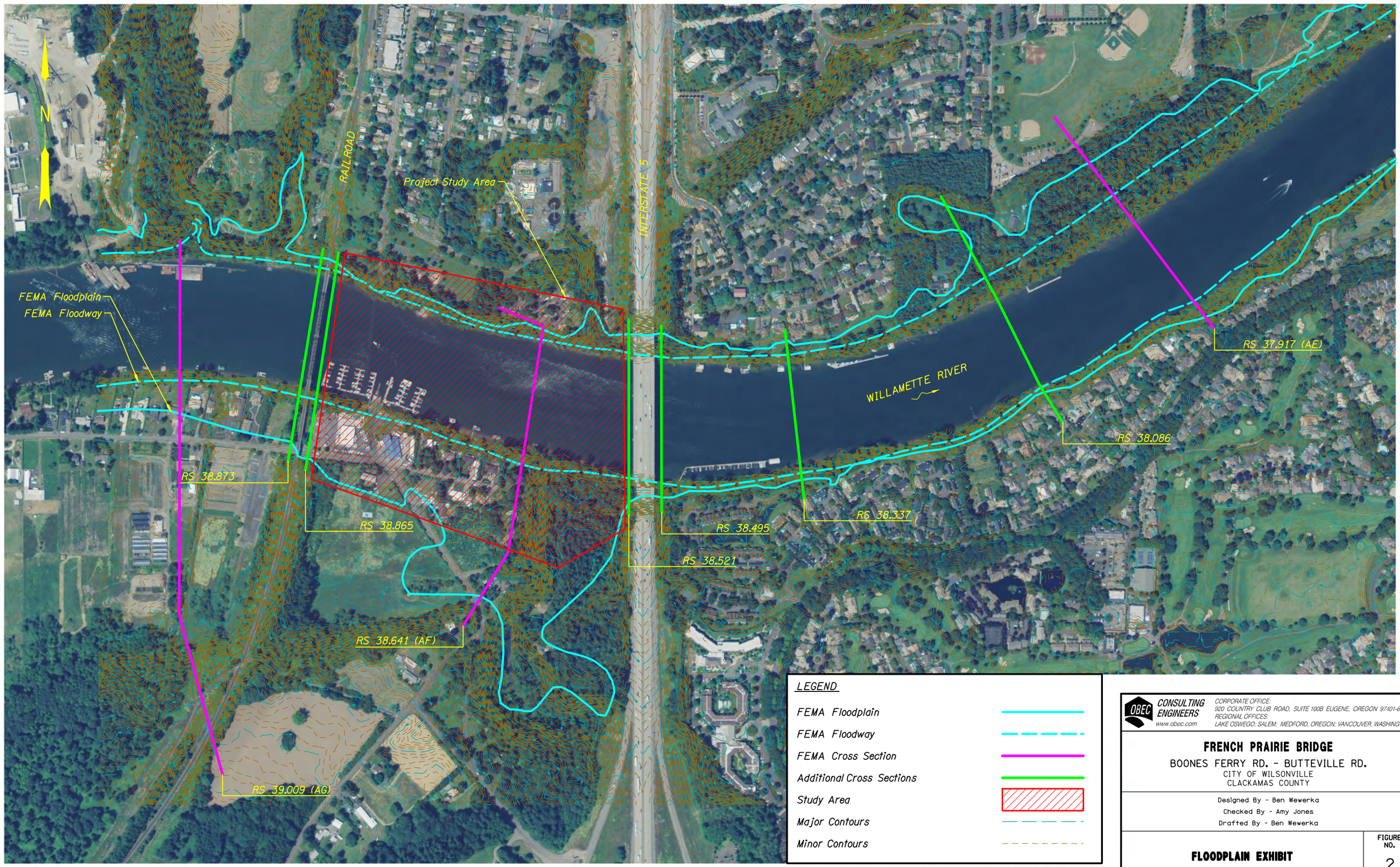
0 1000 2000 3000 4000 5000 6000

Feet

Figure 1



LEGEND

- FEMA Floodplain
- FEMA Floodway
- FEMA Cross Section
- Additional Cross Sections
- Study Area
- Major Contours
- Minor Contours

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FRENCH PRAIRIE BRIDGE

BOONES FERRY RD. - BUTTEVILLE RD.
CITY OF WILSONVILLE
CLACKAMAS COUNTY

Designed By - Ben Wewerka
Checked By - Amy Jones
Drafted By - Ben Wewerka

FLOODPLAIN EXHIBIT

FIGURE NO. 2

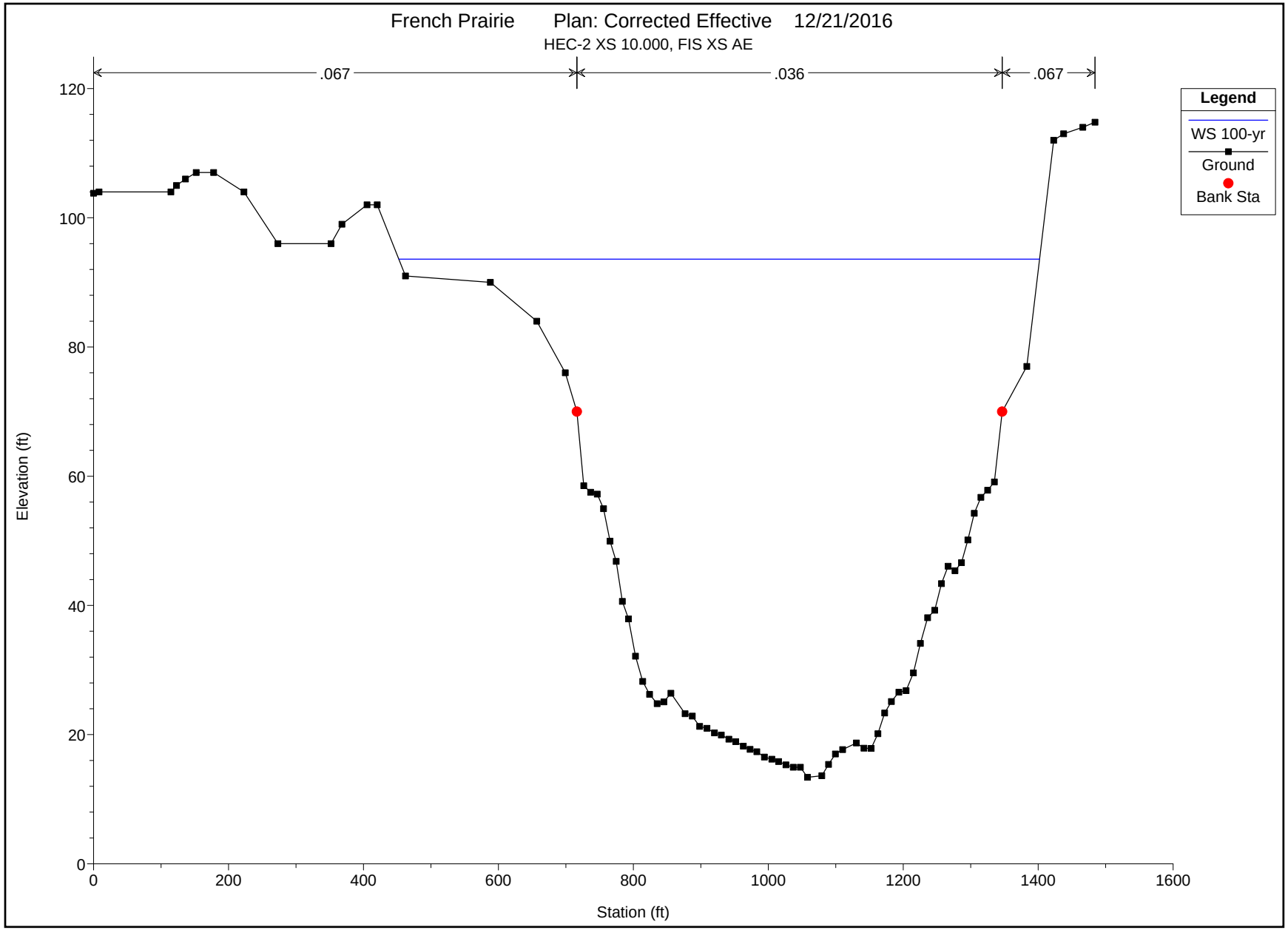
French Prairie Plan: Corrected Effective 12/21/2016
HEC-2 XS 10.000, FIS XS AE
.067
.036
.067
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
20
40
60
80
100
120
0
200
400
600
800
1000
1200
1400
1600

Figure 3

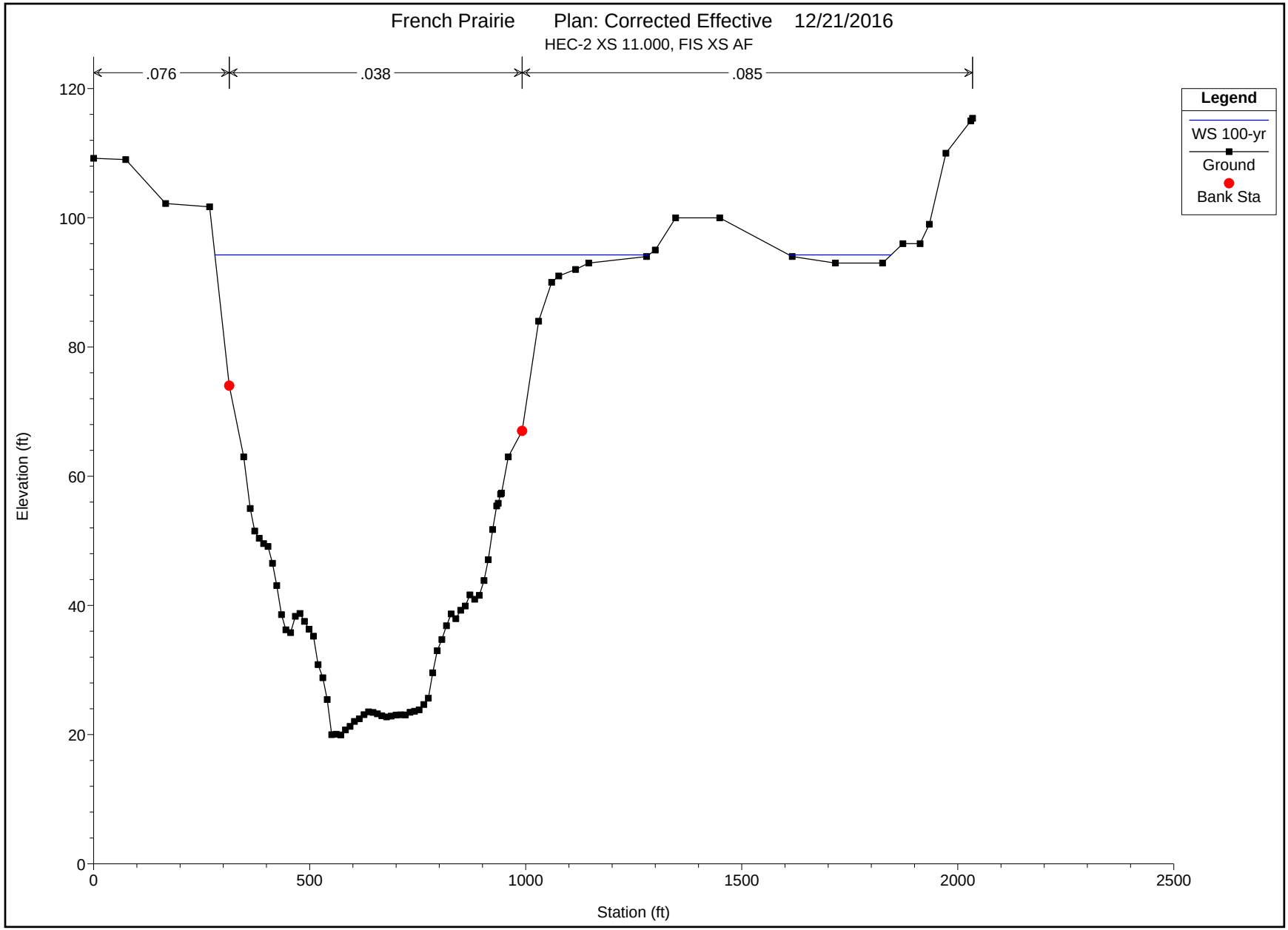
French Prairie Plan: Corrected Effective 12/21/2016
HEC-2 XS 11.000, FIS XS AF
.076
.038
.085
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
0
20
40
60
80
100
120
0
500
1000
1500
2000
2500

Figure 4

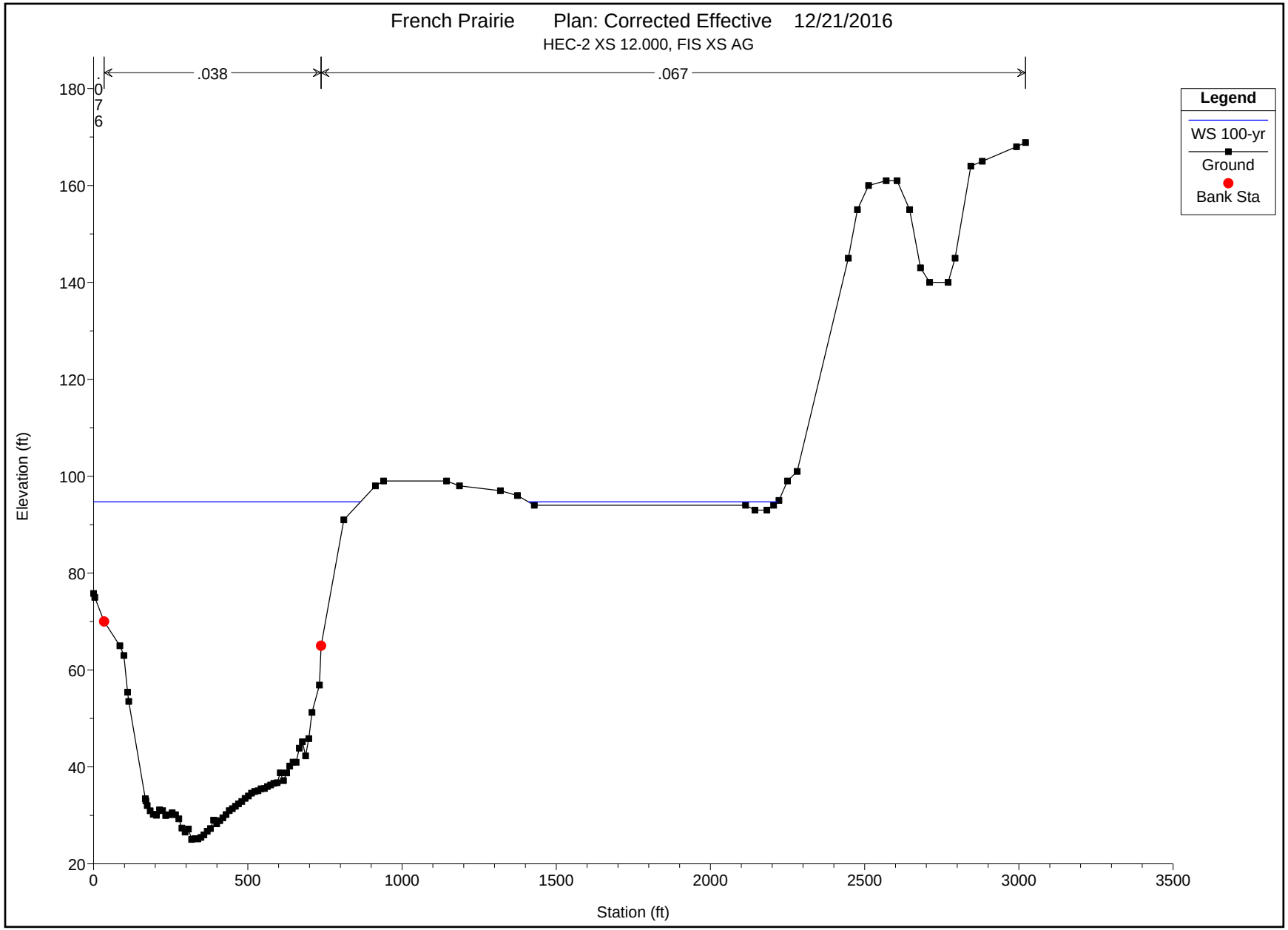
French Prairie Plan: Corrected Effective 12/21/2016
HEC-2 XS 12.000, FIS XS AG
.038
.067
.076
Legend
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
180
160
140
120
100
80
60
40
20
0
500
1000
1500
2000
2500
3000
3500

Figure 5