BOWEN COLLINS & ASSOCIATES
Celebrating 20 Years

TECHNICAL MEMORANDUM

TO: Connely Baldwin
PacifiCorp Energy
Hydro Resources
NTO 110

COPIES: File

FROM: Craig Bagley, P.E. CFM, and Tyler Seamons, P.E.
Bowen, Collins and Associates
154 E 14000 South, Draper, Utah

DATE: October 25, 2017

SUBJECT: Updated Bear River Floodplain Analysis

JOB NO.: 166-13-03

SECTION 1 – PURPOSE, SCOPE, AND AUTHORIZATION

Introduction

Bowen, Collins & Associates (BC&A) was retained by PacifiCorp Energy to update the Bear River floodplain analysis that we performed in 2014 (2014 Study). That study was performed to evaluate the floodplain impacts of increasing the maximum release rate into the Bear River from the Soda Power Plant to 2,500 cfs. The floodplain mapping prepared as part of the 2014 Study was developed using a hydraulic river model that included 11 field-surveyed cross sections and 10 meter USGS DEM mapping of the study reach.

PacifiCorp recently obtained more accurate and detailed topographic mapping of the floodplain along the Bear River in between Grace, Idaho and Oneida Reservoir. Also, on March 27, 2017, a 2,500 cfs release from the Soda Power Plant (producing a flow rate of approximately 3,000 cfs within the study reach) was observed. Based on the availability of this new data, analyses were performed to accomplish the following objectives:

- Utilize observations and data collected during a 3,000 cfs flood event and more accurate topographic mapping information developed from LiDAR data collected in 2017 to update the hydraulic model and associated floodplain mapping along the Bear River in the study area shown in Figure 1.

- Modify the hydraulic model developed in 2014 to evaluate the potential impacts that dredging sediment deposits from the Bear River in the vicinity of the Cottonwood Creek confluence would have on the water surface profile and associated floodplain in the study area.

This Technical Memorandum has been prepared to document the analyses associated with these two objectives.

Project Staff
The project work was performed by the following BC&A team members: Craig Bagley/Project Manager, and Tyler Seamons/Project Engineer. The project was completed in BC&A's Draper, Utah office. These individuals can be contacted at 801-495-2224 to answer questions pertaining to this study.

SECTION 2 – ANALYSIS

A detailed summary of the process used to update and calibrate the model and floodplain is described in this section. The data listed in Table 1 were provided to BC&A by PacifiCorp and was used in this study.

Table 1
Data Used and Source

Description	Source	Notes
Digital Elevation Model	GeoTerra	LiDAR data (June 23, 2017)
Bathymetric Survey Data	Electrical Consultants Inc. (Chad Moser PLS)	5 underwater channel cross sections near Cottonwood Creek (Sept. 15, 2017)
Bear River Flow Data	PacifiCorp	3,000 cfs used in floodplain model; 1,100 cfs used for calibration with LiDAR data
Miscellaneous Photographs of the Bear River Floodplain during the 3,000 cfs flood event	PacifiCorp	Photographs were taken by PacifiCorp personnel from various vantage points to document floodplain boundaries.

Updating and Calibrating the 2014 Hydraulic Model
A hydraulic model has four main components: flow data, channel geometry data, channel roughness values, and model boundary conditions to define hydraulic conditions to use at the downstream end of the hydraulic model. The data and processes that were used to revise and update these model elements as part of this project are described below.
Flow Data
PacifiCorp personnel requested that the updated hydraulic analysis be based on conditions that existed during the March 2017 flood event. During that event, 2,500 cfs was being released in

the river from the Soda Power Plant and an estimated 3,760 cfs was flowing into the Oneida Narrows Reservoir. It was estimated that Cottonwood Creek was discharging about 760 cfs into the Bear River and that about 3,000 cfs was flowing through the river reach between the Cheese Factory Bridge and Cleveland Bridge. These are the flow conditions used in the updated steady-state model simulations. The locations of the measured and estimate flow rates and are shown in Appendix A.

Channel Geometry Data

The 2014 hydraulic model was based on channel geometry data collected at 11 channel cross sections that were derived from a detailed channel and floodplain survey. The locations of those cross sections are shown in Figure 1. The topographic survey data for the overbank and floodplain areas were compared to the 2017 LiDAR data. The LiDAR data closely matched the field survey data, providing confidence in the use of the LiDAR data in updating the model and floodplain mapping.

The original hydraulic model included some internally-interpolated channel cross sections to provide data that the modeling software needed to be stable and compute water surface elevations. In the updated analysis, the interpolated cross sections were eliminated and 16 new cross sections were added to the model throughout the study area to provide computations needed to more accurately define the floodplain boundaries. Five of these cross sections, near the confluence of Cottonwood Creek, included underwater survey data in the channel. The low flow (underwater) channel cross section data for the remaining 11 cross sections were interpolated based on surveyed channel cross section data collected in 2014. All overbank geometry data for the 16 new cross sections were developed using the 2017 LiDAR data.

Channel Roughness Values

Channel roughness coefficients (Manning's n values) were based on published values found in *Open-Channel Hydraulics* (Chow, 1959). A range of values is typical for each given channel type or floodplain. The values in this model were adjusted within this range as part of the calibration process. Roughness coefficients used in this model are listed in Table 2.

Table 2
Roughness Coefficients used in Hydraulic Model

Description	Manning's n Values Used
Main Channel	0.025-0.03
Overbanks – Pasture/Fields	0.03
Overbanks – Dense Brush	0.1

Model Boundary Conditions

The model boundary condition was set at the downstream end. A normal depth calculation with a hydraulic slope of 0.00023 was used. This slope was estimated based on the calibration results from to the approximate water surface elevation from the LiDAR data. This proved to provide good results throughout the calibration process.

Updated Model Calibration

After updating the HEC-RAS hydraulic computer model developed as part of the 2014 Study as described above, photographs taken during the 2017 flood event of about 3,000 cfs were used to calibrate the model (see Appendix A). The calibration process included adjusting the Manning's "n" values to attain a computed water surface elevation that approximately predicted the floodplain boundaries documented in the photographs taken during the event. After the model was calibrated at a discharge of 3,000 cfs, it was run again at 1,100 cfs to produce a water surface profile that could be compared to the approximate water surface elevation derived from LiDAR data collected on the river banks near the edge of the water surface. The 1,100 cfs discharge was the approximate discharge that existed in the Bear River the day that the LiDAR data was collected. The computed profile at 1,100 cfs reasonably matches the approximate observed water profile the day of the LiDAR flight (0.4 ft average). This added some confidence that the model was reasonably simulating existing field hydraulic conditions.

The updated hydraulic profile from the analysis is presented in Figure 2. As Figure 2 indicates, there is a significant amount of sediment deposition in the river at the Cottonwood Creek confluence. The updated floodplain mapping of the study area is presented in Figures 3 and 4.

Detailed cross sections plots with computed water surface elevations from the hydraulic analysis are included in Appendix B.

Dredging Evaluation

A hydraulic analysis was performed to evaluate the potential effects of dredging near the confluence of Cottonwood Creek on the mapped floodplain. After plotting the profile of the newly surveyed cross sections, it was evident there was existing sediment deposits (3+ ft) at and near the confluence that was creating a flow restriction (see Figure 2). Another hydraulic simulation was performed with the HEC-RAS hydraulic computer model assuming that much of the sediment would be removed. The assumed dredged cross section used to update Cross Section 26727 in the model simulation is shown in Figure 5. The channel dimensions shown in Figure 5 were based on the adjacent model cross section geometries. The assumed new channel invert was selected to maintain the assumed natural channel slope.

The dredging scenario model results show a maximum drop in water surface elevation of 2.4 feet at the confluence of Cottonwood Creek, as illustrated in Figure 6. Also shown in Figure 6, the computed water surface elevation returns to pre-dredging depths near cross section 47895.41 (4 miles upstream). Upstream of that point the river water surface elevation and floodplain boundaries are not significantly impacted. The reduced floodplain boundaries are compared to the existing floodplain boundaries with 3,000 cfs flowing in the river in Figure 7. As Figure 7 indicates, within the channel reach where the computed water surface elevation is reduced there is a reduction to the areal extent of the floodplain adjacent to the river of about 60 acres (15 acres downstream of the Cleveland Bridge and 45 acres upstream of the bridge). This is because most of the river is contained in the main river channel at a discharge of 3,000 cfs.

It is impossible to accurately estimate the dredging volume required to achieve the condition simulated in the dredged condition model run. The HEC-RAS computer software utilizes channel geometries that are linearly interpolated in between cross sections. Using this premise, the average end area method was used to roughly estimate dredging volumes with the assumption that there would be no dredging required at the upstream and downstream cross sections. This yielded an estimated cut volume of 15,000 to 30,000 cubic yards. In order to more accurately estimate this volume a more detailed survey must be performed.

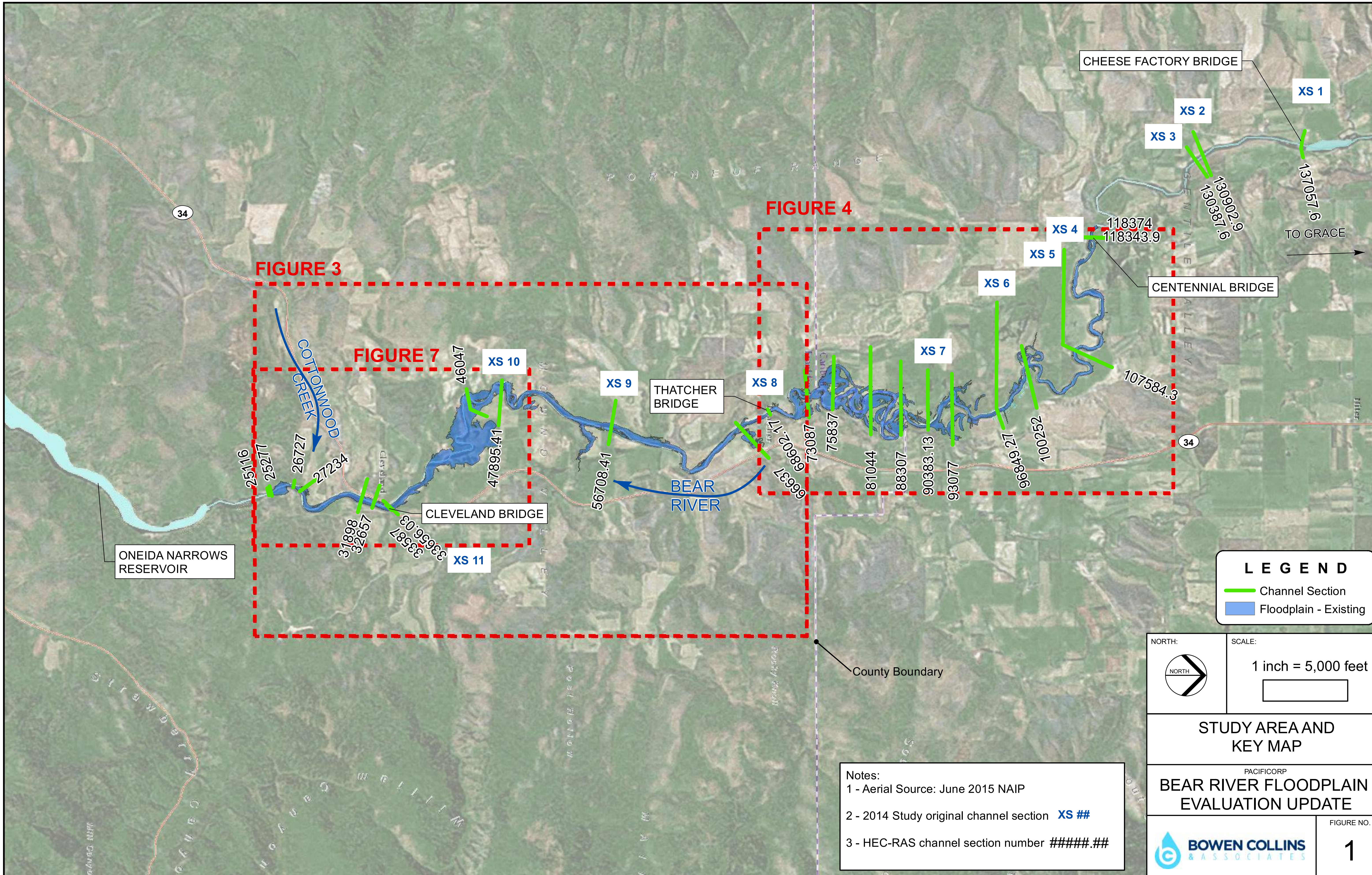
SECTION 3 – CONCLUSIONS

Updating and calibrating the HEC-RAS hydraulic computer model used in the 2014 Study with recent LiDAR and bathymetric survey has produced a floodplain boundary that closely approximate conditions that were observed and photographically documented during the 2017 flood of approximately 3,000 cfs (2,500 cfs release from the Soda Power Plant) in the study area.

The model analysis used to simulate the potential effects of dredging sediment deposits in the Bear River near the confluence of Cottonwood Creek indicates that only a minor reduction to the floodplain would be experienced if dredging is performed.

The results of this analysis are intended to give PacifiCorp an approximation of the limits of the floodplain boundaries during a 3,000 cfs flood event with the existing channel conditions and location. While a more detailed analysis may produce slightly different floodplain extents, we believe the HEC-RAS model was calibrated well and the resulting floodplain provides a reasonable magnitude of inundated areas.

FIGURES



NORTH:

SCALE:

1 inch = 5,000 feet

STUDY AREA AND KEY MAP

PACIFICORP

BEAR RIVER FLOODPLAIN EVALUATION UPDATE

FIGURE NO.

1

BOWEN COLLINS & ASSOCIATES

Notes:

1 - Aerial Source: June 2015 NAIP

2 - 2014 Study original channel section XS ##

3 - HEC-RAS channel section number #####.##

P:\PacifiCorp\166-17-03 Bear River Floodplain\4.0 GIS\4.1 Projects\Tech Memo Figures\Figure 1.mxd tseamons 10/25/2017

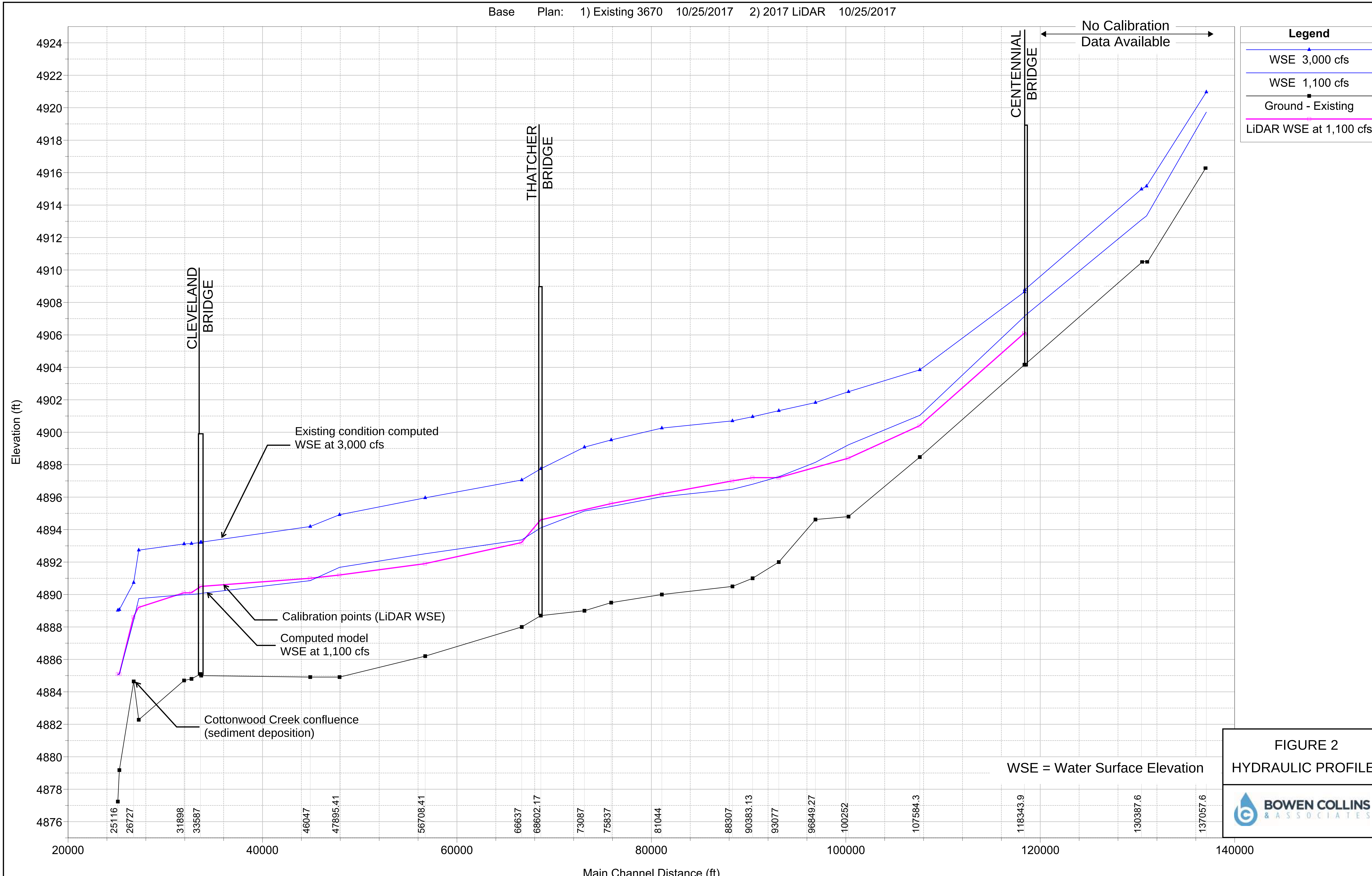
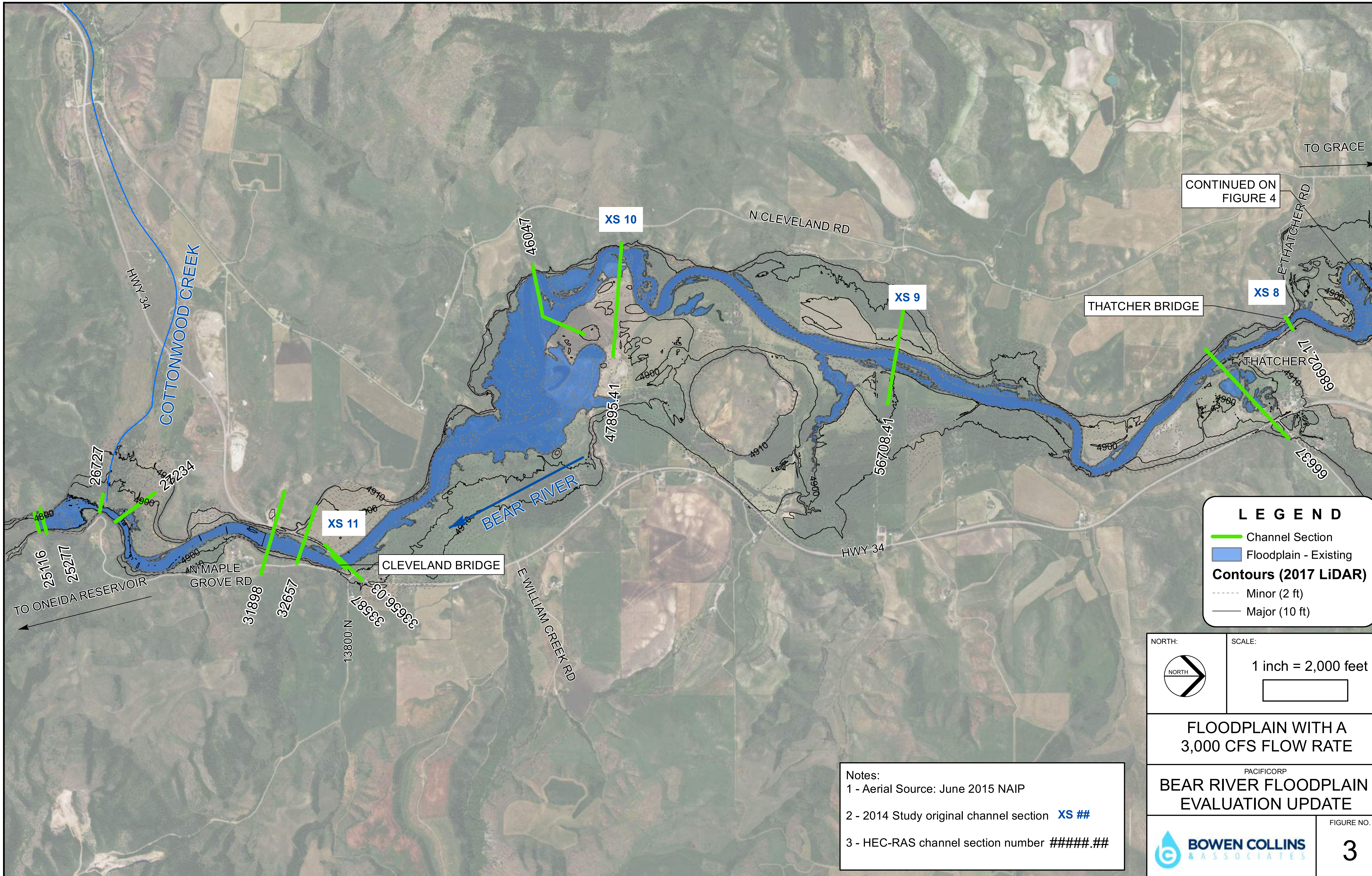
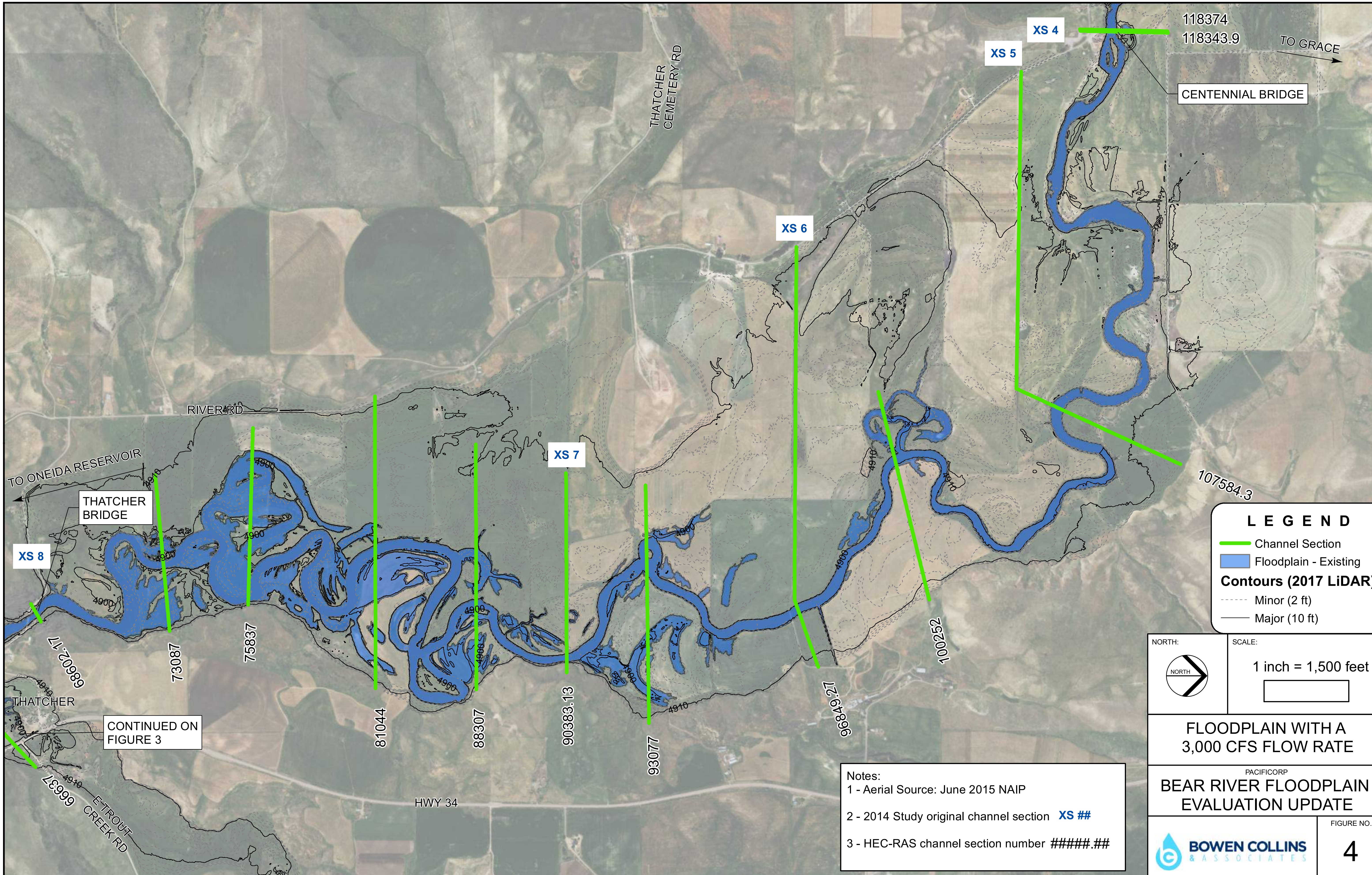


FIGURE 2
HYDRAULIC PROFILE
BOWEN COLLINS & ASSOCIATES



P:\PacifiCorp\166-17-03 Bear River Floodplain\4.0 GIS\4.1 Projects\Tech Memo Figures\Figure 3.mxd tseamons 10/25/2017



Notes:
1 - Aerial Source: June 2015 NAIP
2 - 2014 Study original channel section XS ##
3 - HEC-RAS channel section number #####.##

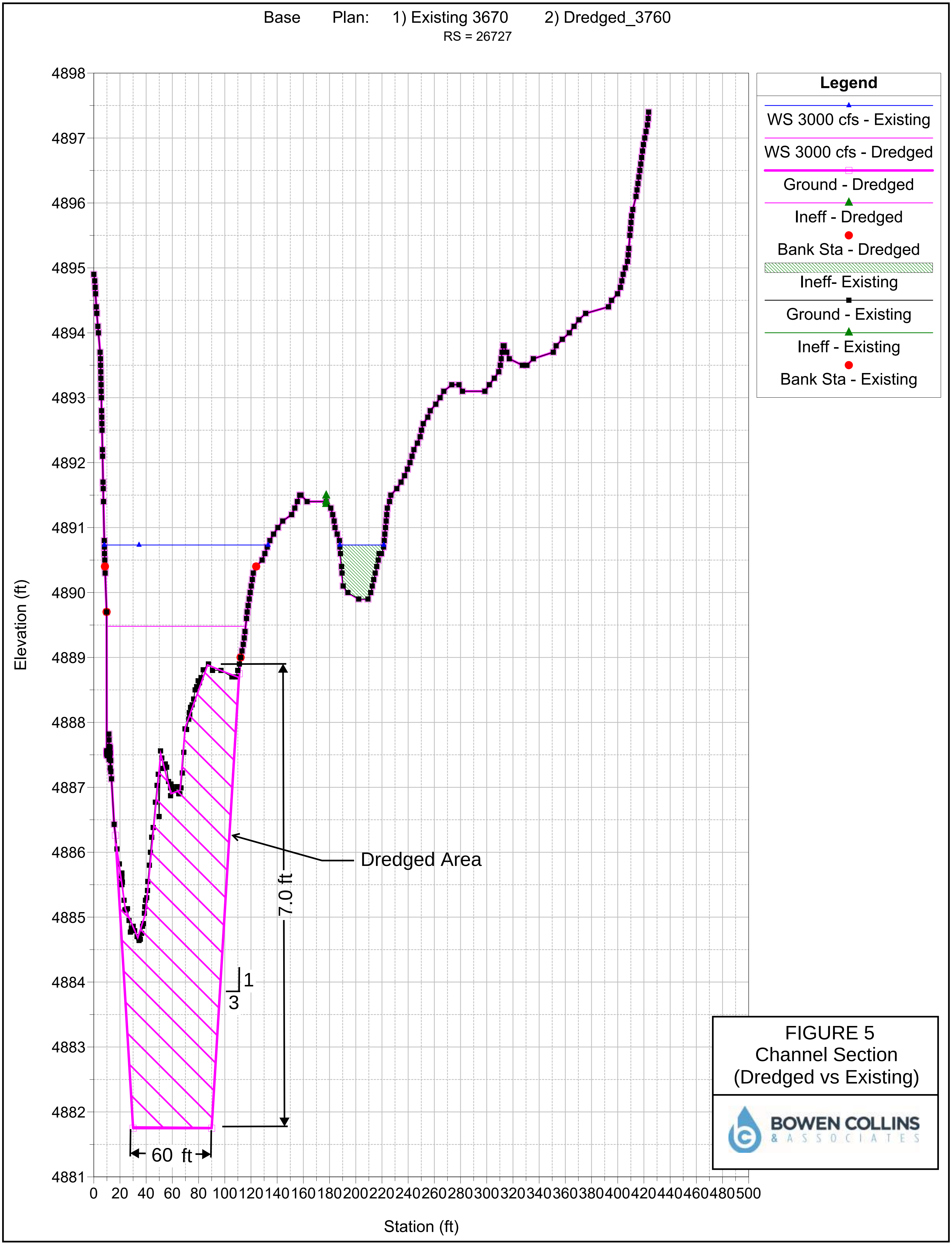
FLOODPLAIN WITH A 3,000 CFS FLOW RATE

PACIFICORP
BEAR RIVER FLOODPLAIN EVALUATION UPDATE

BOWEN COLLINS & ASSOCIATES

FIGURE NO.
4

P:\PacifiCorp\166-17-03 Bear River Floodplain\4.0 GIS\4.1 Projects\Tech Memo Figures\Figure 4.mxd tseamons 10/25/2017



Base Plan: 1) Existing 3670 2) Dredged_3760
RS = 26727
Legend
WS 3000 cfs - Existing
WS 3000 cfs - Dredged
Ground - Dredged
Ineff - Dredged
Bank Sta - Dredged
Ineff- Existing
Ground - Existing
Ineff - Existing
Bank Sta - Existing
Elevation (ft)
4898
4897
4896
4895
4894
4893
4892
4891
4890
4889
4888
4887
4886
4885
4884
4883
4882
4881
Dredged Area
7.0 ft
1
3
60 ft
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500
Station (ft)
FIGURE 5
Channel Section
(Dredged vs Existing)
BOWEN COLLINS & ASSOCIATES

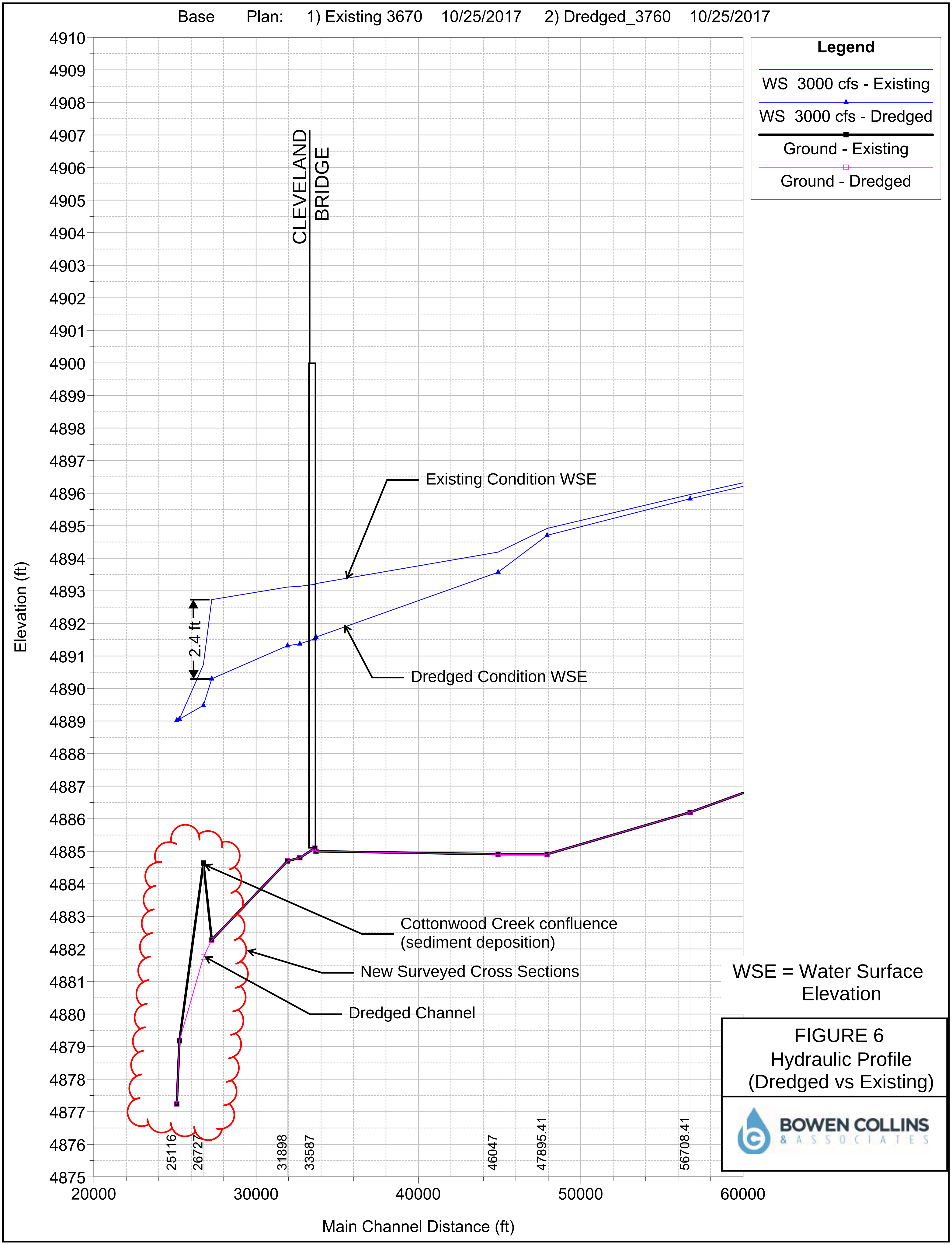
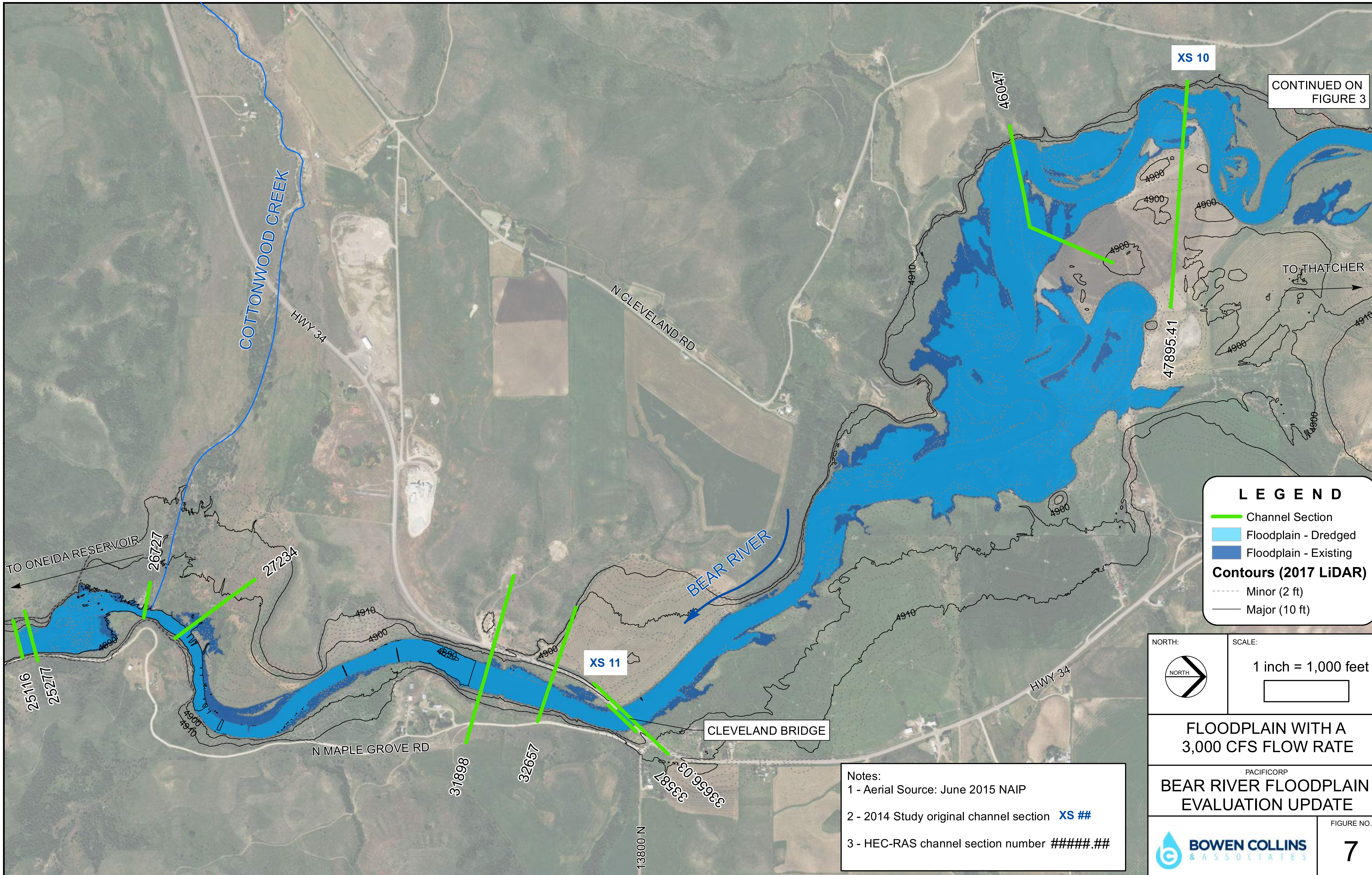


FIGURE 6
Hydraulic Profile
(Dredged vs Existing)

BOWEN COLLINS & ASSOCIATES



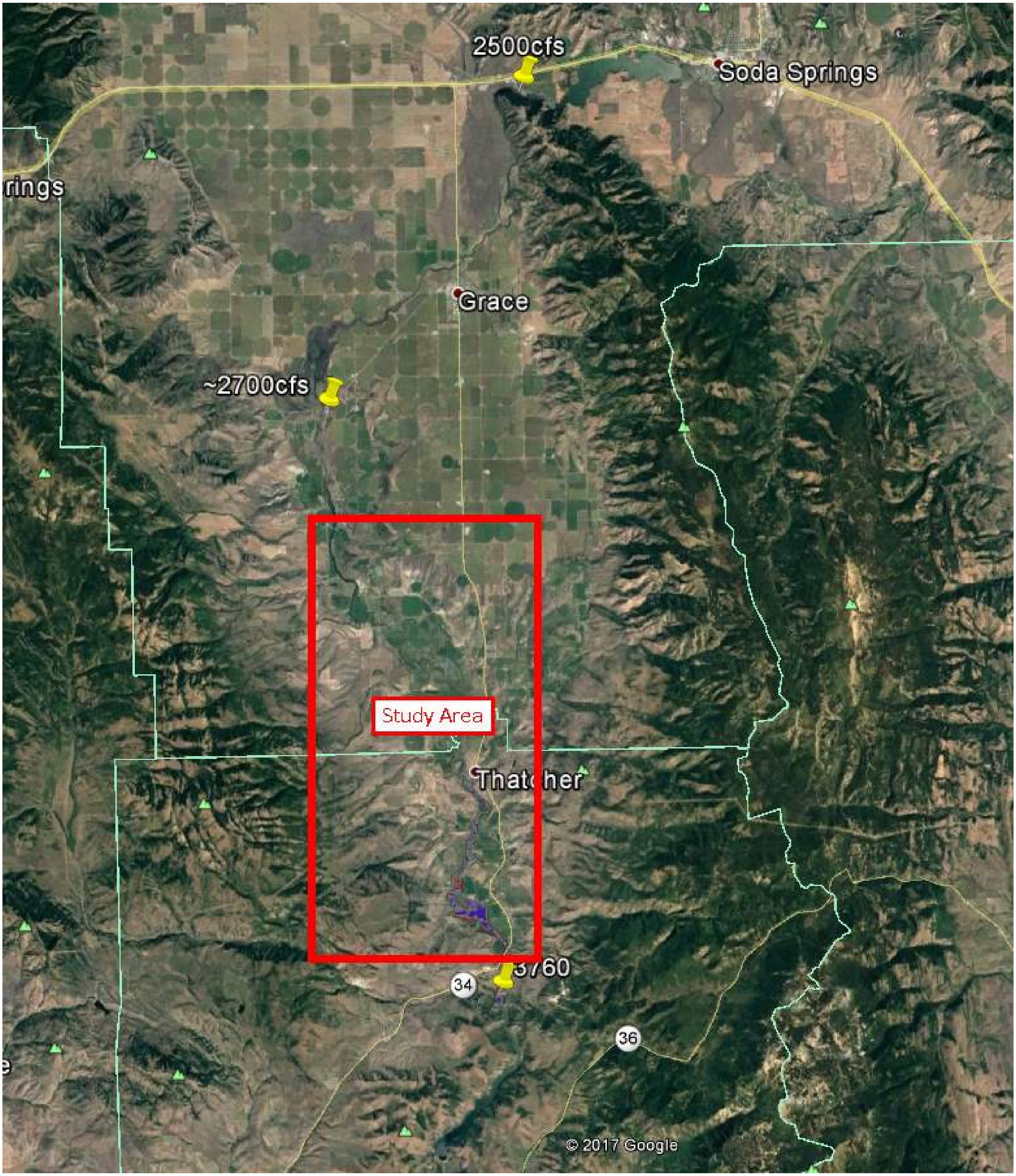
P:\PacifiCorp\166-17-03 Bear River Floodplain\4.0 GIS\4.1 Projects\Tech Memo Figures\Figure 7.mxd tseamons 10/25/2017

APPENDIX A

SUPPORTING DATA

Samples of Photos used in the model calibration process

Basis of Flow Data



Project Identification

Job #: *170002* Job Name: *Bear River Hydroelectric Project*
Job Location: *SE Idaho - North Central Utah*
Job Bounds *(WGS84 decimal degrees)* : North Latitude: *42.671000*
West Longitude: *-112.247000* East Longitude: *-111.602000*
South Latitude: *41.448000*
Job Type: *Mapping & Orthophotography*

Data shipped to: *WEST Consultants, Inc.*
Contact: *Christopher Goodell* Phone: *503-946-8536* Email: *cgoodell@westconsultants.com*
Address: *10300 SW Greenburg Road, Suite 470*
City: *Portland* State: *OR* Zip: *97223*

Project invoiced to: *WEST Consultants, Inc.*
Contact: *Christopher Goodell* Phone: *503-946-8536* Email: *cgoodell@westconsultants.com*
Address: *10300 SW Greenburg Road, Suite 470*
City: *Portland* State: *OR* Zip: *97223*

Client technical contact:
Name: *Christopher Goodell* Phone: *503-946-8536* Email: *cgoodell@westconsultants.com*
Address: *10300 SW Greenburg Road, Suite 470* City: *Portland* State: *OR* Zip: *97223*
Project boundary source: *Client*
Project boundary approved by: *Client*

Scope of services approved by:
Name: *Christopher Goodell* Phone: *503-946-8536* Email: *cgoodell@westconsultants.com*
Address: *10300 SW Greenburg Road, Suite 470* City: *Portland* State: *OR* Zip: *97223*
Notes:

Data Sources

Final products by: *GeoTerra, Inc.*
Contact: *Brad Hille* Phone: *503-239-6010* Email: *bhille@geoterra.us*
Address: *7816 SE 13th Avenue* City: *Portland* State: *OR* Zip: *97202*

Aerial photography by: *GeoTerra, Inc.*
Contact: *Bruce Bergman* Phone: *503-239-6010* Email: *bbergman@geoterra.us*
Address: *7816 SE 13th Avenue* City: *Portland* State: *OR* Zip: *97202*
ABGPS / IMU by: *GeoTerra, Inc.*
Contact: *Bruce Bergman* Phone: *503-239-6010* Email: *bbergman@geoterra.us*
Address: *7816 SE 13th Avenue* City: *Portland* State: *OR* Zip: *97202*
Ground survey by: *Harper-Leavitt Engineering, Inc.*
Contact: *Chris Street* Phone: *208-785-2977* Email: *cstreet@hleinc.com*
Address: *800 W. Judicial Street* City: *Blackfoot* State: *ID* Zip: *83221*
Ground survey coordinated by: *Client*
Notes:

Project Specifications:

170002

Aerial Photography: Flown on: *23-Jun-17* using digital aerial camera number: *10411033*
Camera Type: *Vexcel UltraCam XP* Focal Length: *100.500 mm* Pixel size: *6.0 microns*
Computed Median Ground Sample Distance (GSD): *29.464 cm* *0.967 feet*
lines: *20* # exp: *500* End lap: *60%* Side lap: *30%*
Imagery is *RGB* and was flown with: *ABGPS & IMU*
Aerial Triangulation approved by:
Gordon Peet; ASPRS Certified Photogrammetrist #1252; Oregon Registered Professional Photogrammetrist #80291RPP
Map Scale: *1"=200'* Contour Interval: *5.0'*
Orthophotos: Pixel size: *1.00'* # tiles: *503*
Data Controlled by: *Surveyed targets*
Horizontal Datum: *NAD83 (2011)* Vertical Datum: *NAVD 88*
Coordinate System: *UTM* State: *N/A* Zone: *12* Units: *US Survey feet*
Coordinates are standard grid coordinates
This data has been photogrammetrically compiled to meet National Map Accuracy Standards as shown below:
Note: data in areas covered by dense trees or shadows may not meet these standards.
Horizontal Accuracy: At a map scale of 1"=200' not more than 10% of all well-defined planimetric features are in error by more than 4.0'
Vertical Accuracy: Contour interval: *5.0'*
Not more than 10% of all vertical points are in error by more than 1/2 the above contour interval.
Orthophoto Accuracy: These orthophotos were designed for optimal viewing at 1"=200' scale. Performing quality control or plotting images at scales larger than 1"=100' is not recommended. Anomalies observable only at scales larger than 1"=100' are considered to fall outside the specifications of this project.
IMPORTANT NOTE: Field verification of data accuracy should occur prior to design level tasks that are dependent on this data.
Project performed under the supervision of:
Brad Hille; ASPRS Certified Photogrammetric Technician #1291PT; Oregon Registered Professional Photogrammetrist #80317RPP
Miscellaneous Notes:

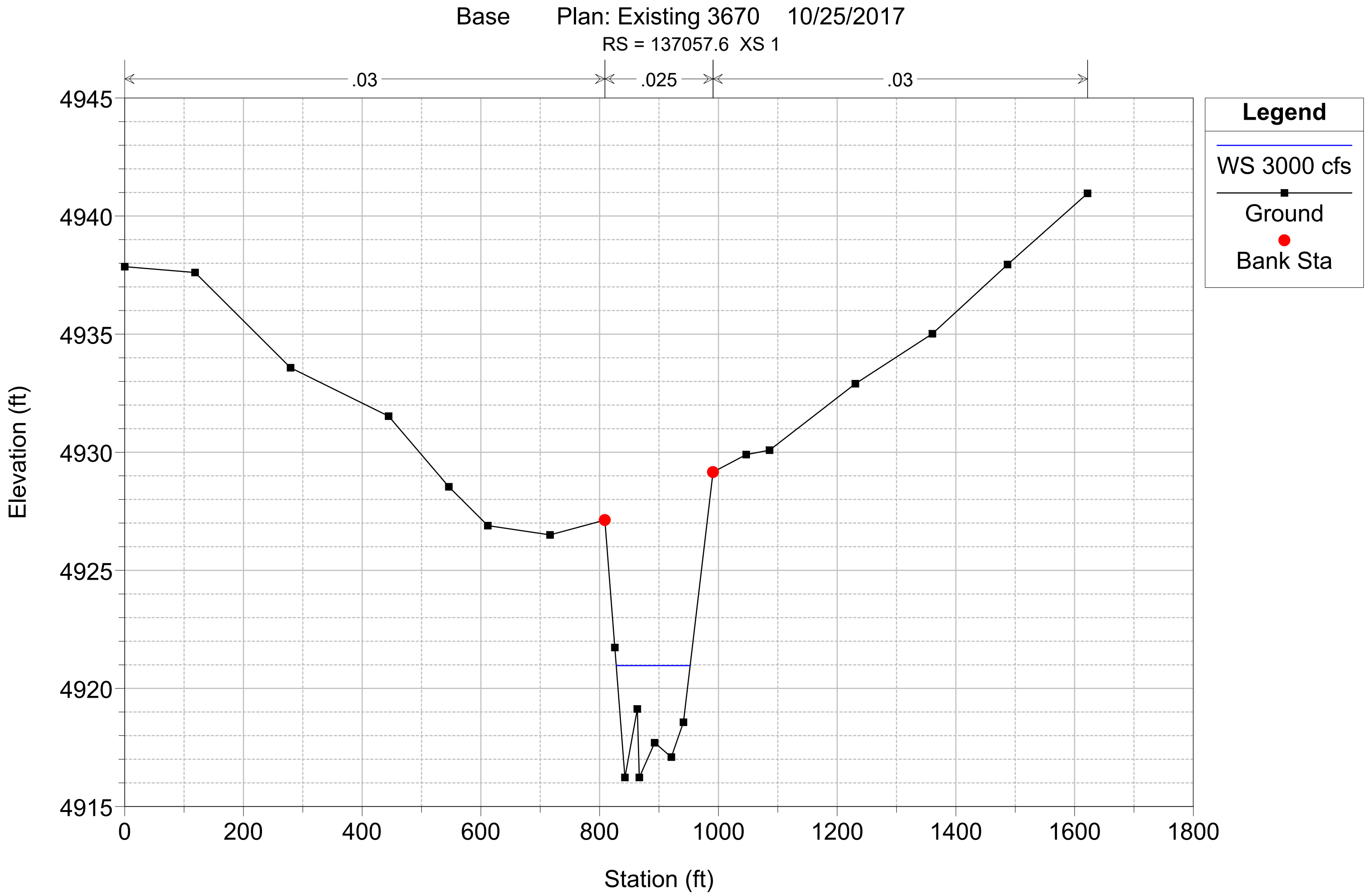
Products Delivered:

- *2' Contours from Ground Classified LiDAR in ArcGIS Geodatabase format*
- *1 foot Bare Earth Raster in ArcGIS Geodatabase format*
- *Terrain dataset in ArcGIS Geodatabase format*
- *Classified (ground/non-ground) in .LAZ format*
- *SBET trajectories in shapefile format*
- *1.0' pixel resolution, 4-band RGBir orothophotography in uncopressed TIF/TFW format*
- *20:1 MrSID compressed, 4-band RGBir orthophotography tiles and mosaic in SID/SDW format*
- *Tile Indexes in shapefile format*
- *Survey Control Data in CSV, JPG & PDF format*
- *Flight index in ACAD DWG format*
- *Metadata Report in Standarad GeoTerra PDF format*

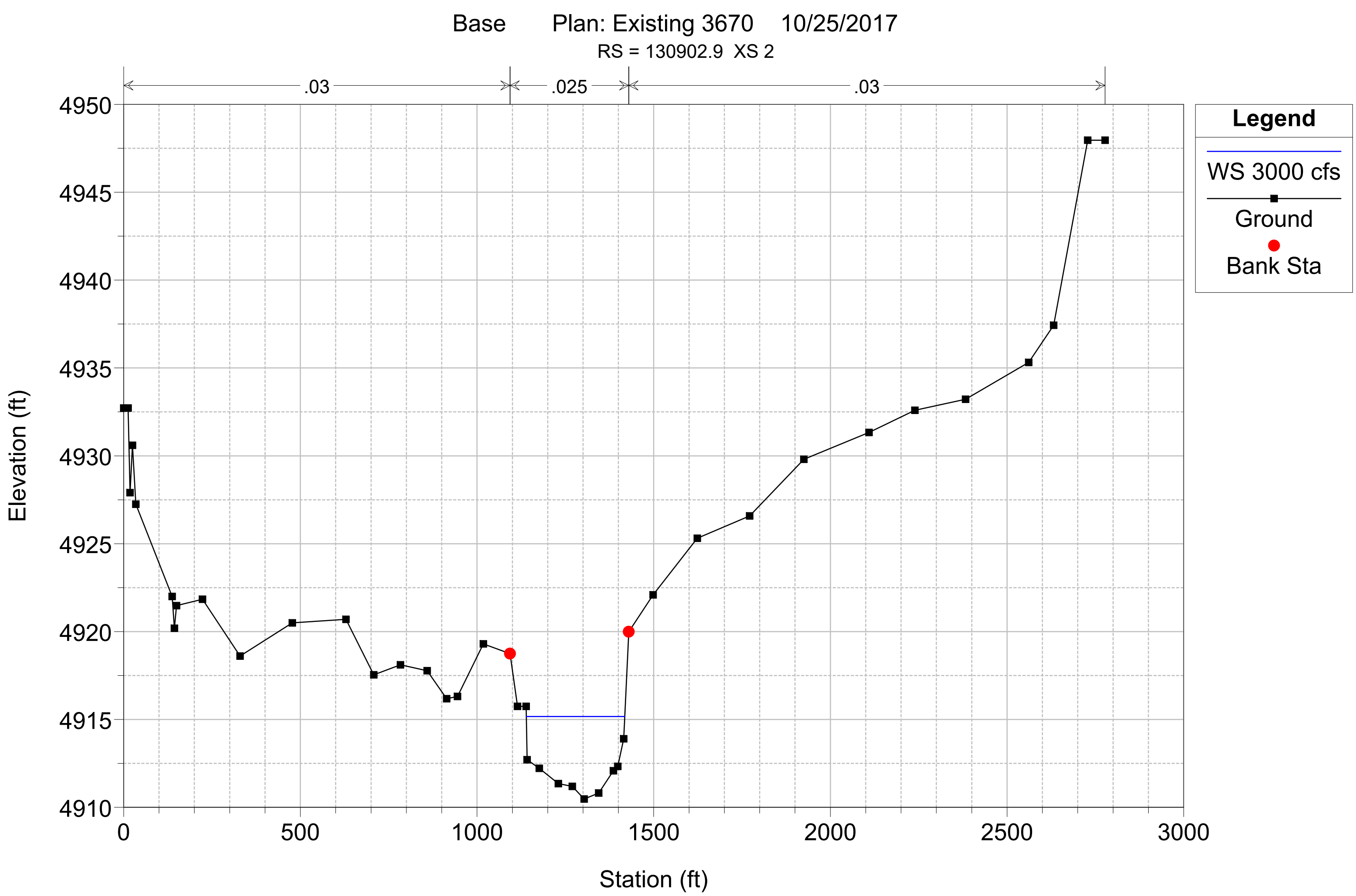
Metadata prepared by: *CO*
Metadata checked by: *SK*

APPENDIX B

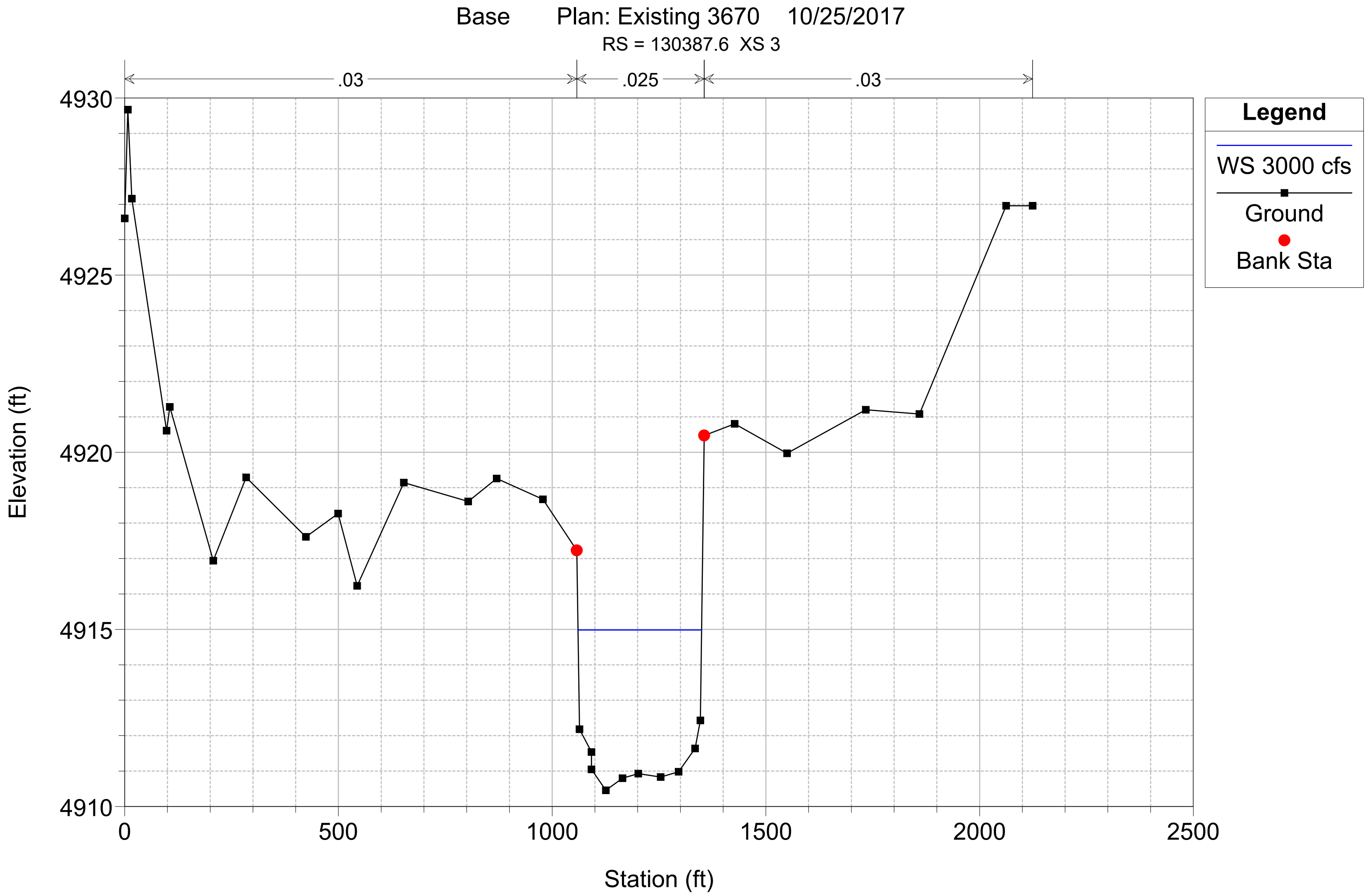
HEC-RAS CROSS SECTIONS

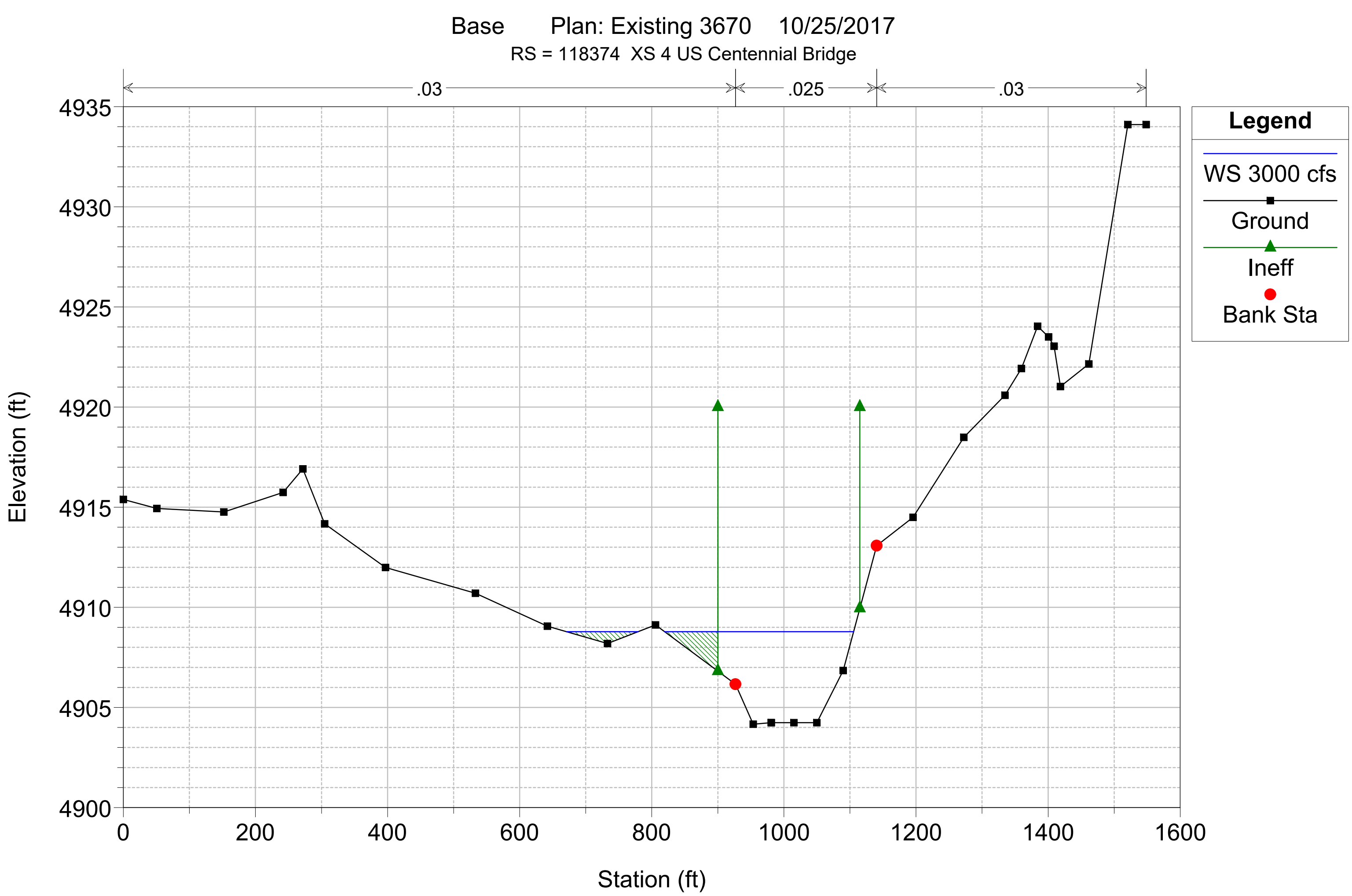


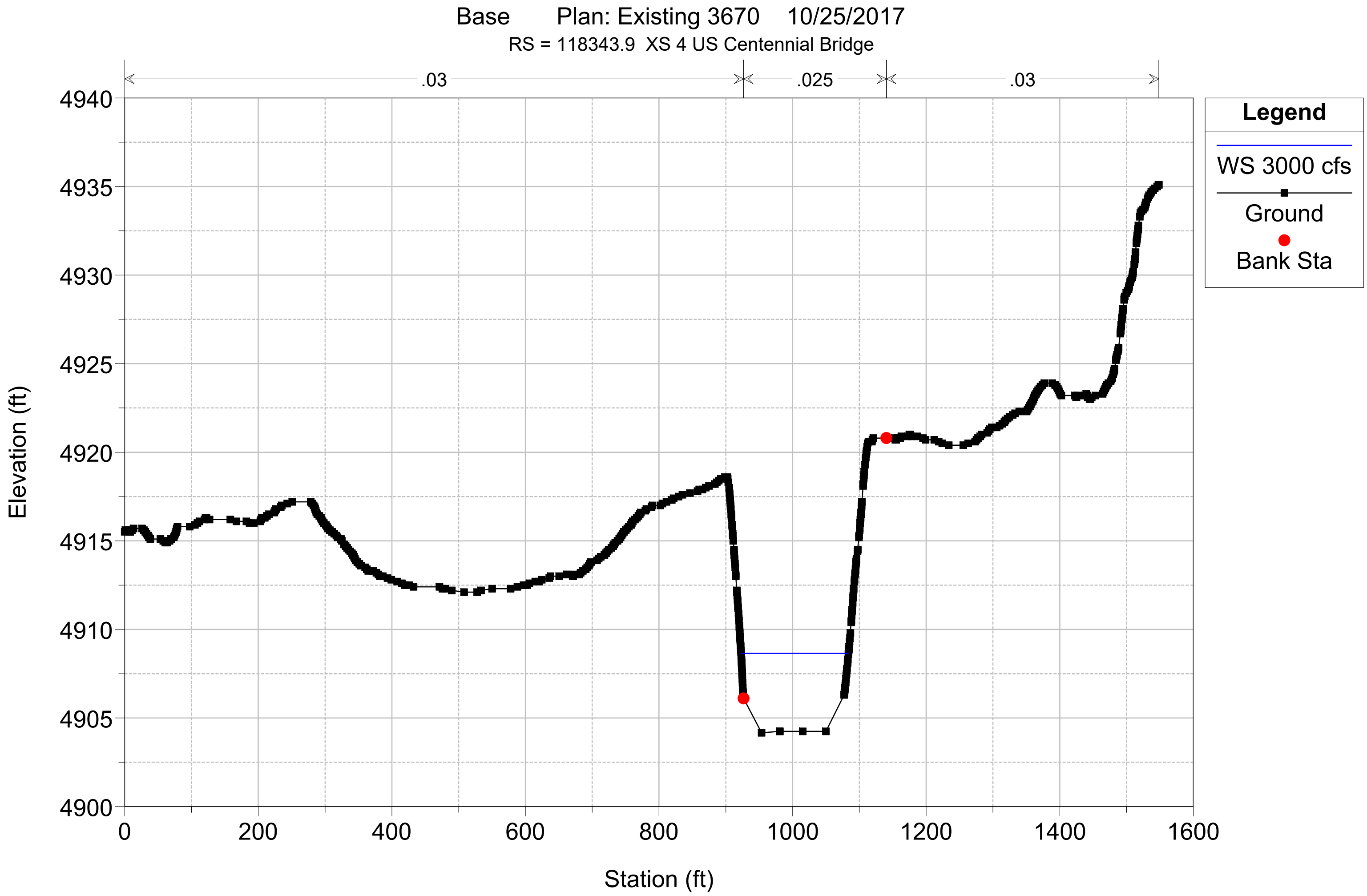
Base Plan: Existing 3670 10/25/2017
RS = 137057.6 XS 1
.03
.025
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
Station (ft)
4945
4940
4935
4930
4925
4920
4915
0
200
400
600
800
1000
1200
1400
1600
1800

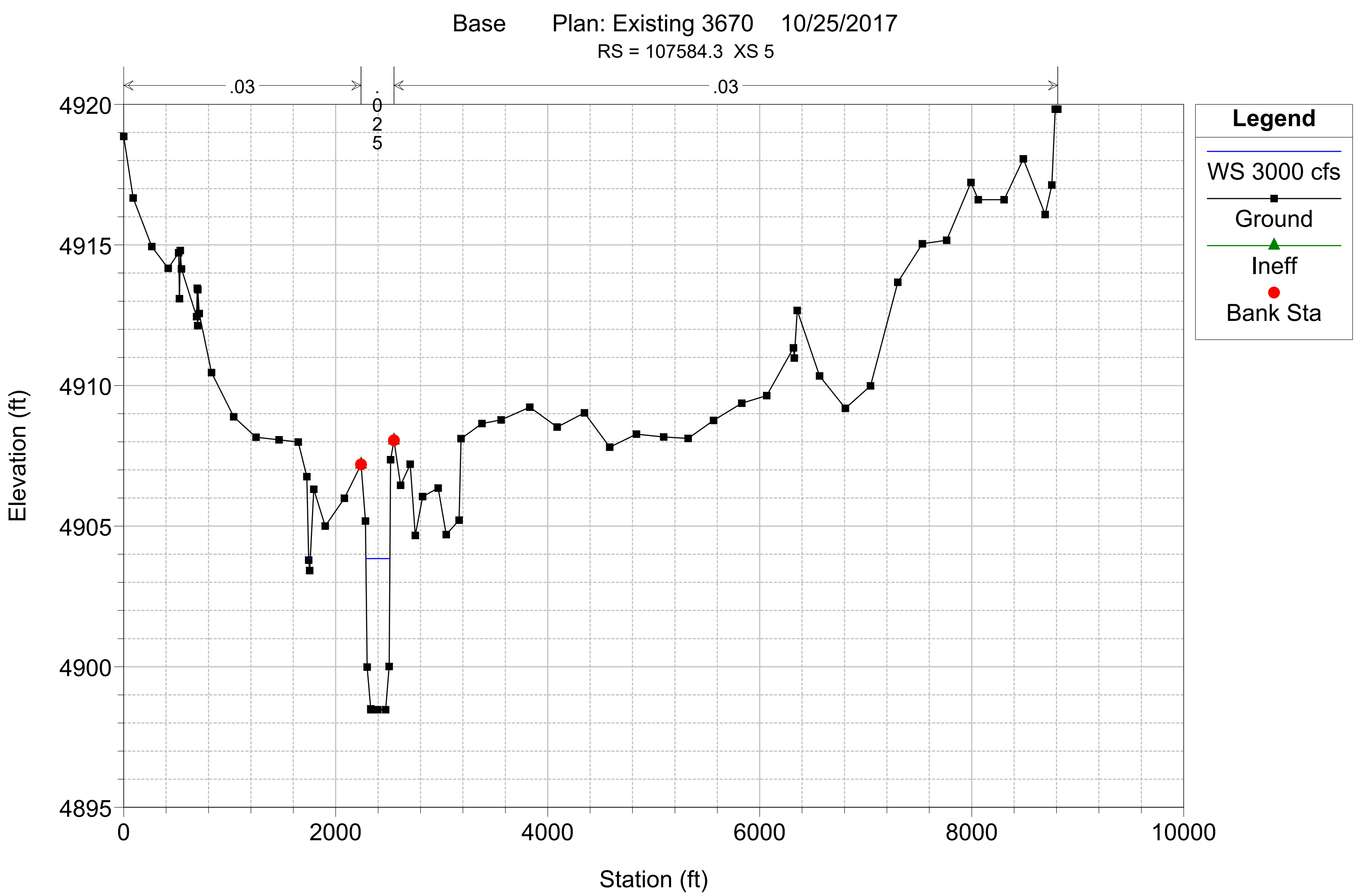


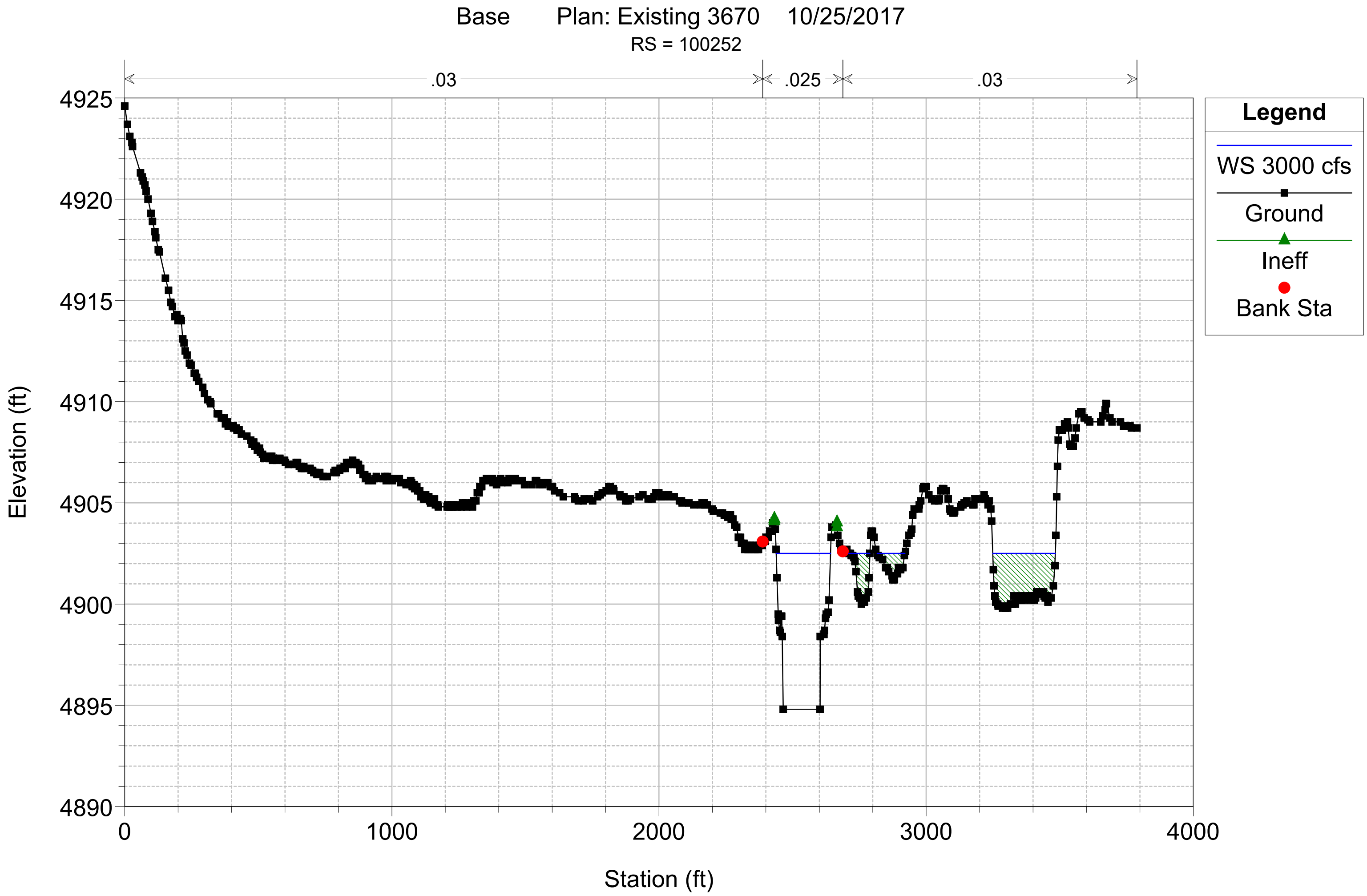
Base Plan: Existing 3670 10/25/2017
RS = 130902.9 XS 2
.03
.025
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
Station (ft)
4950
4945
4940
4935
4930
4925
4920
4915
4910
0
500
1000
1500
2000
2500
3000

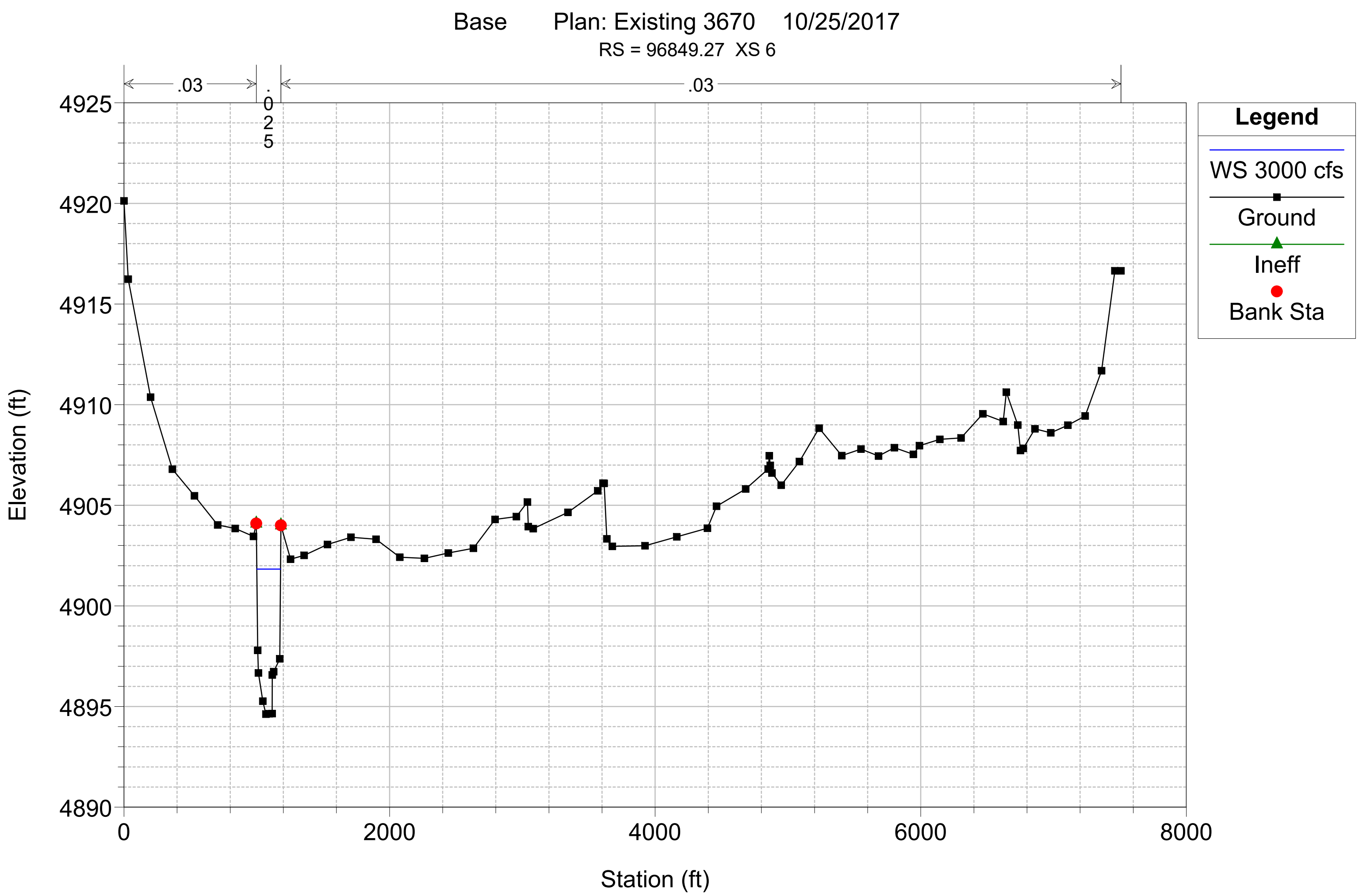

Base Plan: Existing 3670 10/25/2017
RS = 130387.6 XS 3
.03
.025
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
Station (ft)
4910
4915
4920
4925
4930
0
500
1000
1500
2000
2500

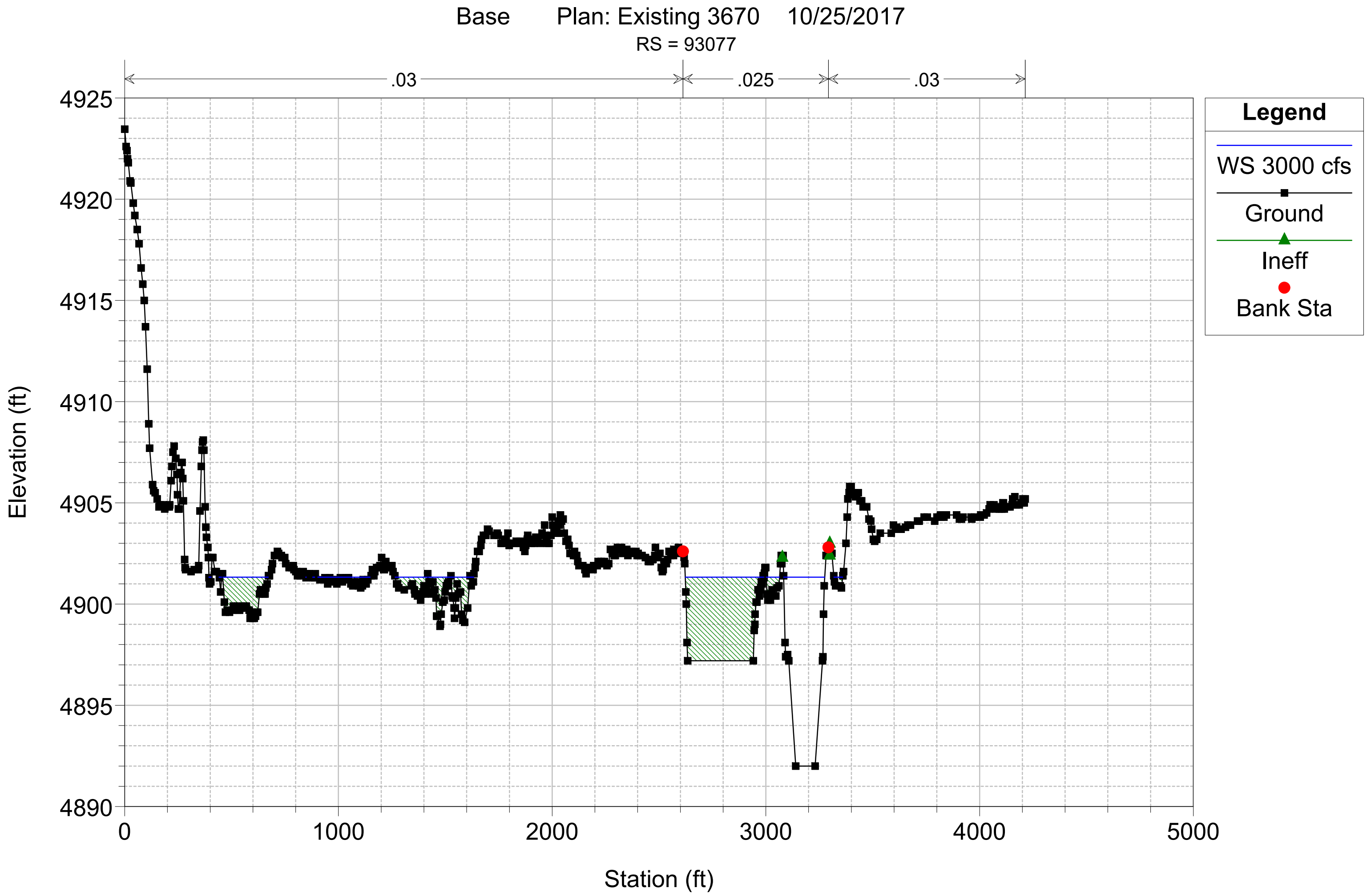

Base Plan: Existing 3670 10/25/2017
RS = 118374 XS 4 US Centennial Bridge
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4900
4905
4910
4915
4920
4925
4930
4935
0
200
400
600
800
1000
1200
1400
1600


Base Plan: Existing 3670 10/25/2017
RS = 118343.9 XS 4 US Centennial Bridge
.03
.025
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
4940
4935
4930
4925
4920
4915
4910
4905
4900
0
200
400
600
800
1000
1200
1400
1600
Station (ft)

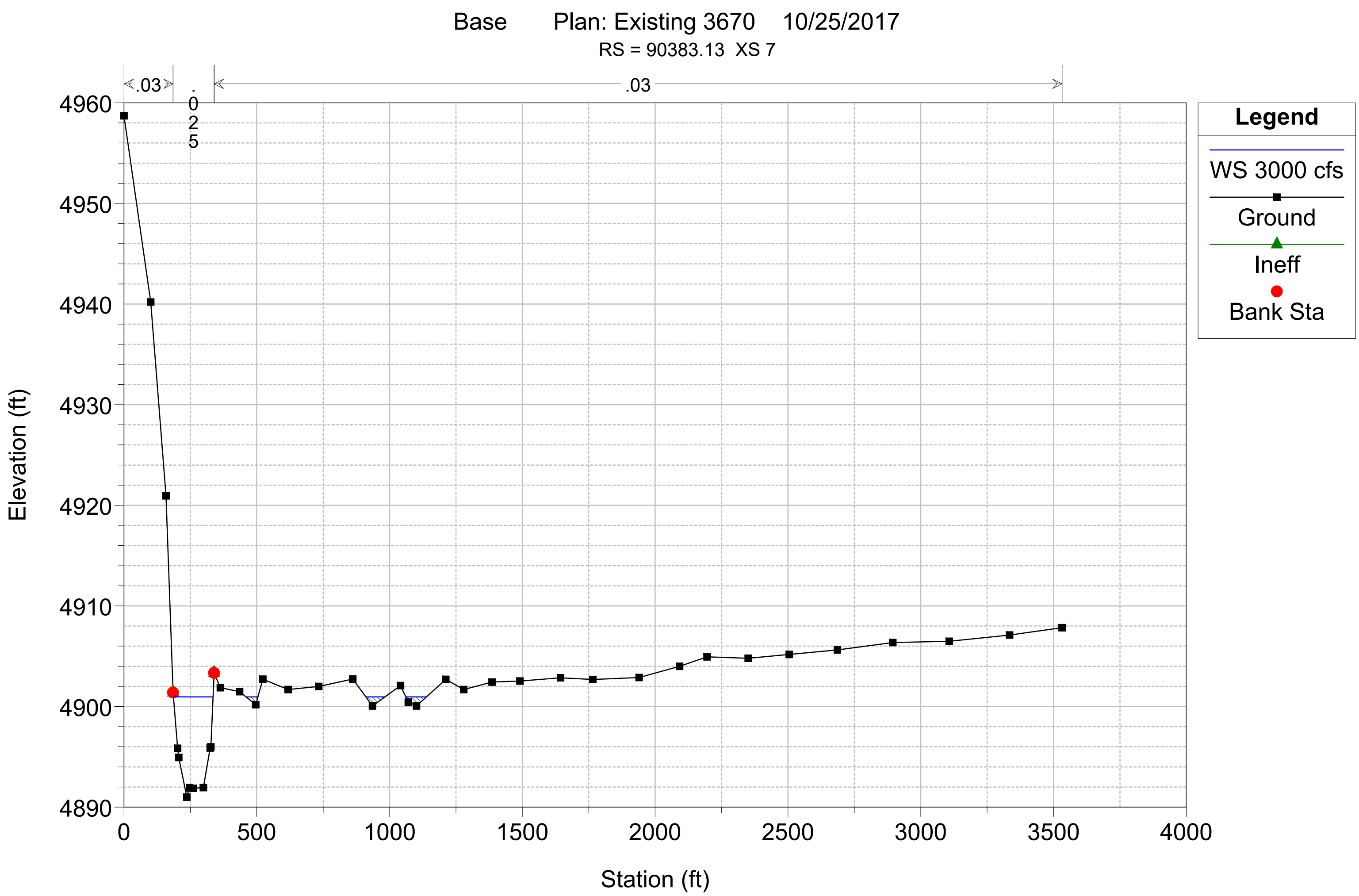

Base Plan: Existing 3670 10/25/2017
RS = 107584.3 XS 5
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
4920
4915
4910
4905
4900
4895
0
2000
4000
6000
8000
10000
Station (ft)


Base Plan: Existing 3670 10/25/2017
RS = 100252
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4925
4920
4915
4910
4905
4900
4895
4890
0
1000
2000
3000
4000

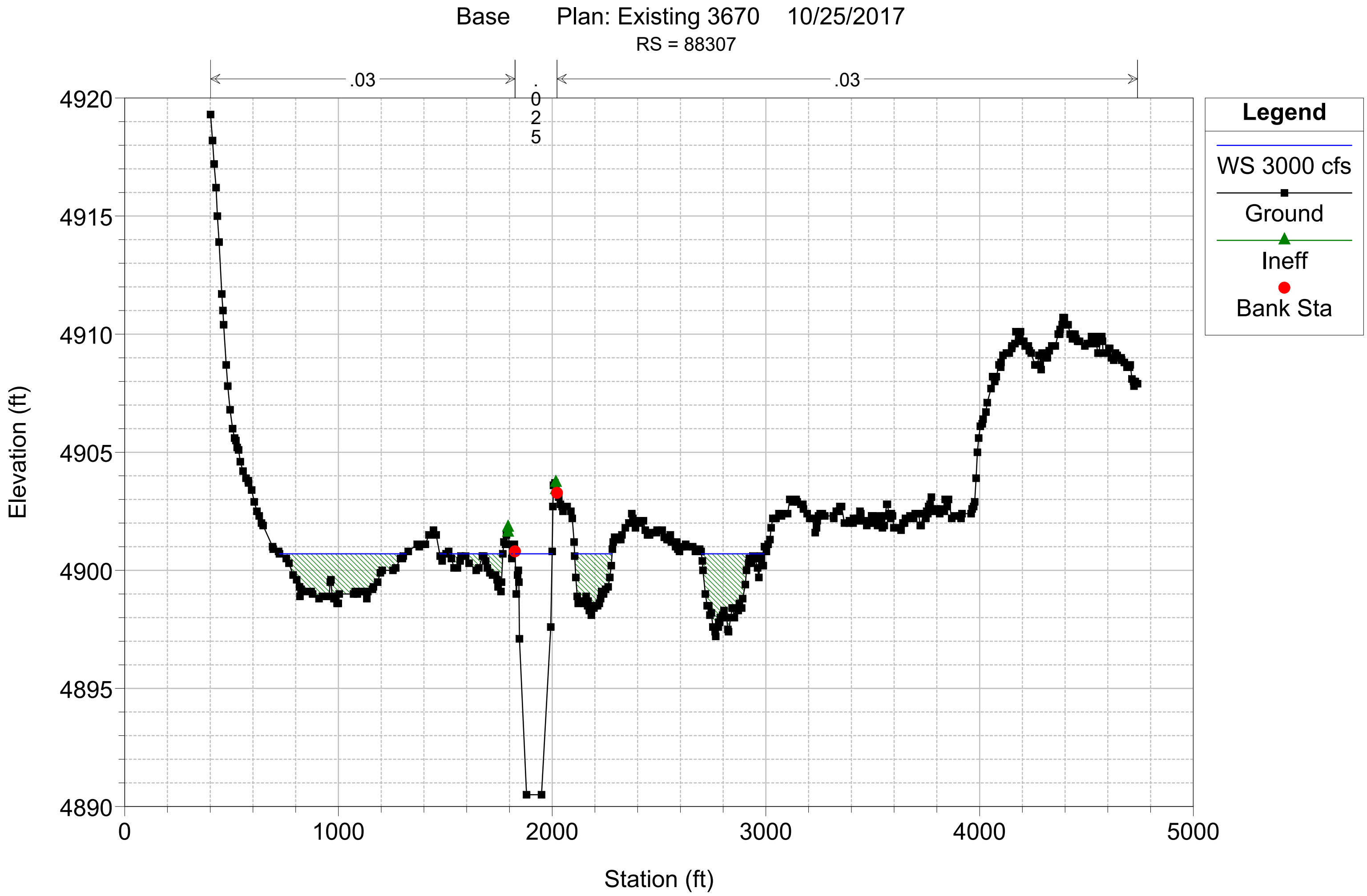

Base Plan: Existing 3670 10/25/2017
RS = 96849.27 XS 6
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4925
4920
4915
4910
4905
4900
4895
4890
0
2000
4000
6000
8000



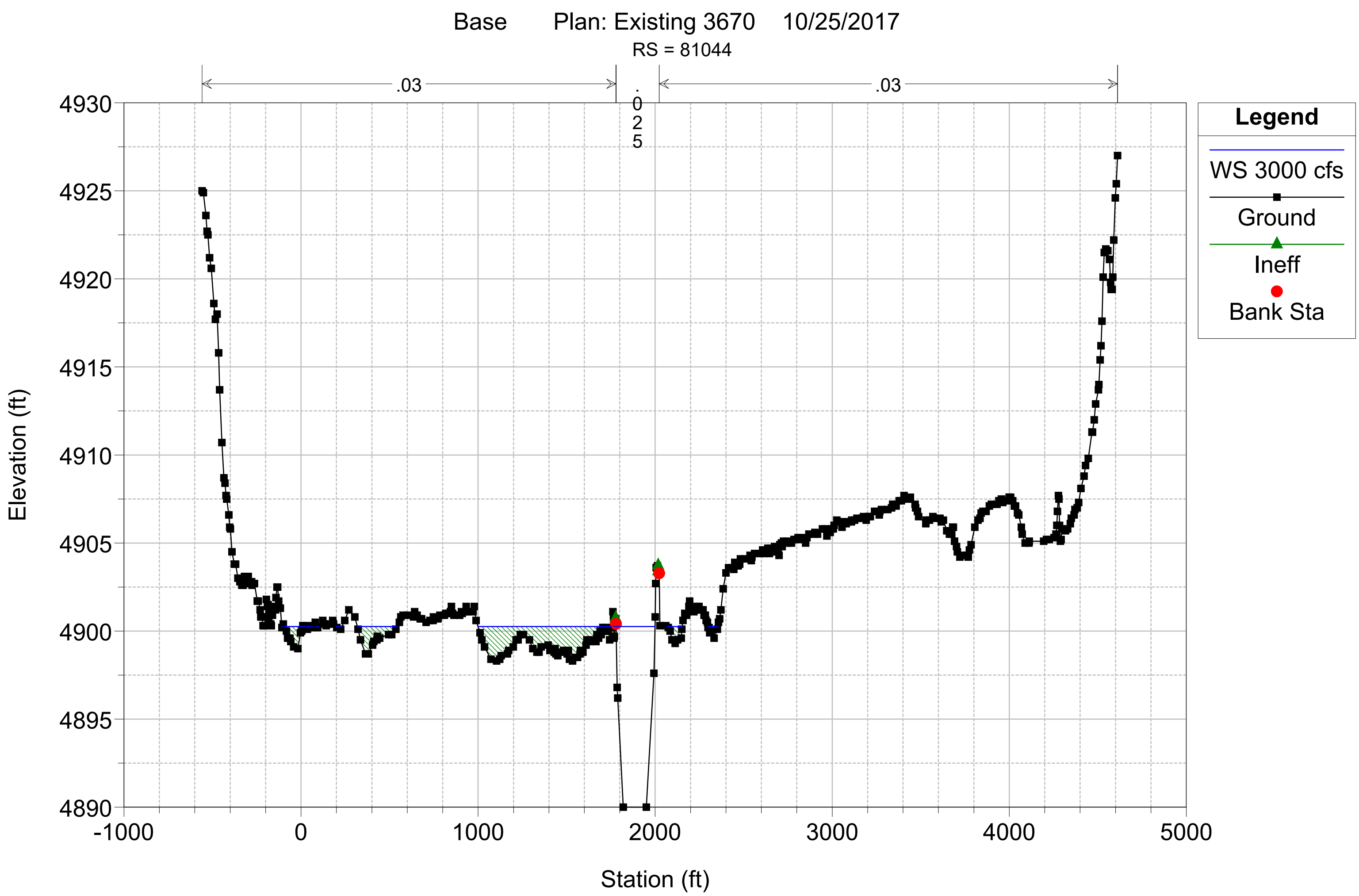
Base Plan: Existing 3670 10/25/2017
RS = 93077
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4925
4920
4915
4910
4905
4900
4895
4890
0
1000
2000
3000
4000
5000



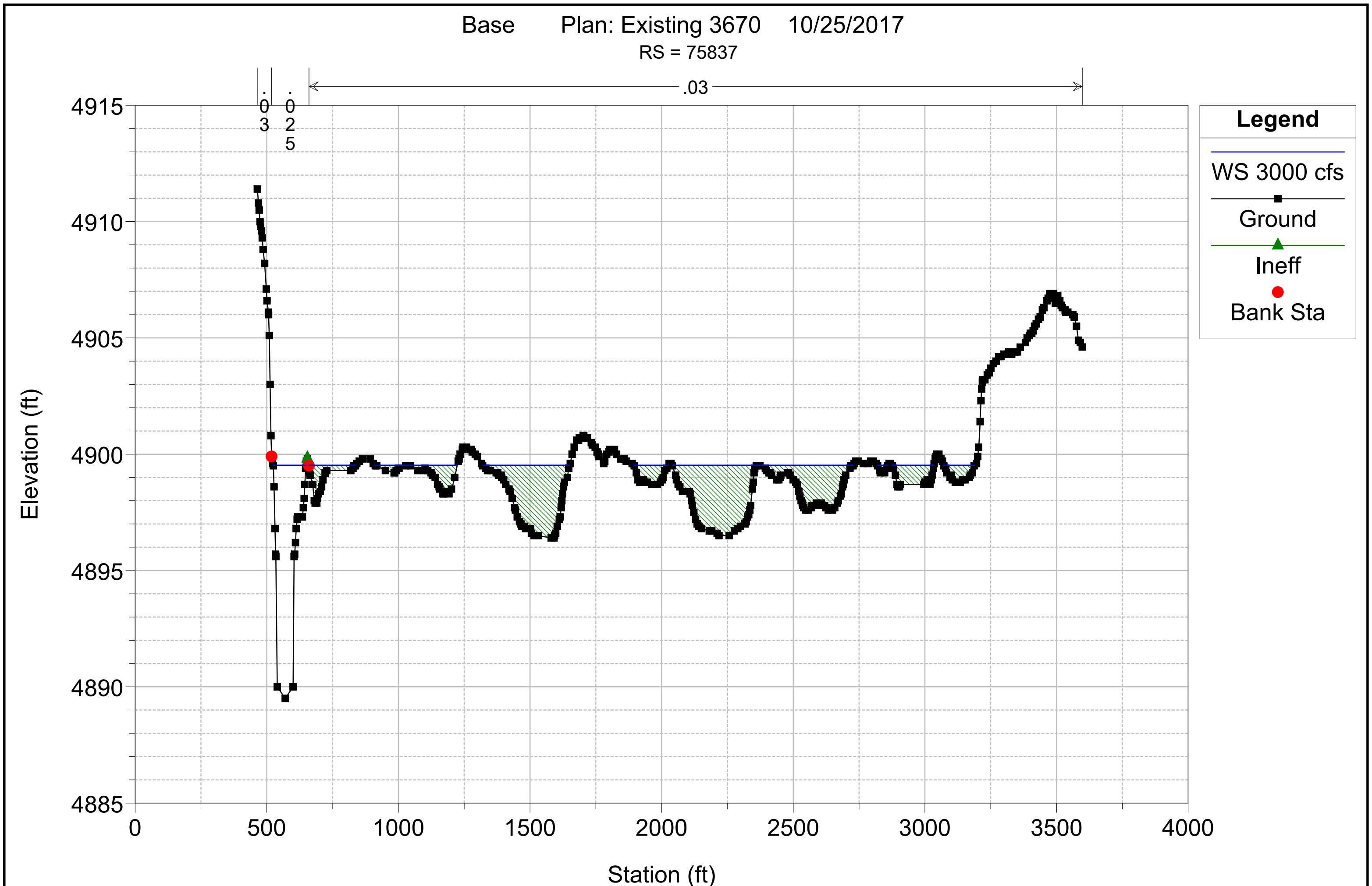
Base Plan: Existing 3670 10/25/2017
RS = 90383.13 XS 7
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4960
4950
4940
4930
4920
4910
4900
4890
0
500
1000
1500
2000
2500
3000
3500
4000



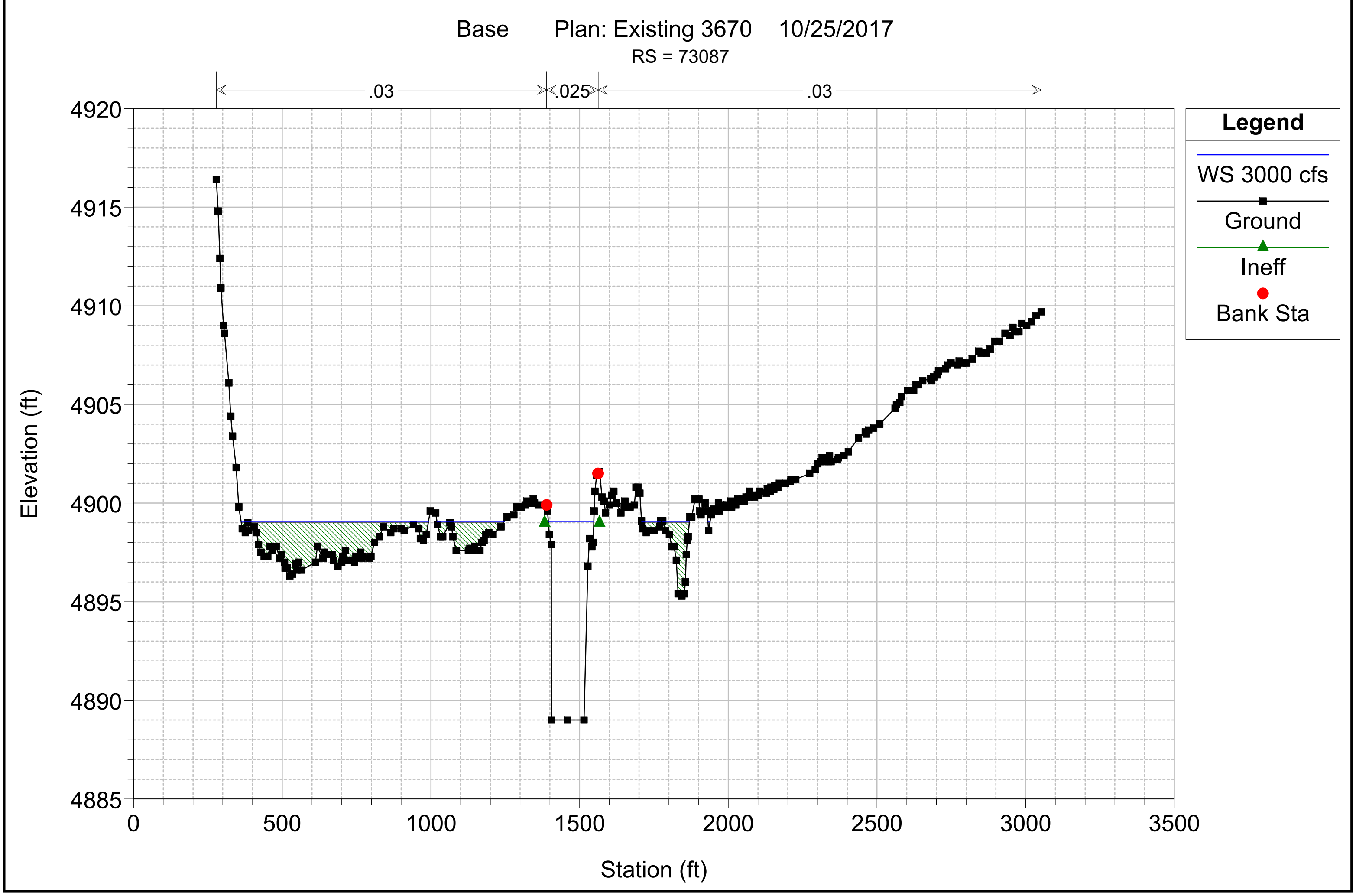
Base Plan: Existing 3670 10/25/2017
RS = 88307
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



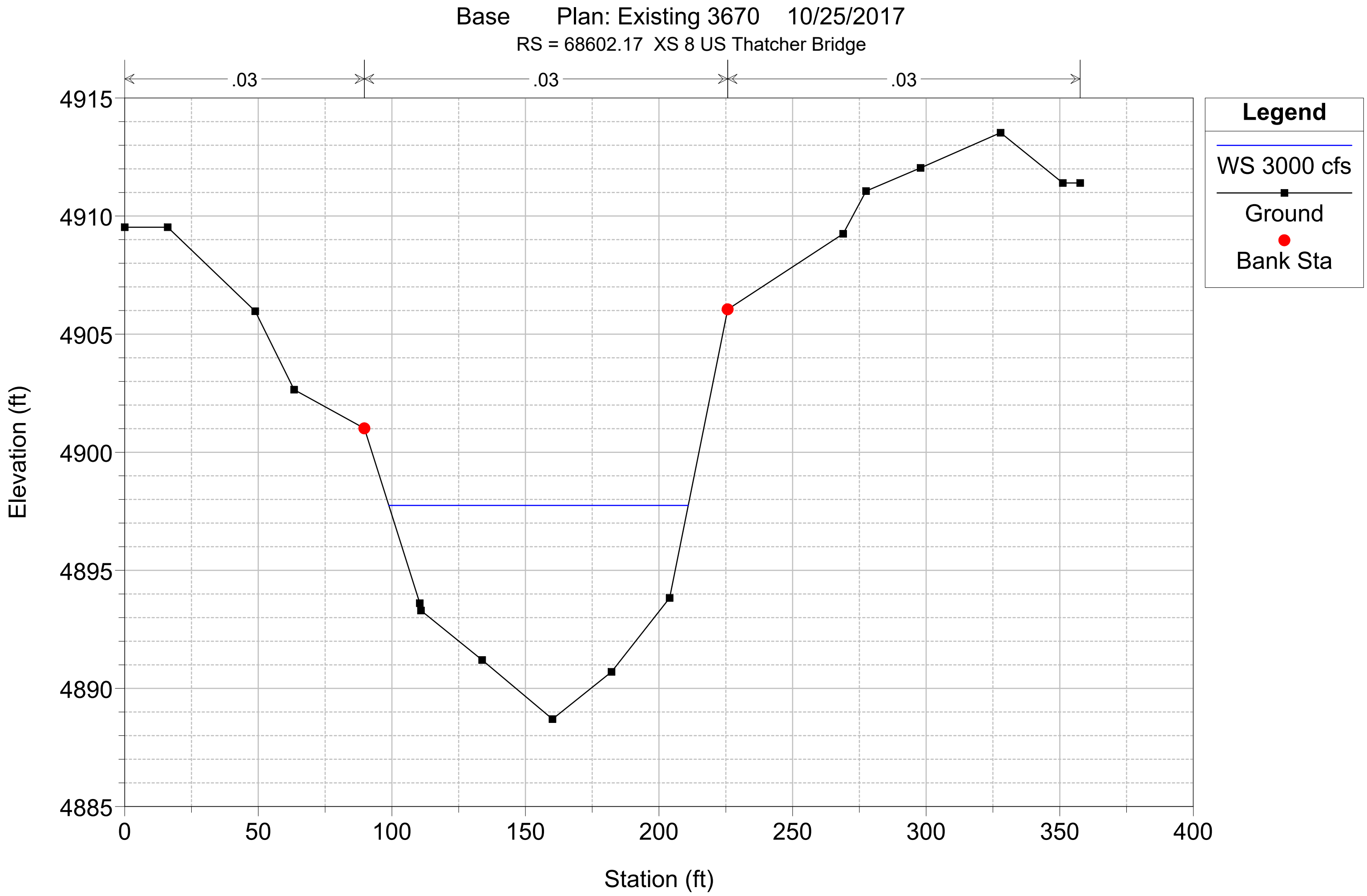
Base Plan: Existing 3670 10/25/2017
RS = 81044
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)



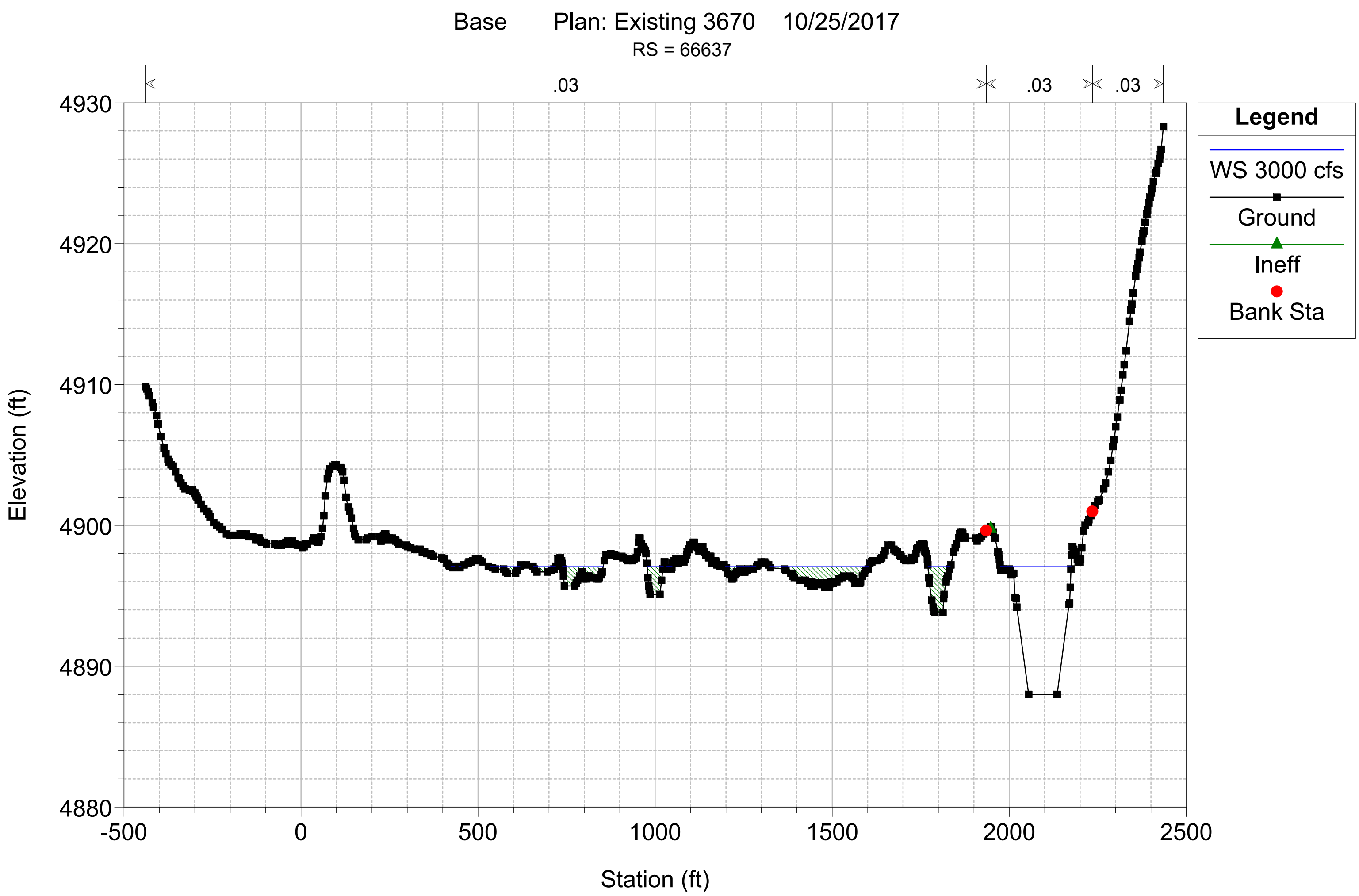
Base Plan: Existing 3670 10/25/2017
RS = 75837
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4915
4910
4905
4900
4895
4890
4885
0
500
1000
1500
2000
2500
3000
3500
4000



Base Plan: Existing 3670 10/25/2017
RS = 73087
.03
.025
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
4920
4915
4910
4905
4900
4895
4890
4885
0
500
1000
1500
2000
2500
3000
3500



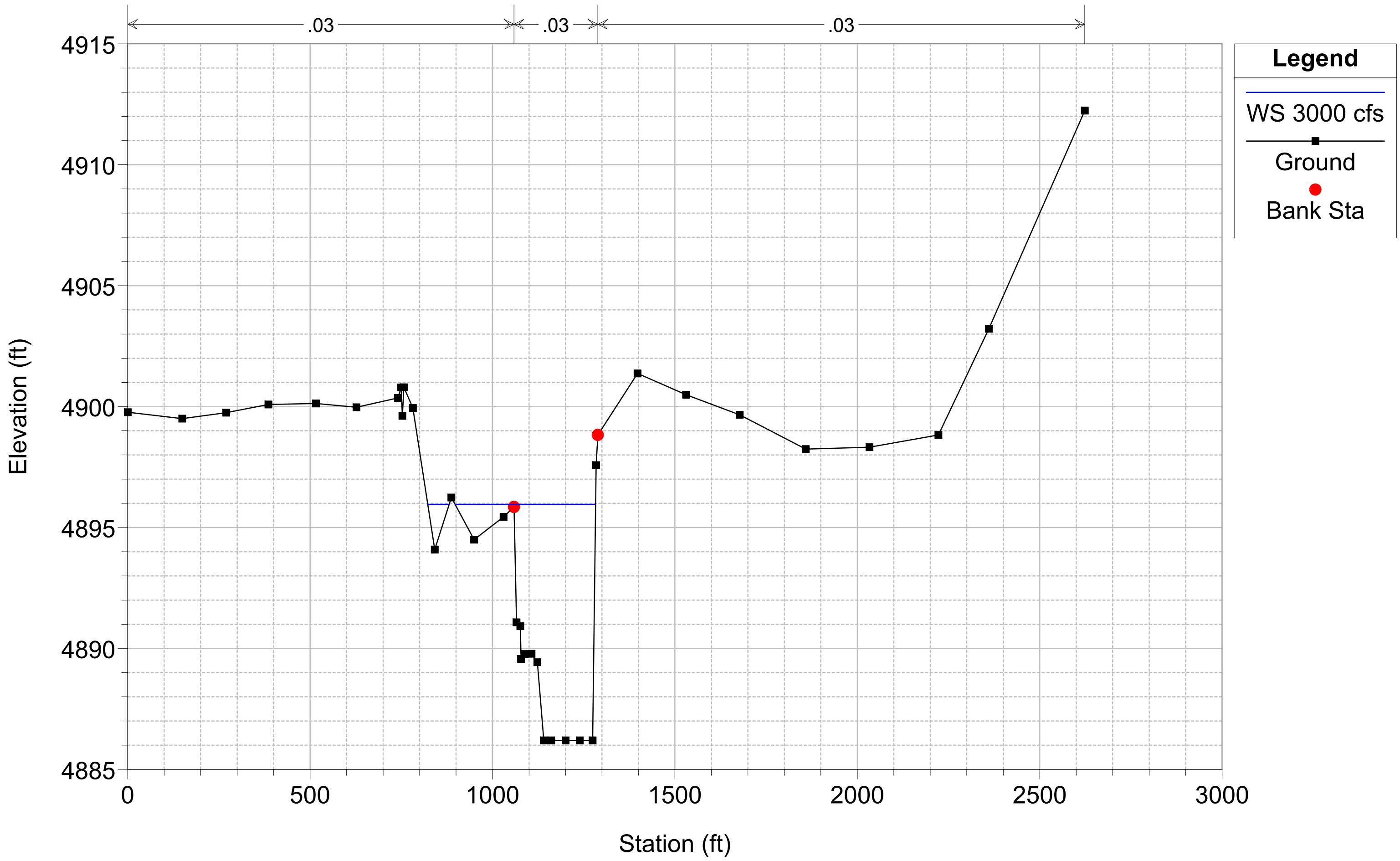
Base Plan: Existing 3670 10/25/2017
RS = 68602.17 XS 8 US Thatcher Bridge
.03
.03
.03
Elevation (ft)
4915
4910
4905
4900
4895
4890
4885
0
50
100
150
200
250
300
350
400
Station (ft)
Legend
WS 3000 cfs
Ground
Bank Sta



Base Plan: Existing 3670 10/25/2017
RS = 66637
.03
.03
.03
Elevation (ft)
4930
4920
4910
4900
4890
4880
-500
0
500
1000
1500
2000
2500
Station (ft)
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta

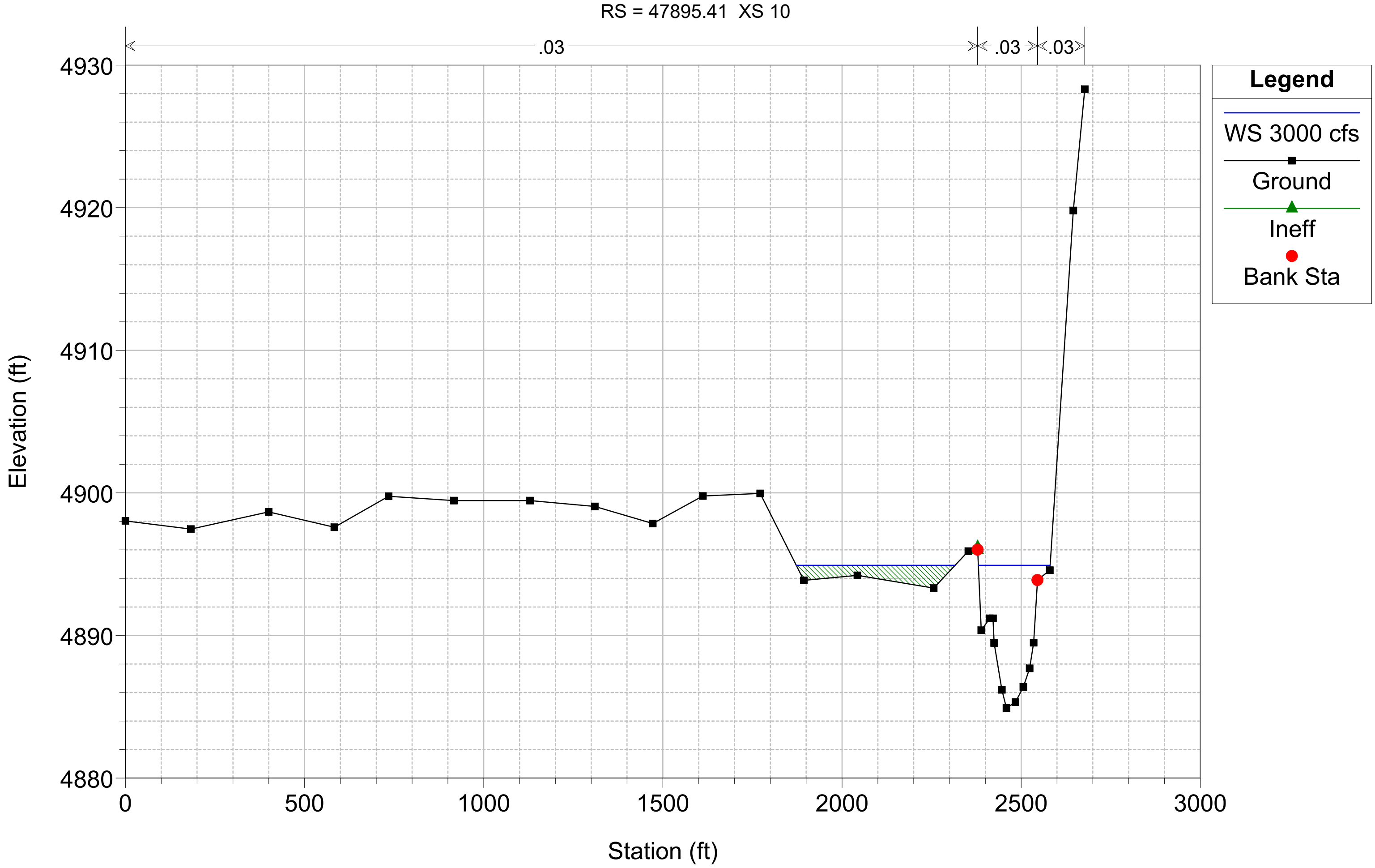
Base Plan: Existing 3670 10/25/2017

RS = 56708.41 XS 9 - Adjusted invert from 4888.87 to 4886.2 according to profi

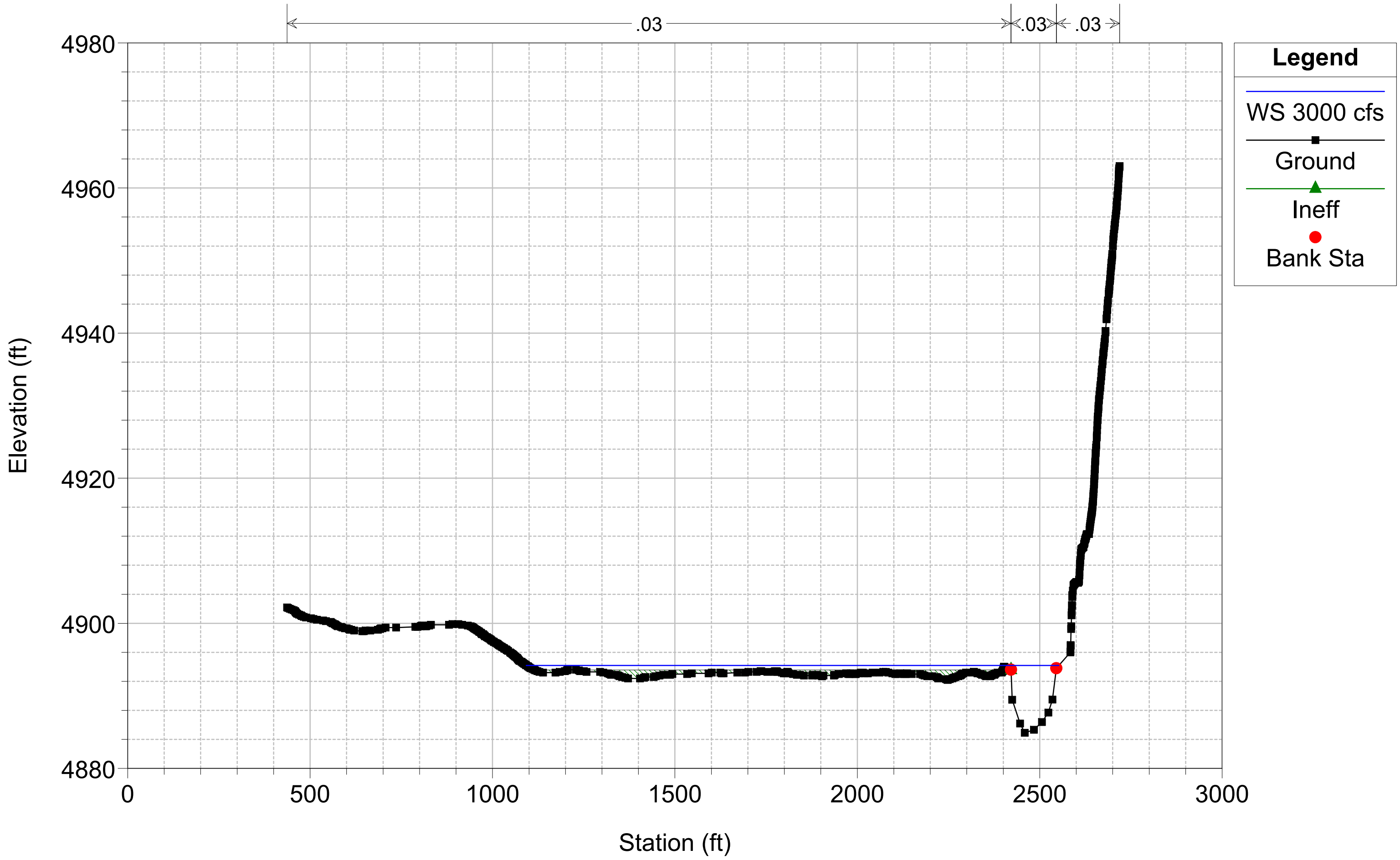


Base Plan: Existing 3670 10/25/2017

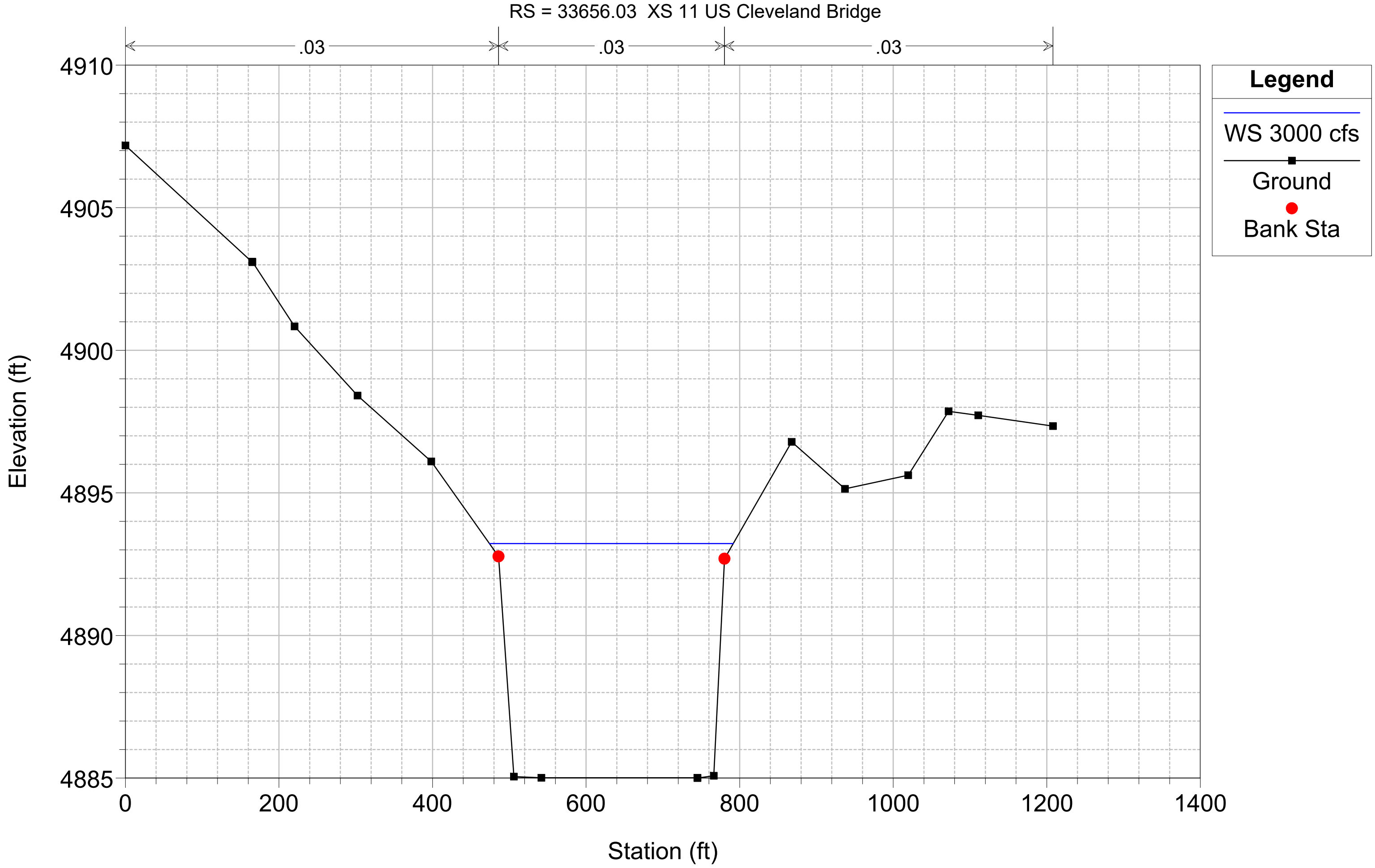
RS = 47895.41 XS 10

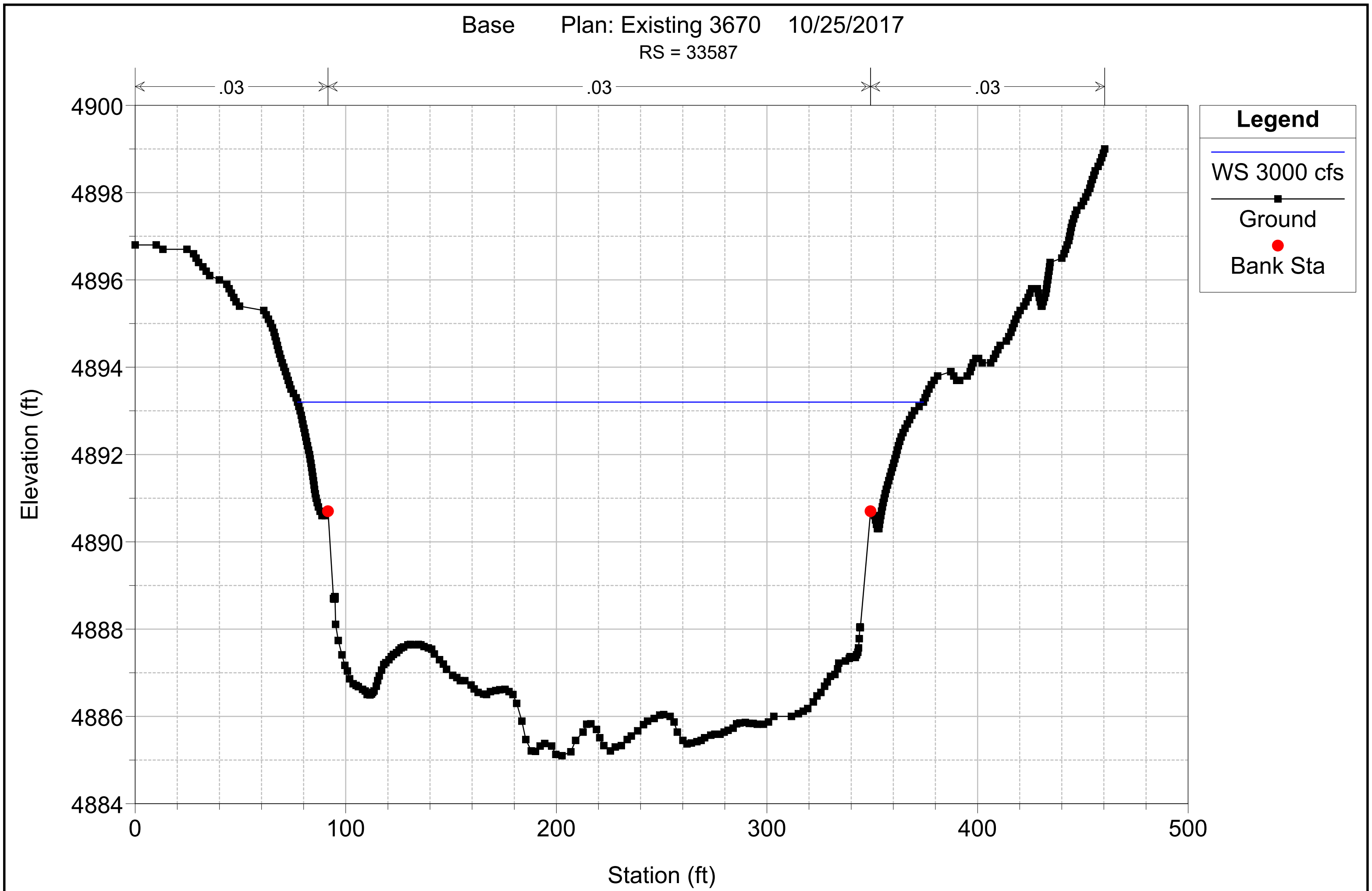


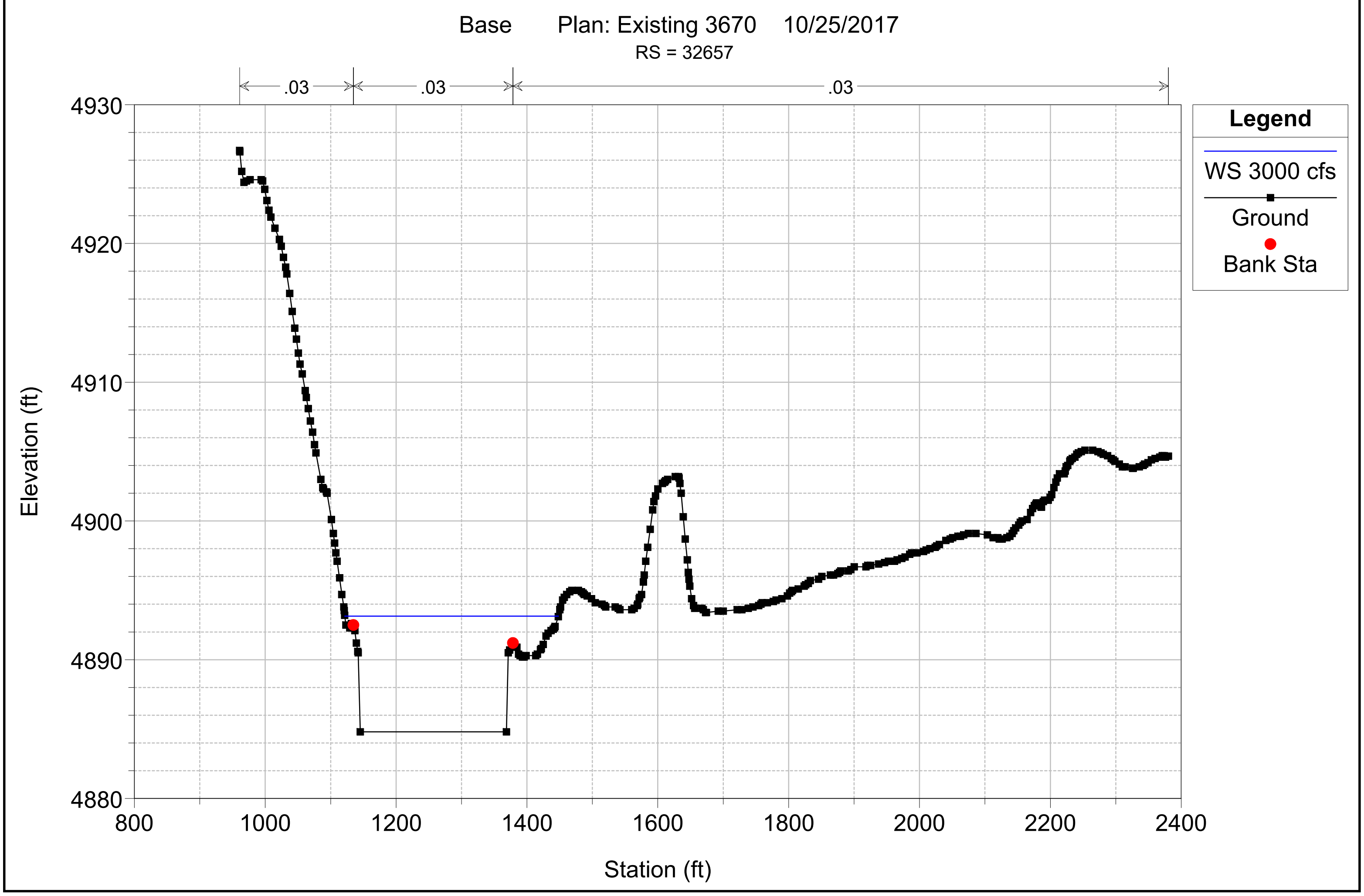
Base Plan: Existing 3670 10/25/2017
RS = 46047 XS 10

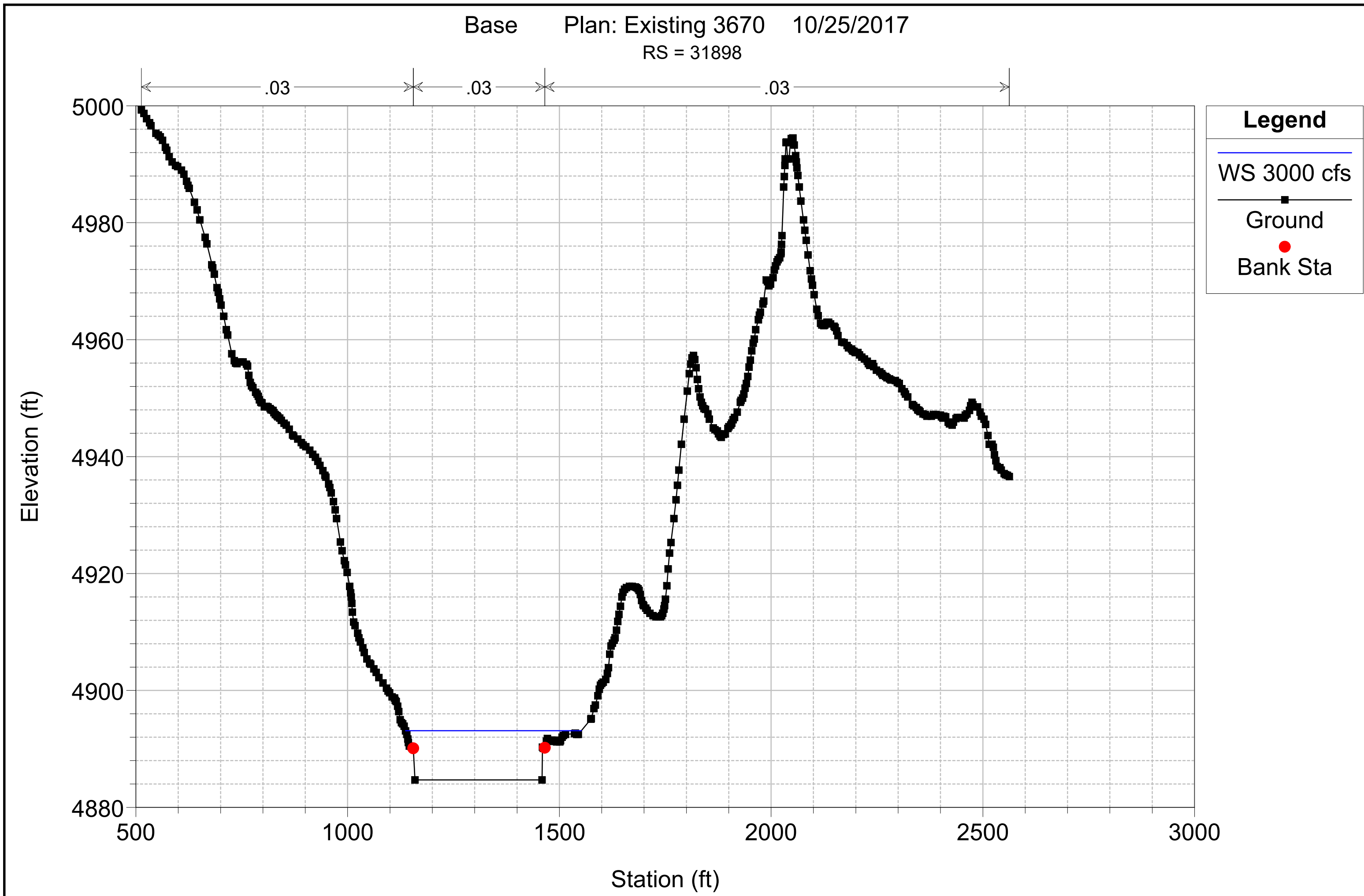


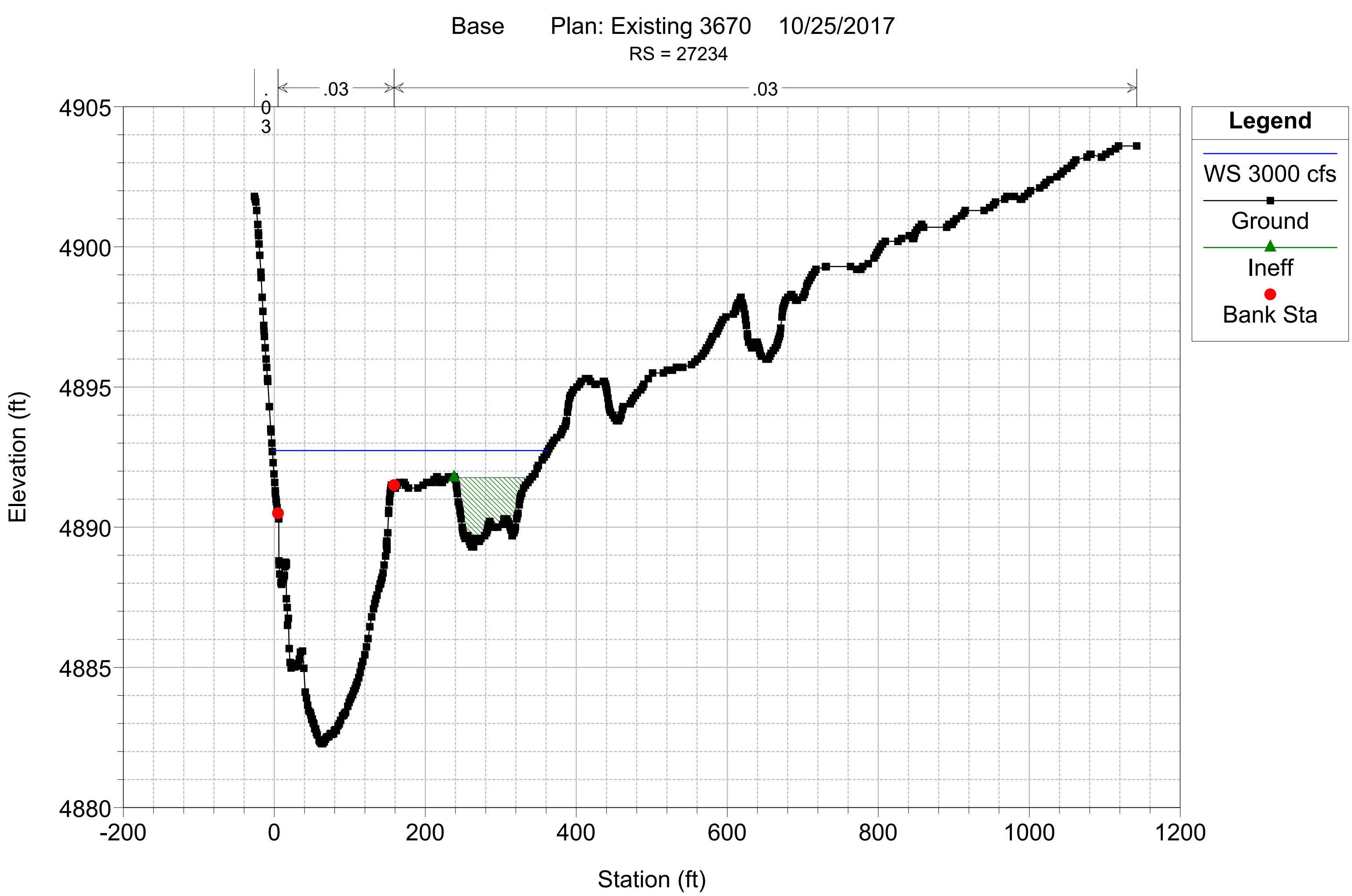
Base Plan: Existing 3670 10/25/2017
RS = 33656.03 XS 11 US Cleveland Bridge



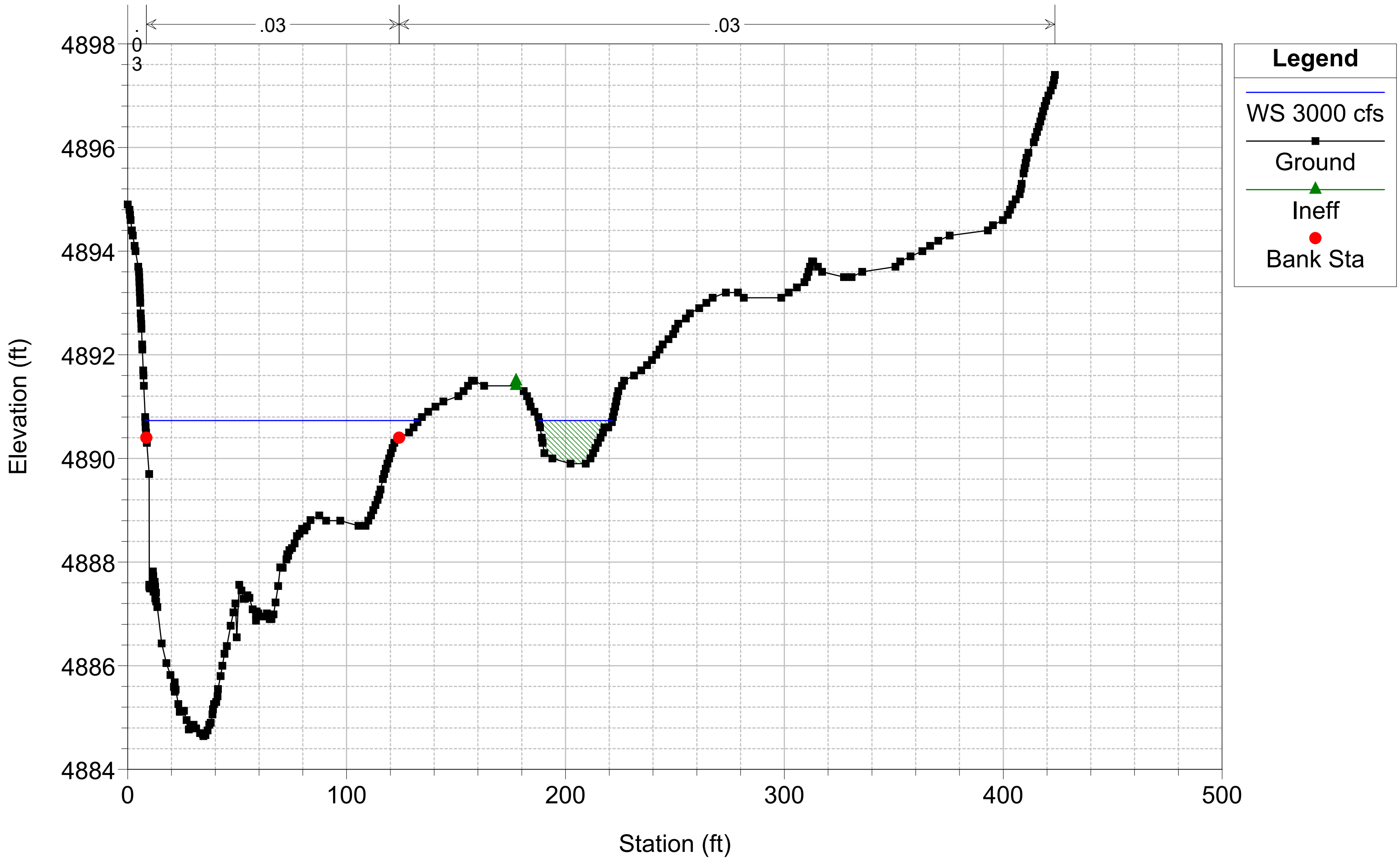

Base Plan: Existing 3670 10/25/2017
RS = 33587
.03
.03
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
4884
4886
4888
4890
4892
4894
4896
4898
4900
Station (ft)
0
100
200
300
400
500


Base Plan: Existing 3670 10/25/2017
RS = 32657
.03
.03
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
4880
4890
4900
4910
4920
4930
Station (ft)
800
1000
1200
1400
1600
1800
2000
2200
2400

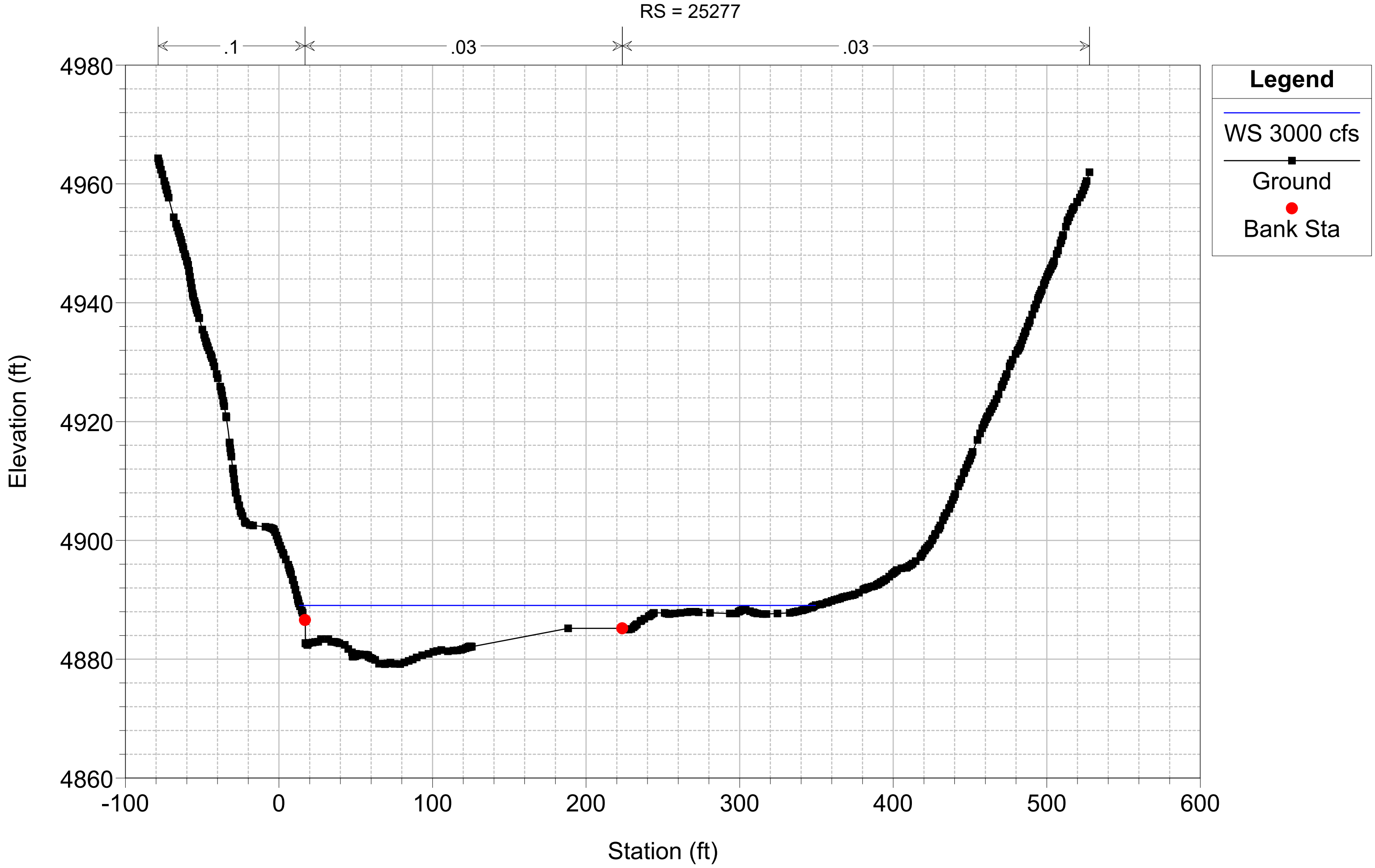

Base Plan: Existing 3670 10/25/2017
RS = 31898
.03
.03
.03
Legend
WS 3000 cfs
Ground
Bank Sta
Elevation (ft)
5000
4980
4960
4940
4920
4900
4880
500
1000
1500
2000
2500
3000
Station (ft)

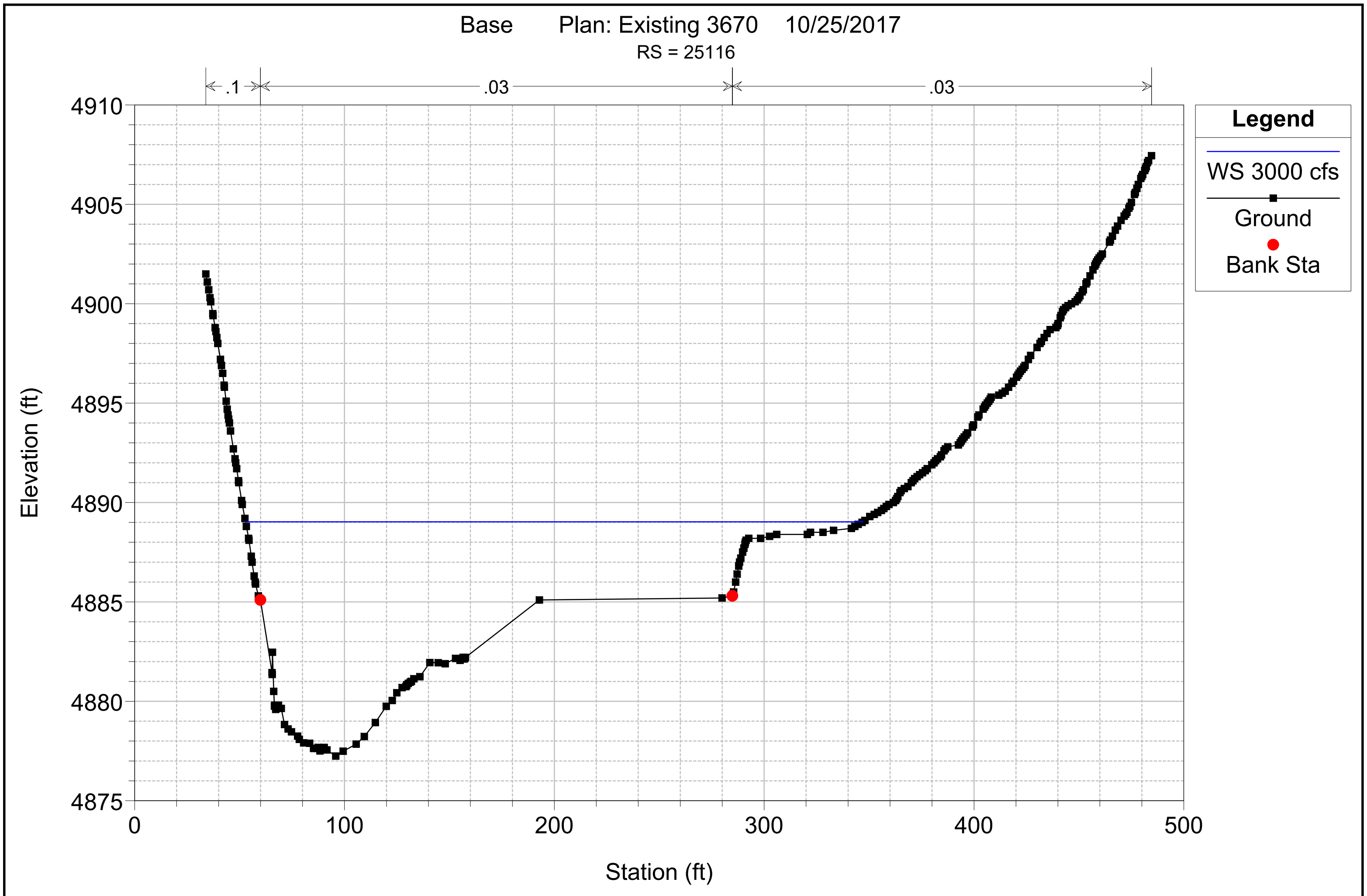

Base Plan: Existing 3670 10/25/2017
RS = 27234
.03
.03
.03
Legend
WS 3000 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
4905
4900
4895
4890
4885
4880
-200
0
200
400
600
800
1000
1200
Station (ft)

Base Plan: Existing 3670 10/25/2017
RS = 26727



Base Plan: Existing 3670 10/25/2017
RS = 25277





Base Plan: Existing 3670 10/25/2017
RS = 25116
.1
.03
.03
4910
4905
4900
4895
4890
4885
4880
4875
Elevation (ft)
0
100
200
300
400
500
Station (ft)
Legend
WS 3000 cfs
Ground
Bank Sta