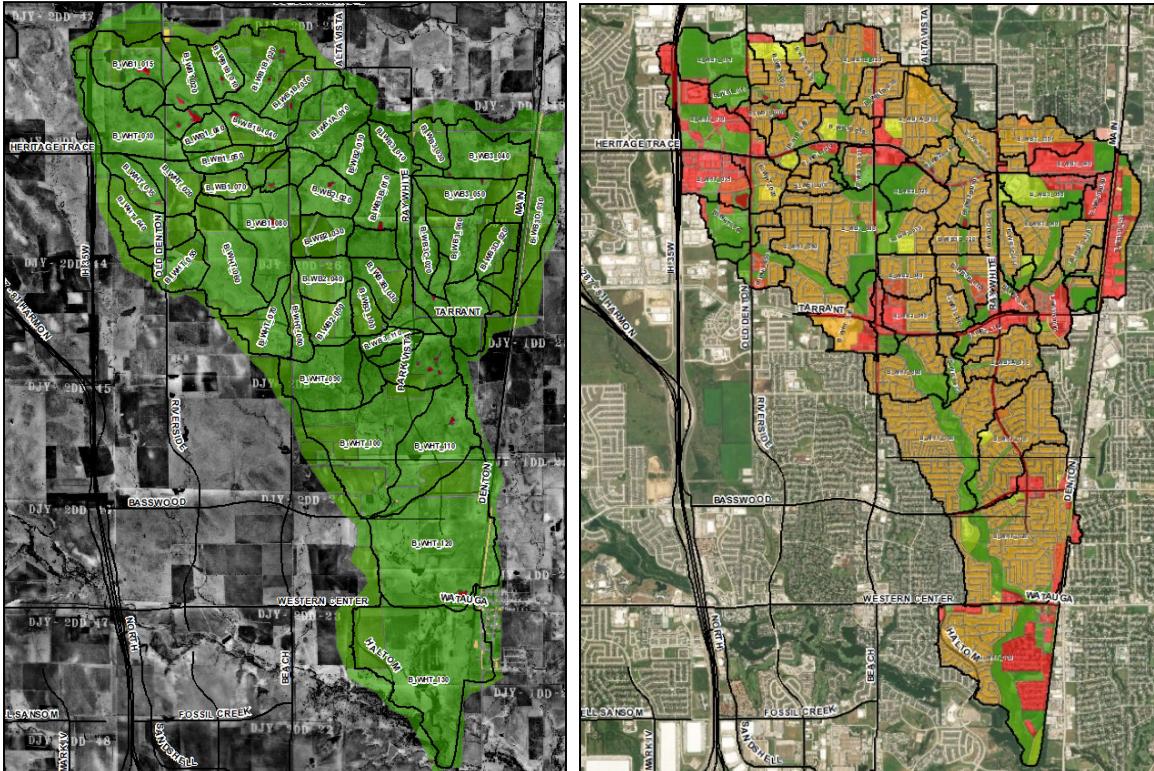


WHITES BRANCH WATERSHED CUMULATIVE IMPACTS ANALYSES REPORT



May 2022

Prepared by:



ECOSYSTEM
PLANNING &
RESTORATION

Ecosystem Planning and Restoration, LLC
PO BOX 15646
San Antonio, Texas 78212
Phone: (210) 664-2100

Prepared for:



City of Fort Worth
Transportation & Public Works
City Hall – Second Floor
200 Texas St.
Fort Worth, 76102

Table of Contents

1	Introduction	5
2	Data Collection and Review	5
3	Watershed Evaluation.....	5
3.1	Baseline Conditions Hydrologic Model	6
3.1.1	Historic Terrain.....	6
3.1.2	Historic Land Use	6
3.1.3	Historic Modified Puls Routing	7
3.1.4	Lag Routing.....	7
3.1.5	Baseline Historic Hydrologic Model Results.....	7
3.2	Baseline Conditions Hydraulic Models.....	7
3.3	Sensitivity Analyses	8
3.3.1	Land Use and Impervious Cover	8
3.3.2	Sub-basin Area Delineation and Time of Concentration	10
3.3.3	Valley Storage	12
3.3.4	Detention	15
3.4	Response Matrix	22
4	Revised Existing Watershed Condition Modeling	22
4.1	Revised Existing Conditions Hydrologic Model.....	22
4.1.1	Land Use and Percent Impervious Cover	22
4.1.2	Detention Basins	23
4.1.3	Modified Puls Routing.....	23
4.2	Revised Existing Conditions Hydraulic Models	24
4.2.1	Cross-section Geometry.....	24
4.2.2	Flow Rates	24
4.3	Comparison of Results	24
5	Impact Analysis	25
5.1	Assessment Area 1.....	25
5.2	Assessment Area 2	27
5.3	Assessment Area 3	29
5.4	Assessment Area 4.....	31
6	Significance of Impacts Evaluation & Recommendations.....	33

Table of Figures

FIGURE 1. PERCENT CHANGE IN PEAK FLOW DUE TO ULTIMATE LAND USE AND % IMPERVIOUS COVER	9
FIGURE 2. PERCENT CHANGE IN PEAK FLOW DUE TO PERCENT CHANGE IN DRAINAGE AREA AND TIME OF CONCENTRATION.....	11
FIGURE 3. PERCENT CHANGE IN PEAK FLOW DUE TO 10% REDUCTION IN VALLEY STORAGE	12
FIGURE 4. PERCENT CHANGE IN PEAK FLOW DUE TO 20% REDUCTION IN VALLEY STORAGE	13
FIGURE 5. PERCENT CHANGE IN PEAK FLOW DUE TO 30% REDUCTION IN VALLEY STORAGE	13
FIGURE 6. PERCENT CHANGE IN PEAK FLOW DUE TO 40% REDUCTION IN VALLEY STORAGE	14
FIGURE 7. PERCENT CHANGE IN PEAK FLOW DUE TO %50 REDUCTION IN VALLEY STORAGE	14
FIGURE 8. PERCENT CHANGE IN PEAK FLOW AND DISCHARGE VOLUME VS PERCENT CHANGE IN IMPERVIOUS COVER FOR THE 50% ACE	15
FIGURE 9. PERVERIOUS CHANGE IN PEAK FLOW AND DISCHARGE VOLUME VS PERCENT CHANGE IN IMPERVIOUS COVER FOR THE 10% ACE	16
FIGURE 10. PERCENT CHANGE IN PEAK FLOW AND DISCHARGE VOLUME VS PERCENT CHANGE IN IMPERVIOUS COVER FOR THE 25% ACE	16
FIGURE 11. PERCENT CHANGE IN PEAK FLOW AND DISCHARGE VOLUME VS PERCENT CHANGE IMPERVIOUS COVER FOR THE 2% ACE	17
FIGURE 12. PERCENT CHANGE IN PEAK FLOW AND DISCHARGE VOLUME VS PERCENT CHANGE IN IMPERVIOUS COVER FOR THE 1% ACE	17
FIGURE 13. PERCENT CHANGE IN PEAK FLOW AND DISCHARGE VOLUME VS PERCENT CHANGE IN IMPERVIOUS COVER FOR THE 0.2% ACE	18
FIGURE 14. PERCENT CHANGE IN PEAK FLOW DUE TO ULTIMATE LAND USE AND PERCENT IMPERVIOUS COVER WITH DETENTION (SUB-BASINS ONLY).....	20
FIGURE 15. PERCENT CHANGE IN PEAK FLOW DUE TO ULTIMATE LAND USE AND PERCENT IMPERVIOUS COVER WITH DETENTION (JUNCTIONS ONLY).....	21
FIGURE 16. ASSESSMENT AREA 1, 1963 VS 2021 AERIAL COMPARISON.....	26
FIGURE 17. ASSESSMENT AREA 1, VALLEY STORAGE-DISCHARGE RATING CURVE	26
FIGURE 18. ASSESSMENT AREA 2, 1963 VS 2021 AERIAL COMPARISON.....	28
FIGURE 19. ASSESSMENT AREA 2, VALLEY STORAGE-DISCHARGE RATING CURVE	28
FIGURE 20. ASSESSMENT AREA 3, 1963 VS 2021 AERIAL COMPARISON.....	30
FIGURE 21. ASSESSMENT AREA 3, VALLEY STORAGE-DISCHARGE RATING CURVE	30
FIGURE 22. ASSESSMENT AREA 4, 1963 VS 2021 AERIAL COMPARISON.....	32
FIGURE 23. ASSESSMENT AREA 4, VALLEY STORAGE-DISCHARGE RATING CURVE	32

List of Tables

TABLE 1 – STORAGE- DISCHARGE REGRESSION EQUATIONS FOR CN VALUES LESS THAN 77	18
TABLE 2 – STORAGE- DISCHARGE REGRESSION EQUATIONS FOR CN VALUES GREATER THAN 77	19
TABLE 3 – REVISED EXISTING CONDITIONS, SUB-BASINS PRECENT IMPERVIOUS VALUES	23
TABLE 4 – REVIED EXISTING CONDITIONS HEC-RAS CROSS-SECTIONS REVISIONS.....	24
TABLE 5 – ASSESSMENT AREA 1, RANGE OF FLOWS	25
TABLE 6 – ASSESSMENT AREA 1, DOWNSTREAM IMPACTS TO PEAK FLOWS (J_WHT_050).....	27
TABLE 7 – ASSESSMENT AREA 2, RANGE OF FLOWS	27
TABLE 8 – ASSESSMENT AREA 2, DOWNSTREAM IMPACTS TO PEAK FLOWS (J_WB1A_015).....	29
TABLE 9 – ASSESSMENT AREA 3, RANGE OF FLOWS	29
TABLE 10 – ASSESSMENT AREA 3, DOWNSTREAM IMPACTS TO PEAK FLOWS (J_WB2_040)	31
TABLE 11 – ASSESSMENT AREA 4, RANGE OF FLOWS	31
TABLE 12 – ASSESSMENT AREA 4, DOWNSTREAM IMPACTS TO PEAK FLOWS (J_WB3D_020).....	33
TABLE 13 – WATER QUALITY RATING	33
TABLE 14 – VALLEY STORAGE IMPACTS SUMMARY FOR ASSESSMENT AREAS	35

List of Exhibits

- EXHIBIT 1 – PROJECT LOCATION MAP
- EXHIBIT 2 – HISTORIC WATERSHED DELINEATION
- EXHIBIT 3 – HISTORIC AND REVISED EXISTING WATERSHED DELINEATION COMPARISON
- EXHIBIT 4 – HISTORIC LAND USE AND PERCENT IMPERVIOUS COVER
- EXHIBIT 5 – 50%, 10% AND 4% ACE HISTORIC FLOODPLAINS
- EXHIBIT 6 – 2%, 1% AND 0.2% ACE HISTORIC FLOODPLAINS
- EXHIBIT 7 – REVISED EXISTING AND HISTORIC FLOODPLAIN COMPARISON
- EXHIBIT 8 – REVISED EXISTING PERCENT IMPERVIOUSNESS
- EXHIBIT 9 – REVISED EXISTING - DETENTION WITHIN WATERSHED
- EXHIBIT 10 – REVISED EXISTING FLOODPLAIN COMPARISON
- EXHIBIT 11 – IMPACT ANALYSIS

List of Appendices

- APPENDIX A. DATA COLLECTION & REVIEW
- APPENDIX B. BASELINE HISTORIC HYDROLOGIC MODEL PARAMETERS
- APPENDIX C. MODIFIED PULS RATING TABLES
- APPENDIX D. BASELINE HISTORIC HYDROLOGIC MODEL RESULTS
- APPENDIX E. SENSITIVITY ANALYSES HYDROLOGIC MODEL PARAMETERS
- APPENDIX F. SENSITIVITY ANALYSES HYDROLOGIC MODEL RESULTS
 - TABLE F.1 LANDUSE AND PERCENT IMPERVIOUS COVER HMS RESULTS
 - TABLE F.2 DA AND TC HMS RESULTS
 - TABLE F.3 VALLEY STORAGE REDUCTION HMS 0.5ACE 2YR RESULTS
 - TABLE F.4 VALLEY STORAGE REDUCTION HMS 0.1ACE 10YR RESULTS
 - TABLE F.5 VALLEY STORAGE REDUCTION HMS 0.04ACE 25YR RESULTS
 - TABLE F.6 VALLEY STORAGE REDUCTION HMS 0.02ACE 50YR RESULTS
 - TABLE F.7 VALLEY STORAGE REDUCTION HMS 0.01ACE 100YR RESULTS
 - TABLE F.8 VALLEY STORAGE REDUCTION HMS 0.002ACE 500YR RESULTS
 - TABLE F.9 DETENTION HMS RESULTS
- APPENDIX G. DETENTION BASIN RATING TABLES FOR SENSITIVITY ANALYSES
- APPENDIX H. SENSITIVITY ANALYSES RESPONSE MATRIX
- APPENDIX I. REVISED EXISTING CONDITIONS HYDROLOGIC MODEL PARAMETERS
- APPENDIX J. DETENTION BASIN RATING TABLES FOR REVISED HYDROLOGIC MODEL
- APPENDIX K. REVISED EXISTING CONDITIONS HEC-RAS CROSS-SECTION PLOTS
- APPENDIX L. REVISED EXISTING CONDITIONS HEC-RAS FLOW DATA
- APPENDIX M. REVISED EXISTING CONDITIONS HEC-HMS RESULTS
- APPENDIX N. REVISED EXISTING CONDITIONS HEC-RAS RESULTS
- APPENDIX O. DIGITAL DATA (FTP)

1 Introduction

Ecosystem Planning and Restoration (EPR) was contracted by the City of Fort Worth (City) to analyze the cumulative impacts within the Whites Branch watershed by studying changes to peak flood flows and runoff volumes over time due to changes in land use and valley storage due to allowable encroachments within the floodplain. The purpose of these analyses is to evaluate the cumulative impacts of development by evaluating the sensitivity that specific hydrologic parameters have on peak flows within the watershed and downstream impacts to flooding. This report documents the findings of the watershed study. Additionally, this evaluation includes updating the current hydrologic and hydraulic models for Whites Branch, developed in 2015, with more recent 2019 LiDAR and capture additional development that has occurred since 2015.

The Whites Branch watershed is approximately 10.4 square miles and located in northwest Fort Worth, Texas (Exhibit 1 – Project Location Map). The watershed has approximately 20.8 miles of studied streams including Whites Branch main stem and nine (9) tributaries labeled WB-1, WB-1A, WB-1B, WB-2, WB-3, WB-3A, WB-3B, WB-3C, and WB-3D. The watershed analyses are based existing hydrologic and hydraulic models for the Whites Branch watershed provided by the City. The following sections describe the analyses methodology.

2 Data Collection and Review

EPR provided the City with a list of data that would be useful for the watershed analyses. The City provided the data as available. EPR also collected additional data through TNRIS, USGS and USDA websites. A list of the data provided was reviewed, compiled and sorted to determine any data gaps. The list of data reviewed, and noted for use, for the watershed analyses is provided in **Appendix A**.

3 Watershed Evaluation

The watershed evaluation consisted of developing a baseline conditions model to determine predevelopment conditions within the watershed. This baseline historic modeling was used to test the sensitivity of development, and associated hydrologic parameters, on peak flows, and evaluate downstream impacts. Results from the sensitivity analyses were used to provide feedback on the effectiveness of current City of Fort Worth development criteria and propose potential revisions to the criteria as described in Section 6.

All models developed for the watershed evaluation follow the current City of Fort Worth iSWM Criteria Manual. HEC-HMS version 4.2 was used for the hydrologic modeling to be consistent with the existing Whites Branch hydrologic modeling. HEC-RAS version 5.0.7 was used for the hydraulic analyses in the evaluation.

3.1 Baseline Conditions Hydrologic Model

The baseline conditions modeling consisted of developing a pre-development hydrologic model. Historic imagery and topographic data for the Whites Branch watershed was reviewed to determine the year that had the best usable data to develop the baseline hydrologic and hydraulic models. The USDA 1963 historical arial imagery was selected to determine baseline land use, and the USGS 1955 Keller, Texas and Haltom City, Texas and 1959 Colleyville, Texas quadrangle topographic maps were used to develop the baseline terrain. The existing Whites Branch HEC-HMS hydrologic model was used as the base modeling schematic and modified to reflect the historic conditions of the watershed. The sub-basin delineation, routing reaches, and paired data naming conventions were preserved for comparison purposes with the sensitivity analyses modeling and revised existing condition modeling. The 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies were evaluated for comparison purposes. The existing Whites Branch hydrologic model meteorologic models and annual duration curves for each frequency event were used for all modeled scenarios. Modified hydrologic parameters calculated for the baseline historic model are provided in **Appendix B**.

3.1.1 Historic Terrain

The historic USGS topographic maps were used to delineate the historic sub-basin delineations for the Whites Branch watershed. The Whites Branch watershed is subdivided into of 62 sub-basins. The existing sub-basin delineation provided by the City was used as a base and modified to reflect the historic topographic conditions as shown on Exhibit 2 – Historic Watershed Delineation. Exhibit 3 – Historic and Revised Existing Watershed Delineation Comparison shows a comparison between the historic sub-basins and the revised existing sub-basins. The sub-basin naming convention was preserved from the current existing delineation for comparison purposes. Existing major roadways are included on the historic figures for location refence.

The SCS method for determining Lag time is used in the existing hydrology model for the watershed and was also used for the baseline historic modeling. Time of concentration (Tc) flow paths for each sub-basin were drawn to reflect the historic flow paths based on the historic USGS topographic maps as shown on Exhibit 2 - Historic Watershed Delineation. When appropriate, the outfall location of each sub-basin was preserved from the current delineation for comparison purposes.

3.1.2 Historic Land Use

The Whites Branch watershed was predominately agricultural lands for grazing, and some row crops in the 1950's and 1960's. The land use and percent imperviousness were digitized as GIS shapefiles based on the USDA 1963 historical arial imagery for the watershed. Exhibit 3 – Historic Land Use and % Impervious Cover, shows the historic land use and percent imperviousness for the watershed.

CN values were estimated using the historic land use and hydrologic soil groups within the watershed for each sub-basin. Percent imperiousness was calculated for each sub-basin using the weighted values based on land use.

3.1.3 Historic Modified Puls Routing

Modified Puls routing reaches rating tables were developed using the existing Whites Branch hydraulic models provided by the City of Fort Worth for Whites Branch main stem and the nine (9) tributaries. The existing HEC-RAS models contained a Modified Puls plan and steady flow file that were used to develop the existing hydrologic model routing reach rating tables. The existing hydraulic models were modified to reflect historic stream conditions and develop the historic Modified Puls rating tables for use in the HEC-HMS model paired data. Routing reach labels were preserved from the current existing conditions hydrologic model for White Branch for comparison purposes. Rating table plots for the baseline historic routing reaches are provided in **Appendix C**.

Details about the development of the baseline historic Hydraulic models are provided in Section 3.2.

3.1.4 Lag Routing

One routing reach, labeled R_WB3_020, within the Whites Branch watershed was modeled using Lag time in the current hydrologic model. Lag time was estimated for the historic condition for this reach.

3.1.5 Baseline Historic Hydrologic Model Results

Results of the baseline historic hydrologic model are provided in **Appendix D**. The results are used as a base comparison for the sensitivity analyses described in Section 3.3.

3.2 Baseline Conditions Hydraulic Models

The existing conditions HEC-RAS hydraulic models for Whites Branch main stem, and the tributaries WB-1, WB-1A, WB-1B, WB-2, WB-3, WB-3A, WB-3B, WB-3C, and WB-3D, were used as the base models for developing the baseline historic hydraulic models. The HEC-RAS models were modified to reflect the historic terrain using HEC-RAS version 5.0.7. A historic surface was developed using ArcMap tools and imported as a terrain into RASMapper.

Cross-section geometries were modified to reflect the historic terrain. Streamline alignments and reach lengths were modified to reflect historic stream alignments. Cross-sections alignments were adjusted to be perpendicular to the historic contours. River stationing was preserved from the current hydraulic models for comparison purposes. Manning's n-values were selected to reflect the historic roughness based on the historic aerial photography.

Structures such as bridges, culverts and lateral weirs, were removed from the historic model to reflect historic stream conditions. While some small culverts may have existed historically, information about historic structures is not available nor reflected in the available historic topographic data.

As stated in Section 3.1.3, the historic hydraulic models were used to develop the Modified Puls rating tables for the baseline historic hydrology model. The 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies were evaluated for comparison purposes to the sensitivity analyses described

in Section 3.3. Additionally, the historic floodplain extents were mapped using RASMapper tools as shown on Exhibits 5 and 6 – Historic Floodplains. The historic 100-year floodplain is also compared to the Revised Existing 100-year floodplain as shown on Exhibit 7 – Revised Existing and Historic Floodplain Comparison.

3.3 Sensitivity Analyses

Sensitivity analyses were conducted on various hydrologic variables to determine the impact on peak flows and downstream impact to flooding when compared to the base historic hydrologic model. The sensitivity analyses evaluated hydrologic model parameters in terms of percent change in peak flows at the sub-basin level, and peak flows at downstream at junction points. The variables evaluated include:

- Land use and impervious cover
- Sub-basin area delineation and time of concentration
- Valley storage
- Detention/retention volume

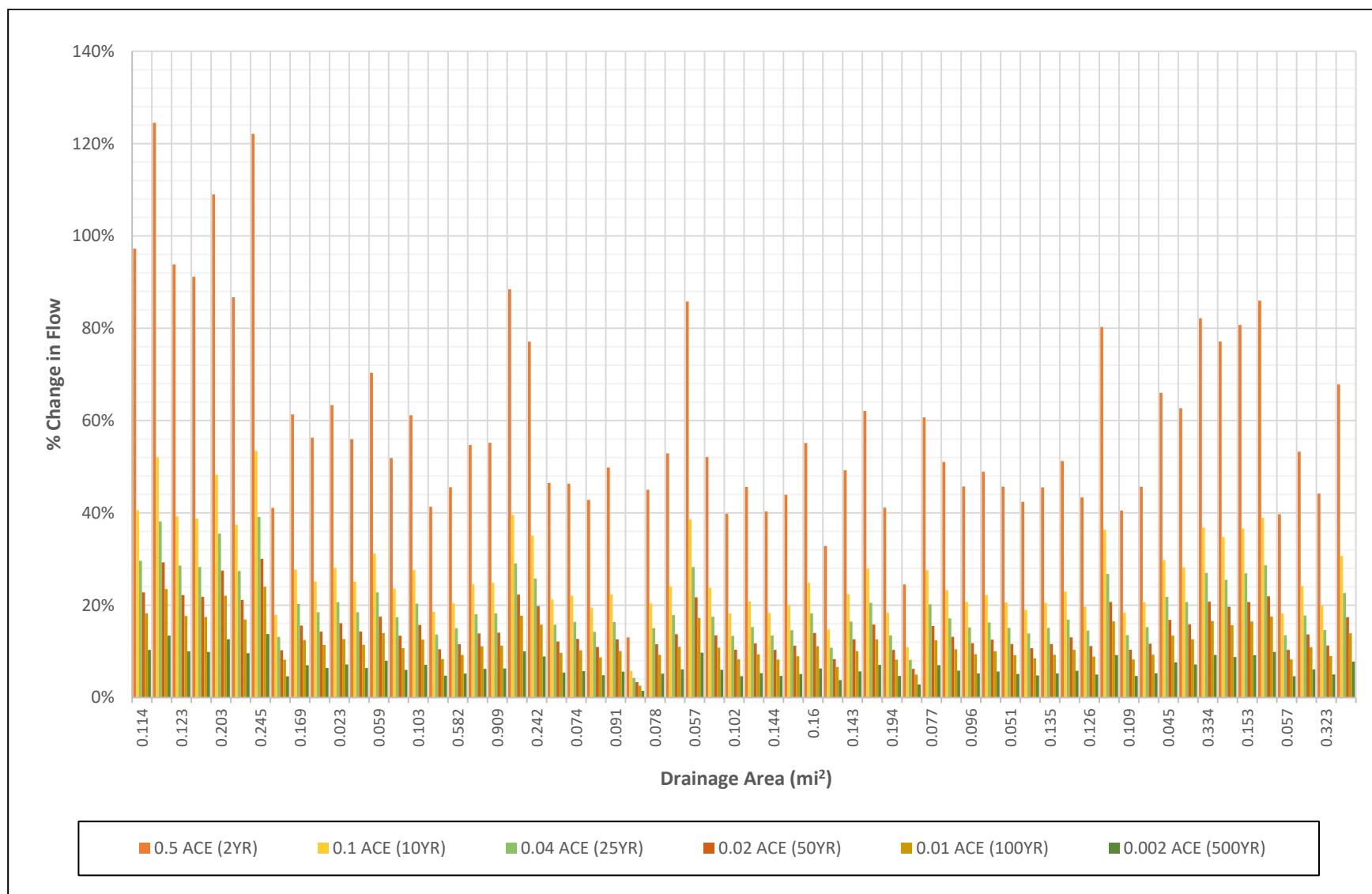
3.3.1 Land Use and Impervious Cover

Urbanization in metropolitan areas leads to land use changes with increased impervious cover that affects the infiltration and runoff relationships. These two variables were evaluated together. The sensitivity analyses included changing the baseline historic hydrologic model percent imperviousness to the revised existing hydrologic modeling ultimate conditions value. A summary of sub-basin parameters is provided in **Appendix E**.

It was noted that there appears to be a predictable relationship between the change in discharge volume, change in percent impervious cover and the percent change in peak flows. This relationship was used to develop the detention storage-discharge rating curves used in the detention sensitivity analyses and further described in Section 3.3.4.

Results of the sensitivity analysis are provided in **Appendix F**, Table F1 for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies, respectively. Figure 1 shows the percent change in peak flows for each sub-basin and junctions compared to the base historic hydrologic model results for all modeled return frequencies.

The results show that impacts to peak flows are more significant with more frequent storm events and impacts are less significant with less frequent storm events.

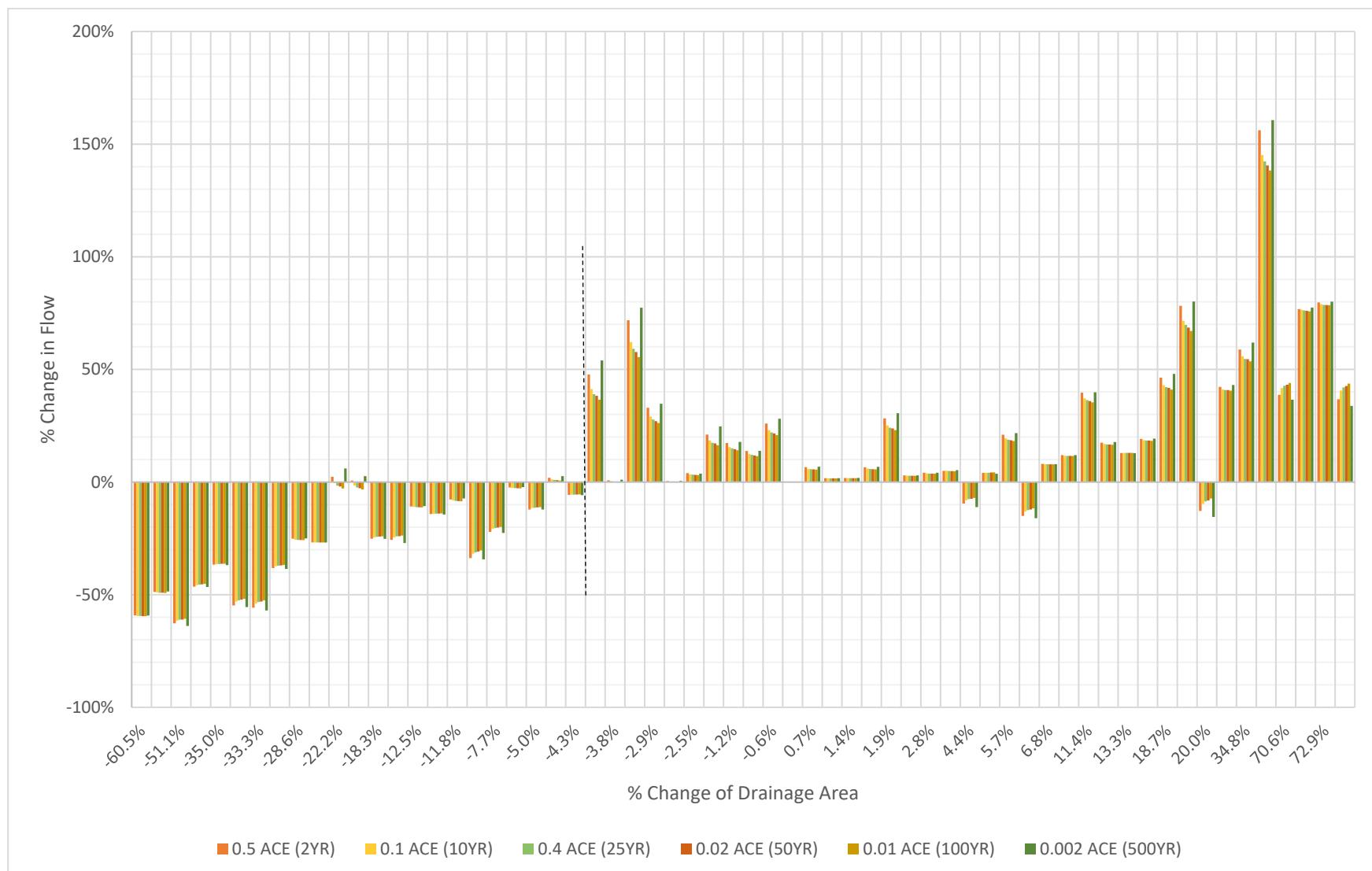
Figure 1. Percent Change in Peak Flow due to Ultimate Land Use and % Impervious Cover

3.3.2 Sub-basin Area Delineation and Time of Concentration

As watersheds develop, drainage areas are sometimes modified due to major roadway construction, railroads, and/or storm drain systems. Additionally, sub-basins may be further divided to account for localized drainage patterns within a development. Factors that influence time of concentration flow paths, including ground cover, length and piping, affect the response time of the sub-basin. The sensitivity analyses included changing the baseline historic hydrologic model sub-basin areas and lag times to the revised existing condition ultimate conditions values. A summary of sub-basin parameters is provided in **Appendix E**.

Results of the sensitivity analysis are provided in **Appendix F**, Table F2 for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies, respectively. Figure 2 shows the percent change in peak flows for each sub-basin versus percent change in drainage area. The percent change is a comparison between the revised existing ultimate conditions and the baseline historic hydrologic model results for all modeled return frequencies.

The results show that the impact to peak flows is relatively consistent for all storm frequencies within each sub-basin. Generally, a reduction in peak flows is observed with a reduction in drainage area up to -4%, and an increase in peak flows is observed for increases in drainage area.

Figure 2. Percent Change in Peak Flow due to Percent Change in Drainage Area and Time of Concentration

3.3.3 Valley Storage

Valley storage accounts for the floodplain storage within a channel and its overbank areas and impacts modeling results by attenuating the floodwave. Valley storage can be either overestimated or underestimated in hydrologic modeling depending on the storage routing method that is used and often valley storage is not accounted for at all in modeling. Valley storage in waterways can be accounted for within the watershed using Modified Puls routing. The sensitivity analyses included reducing the storage of the baseline historic Modified Puls rating tables by 10%, 20%, 30%, 40% and 50% and then modifying the base historic hydrologic model paired data for each of the storage reduction scenarios.

The Modified Puls rating tables for the baseline historic model, the valley storage sensitivity models, and the revised existing conditions model for each routing reach are provided graphically in **Appendix C** to show a comparison between each of the modeled scenarios. It was noted that the revised existing condition valley storage was generally less than 50% or less than the baseline historic valley storage, therefore the sensitivity analyses did not include reductions more than 50% for the purposes of this evaluation.

Results of the sensitivity analysis are provided in **Appendix F**, Tables F3 through F8 for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies, respectively. Figures 3 through 7 show the percent change in peak flows at junctions compared to the baseline historic hydrologic model results for all modeled return frequencies.

Figure 3. Percent Change in Peak Flow due to 10% Reduction in Valley Storage

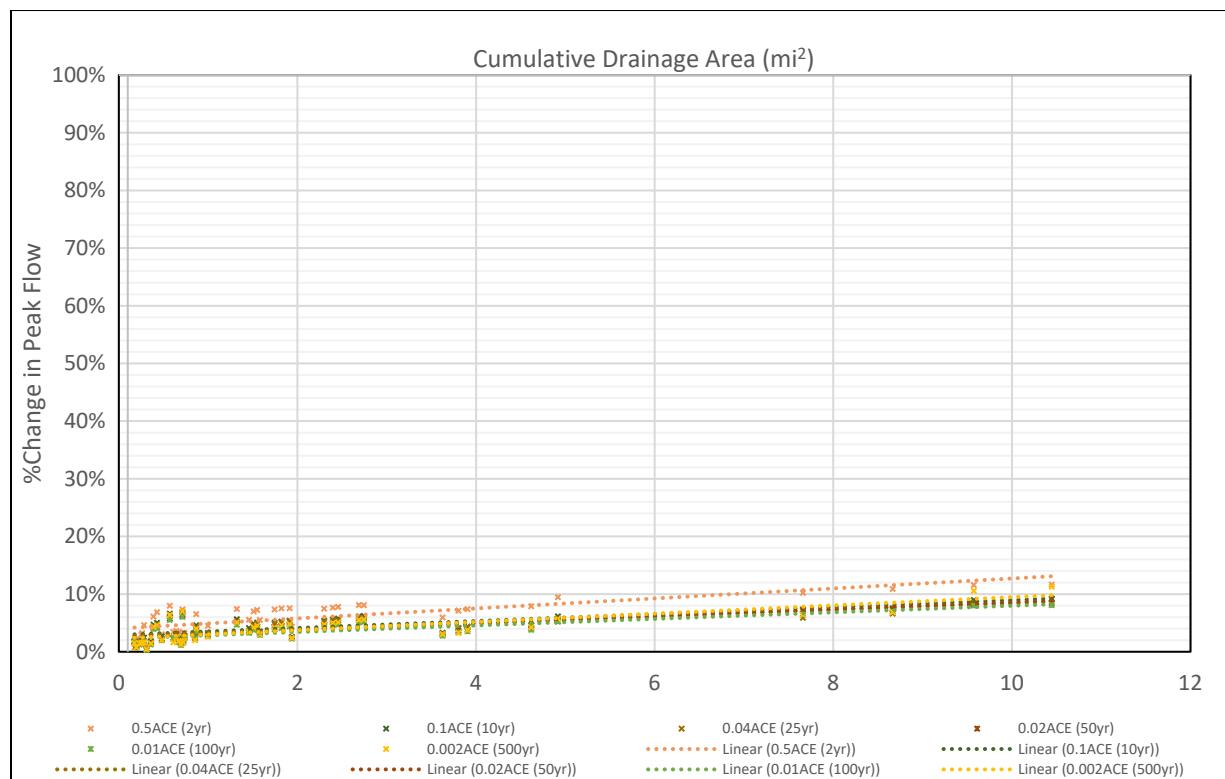


Figure 4. Percent Change in Peak Flow due to 20% Reduction in Valley Storage

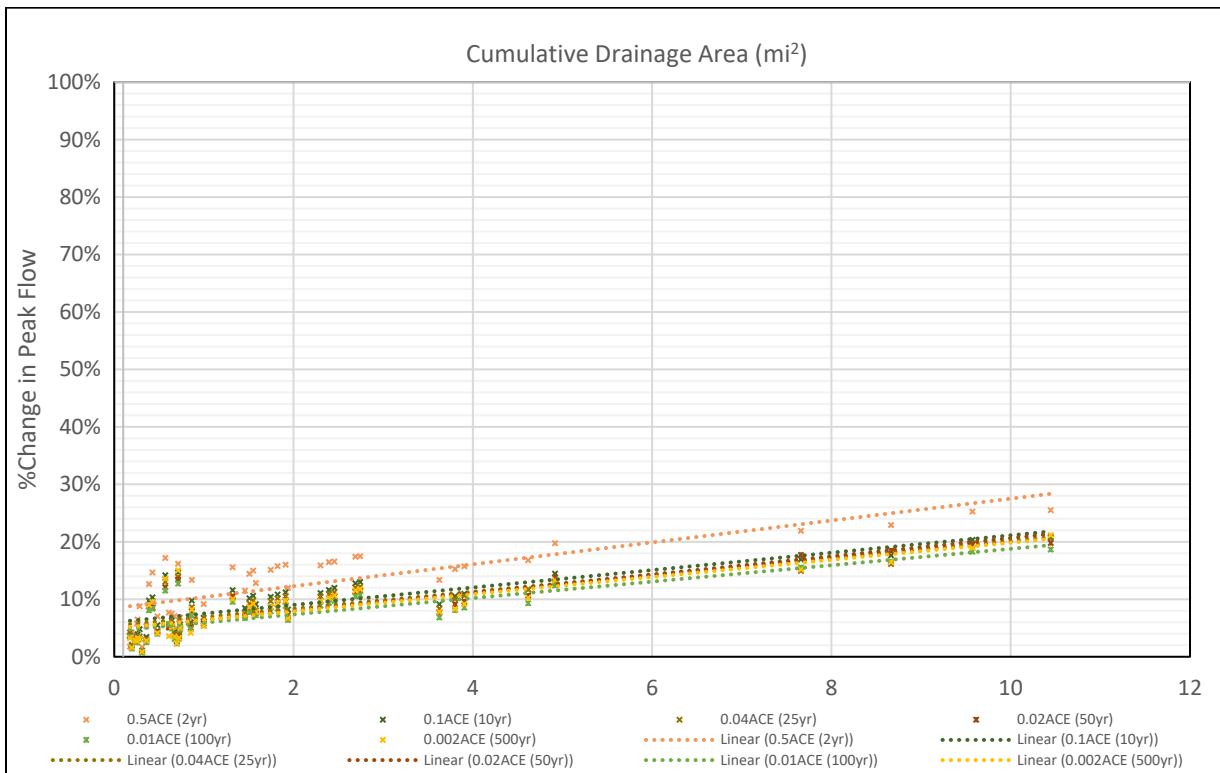


Figure 5. Percent Change in Peak Flow due to 30% Reduction in Valley Storage

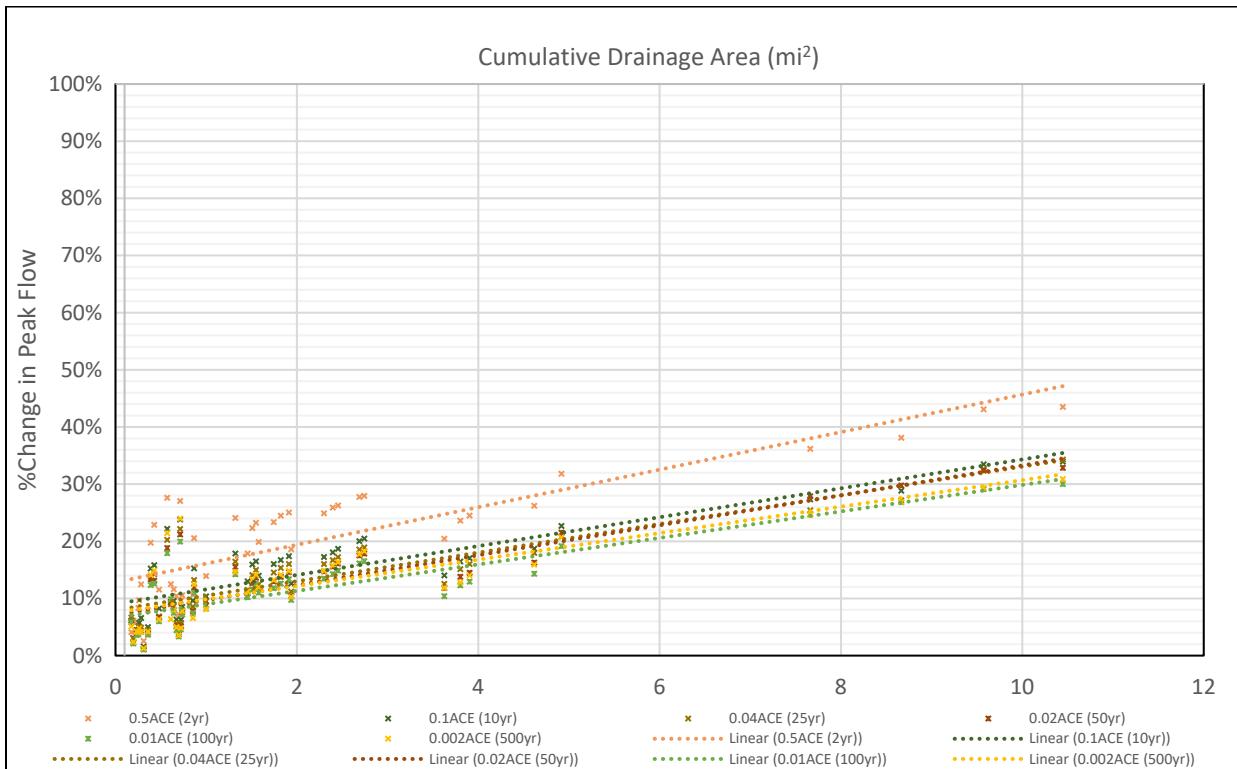


Figure 6. Percent Change in Peak Flow due to 40% Reduction in Valley Storage

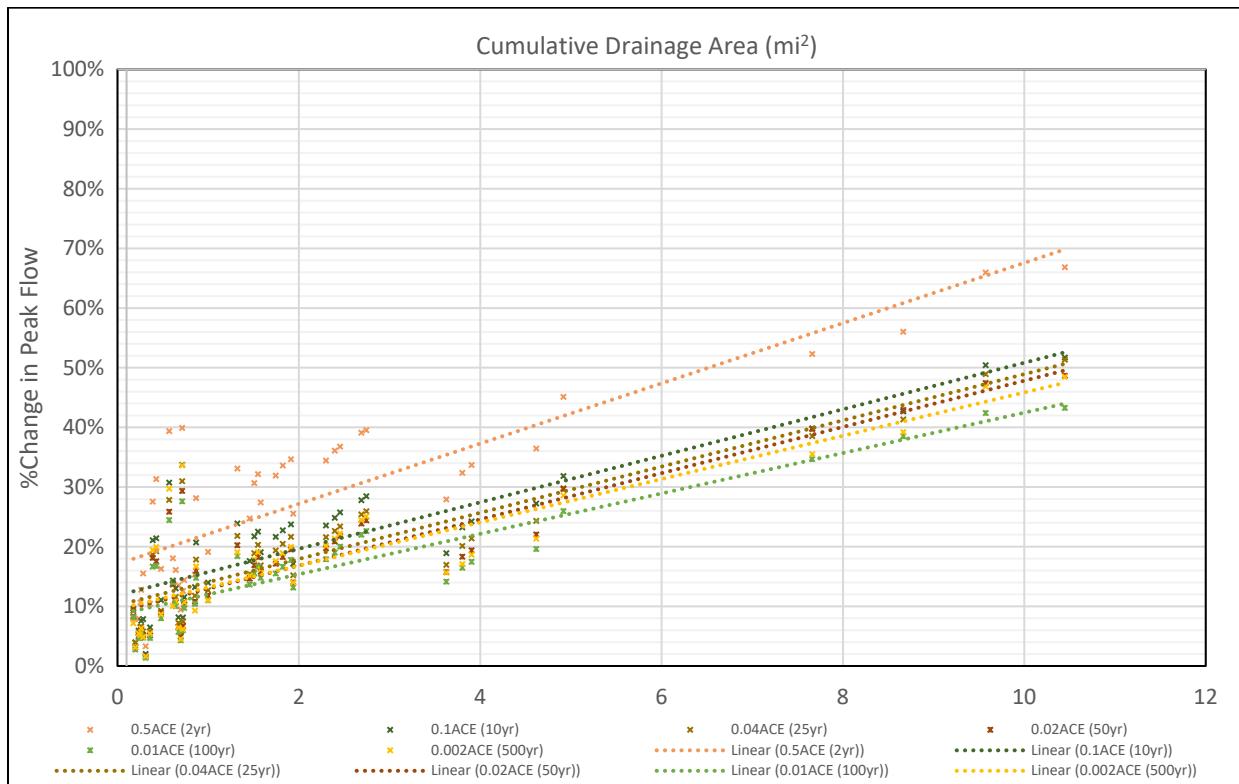
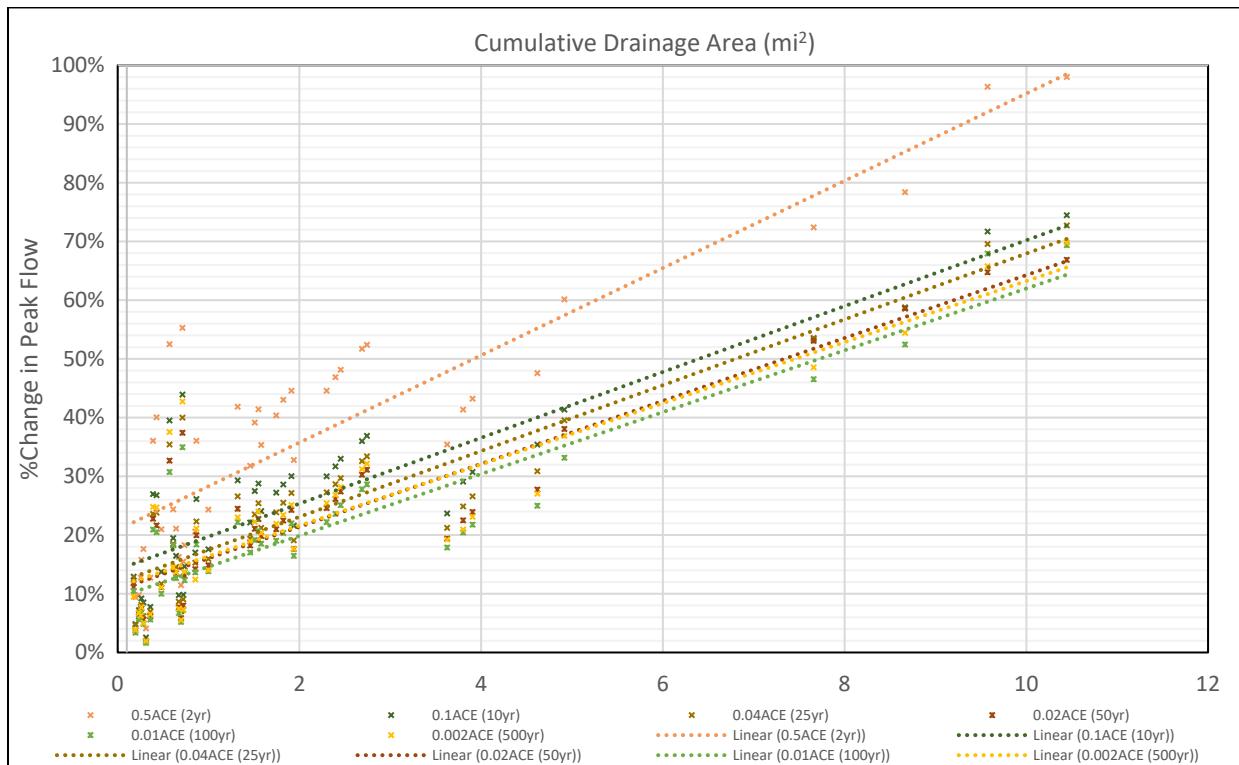


Figure 7. Percent Change in Peak Flow due to %50 Reduction in Valley Storage



The results indicate that reducing valley storage impacts the 50% ACE frequency event (2-yr) much more than the less frequent events, with peak flows exponentially increasing with increased reductions in valley storage and increases in the contributing drainage area. Typically, the 50% ACE is near channel forming discharge and reduction in valley storage can trigger channel incision due to erosive velocities and shear stresses within the channel. The results also indicate that the peak flows increase nearly proportionally for the less frequent storm events as the contributing drainage area increases and the percent of valley storage decreases.

3.3.4 Detention

The cumulative effect of detention within a watershed affects runoff volume and peak flow rates. The sensitivity analyses included modifying the revised existing ultimate conditions land use and percent impervious sensitivity model by adding detention using reservoir elements in HEC-HMS for each sub-basin. As noted in Section 3.3.1, there appears to be a predictable relationship between the change in discharge volume, change in percent impervious cover and the percent change in peak flows. The relationship varies with storm frequency. Figures 8 through 13 show this relationship by plotting percent change in discharge volume for sub-basins on the primary y-axis, percent change in peak flow on the secondary y-axis, and change in percent impervious cover on the x-axis for reach storm frequency. When the data are grouped by CN values, a break-point in the data indicated a relationship for sub-basins with CN values less than 77 and for those with CN values greater than 77.

Figure 8. Percent Change in Peak Flow and Discharge Volume vs Percent Change in Impervious Cover for the 50% ACE

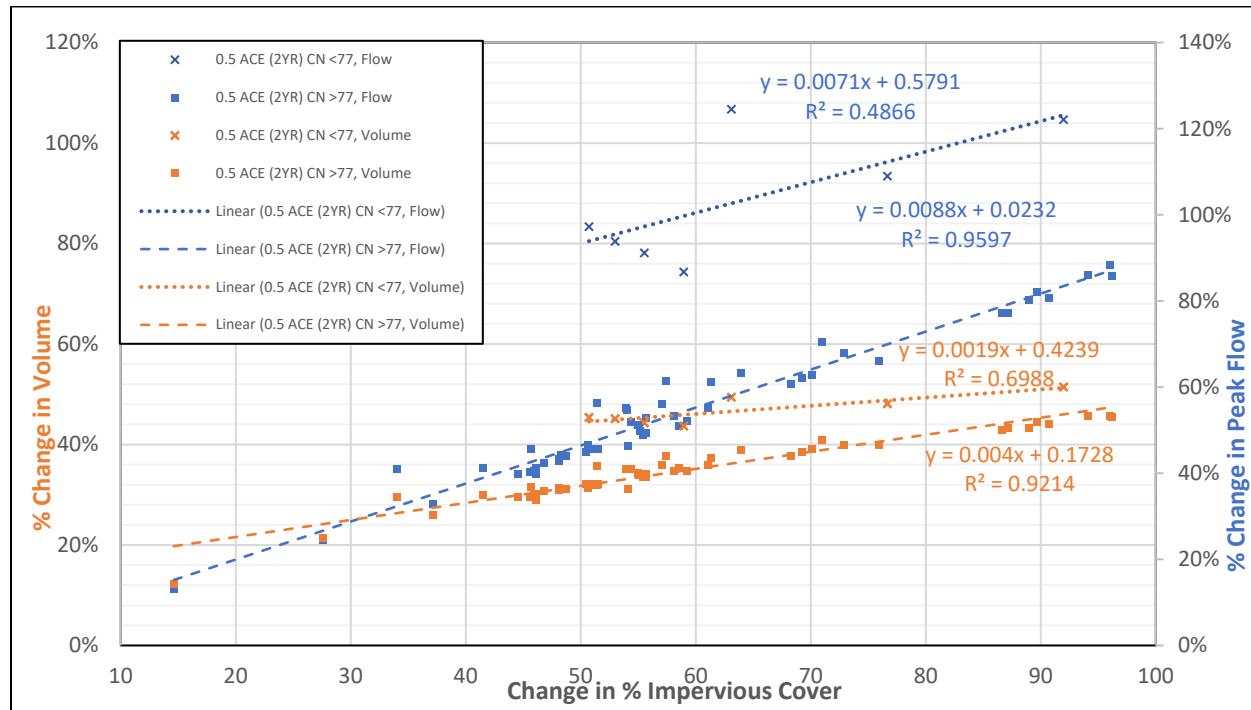


Figure 9. Pervious Change in Peak Flow and Discharge Volume vs Percent Change in Impervious Cover for the 10% ACE

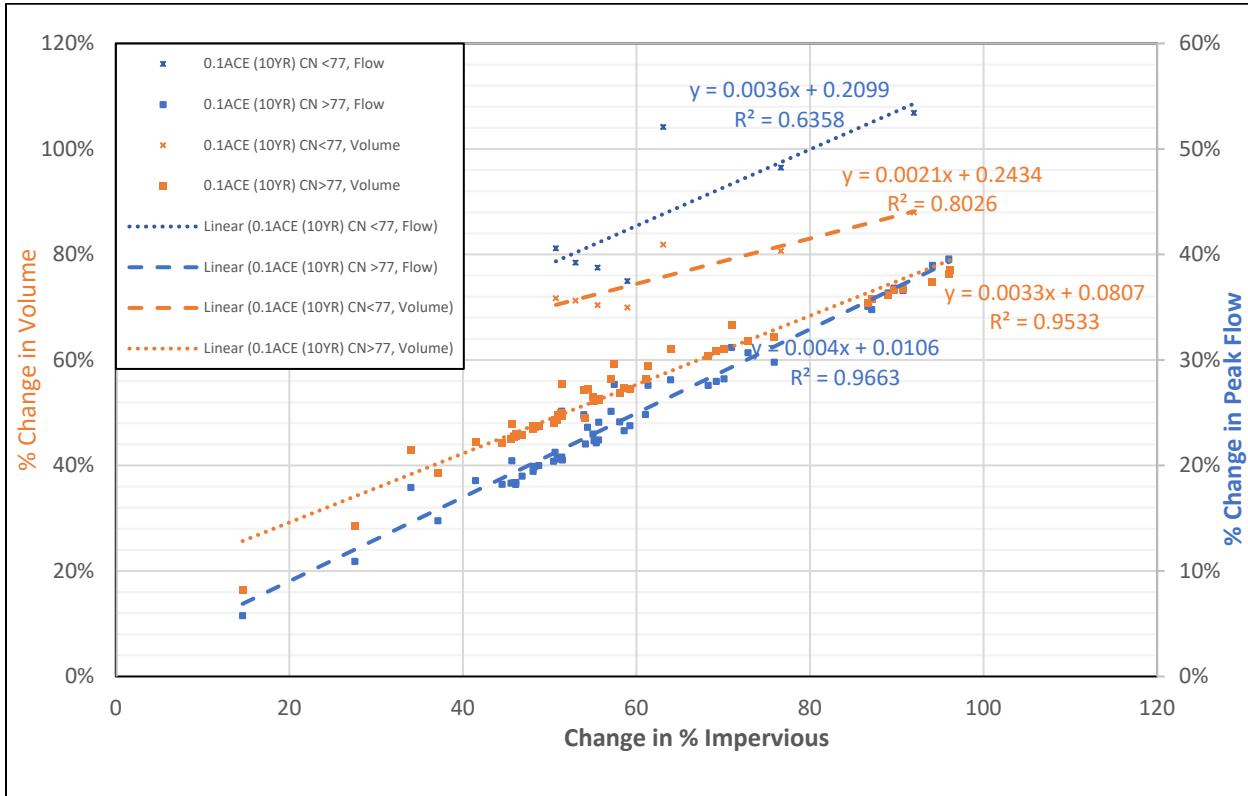


Figure 10. Percent Change in Peak Flow and Discharge Volume vs Percent Change in Impervious Cover for the 25% ACE

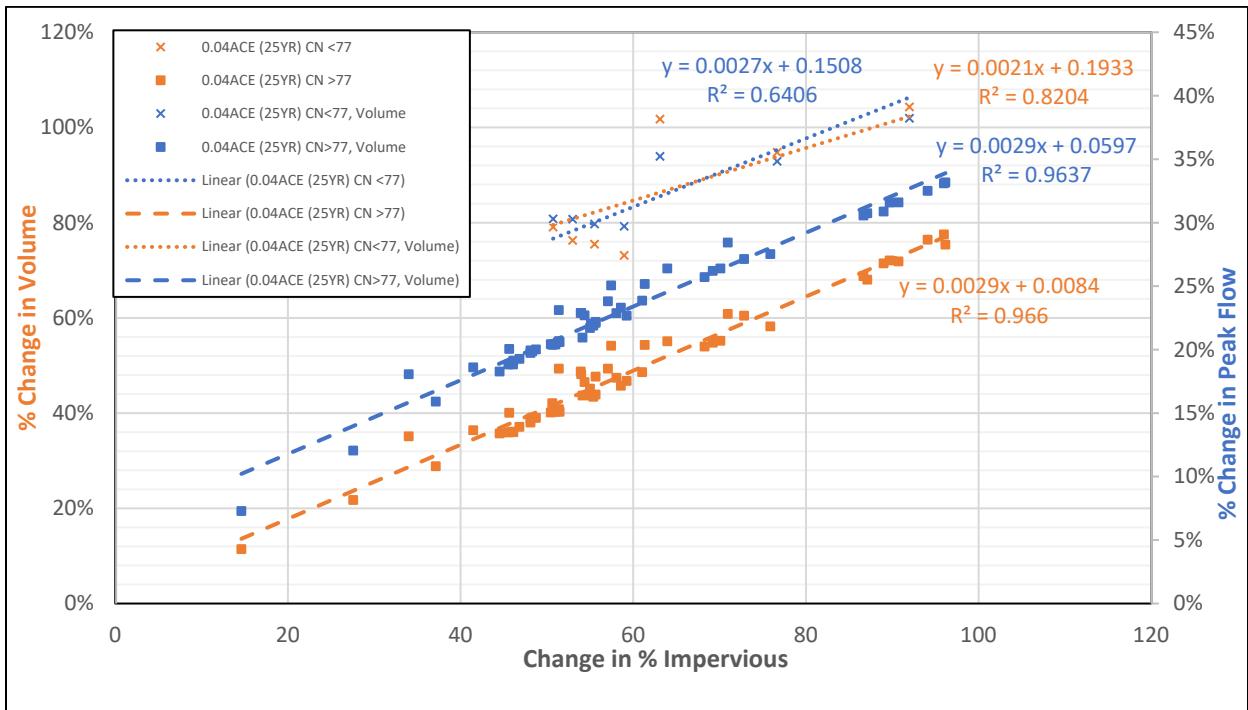


Figure 11. Percent Change in Peak Flow and Discharge Volume vs Percent Change Impervious Cover for the 2% ACE

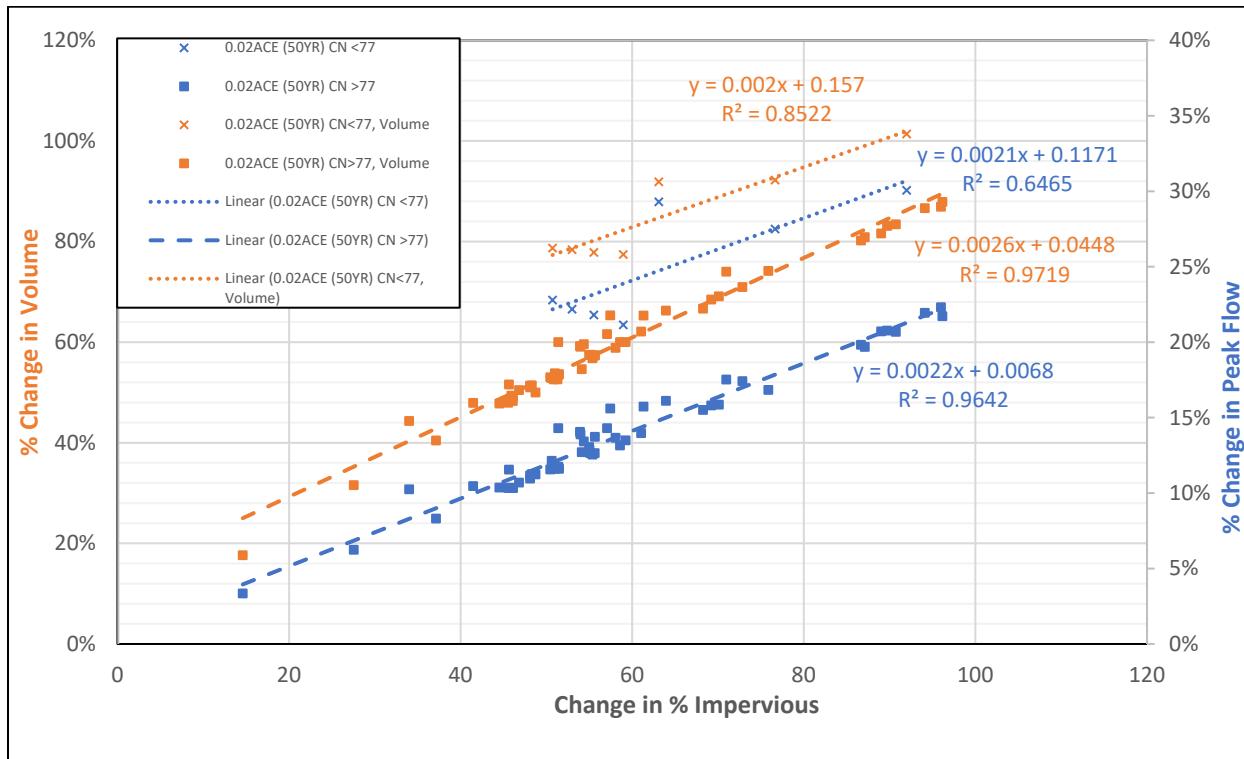


Figure 12. Percent Change in Peak Flow and Discharge Volume vs Percent Change in Impervious Cover for the 1% ACE

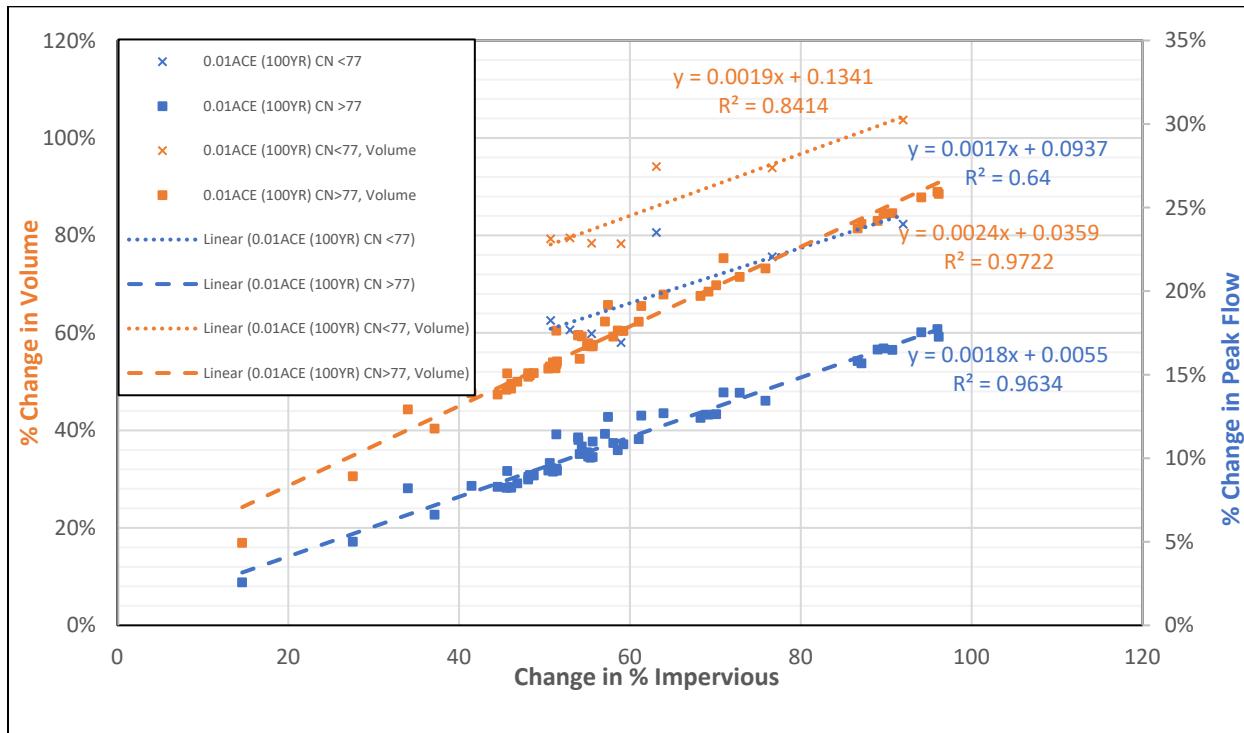
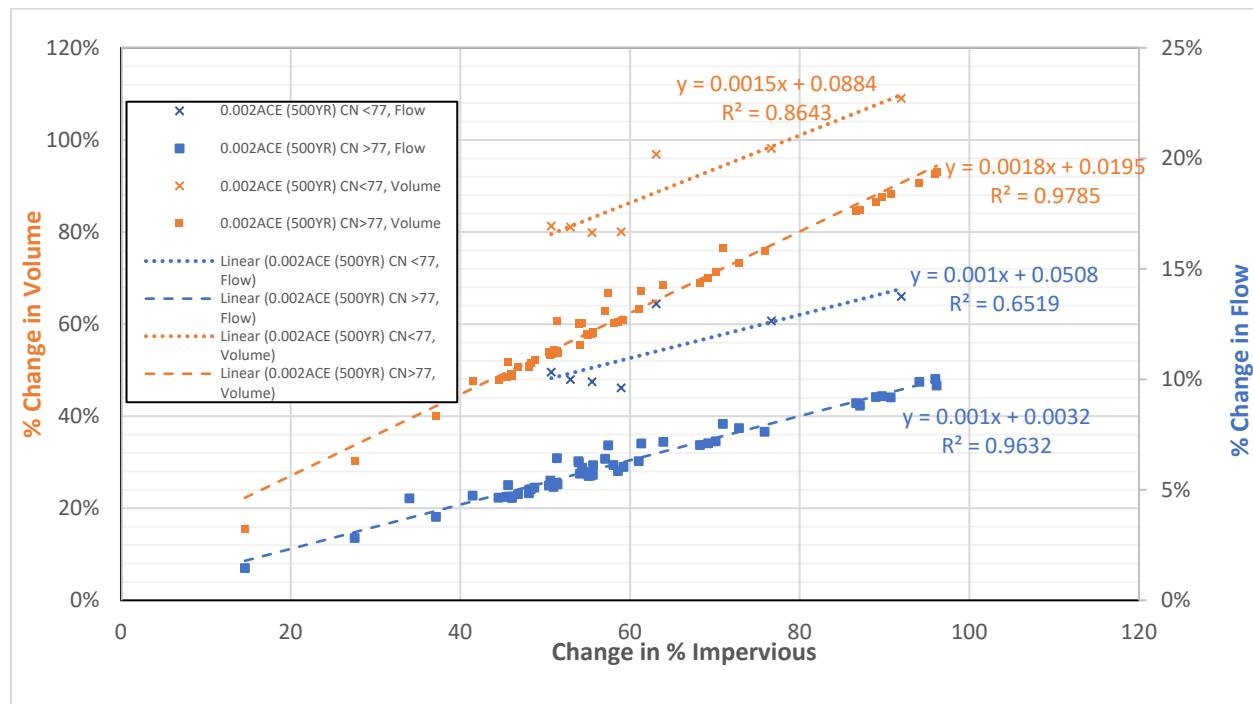


Figure 13. Percent Change in Peak Flow and Discharge Volume vs Percent Change in Impervious Cover for the 0.2% ACE



The regression equations from these relationship curves were used to develop the detention storage-discharge and rating tables used for the sensitivity analyses. The equations were applied under the premise that using these relationships, it may be possible to estimate the required detention to mitigate peak flow impacts on a watershed scale.

Tables 1 and 2 list the equations were used to develop the detention storage-discharge rating tables for each sub-basin.

Table 1 – Storage- Discharge Regression Equations for CN values less than 77

Return Period	Storage Volume (AC-FT)	R ²	Flow (CFS)	R ²
2-YR	0.0019x + 0.4239	0.70	0.0071x + 0.5791	0.49
10-YR	0.0021x + 0.2434	0.80	0.0036x + 0.2099	0.64
25-YR	0.0021x + 0.1933	0.82	0.0027x + 0.1508	0.64
50-YR	0.002x + 0.157	0.85	0.0021x + 0.1171	0.65
100-YR	0.0019x + 0.1341	0.84	0.0017x + 0.0937	0.64
500-YR	0.0015x + 0.0884	0.86	0.001x + 0.0508	0.65

Table 2 – Storage- Discharge Regression Equations for CN values greater than 77

Return Period	Storage Volume (AC-FT)	R ²	Flow (CFS)	R ²
2-YR	0.004x + 0.1728	0.92	0.0088x + 0.0232	0.96
10-YR	0.0033x + 0.0807	0.95	0.004x + 0.0106	0.97
25-YR	0.0029x + 0.0597	0.97	0.0029x + 0.0084	0.96
50-YR	0.0026x + 0.0448	0.97	0.0022x + 0.0068	0.96
100-YR	0.0024x + 0.0359	0.97	0.0018x + 0.0055	0.96
500-YR	0.0018x + 0.0195	0.98	0.001x + 0.0032	0.96

The R² values indicate a strong relationship for sub-basins with CN values greater than 77 for all storm events. The R² values indicate further evaluation of sub-basins with CN values less than 77 may improve the estimate of required storage volume and flow releases particularly for more frequent storm events. Rating tables for paired data in HEC-HMS for each reservoir element are provided in **Appendix G**.

Results of the sensitivity analysis are provided in **Appendix F**, Tables F9 for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies, respectively. Figures 14 and 15 show the percent change in peak flows at sub-basins only and at junctions only, respectively, compared to the baseline historic hydrologic model results for all modeled return frequencies.

The results indicate that the predicted detention required to mitigate the change in land use and percent impervious cover using the developed formulas generally mitigate peak flows at the sub-basin level for all frequency storm events with some outliers. Additionally, the results indicate that the predicted detention required to mitigate peak flows generally mitigate peak flows at junctions for all frequency storm events, except for the 0.5 ACE storm frequency.

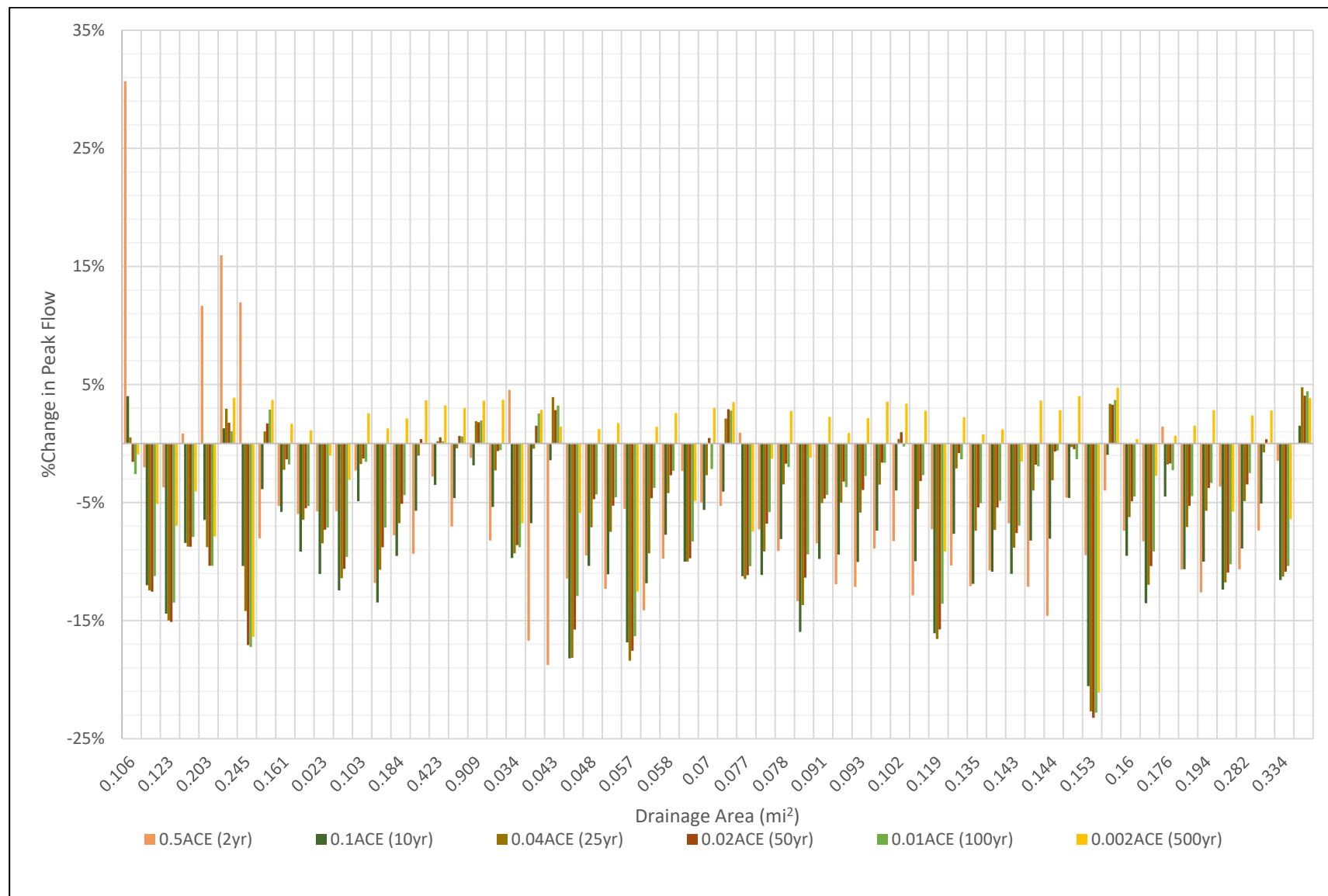
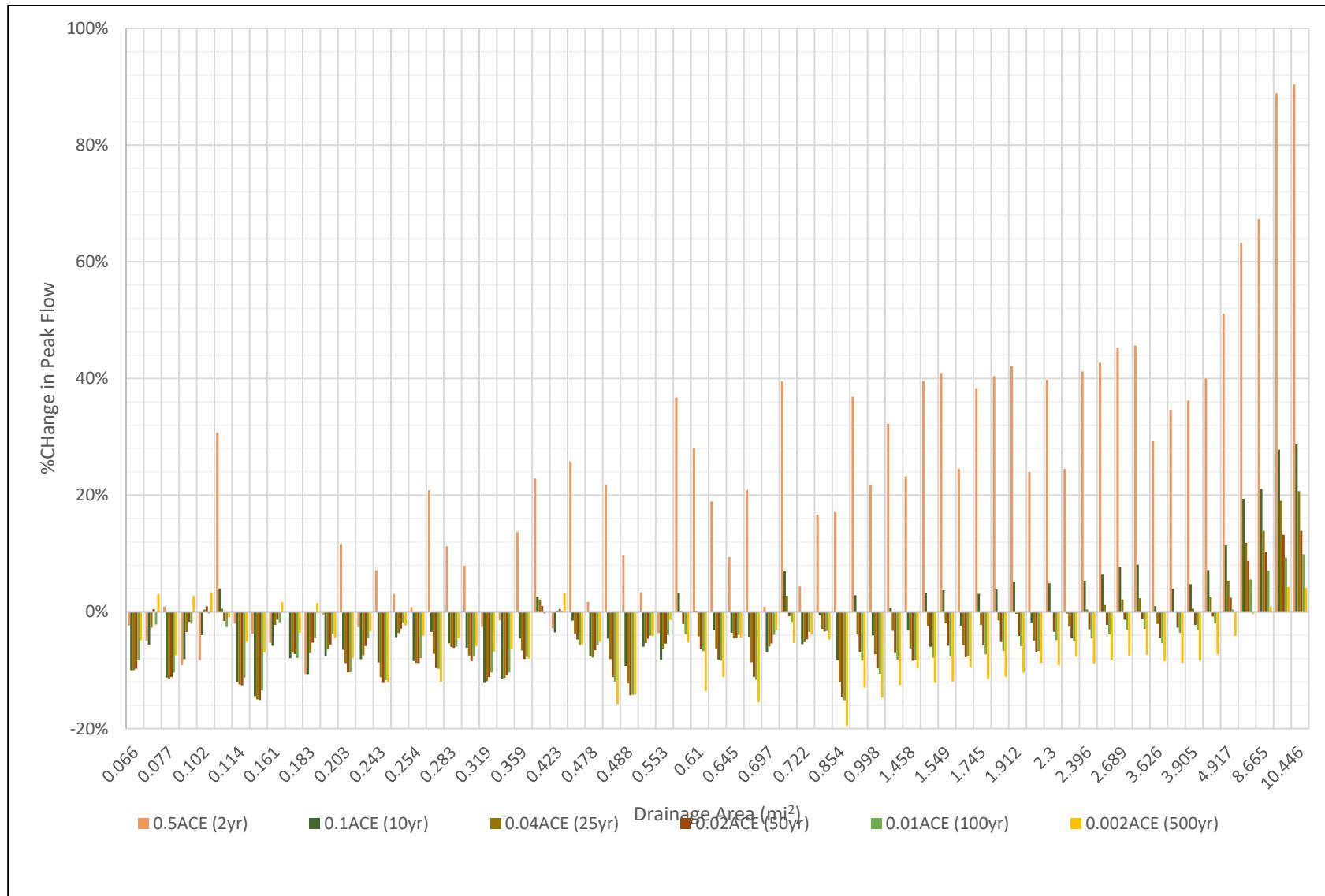
Figure 14. Percent Change in Peak Flow due to Ultimate Land Use and Percent Impervious Cover with Detention (Sub-basins Only)

Figure 15. Percent Change in Peak Flow due to Ultimate Land Use and Percent Impervious Cover with Detention (Junctions Only)

There appears to be a threshold limit with drainage areas greater than approximately 7 mi² for all frequency storm events. Further investigation into the relationships between the change in discharge volume, change in percent impervious cover and the percent change in peak flows could improve the predictions. Overall, the sensitivity analyses demonstrates that detention within the watershed mitigates increases in peak flow due to development at a sub-basin level, and downstream at junctions, for the modeled frequency storm events. However, the analyses indicates that detention increases peak flows at junctions for the 50% ACE storm, with increasing impacts as the drainage area increases.

3.4 Response Matrix

A response matrix was developed to summarize the results of the sensitivity analyses and is included **Appendix H**. Results of the sensitivity analyses indicate that the more frequent storm events are more sensitive to development at the sub-basin level, and downstream at junction locations. Changes in land use and increases in percent impervious cover cause the greatest downstream impacts and increases to peak flows. Loss of valley storage also has a significant impact of downstream peak flows.

Additionally, detention is effective at mitigating peak flows at the sub-basin level. However, detention does not appear to effectively mitigate downstream impacts at junctions for more frequent storm events.

4 Revised Existing Watershed Condition Modeling

The current Whites Branch hydrologic and hydraulic models were revised to incorporate additional development that has occurred since 2015 and updated with the latest available LiDAR topographic data. The following sections describe the revisions to the hydrologic and hydraulic models.

4.1 Revised Existing Conditions Hydrologic Model

4.1.1 Land Use and Percent Impervious Cover

The land use and percent impervious cover GIS datasets provided by the City were reviewed and compared against current aerial photography for the Whites Branch watershed. Areas of new development were identified, and the land use and percent impervious cover were revised for the affected sub-basin as shown on Exhibit 8 – Revised Existing Percent Imperviousness. The affected sub-basin and resulting changes in percent imperviousness listed in Table 3.

Table 3 – Revised Existing Conditions, Sub-basins Percent Impervious Values

HMS Basin Name	Existing Model CN	Existing Model % Impervious	Revised % Impervious
B_WB1A_020	80	41	58
B_WB1_010	80	9	22
B_WB1_015	80	14	28
B_WB1_030	80	61	65
B_WHT_010	79.9	58	62
B_WHT_040	80	15	41
B_WHT_055	80	43	48
B_WHT_130	74.9	51	53

Revised hydraulic parameter calculations are provided in [Appendix I](#).

4.1.2 Detention Basins

The existing condition HEC-HMS hydrologic model for Whites Branch includes some detention areas modeled as reservoirs. A review of current aerial photography and topographic data was conducted to identify significant detention facilities within the Whites Branch watershed. A GIS shapefile was created to mark detention area locations. These locations were compared to the existing condition HEC-HMS model and areas that were not included in the model were noted.

Additionally, some detention facilities are located within stream corridors and storage in these facilities are accounted for in the cross-section geometry. The existing condition HEC-RAS hydraulic models were reviewed to identify which inline detention facilities are accounted for in the hydraulic models, and hence Modified Puls routing.

Detention facilities that were not included in the existing hydrologic or hydraulic models were incorporated into the revised hydrologic model. Reservoir storage-discharge and storage elevation tables were developed using LiDAR contours to estimate the available storage within the facility. Exhibit 9 – Revised Existing - Detention within Watershed shows the locations of the detention facilities previously accounted for in the existing condition HEC-HMS model, facilities accounted for in the hydraulic model routing reaches, and facilities that were added to the revised existing conditions HEC-HMS model. Rating tables for the added facilities are provided in [Appendix J](#).

4.1.3 Modified Puls Routing

The Modified Puls routing paired data were revised by incorporating more recent 2019 LiDAR topographic data into the existing conditions HEC-RAS hydraulic models used to develop the rating tables. The paired data for the existing conditions HEC-HMS model is linked to DSS files created for each routing reach using HEC-RAS. The DSS files were exported from HEC-RAS and linked to the corresponding storage-volume paired data. Details on the revisions to the existing

conditions HEC-RAS hydraulic models for the Whites Branch watershed are provided in Section 4.2. Rating tables for the revised existing conditions are provided in **Appendix C**.

4.2 Revised Existing Conditions Hydraulic Models

4.2.1 Cross-section Geometry

The existing conditions HEC-RAS hydraulic models for Whites Branch main stem, and nine (9) tributaries labeled WB-1, WB-1A, WB-1B, WB-2, WB-3, WB-3A, WB-3B, WB-3C, and WB-3D, were revised using more recent 2019 LiDAR in the overbank areas where there was significant difference in the 2015 terrain and the 2019 LiDAR. These areas include locations where new development has occurred as reflected in the newer LiDAR and confirmed with aerial photography. Impacted reaches and cross-sections are listed in Table 4.

Table 4 – Revised Existing Conditions HEC-RAS Cross-sections Revisions

HEC-RAS Model	Updated Cross Sections
WB-1	15059 ROB, 15005 LOB & ROB, 6899 LOB
WB-1A	1034 LOB
WB-3	16335, 16190, 8223, 7877, 7735 (ALL LOB)
Whites Main	42344 LOB & ROB, 31827 LOB, 31711 LOB

HEC-RAS cross-section plots for Whites Branch main stem and the nine (9) tributaries are provided in **Appendix K**.

4.2.2 Flow Rates

HEC-RAS flow rates were revised based on the revised existing conditions hydrologic model results. The reaches revised include WB-1 WB-1A, WB-3, and Whites Branch main stem. Revised flow data tables for the affected hydraulic modes are included in **Appendix L**.

4.3 Comparison of Results

The results of the revised existing condition hydrologic modeling results are provided in **Appendix M** and are compared to the 2015 hydrologic model peak flows for sub-basins and at junctions. The results show minor changes to peak flows at some locations, but no significant changes.

The results of revised existing conditions hydraulic modeling results for each hydraulic model are provided in **Appendix N** and are compared to the 2015 hydraulic model 100-year water surface elevations. The results show minor changes in 100-year water surface elevations at some location. Exhibit 10 – Revised Existing Floodplain Comparison shows the revised floodplain mapping overlain with the existing floodplain mapping.

5 Impact Analysis

The results of the watershed analysis were used to identify stream reaches where valley storage has been significantly reduced due to channelization or piping of open channels. The results are compared to the baseline historic conditions streamlines and floodplain as shown on Exhibit 11 – Impact Analysis. Additionally, flooding incident reports data and channel erosion potential mapping, provided by the City, were overlain on the impact analysis results to determine the correlation, if any, with flooding incidents or areas or erosion risk.

Four (4) assessment areas were identified and labeled 1 through 4 as shown on Exhibit 11 – Impact Analyses. They include a portion of Whites Branch main stem, WB-1A, WB-2, and WB-3D.

5.1 Assessment Area 1

Assessment Area 1 is located along Whites Branch main, stem east of Old Denton Road and extends from just south of Heritage Trace Parkway to Shiver Road. In 1963 this portion of Whites Branch main stem had been altered by agricultural uses. Whites Branch main stem flowed south along the east side of Old Denton Road, close to its current alignment, but was not confined. Old Denton Road was not a major roadway at the time and floodwaters were able to expand east into the crop land. Whites Branch main stem has since been channelized and is confined by an improved Old Denton Road to the west, and residential areas to the east as shown in Figure 16.

The impact of this channelization includes a 40% to 50% reduction in valley storage as shown in Figure 17. Figure 17 is a plot of the baseline historic conditions storage discharge rating curve (shown in green) against the revised existing conditions (shown as a red dashed line), and the valley storage sensitivity model runs, for this reach of Whites Branch main stem. The plot shows how valley storage has been reduced overtime. Table 5 lists the range of flows for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies historically and currently for this reach.

Table 5 – Assessment Area 1, Range of Flows

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)
5% ACE	357	604
10% ACE	756	986
4% ACE	997	1212
2% ACE	1201	1381
1% ACE	1423	1567
0.2% ACE	2139	2060

Figure 16. Assessment Area 1, 1963 vs 2021 Aerial Comparison

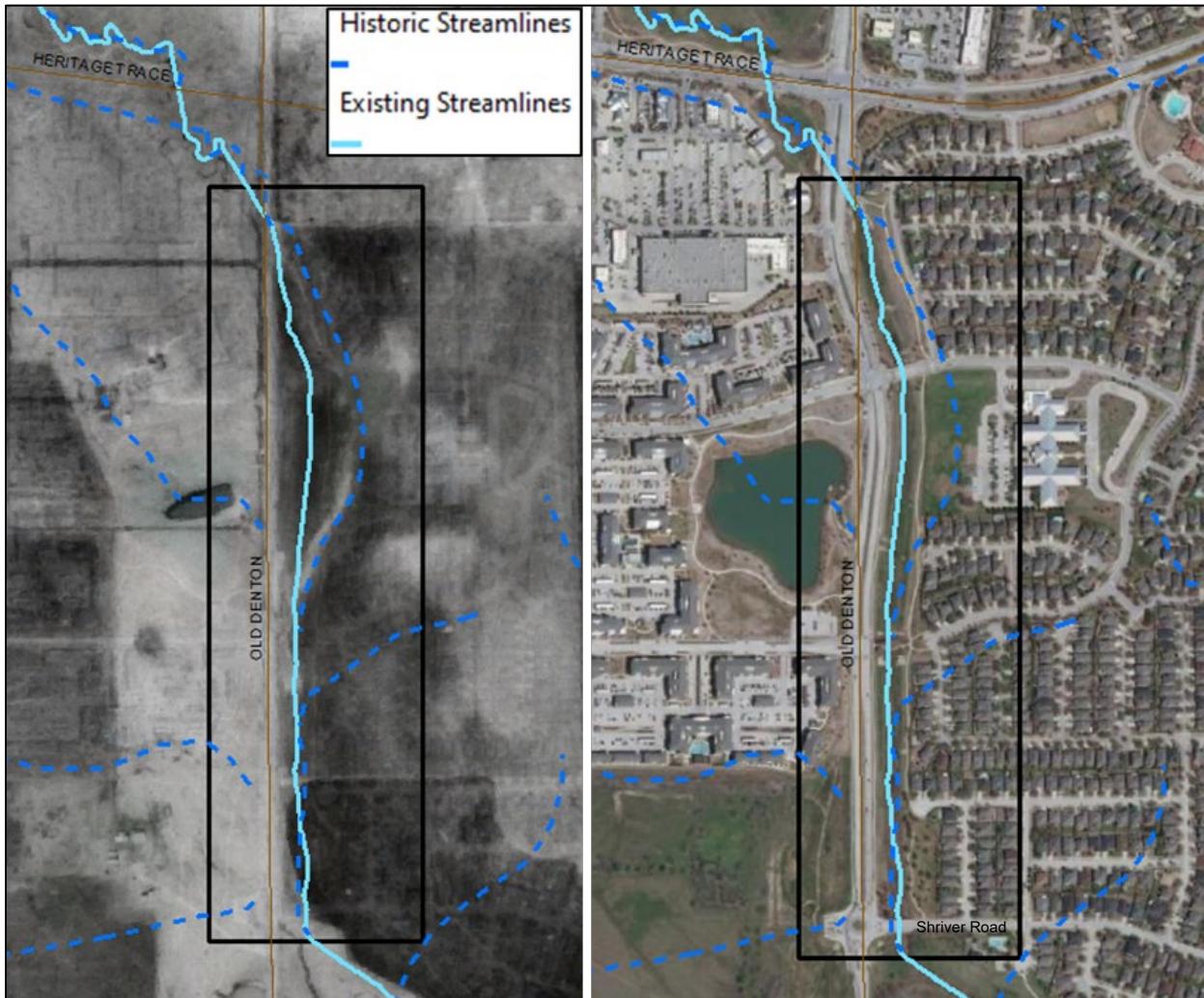


Figure 17. Assessment Area 1, Valley Storage-Discharge Rating Curve

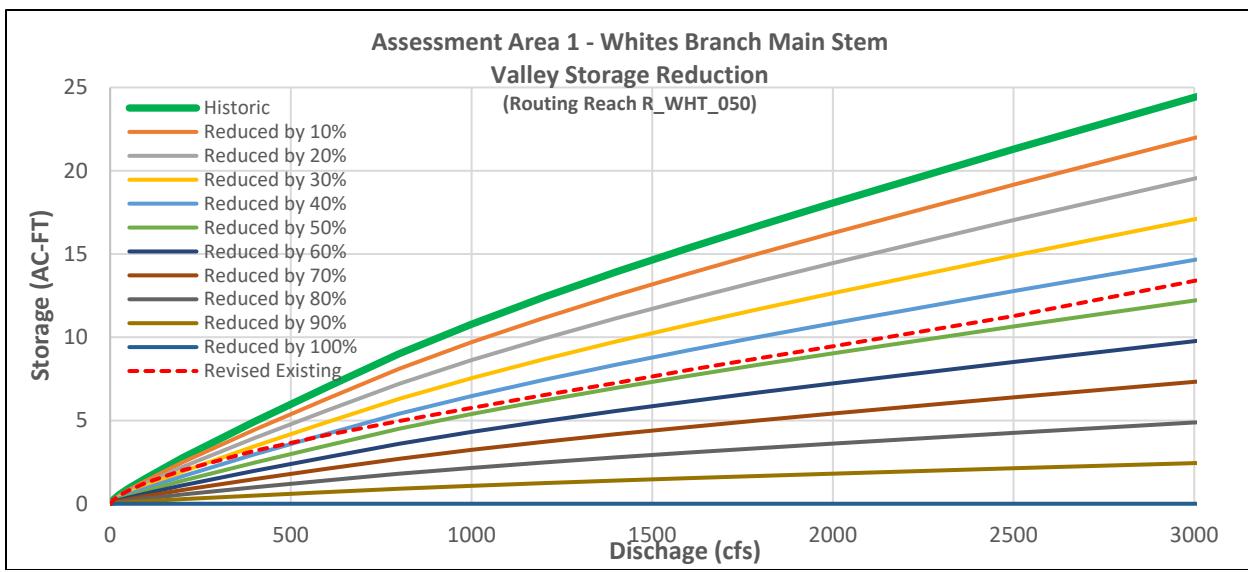


Table 6 compares peak flows immediately downstream of the channelized reach at Junction J_WHT_050. The results demonstrate the immediate increase to peak flows due to reduction in valley storage for the 5% ACE, while the less frequent events do not see increases in peak flow immediately downstream.

Table 6 – Assessment Area 1, Downstream Impacts to Peak Flows (J_WHT_050)

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)	%Change
5% ACE	560	679.6	21%
10% ACE	1183.2	1129.5	-5%
4% ACE	1557.5	1397.2	-10%
2% ACE	1873.1	1601.4	-15%
1% ACE	2205.6	1829.2	-17%
0.2% ACE	3398.4	2402.7	-29%

5.2 Assessment Area 2

Assessment Area 2 is located along tributary WB-1A and extends approximately 520-feet upstream of Heritage Trace Parkway to just downstream of Beach Street. In 1963 this portion of WB-1A was an open channel swale flow through pasturelands. Heritage Trace Parkway was not yet constructed, and Beach Street was not a major roadway. WB-1A has been channelized upstream of Heritage Trace Parkway and piped through a commercial center downstream of Heritage Trace Parkway. The stream daylighted approximately 330-ft upstream of Beach Street as shown in Figure 18.

The impact of this channelization and piping includes a 30% to 40% reduction in valley storage as shown in Figure 19. Figure 19 is a plot of the baseline historic conditions storage discharge rating curve against the revised existing conditions (shown as a red dashed line), and the valley storage sensitivity model runs, for this reach of WB-1A. The plot shows how valley storage has been reduced overtime up to a flow rate of 1,200 cfs. At approximately 1,200 cfs the capacity of the storm pipe is exceeded, and overland flow begins, and the valley storage dramatically increases for the revised existing condition at this point as floodwaters access overland flow paths. Table 7 lists the range of flows for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies historically and currently for this reach.

Table 7 – Assessment Area 2, Range of Flows

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)
5% ACE	162	420
10% ACE	372	682
4% ACE	497	835
2% ACE	604	959
1% ACE	716	1091
0.2% ACE	1131	1587

Figure 18. Assessment Area 2, 1963 vs 2021 Aerial Comparison

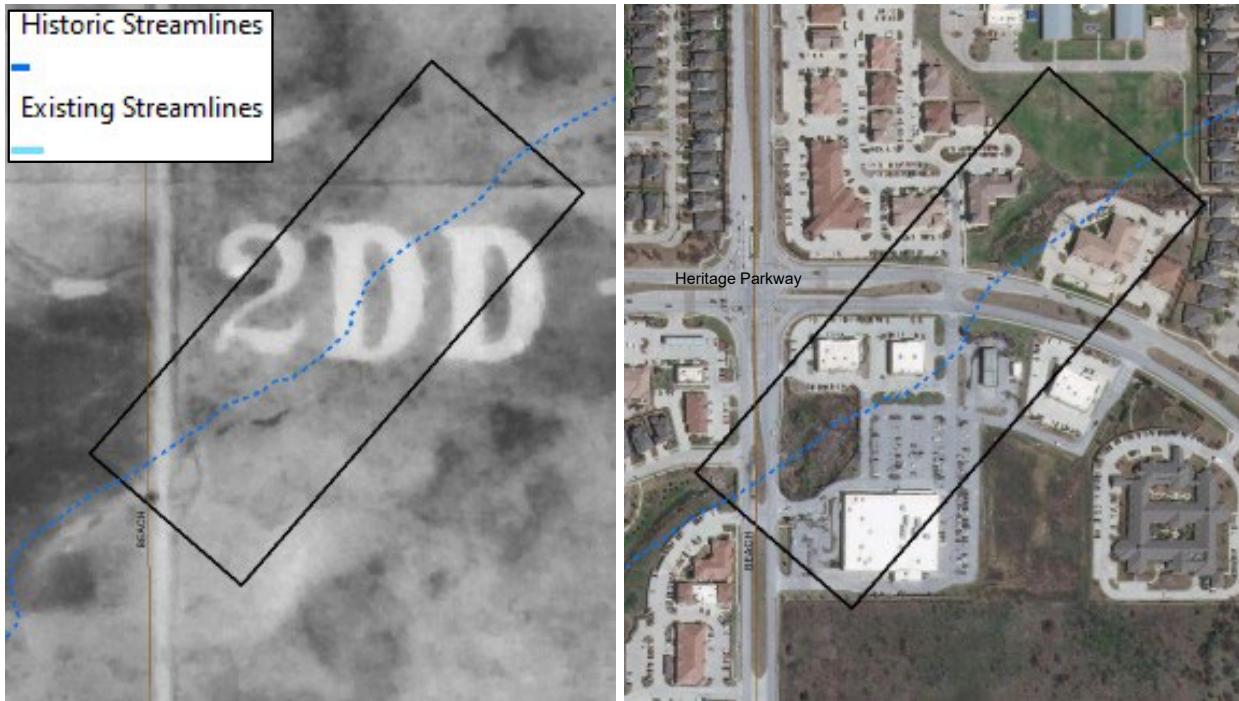


Figure 19. Assessment Area 2, Valley Storage-Discharge Rating Curve

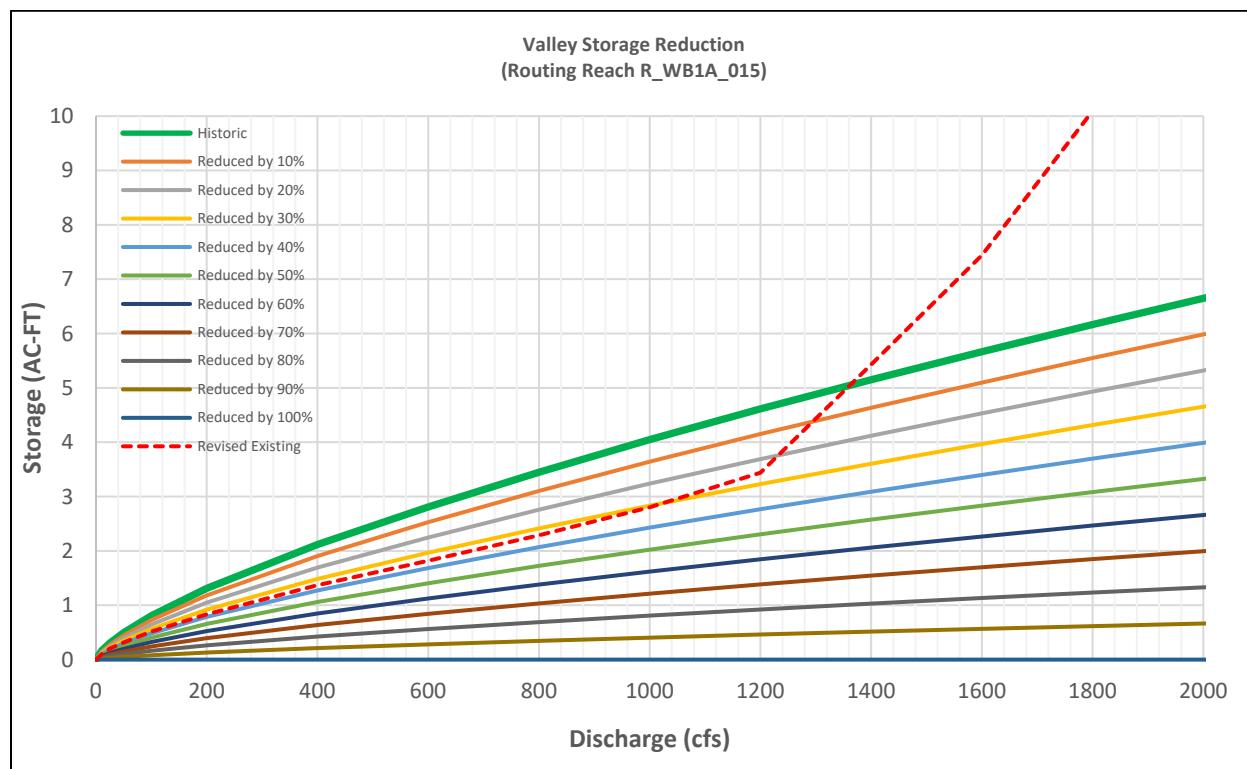


Table 8 compares peak flows immediately downstream of the channelized reach at Junction J_WB1A_015. The results demonstrate immediate increases to peak flows due to reduction in valley storage for all storm frequencies, and most significantly with the 5% ACE.

Table 8 – Assessment Area 2, Downstream Impacts to Peak Flows (J_WB1A_015)

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)	%Change
5% ACE	204	507	149%
10% ACE	461	818	77%
4% ACE	615	997	62%
2% ACE	743	1144	54%
1% ACE	881	1292	47%
0.2% ACE	1378	1762	28%

5.3 Assessment Area 3

Assessment Area 3 is located along tributary WB-2 and extends from Shiver Road to Tarrant Parkway. In 1963 this portion of WB-2 flowed through pasturelands. An inline stock tank was located at approximately 1,100-ft downstream of Shiver Road along the historic stream alignment. Shiver Road and Tarrant Parkway were not yet constructed. WB-2 has been channelized and the alignment altered through a residential neighborhood as shown in Figure 20.

The impact of this channelization includes a 50% to 60% reduction in valley storage as shown in Figure 20. Figure 20 is a plot of the baseline historic conditions storage discharge rating curve against the revised existing conditions (shown as a red dashed line), and the valley storage sensitivity model runs, for this reach of WB-2. The plot shows how valley storage has been reduced overtime. Table 9 lists the range of flows for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies historically and currently for this reach.

Table 9 – Assessment Area 3, Range of Flows

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)
5% ACE	241	363
10% ACE	571	703
4% ACE	770	903
2% ACE	938	1061
1% ACE	1117	1239
0.2% ACE	2013	2312

Figure 20. Assessment Area 3, 1963 vs 2021 Aerial Comparison



Figure 21. Assessment Area 3, Valley Storage-Discharge Rating Curve

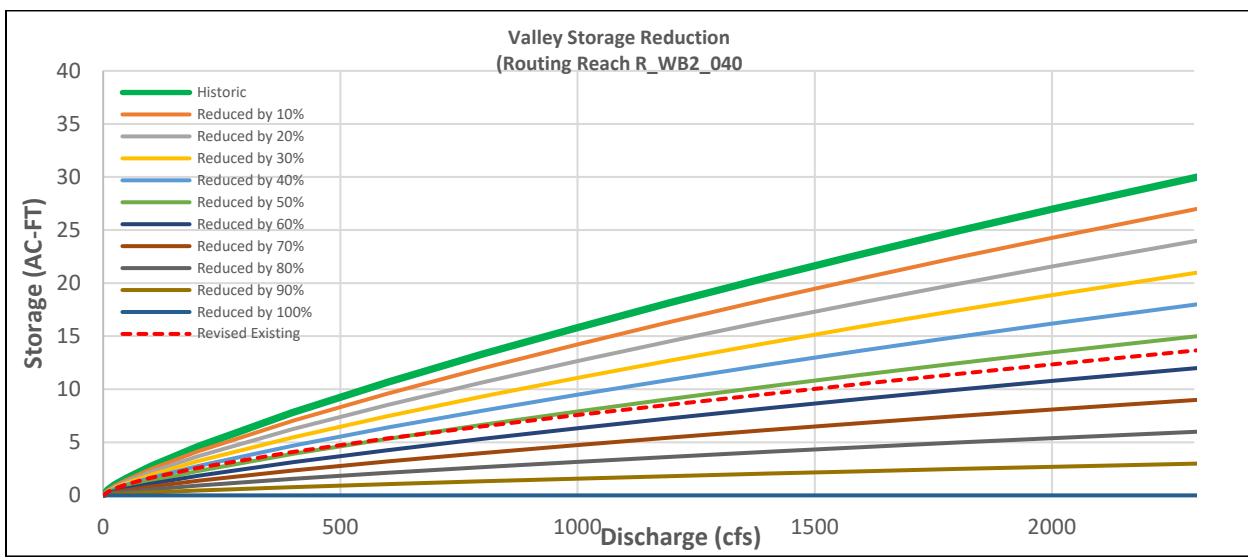


Table 10 compares peak flows immediately downstream of the channelized reach at Junction J_WB2_040. The results demonstrate immediate increases to peak flows due to reduction in valley storage for the 5% through 1% ACE storm frequencies, and most significantly with the 5% ACE. The 0.2% ACE shows a slight reduction.

Table 10 – Assessment Area 3, Downstream Impacts to Peak Flows (J_WB2_040)

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)	%Change
5% ACE	287	467	63%
10% ACE	688	839	22%
4% ACE	934	1089	17%
2% ACE	1142	1290	13%
1% ACE	1367	1515	11%
0.2% ACE	2192	2056	-6%

5.4 Assessment Area 4

Assessment Area 4 is located along tributary WB-3D and extends approximately 1,000-ft upstream of Ridge Lake Drive to 380-ft downstream of Ridge Lake Drive. In 1963 this portion of WB-3D flowed through cultivated lands and maintained. WB-3D has been channelized and the alignment altered through a residential neighborhood as shown in Figure 22.

The impact of this channelization includes a 20% to 30% reduction in valley storage as shown in Figure 23. Figure 23 is a plot of the baseline historic conditions storage discharge rating curve against the revised existing conditions (shown as a red dashed line), and the valley storage sensitivity model runs, for this reach of WB-3D. The plot shows how valley storage has been reduced overtime. Table 11 lists the range of flows for the 50%, 10%, 40%, 2%, 1%, and 0.2% ACE frequencies historically and currently for this reach.

Table 11 – Assessment Area 4, Range of Flows

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)
5% ACE	48	125
10% ACE	101	186
4% ACE	132	222
2% ACE	156	250
1% ACE	280	472
0.2% ACE	270	401

Figure 22. Assessment Area 4, 1963 vs 2021 Aerial Comparison



Figure 23. Assessment Area 4, Valley Storage-Discharge Rating Curve

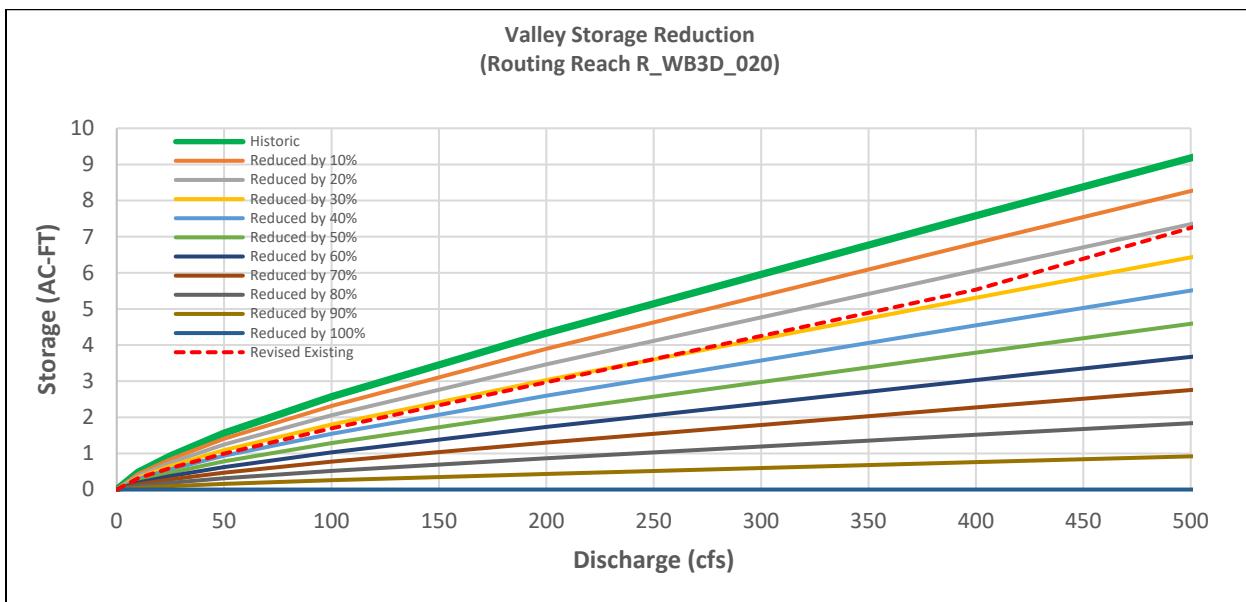


Table 12 compares peak flows immediately downstream of the channelized reach at Junction J_WB3D_020. The results demonstrate immediate increases to peak flows due to reduction in valley storage and residential development for all storm frequencies, and most significantly with the 5% ACE.

Table 12 – Assessment Area 4, Downstream Impacts to Peak Flows (J_WB3D_020)

Storm Event	Baseline Historic Flows (cfs)	Revised Existing Flows (cfs)	%Change
5% ACE	125	256	105%
10% ACE	257	417	62%
4% ACE	402	585	45%
2% ACE	473	664	40%
1% ACE	473	664	40%
0.2% ACE	1063	1620	52%

6 Significance of Impacts Evaluation & Recommendations

Evaluation of the four assessment areas demonstrates that loss of valley storage does create significant impacts to peak flows downstream of the assessment areas, and particularly with more frequent storm events. This observation was further confirmed with the valley storage sensitivity analyses. Table 14 summarizes the assessment area evaluation. All the assessment reaches included valley storage loss of 20% or greater.

There are no incident reports or high-risk erosion potential locations that correlate with the assessment areas. Erosion potential is moderate to low for all four locations.

For the purposes of this study, a high-level literature review of research on the impacts of urbanization on water quality was performed. Using the results of the research reviewed and best professional judgement, a high-level water quality rating was developed based on the percent imperviousness of the upstream contributing watershed. This ratings for water quality were qualitative using the criteria listed in Table 13.

Table 13 – Water Quality Rating

Percent Impervious Cover	Water Quality Rating
0 - 11	Good
12 - 32	Good to Fair
33 - 50	Fair
51 - 71	Fair to Poor
72 - 100	Poor

The current City of Fort Worth iSWM design criteria do not include evaluation or mitigation of valley storage loss due to development. It is recommended that valley storage impact analyses for a range of storm events be included in future version of the design criteria. Proposed

criteria could include a maximum limit to valley storage loss, potentially based on drainage area. Further evaluation is required to establish what those limits and thresholds should be.

Additionally, the land use and impervious cover sensitivity analyses revealed a potential relationship between the change in discharge volume, change in percent impervious cover and the percent change in peak flows. The preliminary regression equations of these relationship were used for the detention sensitivity analyses and the results indication they are reasonable to for estimating the required detention based on change in percent imperviousness on a sub-basin scale. Further evaluation of this relationship could prove beneficial to improving detention requirements for future development.

Digital copies of all models, supporting data, spreadsheets and GIS files at provided digitally in **Appendix 0**.

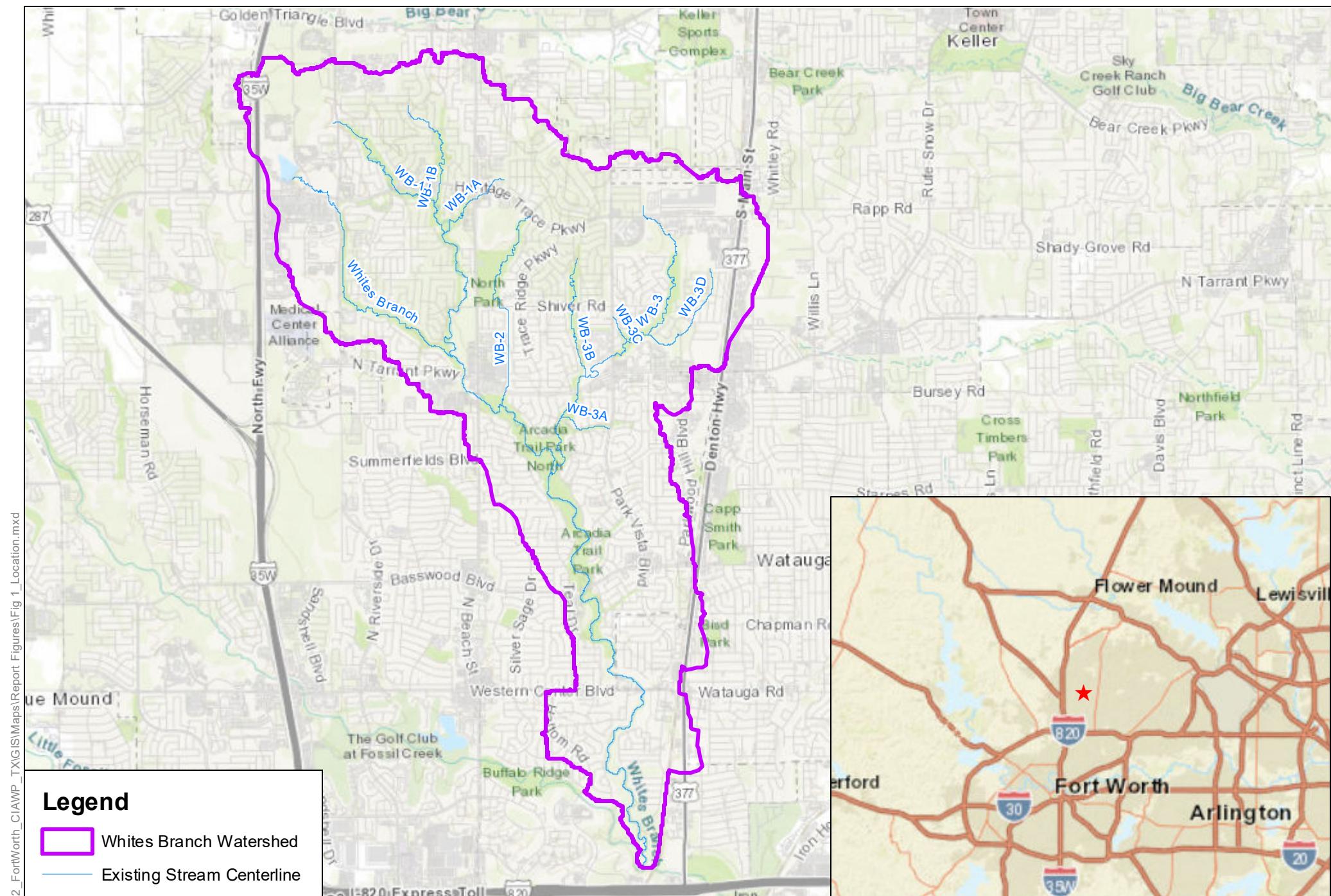


Table 14 – Valley Storage Impacts Summary for Assessment Areas

Assessment Area	Evaluation Item	Baseline Historic Condition , 50% ACE (2-year)	Revised Existing Condition, 50% ACE (2-year)	Baseline Historic Condition , 1% ACE (100-year)	Revised Existing Condition, 1% ACE (100-year)	HEC-HMS Evaluation Point	Revised Existing Q (cfs) 50% ACE (2-yr)	Revised Existing Q (cfs) 1% ACE (100-yr)	Notes
1	Volume of Valley Storage provided (reaches) (acre-feet)	7.5	4.0	15.1	7.5	R_WHT_050	604	1567	Comparisons were made based on the revised existing conditions discharge for the routing reach
2		2.2	1.5	4.0	3.0	R_WB1A_015	420	1091	
3		5.4	3.0	18.0	8.0	R_WB2_040	363	1239	
4		3.0	2.0	5.8	4.0	R_WB3D_020	125	280	
1	Acres of inundation (acres)	9.7	6.3	18.2	7.5				Floodplain limits within assessment reach
2		2.4	1.6	4.0	2.5				
3		13.6	4.5	28.1	5.6				
4		4.1	3.0	18.4	6.5				
1	Average Time of Concentration (Lag in min)	14.9	14.9	14.9	14.9				Average lag time for contributing sub-basin to the assessment reach.
2		14.6	10.0	14.6	10.0				
3		15.5	10.8	15.5	10.8				
4		14.4	13.0	14.4	13.0				
1	Number of flood prone properties	0	0	0	0				Count of inundated properties within assessment reach
2		0	0	0	0				
3		0	0	0	0				
4		0	0	0	0				
1	Overall volume of runoff of the drainage basin (acre-feet)	70.3	114.9	305.0	397.8	J_WHT_050			Junction directly downstream from the assessment reach
2		20.3	44.3	101.0	144.1	J_WB1A_015			
3		44.2	65.4	198.0	227.7	J_WB2_040			
4		14.7	27.4	62.9	84.3	J_WB3D_020			
1	Overall Erosion Risk Rating				Moderate to Low				Based on City provided erosion risk data.
2					Moderate to Low				
3					Moderate to Low				
4					Low				
1	Overall Water Quality Rating				Fair				Based on percent imperious cover upstream of assessment reach
2					Fair to Poor				
3					Poor				
4					Poor				

EXHIBITS





Whites Branch
Project Location Map
(Exhibit 1)

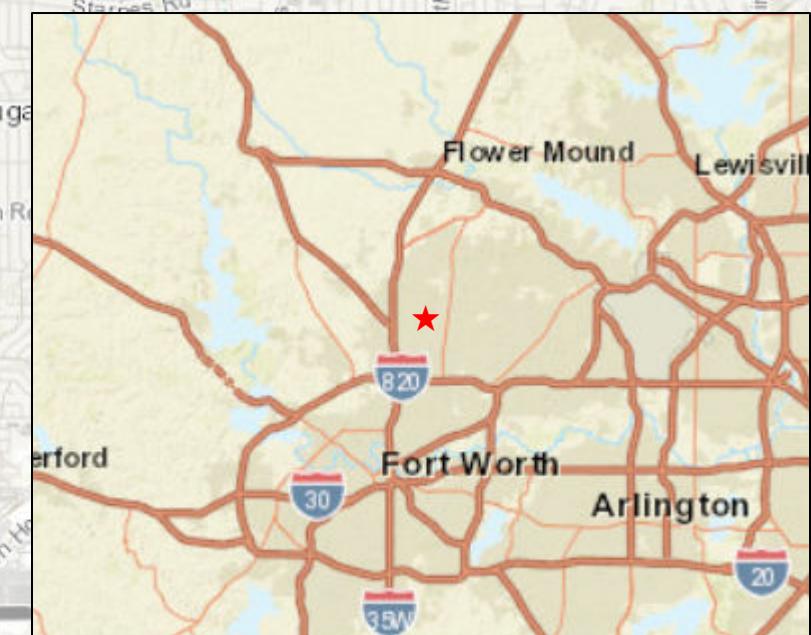
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR

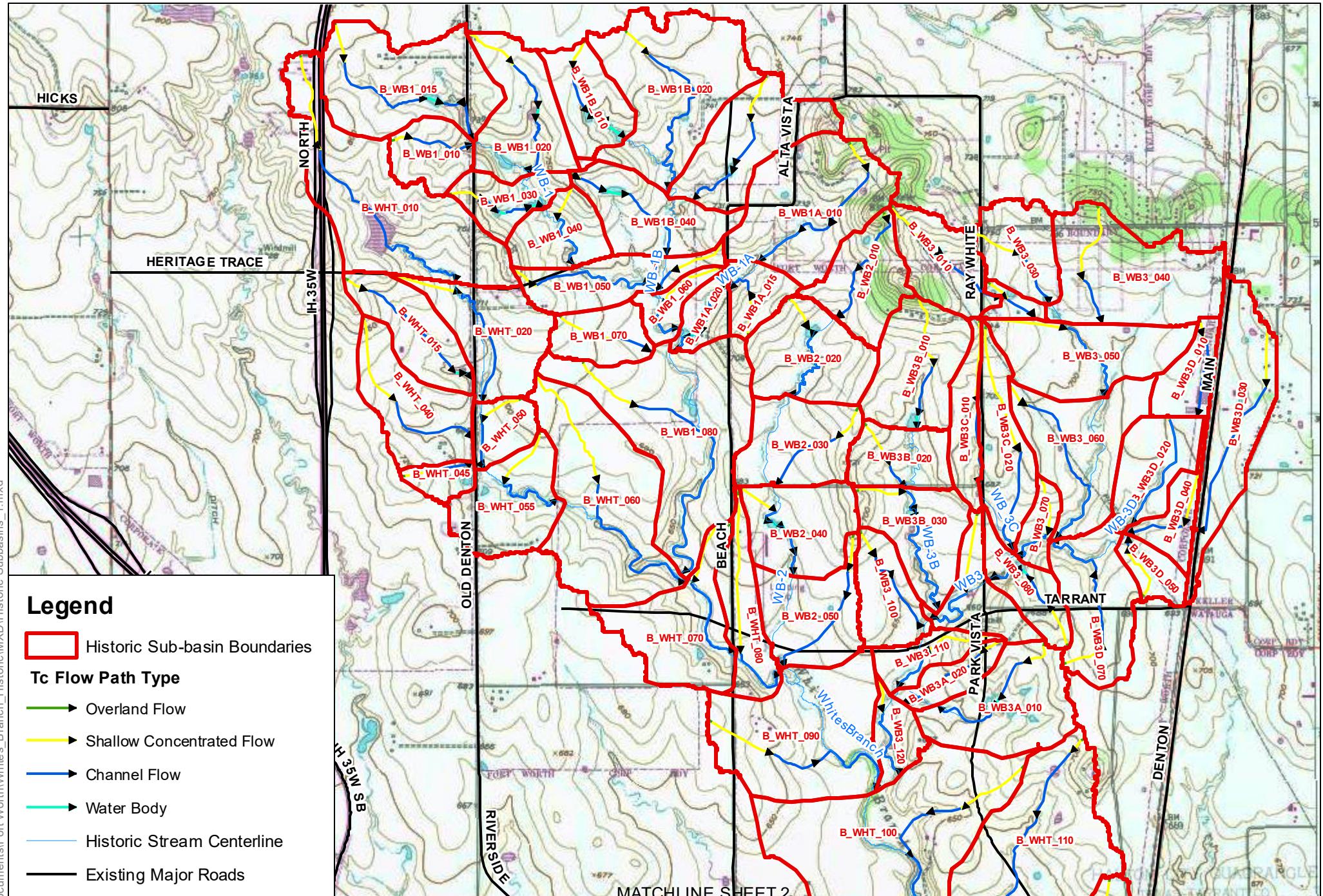


0 2,000 4,000 8,000
Feet
0 0.25 0.5 Miles



ECOSYSTEM
PLANNING &
RESTORATION





Whites Branch
Historic Watershed Delineation (Exhibit 2, Sheet 1)
1955 USGS Topographic Maps
NAD 1983 StatePlane Texas North FIPS 4200 Feet

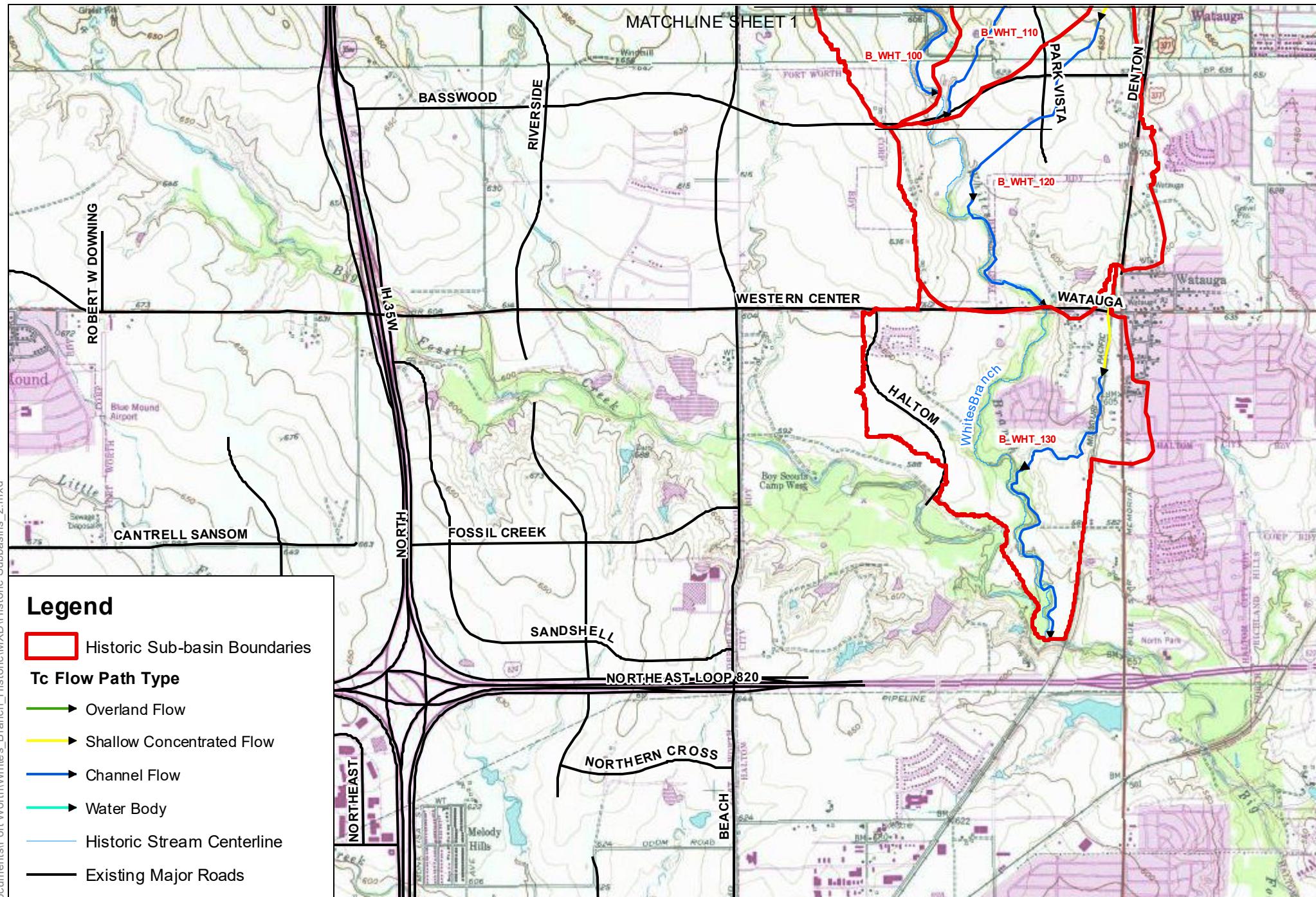
MATCHLINE SHEET



A scale bar with two horizontal lines. The top line is labeled "0", "1,000", "2,000", and "4,000" with arrows pointing to the right, followed by the word "Feet". The bottom line is labeled "0", "0.25", and "0.5" with arrows pointing to the right, followed by the word "Miles".



ECOSYSTEM PLANNING & RESTORATION



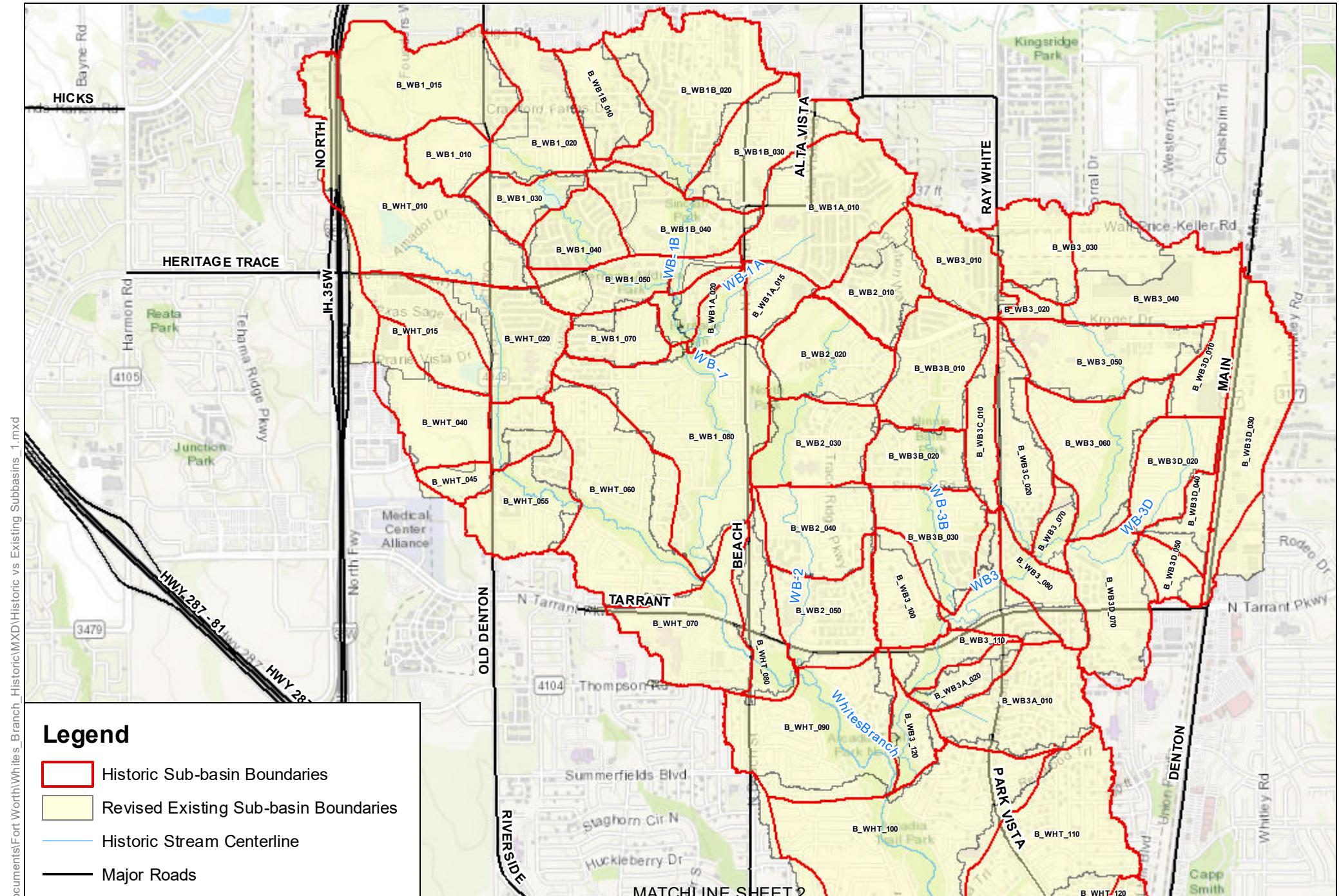
Whites Branch
Historic Watershed Delineation (Exhibit 2, Sheet 2)
1955 USGS Topographic Maps
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Whites Branch
Watershed Delineation (Exhibit 3, Sheet 1)
Historic vs Revised Existing

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Map produced 5/5/2022, EPR

[View all posts](#) | [View all categories](#)



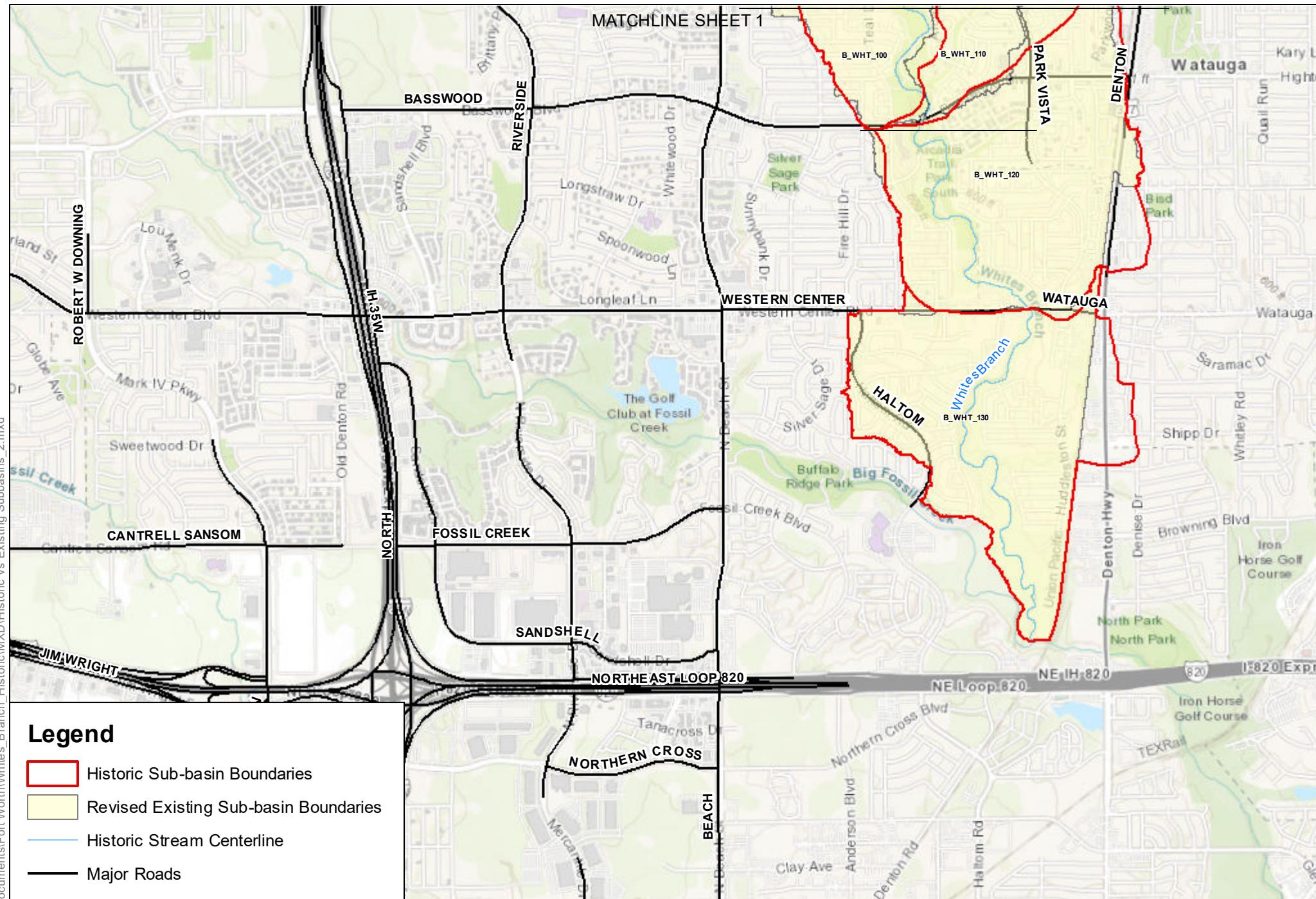
0 1,000 2,000 4,000

0 0.25 0.5



ECOSYSTEM PLANNING & RESTORATION

MATCHLINE SHEET 1

**Legend**

- Historic Sub-basin Boundaries
- Revised Existing Sub-basin Boundaries
- Historic Stream Centerline
- Major Roads

Whites Branch
Watershed Delineation (Exhibit 3, Sheet 2)
Historic vs Revised Existing

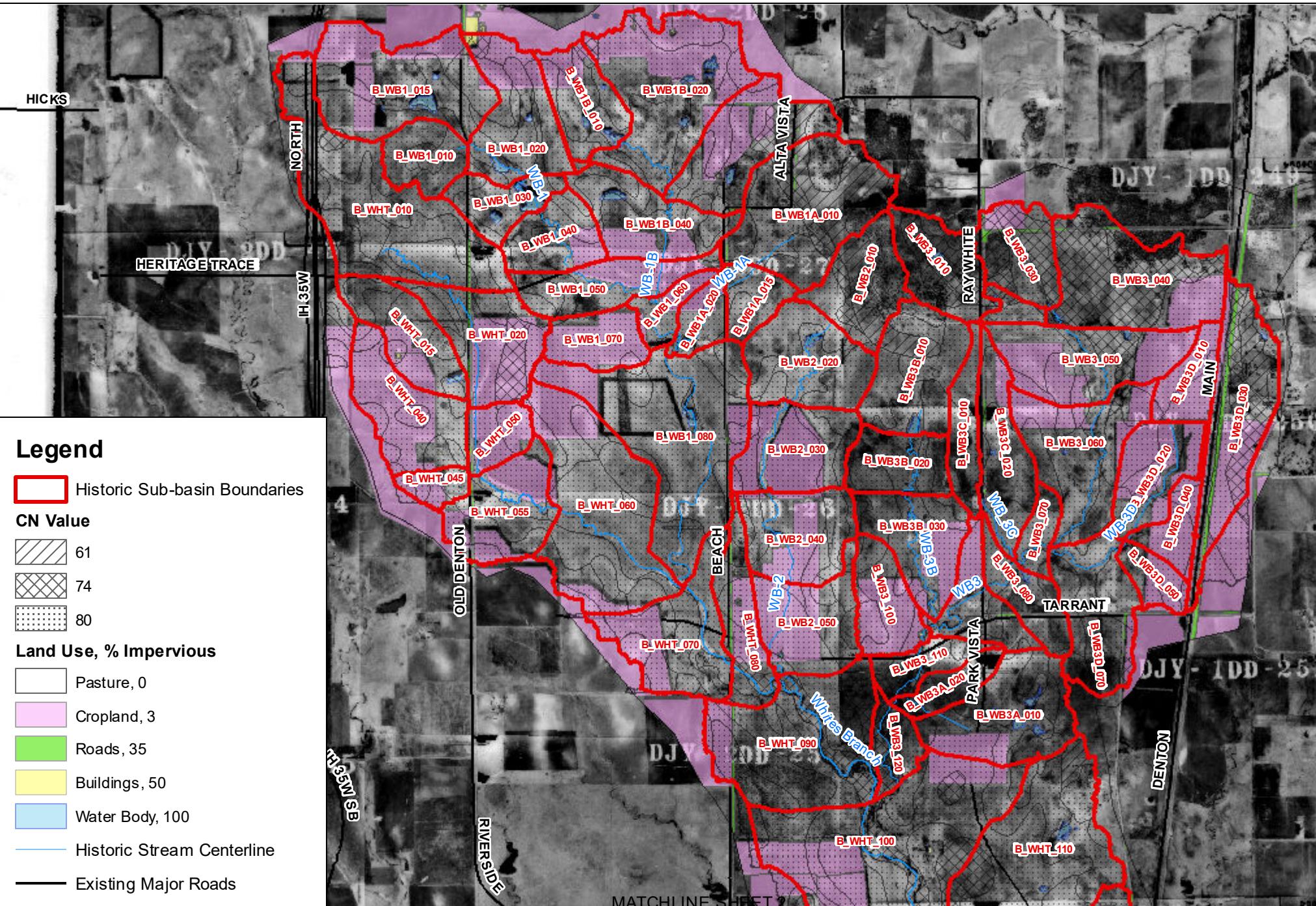
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Whites Branch
Historic Land Use and % Impervious Cover (Exhibit 4, Sheet 1)
USDA 1963 Aerial Photography

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

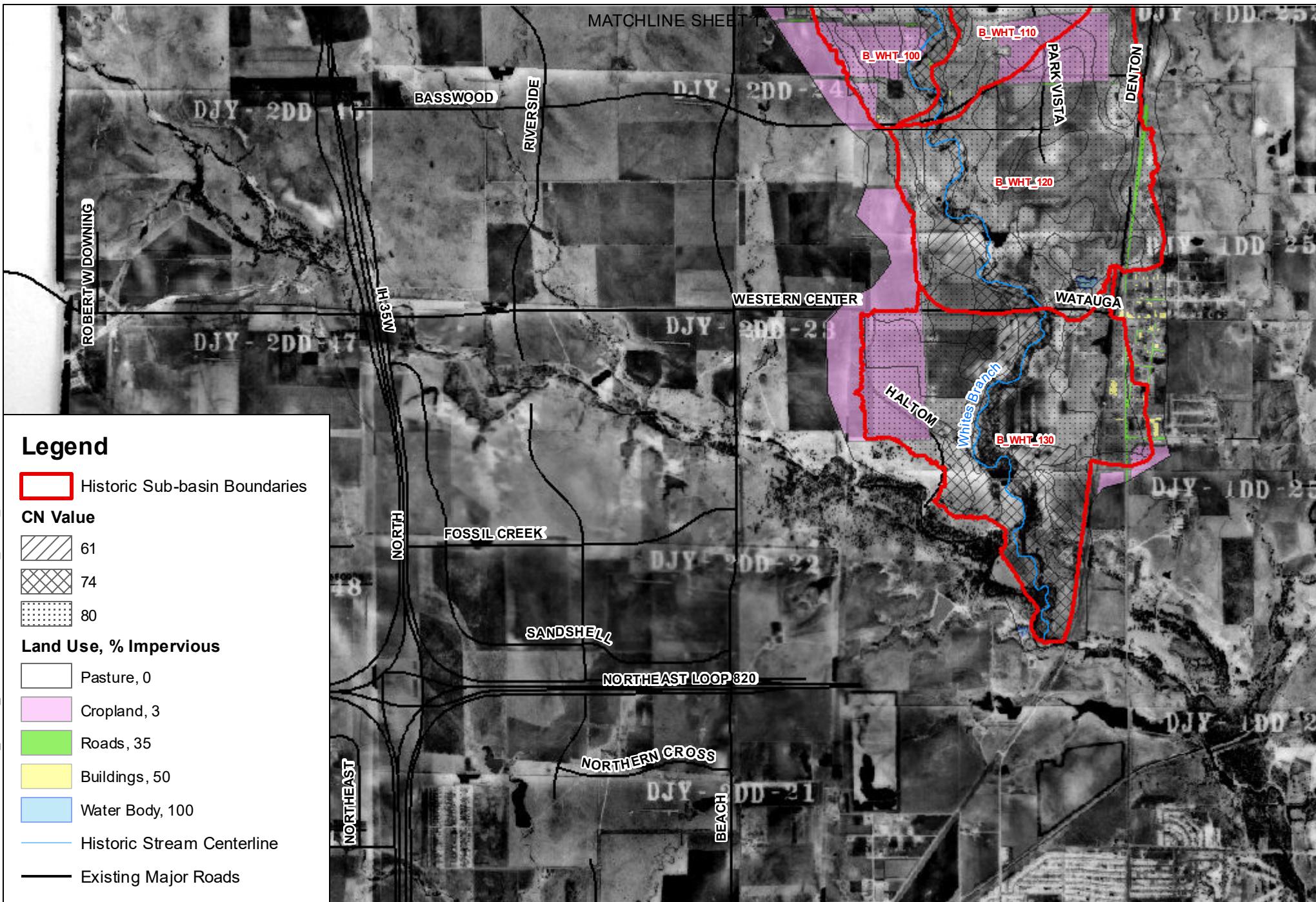
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
0 0.25 0.5
Feet Miles



ECOSYSTEM
PLANNING &
RESTORATION



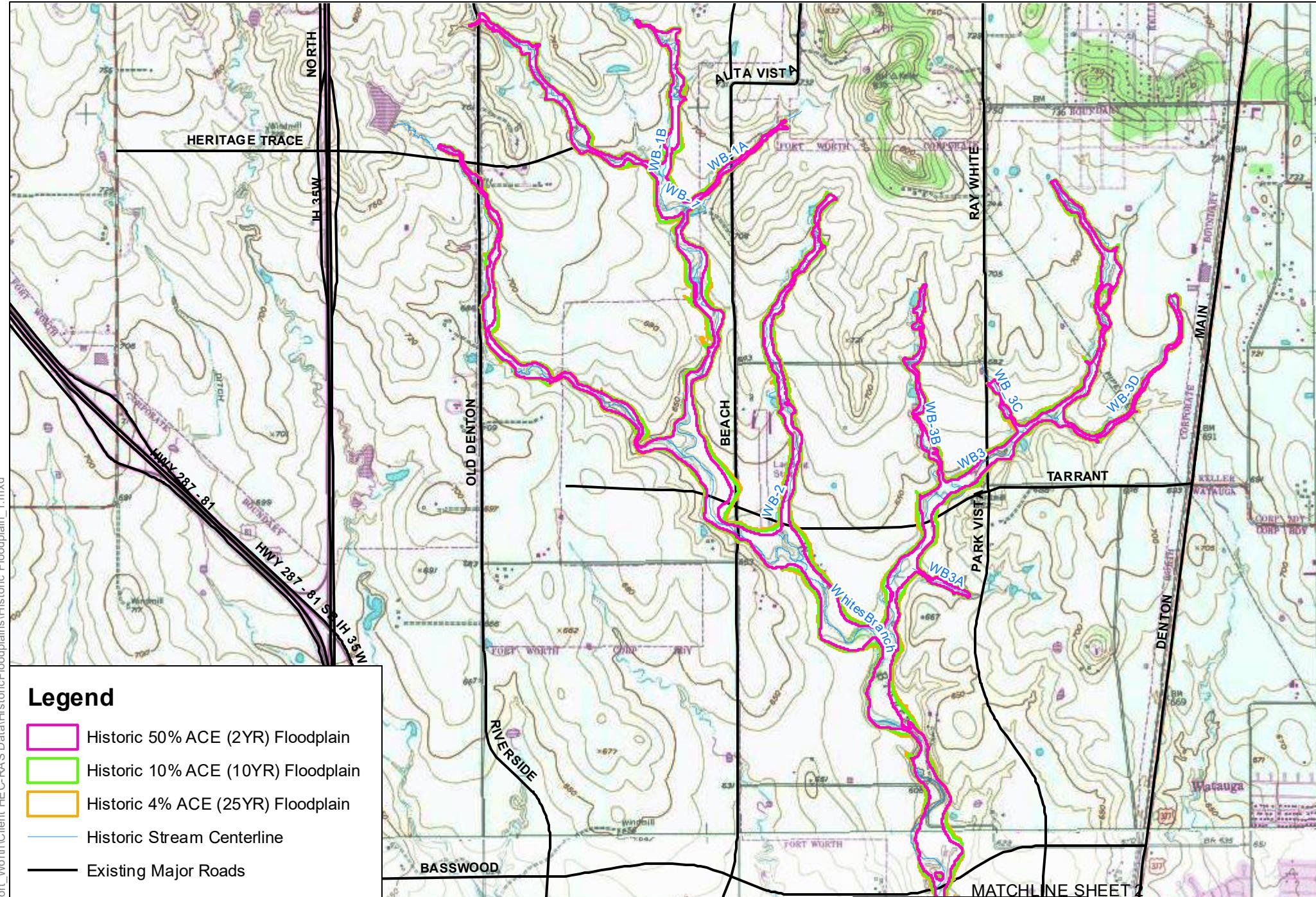
Whites Branch
Historic Land Use and % Impervious Cover (Exhibit 4, Sheet 2)
USDA 1963 Aerial Photography
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Legend

- Historic 50% ACE (2YR) Floodplain
- Historic 10% ACE (10YR) Floodplain
- Historic 4% ACE (25YR) Floodplain
- Historic Stream Centerline
- Existing Major Roads

Whites Branch
50%, 10% and 4% ACE Historic Floodplains (Exhibit 5, Sheet 1)
1955 USGS Topographic Maps

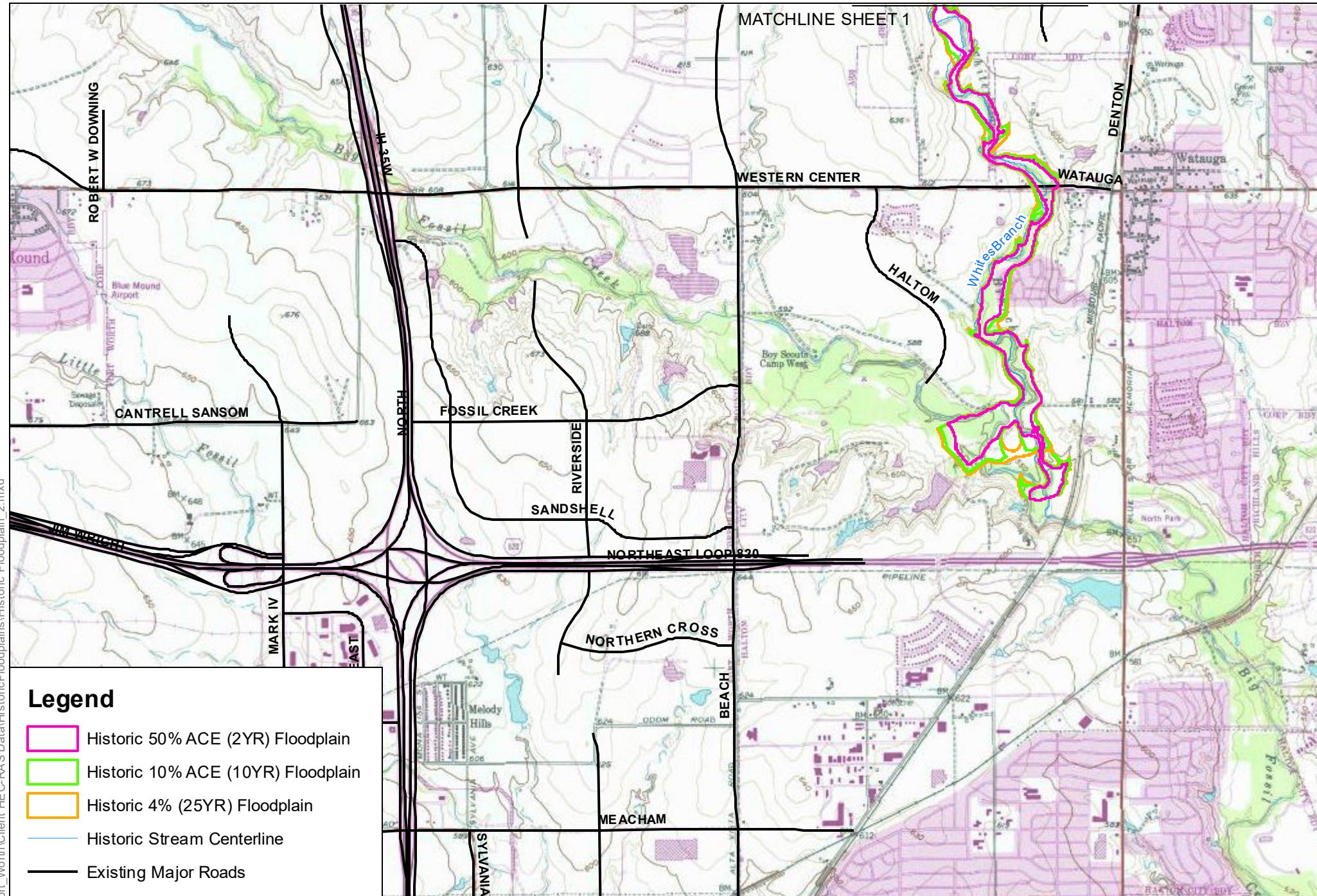
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



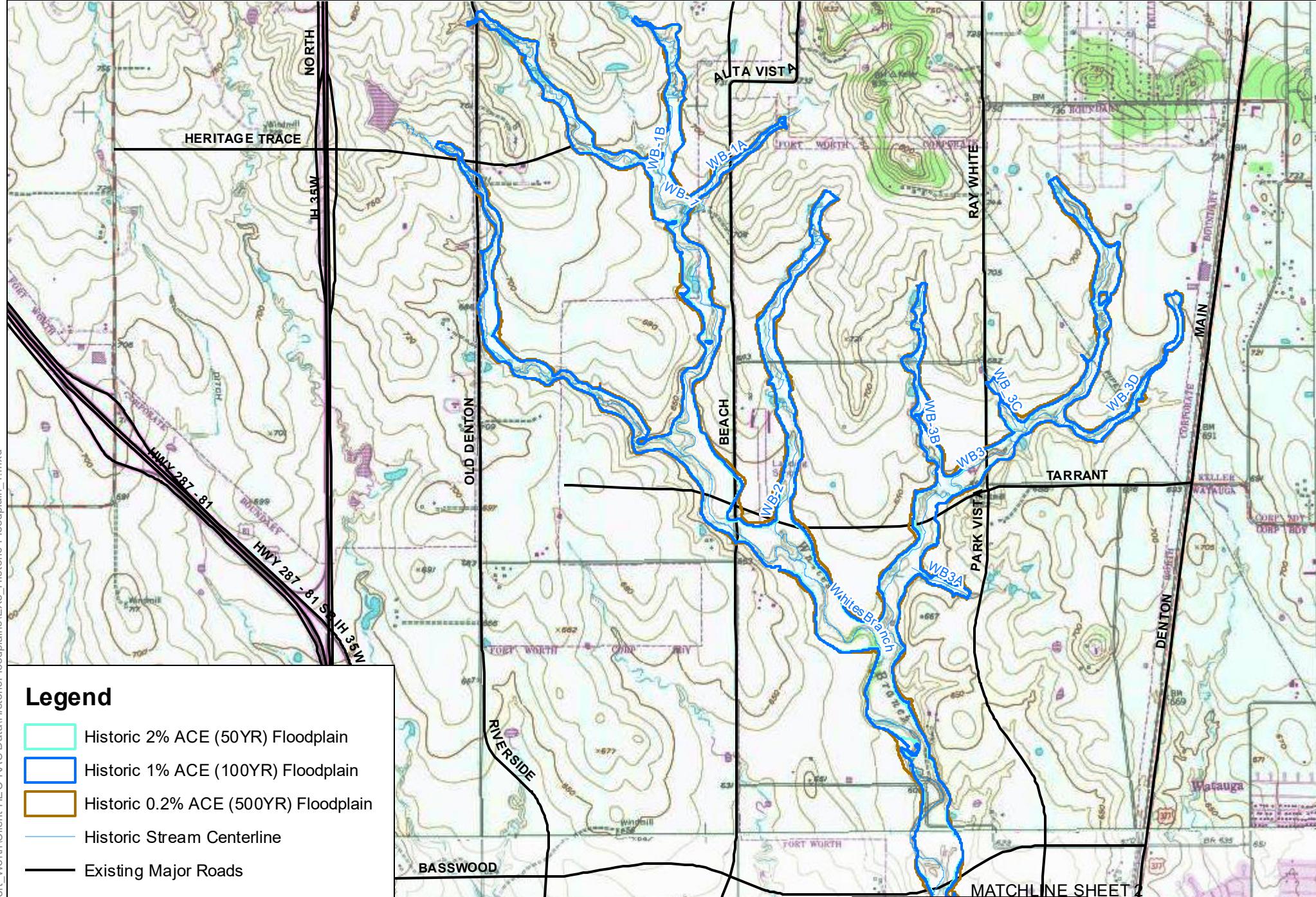
Whites Branch
50%, 10% and 4% ACE Historic Floodplains (Exhibit 5, Sheet 2)
1955 USGS Topographic Maps
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



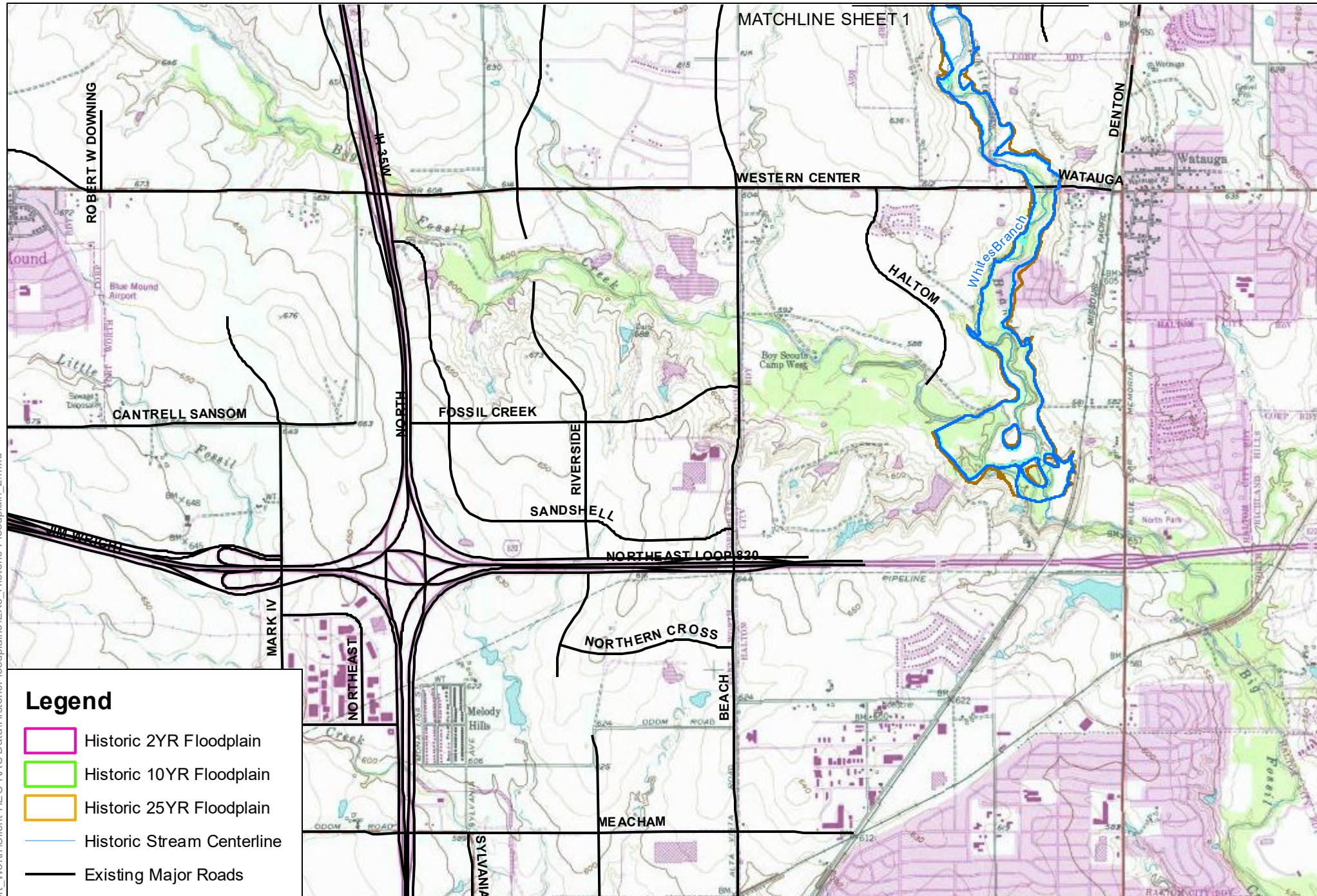
Whites Branch
2%, 1% and 0.2% ACE Historic Floodplains (Exhibit 6, Sheet 1)
1955 USGS Topographic Maps
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



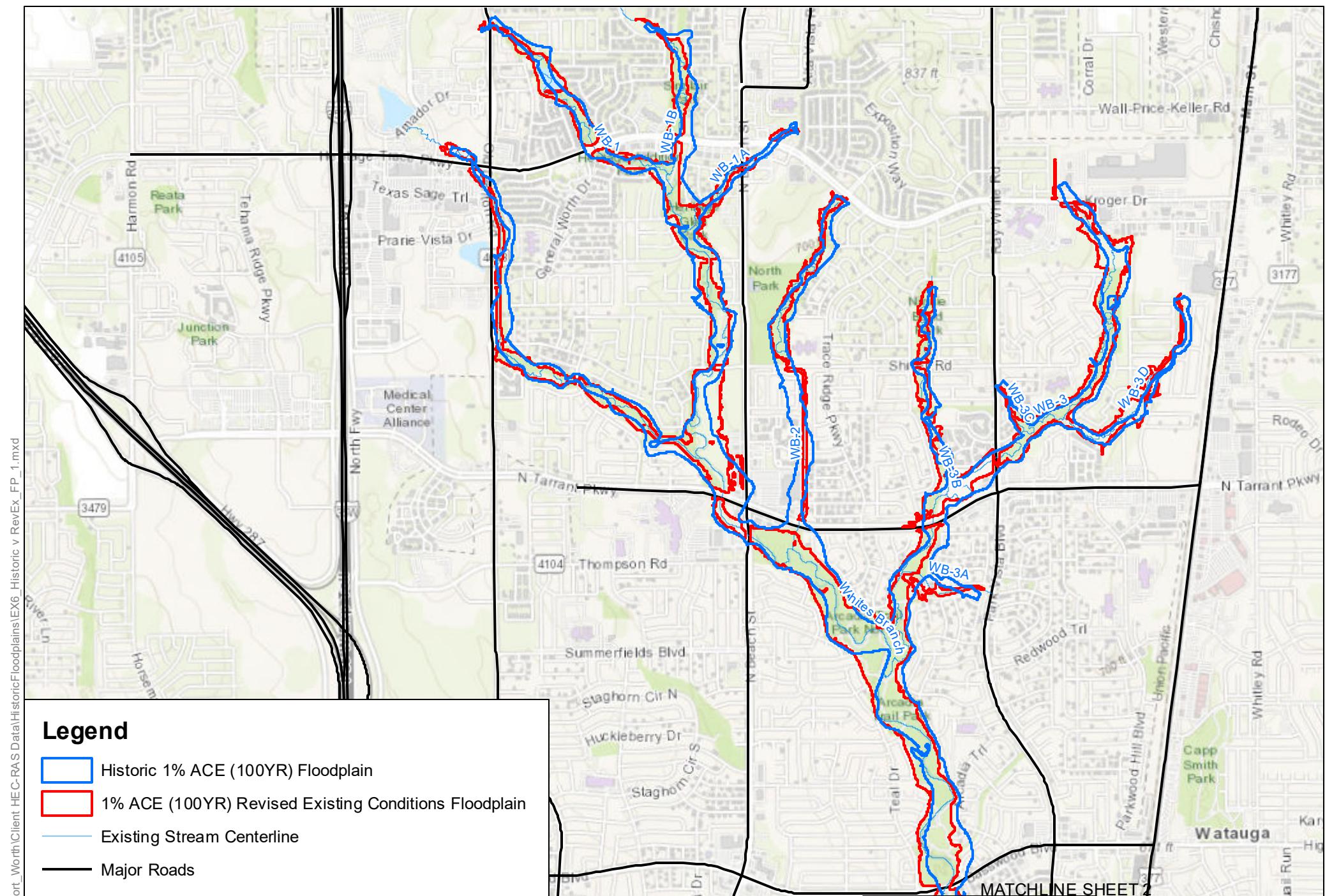
Whites Branch
2%, 1% and 0.2% ACE Historic Floodplains (Exhibit 6, Sheet 2)
1955 USGS Topographic Maps
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Whites Branch
Revised Existing Floodplain and Historic Floodplain Comparison
(Exhibit 7, Sheet 1)

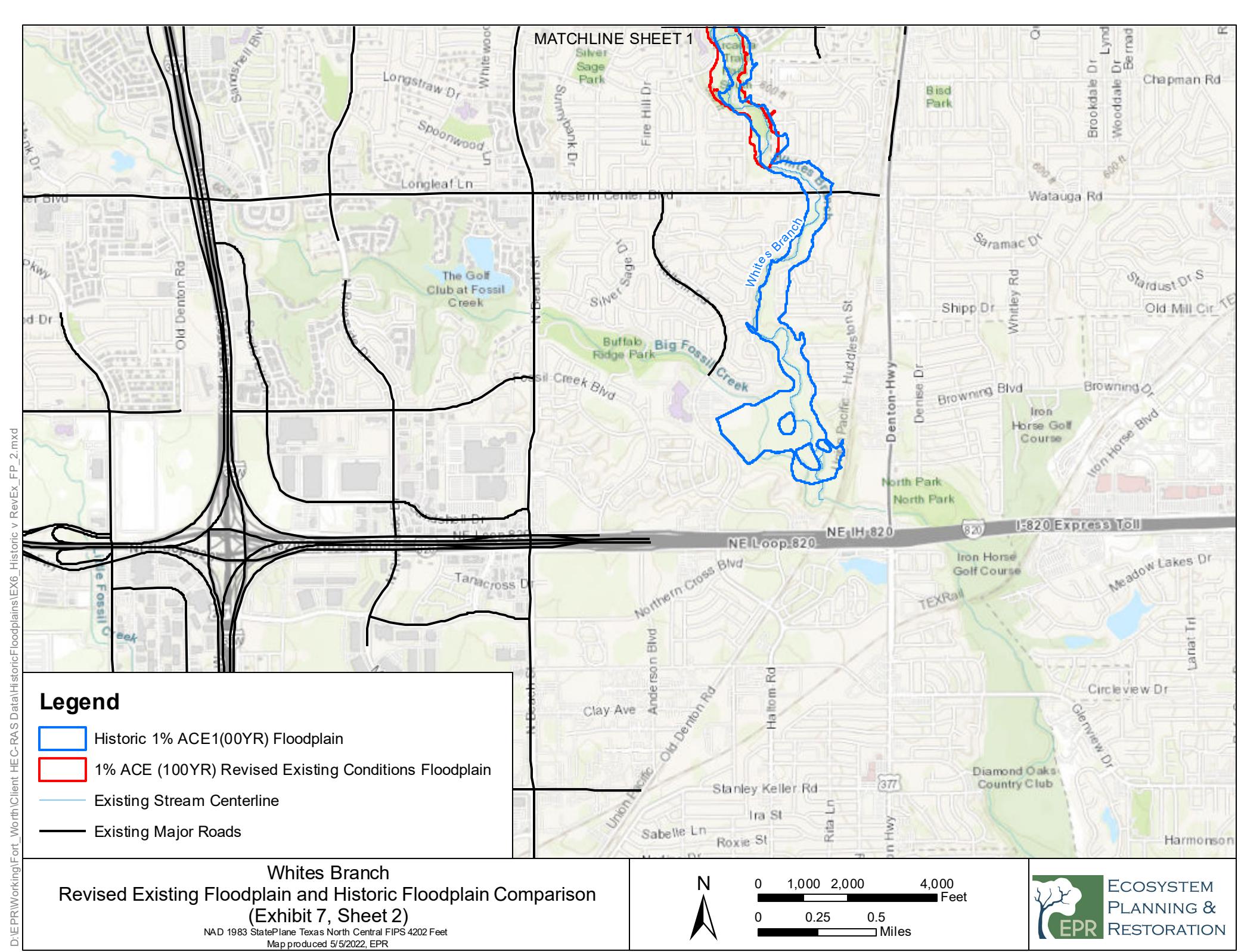
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR

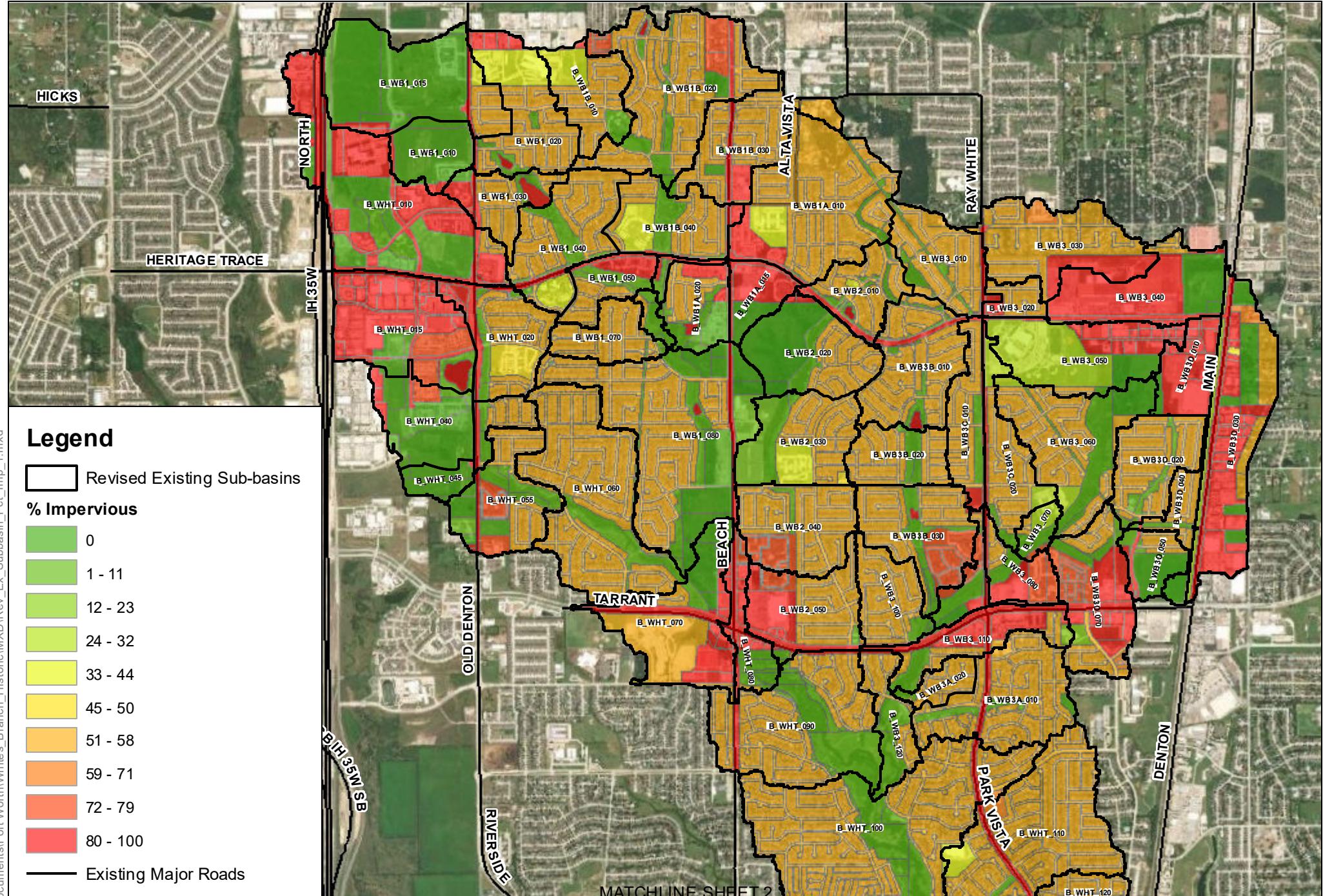


0 1,000 2,000 4,000
0 0.25 0.5
Feet Miles



ECOSYSTEM
PLANNING &
RESTORATION





Whites Branch Revised Existing Percent Impervious (Exhibit 8, Sheet 1)

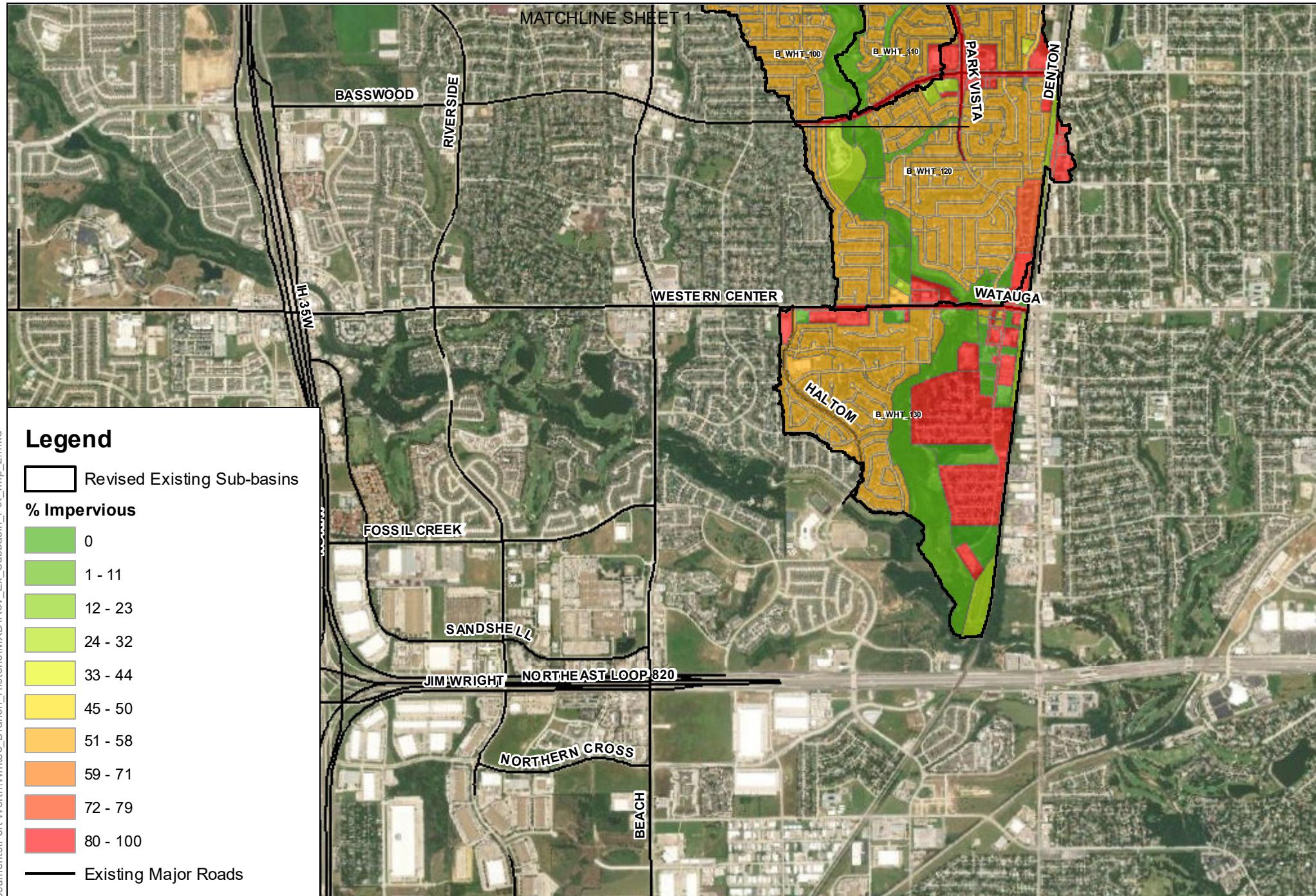
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



A scale bar with two horizontal bars. The top bar is labeled "Feet" and has tick marks at 0, 1,000, 2,000, and 4,000. The bottom bar is labeled "Miles" and has tick marks at 0, 0.25, and 0.5.



ECOSYSTEM PLANNING & RESTORATION



Whites Branch
Revised Existing Percent Impervious
(Exhibit 8, Sheet 2)

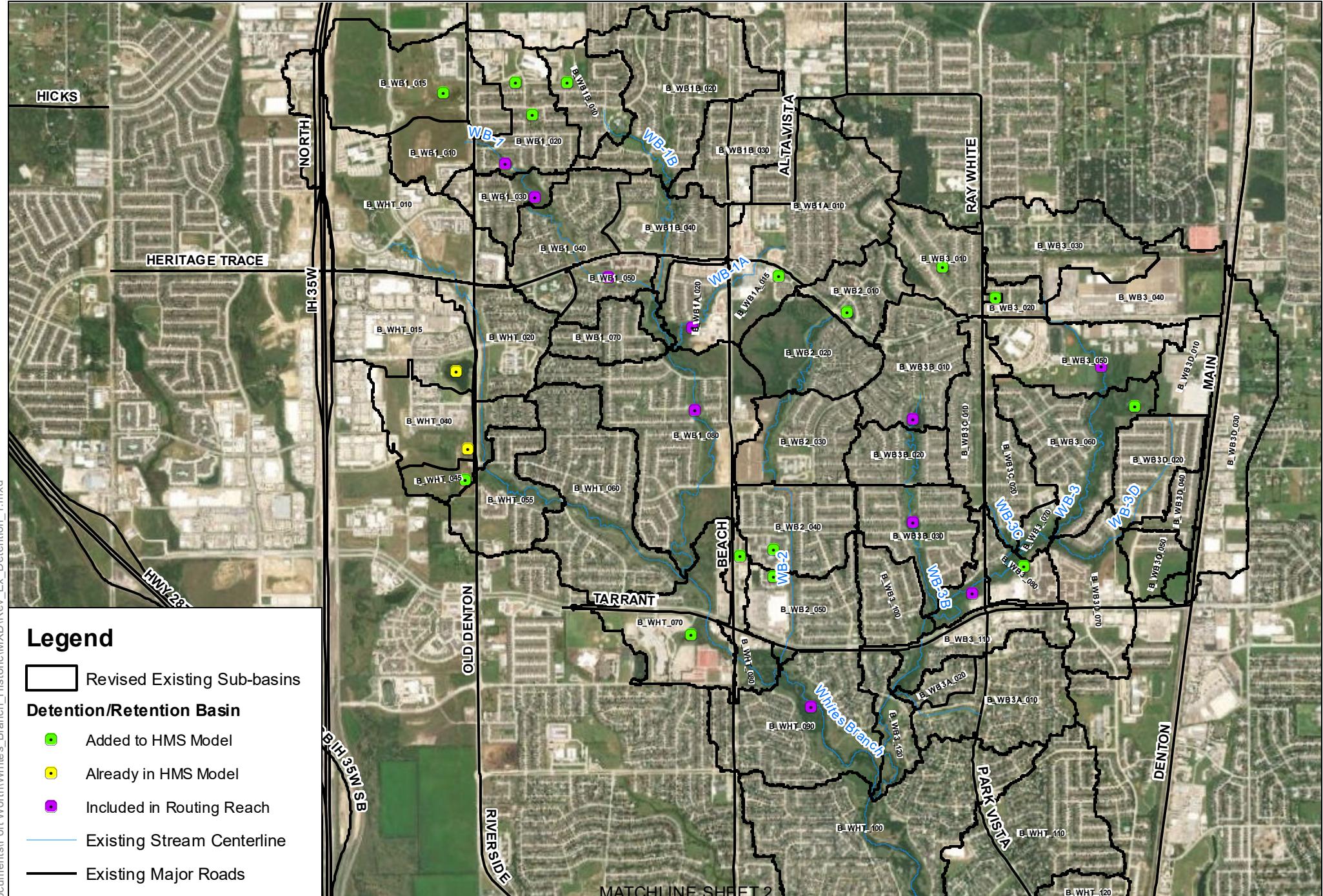
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Whites Branch
Revised Existing - Detention within Watershed
(Exhibit 9, Sheet 1)

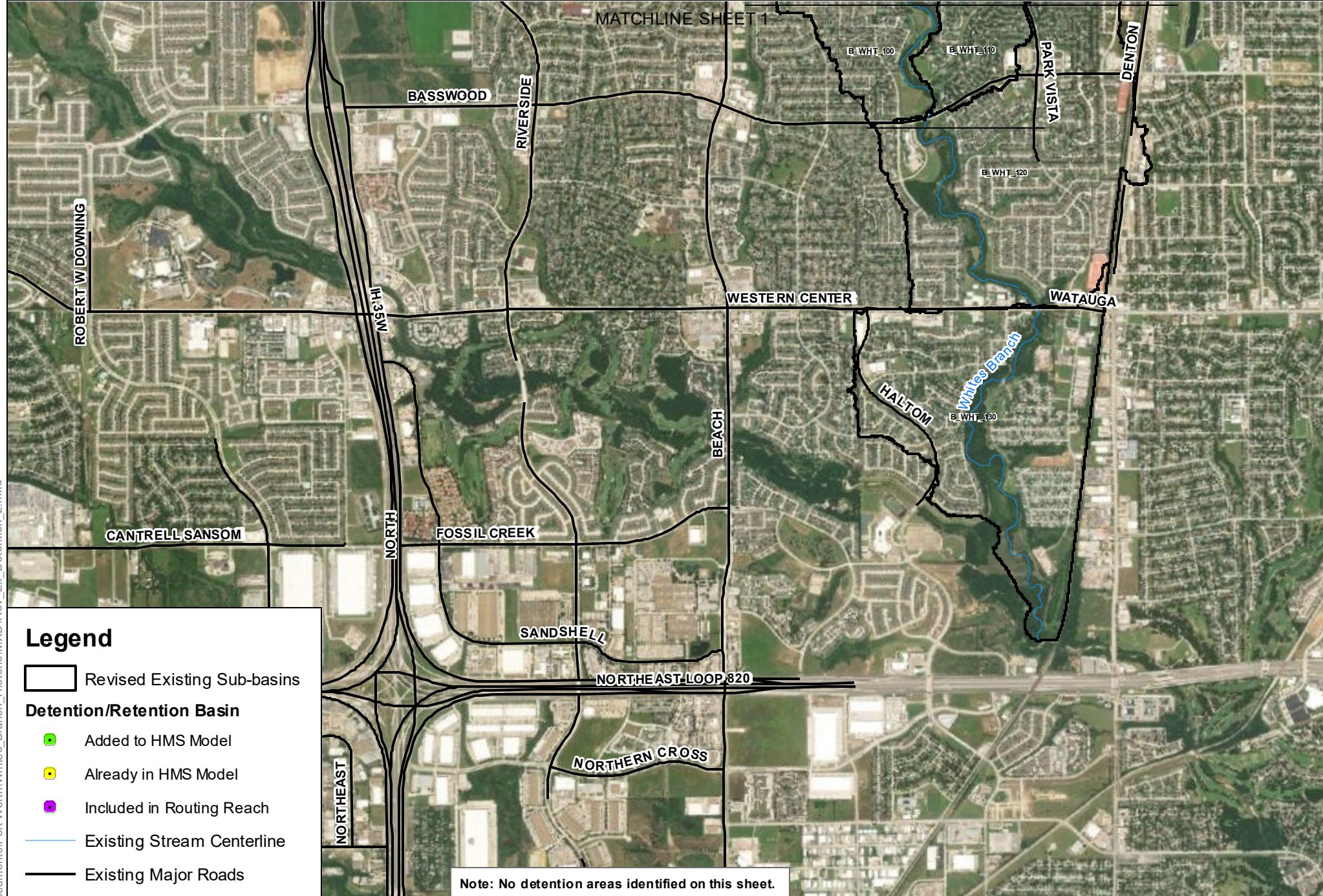
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPP



A scale bar with two horizontal lines. The top line is labeled "0", "1,000", "2,000", and "4,000" with arrows pointing to the right, followed by the word "Feet". The bottom line is labeled "0", "0.25", and "0.5" with arrows pointing to the right, followed by the word "Miles".



ECOSYSTEM PLANNING & RESTORATION



Whites Branch
Revised Existing - Detention within Watershed
(Exhibit 9, Sheet 2)

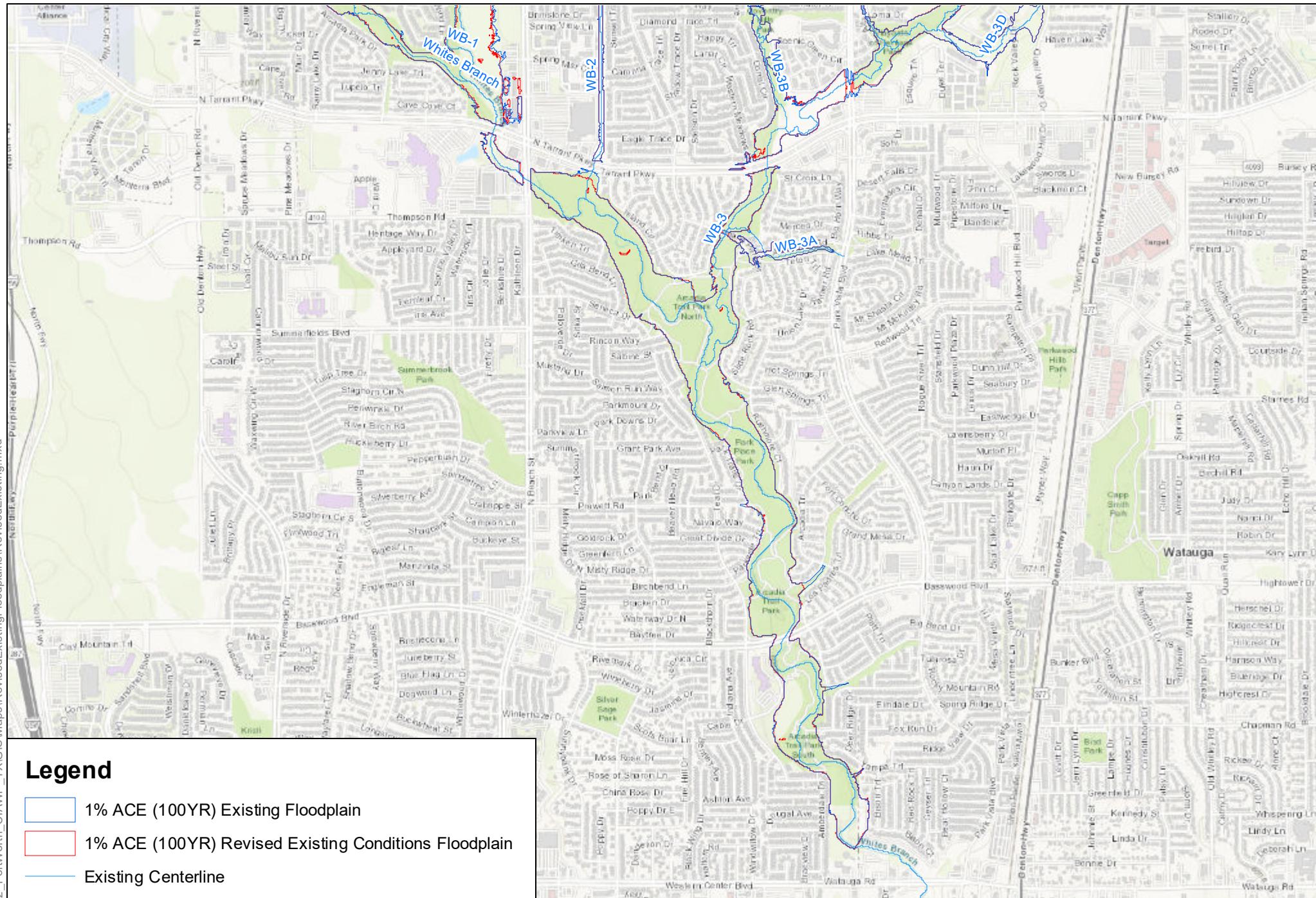
NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Legend

- 1% ACE (100YR) Existing Floodplain
- 1% ACE (100YR) Revised Existing Conditions Floodplain
- Existing Centerline

Whites Branch
Revised Existing Floodplain Comparison (Exhibit 10)
Revised Areas: Main Stem, WB-1, WB-1A and WB-3

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

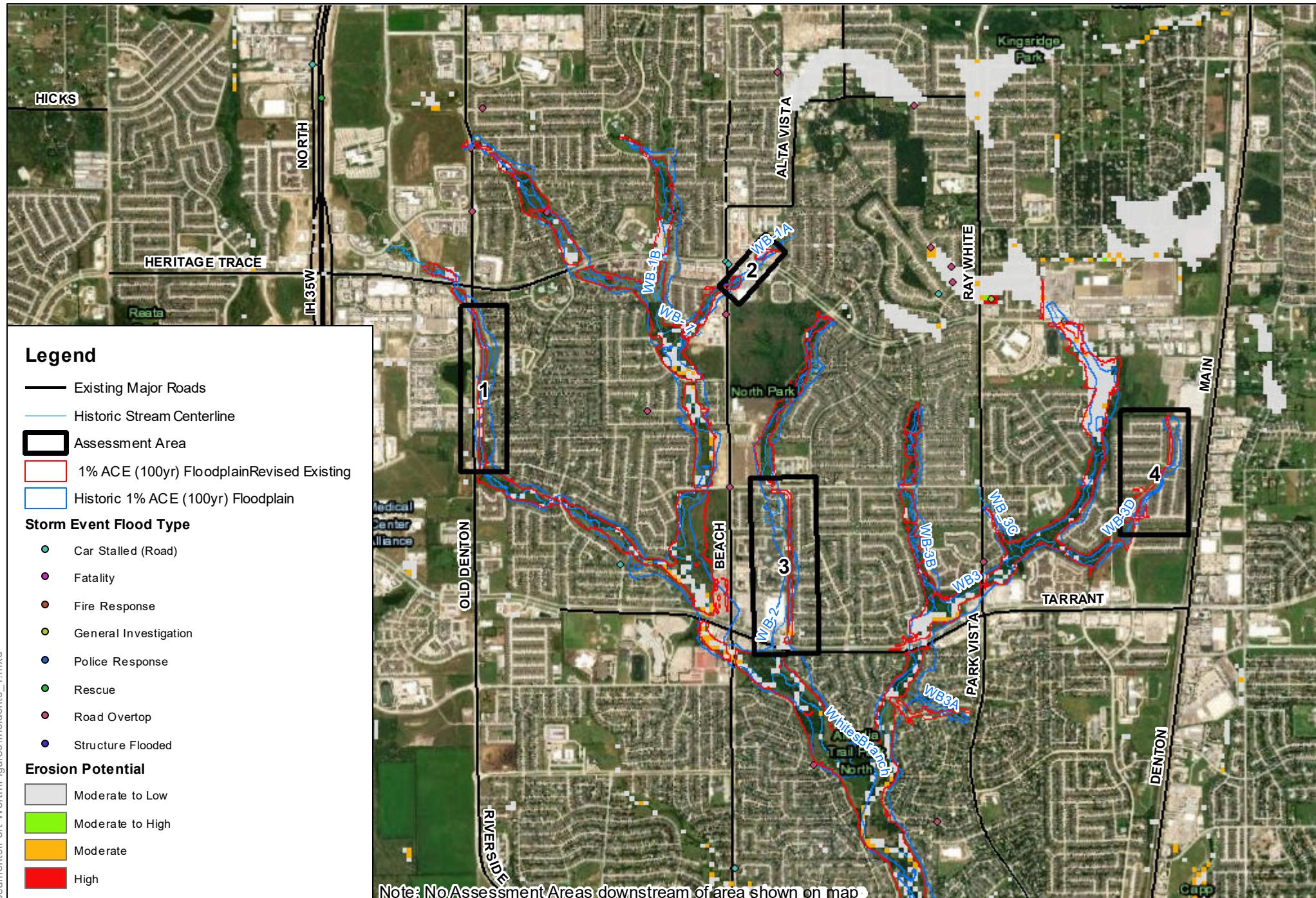
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION



Whites Branch Impact Analysis (Exhibit 11) Assessment Areas

NAD 1983 StatePlane Texas North Central FIPS 4202 Feet
Map produced 5/5/2022, EPR



0 1,000 2,000 4,000
Feet
0 0.25 0.5
Miles



ECOSYSTEM
PLANNING &
RESTORATION

Appendix A

DATA COLLECTION & REVIEW



File Path	File Names	Include for Review? Notes	Questions / Other internal comments
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\TNRIS\TX_Colleyville_108765_1959_24000_geo.tif	TX_Colleyville_108765_1959_24000_ge.tif	Yes Historic USGS topo map, georeferenced tiff	Used for baseline Historic Conditions modeling
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\TNRIS\TX_H_TX_Haltom City_117785_1955_24000.tif	TX_H_TX_Haltom City_117785_1955_24000.tif	Yes Historic USGS topo map, georeferenced tiff	Used for baseline Historic Conditions modeling
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\TNRIS\TX_Ke TX_Keller_117927_1955_24000_geo.tif	TX_Ke TX_Keller_117927_1955_24000_geo.tif	Yes Historic USGS topo map, georeferenced tiff	Used for baseline Historic Conditions modeling
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\TNRIS	USDA_1963_1.tif	Yes Historic USDA aerial photography, georeferenced tiff	
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\TNRIS	USDA_1958_1.tif	Yes Historic USDA aerial photography, georeferenced tiff	
	tif1.*	Yes 1963 Historic USDA aerial photography, manually georeferenced by EPR	Used for baseline Historic Conditions modeling

File Path	File Names	Include for Review?	Notes
S:\Projects\SAT0042_FortWorth_CIA WP_TX\Data\From_Client\202008026 * 2016-02-04 Near Southside Development Impacts A	ImpactofDevelopment.pptx	Yes	Near Southside regional drainage study results (2016). The study area includes Fairmount, Henderson, and Van Zandt watersheds. Four development scenarios were explored, ranging from existing conditions (scenario 1) to upper threshold for limited impacts). A GIS process was implemented to generate impervious areas for the first three development scenarios. Hydrologic and hydraulic analyses were performed using InfoWorks ICM models that were developed as part of the Near Southside Regional Drainage Study.
	New Task Imp Cover for Southside.docx	Yes	Summarizes findings outlined in B3.2 Development Task Memo for the Zoo Study in a powerpoint.
	White's Branch Cumulative Impacts Data Dump_em	Yes	Near Southside regional drainage study scope (2015) (same analysis and purpose as Zoo Study).
			Includes list of files provided (checks out with what we have on file). Additional link provided to track down final SWMPs that include detention ponds: https://mapitwest.fortworthtexas.gov/html5viewer/?viewer=sw_dev_services

			Terrain, Hydrology, Hydraulics and Floodplain Mapping for Whites Branch Watershed (more about models in rows below). Uses 2009 LiDAR terrain data provided by Tarrant County and 2015 LiDAR FT worth data; project survey includes limited field reconnaissance to the study area to determine conditions of floodplain and hydraulic/flood control structures, maintenance, and location of XSecs to be surveyed. Sketches and photo are avail (5 photos avail for each structure). Existing land use and future land use map available; list of computed runoff CNs available.
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\From_Client\202008026\WhitesBranch\WhitesBranchTSDN_02132018*	WhitesBranchTSDNDRAFT_02132018.pdf	yes	
Sub-Folder	Whites_Branch.hms	Yes	Model runs in version 4.2
Sub-Folder-Folder			
Sub-Folder			
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\From_Client\202008		Yes	1-d model, version 5.0.3
Sub-Folder-Folder		Yes	
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\From_Client\202008		Yes	
Sub-Folder			
S:\Projects\SAT0042_FortWorth_CIAWP_TX\Data\From_Client\202008\100yr_floodplain.shp		Yes	Shp. includes flood zone (A or AE)
	500yr_floodplain.shp	Yes	None
	Combined_XS.shp	Yes	Shp. includes: stationing, length of XS, length of channel, length of right and left floodplains within the XS
	Existing_land_use.shp	Yes	Developed based on the 2005 North Central Texas Council of Governments zoning maps and updated based on current aerial photography. Shp. Includes land use description, pct impervious, and area (sq ft and acres) per polygon.
	Existing_LFP.shp	Yes	Shp. includes: unique id/name, description (paved, grass, main channel, open channel, storm drain, grass unpaved, channel, etc), flow type (shallow, overland), length, pipe size (if applicable), and pipe mat
	final_subbasins.shp	Yes	Shp. Includes basin slope and area of sub-basin.
	Floodway.shp	Yes	Effective floodway for part of WhitesBranch and WB-1 as labeled in the attribute table. Used in hydraulics model.
	FloodwayCopy.shp	Yes	Copy of effective floodway.shp
	Future_land_use.shp	Yes	Future land use designations per the City of Fort Worth's Comprehensive Plan. Shp. Includes land use description, pct impervious, and area (sq ft and acres) per polygon.
	Future_LFP.shp	Yes	Shp. Includes land use description, pct impervious, and area (sq ft and acres) per polygon.
	LetterredXS.shp	Yes	Duplicated, select "lettered" cross sections included in combined_XS.shp.
	QBreaks.shp	Yes	Shp. Includes "ProfileM" in attribute table. This is not clear, but I think this includes the "flow change locations" indicating where discharge locations used in the model are located.
	soils.shp	Yes	No date of download included in the report. Shp. Includes percent HSG per polygon, overall HSG group description, pct sand, clay and silt, and calculated runoff curve number per polygon.
	Whites_Combined_CL.shp	Yes	Combined stream centerline for reaches within sub-basins.

S:\Projects\SAT0042_FortWorth_CIAWP_T X\Data\From_Client\202008026\Zoo Study*	B3.1 Impervious Cover Evaluation Scenario 1	yes	PDF Map of existing conditions in 2015, where the watershed is 56% impervious. Halff found that Fort Worth's GIS impervious layer underestimated impervious levels by about 5%, so the corrected impervious layer was used in scenario evaluations.
	B3.1 Impervious Cover Evaluation Scenario 2	yes	This PDF map depicts the full build-out single family residential (SFR) zones, but keeps non-single family residential (NSFR) zones constant (no change from existing condition). This amounts to a scenario with 68% impervious cover.
	B3.1 Impervious Cover Evaluation Scenario 3	yes	Scenario 3 pdf AMP assumes all SFR and NSFR are built out per the current zoning classification, following the Berry/University Development Plan (2016). This amounts to 73% impervious cover.
	B3.1 Impervious Cover Evaluation Scenario 4	yes	Scenario 4 PDF map depicts existing SFR and incremental development of NSFR, amounting to 61% impervious cover.
	B3.1 Impervious Cover Memo	yes	Halff Associates found that there was no concern that future development in the Zoo Creek Storm Drain study area from single family residential lots to duplex and quad-plex style housing would result in changes in runoff. This is because the impervious cover estimates in the AECOM models are conservative, and that actual impervious cover in the study area is nearly 20% below the assumed impervious cover values in the model.
	B3.2 Development Task Memo	yes	Halff Associates set out to identify areas potentially impacted by flooding as a result of future development in the Zoo Creek flood mitigation study. Three future development scenarios with varying levels of impervious cover were modeled. The three scenarios were used to determine if the level of development could exceed the City of Froth Worth thresholds described in the City of Forth Worth Stormwater Manual. HALFF found that there are about 580 habitable structures at risk of flooding in existing conditions and appoximately 600 habitable structure at risk of flooding when the watershed is fully developed to planned zoning.
	B3.2 Impacts of Development 1 to 2	yes	The PDF map shows the impacts of SFR developing to planned zoning (all else held constant), resulting in an additional of 96.4 acres of impervious area. Visually, many areas will show a rise less than 0.1 ft and some area will show a rise greater than 0.1 ft. Highest increase in WD is 0.82 ft.
	B3.2 Impacts of Development 1 to 3	yes	This map shows impacts of a transition from scenarios 1 to 3, where the entire watershed develops to planned zoning. This development represents an additional 135.5 acres of impervious area. The highest increase in water surface is 0.96 feet.
	B3.2 Impacts of Development 1 to 4	yes	This map shows the impacts of a transition from scenario 1 to 4, wheren NSFR full develops. Two ares in purple and blow will can expect a WS el rise greater than 0.1 ft.
	B3.2 Impacts of Development 2 to 3		Map depicts impacts from transiton from scenario 2 to 3. Results are not described in detail in the Impacts of Development memo.

File Path	File Names	Include for Review?	Notes
S:\Projects\SAT0042_FortWorth_CIAWP_TX\GIS\City of Fort Worth Data*	Geodatabase Breakdown.xlsx	Yes	Describes contents listed below for each database.
S:\Projects\SAT0042_FortWorth_CIAWP_TX\GIS\City of Fort Worth Data\Contours.gdb*	Geodatabase	Yes	Land Use 1990-2015; Ponds (retention, lake, dry detention, etc) and information about lining, area, and ownership; Contours 1965-2007. 1965 Contours don't cover entire watershed.
S:\Projects\SAT0042_FortWorth_CIAWP_TX\GIS\City of Fort Worth Data\Orthos.gdb*	Geodatabase	Yes	aerial imagery 2007, 2009, 2011, 2012
S:\Projects\SAT0042_FortWorth_CIAWP_TX\GIS\City of Fort Worth Data\Orthos2.gdb*	Geodatabase	Yes	aerial imagery 2001, 2003, 2005
S:\Projects\SAT0042_FortWorth_CIAWP_TX\GIS\City of Fort Worth Data\Terrain.gdb*	Geodatabase	Yes	Terrain from 1965, 2010, and 2015 (top of watershed is cut off on 1965 image); Orthos 2013, 2014, 2015, 2017, 2019

Appendix B

BASELINE HISTORIC HYDROLOGIC MODEL PARAMETERS



Summary of Hydrologic Parameters Comparison

Hydrologic Element	Revised Existing	Baseline	% Change	Revised Existing		Baseline		% Change		Revised Existing	Baseline	% Change
	Drainage Area (mi ²)	Drainage Area		CN	% Imp	CN	% Imp	CN	% Imp	Lag Time (Min)		Lag Time
B_WB1_015	0.246	0.242	2%	80	28	80	3.34	0%	25	28.9	18	61%
B_WB1_010	0.075	0.077	-3%	80	22	80	0	0%	22	10	20.2	-50%
B_WB1_020	0.155	0.159	-3%	79.7	54	80	3.38	0%	51	10.4	38	-73%
B_WB1_030	0.08	0.074	8%	80	65	80	10.88	0%	54	11.9	34.7	-66%
B_WB1_040	0.16	0.093	72%	80	49	80	0.9	0%	48	12.8	13.6	-6%
B_WB1_050	0.065	0.091	-29%	80	56	80	0.89	0%	55	8.6	16.7	-49%
B_WB1B_020	0.103	0.282	-63%	79.8	48	80	2.6	0%	45	11.7	16.4	-29%
B_WB1B_030	0.286	0.169	69%	79.9	52	78	2.56	2%	49	22.5	11.6	94%
B_WB1B_010	0.149	0.102	46%	78.2	59	80	3.48	-2%	56	15.4	24.4	-37%
B_WB1B_040	0.126	0.144	-13%	80	48	80	2.45	0%	46	14.8	15.3	-3%
B_WB1B_050	0.012	0.025	-52%	80	51	80	2.26	0%	49	7.2	21.9	-67%
B_WB1_070	0.074	0.078	-5%	80	53	80	2.55	0%	50	11.8	18.7	-37%
B_WB1_060	0.017	0.043	-60%	80	16	80	1.39	0%	15	12.6	13.1	-4%
B_WB1A_010	0.284	0.254	12%	73.7	56	74	0.48	0%	56	13.3	18.4	-28%
B_WB1A_015	0.057	0.057	0%	80	66	80	0.84	0%	65	7.9	11.6	-32%
B_WB1A_020	0.083	0.048	73%	80	58	80	3.76	0%	54	8.9	16.7	-47%
B_WB1_080	0.392	0.367	7%	80	36	80	1.35	0%	35	33.9	50.3	-33%
B_WHT_010	0.332	0.334	-1%	79.9	62	80	0.3	0%	62	25.5	18.7	36%
B_WHT_015	0.203	0.157	29%	80	79	79	2.63	1%	76	13.7	9	52%
B_WHT_020	0.132	0.119	11%	78.6	57	80	1.89	-2%	55	13.1	12.1	8%
B_WHT_040	0.119	0.153	-22%	80	41	80	2.27	0%	39	22.1	14.6	51%
B_WHT_045	0.033	0.057	-42%	80	3	80	3.92	0%	-1	16.3	10.9	50%
B_WHT_050	0.038	0.034	12%	79.9	48	80	1.89	0%	46	11.9	24.2	-51%
B_WHT_055	0.139	0.144	-3%	80	48	80	1.94	0%	46	20	27.7	-28%
B_WHT_060	0.307	0.323	-5%	80	49	80	0.7	0%	48	16.6	23.5	-29%
B_WHT_070	0.196	0.176	11%	80	58	80	1.15	0%	57	14	32.7	-57%
B_WHT_080	0.065	0.103	-37%	79.1	64	79	2.67	0%	61	9.3	23.1	-60%
B_WB2_020	0.09	0.16	-44%	73.1	53	80	0.96	-9%	52	7	18	-61%
B_WB2_010	0.154	0.123	25%	80	25	73	0.02	10%	25	15	8.9	69%
B_WB2_030	0.148	0.144	3%	80	39	80	1.87	0%	37	11.8	13.1	-10%
B_WB2_040	0.148	0.143	3%	80	58	80	2.36	0%	56	9.4	14.5	-35%
B_WB2_050	0.144	0.143	1%	80	71	80	1.79	0%	69	11.4	16.9	-33%
B_WHT_090	0.276	0.299	-8%	78.7	42	79	0.54	0%	41	21.5	16.3	32%
B_WB3_030	0.178	0.245	-27%	73.3	65	76	1.02	-4%	64	8.8	12.5	-30%
B_WB3_010	0.119	0.114	4%	71.5	52	72	1.29	-1%	51	4.2	9.7	-57%
B_WB3_020	0.031	0.106	-71%	78.9	65	72	1.91	10%	63	12.9	25.1	-49%
B_WB3_040	0.161	0.023	600%	76	70	79	1.06	-4%	69	30.1	12.9	133%
B_WB3_050	0.175	0.184	-5%	78.9	47	79	1.92	0%	45	15.3	13.8	11%
B_WB3_060	0.205	0.194	6%	79.9	36	80	0.89	0%	35	33	13.1	152%
B_WB3D_030	0.241	0.203	19%	75.7	68	75	4.34	1%	64	14.1	19.2	-27%
B_WB3D_040	0.051	0.058	-12%	80	39	80	2.71	0%	36	22.8	18	27%
B_WB3D_020	0.075	0.109	-31%	80	88	80	2.08	0%	86	16.7	13.4	25%
B_WB3D_010	0.116	0.066	76%	80	48	80	2.99	0%	45	9.3	21.4	-57%
B_WB3D_050	0.054	0.045	20%	80	27	80	2.12	0%	25	24.4	9.3	162%
B_WB3D_070	0.158	0.162	-2%	79.9	71	80	0.9	0%	70	13.9	13.4	4%
B_WB3_070	0.026	0.04	-35%	80	28	80	0.44	0%	28	4.7	11.9	-61%

Summary of Hydrologic Parameters Comparison

Hydrologic Element	Revised Existing	Baseline	% Change	Revised Existing		Baseline		% Change		Revised Existing	Baseline	% Change
	Drainage Area (mi ²)	Drainage Area		CN	% Imp	CN	% Imp	CN	% Imp	Lag Time (Min)		Lag Time
B_WB3C_020	0.084	0.126	-33%	80	55	80	1.89	0%	53	9.5	21.1	-55%
B_WB3C_010	0.103	0.07	47%	80	50	80	0.01	0%	50	9.5	28.4	-67%
B_WB3_080	0.062	0.077	-19%	80	71	80	2.74	0%	68	7.5	17.1	-56%
B_WB3_090	0.044	0.09	-51%	80	49	80	1.42	0%	48	12.9	9	43%
B_WB3B_010	0.164	0.161	2%	77.7	53	78	1.61	0%	51	10.5	17.4	-40%
B_WB3B_020	0.088	0.092	-4%	80	47	80	0.18	0%	47	9.9	16.1	-39%
B_WB3B_030	0.153	0.135	13%	80	54	80	2.53	0%	51	17.8	15	19%
B_WB3_100	0.092	0.096	-4%	80	52	80	2.14	0%	50	11.5	19.4	-41%
B_WB3_110	0.107	0.059	81%	79.5	71	79	0.04	1%	71	13.7	11.3	21%
B_WB3A_010	0.187	0.183	2%	80	58	80	2.62	0%	55	11.36	14.9	-24%
B_WB3A_020	0.0351	0.051	-31%	80	51	80	0	0%	51	10.2	12.6	-19%
B_WB3_120	0.072	0.054	33%	77	34	77	0	0%	34	13.2	12.8	3%
B_WHT_100	0.418	0.582	-28%	78.4	55	79	1.36	-1%	54	15.3	19.7	-22%
B_WHT_110	0.615	0.423	45%	79.2	47	79	1.03	0%	46	24.1	24.5	-2%
B_WHT_120	0.9	0.909	-1%	78.6	54	79	1.07	-1%	53	21.1	29.2	-28%
B_WHT_130	0.786	0.872	-10%	74.9	53	75	1.05	0%	52	24.4	15.7	55%

Baseline Historic Model
Hydrologic Parameter Summary

HMS ALPA ORDER	HMS Basin Name	Sub-basin	Area (mi ²)	CN Value	% Impervious	Initial Abstraction (in)	Lag (min)
1	B_WB1A_010	29	0.254	74	0.48	0.69	18.4
2	B_WB1A_015	56	0.057	80	0.84	0.50	11.6
3	B_WB1A_020	58	0.048	80	3.76	0.50	16.7
4	B_WB1B_010	38	0.102	80	3.48	0.51	24.4
5	B_WB1B_020	27	0.282	80	2.60	0.50	16.4
6	B_WB1B_030	28	0.169	78	2.56	0.58	11.6
7	B_WB1B_040	36	0.144	80	2.45	0.50	15.3
8	B_WB1B_050	57	0.025	80	2.26	0.50	21.9
9	B_WB1_010	54	0.077	80	0.00	0.50	20.2
10	B_WB1_015	30	0.242	80	3.34	0.50	18.0
11	B_WB1_020	31	0.159	80	3.38	0.51	38.0
12	B_WB1_030	39	0.074	80	10.88	0.50	34.7
13	B_WB1_040	37	0.093	80	0.90	0.50	13.6
14	B_WB1_050	41	0.091	80	0.89	0.50	16.7
15	B_WB1_060	40	0.043	80	1.39	0.50	13.1
16	B_WB1_070	35	0.078	80	2.55	0.50	18.7
17	B_WB1_080	33	0.367	80	1.35	0.50	50.3
18	B_WB2_010	47	0.123	73	0.02	0.75	8.9
19	B_WB2_020	49	0.160	80	0.96	0.50	18.0
20	B_WB2_030	48	0.144	80	1.87	0.50	13.1
21	B_WB2_040	46	0.143	80	2.36	0.50	14.5
22	B_WB2_050	3	0.143	80	1.79	0.50	16.9
23	B_WB3A_010	11	0.183	80	2.62	0.50	14.9
24	B_WB3A_020	61	0.051	80	0.00	0.51	12.6
25	B_WB3B_010	18	0.161	78	1.61	0.57	17.4
26	B_WB3B_020	19	0.092	80	0.18	0.50	16.1
27	B_WB3B_030	5	0.135	80	2.53	0.50	15.0
28	B_WB3C_010	21	0.070	80	0.01	0.50	28.4
29	B_WB3C_020	20	0.126	80	1.89	0.50	21.1
30	B_WB3D_010	17	0.066	80	2.99	0.50	21.4
31	B_WB3D_020	16	0.109	80	2.08	0.50	13.4
32	B_WB3D_030	14	0.203	75	4.34	0.67	19.2
33	B_WB3D_040	6	0.058	80	2.71	0.50	18.0
34	B_WB3D_050	62	0.045	80	2.12	0.50	9.3
35	B_WB3D_070	8	0.162	80	0.90	0.50	13.4
36	B_WB3_010	26	0.114	72	1.29	0.80	9.7
37	B_WB3_020	55	0.023	79	1.06	0.54	12.9
38	B_WB3_030	1	0.106	72	1.91	0.76	25.1
39	B_WB3_040	2	0.245	76	1.02	0.65	12.5
40	B_WB3_050	22	0.184	79	1.92	0.53	13.8
41	B_WB3_060	4	0.194	80	0.89	0.50	13.1
42	B_WB3_070	7	0.040	80	0.44	0.50	11.9
43	B_WB3_080	23	0.077	80	2.74	0.50	17.1
44	B_WB3_090	60	0.090	80	1.42	0.50	9.0
45	B_WB3_100	15	0.096	80	2.14	0.50	19.4
46	B_WB3_110	9	0.059	79	0.04	0.54	11.3
47	B_WB3_120	59	0.054	77	0.00	0.60	12.8
48	B_WHT_010	32	0.334	80	0.30	0.50	18.7
49	B_WHT_015	52	0.119	80	1.89	0.50	12.1
50	B_WHT_020	44	0.157	79	2.63	0.54	9.0
51	B_WHT_040	34	0.153	80	2.27	0.50	14.6
52	B_WHT_045	53	0.034	80	1.89	0.50	24.2
53	B_WHT_050	45	0.057	80	3.92	0.50	10.9
54	B_WHT_055	51	0.144	80	1.94	0.50	27.7
55	B_WHT_060	50	0.323	80	0.70	0.50	23.5
56	B_WHT_070	43	0.176	80	1.15	0.50	32.7
57	B_WHT_080	42	0.103	79	2.67	0.52	23.1
58	B_WHT_090	10	0.299	79	0.54	0.54	16.3
59	B_WHT_100	12	0.582	79	1.36	0.54	19.7
60	B_WHT_110	25	0.423	79	1.03	0.54	24.5
61	B_WHT_120	13	0.909	79	1.07	0.54	29.2
62	B_WHT_130	24	0.872	75	1.05	0.65	15.7

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
1	Sheet / Overland Flow	100	784.8	782.2	0.026	0.15	4.45	n/a	n/a	0.12	7.5	4.5	
	Shallow Conc Flow	1227	782.2	719.9	0.051	n/a	n/a	unpaved	3.64	0.09	5.6	3.4	
	Channel Flow	1226	719.9	706.4	0.011	0.04	n/a	n/a	8.49	0.04	2.4	1.4	9.3
2	Sheet / Overland Flow	100	785	770	0.150	0.4	4.45	n/a	n/a	0.14	8.1	4.9	
	Shallow Conc Flow	1675	770	710	0.036	n/a	n/a	unpaved	3.05	0.15	9.1	5.5	
	Channel Flow	1020	710	707	0.003	0.04	n/a	n/a	4.63	0.06	3.7	2.2	12.6
3	Sheet / Overland	100	703	697	0.060	0.15	4.45	n/a	n/a	0.09	5.4	3.2	
	Shallow Conc Flow	695	697	670	0.039	n/a	n/a	unpaved	3.18	0.06	3.6	2.2	
	Channel 1 Flow	606	670	660	0.017	0.04	n/a	n/a	3.87	0.04	2.6	1.6	
	Channel 2 Flow	2030	660	625	0.017	0.04	n/a	n/a	10.04	0.06	3.4	2.0	9.0
4	Sheet / Overland Flow	100	709	707.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	515	707.5	700	0.015	n/a	n/a	unpaved	1.95	0.07	4.4	2.6	
	Channel Flow	3789	700	653	0.012	0.04	n/a	n/a	9.63	0.11	6.6	3.9	12.8
5	Sheet / Overland Flow	100	715	707.8	0.072	0.17	4.45	n/a	n/a	0.09	5.5	3.3	
	Shallow Conc Flow	1403	707.8	670	0.027	n/a	n/a	unpaved	2.65	0.15	8.8	5.3	
	Channel 1 Flow	631	670	665	0.008	0.04	n/a	n/a	4.75	0.04	2.2	1.3	
	Lake	190	665	663	0.011	n/a	n/a	n/a	1.00	0.05	3.2	1.9	
	Channel 2 Flow	2750	663	641	0.008	0.04	n/a	n/a	5.64	0.14	8.1	4.9	16.7
6	Sheet / Overland Flow	100	703	703	0.006	0.17	4.45	n/a	n/a	0.25	14.9	8.9	
	Shallow Conc Flow	1611	703	690	0.008	n/a	n/a	unpaved	1.43	0.31	18.7	11.2	
	Channel Flow	1217	690	680	0.008	0.04	n/a	n/a	7.00	0.05	2.9	1.7	21.9
7	Sheet / Overland Flow	100	700.4	699.7	0.007	0.17	4.45	n/a	n/a	0.23	14.0	8.4	
	Shallow Conc Flow	1182	699.7	660.5	0.033	n/a	n/a	paved	3.70	0.09	5.3	3.2	
	Channel Flow	1020	660.5	659	0.001	0.04	n/a	n/a	2.63	0.11	6.5	3.9	11.6
8	Sheet / Overland Flow	100	717	715	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	913	715	690	0.027	n/a	4.45	unpaved	2.669870071	0.09	5.7	3.4	
	Channel 1 Flow	1580	690	670	0.013	0.04	n/a	n/a	8.02	0.05	3.3	2.0	
	Channel 2 Flow	1560	670	659	0.007	0.04	n/a	n/a	7.70	0.06	3.4	2.0	12.9
9	Sheet / Overland Flow	100	691	690.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	1508	690.8	639	0.034	n/a	n/a	unpaved	2.99	0.14	8.4	5.0	
	Channel Flow	993	639	629	0.010	0.04	n/a	n/a	7.30	0.04	2.3	1.4	20.2

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
10	Sheet / Overland Flow	100	673	672.1	0.009	0.17	4.45	n/a	n/a	0.21	12.6	7.6	
	Shallow Conc Flow	1452	672.1	650	0.015	n/a	n/a	unpaved	1.99	0.20	12.2	7.3	
	Channel 1 Flow	1064	650	620	0.028	0.04	n/a	n/a	6.35	0.05	2.8	1.7	
	Channel 2 Flow	2205	620	612.5	0.003	0.04	n/a	n/a	2.88	0.21	12.7	7.6	24.2
11	Sheet / Overland Flow	100	711	706	0.050	0.17	4.45	n/a	n/a	0.11	6.4	3.8	
	Shallow Conc Flow	683	706	690	0.023	n/a	n/a	unpaved	2.47	0.08	4.6	2.8	
	Channel 1 Flow	988	690	665	0.025	0.04	n/a	n/a	8.60	0.03	1.9	1.1	
	Lake	209	665	660	0.024	n/a	n/a	n/a	1.00	0.06	3.5	2.1	
	Channel 2 Flow	1561	660	641	0.012	0.04	n/a	n/a	6.74	0.06	3.9	2.3	12.1
12	Sheet / Overland Flow	100	688	685	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1543	685	640.5	0.029	n/a	n/a	unpaved	2.74	0.16	9.4	5.6	
	Channel 1 Flow	755	640.5	620	0.027	0.04	n/a	n/a	6.80	0.03	1.8	1.1	
	Channel 2 Flow	1226	620	600	0.016	0.04	n/a	n/a	7.86	0.04	2.6	1.6	
	Channel 3 Flow	3705	600	592	0.002	0.04	n/a	n/a	2.51	0.41	24.6	14.7	27.7
13	Sheet / Overland Flow	100	683.7	683.4	0.003	0.17	4.45	n/a	n/a	0.33	19.6	11.8	
	Shallow Conc Flow	758	683.4	650	0.044	n/a	n/a	unpaved	3.39	0.06	3.7	2.2	
	Channel 1 Flow	5054	650	589.5	0.012	0.04	n/a	n/a	9.94	0.14	8.5	5.1	
	Channel 2 Flow	3570	589.5	574	0.004	0.04	n/a	n/a	8.15	0.12	7.3	4.4	23.5
14	Sheet / Overland Flow	100	752	745	0.070	0.17	4.45	n/a	n/a	0.09	5.6	3.3	
	Shallow Conc Flow	1220	745	730	0.012	n/a	n/a	unpaved	1.79	0.19	11.4	6.8	
	Channel Flow	3523	730	690	0.011	0.04	n/a	n/a	4.48	0.22	13.1	7.9	18.0
15	Sheet / Overland Flow	100	714	712	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	587	712	670	0.072	n/a	n/a	unpaved	4.32	0.04	2.3	1.4	
	Channel 1 Flow	685	670	660	0.015	0.04	n/a	n/a	2.34	0.08	4.9	2.9	
	Channel 2 Flow	1215	660	638	0.018	0.04	n/a	n/a	3.66	0.09	5.5	3.3	13.1
16	Sheet / Overland Flow	50	701	700.4	0.012	0.17	4.45	n/a	n/a	0.11	6.5	3.9	
	Shallow Conc Flow	40	700.4	700	0.010	n/a	n/a	unpaved	1.61	0.01	0.4	0.2	
	Channel Flow	2594	700	677	0.009	0.04	n/a	n/a	5.42	0.13	8.0	4.8	8.9
17	Sheet / Overland Flow	100	714.5	713.5	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	317	713.5	710	0.011	n/a	n/a	unpaved	1.70	0.05	3.1	1.9	
	Channel Flow	1692	710	703	0.004	0.04	n/a	n/a	3.14	0.15	9.0	5.4	14.5

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
18	Sheet / Overland Flow	100	821	805	0.160	0.17	4.45	n/a	n/a	0.07	4.0	2.4	
	Shallow Conc Flow	1516	805	710	0.063	n/a	n/a	unpaved	4.04	0.10	6.3	3.8	
	Channel Flow	1106	710	692	0.016	0.04	n/a	n/a	5.88	0.05	3.1	1.9	
	Lake	283	692	691	0.004	0.04	n/a	n/a	1.00	0.08	4.7	2.8	10.9
19	Sheet / Overland Flow	100	724	721	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1005	721	680	0.041	n/a	n/a	unpaved	3.26	0.09	5.1	3.1	
	Channel Flow	593	680	669	0.019	0.04	n/a	n/a	4.79	0.03	2.1	1.2	9.0
20	Sheet / Overland Flow	100	742	741.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	2702	741.8	700	0.015	n/a	n/a	unpaved	2.01	0.37	22.4	13.5	
	Channel Flow	2217	700	669	0.014	0.04	n/a	n/a	4.11	0.15	9.0	5.4	32.7
21	Sheet / Overland Flow	100	743	742.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	1709	742.8	700	0.025	n/a	n/a	unpaved	2.55	0.19	11.2	6.7	
	Channel Flow	1747	700	677	0.013	0.04	n/a	n/a	6.78	0.07	4.3	2.6	23.1
22	Sheet / Overland Flow	100	742.5	741	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	1639	741	700	0.025	n/a	n/a	unpaved	2.55	0.18	10.7	6.4	
	Channel Flow	1980	700	688	0.006	0.04	n/a	n/a	4.79	0.11	6.9	4.1	16.7
23	Sheet / Overland Flow	100	712	710.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	919	710.5	682	0.031	n/a	n/a	unpaved	2.84	0.09	5.4	3.2	
	Channel 1 Flow	760	682	668	0.018	0.04	n/a	n/a	5.87	0.04	2.2	1.3	
	Lake	129	668	667	0.008	n/a	n/a	n/a	1.00	0.04	2.2	1.3	
	Channel 2 Flow	197	667	655	0.061	0.04	n/a	n/a	9.20	0.01	0.4	0.2	
	Channel 3 Flow	626	655	648	0.011	0.04	n/a	n/a	7.39	0.02	1.4	0.8	13.1
24	Sheet / Overland Flow	100	618	617.5	0.005	0.17	4.45	n/a	n/a	0.27	16.0	9.6	
	Shallow Conc Flow	1530	619	601	0.012	n/a	n/a	unpaved	1.75	0.24	14.6	8.7	
	Channel 1 Flow	3638	601	550	0.014	0.04	n/a	n/a	6.20	0.16	9.8	5.9	
	Channel 2 Flow	4873	550	537	0.003	0.04	n/a	n/a	4.64	0.29	17.5	10.5	34.7
25	Sheet / Overland Flow	100	701	699.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	363	699.5	690	0.026	n/a	n/a	unpaved	2.61	0.04	2.3	1.4	
	Channel 1 Flow	1563	690	650	0.026	0.04	n/a	n/a	3.32	0.13	7.8	4.7	
	Channel 2 Flow	4811	650	595	0.011	0.04	n/a	n/a	3.98	0.34	20.1	12.1	24.4
26	Sheet / Overland Flow	100	833	829.5	0.035	0.17	4.45	n/a	n/a	0.12	7.3	4.4	
	Shallow Conc Flow	1221	829.5	766	0.052	n/a	n/a	unpaved	3.68	0.09	5.5	3.3	
	Lake	262	766	761.8	0.016	n/a	n/a	n/a	1.00	0.07	4.4	2.6	
	Channel Flow	1561	761.8	723	0.025	0.04	n/a	n/a	4.85	0.09	5.4	3.2	13.6

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
27	Sheet / Overland Flow	100	772	771	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	676	771	750	0.031	n/a	n/a	unpaved	2.84	0.07	4.0	2.4	
	Channel Flow	4269	750	705	0.011	0.04	n/a	n/a	7.62	0.16	9.3	5.6	15.3
28	Sheet / Overland Flow	100	762	761	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	1013	761	740	0.021	n/a	n/a	unpaved	2.32	0.12	7.3	4.4	
	Channel 1 Flow	1097	740	732	0.007	0.04	n/a	n/a	2.74	0.11	6.7	4.0	
	Lake	172	732	730.2	0.010	n/a	n/a	n/a	1.00	0.05	2.9	1.7	
	Channel 2 Flow	1120	730.2	705	0.023	0.04	n/a	n/a	8.11	0.04	2.3	1.4	18.7
29	Sheet / Overland Flow	100	831.5	830.2	0.013	0.17	4.45	n/a	n/a	0.18	10.9	6.5	
	Shallow Conc Flow	698	830.2	780	0.072	n/a	n/a	unpaved	4.33	0.04	2.7	1.6	
	Channel 1 Flow	1447	780	730	0.035	0.04	n/a	n/a	5.06	0.08	4.8	2.9	
	Channel 2 Flow	650	730	720	0.015	0.04	n/a	n/a	3.38	0.05	3.2	1.9	
	Channel 3 Flow	1040	720	699	0.020	0.04	n/a	n/a	6.41	0.05	2.7	1.6	14.6
30	Sheet / Overland Flow	100	802	801.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	802	801.8	790	0.015	n/a	n/a	unpaved	1.96	0.11	6.8	4.1	
	Channel 1 Flow	2310	790	762	0.012	0.04	4.45	n/a	5.96	0.72	43.5	26.1	
	Lake	347	762	761	0.003	n/a	n/a	n/a	1.00	0.10	5.8	3.5	
	Channel 2 Flow	543	761	739.5	0.040	0.04	n/a	n/a	6.78	0.02	1.3	0.8	
	Channel 3 Flow	756	739.5	736	0.005	0.04	n/a	n/a	3.68	0.06	3.4	2.1	50.3
31	Sheet / Overland Flow	100	793	792	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	1156	792	770	0.019	n/a	n/a	unpaved	2.23	0.14	8.7	5.2	
	Channel 1 Flow	1234	770	741	0.024	0.04	n/a	n/a	6.33	0.05	3.2	1.9	
	Lake	276	741	740	0.004	n/a	n/a	n/a	1.00	0.08	4.6	2.8	
	Channel 2 Flow	1292	740	712	0.022	0.04	n/a	n/a	8.71	0.04	2.5	1.5	18.7
32	Sheet / Overland Flow	100	802	801.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	2036	801.8	790	0.006	n/a	n/a	unpaved	1.23	0.46	27.6	16.6	
	Channel Flow	4671	790	716	0.016	0.04	n/a	n/a	6.14	0.21	12.7	7.6	38.0
33	Sheet / Overland Flow	100	705.5	704.5	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	1470	704.5	680	0.017	n/a	n/a	unpaved	2.08	0.20	11.8	7.1	
	Channel Flow	5746	680	638	0.007	0.04	n/a	n/a	6.35	0.25	15.1	9.1	23.4

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
34	Sheet / Overland Flow	100	772	765	0.070	0.17	4.45	n/a	n/a	0.09	5.6	3.3	
	Shallow Conc Flow	1954	765	710	0.028	n/a	n/a	unpaved	2.71	0.20	12.0	7.2	
	Channel Flow	2134	710	696	0.007	0.04	n/a	n/a	2.74	0.22	13.0	7.8	18.4
35	Sheet / Overland Flow	100	728.5	725.5	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1293	725.5	690	0.027	n/a	n/a	unpaved	2.67	0.13	8.1	4.8	
	Channel Flow	749	690	684	0.008	0.04	n/a	n/a	3.61	0.06	3.5	2.1	11.6
36	Sheet / Overland Flow	100	757	755	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	177	755	750	0.028	n/a	4.45	unpaved	2.71	0.02	1.1	0.7	
	Channel 1 Flow	630	750	732	0.029	0.04	n/a	n/a	4.32	0.04	2.4	1.5	
	Lake	482	732	731	0.002	n/a	n/a	n/a	1.00	0.13	8.0	4.8	
	Channel 2 Flow	979	731	697	0.035	0.04	n/a	n/a	4.76	0.06	3.4	2.1	
	Channel 3 Flow	760	697	690.5	0.009	0.04	n/a	n/a	4.00	0.05	3.2	1.9	16.4
37	Sheet / Overland Flow	100	752.5	750.5	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	760	750.5	708	0.056	n/a	n/a	unpaved	3.82	0.06	3.3	2.0	
	Channel Flow	1380	708	698	0.007	0.04	n/a	n/a	6.32	0.06	3.6	2.2	9.7
38	Sheet / Overland Flow	100	774	773	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	575	773	770	0.005	n/a	4.45	unpaved	1.17	0.14	8.2	4.9	
	Channel 1 Flow	997	770	758.5	0.012	0.04	4.45	n/a	3.66	0.08	4.5	2.7	
	Lake	460	758.5	754	0.010	n/a	n/a	n/a	1.00	0.13	7.7	4.6	
	Channel 2 Flow	328	754	745.5	0.026	0.04	n/a	n/a	8.71	0.01	0.6	0.4	
	Lake	460	745.5	736	0.021	n/a	n/a	n/a	1.00	0.13	7.7	4.6	24.5
39	Sheet / Overland Flow	100	781	780.1	0.009	0.17	4.45	n/a	n/a	0.21	12.6	7.6	
	Shallow Conc Flow	767	780.1	740	0.052	n/a	4.45	unpaved	3.69	0.06	3.5	2.1	
	Channel 1 Flow	364	740	729.5	0.029	0.04	4.45	n/a	3.99	0.03	1.5	0.9	
	Lake	131	729.5	727	0.019	n/a	n/a	n/a	1.00	0.04	2.2	1.3	
	Channel 2 Flow	623	727	714	0.021	0.04	n/a	n/a	5.96	0.03	1.7	1.0	
	Lake	275	714	713.5	0.002	n/a	n/a	n/a	1.00	0.08	4.6	2.7	15.7
40	Sheet / Overland Flow	100	701	699.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	1506	699.5	682	0.012	n/a	n/a	unpaved	1.74	0.24	14.4	8.7	
	Channel Flow	958	682	676	0.006	0.04	n/a	n/a	4.24	0.06	3.8	2.3	17.1
41	Sheet / Overland Flow	100	762	761	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	572	761	730	0.054	n/a	n/a	unpaved	3.76	0.04	2.5	1.5	
	Channel Flow	2777	730	686	0.016	0.04	n/a	n/a	5.51	0.14	8.4	5.0	13.8

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
42	Sheet / Overland Flow	100	682	680.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	3312	680.5	645	0.011	n/a	n/a	unpaved	1.67	0.55	33.0	19.8	
	Channel Flow	1287	645	637	0.006	0.04	n/a	n/a	5.32	0.07	4.0	2.4	28.4
43	Sheet / Overland Flow	100	672	669	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1511	669	638	0.021	n/a	n/a	unpaved	2.31	0.18	10.9	6.5	
	Channel Flow	2072	638	636	0.001	0.04	n/a	n/a	2.10	0.27	16.5	9.9	21.1
44	Sheet / Overland Flow	100	771	769	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	1473	769	719	0.034	n/a	n/a	unpaved	2.97	0.14	8.3	5.0	
	Channel Flow	2952	719	686	0.011	0.04	n/a	n/a	5.26	0.16	9.3	5.6	16.1
45	Sheet / Overland Flow	100	702	701	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	961	701	680	0.022	n/a	n/a	unpaved	2.39	0.11	6.7	4.0	
	Channel Flow	988	680	676	0.004	0.04	n/a	n/a	1.63	0.17	10.1	6.1	17.4
46	Sheet / Overland Flow	100	682	680.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	845	680.5	676	0.005	n/a	n/a	unpaved	1.18	0.20	12.0	7.2	
	Channel 1 Flow	451	676	674	0.004	0.04	n/a	n/a	2.48	0.05	3.0	1.8	
	Lake	324	674	661	0.040	n/a	n/a	n/a	1.00	0.09	5.4	3.2	
	Channel 2 Flow	663	661	650	0.017	0.04	n/a	n/a	3.51	0.05	3.1	1.9	
	Channel 3 Flow	433	650	646	0.009	0.04	n/a	n/a	4.15	0.03	1.7	1.0	21.4
47	Sheet / Overland Flow	100	833	829.5	0.035	0.4	4.45	n/a	n/a	0.24	14.6	8.7	
	Shallow Conc Flow	195	829.5	810	0.100	n/a	n/a	unpaved	5.10	0.01	0.6	0.4	
	Channel 1 Flow	1350	810	740	0.052	0.08	n/a	n/a	7.60	0.05	3.0	1.8	
	Channel 2 Flow	1205	740	708	0.027	0.04	n/a	n/a	4.79	0.07	4.2	2.5	13.4
48	Sheet / Overland Flow	100	730.25	730	0.003	0.17	4.45	n/a	n/a	0.35	21.1	12.7	
	Shallow Conc Flow	757	730	700	0.040	n/a	n/a	unpaved	3.21	0.07	3.9	2.4	
	Channel Flow	1688	700	671	0.017	0.04	n/a	n/a	3.85	0.12	7.3	4.4	19.4
49	Sheet / Overland Flow	100	740.4	740.1	0.003	0.17	4.45	n/a	n/a	0.33	19.6	11.8	
	Shallow Conc Flow	738	740.1	706	0.046	n/a	n/a	unpaved	3.47	0.06	3.5	2.1	
	Lake	218	706	705.5	0.002	n/a	n/a	n/a	1.00	0.06	3.6	2.2	
	Channel Flow	2132	705.5	688	0.008	0.04	n/a	n/a	6.72	0.09	5.3	3.2	19.2
50	Sheet / Overland Flow	100	706	705	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	2742	705	670	0.013	n/a	n/a	unpaved	1.82	0.42	25.1	15.0	
	Channel Flow	3832	670	638	0.008	0.04	n/a	n/a	5.58	0.19	11.4	6.9	29.2
51	Sheet / Overland Flow	100	700.5	700.1	0.004	0.17	4.45	n/a	n/a	0.29	17.5	10.5	
	Shallow Conc Flow	1341	700.1	674	0.019	n/a	n/a	unpaved	2.25	0.17	9.9	6.0	
	Channel Flow	1762	674	660	0.008	0.04	n/a	n/a	5.45	0.09	5.4	3.2	19.7

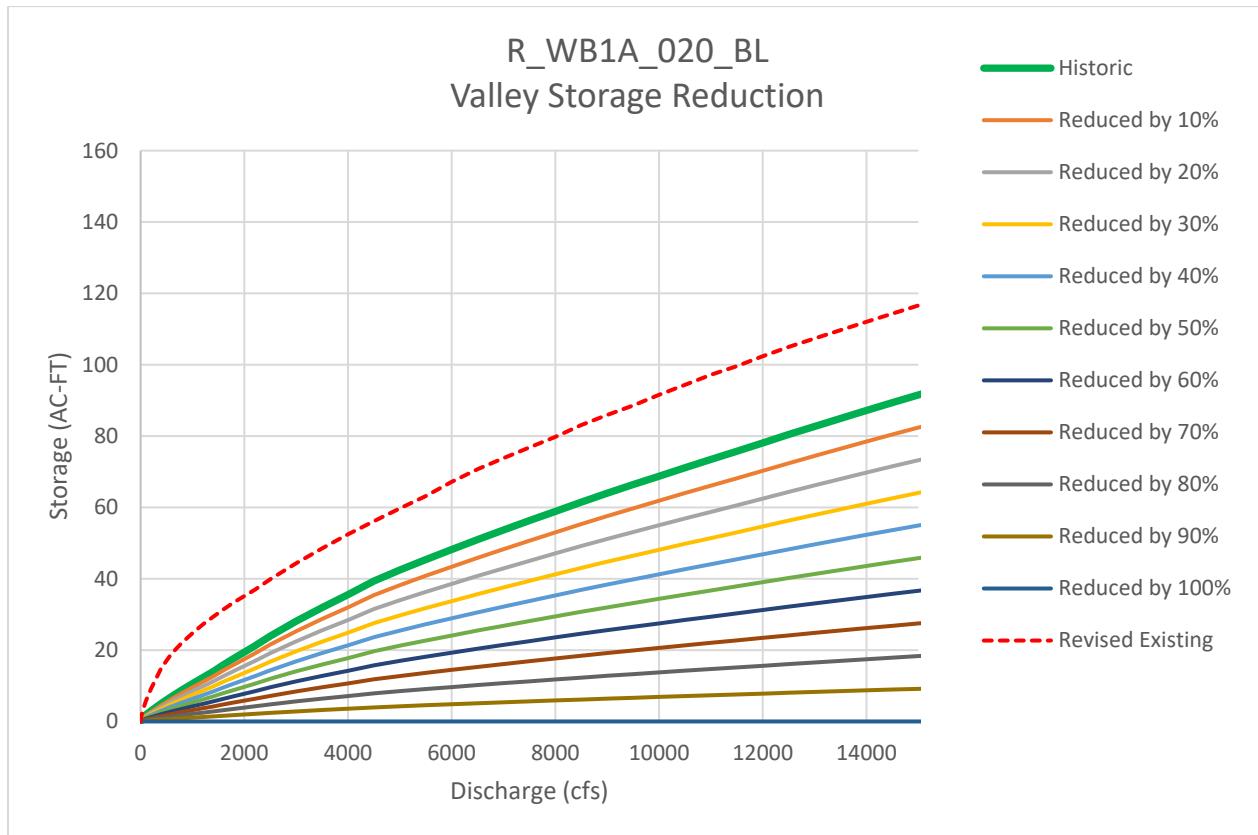
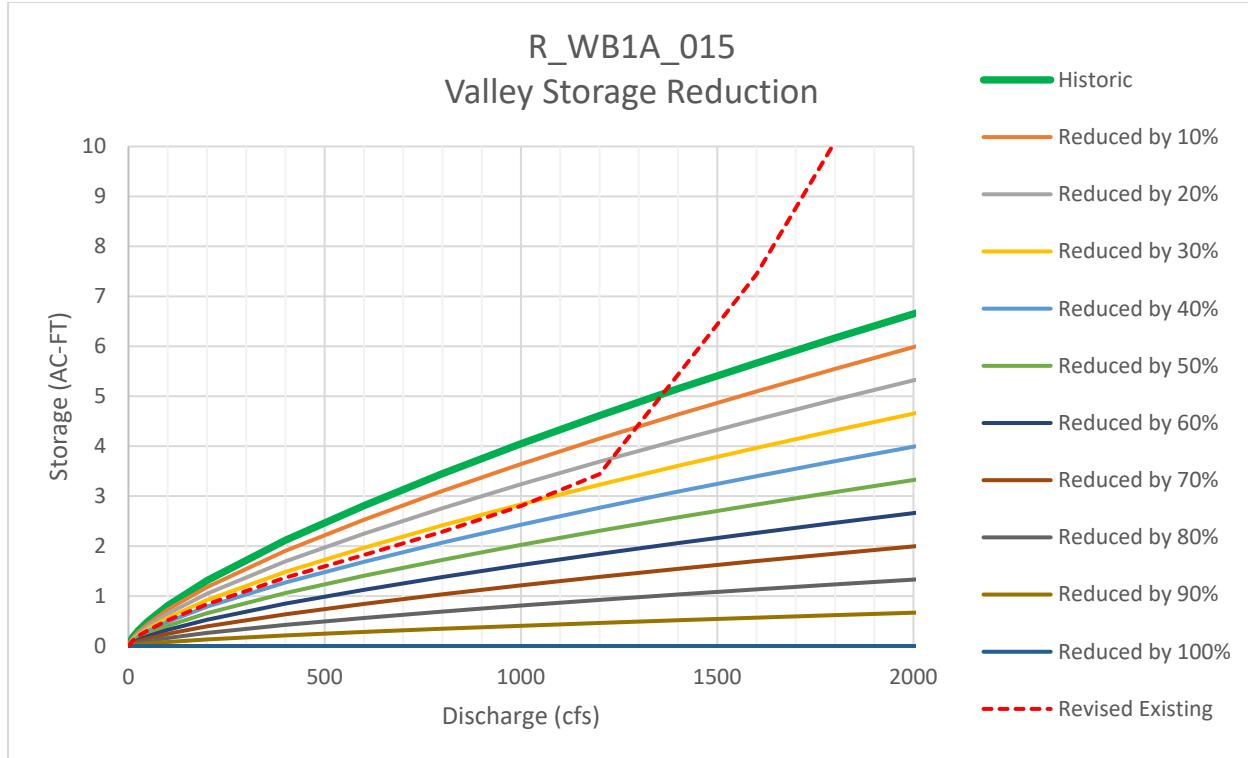
Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
52	Sheet / Overland Flow	100	790.5	787	0.035	0.17	4.45	n/a	n/a	0.12	7.3	4.4	
	Shallow Conc Flow	457	787	760	0.059	n/a	n/a	unpaved	3.92	0.03	1.9	1.2	
	Channel 1 Flow	2600	760	698	0.024	0.04	n/a	n/a	4.39	0.16	9.9	5.9	
	Lake	241	698	697.5	0.002	n/a	n/a	n/a	1.00	0.07	4.0	2.4	
	Channel 2 Flow	208	697.5	696.5	0.005	0.04	n/a	n/a	2.08	0.03	1.7	1.0	14.9
53	Sheet / Overland Flow	100	721	720.6	0.004	0.17	4.45	n/a	n/a	0.29	17.5	10.5	
	Shallow Conc Flow	703	720.6	710	0.015	n/a	n/a	unpaved	1.98	0.10	5.9	3.5	
	Channel Flow	740	710	686.5	0.032	0.04	n/a	n/a	3.30	0.06	3.7	2.2	16.3
54	Sheet / Overland Flow	100	795.5	793.5	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	381	793.5	780	0.035	n/a	n/a	n/a	3.04	0.03	2.1	1.3	
	Channel Flow	1363	780	736	0.032	0.04	n/a	n/a	3.00	0.13	7.6	4.5	11.3
55	Sheet / Overland Flow	100	732	731	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	495	731	720	0.022	n/a	n/a	unpaved	2.41	0.06	3.4	2.1	
	Channel Flow	708	720	710	0.014	0.04	n/a	n/a	1.76	0.11	6.7	4.0	13.4
56	Sheet / Overland Flow	100	741	740.2	0.008	0.17	4.45	n/a	n/a	0.22	13.2	7.9	
	Shallow Conc Flow	897	740.2	710.5	0.033	n/a	n/a	unpaved	2.94	0.08	5.1	3.1	
	Channel Flow	681	710.5	690	0.030	0.04	n/a	n/a	7.64	0.02	1.5	0.9	11.9
57	Sheet / Overland Flow	100	731	730.2	0.008	0.24	4.45	n/a	n/a	0.29	17.5	10.5	
	Shallow Conc Flow	1271	730.2	690	0.032	n/a	n/a	unpaved	2.87	0.12	7.4	4.4	
	Channel Flow	517	690	685	0.010	0.035	n/a	n/a	1.66	0.09	5.2	3.1	18.0
58	Sheet / Overland Flow	100	701	699	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	323	699	690	0.028	n/a	n/a	unpaved	2.69	0.03	2.0	1.2	
	Channel 1 Flow	1410	690	681	0.006	0.04	n/a	n/a	3.52	0.11	6.7	4.0	
	Lake	378	681	680.5	0.001	n/a	n/a	n/a	1.00	0.10	6.3	3.8	
	Channel 2 Flow	440	680.5	672.5	0.018	0.05	n/a	n/a	8.44	0.01	0.9	0.5	15.0
59	Sheet / Overland Flow	100	642	641	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	674	641	629	0.018	n/a	n/a	unpaved	2.15	0.09	5.2	3.1	
	Channel Flow	1659	629	616	0.008	0.04	n/a	n/a	6.07	0.08	4.6	2.7	13.1
60	Sheet / Overland Flow	100	678	675.5	0.025	0.17	4.45	n/a	n/a	0.14	8.4	5.0	
	Shallow Conc Flow	1623	675.5	648	0.017	n/a	n/a	unpaved	2.10	0.21	12.9	7.7	
	Channel Flow	1781	648	639	0.005	0.04	n/a	n/a	4.34	0.11	6.8	4.1	16.9
61	Sheet / Overland Flow	100	695	694	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	516	694	680	0.027	n/a	n/a	unpaved	2.66	0.05	3.2	1.9	
	Channel Flow	1985	680	630	0.025	0.04	n/a	n/a	6.07	0.09	5.4	3.3	12.5
62	Sheet / Overland Flow	100	700.2	700	0.002	0.24	4.45	n/a	n/a	0.51	30.4	18.2	
	Shallow Conc Flow	1247	700	680	0.016	n/a	n/a	unpaved	2.04	0.17	10.2	6.1	
	Channel Flow	217	680	677	0.014	0.04	n/a	n/a	3.06	0.02	1.2	0.7	25.1

Appendix C

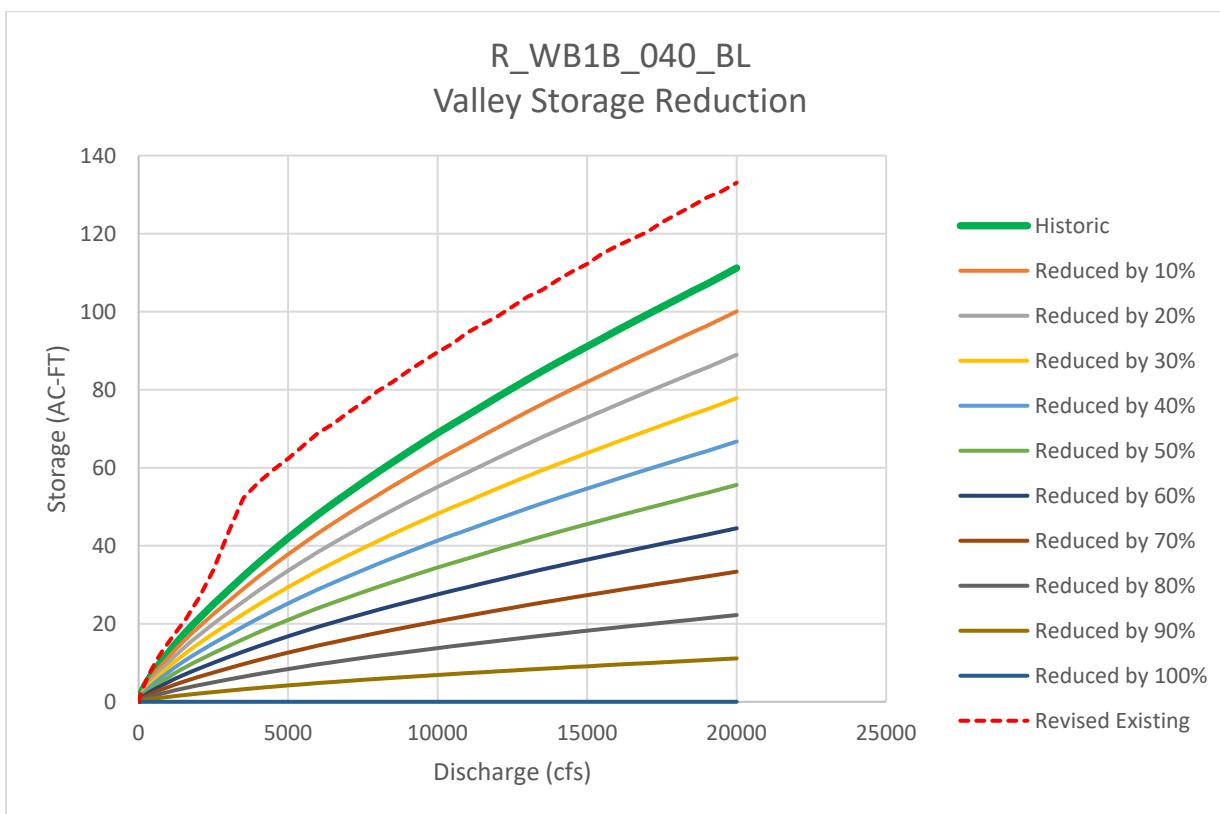
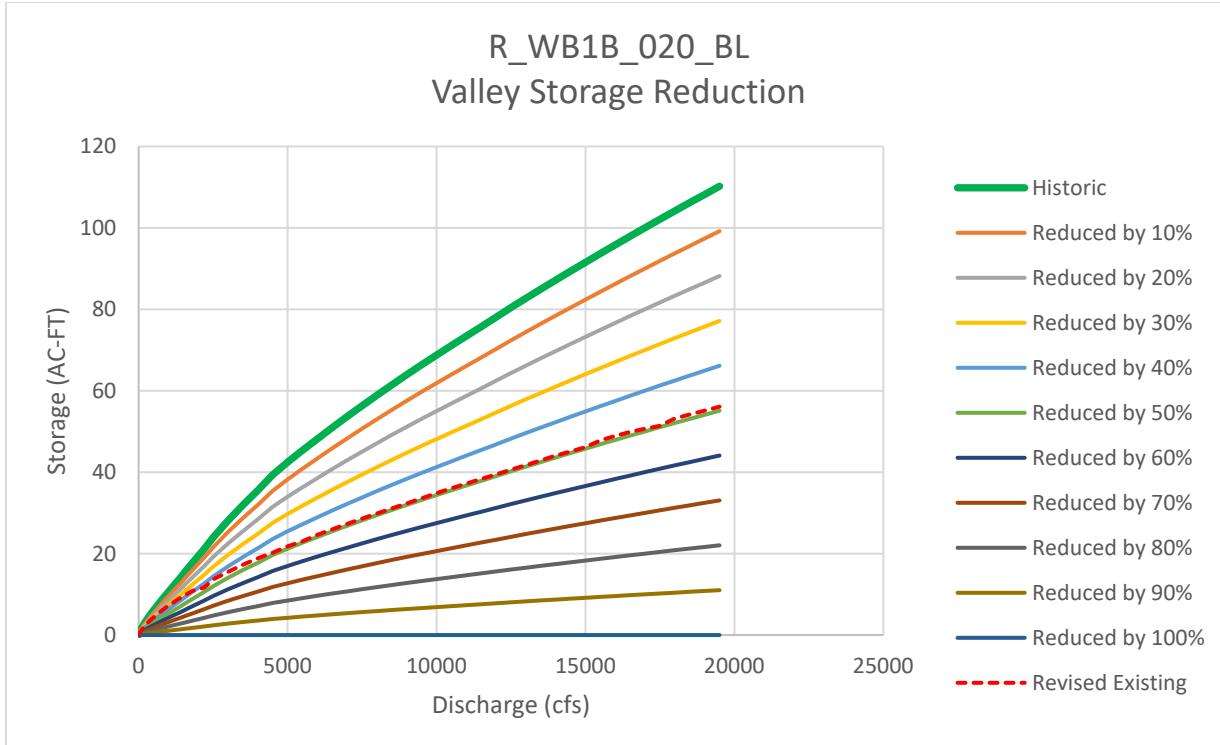
MODIFIED PULS RATING TABLES



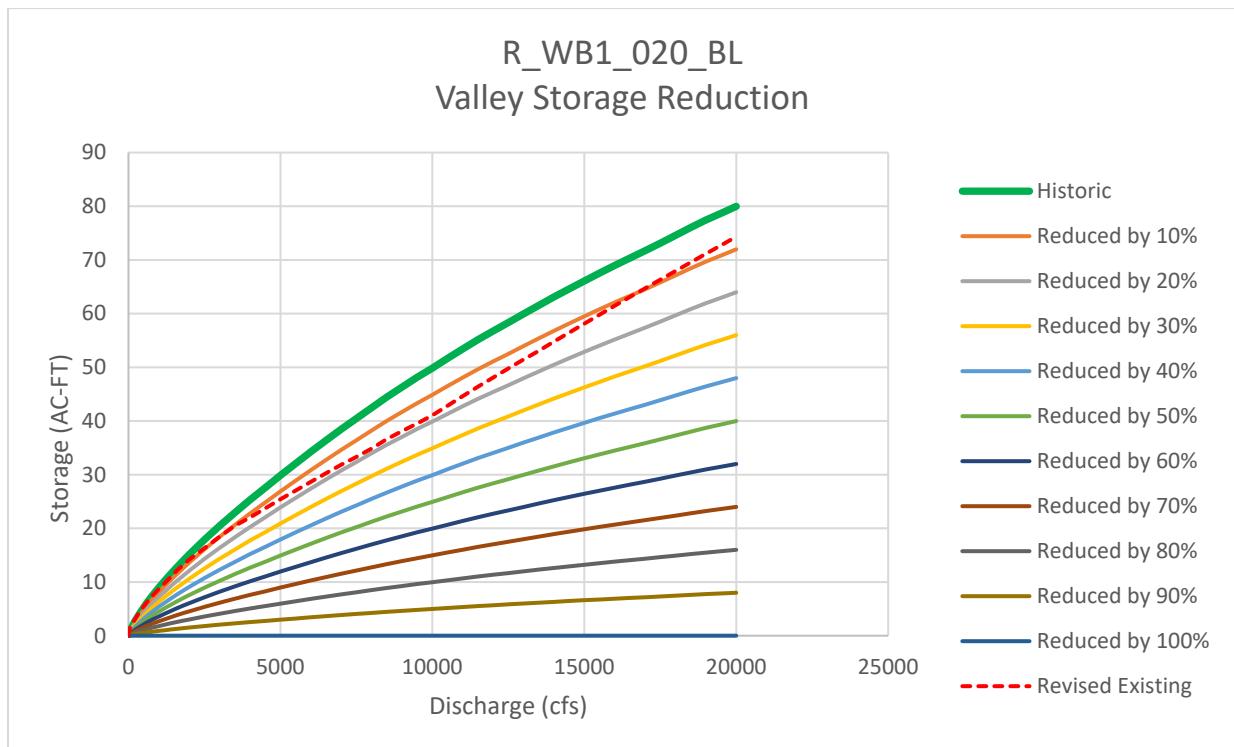
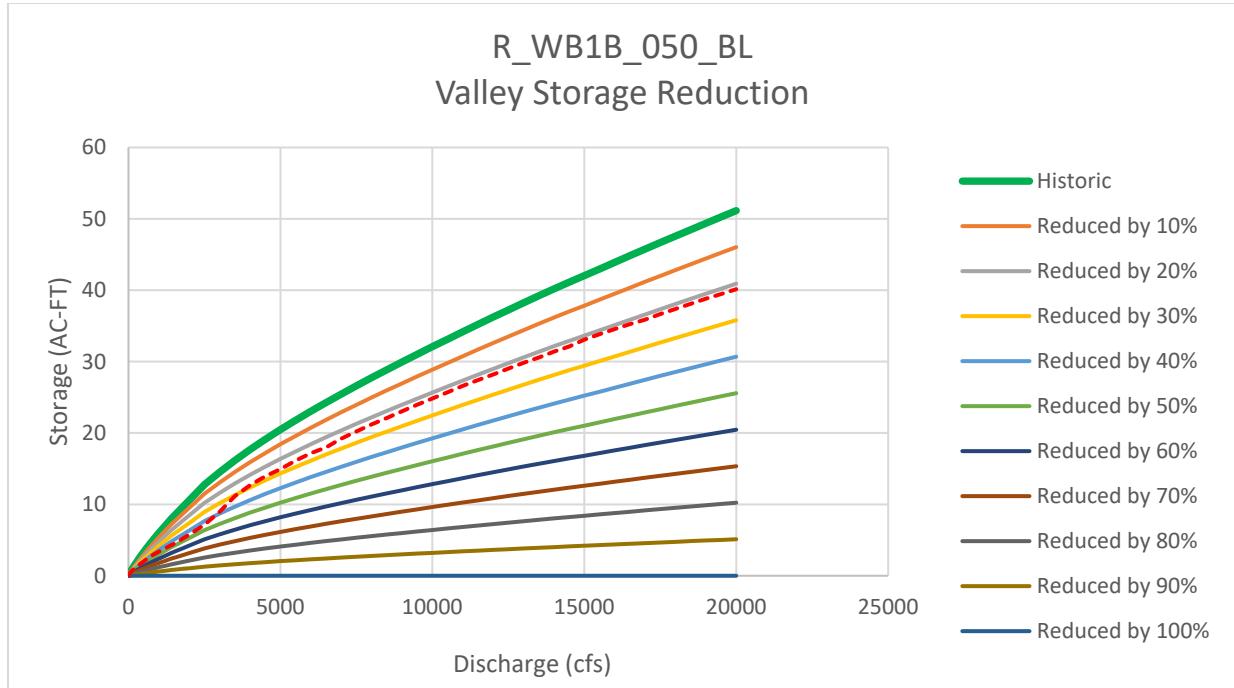
Modified Puls Routing Rating Tables



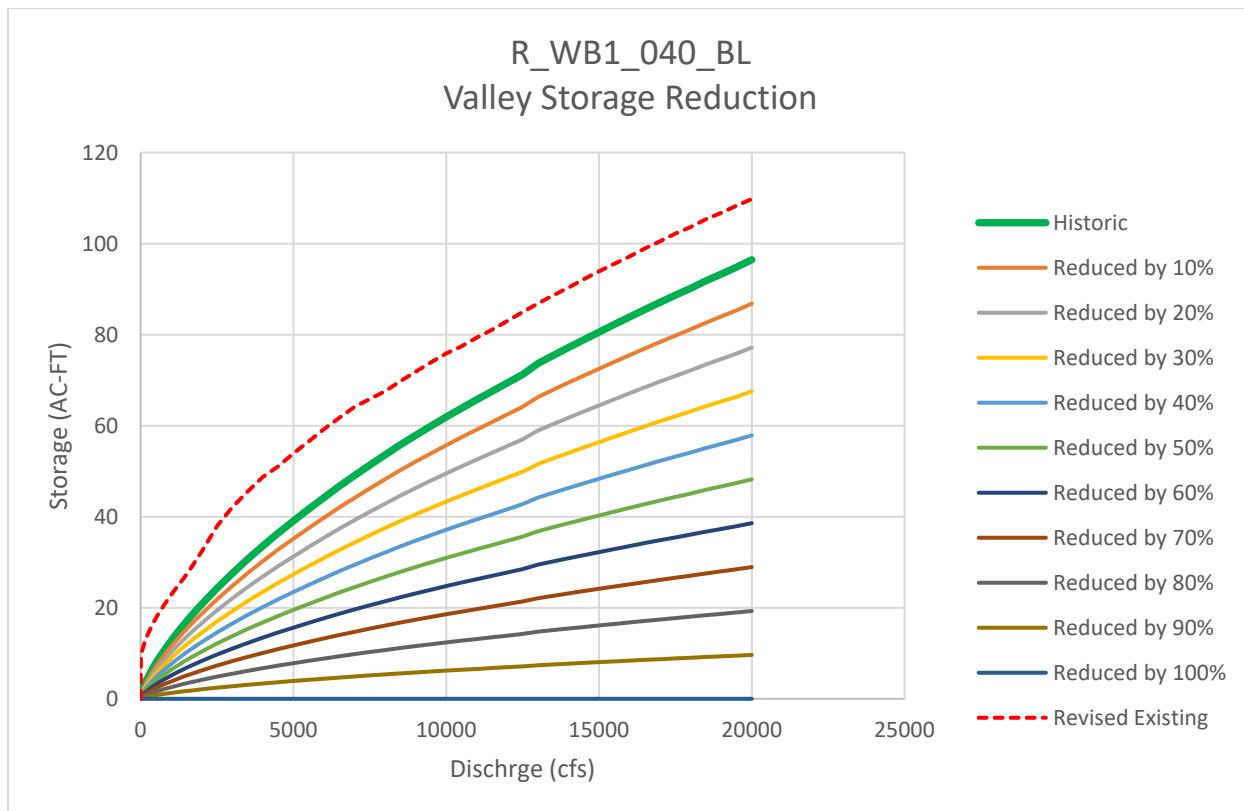
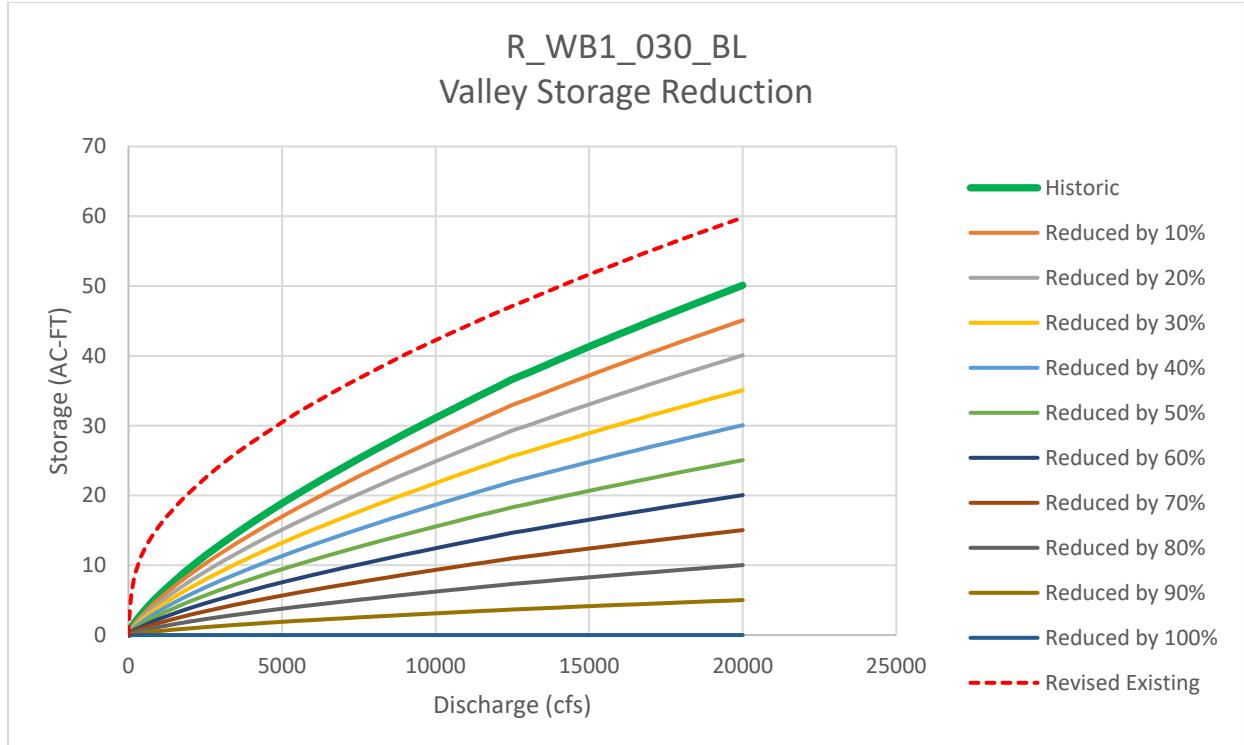
Modified Puls Routing Rating Tables



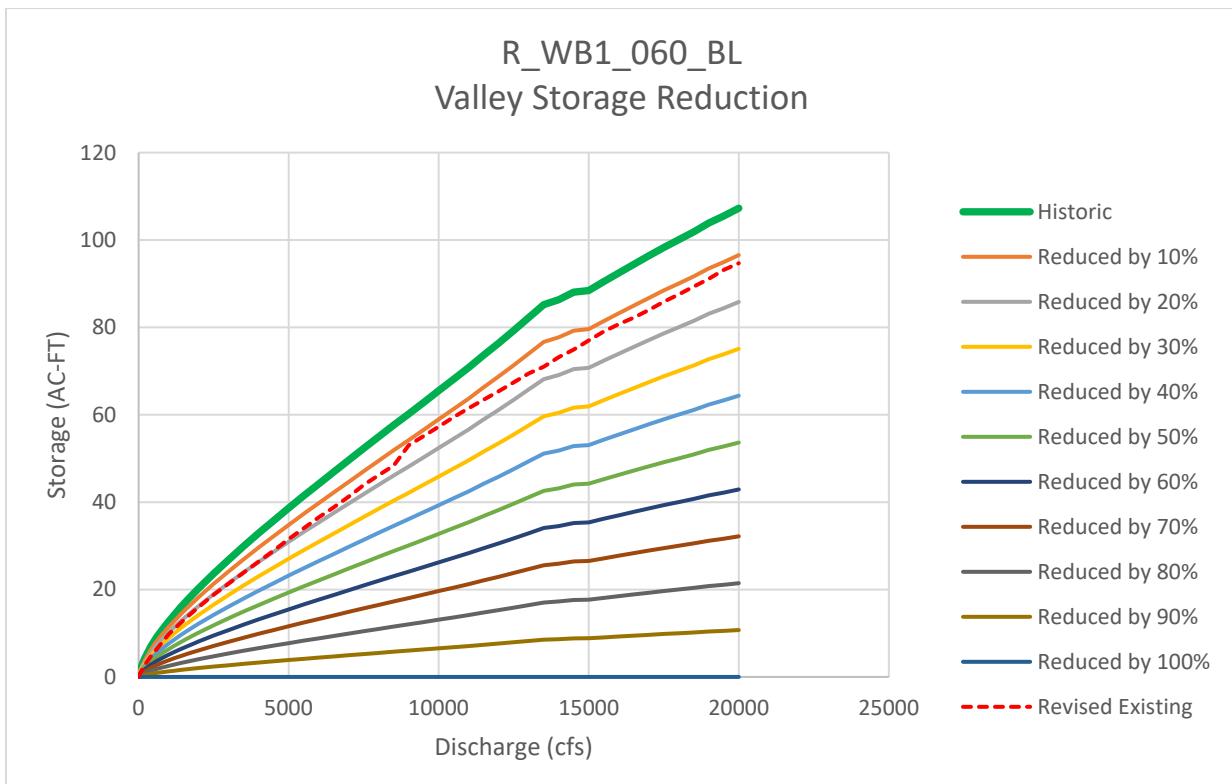
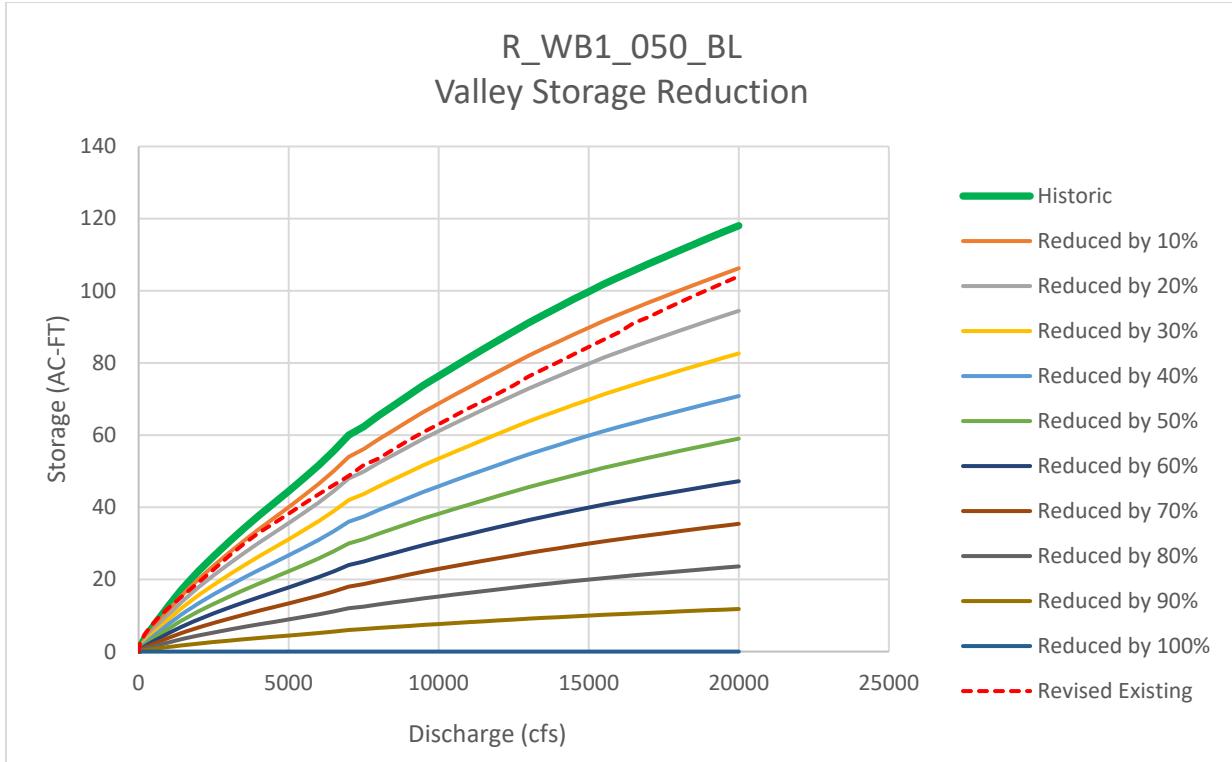
Modified Puls Routing Rating Tables



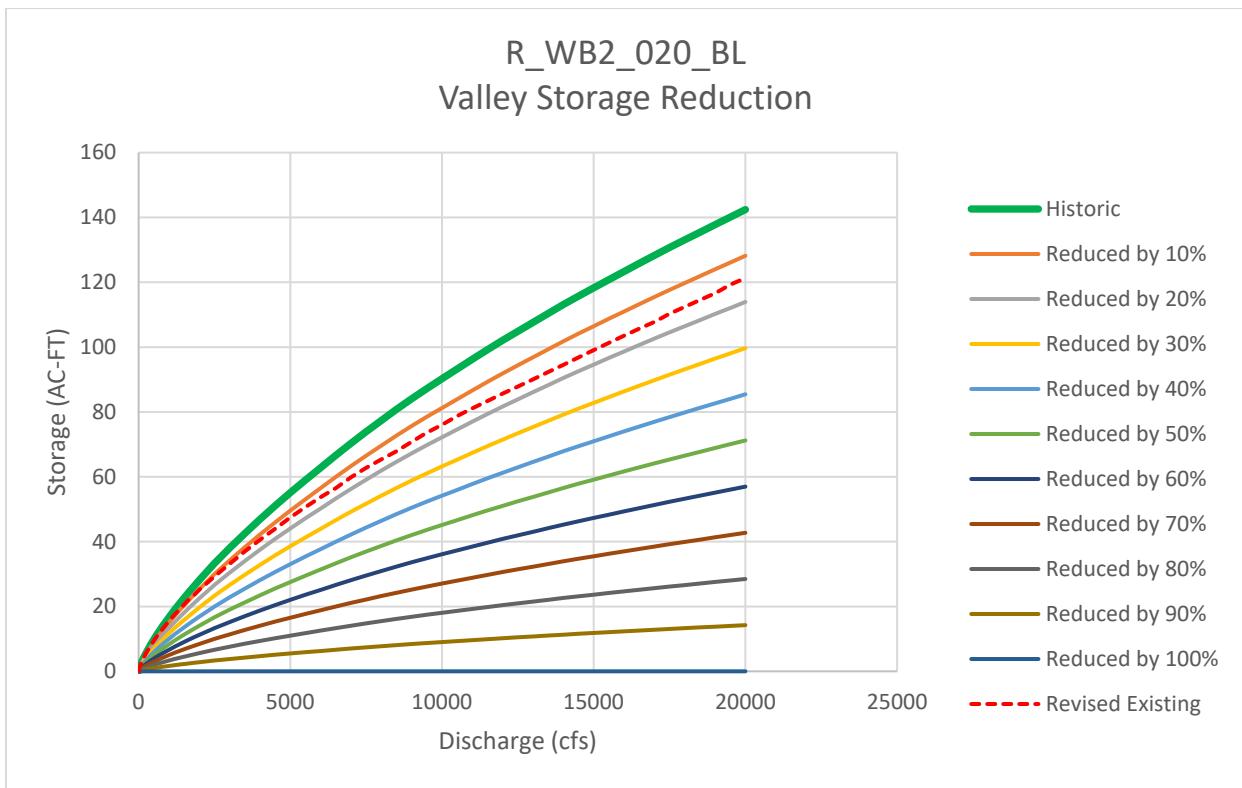
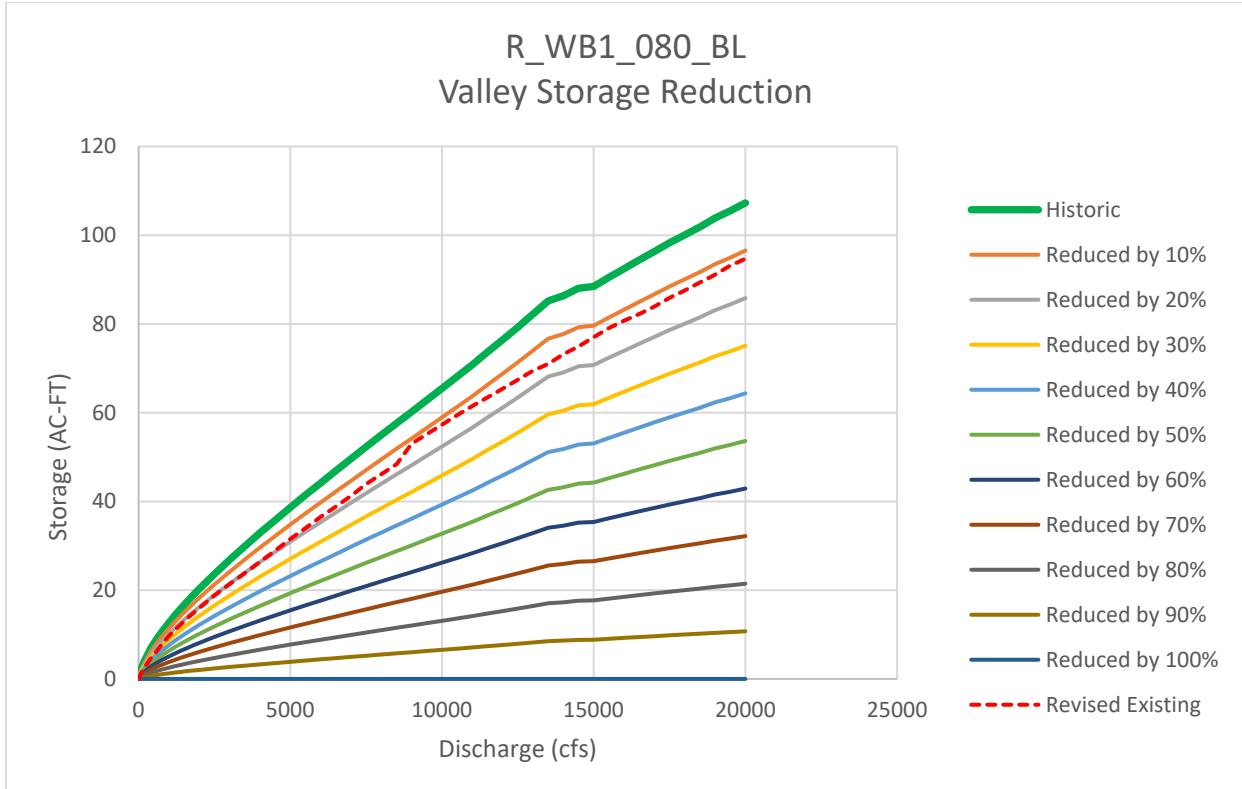
Modified Puls Routing Rating Tables



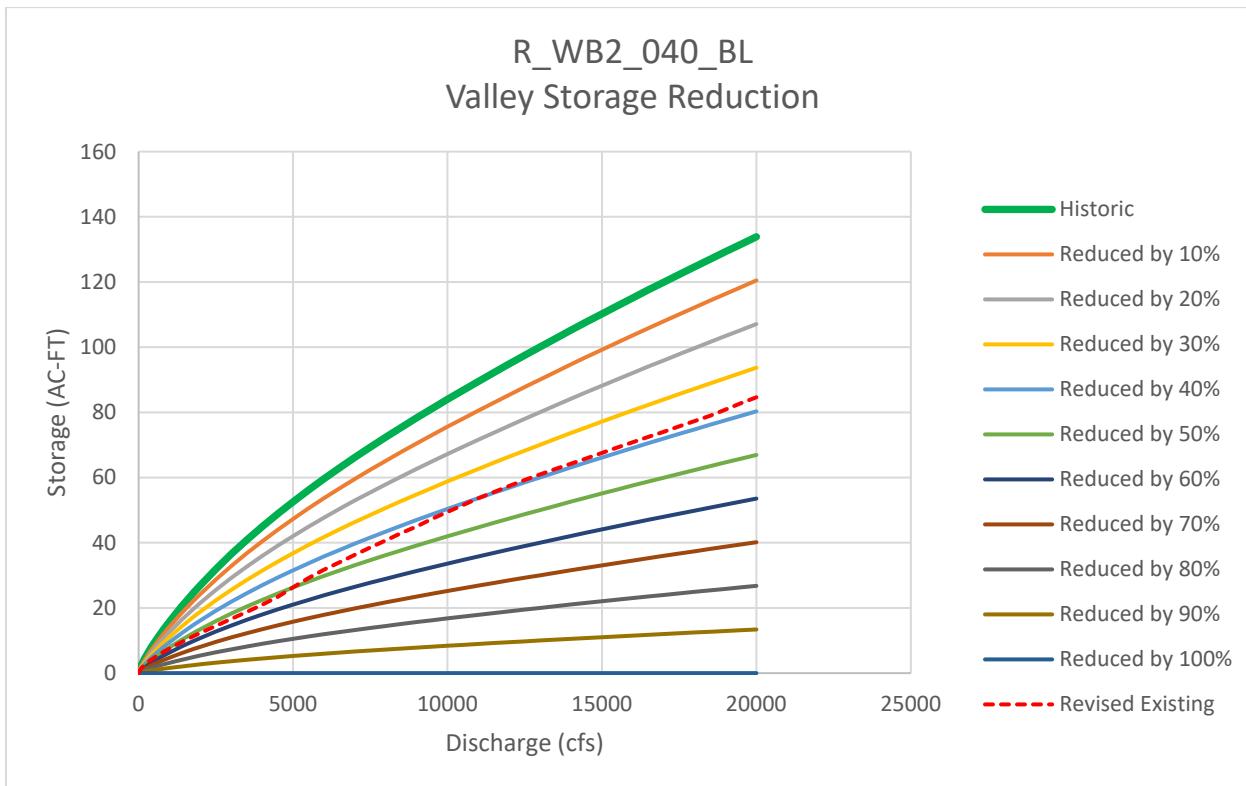
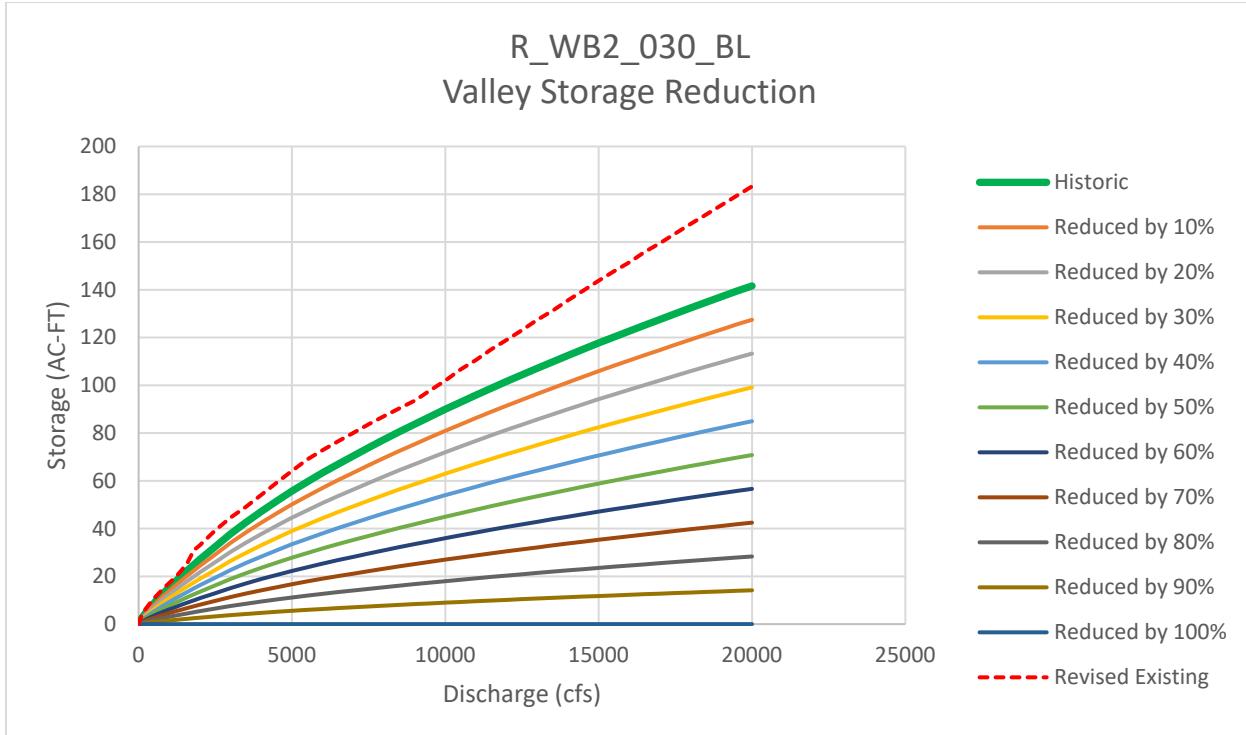
Modified Puls Routing Rating Tables



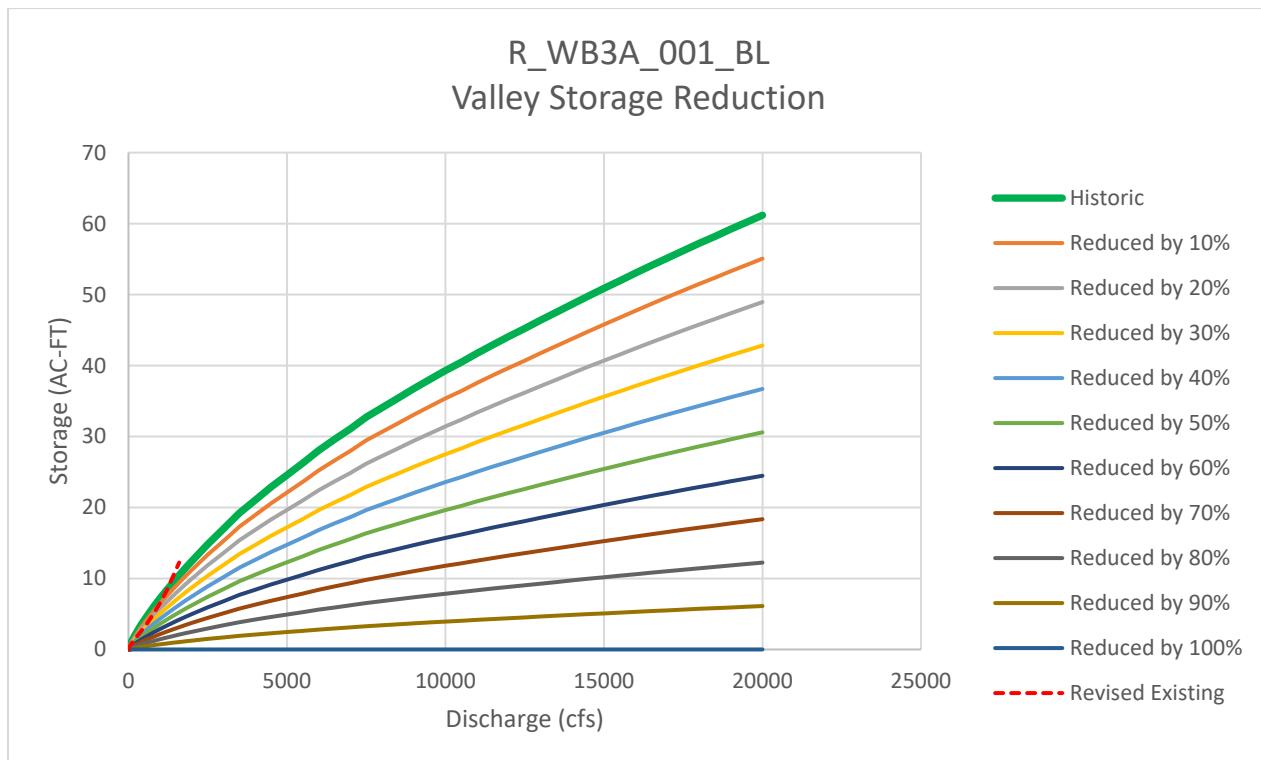
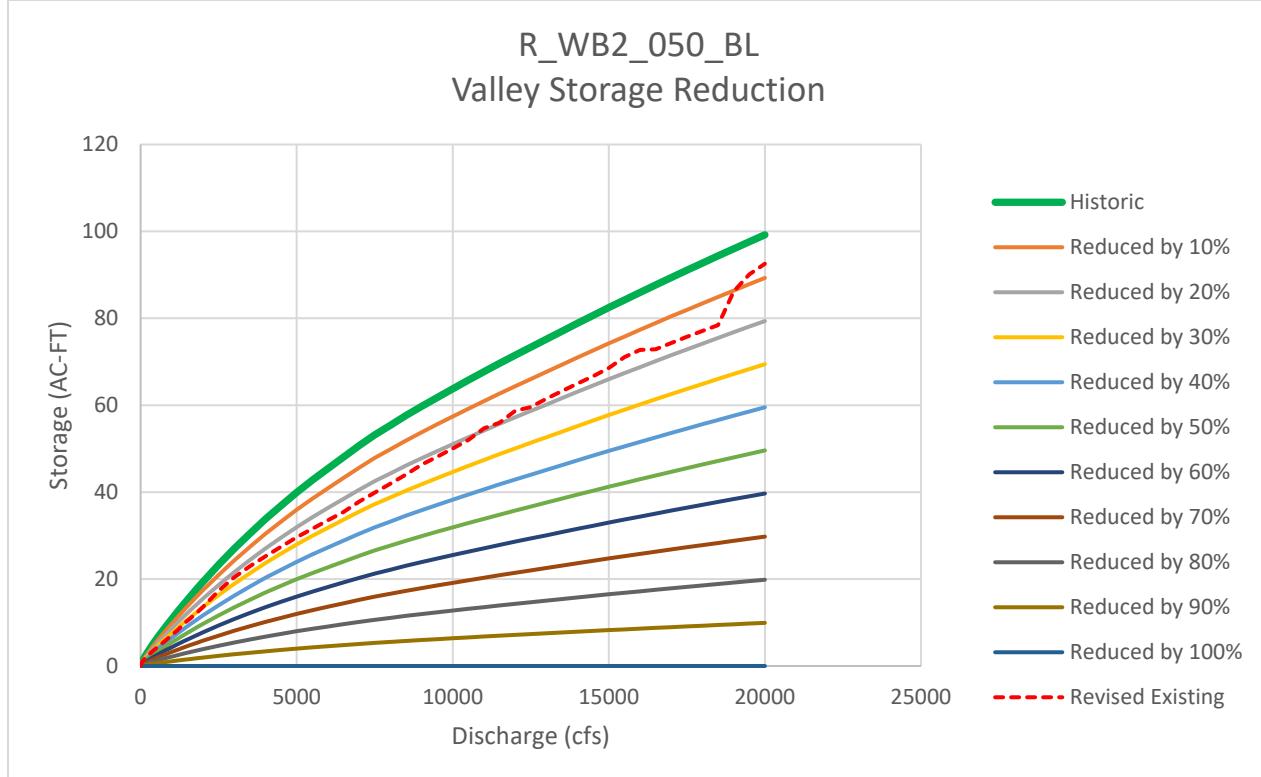
Modified Puls Routing Rating Tables



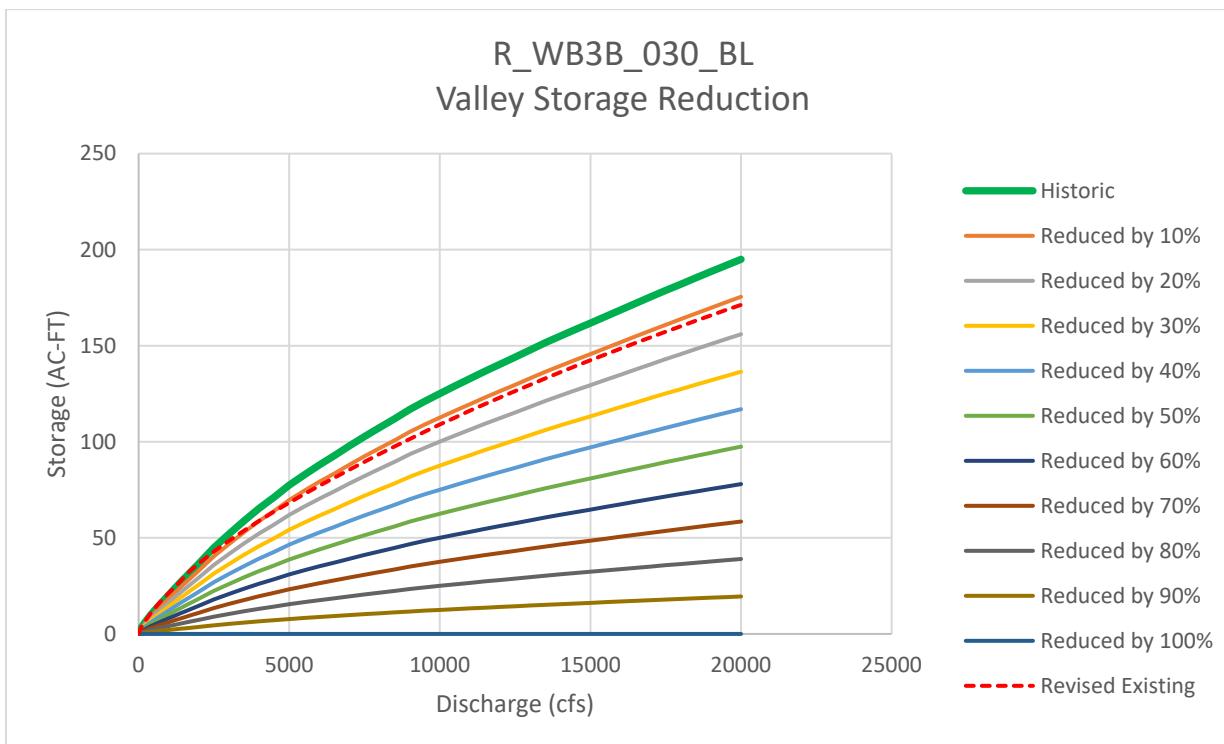
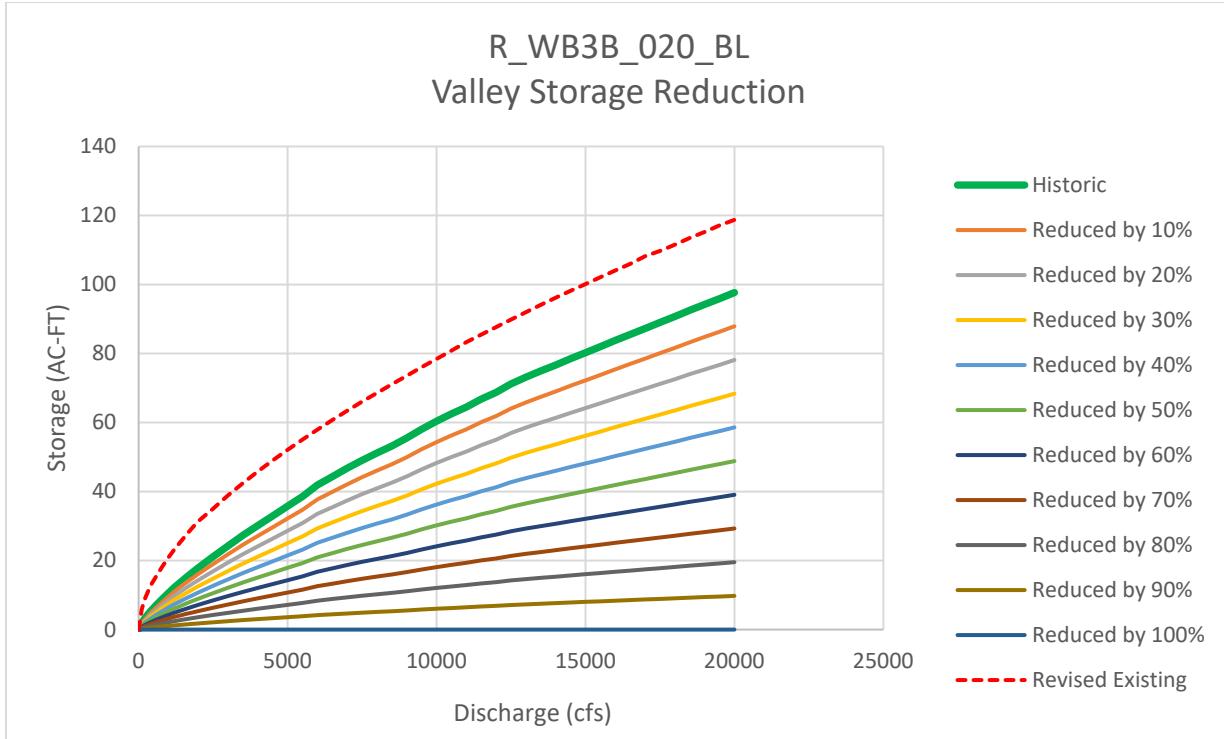
Modified Puls Routing Rating Tables



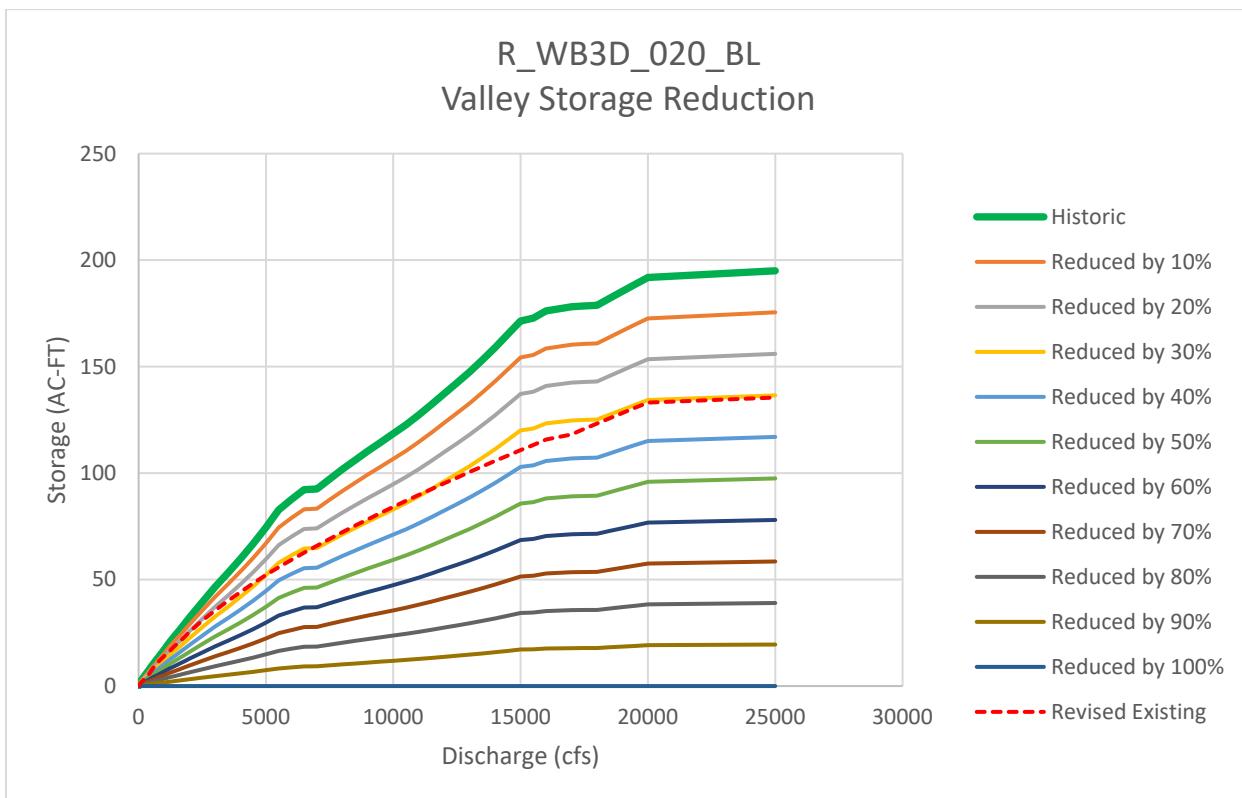
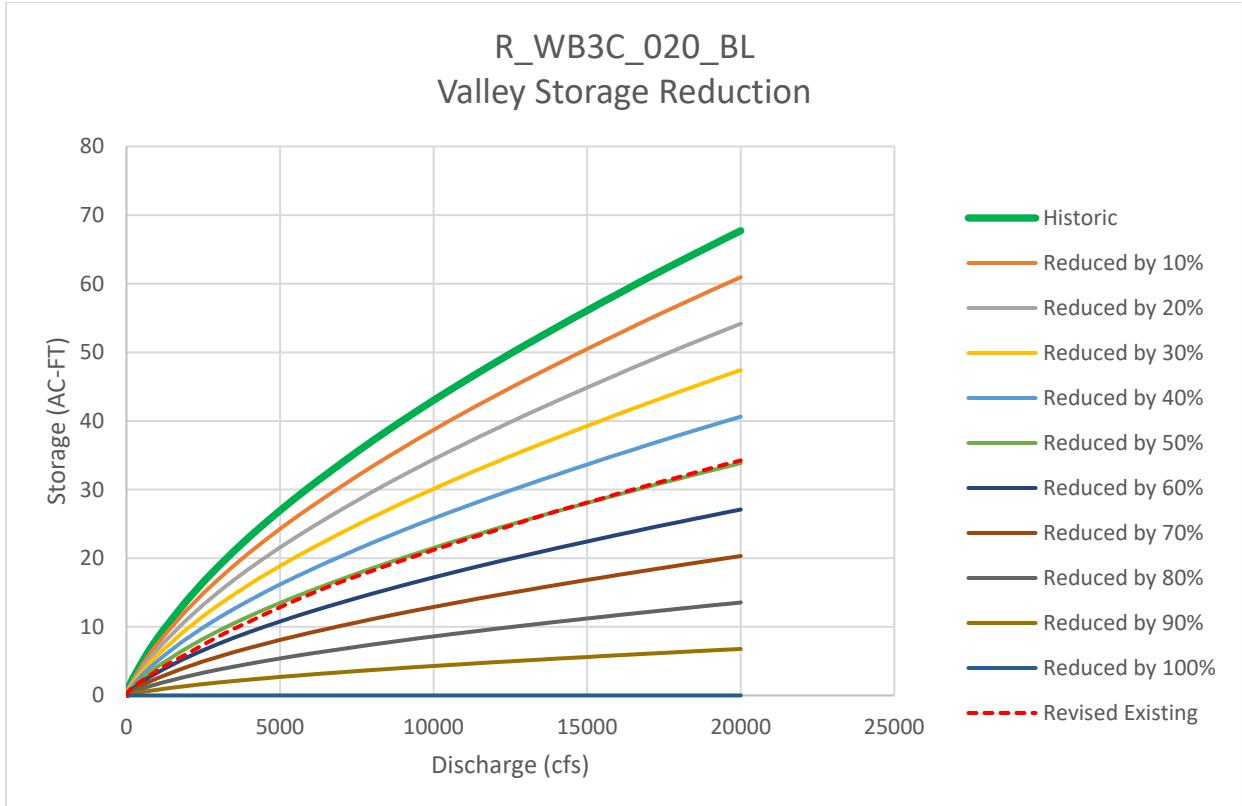
Modified Puls Routing Rating Tables



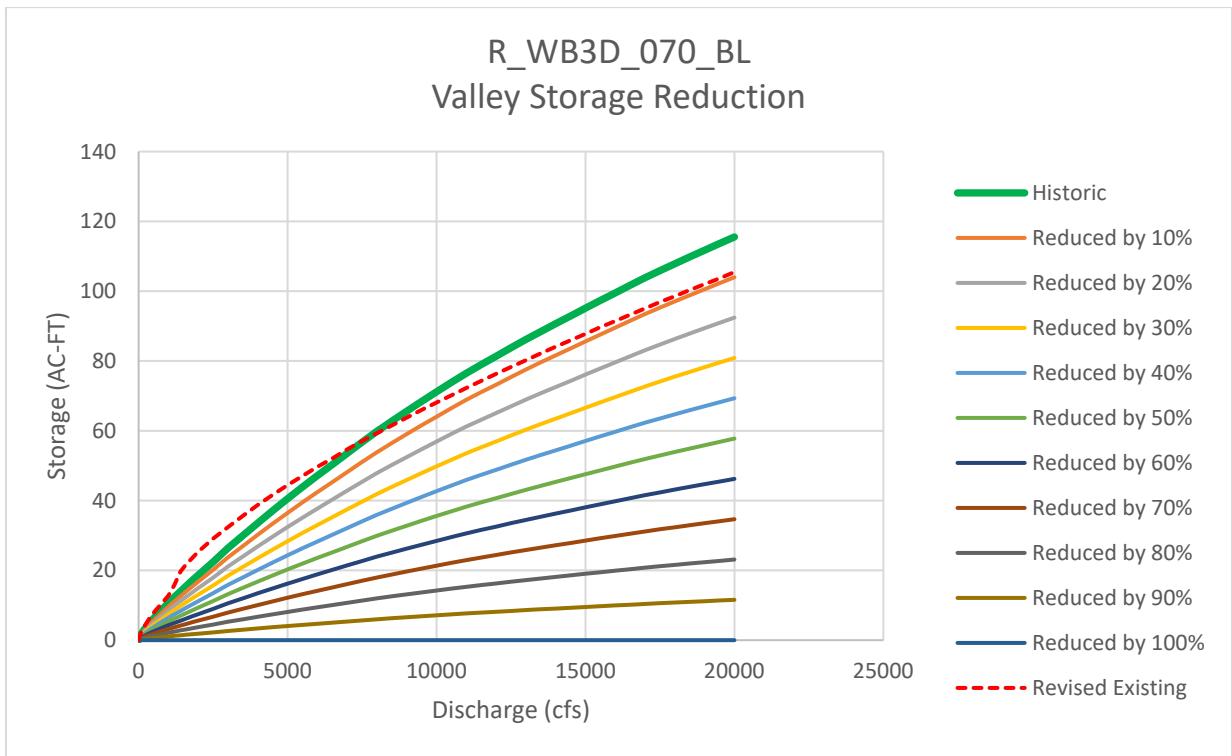
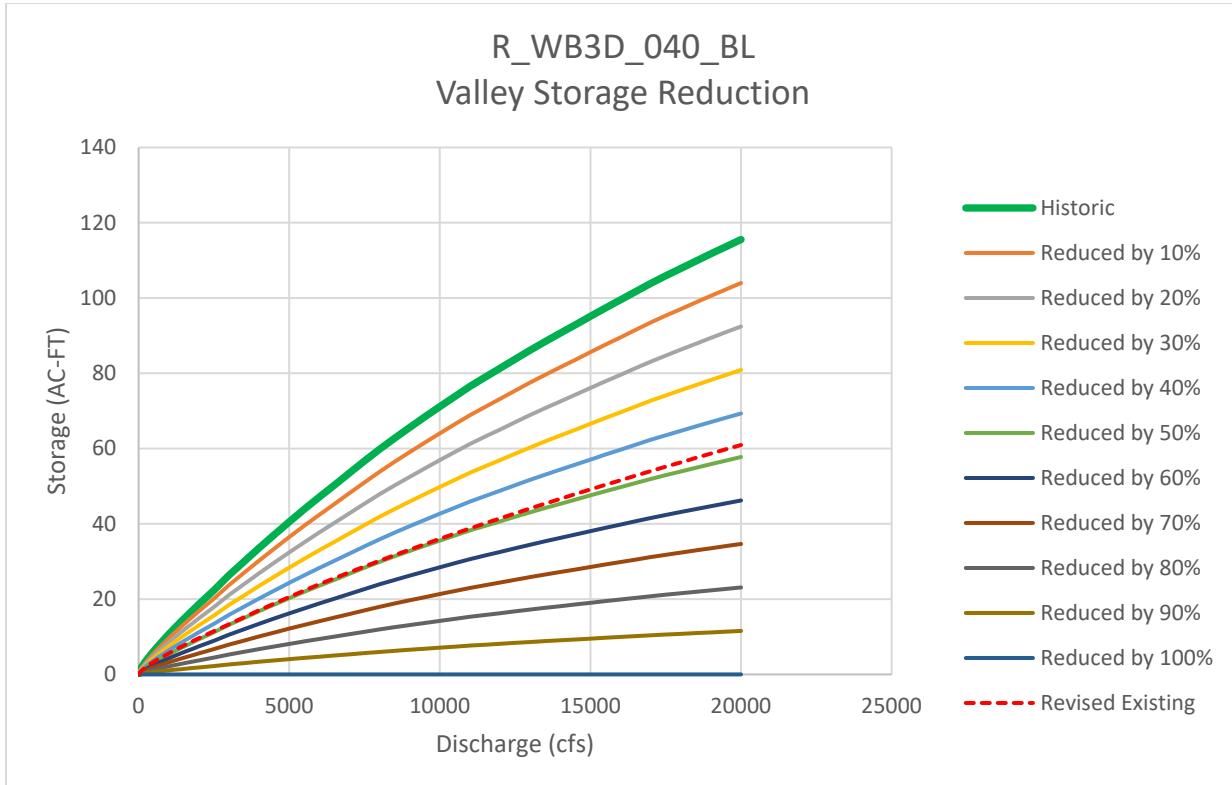
Modified Puls Routing Rating Tables



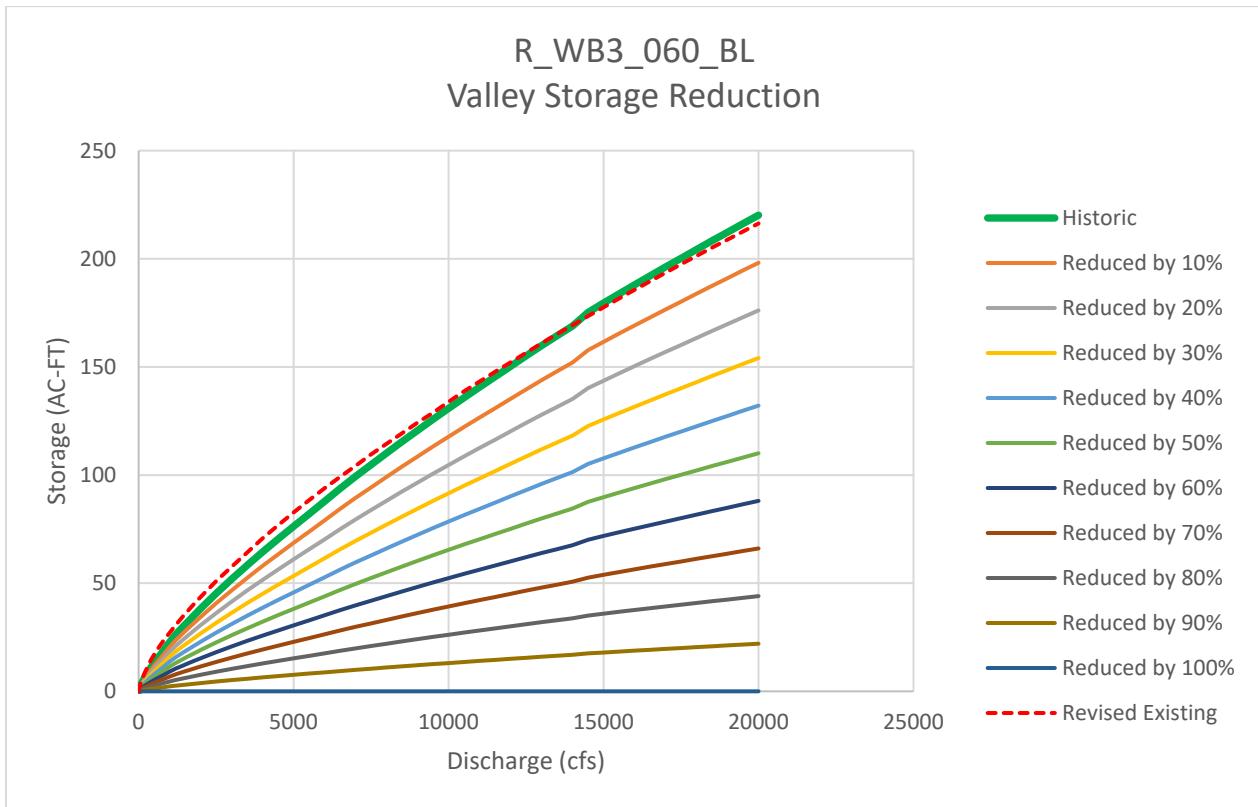
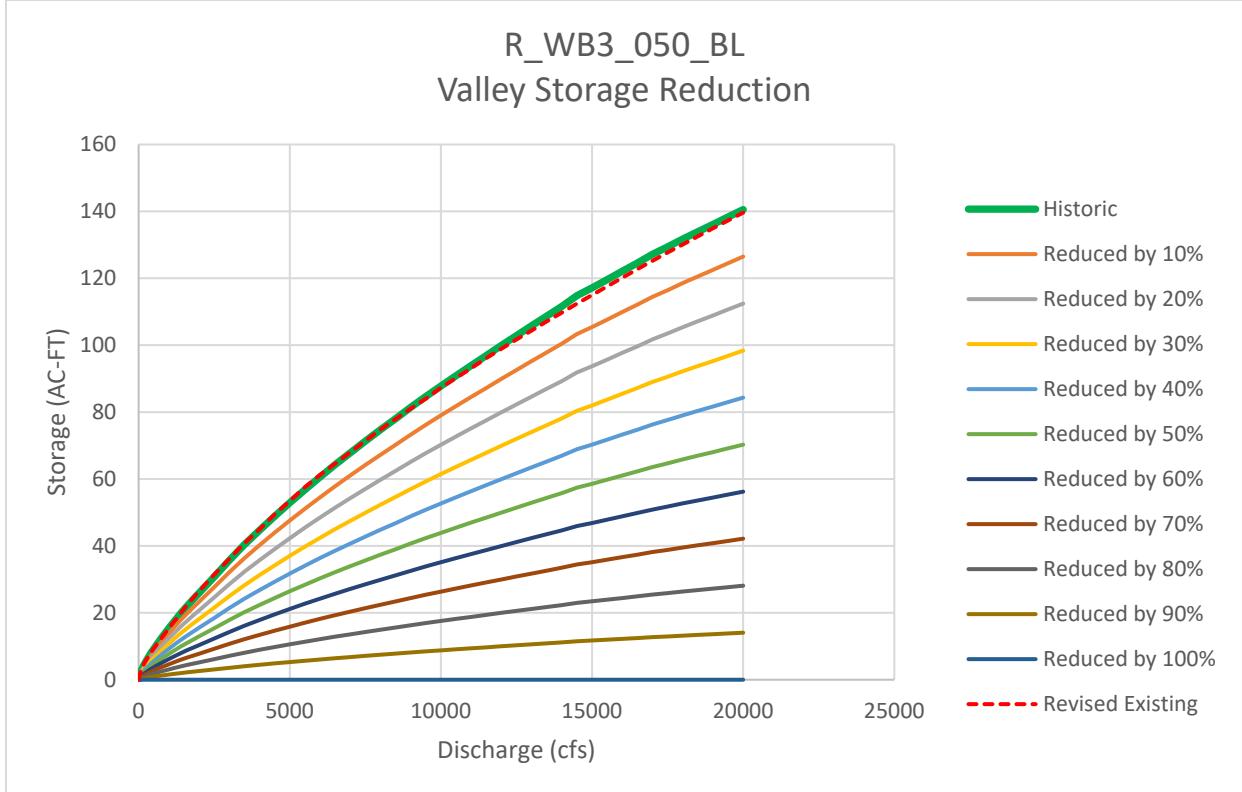
Modified Puls Routing Rating Tables



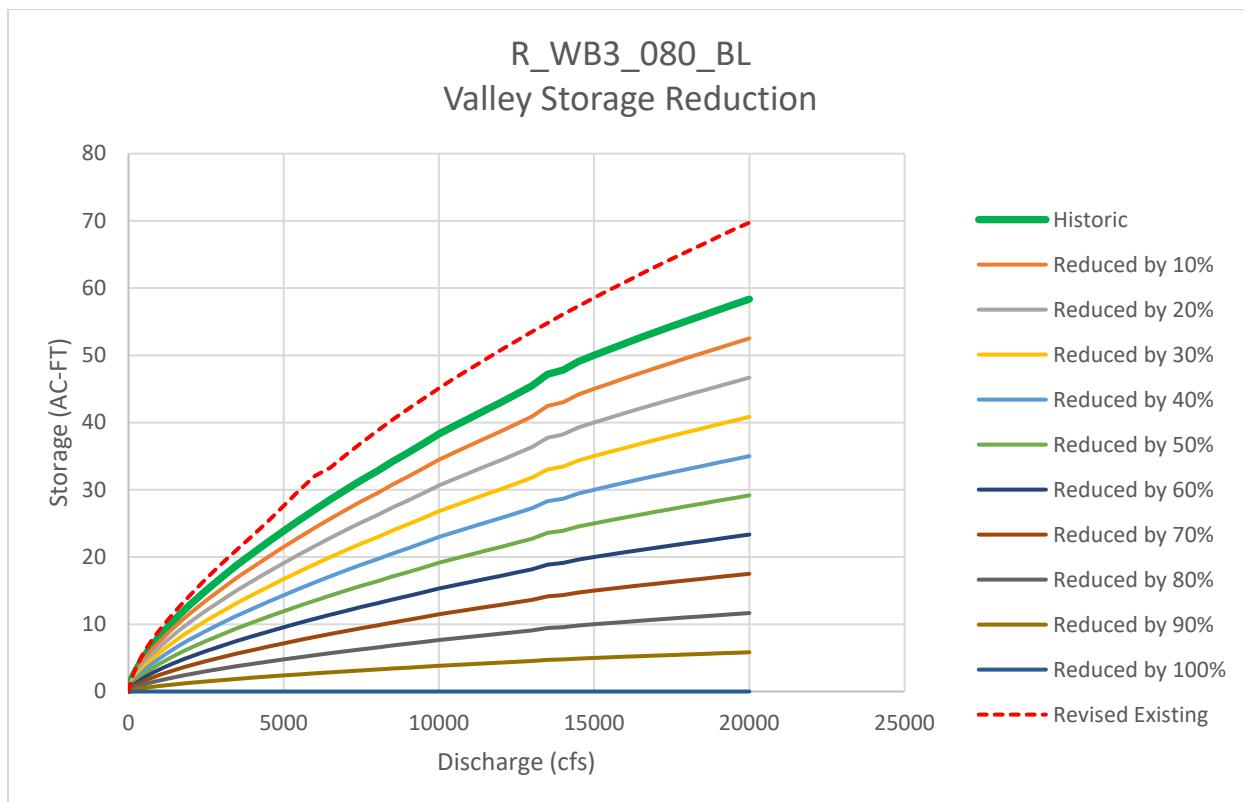
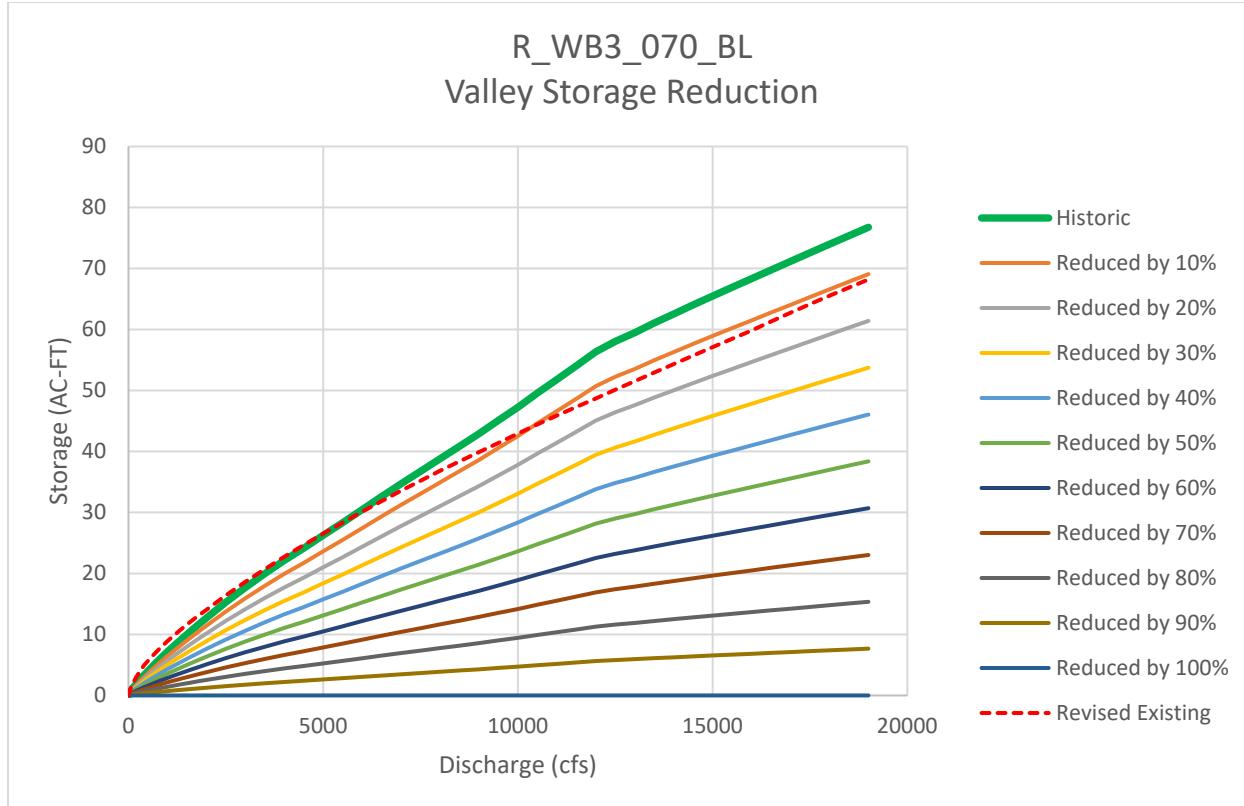
Modified Puls Routing Rating Tables



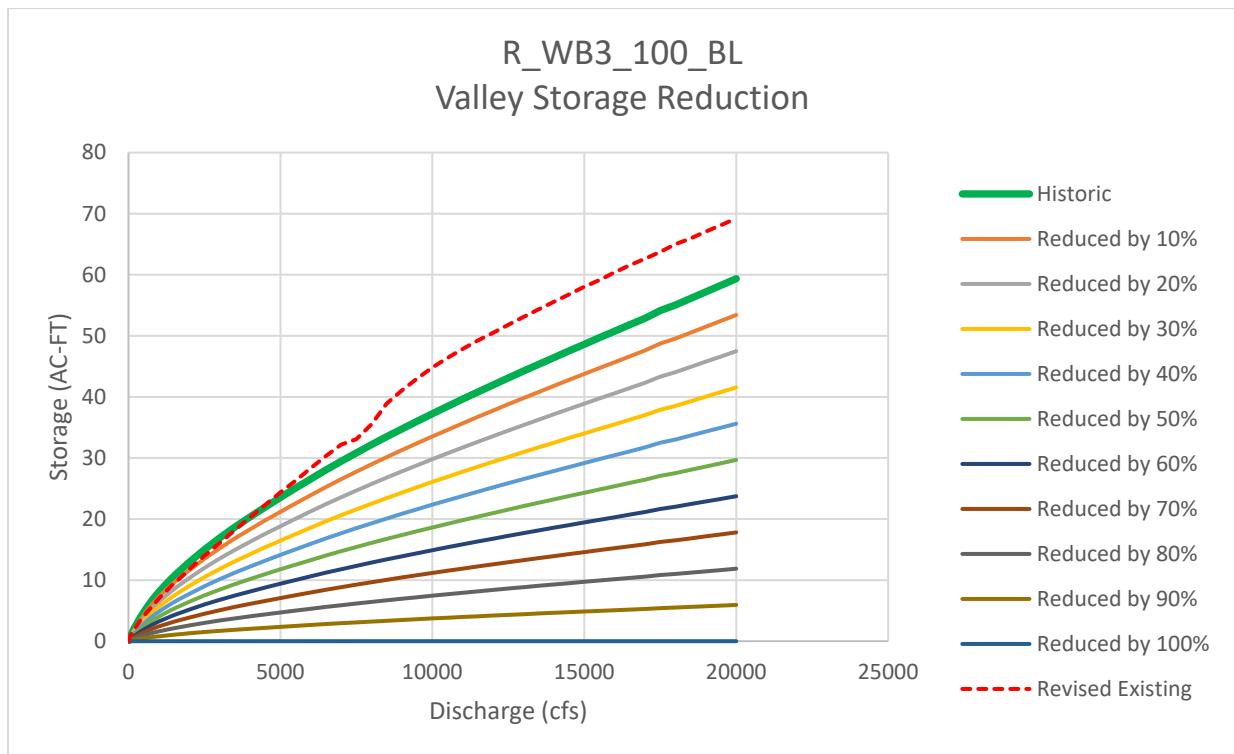
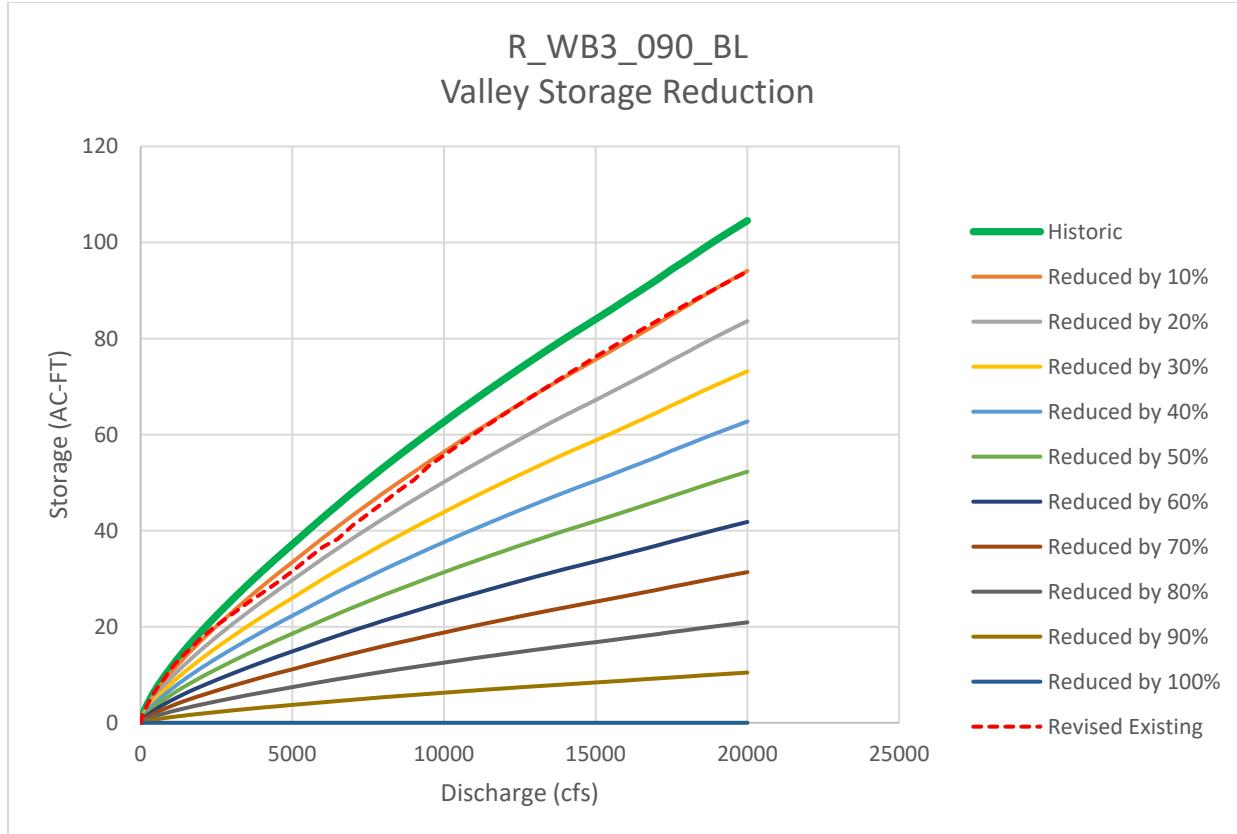
Modified Puls Routing Rating Tables



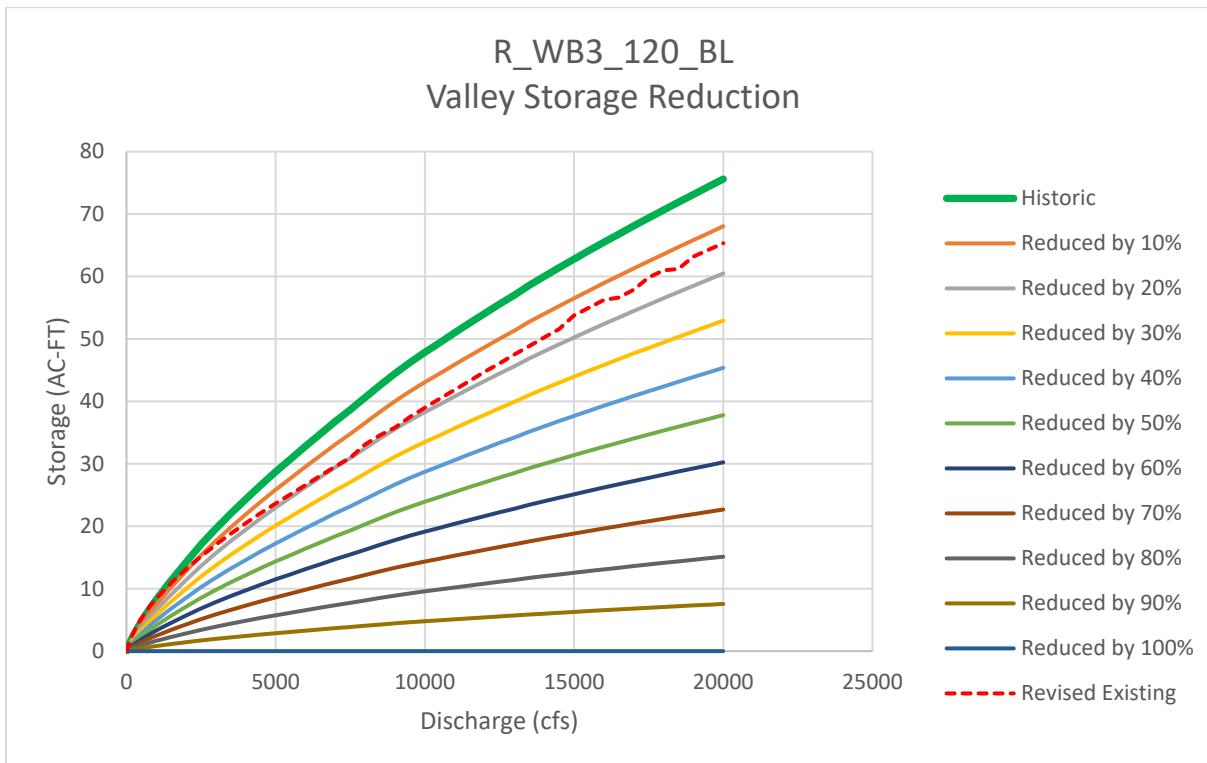
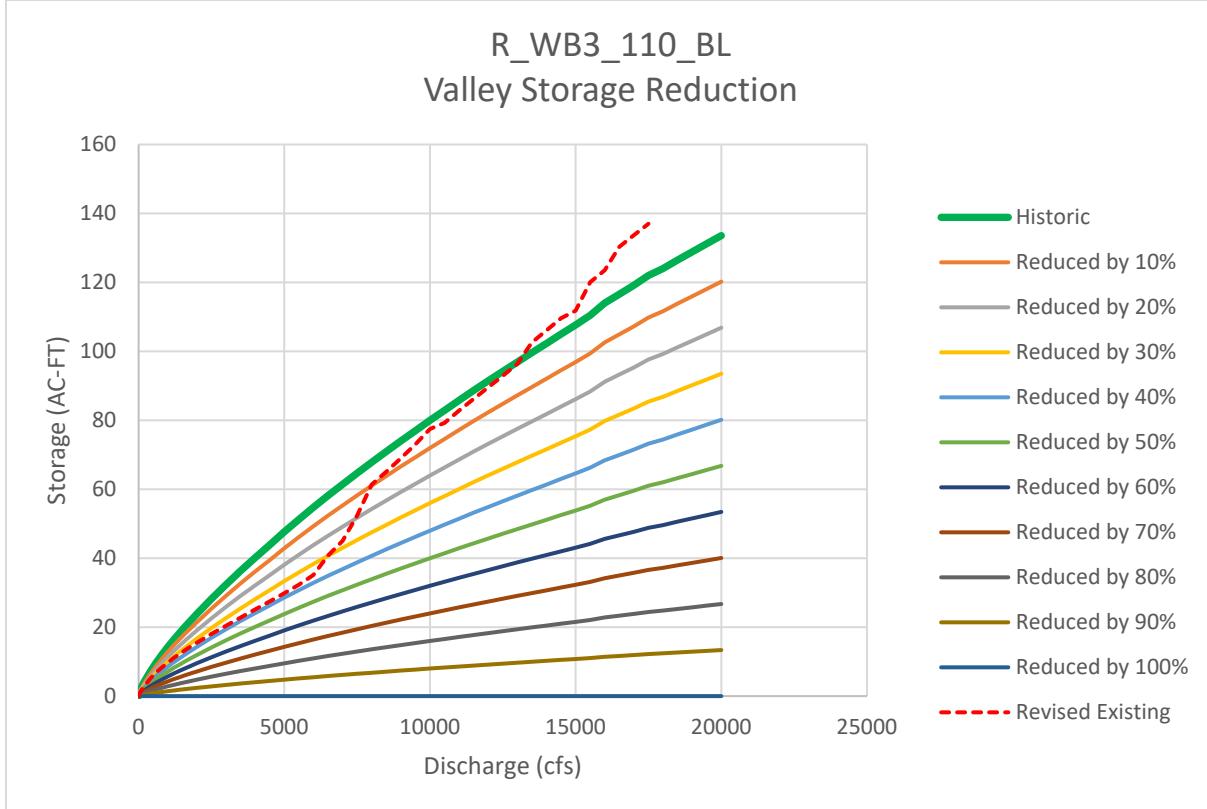
Modified Puls Routing Rating Tables



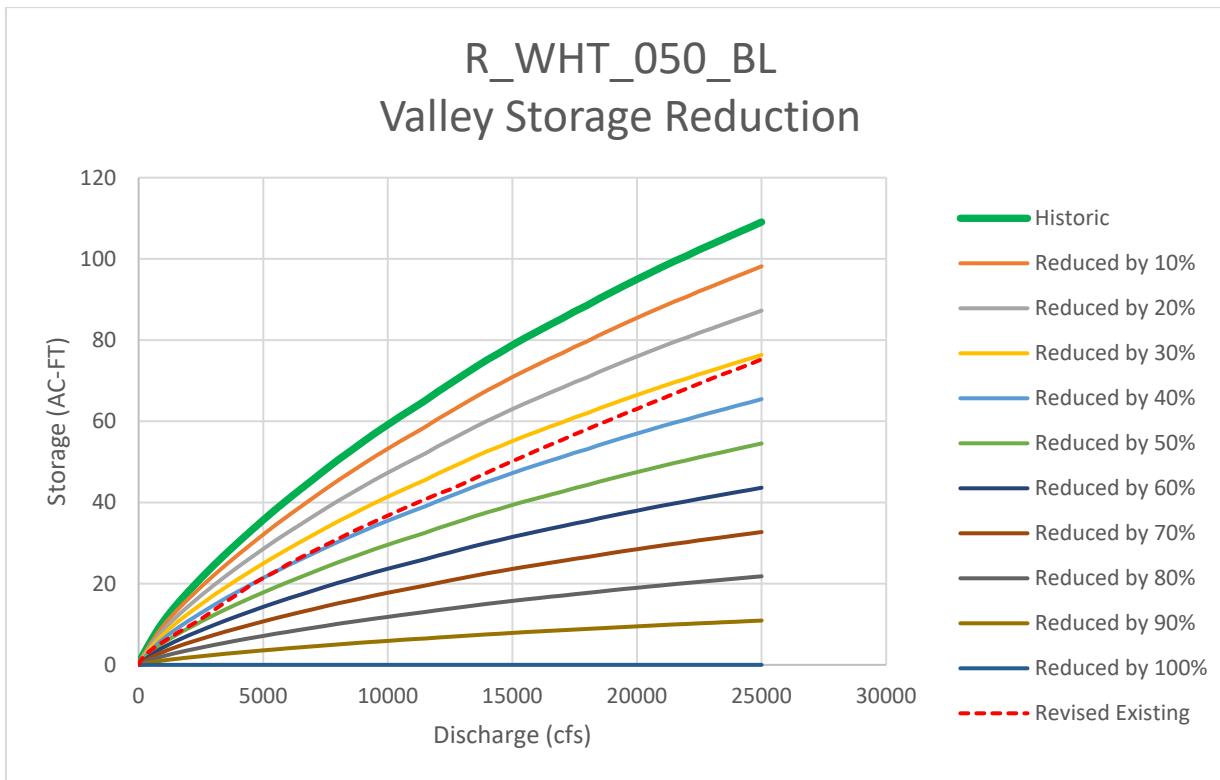
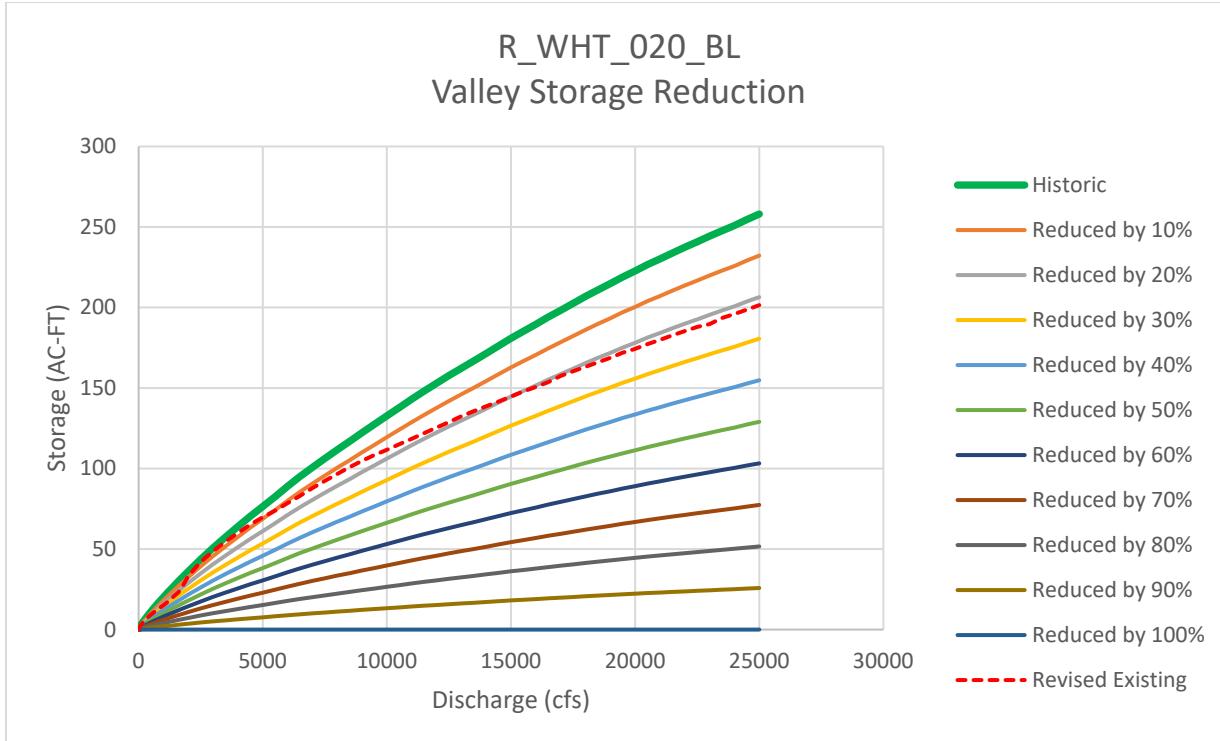
Modified Puls Routing Rating Tables



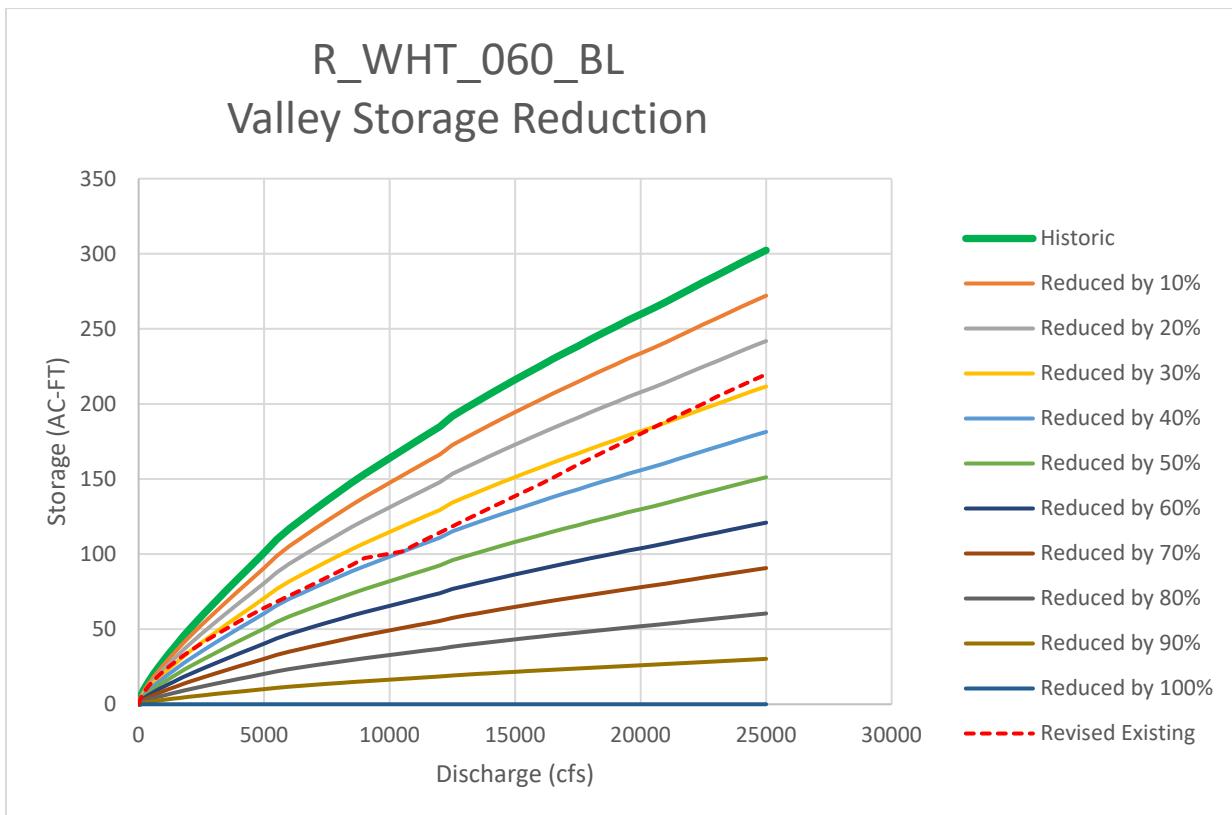
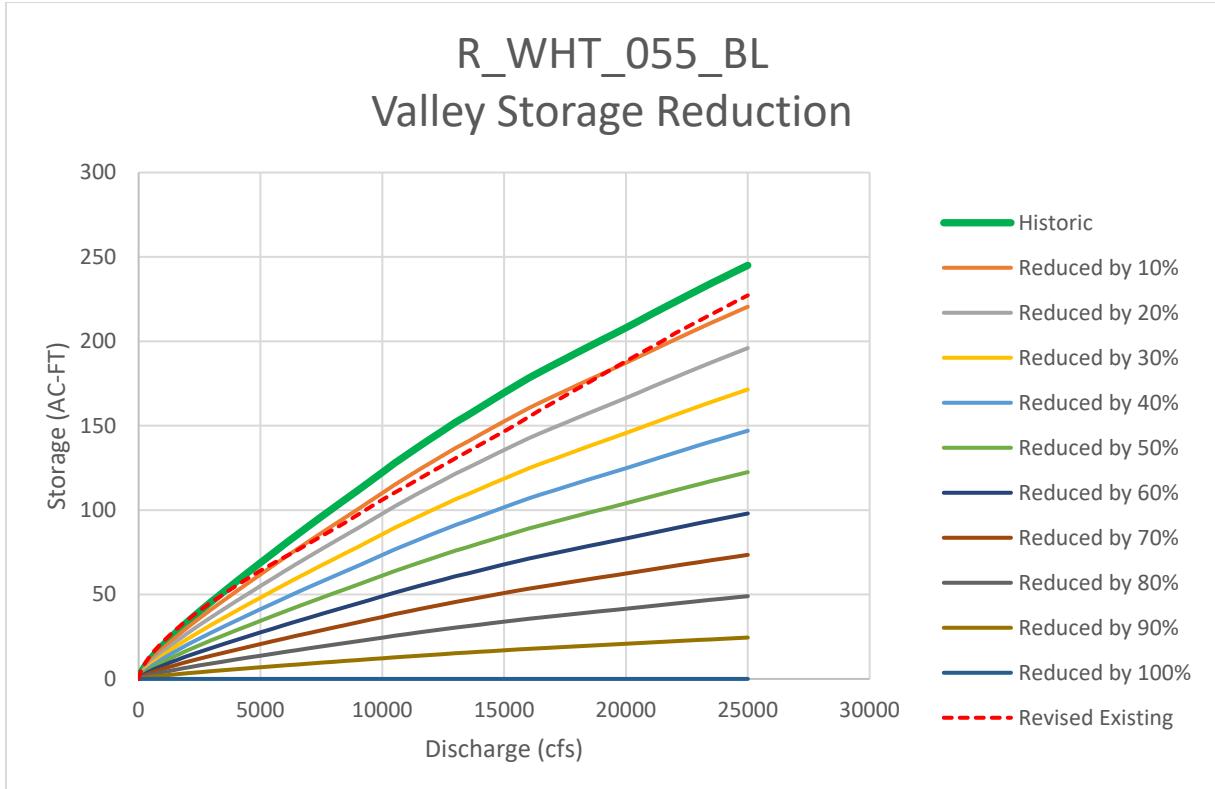
Modified Puls Routing Rating Tables



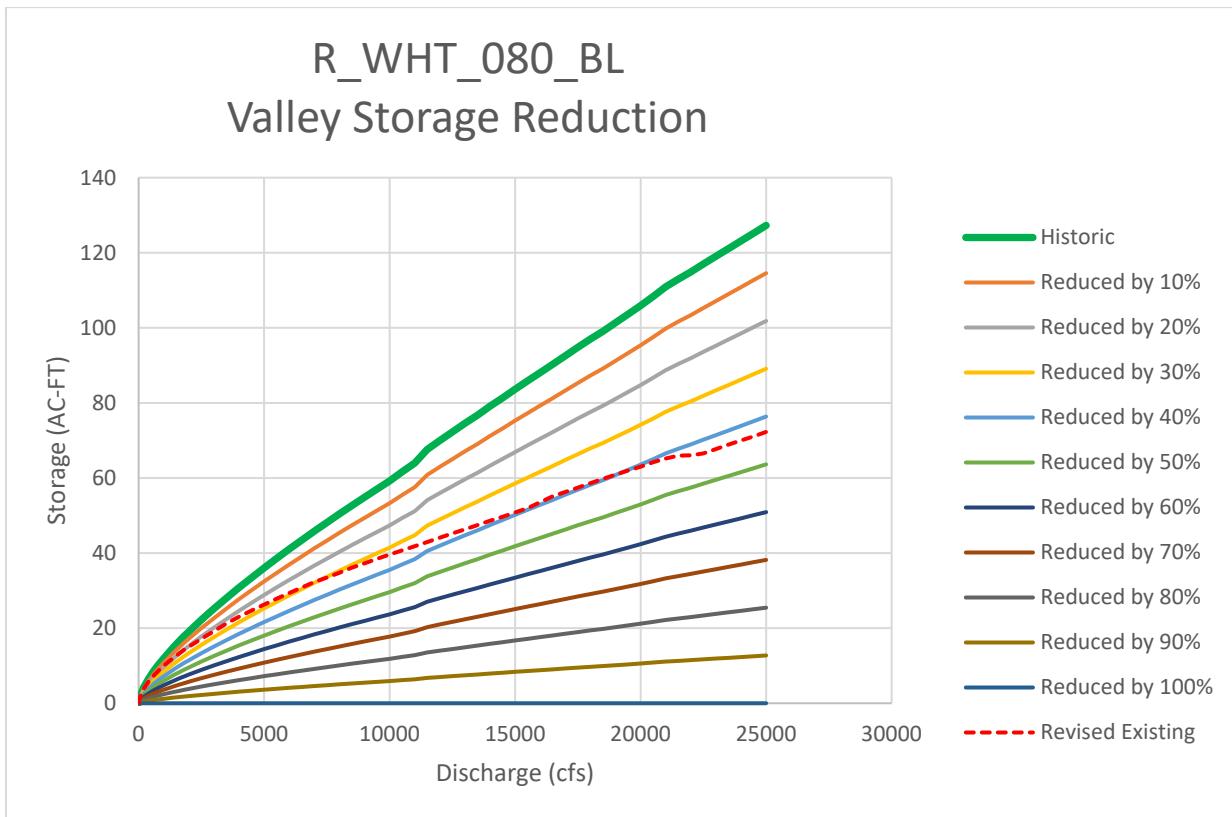
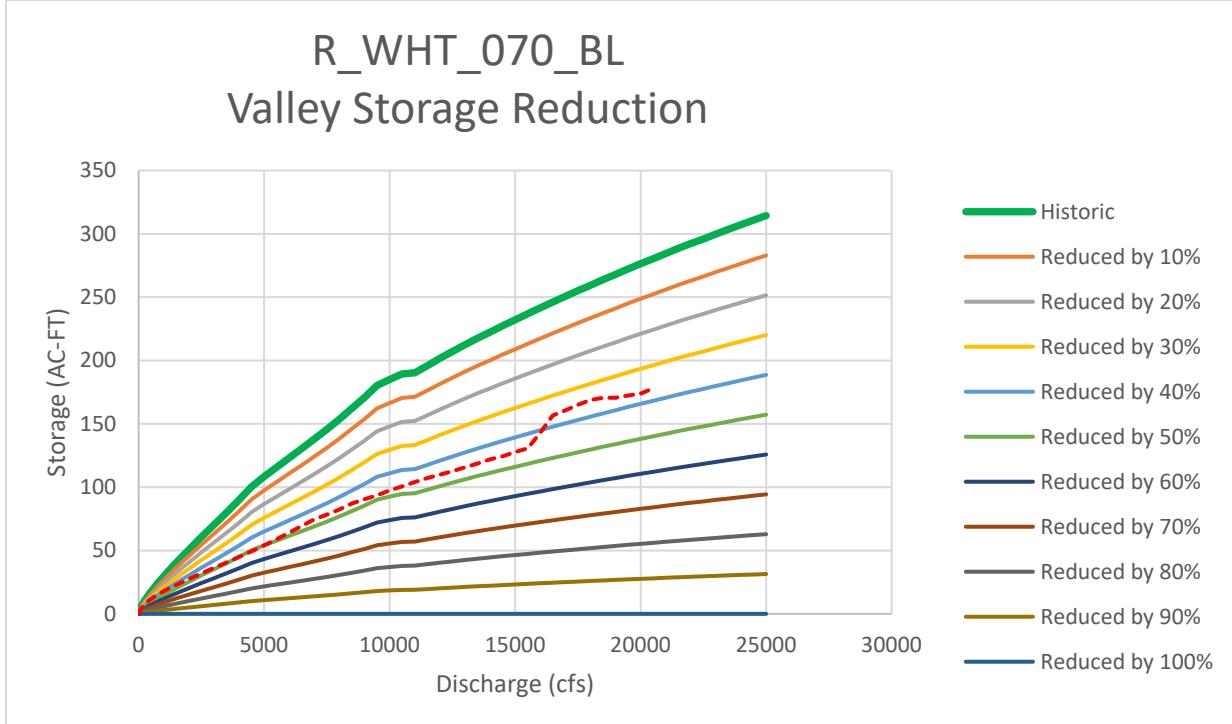
Modified Puls Routing Rating Tables



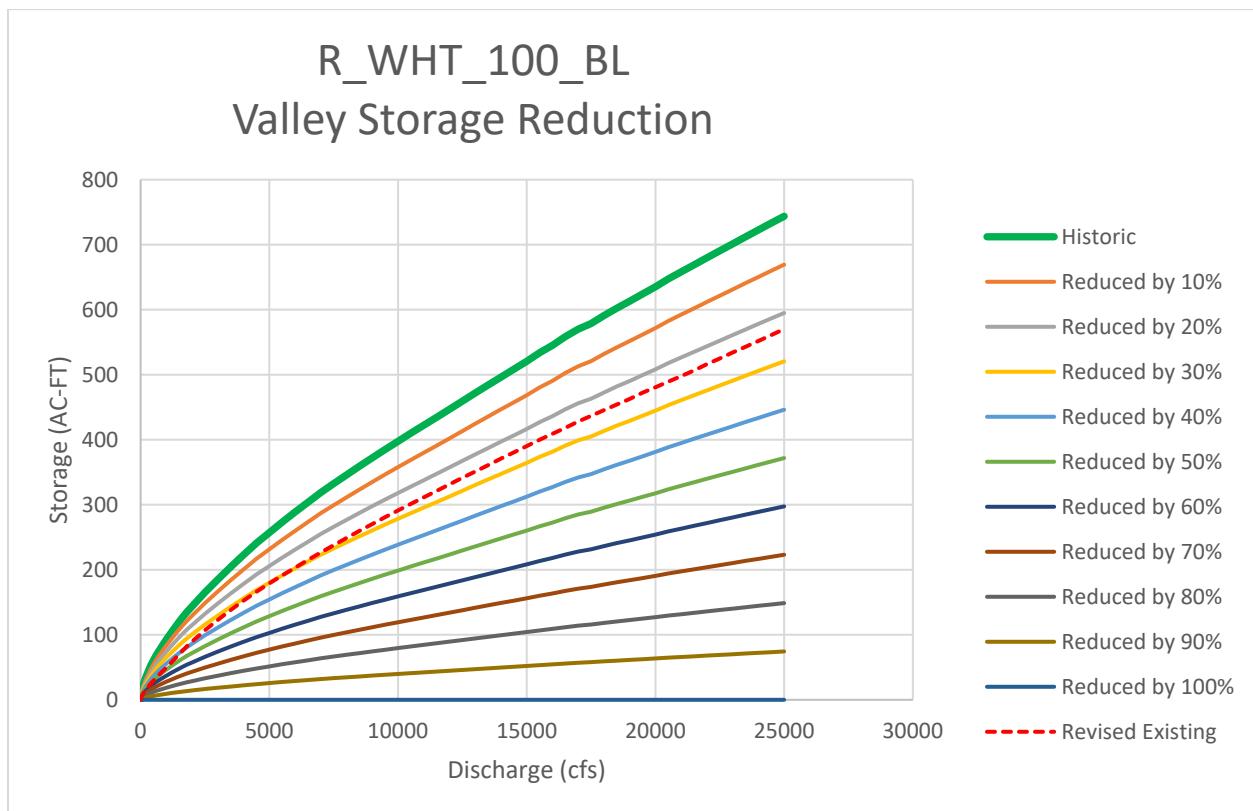
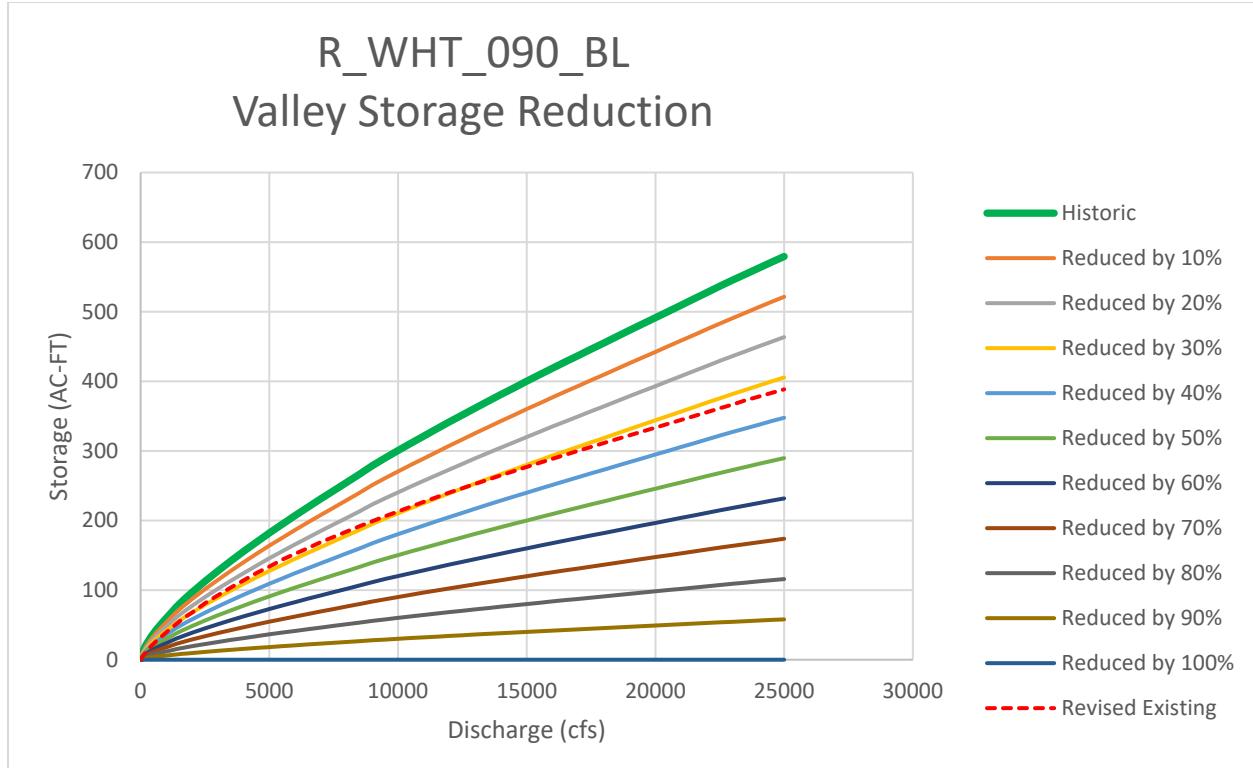
Modified Puls Routing Rating Tables



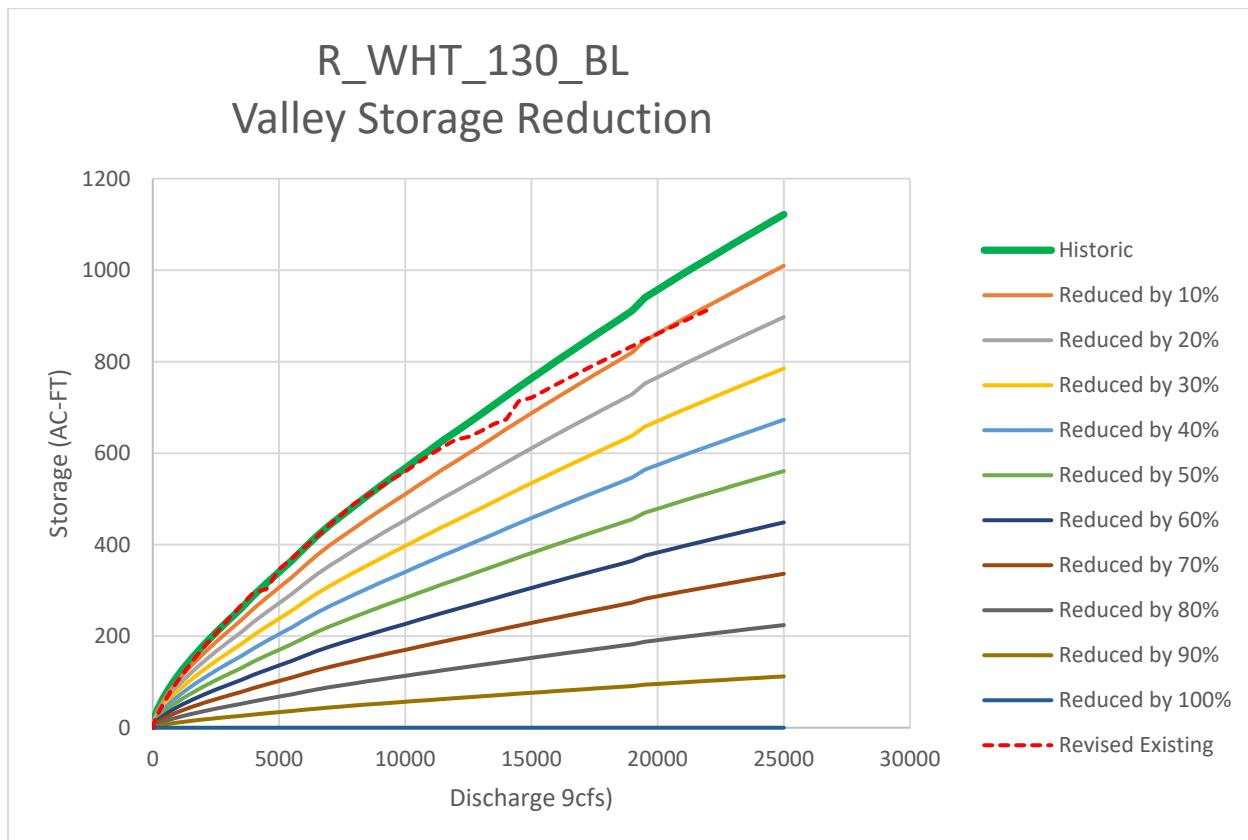
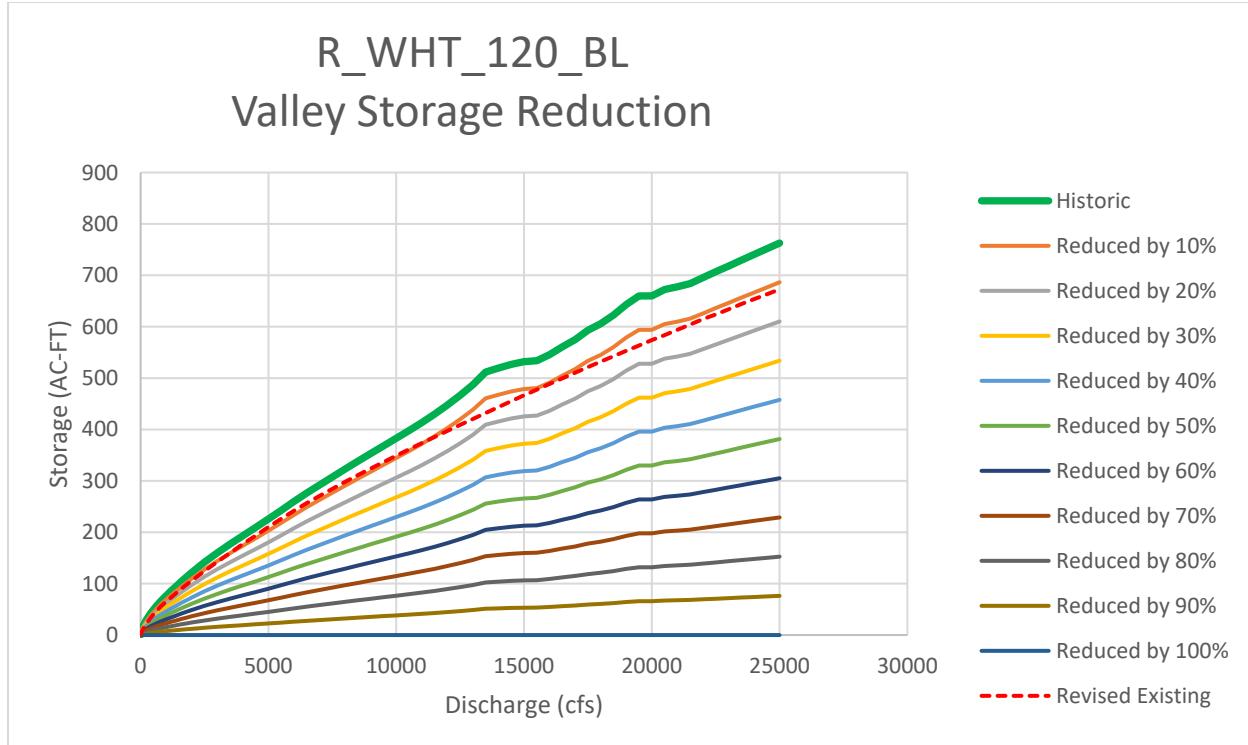
Modified Puls Routing Rating Tables



Modified Puls Routing Rating Tables



Modified Puls Routing Rating Tables



Appendix D

BASELINE HISTORIC HYDROLOGIC MODEL RESULTS



Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (40YR)	0.01 ACE (100YR)	0.02 ACE (500YR)
B_WB1_010	65.7	130.9	168.2	168.2	231.8	348.4
B_WB1_015	227.6	443	566.5	566.5	775.3	1179.2
B_WB1_020	92.9	188.2	243.4	243.4	338.7	479.5
B_WB1_030	49.2	95.7	122.7	122.7	168.8	239.1
B_WB1_040	100.4	194.3	247.8	247.8	338.1	534.7
B_WB1_050	87.5	171.8	219.9	219.9	301.1	463.4
B_WB1_060	47.5	91.8	116.8	116.8	159.1	253.1
B_WB1_070	71.3	139.7	178.8	178.8	245.1	371.4
B_WB1_080	172.8	357.7	465.7	465.7	653.5	913.1
B_WB1A_010	165.9	376.7	501.7	501.7	721.3	1138.8
B_WB1A_015	66.8	128.3	163.1	163.1	221.8	359
B_WB1A_020	47.4	91.7	117	117	159.7	245.2
B_WB1B_010	79.9	158.1	203.2	203.2	279.9	411.3
B_WB1B_020	278	539.9	689.7	689.7	943.1	1451.1
B_WB1B_030	182.4	361.5	464.2	464.2	638.9	1045
B_WB1B_040	147.6	285.8	364.7	364.7	497.9	773.4
B_WB1B_050	20.7	41	52.7	52.7	72.5	107.9
B_WB2_010	110.2	247.8	327.6	327.6	467.6	829.2
B_WB2_020	147.5	290.3	372.1	372.1	510.7	778.2
B_WB2_030	159.7	307.6	391.6	391.6	532.8	847.3
B_WB2_040	150.9	291.2	371.3	371.3	506.5	792.5
B_WB2_050	137.7	269.2	344.3	344.3	471.3	723.5
B_WB3_010	94.2	215.8	287.1	287.1	413.3	725.2
B_WB3_020	24.3	48	61.5	61.5	84.3	135.2
B_WB3_030	51.8	124.6	168.5	168.5	247.5	382.2
B_WB3_040	224.9	472.6	616.1	616.1	864.1	1416.6
B_WB3_050	189.2	372.8	477.5	477.5	654.8	1039.9
B_WB3_060	213.2	412.7	525.8	525.8	716.3	1140
B_WB3_070	46.1	88.9	113	113	153.8	248.5
B_WB3_080	74.3	144.6	184.9	184.9	252.9	387.3
B_WB3_090	119.9	226.2	285.7	285.7	386.5	653.3
B_WB3_100	85.5	168.2	215.6	215.6	295.9	446.4
B_WB3_110	66.1	130.2	166.6	166.6	228.1	373.5
B_WB3_120	51.1	106	137.5	137.5	191.5	311.8
B_WB3A_010	190.5	368.3	469.5	469.5	640.1	999
B_WB3A_020	56.9	110.1	140.4	140.4	191.4	306.2
B_WB3B_010	137.8	281.5	364.5	364.5	506.5	783.7
B_WB3B_020	89.8	176.4	225.9	225.9	309.5	478.6
B_WB3B_030	139.9	270.8	345.3	345.3	471	734.3
B_WB3C_010	48.2	97.9	126.5	126.5	175.7	255.1
B_WB3C_020	106.5	210.6	270.3	270.3	372.1	555.9
B_WB3D_010	55.8	110	141.1	141.1	193.9	289.1
B_WB3D_020	119.8	230.5	293.5	293.5	399.7	632.7
B_WB3D_030	144.9	312	410.3	410.3	581.7	903.2
B_WB3D_040	54.3	106.1	135.7	135.7	185.9	282.8

B_WB3D_050	59.4	112.1	141.6	141.6	191.2	321.1
B_WB3D_070	176.1	340.9	434.6	434.6	592.6	938.8
B_WHT_010	298.7	591.6	759.3	759.3	1043.5	1583.9
B_WHT_015	137.7	263.9	335.3	335.3	455.4	733.2
B_WHT_020	201.4	385.6	489.1	489.1	665.2	1129.8
B_WHT_040	160.7	310.5	395.7	395.7	540	844.7
B_WHT_045	26.4	52.6	67.7	67.7	93.5	137.6
B_WHT_050	70.8	133.5	168.8	168.8	228.6	373.4
B_WHT_055	102.5	205.9	265.5	265.5	367.6	534.2
B_WHT_060	252.3	505	650.5	650.5	898.4	1328.4
B_WHT_070	111.6	226.8	293.4	293.4	408	584.9
B_WHT_080	79	159.7	206.3	206.3	286.1	425.4
B_WHT_090	276.4	553.4	712.5	712.5	983.5	1526.3
B_WHT_100	484.1	976.6	1260.4	1260.4	1744.8	2645
B_WHT_110	306.9	627.8	813.6	813.6	1132.6	1676.9
B_WHT_120	587.3	1212.8	1576.2	1576.2	2202.6	3207.4
B_WHT_130	664.9	1451.9	1913.4	1913.4	2716.1	4344.9
J_WB1_010	65.7	130.9	168.2	199	231.8	348.4
J_WB1_015	292.4	572.5	732.7	864.4	1004.4	1522.9
J_WB1_020	349.8	701.3	904.6	1072.1	1251.5	1854.1
J_WB1_030	385.1	777.6	1003.7	1190.7	1392.3	2043.8
J_WB1_040	398.6	829	1079.6	1286.9	1512.9	2207.6
J_WB1_050	407.1	863.2	1131.9	1356	1605.1	2337.9
J_WB1_060	813.7	1862.7	2483.5	2999.4	3564	5287
J_WB1_070	71.3	139.7	178.8	211	245.1	371.4
J_WB1_080	1126.5	2609.7	3479.6	4213.7	5013.6	7419.9
J_WB1_WB1A	1007.9	2341.2	3124.4	3786.8	4499.4	6764
J_WB1_WB1B	776.4	1749.2	2330.2	2806.1	3332	4932.7
J_WB1A_010	165.9	376.7	501.7	608.5	721.3	1138.8
J_WB1A_015	203.5	460.8	614.7	743	881	1378.4
J_WB1A_020	223.4	513.7	683.9	830.3	985.4	1525.6
J_WB1B_010	79.9	158.1	203.2	240.2	279.9	411.3
J_WB1B_020	464	940.9	1214.3	1443.3	1683	2596.4
J_WB1B_040	554.5	1157.6	1490.5	1786	2092.7	3226
J_WB1B_050	544.1	1153	1495.8	1792.8	2103.6	3246.4
J_WB2_010	110.2	247.8	327.6	397	467.6	829.2
J_WB2_020	208.3	476.1	635	764	898.9	1451.9
J_WB2_030	249	591.1	793.5	964.6	1146.2	1767.5
J_WB2_040	286.9	687.9	933.5	1142	1366.6	2056.1
J_WB2_050	345.3	817.8	1108.2	1353.6	1624.4	2413.7
J_WB3_010	94.2	215.8	287.1	349.7	413.3	725.2
J_WB3_020	152.8	354	473.6	577.6	685.9	1137.5
J_WB3_030	51.8	124.6	168.5	206.8	247.5	382.2
J_WB3_040	374.6	820.4	1081.2	1305.6	1538.4	2533.9
J_WB3_050	458.2	1051.9	1396.3	1694.7	2012.7	3243.9
J_WB3_060	473.4	1121.8	1541.3	1892.3	2265.6	3547.1
J_WB3_070	795.6	1906.3	2600.2	3196.4	3835.4	5836.3

Appendix D

Baseline Historic HMS Results

J_WB3_080	924.5	2226.2	3022.9	3719.9	4463.3	6758.1
J_WB3_090	933.2	2257	3062.6	3769.2	4528.9	6826.7
J_WB3_100	1155.4	2806.2	3800.7	4664.2	5608.1	8419.5
J_WB3_110	1149.8	2800.6	3798.5	4658.2	5604.6	8406.4
J_WB3_120	1211.5	2976.9	4050.2	4971.7	5994.8	8942.7
J_WB3_WB3A	1208.4	2965.4	4029.2	4944.5	5960.8	8898
J_WB3_WB3B	1136.3	2738.1	3701.1	4545.3	5459.5	8202.6
J_WB3_WB3C	903.9	2158.4	2935.2	3607.7	4323.3	6557.5
J_WB3_WB3D	796.1	1892.3	2589.6	3177.5	3803.3	5813.9
J_WB3A_010	190.5	368.3	469.5	552.8	640.1	999
J_WB3A_020	213.1	427.2	550.9	654.4	761.9	1175.8
J_WB3B_010	137.8	281.5	364.5	433.5	506.5	783.7
J_WB3B_020	192.2	411.3	535.5	639	754.1	1156.6
J_WB3B_030	220.4	499	667.6	802.6	956.2	1402.2
J_WB3C_010	48.2	97.9	126.5	150.2	175.7	255.1
J_WB3C_020	131.5	278.9	362.1	433.5	507.8	745.6
J_WB3D_010	55.8	110	141.1	166.6	193.9	289.1
J_WB3D_020	124.5	257.1	335.1	402.4	472.5	723.8
J_WB3D_030	144.9	312	410.3	493.4	581.7	903.2
J_WB3D_040	160.6	366.7	485.2	586.9	694.9	1062.6
J_WB3D_070	398.5	876.9	1162.4	1401.2	1656.9	2506.3
J_WB3D_WB3D_040	287.4	652.1	867	1043.9	1237.6	1853.8
J_WHT_010	298.7	591.6	759.3	897.3	1043.5	1583.9
J_WHT_020	365.7	784.8	1029.6	1233.6	1449.1	2229.6
J_WHT_050	560	1183.2	1557.5	1873.1	2205.6	3398.4
J_WHT_055	613.3	1328.8	1747.6	2101.1	2483.6	3725.1
J_WHT_060	688.2	1562.4	2075.2	2519.1	3008.7	4477
J_WHT_070	1724.5	4029.5	5463.6	6652.7	7922.4	11940.9
J_WHT_080	1727	4053.2	5496.1	6708.1	7996.2	11991.7
J_WHT_090	1672	4146.5	5632.8	6893.9	8417.9	12320.8
J_WHT_100	2020.8	5179	7104.4	8759.6	10872.6	15976.7
J_WHT_110	306.9	627.8	813.6	967.9	1132.6	1676.9
J_WHT_120	1663.3	4722.1	6570.7	8235.2	10157.3	15078.3
J_WHT_130	1644.5	4694	6523.1	8251.3	10185.9	14948.2
J_WHT_WB1	1759.7	4082.7	5451.2	6616.3	7884.7	11697.5
J_WHT_WB2	1888.5	4479.1	6121.3	7506.4	8964.9	13527.1
J_WHT_WB3	2029.4	5087.2	6962.5	8572.9	10634.8	15643.2

Appendix E

SENSITIVITY ANALYSES HYDROLOGIC MODEL PARAMETERS



Subbasins	Historic Values		Ultimate Values		Change	
	CN	Impervious (%)	CN	Impervious (%)	CN	Impervious (%)
B_WB1_010	80	0	80	96	0	16
B_WB1_015	80	3.34	80	90	0	10
B_WB1_020	80	3.38	79.7	54	-0.3	-25.7
B_WB1_030	80	10.88	80	65	0	-15
B_WB1_040	80	0.9	80	49	0	-31
B_WB1_050	80	0.89	80	56	0	-24
B_WB1_060	80	1.39	80	16	0	-64
B_WB1_070	80	2.55	80	53	0	-27
B_WB1_080	80	1.35	80	57	0	-23
B_WB1A_010	74	0.48	73.7	56	-0.3	-17.7
B_WB1A_015	80	0.84	80	97	0	17
B_WB1A_020	80	3.76	80	63	0	-17
B_WB1B_010	80	3.48	79.8	48	-0.2	-31.8
B_WB1B_020	80	2.6	79.9	54	-0.1	-25.9
B_WB1B_030	78	2.56	78.2	60	0.2	-18.2
B_WB1B_040	80	2.45	80	48	0	-32
B_WB1B_050	80	2.26	80	51	0	-29
B_WB2_010	73	0.02	73.1	53	0.1	-20.1
B_WB2_020	80	0.96	80	62	0	-18
B_WB2_030	80	1.87	80	39	0	-41
B_WB2_040	80	2.36	80	58	0	-22
B_WB2_050	80	1.79	80	71	0	-9
B_WB3_010	72	1.29	71.5	52	-0.5	-19.5
B_WB3_020	79	1.06	78.9	65	-0.1	-13.9
B_WB3_030	72	1.91	73.3	65	1.3	-8.3
B_WB3_040	76	1.02	76	93	0	17
B_WB3_050	79	1.92	78.9	59	-0.1	-19.9
B_WB3_060	80	0.89	79.9	47	-0.1	-32.9
B_WB3_070	80	0.44	80	28	0	-52
B_WB3_080	80	2.74	80	71	0	-9
B_WB3_090	80	1.42	80	60	0	-20
B_WB3_100	80	2.14	80	53	0	-27
B_WB3_110	79	0.04	79.5	71	0.5	-8.5
B_WB3_120	77	0	77	34	0	-43
B_WB3A_010	80	2.62	80	58	0	-22
B_WB3A_020	80	0	80	51	0	-29
B_WB3B_010	78	1.61	77.7	53	-0.3	-24.7
B_WB3B_020	80	0.18	80	47	0	-33
B_WB3B_030	80	2.53	80	54	0	-26
B_WB3C_010	80	0.01	80	55	0	-25
B_WB3C_020	80	1.89	80	50	0	-30
B_WB3D_010	80	2.99	80	92	0	12
B_WB3D_020	80	2.08	80	48	0	-32
B_WB3D_030	75	4.34	75.7	81	0.7	5.3
B_WB3D_040	80	2.71	80	54	0	-26
B_WB3D_050	80	2.12	80	78	0	-2
B_WB3D_070	80	0.9	79.9	71	-0.1	-8.9
B_WHT_010	80	0.3	79.9	90	-0.1	10.1
B_WHT_015	80	1.89	80	89	0	9
B_WHT_020	79	2.63	78.6	57	-0.4	-21.6
B_WHT_040	80	2.27	80	93	0	13
B_WHT_045	80	1.89	80	96	0	16
B_WHT_050	80	3.92	79.9	50	-0.1	-29.9
B_WHT_055	80	1.94	80	60	0	-20
B_WHT_060	80	0.7	80	49	0	-31

Subbasins	Historic Values		Ultimate Values		Change	
	CN	Impervious (%)	CN	Impervious (%)	CN	Impervious (%)
B_WHT_070	80	1.15	80	74	0	-6
B_WHT_080	79	2.67	79.1	64	0.1	-15.1
B_WHT_090	79	0.54	78.7	42	-0.3	-36.7
B_WHT_100	79	1.36	79.2	47	0.2	-32.2
B_WHT_110	79	1.03	78.4	55	-0.6	-23.4
B_WHT_120	79	1.07	78.6	55	-0.4	-23.6
B_WHT_130	75	1.05	74.9	60	-0.1	-14.9

HMS ALPA ORDER	HMS Basin Name	Sub-basin	Area (mi ²)	CN Value	% Impervious	Initial Abstraction (in)	Lag (min)
1	B_WB1A_010	29	0.254	74	0.48	0.69	16.9
2	B_WB1A_015	56	0.057	80	0.84	0.50	11.6
3	B_WB1A_020	58	0.048	80	3.76	0.50	15.6
4	B_WB1B_010	38	0.102	80	3.48	0.51	24.1
5	B_WB1B_020	27	0.282	80	2.60	0.50	16.3
6	B_WB1B_030	28	0.169	78	2.56	0.58	10.6
7	B_WB1B_040	36	0.144	80	2.45	0.50	14.8
8	B_WB1B_050	57	0.025	80	2.26	0.50	19.6
9	B_WB1_010	54	0.077	80	0.00	0.50	19.2
10	B_WB1_015	30	0.242	80	3.34	0.50	16.6
11	B_WB1_020	31	0.159	80	3.38	0.51	34.6
12	B_WB1_030	39	0.074	80	10.88	0.50	32.9
13	B_WB1_040	37	0.093	80	0.90	0.50	12.9
14	B_WB1_050	41	0.091	80	0.89	0.50	15.4
15	B_WB1_060	40	0.043	80	1.39	0.50	12.4
16	B_WB1_070	35	0.078	80	2.55	0.50	17.8
17	B_WB1_080	33	0.367	80	1.35	0.50	49.5
18	B_WB2_010	47	0.123	73	0.02	0.75	8.9
19	B_WB2_020	49	0.160	80	0.96	0.50	16.6
20	B_WB2_030	48	0.144	80	1.87	0.50	12.8
21	B_WB2_040	46	0.143	80	2.36	0.50	14.1
22	B_WB2_050	3	0.143	80	1.79	0.50	15.3
23	B_WB3A_010	11	0.183	80	2.62	0.50	14.7
24	B_WB3A_020	61	0.051	80	0.00	0.51	11.4
25	B_WB3B_010	18	0.161	78	1.61	0.57	16.5
26	B_WB3B_020	19	0.092	80	0.18	0.50	15.1
27	B_WB3B_030	5	0.135	80	2.53	0.50	14.8
28	B_WB3C_010	21	0.070	80	0.01	0.50	24.3
29	B_WB3C_020	20	0.126	80	1.89	0.50	19.8
30	B_WB3D_010	17	0.066	80	2.99	0.50	19.9
31	B_WB3D_020	16	0.109	80	2.08	0.50	13.3
32	B_WB3D_030	14	0.203	75	4.34	0.67	18.8
33	B_WB3D_040	6	0.058	80	2.71	0.50	17.1
34	B_WB3D_050	62	0.045	80	2.12	0.50	8.6
35	B_WB3D_070	8	0.162	80	0.90	0.50	12.9
36	B_WB3_010	26	0.114	72	1.29	0.80	9.3
37	B_WB3_020	55	0.023	79	1.06	0.54	12.2
38	B_WB3_030	1	0.106	72	1.91	0.76	23.8
39	B_WB3_040	2	0.245	76	1.02	0.65	12.1
40	B_WB3_050	22	0.184	79	1.92	0.53	13.5
41	B_WB3_060	4	0.194	80	0.89	0.50	12.5
42	B_WB3_070	7	0.040	80	0.44	0.50	11.3
43	B_WB3_080	23	0.077	80	2.74	0.50	15.3
44	B_WB3_090	60	0.090	80	1.42	0.50	8.5
45	B_WB3_100	15	0.096	80	2.14	0.50	18.9
46	B_WB3_110	9	0.059	79	0.04	0.54	11.3
47	B_WB3_120	59	0.054	77	0.00	0.60	12.2
48	B_WHT_010	32	0.334	80	0.30	0.50	17.6
49	B_WHT_015	52	0.119	80	1.89	0.50	11.6
50	B_WHT_020	44	0.157	79	2.63	0.54	8.4
51	B_WHT_040	34	0.153	80	2.27	0.50	14.2
52	B_WHT_045	53	0.034	80	1.89	0.50	22.7
53	B_WHT_050	45	0.057	80	3.92	0.50	10.1
54	B_WHT_055	51	0.144	80	1.94	0.50	26.6
55	B_WHT_060	50	0.323	80	0.70	0.50	23.0
56	B_WHT_070	43	0.176	80	1.15	0.50	29.9
57	B_WHT_080	42	0.103	79	2.67	0.52	21.7
58	B_WHT_090	10	0.299	79	0.54	0.54	15.6
59	B_WHT_100	12	0.582	79	1.36	0.54	18.5
60	B_WHT_110	25	0.423	79	1.03	0.54	23.5
61	B_WHT_120	13	0.909	79	1.07	0.54	26.1
62	B_WHT_130	24	0.872	75	1.05	0.65	15.3

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
1	Sheet / Overland Flow	100	784.8	782.2	0.026	0.15	4.45	n/a	n/a	0.12	7.5	4.5	
	Shallow Conc Flow	1227	782.2	719.9	0.051	n/a	n/a	paved	4.58	0.07	4.5	2.7	
	Channel Flow	1226	719.9	706.4	0.011	0.04	n/a	n/a	8.49	0.04	2.4	1.4	8.6
2	Sheet / Overland Flow	100	785	770	0.150	0.4	4.45	n/a	n/a	0.14	8.1	4.9	
	Shallow Conc Flow	1675	770	710	0.036	n/a	n/a	paved	3.85	0.12	7.3	4.4	
	Channel Flow	1020	710	707	0.003	0.04	n/a	n/a	4.63	0.06	3.7	2.2	11.4
3	Sheet / Overland	100	703	697	0.060	0.15	4.45	n/a	n/a	0.09	5.4	3.2	
	Shallow Conc Flow	695	697	670	0.039	n/a	n/a	paved	4.01	0.05	2.9	1.7	
	Channel 1 Flow	606	670	660	0.017	0.04	n/a	n/a	3.87	0.04	2.6	1.6	
	Channel 2 Flow	2030	660	625	0.017	0.04	n/a	n/a	10.04	0.06	3.4	2.0	8.5
4	Sheet / Overland Flow	100	709	707.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	515	707.5	700	0.015	n/a	n/a	paved	2.45	0.06	3.5	2.1	
	Channel Flow	3789	700	653	0.012	0.04	n/a	n/a	9.63	0.11	6.6	3.9	12.2
5	Sheet / Overland Flow	100	715	707.8	0.072	0.17	4.45	n/a	n/a	0.09	5.5	3.3	
	Shallow Conc Flow	1403	707.8	670	0.027	n/a	n/a	paved	3.34	0.12	7.0	4.2	
	Channel 1 Flow	631	670	665	0.008	0.04	n/a	n/a	4.75	0.04	2.2	1.3	
	Lake	190	665	663	0.011	n/a	n/a	n/a	1.00	0.05	3.2	1.9	
	Channel 2 Flow	2750	663	641	0.008	0.04	n/a	n/a	5.64	0.14	8.1	4.9	15.6
6	Sheet / Overland Flow	100	703	703	0.006	0.17	4.45	n/a	n/a	0.25	14.9	8.9	
	Shallow Conc Flow	1611	703	690	0.008	n/a	n/a	paved	1.80	0.25	14.9	8.9	
	Channel Flow	1217	690	680	0.008	0.04	n/a	n/a	7.00	0.05	2.9	1.7	19.6
7	Sheet / Overland Flow	100	700.4	699.7	0.007	0.17	4.45	n/a	n/a	0.23	14.0	8.4	
	Shallow Conc Flow	1182	699.7	660.5	0.033	n/a	n/a	paved	3.70	0.09	5.3	3.2	
	Channel Flow	1020	660.5	659	0.001	0.04	n/a	n/a	2.63	0.11	6.5	3.9	11.6
8	Sheet / Overland Flow	100	717	715	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	913	715	690	0.027	n/a	4.45	paved	3.363826	0.08	4.5	2.7	
	Channel 1 Flow	1580	690	670	0.013	0.04	n/a	n/a	8.02	0.05	3.3	2.0	
	Channel 2 Flow	1560	670	659	0.007	0.04	n/a	n/a	7.70	0.06	3.4	2.0	12.2
9	Sheet / Overland Flow	100	691	690.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	1508	690.8	639	0.034	n/a	n/a	paved	3.77	0.11	6.7	4.0	
	Channel Flow	993	639	629	0.010	0.04	n/a	n/a	7.30	0.04	2.3	1.4	19.2
10	Sheet / Overland Flow	100	673	672.1	0.009	0.17	4.45	n/a	n/a	0.21	12.6	7.6	
	Shallow Conc Flow	1452	672.1	650	0.015	n/a	n/a	paved	2.51	0.16	9.6	5.8	
	Channel 1 Flow	1064	650	620	0.028	0.04	n/a	n/a	6.35	0.05	2.8	1.7	
	Channel 2 Flow	2205	620	612.5	0.003	0.04	n/a	n/a	2.88	0.21	12.7	7.6	22.7

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
11	Sheet / Overland Flow	100	711	706	0.050	0.17	4.45	n/a	n/a	0.11	6.4	3.8	
	Shallow Conc Flow	683	706	690	0.023	n/a	n/a	paved	3.11	0.06	3.7	2.2	
	Channel 1 Flow	988	690	665	0.025	0.04	n/a	n/a	8.60	0.03	1.9	1.1	
	Lake	209	665	660	0.024	n/a	n/a	n/a	1.00	0.06	3.5	2.1	
	Channel 2 Flow	1561	660	641	0.012	0.04	n/a	n/a	6.74	0.06	3.9	2.3	11.6
12	Sheet / Overland Flow	100	688	685	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1543	685	640.5	0.029	n/a	n/a	paved	3.45	0.12	7.4	4.5	
	Channel 1 Flow	755	640.5	620	0.027	0.04	n/a	n/a	6.80	0.03	1.8	1.1	
	Channel 2 Flow	1226	620	600	0.016	0.04	n/a	n/a	7.86	0.04	2.6	1.6	
	Channel 3 Flow	3705	600	592	0.002	0.04	n/a	n/a	2.51	0.41	24.6	14.7	26.6
13	Sheet / Overland Flow	100	683.7	683.4	0.003	0.17	4.45	n/a	n/a	0.33	19.6	11.8	
	Shallow Conc Flow	758	683.4	650	0.044	n/a	n/a	paved	4.27	0.05	3.0	1.8	
	Channel 1 Flow	5054	650	589.5	0.012	0.04	n/a	n/a	9.94	0.14	8.5	5.1	
	Channel 2 Flow	3570	589.5	574	0.004	0.04	n/a	n/a	8.15	0.12	7.3	4.4	23.0
14	Sheet / Overland Flow	100	752	745	0.070	0.17	4.45	n/a	n/a	0.09	5.6	3.3	
	Shallow Conc Flow	1220	745	730	0.012	n/a	n/a	paved	2.25	0.15	9.0	5.4	
	Channel Flow	3523	730	690	0.011	0.04	n/a	n/a	4.48	0.22	13.1	7.9	16.6
15	Sheet / Overland Flow	100	714	712	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	587	712	670	0.072	n/a	n/a	paved	5.44	0.03	1.8	1.1	
	Channel 1 Flow	685	670	660	0.015	0.04	n/a	n/a	2.34	0.08	4.9	2.9	
	Channel 2 Flow	1215	660	638	0.018	0.04	n/a	n/a	3.66	0.09	5.5	3.3	12.8
16	Sheet / Overland Flow	50	701	700.4	0.012	0.17	4.45	n/a	n/a	0.11	6.5	3.9	
	Shallow Conc Flow	40	700.4	700	0.010	n/a	n/a	paved	2.03	0.01	0.3	0.2	
	Channel Flow	2594	700	677	0.009	0.04	n/a	n/a	5.42	0.13	8.0	4.8	8.9
17	Sheet / Overland Flow	100	714.5	713.5	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	317	713.5	710	0.011	n/a	n/a	paved	2.14	0.04	2.5	1.5	
	Channel Flow	1692	710	703	0.004	0.04	n/a	n/a	3.14	0.15	9.0	5.4	14.1
18	Sheet / Overland Flow	100	821	805	0.160	0.17	4.45	n/a	n/a	0.07	4.0	2.4	
	Shallow Conc Flow	1516	805	710	0.063	n/a	n/a	paved	5.09	0.08	5.0	3.0	
	Channel Flow	1106	710	692	0.016	0.04	n/a	n/a	5.88	0.05	3.1	1.9	
	Lake	283	692	691	0.004	0.04	n/a	n/a	1.00	0.08	4.7	2.8	10.1
19	Sheet / Overland Flow	100	724	721	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1005	721	680	0.041	n/a	n/a	paved	4.11	0.07	4.1	2.4	
	Channel Flow	593	680	669	0.019	0.04	n/a	n/a	4.79	0.03	2.1	1.2	8.4
20	Sheet / Overland Flow	100	742	741.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
	Shallow Conc Flow	2702	741.8	700	0.015	n/a	n/a	paved	2.53	0.30	17.8	10.7	
	Channel Flow	2217	700	669	0.014	0.04	n/a	n/a	4.11	0.15	9.0	5.4	29.9
21	Sheet / Overland Flow	100	743	742.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	1709	742.8	700	0.025	n/a	n/a	paved	3.22	0.15	8.9	5.3	
	Channel Flow	1747	700	677	0.013	0.04	n/a	n/a	6.78	0.07	4.3	2.6	21.7
22	Sheet / Overland Flow	100	742.5	741	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	1639	741	700	0.025	n/a	n/a	paved	3.22	0.14	8.5	5.1	
	Channel Flow	1980	700	688	0.006	0.04	n/a	n/a	4.79	0.11	6.9	4.1	15.4
23	Sheet / Overland Flow	100	712	710.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	919	710.5	682	0.031	n/a	n/a	paved	3.58	0.07	4.3	2.6	
	Channel 1 Flow	760	682	668	0.018	0.04	n/a	n/a	5.87	0.04	2.2	1.3	
	Lake	129	668	667	0.008	n/a	n/a	n/a	1.00	0.04	2.2	1.3	
	Channel 2 Flow	197	667	655	0.061	0.04	n/a	n/a	9.20	0.01	0.4	0.2	
	Channel 3 Flow	626	655	648	0.011	0.04	n/a	n/a	7.39	0.02	1.4	0.8	12.4
24	Sheet / Overland Flow	100	618	617.5	0.005	0.17	4.45	n/a	n/a	0.27	16.0	9.6	
	Shallow Conc Flow	1530	619	601	0.012	n/a	n/a	paved	2.21	0.19	11.6	6.9	
	Channel 1 Flow	3638	601	550	0.014	0.04	n/a	n/a	6.20	0.16	9.8	5.9	
	Channel 2 Flow	4873	550	537	0.003	0.04	n/a	n/a	4.64	0.29	17.5	10.5	32.9
25	Sheet / Overland Flow	100	701	699.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	363	699.5	690	0.026	n/a	n/a	paved	3.29	0.03	1.8	1.1	
	Channel 1 Flow	1563	690	650	0.026	0.04	n/a	n/a	3.32	0.13	7.8	4.7	
	Channel 2 Flow	4811	650	595	0.011	0.04	n/a	n/a	3.98	0.34	20.1	12.1	24.1
26	Sheet / Overland Flow	100	833	829.5	0.035	0.17	4.45	n/a	n/a	0.12	7.3	4.4	
	Shallow Conc Flow	1221	829.5	766	0.052	n/a	n/a	paved	4.64	0.07	4.4	2.6	
	Lake	262	766	761.8	0.016	n/a	n/a	n/a	1.00	0.07	4.4	2.6	
	Channel Flow	1561	761.8	723	0.025	0.04	n/a	n/a	4.85	0.09	5.4	3.2	12.9
27	Sheet / Overland Flow	100	772	771	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	676	771	750	0.031	n/a	n/a	paved	3.58	0.05	3.1	1.9	
	Channel Flow	4269	750	705	0.011	0.04	n/a	n/a	7.62	0.16	9.3	5.6	14.8
28	Sheet / Overland Flow	100	762	761	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	1013	761	740	0.021	n/a	n/a	paved	2.93	0.10	5.8	3.5	
	Channel 1 Flow	1097	740	732	0.007	0.04	n/a	n/a	2.74	0.11	6.7	4.0	
	Lake	172	732	730.2	0.010	n/a	n/a	n/a	1.00	0.05	2.9	1.7	
	Channel 2 Flow	1120	730.2	705	0.023	0.04	n/a	n/a	8.11	0.04	2.3	1.4	17.8
29	Sheet / Overland Flow	100	831.5	830.2	0.013	0.17	4.45	n/a	n/a	0.18	10.9	6.5	

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
	Shallow Conc Flow	698	830.2	780	0.072	n/a	n/a	paved	5.45	0.04	2.1	1.3	
	Channel 1 Flow	1447	780	730	0.035	0.04	n/a	n/a	5.06	0.08	4.8	2.9	
	Channel 2 Flow	650	730	720	0.015	0.04	n/a	n/a	3.38	0.05	3.2	1.9	
	Channel 3 Flow	1040	720	699	0.020	0.04	n/a	n/a	6.41	0.05	2.7	1.6	14.2
30	Sheet / Overland Flow	100	802	801.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	802	801.8	790	0.015	n/a	n/a	paved	2.47	0.09	5.4	3.3	
	Channel 1 Flow	2310	790	762	0.012	0.04	4.45	n/a	5.96	0.72	43.5	26.1	
	Lake	347	762	761	0.003	n/a	n/a	n/a	1.00	0.10	5.8	3.5	
	Channel 2 Flow	543	761	739.5	0.040	0.04	n/a	n/a	6.78	0.02	1.3	0.8	
	Channel 3 Flow	756	739.5	736	0.005	0.04	n/a	n/a	3.68	0.06	3.4	2.1	49.5
31	Sheet / Overland Flow	100	793	792	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	1156	792	770	0.019	n/a	n/a	paved	2.80	0.11	6.9	4.1	
	Channel 1 Flow	1234	770	741	0.024	0.04	n/a	n/a	6.33	0.05	3.2	1.9	
	Lake	276	741	740	0.004	n/a	n/a	n/a	1.00	0.08	4.6	2.8	
	Channel 2 Flow	1292	740	712	0.022	0.04	n/a	n/a	8.71	0.04	2.5	1.5	17.6
32	Sheet / Overland Flow	100	802	801.8	0.002	0.17	4.45	n/a	n/a	0.38	23.1	13.8	
	Shallow Conc Flow	2036	801.8	790	0.006	n/a	n/a	paved	1.55	0.37	21.9	13.2	
	Channel Flow	4671	790	716	0.016	0.04	n/a	n/a	6.14	0.21	12.7	7.6	34.6
33	Sheet / Overland Flow	100	705.5	704.5	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	1470	704.5	680	0.017	n/a	n/a	paved	2.62	0.16	9.3	5.6	
	Channel Flow	5746	680	638	0.007	0.04	n/a	n/a	6.35	0.25	15.1	9.1	21.9
34	Sheet / Overland Flow	100	772	765	0.070	0.17	4.45	n/a	n/a	0.09	5.6	3.3	
	Shallow Conc Flow	1954	765	710	0.028	n/a	n/a	paved	3.41	0.16	9.5	5.7	
	Channel Flow	2134	710	696	0.007	0.04	n/a	n/a	2.74	0.22	13.0	7.8	16.9
35	Sheet / Overland Flow	100	728.5	725.5	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1293	725.5	690	0.027	n/a	n/a	paved	3.37	0.11	6.4	3.8	
	Channel Flow	749	690	684	0.008	0.04	n/a	n/a	3.61	0.06	3.5	2.1	10.6
36	Sheet / Overland Flow	100	757	755	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	177	755	750	0.028	n/a	4.45	paved	3.42	0.01	0.9	0.5	
	Channel 1 Flow	630	750	732	0.029	0.04	n/a	n/a	4.32	0.04	2.4	1.5	
	Lake	482	732	731	0.002	n/a	n/a	n/a	1.00	0.13	8.0	4.8	
	Channel 2 Flow	979	731	697	0.035	0.04	n/a	n/a	4.76	0.06	3.4	2.1	
	Channel 3 Flow	760	697	690.5	0.009	0.04	n/a	n/a	4.00	0.05	3.2	1.9	16.3
37	Sheet / Overland Flow	100	752.5	750.5	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	760	750.5	708	0.056	n/a	n/a	paved	4.81	0.04	2.6	1.6	

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
	Channel Flow	1380	708	698	0.007	0.04	n/a	n/a	6.32	0.06	3.6	2.2	9.3
38	Sheet / Overland Flow	100	774	773	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	575	773	770	0.005	n/a	4.45	paved	1.47	0.11	6.5	3.9	
	Channel 1 Flow	997	770	758.5	0.012	0.04	4.45	n/a	3.66	0.08	4.5	2.7	
	Lake	460	758.5	754	0.010	n/a	n/a	n/a	1.00	0.13	7.7	4.6	
	Channel 2 Flow	328	754	745.5	0.026	0.04	n/a	n/a	8.71	0.01	0.6	0.4	
	Lake	460	745.5	736	0.021	n/a	n/a	n/a	1.00	0.13	7.7	4.6	23.5
39	Sheet / Overland Flow	100	781	780.1	0.009	0.17	4.45	n/a	n/a	0.21	12.6	7.6	
	Shallow Conc Flow	767	780.1	740	0.052	n/a	4.45	paved	4.65	0.05	2.8	1.7	
	Channel 1 Flow	364	740	729.5	0.029	0.04	4.45	n/a	3.99	0.03	1.5	0.9	
	Lake	131	729.5	727	0.019	n/a	n/a	n/a	1.00	0.04	2.2	1.3	
	Channel 2 Flow	623	727	714	0.021	0.04	n/a	n/a	5.96	0.03	1.7	1.0	
	Lake	275	714	713.5	0.002	n/a	n/a	n/a	1.00	0.08	4.6	2.7	15.3
40	Sheet / Overland Flow	100	701	699.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	1506	699.5	682	0.012	n/a	n/a	paved	2.19	0.19	11.5	6.9	
	Channel Flow	958	682	676	0.006	0.04	n/a	n/a	4.24	0.06	3.8	2.3	15.3
41	Sheet / Overland Flow	100	762	761	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	572	761	730	0.054	n/a	n/a	paved	4.73	0.03	2.0	1.2	
	Channel Flow	2777	730	686	0.016	0.04	n/a	n/a	5.51	0.14	8.4	5.0	13.5
42	Sheet / Overland Flow	100	682	680.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	3312	680.5	645	0.011	n/a	n/a	paved	2.10	0.44	26.2	15.7	
	Channel Flow	1287	645	637	0.006	0.04	n/a	n/a	5.32	0.07	4.0	2.4	24.3
43	Sheet / Overland Flow	100	672	669	0.030	0.17	4.45	n/a	n/a	0.13	7.8	4.7	
	Shallow Conc Flow	1511	669	638	0.021	n/a	n/a	paved	2.91	0.14	8.6	5.2	
	Channel Flow	2072	638	636	0.001	0.04	n/a	n/a	2.10	0.27	16.5	9.9	19.8
44	Sheet / Overland Flow	100	771	769	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	1473	769	719	0.034	n/a	n/a	paved	3.75	0.11	6.6	3.9	
	Channel Flow	2952	719	686	0.011	0.04	n/a	n/a	5.26	0.16	9.3	5.6	15.1
45	Sheet / Overland Flow	100	702	701	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	961	701	680	0.022	n/a	n/a	paved	3.01	0.09	5.3	3.2	
	Channel Flow	988	680	676	0.004	0.04	n/a	n/a	1.63	0.17	10.1	6.1	16.5
46	Sheet / Overland Flow	100	682	680.5	0.015	0.17	4.45	n/a	n/a	0.17	10.3	6.2	
	Shallow Conc Flow	845	680.5	676	0.005	n/a	n/a	paved	1.48	0.16	9.5	5.7	
	Channel 1 Flow	451	676	674	0.004	0.04	n/a	n/a	2.48	0.05	3.0	1.8	
	Lake	324	674	661	0.040	n/a	n/a	n/a	1.00	0.09	5.4	3.2	

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
	Channel 2 Flow	663	661	650	0.017	0.04	n/a	n/a	3.51	0.05	3.1	1.9	
	Channel 3 Flow	433	650	646	0.009	0.04	n/a	n/a	4.15	0.03	1.7	1.0	19.9
47	Sheet / Overland Flow	100	833	829.5	0.035	0.4	4.45	n/a	n/a	0.24	14.6	8.7	
	Shallow Conc Flow	195	829.5	810	0.100	n/a	n/a	paved	6.43	0.01	0.5	0.3	
	Channel 1 Flow	1350	810	740	0.052	0.08	n/a	n/a	7.60	0.05	3.0	1.8	
	Channel 2 Flow	1205	740	708	0.027	0.04	n/a	n/a	4.79	0.07	4.2	2.5	13.3
48	Sheet / Overland Flow	100	730.25	730	0.003	0.17	4.45	n/a	n/a	0.35	21.1	12.7	
	Shallow Conc Flow	757	730	700	0.040	n/a	n/a	paved	4.05	0.05	3.1	1.9	
	Channel Flow	1688	700	671	0.017	0.04	n/a	n/a	3.85	0.12	7.3	4.4	18.9
49	Sheet / Overland Flow	100	740.4	740.1	0.003	0.17	4.45	n/a	n/a	0.33	19.6	11.8	
	Shallow Conc Flow	738	740.1	706	0.046	n/a	n/a	paved	4.37	0.05	2.8	1.7	
	Lake	218	706	705.5	0.002	n/a	n/a	n/a	1.00	0.06	3.6	2.2	
	Channel Flow	2132	705.5	688	0.008	0.04	n/a	n/a	6.72	0.09	5.3	3.2	18.8
50	Sheet / Overland Flow	100	706	705	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	2742	705	670	0.013	n/a	n/a	paved	2.30	0.33	19.9	11.9	
	Channel Flow	3832	670	638	0.008	0.04	n/a	n/a	5.58	0.19	11.4	6.9	26.1
51	Sheet / Overland Flow	100	700.5	700.1	0.004	0.17	4.45	n/a	n/a	0.29	17.5	10.5	
	Shallow Conc Flow	1341	700.1	674	0.019	n/a	n/a	paved	2.84	0.13	7.9	4.7	
	Channel Flow	1762	674	660	0.008	0.04	n/a	n/a	5.45	0.09	5.4	3.2	18.5
52	Sheet / Overland Flow	100	790.5	787	0.035	0.17	4.45	n/a	n/a	0.12	7.3	4.4	
	Shallow Conc Flow	457	787	760	0.059	n/a	n/a	paved	4.94	0.03	1.5	0.9	
	Channel 1 Flow	2600	760	698	0.024	0.04	n/a	n/a	4.39	0.16	9.9	5.9	
	Lake	241	698	697.5	0.002	n/a	n/a	n/a	1.00	0.07	4.0	2.4	
	Channel 2 Flow	208	697.5	696.5	0.005	0.04	n/a	n/a	2.08	0.03	1.7	1.0	14.7
53	Sheet / Overland Flow	100	721	720.6	0.004	0.17	4.45	n/a	n/a	0.29	17.5	10.5	
	Shallow Conc Flow	703	720.6	710	0.015	n/a	n/a	paved	2.50	0.08	4.7	2.8	
	Channel Flow	740	710	686.5	0.032	0.04	n/a	n/a	3.30	0.06	3.7	2.2	15.6
54	Sheet / Overland Flow	100	795.5	793.5	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	381	793.5	780	0.035	n/a	n/a	n/a	3.04	0.03	2.1	1.3	
	Channel Flow	1363	780	736	0.032	0.04	n/a	n/a	3.00	0.13	7.6	4.5	11.3
55	Sheet / Overland Flow	100	732	731	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	495	731	720	0.022	n/a	n/a	paved	3.03	0.05	2.7	1.6	
	Channel Flow	708	720	710	0.014	0.04	n/a	n/a	1.76	0.11	6.7	4.0	12.9
56	Sheet / Overland Flow	100	741	740.2	0.008	0.17	4.45	n/a	n/a	0.22	13.2	7.9	
	Shallow Conc Flow	897	740.2	710.5	0.033	n/a	n/a	paved	3.70	0.07	4.0	2.4	

Sub-basin Delineation and Tc Analyses

SCS Transform Method

Lag Calculations

Sub-basin	Type	Length (ft)	Ele High (ft)	Ele Low (ft)	Slope	n-value	P2	Cover	Velocity	Tc (hr)	Tc (min)	Lag (min)	Total Lag (min)
	Channel Flow	681	710.5	690	0.030	0.04	n/a	n/a	7.64	0.02	1.5	0.9	11.3
57	Sheet / Overland Flow	100	731	730.2	0.008	0.24	4.45	n/a	n/a	0.29	17.5	10.5	
	Shallow Conc Flow	1271	730.2	690	0.032	n/a	n/a	paved	3.62	0.10	5.9	3.5	
	Channel Flow	517	690	685	0.010	0.035	n/a	n/a	1.66	0.09	5.2	3.1	17.1
58	Sheet / Overland Flow	100	701	699	0.020	0.17	4.45	n/a	n/a	0.15	9.2	5.5	
	Shallow Conc Flow	323	699	690	0.028	n/a	n/a	paved	3.39	0.03	1.6	1.0	
	Channel 1 Flow	1410	690	681	0.006	0.04	n/a	n/a	3.52	0.11	6.7	4.0	
	Lake	378	681	680.5	0.001	n/a	n/a	n/a	1.00	0.10	6.3	3.8	
	Channel 2 Flow	440	680.5	672.5	0.018	0.05	n/a	n/a	8.44	0.01	0.9	0.5	14.8
59	Sheet / Overland Flow	100	642	641	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	674	641	629	0.018	n/a	n/a	paved	2.71	0.07	4.1	2.5	
	Channel Flow	1659	629	616	0.008	0.04	n/a	n/a	6.07	0.08	4.6	2.7	12.5
60	Sheet / Overland Flow	100	678	675.5	0.025	0.17	4.45	n/a	n/a	0.14	8.4	5.0	
	Shallow Conc Flow	1623	675.5	648	0.017	n/a	n/a	paved	2.65	0.17	10.2	6.1	
	Channel Flow	1781	648	639	0.005	0.04	n/a	n/a	4.34	0.11	6.8	4.1	15.3
61	Sheet / Overland Flow	100	695	694	0.010	0.17	4.45	n/a	n/a	0.20	12.1	7.3	
	Shallow Conc Flow	516	694	680	0.027	n/a	n/a	paved	3.35	0.04	2.6	1.5	
	Channel Flow	1985	680	630	0.025	0.04	n/a	n/a	6.07	0.09	5.4	3.3	12.1
62	Sheet / Overland Flow	100	700.2	700	0.002	0.24	4.45	n/a	n/a	0.51	30.4	18.2	
	Shallow Conc Flow	1247	700	680	0.016	n/a	n/a	paved	2.57	0.13	8.1	4.8	
	Channel Flow	217	680	677	0.014	0.04	n/a	n/a	3.06	0.02	1.2	0.7	23.8

Appendix F

SENSITIVITY ANALYSES HYDROLOGIC MODEL RESULTS



Table 1. Land Use and Impervious Cover HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
B_WB3_010	186	303	372	429	489	800
B_WB3_030	116	190	233	267	306	434
B_WB2_010	214	345	421	485	550	912
B_WB1A_010	317	523	644	741	847	1252
B_WB3D_030	303	463	556	629	710	1017
B_WHT_130	1242	1996	2438	2793	3176	4763
B_WB3_040	500	725	857	960	1072	1611
B_WB3_120	72	125	156	181	207	326
B_WB1B_030	294	462	558	636	719	1118
B_WB3B_010	215	352	432	496	564	834
B_WB3_020	40	62	74	84	95	145
B_WB3_050	295	467	566	645	730	1107
B_WB3_110	113	171	205	231	260	403
B_WHT_020	306	477	574	654	736	1198
B_WHT_080	127	204	248	283	322	456
B_WHT_090	391	656	810	933	1066	1599
B_WHT_100	705	1176	1450	1668	1906	2783
B_WHT_110	475	782	961	1102	1258	1782
B_WHT_120	912	1514	1864	2142	2450	3409
B_WB1_010	124	183	217	243	273	383
B_WB1_015	403	598	713	800	898	1284
B_WB1_020	136	228	282	324	372	506
B_WB1_030	72	117	143	163	186	253
B_WB1_040	143	232	283	324	368	561
B_WB1_050	131	210	256	292	332	490
B_WB1_060	54	97	122	142	163	257
B_WB1_070	103	168	206	235	268	391
B_WB1_080	264	444	549	632	725	969
B_WB1A_015	124	178	209	234	260	394
B_WB1A_020	72	114	138	156	177	260
B_WB1B_010	112	187	230	265	303	430
B_WB1B_020	405	652	795	909	1032	1528
B_WB1B_040	207	338	414	474	539	810
B_WB1B_050	30	49	60	69	79	113
B_WB2_020	229	362	440	501	568	827
B_WB2_030	212	353	434	499	568	879
B_WB2_040	225	357	432	493	558	838
B_WB2_050	223	345	415	470	531	775
B_WB3_060	301	489	597	683	775	1194
B_WB3_070	57	99	122	141	162	256
B_WB3_080	119	185	222	252	284	415
B_WB3_090	181	279	335	380	427	692
B_WB3_100	125	203	248	285	324	470
B_WB3A_010	284	450	546	622	704	1055
B_WB3A_020	83	133	162	185	209	322

Table 1. Land Use and Impervious Cover HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
B_WB3B_020	128	210	257	295	336	502
B_WB3B_030	204	326	397	454	515	773
B_WB3C_010	73	120	148	170	194	270
B_WB3C_020	153	252	310	355	405	584
B_WB3D_010	101	150	179	201	226	316
B_WB3D_020	168	273	333	381	433	662
B_WB3D_040	79	128	156	179	203	298
B_WB3D_050	99	146	173	194	217	346
B_WB3D_070	287	437	525	593	668	1006
B_WHT_010	544	809	964	1084	1216	1730
B_WHT_015	244	356	421	472	527	798
B_WHT_040	290	424	502	563	629	922
B_WHT_045	49	73	87	98	110	151
B_WHT_050	99	158	192	219	248	391
B_WHT_055	157	256	313	358	408	567
B_WHT_060	364	606	746	857	979	1395
B_WHT_070	187	296	360	409	465	631
J_WB1_010	124	183	217	243	273	383
J_WB1_015	526	780	928	1042	1169	1662
J_WB1_020	609	936	1126	1274	1439	2011
J_WB1_030	660	1027	1241	1408	1594	2212
J_WB1_040	688	1095	1334	1521	1731	2390
J_WB1_050	704	1140	1399	1607	1841	2531
J_WB1_060	1389	2414	3011	3490	4030	5678
J_WB1_070	103	168	206	235	268	391
J_WB1_080	1957	3403	4252	4933	5679	7997
J_WB1_WB1A	1773	3071	3834	4443	5120	7297
J_WB1_WB1B	1323	2279	2830	3275	3779	5306
J_WB1A_010	317	523	644	741	847	1252
J_WB1A_015	396	645	792	909	1037	1518
J_WB1A_020	432	713	878	1010	1153	1667
J_WB1B_010	112	187	230	265	303	430
J_WB1B_020	715	1165	1427	1637	1862	2752
J_WB1B_040	857	1418	1756	2020	2311	3420
J_WB1B_050	844	1418	1761	2031	2322	3443
J_WB2_010	214	345	421	485	550	912
J_WB2_020	382	639	785	904	1037	1575
J_WB2_030	442	775	970	1127	1304	1905
J_WB2_040	499	899	1139	1332	1550	2215
J_WB2_050	589	1063	1348	1579	1839	2597
J_WB3_010	186	303	372	429	489	800
J_WB3_020	313	510	626	721	823	1265
J_WB3_030	116	190	233	267	306	434
J_WB3_040	804	1225	1471	1668	1880	2851
J_WB3_050	965	1528	1862	2132	2426	3598

Table 1. Land Use and Impervious Cover HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
J_WB3_060	981	1651	2046	2359	2707	3933
J_WB3_070	1614	2742	3418	3951	4550	6439
J_WB3_080	1833	3141	3935	4555	5256	7417
J_WB3_090	1846	3172	3981	4615	5331	7494
J_WB3_100	2215	3857	4856	5646	6536	9185
J_WB3_110	2203	3846	4840	5636	6532	9175
J_WB3_120	2305	4070	5140	6000	6970	9753
J_WB3_WB3A	2304	4056	5117	5973	6935	9702
J_WB3_WB3B	2181	3773	4742	5508	6367	8955
J_WB3_WB3C	1791	3058	3821	4418	5090	7199
J_WB3_WB3D	1615	2738	3403	3927	4510	6417
J_WB3A_010	284	450	546	622	704	1055
J_WB3A_020	323	524	645	738	841	1243
J_WB3B_010	215	352	432	496	564	834
J_WB3B_020	299	510	629	730	835	1227
J_WB3B_030	352	627	784	917	1060	1484
J_WB3C_010	73	120	148	170	194	270
J_WB3C_020	201	340	422	487	557	786
J_WB3D_010	101	150	179	201	226	316
J_WB3D_020	195	327	403	463	530	770
J_WB3D_030	303	463	556	629	710	1017
J_WB3D_040	334	529	645	734	834	1184
J_WB3D_070	728	1197	1470	1684	1923	2728
J_WB3D_WB3D_040	552	904	1110	1271	1448	2029
J_WHT_010	544	809	964	1084	1216	1730
J_WHT_020	688	1084	1313	1493	1696	2430
J_WHT_050	1032	1635	1991	2268	2576	3702
J_WHT_055	1124	1806	2212	2531	2884	4054
J_WHT_060	1260	2098	2619	3021	3482	4860
J_WHT_070	3086	5398	6772	7844	8989	12857
J_WHT_080	3097	5424	6826	7914	9075	12957
J_WHT_090	3129	5541	7004	8296	9698	13450
J_WHT_100	3848	6930	8861	10656	12573	17443
J_WHT_110	475	782	961	1102	1258	1782
J_WHT_120	3483	6517	8401	10029	11833	16855
J_WHT_130	3445	6477	8409	10048	11870	16881
J_WHT_WB1	3130	5392	6738	7809	8957	12652
J_WHT_WB2	3395	6018	7623	8854	10136	14639
J_WHT_WB3	3834	6816	8699	10451	12299	17026

Table 2. Sub-basin Delineation and Tc HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
B_WB1_060	19	37	47	56	64	103
B_WB1B_050	11	21	27	32	37	56
B_WB3_090	45	87	111	131	152	236
B_WHT_080	42	87	112	134	157	227
B_WB3_070	29	57	72	85	98	157
B_WB3_040	102	222	293	353	417	630
B_WHT_050	31	62	79	93	109	161
B_WB3A_020	35	69	88	104	121	188
B_WB1_050	66	128	163	193	224	347
B_WB2_010	81	181	240	291	342	607
B_WHT_040	165	309	389	457	525	896
B_WB3_080	75	142	181	212	245	397
B_WB3C_020	80	159	205	242	282	416
B_WHT_020	150	291	371	438	507	825
B_WB1B_040	132	254	324	382	442	691
B_WB3D_040	47	91	117	138	160	242
B_WB1B_030	168	332	425	504	584	969
B_WHT_130	440	990	1317	1595	1892	2855
B_WHT_090	215	438	567	674	788	1182
B_WB1_070	70	136	174	205	238	363
B_WHT_060	222	447	577	684	799	1166
B_WB3_050	193	377	482	569	659	1068
B_WB3B_020	85	167	213	252	293	451
B_WB3_100	126	238	300	352	404	688
B_WB2_020	149	292	373	440	511	787
B_WHT_055	176	334	423	496	572	948
B_WHT_045	35	68	87	102	118	185
B_WB1_010	66	131	168	199	232	350
B_WB1_020	97	195	251	298	349	498
B_WB3D_070	213	404	510	600	689	1171
B_WHT_110	360	725	935	1109	1293	1976
B_WHT_120	668	1364	1766	2100	2456	3652
B_WHT_010	376	728	926	1091	1261	2029
B_WB1A_015	67	128	163	192	222	359
B_WB2_050	147	285	364	429	497	773
B_WB1B_010	81	161	207	244	285	419
B_WB1B_020	283	549	702	827	959	1478
B_WB1_015	243	470	600	706	819	1259
B_WB3B_010	177	352	453	537	623	1023
B_WB3A_010	196	379	483	568	658	1029
B_WB2_030	166	320	406	478	553	882
B_WB2_040	158	306	390	459	531	835
B_WB3_010	85	198	266	324	384	645
B_WB3_060	222	430	548	646	747	1182

Table 2. Sub-basin Delineation and Tc HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
B_WHT_100	586	1166	1498	1773	2063	3220
B_WB3D_020	102	200	257	304	353	531
B_WB1_080	187	386	503	600	705	986
B_WB1_030	55	107	137	162	188	268
B_WHT_070	156	311	400	474	552	818
B_WB1A_010	195	440	586	710	841	1341
B_WB3B_030	158	306	390	459	532	829
B_WB3D_010	67	131	167	197	229	345
B_WB3D_030	212	446	583	700	821	1337
B_WB3C_010	86	168	215	253	294	460
B_WB3D_050	52	101	129	153	177	272
B_WB3_120	73	150	194	231	269	446
B_WB3_020	39	75	95	112	130	219
B_WB3_030	133	306	408	498	590	996
B_WHT_015	191	374	479	565	656	1001
B_WB1_040	178	343	437	514	594	949
B_WB1A_020	85	164	209	246	285	442
B_WB3_110	90	183	237	281	328	500
J_WB3D_010	67	131	167	197	229	345
J_WB3C_010	86	599	215	253	294	460
J_WB1_010	66	733	168	199	232	350
J_WB1_070	70	818	174	205	238	363
J_WB1B_010	81	923	207	244	285	419
J_WB3_030	133	939	408	498	590	996
J_WB3_010	85	1879	266	324	384	645
J_WB2_010	81	136	240	291	342	607
J_WB3B_010	177	2730	453	537	623	1023
J_WB3D_020	132	2440	376	447	523	775
J_WB3A_010	196	1797	483	568	658	1029
J_WB3C_020	154	440	401	476	554	833
J_WB3D_030	212	533	583	700	821	1337
J_WB3A_020	205	635	529	627	730	1127
J_WB3_020	242	161	736	895	1060	1760
J_WB3B_020	231	908	623	744	867	1384
J_WB1A_010	195	1096	586	710	841	1341
J_WB3D_040	209	1072	618	745	881	1391
J_WB2_020	177	181	545	662	781	1248
J_WB1A_015	235	413	707	855	1012	1604
J_WB1_015	307	540	765	903	1048	1603
J_WHT_010	376	667	926	1091	1261	2029
J_WB1A_020	279	815	845	1023	1210	1874
J_WB3B_030	262	198	790	955	1129	1693
J_WHT_110	360	553	935	1109	1293	1976
J_WB2_030	231	306	727	881	1051	1601

Table 2. Sub-basin Delineation and Tc HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
J_WB1_020	367	728	945	1120	1306	1950
J_WB3D_WB3D_040	381	924	1099	1318	1552	2382
J_WB3_040	319	1035	971	1180	1399	2251
J_WB1_030	406	1932	1055	1251	1461	2160
J_WB1B_020	448	2224	1172	1394	1626	2506
J_WB2_040	285	2244	899	1095	1309	1950
J_WHT_020	553	2794	1479	1764	2065	3142
J_WB3D_070	423	2838	1251	1505	1780	2652
J_WB1_040	440	3027	1207	1441	1697	2482
J_WB3_050	389	3011	1237	1509	1801	2856
J_WB1B_040	523	2773	1412	1692	1980	3057
J_WB2_050	350	2191	1098	1337	1598	2382
J_WB1B_050	505	1930	1392	1669	1961	3019
J_WB1_050	442	379	1234	1481	1755	2559
J_WHT_050	620	410	1718	2060	2426	3624
J_WB3_060	420	352	1412	1754	2111	3268
J_WHT_055	624	481	1781	2146	2542	3747
J_WHT_060	699	596	2097	2561	3060	4504
J_WB1_WB1B	805	168	2393	2880	3427	5087
J_WB3_WB3D	798	312	2597	3204	3839	5849
J_WB3_070	796	131	2602	3208	3852	5851
J_WB1_060	833	287	2503	3020	3594	5343
J_WB3_WB3C	906	446	2942	3623	4349	6595
J_WB3_080	916	467	2990	3681	4421	6691
J_WB3_090	922	944	3019	3715	4467	6747
J_WB1_WB1A	1053	835	3252	3943	4695	7104
J_WB3_WB3B	1146	728	3726	4566	5492	8298
J_WB1_080	1182	1133	3640	4411	5249	7816
J_WB3_100	1147	1306	3765	4614	5552	8364
J_WB3_110	1156	1346	3837	4703	5663	8520
J_WB3_WB3A	1219	1574	4083	5006	6033	9037
J_WB3_120	1223	4170	4111	5046	6081	9095
J_WHT_WB1	1860	4187	5706	6929	8245	12286
J_WHT_070	1802	4230	5673	6900	8204	12366
J_WHT_080	1800	5253	5695	6937	8259	12427
J_WHT_WB2	1950	725	6278	7672	9137	13828
J_WHT_090	1713	4762	5739	7038	8598	12676
J_WHT_WB3	2076	4726	7059	8740	10821	15979
J_WHT_100	2062	4274	7195	8902	11029	16301
J_WHT_120	1679	4575	6621	8293	10221	15373
J_WHT_130	1657	5173	6561	8299	10237	15123

Table 3. Valley Storage Reduction HMS Results
0.5 ACE (2YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB1_010	66	66	66	66	66
B_WB1_015	228	228	228	228	228
B_WB1_020	93	93	93	93	93
B_WB1_030	49	49	49	49	49
B_WB1_040	100	100	100	100	100
B_WB1_050	88	88	88	88	88
B_WB1_060	48	48	48	48	48
B_WB1_070	71	71	71	71	71
B_WB1_080	173	173	173	173	173
B_WB1A_010	166	166	166	166	166
B_WB1A_015	67	67	67	67	67
B_WB1A_020	47	47	47	47	47
B_WB1B_010	80	80	80	80	80
B_WB1B_020	278	278	278	278	278
B_WB1B_030	182	182	182	182	182
B_WB1B_040	148	148	148	148	148
B_WB1B_050	21	21	21	21	21
B_WB2_010	110	110	110	110	110
B_WB2_020	148	148	148	148	148
B_WB2_030	160	160	160	160	160
B_WB2_040	151	151	151	151	151
B_WB2_050	138	138	138	138	138
B_WB3_010	94	94	94	94	94
B_WB3_020	24	24	24	24	24
B_WB3_030	52	52	52	52	52
B_WB3_040	225	225	225	225	225
B_WB3_050	189	189	189	189	189
B_WB3_060	213	213	213	213	213
B_WB3_070	46	46	46	46	46
B_WB3_080	74	74	74	74	74
B_WB3_090	120	120	120	120	120
B_WB3_100	86	86	86	86	86
B_WB3_110	66	66	66	66	66
B_WB3_120	51	51	51	51	51
B_WB3A_010	191	191	191	191	191
B_WB3A_020	57	57	57	57	57
B_WB3B_010	138	138	138	138	138
B_WB3B_020	90	90	90	90	90
B_WB3B_030	140	140	140	140	140
B_WB3C_010	48	48	48	48	48
B_WB3C_020	107	107	107	107	107
B_WB3D_010	56	56	56	56	56
B_WB3D_020	120	120	120	120	120
B_WB3D_030	145	145	145	145	145

Table 3. Valley Storage Reduction HMS Results
0.5 ACE (2YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB3D_040	54	54	54	54	54
B_WB3D_050	59	59	59	59	59
B_WB3D_070	176	176	176	176	176
B_WHT_010	299	299	299	299	299
B_WHT_015	138	138	138	138	138
B_WHT_020	201	201	201	201	201
B_WHT_040	161	161	161	161	161
B_WHT_045	26	26	26	26	26
B_WHT_050	71	71	71	71	71
B_WHT_055	103	103	103	103	103
B_WHT_060	252	252	252	252	252
B_WHT_070	112	112	112	112	112
B_WHT_080	79	79	79	79	79
B_WHT_090	276	276	276	276	276
B_WHT_100	484	484	484	484	484
B_WHT_110	307	307	307	307	307
B_WHT_120	587	587	587	587	587
B_WHT_130	665	665	665	665	665
J_WB3D_010	56	56	56	56	56
J_WB3C_010	48	48	48	48	48
J_WB1_010	66	66	66	66	66
J_WB1_070	71	71	71	71	71
J_WB1B_010	80	80	80	80	80
J_WB3_030	52	52	52	52	52
J_WB3_010	94	94	94	94	94
J_WB2_010	110	110	110	110	110
J_WB3B_010	138	138	138	138	138
J_WB3D_020	125	127	130	134	140
J_WB3A_010	191	191	191	191	191
J_WB3C_020	134	137	140	142	144
J_WB3D_030	145	145	145	145	145
J_WB3A_020	217	222	226	230	234
J_WB3_020	153	153	153	153	153
J_WB3B_020	198	203	208	213	217
J_WB1A_010	166	166	166	166	166
J_WB3D_040	166	171	176	181	186
J_WB2_020	218	227	234	241	245
J_WB1A_015	205	207	209	210	212
J_WB1_015	292	292	292	292	292
J_WHT_010	299	299	299	299	299
J_WB1A_020	229	235	241	247	252
J_WB3B_030	234	248	264	281	300
J_WHT_110	307	307	307	307	307
J_WB2_030	266	286	306	327	349

Table 3. Valley Storage Reduction HMS Results
0.5 ACE (2YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
J_WB1_020	351	353	354	355	355
J_WB3D_WB3D_040	296	308	321	334	348
J_WB3_040	375	375	375	375	375
J_WB1_030	388	391	393	395	395
J_WB1B_020	467	470	475	479	484
J_WB2_040	310	336	366	400	438
J_WHT_020	378	394	411	432	455
J_WB3D_070	413	428	445	463	483
J_WB1_040	407	415	423	431	438
J_WB3_050	474	491	506	520	533
J_WB1B_040	569	582	595	607	618
J_WB2_050	371	401	439	483	536
J_WB1B_050	562	580	597	613	628
J_WB1_050	420	435	450	466	482
J_WHT_050	578	597	620	646	675
J_WB3_060	504	537	571	607	644
J_WHT_055	641	670	699	731	762
J_WHT_060	739	795	854	916	976
J_WB1_WB1B	820	866	915	969	1023
J_WB3_WB3D	852	911	974	1040	1108
J_WB3_070	853	915	981	1052	1125
J_WB1_060	859	918	976	1037	1101
J_WB3_WB3C	970	1041	1115	1192	1269
J_WB3_080	994	1070	1151	1235	1322
J_WB3_090	1004	1083	1167	1257	1349
J_WB1_WB1A	1052	1129	1195	1265	1338
J_WB3_WB3B	1221	1317	1419	1528	1643
J_WB1_080	1186	1263	1330	1397	1463
J_WB3_100	1244	1346	1455	1573	1697
J_WB3_110	1239	1340	1452	1573	1703
J_WB3_WB3A	1306	1419	1544	1681	1833
J_WB3_120	1310	1423	1550	1691	1846
J_WHT_WB1	1864	1995	2120	2251	2383
J_WHT_070	1847	1988	2132	2283	2438
J_WHT_080	1855	1999	2150	2309	2473
J_WHT_WB2	2038	2206	2383	2577	2787
J_WHT_090	1831	2002	2204	2427	2677
J_WHT_WB3	2237	2475	2764	3091	3498
J_WHT_100	2241	2484	2791	3153	3605
J_WHT_120	1856	2084	2380	2760	3266
J_WHT_130	1836	2064	2360	2744	3256

Table 4. Valley Storage Reduction HMS Results
0.1 ACE (10YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB1_010	131	131	131	131	131
B_WB1_015	443	443	443	443	443
B_WB1_020	188	188	188	188	188
B_WB1_030	96	96	96	96	96
B_WB1_040	194	194	194	194	194
B_WB1_050	172	172	172	172	172
B_WB1_060	92	92	92	92	92
B_WB1_070	140	140	140	140	140
B_WB1_080	358	358	358	358	358
B_WB1A_010	377	377	377	377	377
B_WB1A_015	128	128	128	128	128
B_WB1A_020	92	92	92	92	92
B_WB1B_010	158	158	158	158	158
B_WB1B_020	540	540	540	540	540
B_WB1B_030	362	362	362	362	362
B_WB1B_040	286	286	286	286	286
B_WB1B_050	41	41	41	41	41
B_WB2_010	248	248	248	248	248
B_WB2_020	290	290	290	290	290
B_WB2_030	308	308	308	308	308
B_WB2_040	291	291	291	291	291
B_WB2_050	269	269	269	269	269
B_WB3_010	216	216	216	216	216
B_WB3_020	48	48	48	48	48
B_WB3_030	125	125	125	125	125
B_WB3_040	473	473	473	473	473
B_WB3_050	373	373	373	373	373
B_WB3_060	413	413	413	413	413
B_WB3_070	89	89	89	89	89
B_WB3_080	145	145	145	145	145
B_WB3_090	226	226	226	226	226
B_WB3_100	168	168	168	168	168
B_WB3_110	130	130	130	130	130
B_WB3_120	106	106	106	106	106
B_WB3A_010	368	368	368	368	368
B_WB3A_020	110	110	110	110	110
B_WB3B_010	282	282	282	282	282
B_WB3B_020	176	176	176	176	176
B_WB3B_030	271	271	271	271	271
B_WB3C_010	98	98	98	98	98
B_WB3C_020	211	211	211	211	211
B_WB3D_010	110	110	110	110	110
B_WB3D_020	231	231	231	231	231
B_WB3D_030	312	312	312	312	312

Table 4. Valley Storage Reduction HMS Results
0.1 ACE (10YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB3D_040	106	106	106	106	106
B_WB3D_050	112	112	112	112	112
B_WB3D_070	341	341	341	341	341
B_WHT_010	592	592	592	592	592
B_WHT_015	264	264	264	264	264
B_WHT_020	386	386	386	386	386
B_WHT_040	311	311	311	311	311
B_WHT_045	53	53	53	53	53
B_WHT_050	134	134	134	134	134
B_WHT_055	206	206	206	206	206
B_WHT_060	505	505	505	505	505
B_WHT_070	227	227	227	227	227
B_WHT_080	160	160	160	160	160
B_WHT_090	553	553	553	553	553
B_WHT_100	977	977	977	977	977
B_WHT_110	628	628	628	628	628
B_WHT_120	1213	1213	1213	1213	1213
B_WHT_130	1452	1452	1452	1452	1452
J_WB3D_010	110	110	110	110	110
J_WB3C_010	98	98	98	98	98
J_WB1_010	131	131	131	131	131
J_WB1_070	140	140	140	140	140
J_WB1B_010	158	158	158	158	158
J_WB3_030	125	125	125	125	125
J_WB3_010	216	216	216	216	216
J_WB2_010	248	248	248	248	248
J_WB3B_010	282	282	282	282	282
J_WB3D_020	262	267	273	282	290
J_WB3A_010	368	368	368	368	368
J_WB3C_020	282	285	288	290	292
J_WB3D_030	312	312	312	312	312
J_WB3A_020	434	440	446	453	458
J_WB3_020	354	354	354	354	354
J_WB3B_020	419	426	432	438	443
J_WB1A_010	377	377	377	377	377
J_WB3D_040	374	381	388	395	400
J_WB2_020	488	499	508	514	517
J_WB1A_015	463	466	468	470	473
J_WB1_015	573	573	573	573	573
J_WHT_010	592	592	592	592	592
J_WB1A_020	523	531	539	547	554
J_WB3B_030	523	548	575	604	634
J_WHT_110	628	628	628	628	628
J_WB2_030	621	652	685	718	749

Table 4. Valley Storage Reduction HMS Results
0.1 ACE (10YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
J_WB1_020	703	705	706	706	706
J_WB3D_WB3D_040	670	688	706	724	742
J_WB3_040	820	820	820	820	820
J_WB1_030	781	784	787	788	787
J_WB1B_020	946	952	958	964	970
J_WB2_040	733	786	841	899	960
J_WHT_020	804	829	859	897	938
J_WB3D_070	904	932	961	991	1021
J_WB1_040	841	854	866	877	888
J_WB3_050	1075	1097	1118	1138	1154
J_WB1B_040	1176	1193	1210	1224	1239
J_WB2_050	874	938	1013	1094	1177
J_WB1B_050	1178	1202	1226	1247	1266
J_WB1_050	887	912	937	963	989
J_WHT_050	1216	1254	1297	1340	1385
J_WB3_060	1173	1232	1293	1354	1415
J_WHT_055	1372	1419	1467	1515	1562
J_WHT_060	1651	1744	1842	1936	2020
J_WB1_WB1B	1821	1897	1977	2057	2136
J_WB3_WB3D	1985	2085	2194	2304	2412
J_WB3_070	2003	2109	2221	2336	2455
J_WB1_060	1928	2033	2123	2218	2311
J_WB3_WB3C	2267	2384	2504	2626	2746
J_WB3_080	2342	2468	2598	2733	2863
J_WB3_090	2379	2510	2650	2793	2934
J_WB1_WB1A	2401	2534	2637	2743	2847
J_WB3_WB3B	2885	3042	3210	3383	3559
J_WB1_080	2681	2810	2910	3008	3100
J_WB3_100	2964	3132	3314	3503	3695
J_WB3_110	2962	3136	3324	3522	3725
J_WB3_WB3A	3147	3345	3560	3790	4033
J_WB3_120	3163	3365	3587	3824	4075
J_WHT_WB1	4217	4456	4656	4855	5049
J_WHT_070	4196	4454	4693	4966	5202
J_WHT_080	4230	4497	4745	5036	5298
J_WHT_WB2	4684	5002	5317	5698	6064
J_WHT_090	4401	4746	5088	5467	5861
J_WHT_WB3	5449	5950	6477	7114	7804
J_WHT_100	5558	6093	6672	7390	8223
J_WHT_120	5146	5682	6303	7103	8107
J_WHT_130	5128	5666	6288	7122	8189

Table 5. Valley Storage Reduction HMS Results
0.04 ACE (25YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB1_010	168	168	168	168	168
B_WB1_015	567	567	567	567	567
B_WB1_020	243	243	243	243	243
B_WB1_030	123	123	123	123	123
B_WB1_040	248	248	248	248	248
B_WB1_050	220	220	220	220	220
B_WB1_060	117	117	117	117	117
B_WB1_070	179	179	179	179	179
B_WB1_080	466	466	466	466	466
B_WB1A_010	502	502	502	502	502
B_WB1A_015	163	163	163	163	163
B_WB1A_020	117	117	117	117	117
B_WB1B_010	203	203	203	203	203
B_WB1B_020	690	690	690	690	690
B_WB1B_030	464	464	464	464	464
B_WB1B_040	365	365	365	365	365
B_WB1B_050	53	53	53	53	53
B_WB2_010	328	328	328	328	328
B_WB2_020	372	372	372	372	372
B_WB2_030	392	392	392	392	392
B_WB2_040	371	371	371	371	371
B_WB2_050	344	344	344	344	344
B_WB3_010	287	287	287	287	287
B_WB3_020	62	62	62	62	62
B_WB3_030	169	169	169	169	169
B_WB3_040	616	616	616	616	616
B_WB3_050	478	478	478	478	478
B_WB3_060	526	526	526	526	526
B_WB3_070	113	113	113	113	113
B_WB3_080	185	185	185	185	185
B_WB3_090	286	286	286	286	286
B_WB3_100	216	216	216	216	216
B_WB3_110	167	167	167	167	167
B_WB3_120	138	138	138	138	138
B_WB3A_010	470	470	470	470	470
B_WB3A_020	140	140	140	140	140
B_WB3B_010	365	365	365	365	365
B_WB3B_020	226	226	226	226	226
B_WB3B_030	345	345	345	345	345
B_WB3C_010	127	127	127	127	127
B_WB3C_020	270	270	270	270	270
B_WB3D_010	141	141	141	141	141
B_WB3D_020	294	294	294	294	294
B_WB3D_030	410	410	410	410	410

Table 5. Valley Storage Reduction HMS Results
0.04 ACE (25YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB3D_040	136	136	136	136	136
B_WB3D_050	142	142	142	142	142
B_WB3D_070	435	435	435	435	435
B_WHT_010	759	759	759	759	759
B_WHT_015	335	335	335	335	335
B_WHT_020	489	489	489	489	489
B_WHT_040	396	396	396	396	396
B_WHT_045	68	68	68	68	68
B_WHT_050	169	169	169	169	169
B_WHT_055	266	266	266	266	266
B_WHT_060	651	651	651	651	651
B_WHT_070	293	293	293	293	293
B_WHT_080	206	206	206	206	206
B_WHT_090	713	713	713	713	713
B_WHT_100	1260	1260	1260	1260	1260
B_WHT_110	814	814	814	814	814
B_WHT_120	1576	1576	1576	1576	1576
B_WHT_130	1913	1913	1913	1913	1913
J_WB3D_010	141	141	141	141	141
J_WB3C_010	127	127	127	127	127
J_WB1_010	168	168	168	168	168
J_WB1_070	179	179	179	179	179
J_WB1B_010	203	203	203	203	203
J_WB3_030	169	169	169	169	169
J_WB3_010	287	287	287	287	287
J_WB2_010	328	328	328	328	328
J_WB3B_010	365	365	365	365	365
J_WB3D_020	341	349	358	366	375
J_WB3A_010	470	470	470	470	470
J_WB3C_020	366	370	373	376	379
J_WB3D_030	410	410	410	410	410
J_WB3A_020	559	567	575	581	588
J_WB3_020	474	474	474	474	474
J_WB3B_020	544	552	559	566	572
J_WB1A_010	502	502	502	502	502
J_WB3D_040	494	502	510	517	525
J_WB2_020	647	658	666	672	674
J_WB1A_015	617	620	622	625	627
J_WB1_015	733	733	733	733	733
J_WHT_010	759	759	759	759	759
J_WB1A_020	695	705	715	724	732
J_WB3B_030	697	727	759	792	825
J_WHT_110	814	814	814	814	814
J_WB2_030	830	868	907	946	982

Table 5. Valley Storage Reduction HMS Results
0.04 ACE (25YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
J_WB1_020	906	908	908	909	908
J_WB3D_WB3D_040	886	906	927	947	968
J_WB3_040	1081	1081	1081	1081	1081
J_WB1_030	1008	1011	1012	1013	1013
J_WB1B_020	1221	1228	1236	1244	1251
J_WB2_040	991	1055	1123	1194	1264
J_WHT_020	1054	1084	1122	1170	1220
J_WB3D_070	1195	1229	1263	1297	1332
J_WB1_040	1094	1109	1123	1137	1149
J_WB3_050	1425	1452	1475	1497	1517
J_WB1B_040	1512	1534	1557	1576	1596
J_WB2_050	1180	1262	1354	1452	1551
J_WB1B_050	1526	1554	1582	1608	1632
J_WB1_050	1161	1191	1222	1254	1287
J_WHT_050	1601	1645	1691	1741	1795
J_WB3_060	1607	1675	1745	1816	1885
J_WHT_055	1802	1856	1914	1969	2026
J_WHT_060	2182	2296	2417	2528	2627
J_WB1_WB1B	2415	2506	2598	2690	2782
J_WB3_WB3D	2708	2830	2955	3080	3198
J_WB3_070	2726	2854	2990	3128	3261
J_WB1_060	2565	2684	2794	2903	3011
J_WB3_WB3C	3077	3219	3362	3504	3636
J_WB3_080	3175	3331	3487	3642	3794
J_WB3_090	3223	3387	3553	3725	3894
J_WB1_WB1A	3203	3352	3475	3600	3721
J_WB3_WB3B	3894	4090	4294	4501	4710
J_WB1_080	3570	3718	3835	3946	4053
J_WB3_100	4003	4216	4436	4661	4890
J_WB3_110	4005	4225	4453	4688	4926
J_WB3_WB3A	4262	4514	4778	5053	5342
J_WB3_120	4287	4544	4817	5100	5402
J_WHT_WB1	5626	5907	6136	6375	6608
J_WHT_070	5686	6014	6290	6563	6822
J_WHT_080	5734	6080	6377	6672	6957
J_WHT_WB2	6407	6839	7220	7611	8010
J_WHT_090	5930	6356	6803	7312	7859
J_WHT_WB3	7372	8003	8733	9647	10691
J_WHT_100	7575	8251	9036	10041	11266
J_WHT_120	7132	7859	8714	9785	11140
J_WHT_130	7118	7884	8761	9873	11266

Table 6. Valley Storage Reduction HMS Results
0.02 ACE (50YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB1_010	199	199	199	199	199
B_WB1_015	668	668	668	668	668
B_WB1_020	289	289	289	289	289
B_WB1_030	145	145	145	145	145
B_WB1_040	292	292	292	292	292
B_WB1_050	259	259	259	259	259
B_WB1_060	138	138	138	138	138
B_WB1_070	211	211	211	211	211
B_WB1_080	556	556	556	556	556
B_WB1A_010	609	609	609	609	609
B_WB1A_015	192	192	192	192	192
B_WB1A_020	138	138	138	138	138
B_WB1B_010	240	240	240	240	240
B_WB1B_020	813	813	813	813	813
B_WB1B_030	550	550	550	550	550
B_WB1B_040	430	430	430	430	430
B_WB1B_050	62	62	62	62	62
B_WB2_010	397	397	397	397	397
B_WB2_020	440	440	440	440	440
B_WB2_030	461	461	461	461	461
B_WB2_040	437	437	437	437	437
B_WB2_050	406	406	406	406	406
B_WB3_010	350	350	350	350	350
B_WB3_020	73	73	73	73	73
B_WB3_030	207	207	207	207	207
B_WB3_040	738	738	738	738	738
B_WB3_050	564	564	564	564	564
B_WB3_060	619	619	619	619	619
B_WB3_070	133	133	133	133	133
B_WB3_080	218	218	218	218	218
B_WB3_090	336	336	336	336	336
B_WB3_100	255	255	255	255	255
B_WB3_110	197	197	197	197	197
B_WB3_120	164	164	164	164	164
B_WB3A_010	553	553	553	553	553
B_WB3A_020	165	165	165	165	165
B_WB3B_010	434	434	434	434	434
B_WB3B_020	267	267	267	267	267
B_WB3B_030	407	407	407	407	407
B_WB3C_010	150	150	150	150	150
B_WB3C_020	320	320	320	320	320
B_WB3D_010	167	167	167	167	167
B_WB3D_020	346	346	346	346	346
B_WB3D_030	493	493	493	493	493

Table 6. Valley Storage Reduction HMS Results
0.02 ACE (50YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB3D_040	160	160	160	160	160
B_WB3D_050	166	166	166	166	166
B_WB3D_070	512	512	512	512	512
B_WHT_010	897	897	897	897	897
B_WHT_015	394	394	394	394	394
B_WHT_020	577	577	577	577	577
B_WHT_040	466	466	466	466	466
B_WHT_045	80	80	80	80	80
B_WHT_050	198	198	198	198	198
B_WHT_055	315	315	315	315	315
B_WHT_060	770	770	770	770	770
B_WHT_070	349	349	349	349	349
B_WHT_080	245	245	245	245	245
B_WHT_090	845	845	845	845	845
B_WHT_100	1496	1496	1496	1496	1496
B_WHT_110	968	968	968	968	968
B_WHT_120	1878	1878	1878	1878	1878
B_WHT_130	2305	2305	2305	2305	2305
J_WB3D_010	167	167	167	167	167
J_WB3C_010	150	150	150	150	150
J_WB1_010	199	199	199	199	199
J_WB1_070	211	211	211	211	211
J_WB1B_010	240	240	240	240	240
J_WB3_030	207	207	207	207	207
J_WB3_010	350	350	350	350	350
J_WB2_010	397	397	397	397	397
J_WB3B_010	434	434	434	434	434
J_WB3D_020	410	417	426	436	447
J_WB3A_010	553	553	553	553	553
J_WB3C_020	437	441	444	447	450
J_WB3D_030	493	493	493	493	493
J_WB3A_020	663	672	680	687	694
J_WB3_020	578	578	578	578	578
J_WB3B_020	649	659	667	675	682
J_WB1A_010	609	609	609	609	609
J_WB3D_040	596	606	615	623	631
J_WB2_020	777	788	797	804	807
J_WB1A_015	746	749	752	755	757
J_WB1_015	864	864	864	864	864
J_WHT_010	897	897	897	897	897
J_WB1A_020	842	853	864	873	881
J_WB3B_030	837	873	910	948	985
J_WHT_110	968	968	968	968	968
J_WB2_030	1005	1047	1091	1134	1173

Table 6. Valley Storage Reduction HMS Results
0.02 ACE (50YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
J_WB1_020	1074	1075	1076	1076	1075
J_WB3D_WB3D_040	1066	1089	1114	1137	1160
J_WB3_040	1306	1306	1306	1306	1306
J_WB1_030	1195	1198	1200	1200	1199
J_WB1B_020	1451	1458	1466	1474	1482
J_WB2_040	1208	1280	1357	1437	1515
J_WHT_020	1262	1296	1348	1403	1459
J_WB3D_070	1437	1475	1513	1551	1591
J_WB1_040	1303	1319	1335	1350	1364
J_WB3_050	1725	1755	1782	1806	1825
J_WB1B_040	1810	1833	1853	1874	1890
J_WB2_050	1439	1536	1641	1751	1860
J_WB1B_050	1825	1856	1886	1912	1936
J_WB1_050	1390	1424	1460	1496	1533
J_WHT_050	1919	1968	2019	2075	2139
J_WB3_060	1966	2042	2118	2195	2270
J_WHT_055	2163	2224	2286	2349	2413
J_WHT_060	2651	2783	2910	3029	3135
J_WB1_WB1B	2904	3007	3112	3216	3318
J_WB3_WB3D	3308	3444	3581	3715	3847
J_WB3_070	3337	3483	3632	3780	3922
J_WB1_060	3092	3228	3352	3473	3594
J_WB3_WB3C	3763	3919	4076	4226	4365
J_WB3_080	3890	4061	4232	4400	4556
J_WB3_090	3949	4134	4321	4506	4684
J_WB1_WB1A	3876	4043	4181	4318	4454
J_WB3_WB3B	4763	4988	5215	5441	5664
J_WB1_080	4316	4478	4608	4733	4849
J_WB3_100	4900	5140	5391	5638	5882
J_WB3_110	4896	5148	5409	5674	5935
J_WB3_WB3A	5215	5506	5811	6125	6441
J_WB3_120	5248	5545	5859	6186	6519
J_WHT_WB1	6816	7132	7399	7658	7899
J_WHT_070	6896	7260	7570	7871	8149
J_WHT_080	6966	7351	7680	8009	8313
J_WHT_WB2	7819	8304	8729	9162	9587
J_WHT_090	7291	7848	8378	8939	9517
J_WHT_WB3	9203	10092	10964	11978	13122
J_WHT_100	9422	10378	11367	12520	13892
J_WHT_120	8916	9843	10902	12141	13568
J_WHT_130	8948	9886	10962	12266	13769

Table 7. Valley Storage Reduction HMS Results
0.01 ACE (100YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB1_010	232	232	232	232	232
B_WB1_015	775	775	775	775	775
B_WB1_020	339	339	339	339	339
B_WB1_030	169	169	169	169	169
B_WB1_040	338	338	338	338	338
B_WB1_050	301	301	301	301	301
B_WB1_060	159	159	159	159	159
B_WB1_070	245	245	245	245	245
B_WB1_080	654	654	654	654	654
B_WB1A_010	721	721	721	721	721
B_WB1A_015	222	222	222	222	222
B_WB1A_020	160	160	160	160	160
B_WB1B_010	280	280	280	280	280
B_WB1B_020	943	943	943	943	943
B_WB1B_030	639	639	639	639	639
B_WB1B_040	498	498	498	498	498
B_WB1B_050	73	73	73	73	73
B_WB2_010	468	468	468	468	468
B_WB2_020	511	511	511	511	511
B_WB2_030	533	533	533	533	533
B_WB2_040	507	507	507	507	507
B_WB2_050	471	471	471	471	471
B_WB3_010	413	413	413	413	413
B_WB3_020	84	84	84	84	84
B_WB3_030	248	248	248	248	248
B_WB3_040	864	864	864	864	864
B_WB3_050	655	655	655	655	655
B_WB3_060	716	716	716	716	716
B_WB3_070	154	154	154	154	154
B_WB3_080	253	253	253	253	253
B_WB3_090	387	387	387	387	387
B_WB3_100	296	296	296	296	296
B_WB3_110	228	228	228	228	228
B_WB3_120	192	192	192	192	192
B_WB3A_010	640	640	640	640	640
B_WB3A_020	191	191	191	191	191
B_WB3B_010	507	507	507	507	507
B_WB3B_020	310	310	310	310	310
B_WB3B_030	471	471	471	471	471
B_WB3C_010	176	176	176	176	176
B_WB3C_020	372	372	372	372	372
B_WB3D_010	194	194	194	194	194
B_WB3D_020	400	400	400	400	400
B_WB3D_030	582	582	582	582	582

Table 7. Valley Storage Reduction HMS Results
0.01 ACE (100YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB3D_040	186	186	186	186	186
B_WB3D_050	191	191	191	191	191
B_WB3D_070	593	593	593	593	593
B_WHT_010	1044	1044	1044	1044	1044
B_WHT_015	455	455	455	455	455
B_WHT_020	665	665	665	665	665
B_WHT_040	540	540	540	540	540
B_WHT_045	94	94	94	94	94
B_WHT_050	229	229	229	229	229
B_WHT_055	368	368	368	368	368
B_WHT_060	898	898	898	898	898
B_WHT_070	408	408	408	408	408
B_WHT_080	286	286	286	286	286
B_WHT_090	984	984	984	984	984
B_WHT_100	1745	1745	1745	1745	1745
B_WHT_110	1133	1133	1133	1133	1133
B_WHT_120	2203	2203	2203	2203	2203
B_WHT_130	2716	2716	2716	2716	2716
J_WB3D_010	194	194	194	194	194
J_WB3C_010	176	176	176	176	176
J_WB1_010	232	232	232	232	232
J_WB1_070	245	245	245	245	245
J_WB1B_010	280	280	280	280	280
J_WB3_030	248	248	248	248	248
J_WB3_010	413	413	413	413	413
J_WB2_010	468	468	468	468	468
J_WB3B_010	507	507	507	507	507
J_WB3D_020	480	489	500	511	522
J_WB3A_010	640	640	640	640	640
J_WB3C_020	511	515	519	522	525
J_WB3D_030	582	582	582	582	582
J_WB3A_020	772	781	789	798	806
J_WB3_020	686	686	686	686	686
J_WB3B_020	765	773	782	790	797
J_WB1A_010	721	721	721	721	721
J_WB3D_040	705	715	725	734	743
J_WB2_020	914	927	936	942	943
J_WB1A_015	884	887	890	893	895
J_WB1_015	1004	1004	1004	1004	1004
J_WHT_010	1044	1044	1044	1044	1044
J_WB1A_020	998	1010	1022	1032	1041
J_WB3B_030	994	1034	1074	1115	1156
J_WHT_110	1133	1133	1133	1133	1133
J_WB2_030	1193	1242	1291	1339	1381

Table 7. Valley Storage Reduction HMS Results
0.01 ACE (100YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
J_WB1_020	1254	1254	1255	1255	1254
J_WB3D_WB3D_040	1262	1287	1312	1337	1361
J_WB3_040	1538	1538	1538	1538	1538
J_WB1_030	1396	1398	1400	1400	1399
J_WB1B_020	1691	1699	1707	1715	1724
J_WB2_040	1442	1524	1612	1701	1786
J_WHT_020	1484	1532	1592	1653	1714
J_WB3D_070	1697	1738	1781	1823	1867
J_WB1_040	1530	1548	1565	1581	1597
J_WB3_050	2046	2075	2103	2128	2148
J_WB1B_040	2117	2141	2163	2183	2202
J_WB2_050	1723	1831	1949	2073	2192
J_WB1B_050	2137	2169	2201	2229	2255
J_WB1_050	1643	1682	1721	1761	1802
J_WHT_050	2257	2311	2370	2435	2507
J_WB3_060	2346	2428	2515	2600	2682
J_WHT_055	2551	2619	2688	2758	2827
J_WHT_060	3151	3297	3437	3563	3677
J_WB1_WB1B	3442	3557	3673	3787	3899
J_WB3_WB3D	3949	4097	4244	4394	4532
J_WB3_070	3990	4152	4315	4474	4628
J_WB1_060	3669	3822	3957	4091	4224
J_WB3_WB3C	4492	4666	4833	4994	5145
J_WB3_080	4648	4838	5026	5205	5371
J_WB3_090	4728	4930	5134	5334	5524
J_WB1_WB1A	4602	4787	4938	5091	5240
J_WB3_WB3B	5698	5945	6194	6437	6671
J_WB1_080	5127	5300	5441	5575	5705
J_WB3_100	5868	6133	6408	6676	6931
J_WB3_110	5870	6150	6438	6727	7010
J_WB3_WB3A	6264	6587	6924	7272	7618
J_WB3_120	6307	6638	6985	7351	7710
J_WHT_WB1	8104	8423	8706	8999	9292
J_WHT_070	8192	8566	8897	9228	9541
J_WHT_080	8282	8681	9033	9393	9737
J_WHT_WB2	9308	9801	10249	10723	11205
J_WHT_090	8860	9461	10031	10603	11208
J_WHT_WB3	11319	12285	13267	14323	15582
J_WHT_100	11627	12673	13789	15061	16575
J_WHT_120	10970	12013	13117	14465	17057
J_WHT_130	11010	12088	13244	14594	17251

Table 8. Valley Storage Reduction HMS Results
0.002 ACE (500YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB1_010	348	348	348	348	348
B_WB1_015	1179	1179	1179	1179	1179
B_WB1_020	480	480	480	480	480
B_WB1_030	239	239	239	239	239
B_WB1_040	535	535	535	535	535
B_WB1_050	463	463	463	463	463
B_WB1_060	253	253	253	253	253
B_WB1_070	371	371	371	371	371
B_WB1_080	913	913	913	913	913
B_WB1A_010	1139	1139	1139	1139	1139
B_WB1A_015	359	359	359	359	359
B_WB1A_020	245	245	245	245	245
B_WB1B_010	411	411	411	411	411
B_WB1B_020	1451	1451	1451	1451	1451
B_WB1B_030	1045	1045	1045	1045	1045
B_WB1B_040	773	773	773	773	773
B_WB1B_050	108	108	108	108	108
B_WB2_010	829	829	829	829	829
B_WB2_020	778	778	778	778	778
B_WB2_030	847	847	847	847	847
B_WB2_040	793	793	793	793	793
B_WB2_050	724	724	724	724	724
B_WB3_010	725	725	725	725	725
B_WB3_020	135	135	135	135	135
B_WB3_030	382	382	382	382	382
B_WB3_040	1417	1417	1417	1417	1417
B_WB3_050	1040	1040	1040	1040	1040
B_WB3_060	1140	1140	1140	1140	1140
B_WB3_070	249	249	249	249	249
B_WB3_080	387	387	387	387	387
B_WB3_090	653	653	653	653	653
B_WB3_100	446	446	446	446	446
B_WB3_110	374	374	374	374	374
B_WB3_120	312	312	312	312	312
B_WB3A_010	999	999	999	999	999
B_WB3A_020	306	306	306	306	306
B_WB3B_010	784	784	784	784	784
B_WB3B_020	479	479	479	479	479
B_WB3B_030	734	734	734	734	734
B_WB3C_010	255	255	255	255	255
B_WB3C_020	556	556	556	556	556
B_WB3D_010	289	289	289	289	289
B_WB3D_020	633	633	633	633	633
B_WB3D_030	903	903	903	903	903

Table 8. Valley Storage Reduction HMS Results
0.002 ACE (500YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
B_WB3D_040	283	283	283	283	283
B_WB3D_050	321	321	321	321	321
B_WB3D_070	939	939	939	939	939
B_WHT_010	1584	1584	1584	1584	1584
B_WHT_015	733	733	733	733	733
B_WHT_020	1130	1130	1130	1130	1130
B_WHT_040	845	845	845	845	845
B_WHT_045	138	138	138	138	138
B_WHT_050	373	373	373	373	373
B_WHT_055	534	534	534	534	534
B_WHT_060	1328	1328	1328	1328	1328
B_WHT_070	585	585	585	585	585
B_WHT_080	425	425	425	425	425
B_WHT_090	1526	1526	1526	1526	1526
B_WHT_100	2645	2645	2645	2645	2645
B_WHT_110	1677	1677	1677	1677	1677
B_WHT_120	3207	3207	3207	3207	3207
B_WHT_130	4345	4345	4345	4345	4345
J_WB3D_010	289	289	289	289	289
J_WB3C_010	255	255	255	255	255
J_WB1_010	348	348	348	348	348
J_WB1_070	371	371	371	371	371
J_WB1B_010	411	411	411	411	411
J_WB3_030	382	382	382	382	382
J_WB3_010	725	725	725	725	725
J_WB2_010	829	829	829	829	829
J_WB3B_010	784	784	784	784	784
J_WB3D_020	735	747	761	776	793
J_WB3A_010	999	999	999	999	999
J_WB3C_020	752	758	763	769	774
J_WB3D_030	903	903	903	903	903
J_WB3A_020	1193	1210	1225	1240	1255
J_WB3_020	1138	1138	1138	1138	1138
J_WB3B_020	1174	1189	1204	1217	1229
J_WB1A_010	1139	1139	1139	1139	1139
J_WB3D_040	1079	1097	1113	1130	1144
J_WB2_020	1476	1496	1513	1522	1525
J_WB1A_015	1385	1391	1396	1401	1405
J_WB1_015	1523	1523	1523	1523	1523
J_WHT_010	1584	1584	1584	1584	1584
J_WB1A_020	1548	1569	1589	1608	1625
J_WB3B_030	1463	1528	1600	1675	1750
J_WHT_110	1677	1677	1677	1677	1677
J_WB2_030	1849	1936	2031	2120	2204

Table 8. Valley Storage Reduction HMS Results
0.002 ACE (500YR)

Hydrologic Element	10% Reduction in Valley Storage	20% Reduction in Valley Storage	30% Reduction in Valley Storage	40% Reduction in Valley Storage	50% Reduction in Valley Storage
J_WB1_020	1857	1860	1860	1861	1858
J_WB3D_WB3D_040	1891	1931	1971	2014	2059
J_WB3_040	2534	2534	2534	2534	2534
J_WB1_030	2050	2056	2058	2059	2057
J_WB1B_020	2607	2620	2634	2648	2662
J_WB2_040	2187	2335	2497	2667	2828
J_WHT_020	2266	2310	2373	2454	2553
J_WB3D_070	2571	2637	2706	2778	2849
J_WB1_040	2237	2265	2293	2320	2346
J_WB3_050	3305	3358	3406	3453	3486
J_WB1B_040	3269	3303	3341	3371	3404
J_WB2_050	2583	2777	2993	3226	3446
J_WB1B_050	3301	3354	3403	3447	3483
J_WB1_050	2396	2456	2521	2588	2659
J_WHT_050	3467	3540	3621	3714	3821
J_WB3_060	3688	3838	3989	4139	4295
J_WHT_055	3823	3924	4028	4135	4247
J_WHT_060	4706	4927	5134	5331	5508
J_WB1_WB1B	5107	5295	5486	5679	5866
J_WB3_WB3D	6060	6317	6588	6854	7108
J_WB3_070	6099	6375	6662	6949	7237
J_WB1_060	5448	5698	5917	6144	6363
J_WB3_WB3C	6836	7129	7425	7711	7995
J_WB3_080	7069	7389	7713	8034	8339
J_WB3_090	7154	7493	7839	8190	8541
J_WB1_WB1A	6925	7219	7460	7711	7957
J_WB3_WB3B	8592	8999	9419	9854	10286
J_WB1_080	7602	7881	8110	8339	8553
J_WB3_100	8840	9284	9746	10217	10679
J_WB3_110	8837	9301	9780	10274	10775
J_WB3_WB3A	9389	9923	10478	11075	11676
J_WB3_120	9444	9994	10575	11185	11818
J_WHT_WB1	12057	12614	13086	13530	13946
J_WHT_070	12330	12933	13468	13981	14440
J_WHT_080	12448	13092	13675	14230	14761
J_WHT_WB2	14102	14915	15679	16417	17187
J_WHT_090	13027	13958	14872	15843	16864
J_WHT_WB3	16652	18021	19489	21200	23235
J_WHT_100	17073	18614	20272	22242	24675
J_WHT_120	16670	17929	19509	22143	24996
J_WHT_130	16634	18114	19567	22200	25380

Table 9. Detention HMS Results

Hydrologic Element	0.5 ACE (2YR)	0.1 ACE (10YR)	0.04 ACE (25YR)	0.02 ACE (50YR)	0.01 ACE (100YR)	0.002 ACE (500YR)
B_WB3_030	68	130	169	204	241	379
B_WB3_010	92	190	251	306	367	688
B_WB2_010	106	212	279	337	405	771
B_WB1A_010	167	345	458	555	664	1093
B_WB3D_030	162	292	374	442	522	832
B_WHT_130	771	1471	1970	2346	2745	4514
B_WB3_040	252	424	529	612	715	1185
B_WB3_120	47	102	139	167	197	323
B_WB3B_010	131	265	356	428	498	797
B_WB1B_030	172	328	434	520	605	1057
B_WB3_020	23	43	56	67	78	134
B_WB3_110	62	114	148	176	206	362
B_WHT_080	77	152	203	242	282	436
B_WHT_020	178	334	437	526	618	1144
B_WB3_050	175	337	445	536	626	1062
B_WHT_090	251	522	705	848	984	1582
B_WHT_110	298	606	815	973	1135	1731
B_WHT_100	450	932	1255	1505	1755	2725
B_WHT_120	580	1190	1606	1912	2246	3324
B_WB1B_050	19	39	52	62	72	112
B_WHT_045	28	48	61	73	85	128
B_WB3_070	38	83	113	135	158	256
B_WB1_060	39	91	121	141	164	257
B_WB3D_050	53	92	116	140	167	302
B_WB1A_020	43	82	109	131	153	248
B_WB3A_020	50	98	130	157	183	312
B_WB1A_015	63	107	133	158	186	314
B_WHT_050	61	118	153	189	220	379
B_WB3D_040	49	98	130	156	182	290
B_WB3D_010	55	99	127	150	178	275
B_WB3C_010	46	92	123	151	172	263
B_WB1_030	47	92	125	149	174	248
B_WB1_010	66	116	149	177	208	322
B_WB3_080	69	129	168	203	238	382
B_WB1_070	65	128	173	207	240	382
B_WB3_090	104	190	247	298	350	646
B_WB1_050	80	155	209	247	288	474
B_WB3B_020	79	160	215	258	298	483
B_WB1_040	88	175	233	281	329	546
B_WB3_100	78	156	208	250	291	462
B_WB1B_010	73	152	204	243	279	425
B_WB3D_020	104	208	277	335	389	650
B_WHT_015	128	222	280	332	394	666
B_WB3C_020	96	195	265	317	367	568
B_WB3B_030	123	239	320	385	447	740

Table 9. Detention HMS Results

B_WB2_040	135	260	344	414	482	802
B_WB2_050	128	240	314	375	439	712
B_WB1B_040	130	262	350	422	488	802
B_WB2_030	136	283	379	458	530	871
B_WHT_055	98	196	265	313	363	556
B_WHT_040	146	247	306	358	417	666
B_WB1_020	89	186	252	299	351	502
B_WB2_020	137	263	349	418	488	781
B_WB3D_070	162	295	383	459	538	913
B_WHT_070	113	217	288	343	399	589
B_WB3A_010	170	329	436	524	612	1014
B_WB3_060	186	371	496	596	692	1172
B_WB1_015	219	388	500	595	696	1111
B_WB1B_020	248	492	656	785	919	1486
B_WHT_060	234	479	646	773	899	1366
B_WHT_010	294	523	674	800	935	1482
B_WB1_080	176	363	488	578	682	948
J_WB3D_010	55	99	127	150	178	275
J_WB3C_010	46	92	123	151	172	263
J_WB1_010	66	116	149	177	208	322
J_WB1_070	65	128	173	207	240	382
J_WB1B_010	73	152	204	243	279	425
J_WB3_030	68	130	169	204	241	379
J_WB3_010	92	190	251	306	367	688
J_WB2_010	106	212	279	337	405	771
J_WB3B_010	131	265	356	428	498	797
J_WB3D_020	124	237	312	373	435	698
J_WB3A_010	170	329	436	524	612	1014
J_WB3C_020	131	258	339	409	489	713
J_WB3D_030	162	292	374	442	522	832
J_WB3A_020	208	393	510	616	728	1136
J_WB3_020	164	323	421	507	606	1000
J_WB3B_020	198	393	516	621	740	1130
J_WB1A_010	167	345	458	555	664	1093
J_WB3D_040	194	354	450	530	627	935
J_WB2_020	232	451	597	717	846	1386
J_WB1A_015	220	433	569	680	814	1298
J_WB1_015	285	503	646	768	900	1420
J_WHT_010	294	523	674	800	935	1482
J_WB1A_020	254	490	639	763	909	1404
J_WB3B_030	271	512	682	811	954	1401
J_WHT_110	298	606	815	973	1135	1731
J_WB2_030	313	582	764	919	1081	1669
J_WB1_020	356	648	834	1002	1180	1760
J_WB3D_WB3D_040	350	622	797	927	1090	1562
J_WB3_040	411	745	949	1119	1320	2175
J_WB1_030	398	731	950	1136	1336	1960

Table 9. Detention HMS Results

J_WB1B_020	447	863	1137	1365	1616	2560
J_WB2_040	392	711	935	1118	1315	1949
J_WHT_020	469	786	986	1156	1352	1927
J_WB3D_070	474	850	1089	1287	1519	2226
J_WB1_040	436	800	1031	1230	1454	2111
J_WB3_050	554	1007	1276	1506	1779	2743
J_WB1B_040	559	1077	1402	1690	2011	3128
J_WB2_050	482	875	1139	1344	1596	2286
J_WB1B_050	568	1089	1419	1709	2031	3122
J_WB1_050	475	858	1099	1311	1553	2227
J_WHT_050	656	1087	1370	1600	1872	2734
J_WB3_060	648	1154	1482	1762	2077	3087
J_WHT_055	746	1275	1621	1898	2220	3179
J_WHT_060	910	1574	2008	2342	2764	3917
J_WB1_WB1B	957	1693	2185	2572	3057	4455
J_WB3_WB3D	1111	1953	2527	2988	3505	5108
J_WB3_070	1121	1977	2549	3012	3542	5141
J_WB1_060	1013	1818	2342	2767	3292	4782
J_WB3_WB3C	1250	2226	2870	3402	4010	5805
J_WB3_080	1298	2312	2979	3528	4164	6008
J_WB3_090	1326	2373	3053	3613	4264	6116
J_WB1_WB1A	1250	2299	2970	3528	4198	6174
J_WB3_WB3B	1588	2873	3700	4391	5195	7454
J_WB1_080	1403	2602	3393	4025	4763	6852
J_WB3_100	1632	2956	3816	4525	5355	7677
J_WB3_110	1641	2979	3844	4554	5390	7720
J_WB3_WB3A	1756	3194	4115	4878	5778	8234
J_WB3_120	1764	3217	4147	4915	5820	8288
J_WHT_WB1	2275	4124	5340	6321	7462	10709
J_WHT_070	2322	4189	5460	6473	7638	10900
J_WHT_080	2353	4246	5526	6559	7744	10998
J_WHT_WB2	2644	4800	6274	7447	8788	12547
J_WHT_090	2526	4619	5935	7064	8453	11816
J_WHT_WB3	3315	6073	7787	9322	11225	15589
J_WHT_100	3381	6271	8092	9655	11643	16121
J_WHT_120	3142	6035	7821	9323	11106	15726
J_WHT_130	3131	6042	7874	9397	11191	15570

Appendix G

DETENTION BASIN RATING TABLES FOR SENSITIVITY ANALYSES



Detention Basin Rating Tables

B_WB1_010

Storage	Discharge
0	0
3.5	65.7
5.5	130.9
6.2	168.2
6.7	199.0
7.3	231.8
8.2	348.4
8.5	400.0

B_WB1_015

Storage	Discharge
0	0
10.6	227.6
16.2	443.0
18.1	566.5
19.6	668.0
21.3	775.3
23.7	1179.2
24.8	1550.0

B_WB1_020

Storage	Discharge
0	0
5.1	92.9
7.2	188.2
7.9	243.4
8.4	289.2
9.0	338.7
9.8	479.5
10.0	590.0

B_WB1_030

Storage	Discharge
0	0
2.6	49.2
3.7	95.7
4.0	122.7
4.2	144.8
4.5	168.8
4.9	239.1
5.2	310.0

B_WB1_040

Storage	Discharge
0	0
2.8	100.4
4.0	194.3
4.4	247.8
4.7	292.0
5.0	338.1
5.5	534.7
5.6	600.0

B_WB1_050

Storage	Discharge
0	0
2.9	87.5
4.3	171.8
4.7	219.9
5.1	259.4
5.5	301.1
6.0	463.4
6.1	500.0

B_WB1_060

Storage	Discharge
0.000	0
0.832	47.5
1.006	91.8
1.041	116.8
1.060	137.5
1.093	159.1
1.095	253.1
1.1	260

B_WB1_070

Storage	Discharge
0	0
2.43	71.3
3.51	139.7
3.85	178.8
4.10	211.0
4.41	245.1
4.79	371.4
4.85	400

B_WB1_080

Storage	Discharge
0	0
11.98	172.8
17.47	357.7
19.32	465.7
20.69	555.8
22.27	653.5
24.38	913.1
25	1000

B_WB1A_010

Storage	Discharge
0	0
8.26	165.9
13.64	376.7
15.99	501.7
17.66	608.5
19.31	721.3
22.18	1138.8
23.5	1350

B_WB1A_015

Storage	Discharge
0	0
2.62	66.8
4.06	128.3
4.57	163.1
4.98	192.0
5.44	221.8
6.09	359.0
6.2	400

B_WB1A_020

Storage	Discharge
0	0
1.68	47.4
2.43	91.7
2.69	117.0
2.86	137.8
3.08	159.7
3.38	245.2
3.5	330

Detention Basin Rating Tables

B_WB1B_010

Storage	Discharge
0	0
3.0	79.9
4.2	158.1
4.6	203.2
4.9	240.2
5.3	279.9
5.7	411.3
5.8	450.0

B_WB1B_020

Storage	Discharge
0	0
9.0	278.0
12.8	539.9
14.1	689.7
15.1	813.2
16.1	943.1
17.6	1451.1
17.8	1550.0

B_WB1B_030

Storage	Discharge
0	0
5.2	182.4
7.8	361.5
8.7	464.2
9.4	550.4
10.2	638.9
11.3	1045.0
11.6	1200.0

B_WB1B_040

Storage	Discharge
0	0
4.3	147.6
6.0	285.8
6.6	364.7
7.0	429.7
7.5	497.9
8.1	773.4
8.2	820.0

B_WB1B_050

Storage	Discharge
0	0
0.77	20.7
1.09	41.0
1.21	52.7
1.29	62.3
1.38	72.5
1.49	107.9
1.51	120.0

B_WB2_010

Storage	Discharge
0	0
3.7	110.2
6.3	247.8
7.4	327.6
8.2	397.0
8.9	467.6
10.3	829.2
11.0	1300.0

B_WB2_020

Storage	Discharge
0	0
5.50	147.5
8.13	290.3
9.00	372.1
9.67	439.5
10.43	510.7
11.48	778.2
11.8	850

B_WB2_030

Storage	Discharge
0	0
3.86	159.7
5.28	307.6
5.76	391.6
6.08	460.8
6.46	532.8
6.92	847.3
7	900

B_WB2_040

Storage	Discharge
0	0
4.74	150.9
6.85	291.2
7.56	371.3
8.09	437.4
8.71	506.5
9.52	792.5
9.8	900

B_WB2_050

Storage	Discharge
0	0
5.35	137.7
7.97	269.2
8.88	344.3
9.57	406.1
10.36	471.3
11.45	723.5
11.6	800

B_WB3_010

Storage	Discharge
0	0
3.33	94.2
5.63	215.8
6.63	287.1
7.34	349.7
8.04	413.3
9.28	725.2
9.6	810

B_WB3_020

Storage	Discharge
0	0
0.77	24.3
1.17	48.0
1.30	61.5
1.41	72.6
1.53	84.3
1.70	135.2
1.73	150

Detention Basin Rating Tables

B_WB3_030

Storage	Discharge
0	0
3.3	51.8
5.6	124.6
6.7	168.5
7.5	206.8
8.3	247.5
9.6	382.2
10.0	450.0

B_WB3_040

Storage	Discharge
0	0
10.1	224.9
17.1	472.6
20.4	616.1
22.8	738.1
25.1	864.1
29.1	1416.6
30.0	1650.0

B_WB3_050

Storage	Discharge
0	0
5.9	189.2
8.7	372.8
9.7	477.5
10.4	564.3
11.2	654.8
12.3	1039.9
12.5	1200.0

B_WB3_060

Storage	Discharge
0	0
5.7	213.2
8.1	412.7
8.9	525.8
9.5	619.2
10.2	716.3
11.0	1140.0
11.1	1200.0

B_WB3_070

Storage	Discharge
0.00	0
0.93	46.1
1.24	88.9
1.33	113.0
1.39	133.1
1.46	153.8
1.53	248.5
1.55	300.0

B_WB3_080

Storage	Discharge
0	0
2.9	74.3
4.3	144.6
4.8	184.9
5.1	218.0
5.5	252.9
6.1	387.3
6.3	450.0

B_WB3_090

Storage	Discharge
0	0
3.01	119.9
4.44	226.2
4.91	285.7
5.28	336.1
5.68	386.5
6.25	653.3
6.35	700

B_WB3_100

Storage	Discharge
0	0
3.01	85.5
4.32	168.2
4.77	215.6
5.08	254.5
5.45	295.9
5.93	446.4
6	500

B_WB3_110

Storage	Discharge
0	0
2.10	66.1
3.21	130.2
3.61	166.6
3.92	196.9
4.25	228.1
4.74	373.5
4.8	410

B_WB3_120

Storage	Discharge
0	0
1.17	51.1
1.70	106.0
1.87	137.5
2.00	164.0
2.14	191.5
2.32	311.8
2.38	350

B_WB3A_010

Storage	Discharge
0	0
6.07	190.5
8.75	368.3
9.67	469.5
10.35	552.8
11.11	640.1
12.14	999.0
13.2	1500

B_WB3A_020

Storage	Discharge
0	0
1.58	56.9
2.27	110.1
2.51	140.4
2.68	165.4
2.88	191.4
3.14	306.2
3.25	350

Detention Basin Rating Tables

B_WB3B_010

Storage	Discharge
0	0
4.8	137.8
7.1	281.5
7.9	364.5
8.5	433.5
9.2	506.5
10.3	783.7
10.5	850.0

B_WB3B_020

Storage	Discharge
0	0
2.8	89.8
4.0	176.4
4.4	225.9
4.7	266.6
5.1	309.5
5.6	478.6
5.7	500.0

B_WB3B_030

Storage	Discharge
0	0
4.4	139.9
6.4	270.8
7.0	345.3
7.5	406.7
8.1	471.0
8.9	734.3
9.0	800.0

B_WB3C_010

Storage	Discharge
0	0
2.3	48.2
3.4	97.9
3.8	126.5
4.0	150.2
4.4	175.7
4.8	255.1
4.9	300.0

B_WB3C_020

Storage	Discharge
0	0
4.0	106.5
5.7	210.6
6.2	270.3
6.6	319.6
7.1	372.1
7.8	555.9
7.9	600.0

B_WB3D_010

Storage	Discharge
0	0
3.0	55.8
4.5	110.0
5.1	141.1
5.5	166.6
5.9	193.9
6.6	289.1
6.8	320.0

B_WB3D_020

Storage	Discharge
0	0
3.24	119.8
4.58	230.5
5.03	293.5
5.34	345.6
5.71	399.7
6.19	632.7
6.3	700

B_WB3D_030

Storage	Discharge
0	0
7.97	144.9
13.10	312.0
15.45	410.3
17.13	493.4
18.77	581.7
21.60	903.2
22	1030

B_WB3D_040

Storage	Discharge
0	0
1.85	54.3
2.62	106.1
2.90	135.7
3.10	160.1
3.32	185.9
3.61	282.8
3.65	300

B_WB3D_050

Storage	Discharge
0	0
1.81	59.4
2.72	112.1
3.02	141.6
3.24	166.3
3.53	191.2
3.90	321.1
3.95	350

B_WB3D_070

Storage	Discharge
0	0
6.03	176.1
9.08	340.9
10.13	434.6
10.92	512.1
11.82	592.6
13.08	938.8
13.3	1020

B_WHT_010

Storage	Discharge
0	0
14.51	298.7
22.53	591.6
25.30	759.3
27.50	897.3
29.92	1043.5
33.46	1583.9
34	1750

Detention Basin Rating Tables

B_WHT_015

Storage	Discharge
0	0
5.2	137.7
7.9	263.9
8.9	335.3
9.6	394.3
10.5	455.4
11.7	733.2
12.0	800.0

B_WHT_020

Storage	Discharge
0	0
4.9	201.4
7.2	385.6
8.0	489.1
8.6	577.0
9.2	665.2
10.1	1129.8
10.2	1200.0

B_WHT_040

Storage	Discharge
0	0
7.6	160.7
12.0	310.5
14.0	395.7
15.5	466.2
16.9	540.0
19.1	844.7
19.5	930.0

B_WHT_045

Storage	Discharge
0	0
1.5	26.4
2.4	52.6
2.7	67.7
2.9	80.2
3.2	93.5
3.6	137.6
4.0	180.0

B_WHT_050

Storage	Discharge
0	0
1.7	70.8
2.4	133.5
2.7	168.8
2.8	198.4
3.0	228.6
3.3	373.4
3.4	400.0

B_WHT_055

Storage	Discharge
0	0
4.9	102.5
7.1	205.9
7.8	265.5
8.4	314.7
9.1	367.6
9.9	534.2
10.0	600.0

B_WHT_060

Storage	Discharge
0	0
9.70	252.3
13.93	505.0
15.32	650.5
16.32	770.4
17.50	898.4
19.05	1328.4
19.30	1400.0

B_WHT_070

Storage	Discharge
0	0
6.73	111.6
10.18	226.8
11.35	293.4
12.25	348.6
13.28	408.0
14.72	584.9
15.00	650.0

B_WHT_080

Storage	Discharge
0	0
3.47	79.0
5.15	159.7
5.73	206.3
6.17	244.8
6.66	286.1
7.35	425.4
7.50	480.0

B_WHT_090

Storage	Discharge
0	0
7.92	276.4
11.33	553.4
12.45	712.5
13.25	844.7
14.19	983.5
15.38	1526.3
15.50	1600.0

B_WHT_100

Storage	Discharge
0	0
16.35	484.1
23.55	976.6
25.97	1260.4
27.71	1495.5
29.73	1744.8
32.39	2645.0
33.40	3000.0

B_WHT_110

Storage	Discharge
0	0
12.94	306.9
19.13	627.8
21.21	813.6
22.79	967.9
24.55	1132.6
27.00	1676.9
28.00	2000.0

B_WHT_120

Storage	Discharge
0	0
27.78	587.3
41.05	1212.8
45.53	1576.2
48.90	1878.4
52.71	2202.6
57.94	3207.4
59	3500

B_WHT_130

Storage	Discharge
0	0
23.25	664.9
37.10	1451.9
42.12	1913.4
45.99	2305.2
50.20	2716.1
56.61	4344.9
58	4800

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_010	96	56%	6.3	11.3	87%	65.7	122.7
	96	40%	13.8	34.7	39%	130.9	182.6
	96	34%	18.2	53.8	29%	168.2	216.4
	96	29%	22.8	77.4	22%	199	242.4
	96	27%	27.4	102.9	18%	231.8	273.1
	96	19%	42.6	221.5	10%	348.4	383.0

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_015	87	52%	20.5	39.5	79%	227.6	406.4
	87	37%	44.2	120.5	36%	443	601.3
	87	31%	58.2	187.1	26%	566.5	713.6
	87	27%	72.6	268.8	20%	668	799.9
	87	24%	87.3	358.0	16%	775.3	900.5
	87	18%	135	769.3	9%	1179.2	1285.2

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_020	51	38%	13.5	36.0	47%	92.9	136.4
	51	25%	29	117.1	21%	188.2	228.3
	51	21%	38.3	185.5	16%	243.4	281.2
	51	18%	47.7	270.4	12%	289.2	323.4
	51	16%	57.3	364.1	10%	338.7	371.4
	51	11%	88.7	801.9	5%	479.5	505.3

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_030	54	39%	6.8	17.5	50%	49.2	73.8
	54	26%	14.2	54.8	23%	95.7	117.4
	54	22%	18.5	85.4	17%	122.7	143.0
	54	19%	22.9	123.4	13%	144.8	163.0
	54	17%	27.4	165.3	10%	168.8	186.2
	54	12%	42.1	360.1	6%	239.1	252.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_040	48	37%	7.6	20.8	45%	100.4	145.2
	48	24%	16.7	69.7	20%	194.3	233.7
	48	20%	22.1	110.9	15%	247.8	284.4
	48	17%	27.6	162.5	11%	292	324.9
	48	15%	33.2	219.4	9%	338.1	369.2
	48	11%	51.6	486.4	5%	534.7	562.1

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_050	55	39%	7.5	19.1	51%	87.5	132.0
	55	26%	16.4	62.5	23%	171.8	211.5
	55	22%	21.6	98.4	17%	219.9	256.9
	55	19%	27	143.6	13%	259.4	292.6
	55	17%	32.5	193.3	10%	301.1	332.6
	55	12%	50.5	425.4	6%	463.4	490.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_060	15	23%	3.6	15.6	15%	47.5	54.7
	15	13%	7.8	60.5	7%	91.8	98.1
	15	10%	10.2	99.9	5%	116.8	122.7
	15	8%	12.8	154.6	4%	137.5	142.9
	15	7%	15.4	217.0	3%	159.1	164.2
	15	5%	23.9	521.9	2%	253.1	257.6

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_070	50	37%	6.5	17.4	47%	71.3	104.6
	50	25%	14.2	57.4	21%	139.7	169.4
	50	21%	18.7	90.8	15%	178.8	206.5
	50	18%	23.3	132.4	12%	211	235.9
	50	16%	28.1	179.0	10%	245.1	268.7
	50	11%	43.4	393.4	5%	371.4	391.3

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1_080	56	40%	30.3	76.6	51%	172.8	261.4
	56	26%	66.1	250.1	23%	357.7	441.1
	56	22%	87.4	395.3	17%	465.7	544.8
	56	19%	109.2	576.3	13%	555.8	627.6
	56	17%	131.4	775.4	11%	653.5	722.6
	56	12%	203.7	1702.2	6%	913.1	966.8

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1A_010	56	53%	15.6	29.5	97%	165.9	327.4
	56	36%	37.9	105.3	41%	376.7	531.1
	56	31%	51.6	166.5	30%	501.7	652.6
	56	27%	65.9	245.9	23%	608.5	750.7
	56	24%	80.6	336.4	19%	721.3	857.0
	56	17%	129.2	752.6	11%	1138.8	1259.9

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1A_015	96	56%	4.7	8.4	87%	66.8	124.9
	96	40%	10.2	25.6	40%	128.3	179.0
	96	34%	13.5	39.9	29%	163.1	210.0
	96	29%	16.9	57.3	22%	192	233.9
	96	27%	20.4	76.5	18%	221.8	261.4
	96	19%	31.6	164.1	10%	359	394.7

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1A_020	59	41%	4.1	10.0	54%	47.4	73.2
	59	28%	8.8	31.9	25%	91.7	114.4
	59	23%	11.6	50.1	18%	117	138.1
	59	20%	14.4	72.4	14%	137.8	156.7
	59	18%	17.3	97.1	11%	159.7	177.6
	59	13%	26.8	212.5	6%	245.2	260.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1B_010	45	35%	8.6	24.5	41%	79.9	113.1
	45	23%	18.6	81.7	19%	158.1	187.9
	45	19%	24.6	130.3	14%	203.2	231.1
	45	16%	30.6	190.6	10%	240.2	265.4
	45	14%	36.8	257.8	9%	279.9	303.9
	45	10%	56.9	571.1	5%	411.3	430.9

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1B_020	51	38%	23.7	62.6	48%	278	410.2
	51	25%	51.2	204.5	22%	539.9	656.6
	51	21%	67.6	323.8	16%	689.7	798.3
	51	18%	84.4	473.0	12%	813.2	910.7
	51	16%	101.4	636.7	10%	943.1	1035.5
	51	11%	157	1401.5	5%	1451.1	1530.3

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1B_030	57	40%	13	32.3	53%	182.4	278.8
	57	27%	29	107.3	24%	361.5	448.4
	57	23%	38.6	170.6	17%	464.2	545.4
	57	19%	48.5	249.8	13%	550.4	623.7
	57	17%	58.6	337.3	11%	638.9	708.5
	57	12%	91.7	746.2	6%	1045	1108.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1B_040	46	36%	12.1	34.1	42%	147.6	210.2
	46	23%	26.1	113.0	19%	285.8	340.9
	46	19%	34.5	179.9	14%	364.7	415.9
	46	16%	43.1	264.0	11%	429.7	475.7
	46	15%	51.8	356.7	9%	497.9	541.5
	46	10%	80.2	790.2	5%	773.4	811.1

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB1B_050	49	37%	2.1	5.7	45%	20.7	30.1
	49	24%	4.5	18.6	21%	41	49.4
	49	20%	6	29.8	15%	52.7	60.6
	49	17%	7.5	43.7	11%	62.3	69.4
	49	15%	9	58.9	9%	72.5	79.3
	49	11%	13.9	129.6	5%	107.9	113.5

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB2_010	53	52%	7.1	13.5	96%	110.2	215.5
	53	35%	17.7	49.9	40%	247.8	347.1
	53	30%	24.2	79.5	29%	327.6	423.9
	53	26%	31.1	118.3	23%	397	487.7
	53	23%	38.1	162.3	18%	467.6	553.5
	53	17%	61.5	366.4	10%	829.2	915.3

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in	Historic Flow	Ult Flow (cfs)
B_WB2_020	61	42%	13.2	31.7	56%	147.5	230.2
	61	28%	28.8	102.1	25%	290.3	364.3
	61	24%	38	160.5	19%	372.1	441.1
	61	20%	47.5	233.4	14%	439.5	501.5
	61	18%	57.2	313.6	12%	510.7	569.6
	61	13%	88.7	685.6	6%	778.2	828.2

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB2_030	37	32%	12	37.3	35%	159.7	215.6
	37	20%	26	127.9	16%	307.6	356.5
	37	17%	34.4	205.5	12%	391.6	437.1
	37	14%	43	304.2	9%	460.8	501.6
	37	13%	51.7	413.6	7%	532.8	571.3
	37	9%	80.1	927.8	4%	847.3	881.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB2_040	56	40%	12	30.4	51%	150.9	228.3
	56	26%	25.9	98.0	23%	291.2	359.1
	56	22%	34.2	154.7	17%	371.3	434.3
	56	19%	42.7	225.4	13%	437.4	493.9
	56	17%	51.4	303.4	11%	506.5	560.0
	56	12%	79.6	665.3	6%	792.5	839.1

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB2_050	69	45%	11.9	26.5	63%	137.7	224.8
	69	31%	25.8	83.5	29%	269.2	346.6
	69	26%	34.1	130.9	21%	344.3	416.3
	69	22%	42.6	189.5	16%	406.1	470.7
	69	20%	51.3	254.0	13%	471.3	532.6
	69	14%	79.5	551.8	7%	723.5	775.9

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_010	51	52%	6.4	12.3	94%	94.2	182.7
	51	35%	16.1	46.0	39%	215.8	300.5
	51	30%	22.1	73.7	29%	287.1	369.7
	51	26%	28.4	109.9	22%	349.7	427.9
	51	23%	34.9	151.4	18%	413.3	487.7
	51	16%	56.4	342.9	10%	725.2	798.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_020	64	43%	1.8	4.2	59%	24.3	38.5
	64	29%	4	13.7	27%	48	60.8
	64	25%	5.3	21.6	19%	61.5	73.4
	64	21%	6.7	31.7	15%	72.6	83.3
	64	19%	8.1	42.8	12%	84.3	94.5
	64	13%	12.6	93.6	7%	135.2	144.3

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_030	63	54%	6.1	11.2	103%	51.8	105.0
	63	38%	15	39.9	44%	124.6	179.1
	63	33%	20.6	63.2	32%	168.5	222.6
	63	28%	26.5	93.6	25%	206.8	258.4
	63	25%	32.5	128.0	20%	247.5	297.2
	63	18%	52.6	287.4	11%	382.2	425.7

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_040	92	60%	16.8	28.1	123%	224.9	502.0
	92	44%	39.1	89.6	54%	472.6	728.3
	92	39%	52.7	136.4	40%	616.1	862.0
	92	34%	66.8	195.9	31%	738.1	967.1
	92	31%	81.2	262.9	25%	864.1	1080.2
	92	23%	128.6	568.1	14%	1416.6	1618.9

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_050	57	40%	14.7	36.6	53%	189.2	288.6
	57	27%	32.3	120.0	24%	372.8	461.9
	57	23%	42.9	190.5	17%	477.5	560.6
	57	19%	53.8	278.5	13%	564.3	639.0
	57	17%	64.8	374.8	11%	654.8	725.7
	57	12%	101	826.2	6%	1039.9	1102.6

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_060	46	36%	16	44.8	43%	213.2	304.7
	46	23%	34.9	149.9	20%	412.7	493.2
	46	19%	46.1	238.3	14%	525.8	600.5
	46	16%	57.6	349.8	11%	619.2	686.2
	46	15%	69.3	472.8	9%	716.3	779.7
	46	10%	107.6	1049.8	5%	1140	1196.2

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_070	28	28%	3.3	11.7	27%	46.1	58.4
	28	17%	7.2	41.9	12%	88.9	99.6
	28	14%	9.5	68.0	9%	113	123.0
	28	12%	11.9	102.2	7%	133.1	142.1
	28	10%	14.3	140.1	6%	153.8	162.3
	28	7%	22.2	321.2	3%	248.5	256.1

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_080	68	45%	6.5	14.6	62%	74.3	120.7
	68	31%	14	45.8	28%	144.6	185.6
	68	26%	18.5	71.8	21%	184.9	223.1
	68	22%	23.1	103.9	16%	218	252.2
	68	20%	27.7	138.7	13%	252.9	285.4
	68	14%	42.9	301.3	7%	387.3	415.0

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_090	59	41%	7.4	18.2	54%	119.9	184.5
	59	27%	16.2	59.1	24%	226.2	281.6
	59	23%	21.4	93.2	18%	285.7	336.6
	59	20%	26.8	136.0	14%	336.1	381.7
	59	18%	32.2	182.4	11%	386.5	429.4
	59	12%	50	400.2	6%	653.3	693.7

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_100	51	38%	8	21.3	47%	85.5	125.8
	51	25%	17.4	70.0	21%	168.2	204.2
	51	21%	23	111.0	16%	215.6	249.2
	51	18%	28.7	162.1	12%	254.5	284.7
	51	16%	34.5	218.4	10%	295.9	324.6
	51	11%	53.4	480.9	5%	446.4	470.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_110	71	46%	4.6	10.1	65%	66.1	108.9
	71	31%	10.2	32.4	29%	130.2	168.5
	71	27%	13.6	51.2	21%	166.6	202.3
	71	23%	17.1	74.6	16%	196.9	229.0
	71	21%	20.6	99.9	13%	228.1	258.5
	71	15%	32.2	218.7	7%	373.5	401.2

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3_120	34	31%	3.8	12.3	32%	51.1	67.6
	34	19%	8.8	45.6	15%	106	121.5
	34	16%	11.8	74.5	11%	137.5	152.2
	34	13%	15	112.6	8%	164	177.4
	34	12%	18.2	154.9	7%	191.5	204.3
	34	8%	28.7	355.6	4%	311.8	323.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3A_010	55	39%	15.4	39.1	51%	190.5	287.8
	55	26%	33.2	126.0	23%	368.3	453.8
	55	22%	43.9	199.3	17%	469.5	548.8
	55	19%	54.8	290.3	13%	552.8	623.9
	55	17%	65.8	389.8	11%	640.1	707.4
	55	12%	101.9	855.0	6%	999	1057.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3A_020	51	38%	4.2	11.1	47%	56.9	83.8
	51	25%	9.1	36.5	21%	110.1	133.7
	51	21%	12.1	58.3	16%	140.4	162.3
	51	18%	15.1	85.1	12%	165.4	185.1
	51	16%	18.2	115.0	10%	191.4	210.0
	51	11%	28.2	253.4	5%	306.2	322.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3B_010	51	39%	12.2	31.2	48%	137.8	203.3
	51	26%	27.4	105.7	22%	281.5	342.3
	51	22%	36.6	168.9	16%	364.5	421.9
	51	19%	46	247.8	12%	433.5	485.5
	51	17%	55.6	335.0	10%	506.5	556.1
	51	12%	87.1	738.5	5%	783.7	826.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3B_020	47	37%	7.5	20.1	44%	89.8	128.9
	47	24%	16.5	67.7	20%	176.4	211.3
	47	20%	21.8	107.4	14%	225.9	258.5
	47	17%	27.2	156.9	11%	266.6	295.9
	47	15%	32.8	212.2	9%	309.5	337.3
	47	11%	50.9	465.9	5%	478.6	502.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3B_030	51	39%	11.3	28.9	48%	139.9	206.5
	51	26%	24.5	94.4	22%	270.8	329.4
	51	22%	32.4	149.4	16%	345.3	399.7
	51	19%	40.4	217.4	12%	406.7	455.5
	51	17%	48.5	291.9	10%	471	517.2
	51	12%	75.2	636.8	5%	734.3	774.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3C_010	55	41%	5.7	14.0	51%	48.2	72.6
	55	27%	12.5	46.0	23%	97.9	120.5
	55	23%	16.6	73.0	17%	126.5	147.7
	55	20%	20.7	106.0	13%	150.2	169.4
	55	17%	24.9	142.3	10%	175.7	194.1
	55	12%	38.7	310.1	6%	255.1	269.9

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3C_020	48	38%	10.5	27.8	45%	106.5	154.1
	48	25%	22.8	91.9	20%	210.6	253.4
	48	21%	30.1	145.5	15%	270.3	310.3
	48	18%	37.6	212.7	11%	319.6	355.6
	48	16%	45.2	286.5	9%	372.1	406.4
	48	11%	70.1	627.5	5%	555.9	584.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3D_010	89	53%	5.6	10.6	81%	55.8	100.8
	89	37%	12	32.0	37%	110	150.3
	89	32%	15.9	50.0	27%	141.1	178.7
	89	28%	19.8	71.7	20%	166.6	200.4
	89	25%	23.8	95.4	17%	193.9	226.0
	89	18%	36.8	204.8	9%	289.1	315.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3D_020	46	36%	9.1	25.5	43%	119.8	171.0
	46	23%	19.7	84.8	19%	230.5	275.3
	46	19%	26.1	135.3	14%	293.5	335.1
	46	16%	32.5	197.9	11%	345.6	382.9
	46	15%	39.1	267.6	9%	399.7	434.9
	46	10%	60.6	593.2	5%	632.7	663.8

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3D_030	77	57%	14	24.6	112%	144.9	307.7
	77	40%	32.4	80.1	49%	312	463.6
	77	35%	43.6	123.1	36%	410.3	557.1
	77	31%	55.2	177.9	28%	493.4	630.6
	77	28%	67.1	239.9	22%	581.7	712.0
	77	20%	106.2	522.1	13%	903.2	1018.3

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3D_040	51	38%	4.9	13.0	47%	54.3	80.1
	51	25%	10.5	42.0	22%	106.1	129.0
	51	21%	13.9	66.7	16%	135.7	157.0
	51	18%	17.4	97.7	12%	160.1	179.3
	51	16%	20.9	131.4	10%	185.9	204.1
	51	11%	32.3	288.9	5%	282.8	298.2

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3D_050	76	48%	3.8	8.0	69%	59.4	100.4
	76	33%	8.2	24.8	31%	112.1	147.3
	76	28%	10.8	38.6	23%	141.6	173.9
	76	24%	13.4	55.4	17%	166.3	195.2
	76	22%	16.2	74.3	14%	191.2	218.4
	76	16%	25	160.2	8%	321.1	346.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WB3D_070	70	45%	13.3	29.3	64%	176.1	288.8
	70	31%	29.1	93.3	29%	340.9	440.1
	70	26%	38.5	146.4	21%	434.6	526.6
	70	23%	48.1	211.8	16%	512.1	594.6
	70	20%	57.9	283.6	13%	592.6	670.6
	70	15%	89.8	616.4	7%	938.8	1007.6

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_010	90	53%	27.3	51.4	81%	298.7	541.4
	90	38%	59.8	158.7	37%	591.6	810.1
	90	32%	79.1	247.3	27%	759.3	963.2
	90	28%	98.9	355.7	20%	897.3	1080.5
	90	25%	119.1	474.2	17%	1043.5	1217.7
	90	18%	184.9	1021.8	9%	1583.9	1731.0

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_015	87	52%	9.9	19.0	79%	137.7	246.5
	87	37%	21.5	58.4	36%	263.9	358.7
	87	31%	28.4	90.9	26%	335.3	422.8
	87	27%	35.5	130.9	20%	394.3	472.5
	87	24%	42.7	174.3	16%	455.4	529.3
	87	18%	66.2	375.5	9%	733.2	799.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_020	54	39%	12.6	32.3	50%	201.4	302.4
	54	26%	27.7	106.5	23%	385.6	473.5
	54	22%	36.8	169.3	17%	489.1	570.3
	54	19%	46	247.1	13%	577	649.9
	54	17%	55.5	333.6	10%	665.2	734.0
	54	12%	86.3	735.3	6%	1129.8	1194.8

*Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_040	91	60%	12.8	21.5	122%	160.7	357.3
	91	43%	27.7	63.8	54%	310.5	477.1
	91	38%	36.6	95.4	40%	395.7	552.3
	91	34%	45.7	135.0	31%	466.2	609.6
	91	31%	55	179.5	25%	540	673.9
	91	22%	85.1	379.1	14%	844.7	964.3

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_045	94	55%	2.8	5.1	85%	26.4	48.9
	94	39%	6.2	15.8	39%	52.6	73.0
	94	33%	8.1	24.4	28%	67.7	86.7
	94	29%	10.1	34.9	21%	80.2	97.4
	94	26%	12.2	46.6	17%	93.5	109.9
	94	19%	18.9	100.1	10%	137.6	151.0

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_050	46	36%	4.9	13.7	43%	70.8	101.2
	46	23%	10.4	44.7	19%	133.5	159.5
	46	19%	13.8	71.4	14%	168.8	192.8
	46	16%	17.2	104.5	11%	198.4	219.9
	46	15%	20.6	140.6	9%	228.6	248.8
	46	10%	31.9	311.4	5%	373.4	391.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_055	58	41%	12	29.6	53%	102.5	157.2
	58	27%	26.1	95.9	24%	205.9	255.9
	58	23%	34.4	150.8	18%	265.5	312.4
	58	20%	43	219.7	13%	314.7	357.0
	58	18%	51.7	295.0	11%	367.6	408.0
	58	12%	80.1	645.9	6%	534.2	566.9

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_060	48	37%	26.5	72.4	45%	252.3	365.4
	48	24%	58	241.6	20%	505	607.9
	48	20%	76.7	383.9	15%	650.5	747.1
	48	17%	95.8	562.3	11%	770.4	857.5
	48	15%	115.3	759.5	9%	898.4	981.4
	48	11%	179	1681.7	5%	1328.4	1396.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_070	73	46%	14.5	31.2	66%	111.6	185.7
	73	32%	31.7	98.7	30%	226.8	295.3
	73	27%	41.9	154.6	22%	293.4	357.8
	73	23%	52.3	223.3	17%	348.6	406.8
	73	21%	63	298.9	14%	408	463.7
	73	15%	97.7	648.6	8%	584.9	629.4

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_080	61	42%	8.3	19.9	56%	79	123.5
	61	28%	18.2	64.3	26%	159.7	200.6
	61	24%	24.1	101.4	19%	206.3	244.7
	61	20%	30.2	147.9	14%	244.8	279.5
	61	18%	36.4	198.8	12%	286.1	319.3
	61	13%	56.6	435.7	6%	425.4	452.9

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_090	41	34%	23.4	69.1	39%	276.4	383.7
	41	22%	52.1	239.5	18%	553.4	651.0
	41	18%	69.2	384.6	13%	712.5	804.2
	41	15%	86.8	568.8	10%	844.7	927.5
	41	14%	104.8	774.0	8%	983.5	1062.3
	41	9%	163.4	1735.9	4%	1526.3	1594.5

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_100	46	36%	46	129.4	42%	484.1	689.8
	46	23%	101.8	440.1	19%	976.6	1165.2
	46	19%	135.2	704.0	14%	1260.4	1437.8
	46	16%	169.5	1036.9	11%	1495.5	1655.8
	46	15%	204.4	1405.4	9%	1744.8	1897.7
	46	10%	318.6	3134.2	5%	2645	2774.2

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_110	54	39%	33.3	85.7	50%	306.9	459.8
	54	26%	73.9	285.5	23%	627.8	770.0
	54	22%	98.1	453.7	16%	813.6	947.8
	54	19%	123.1	665.0	13%	967.9	1089.4
	54	17%	148.4	897.1	10%	1132.6	1248.9
	54	12%	231.5	1984.6	6%	1676.9	1772.8

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_120	54	39%	71.5	184.0	50%	587.3	879.6
	54	26%	158.7	613.5	23%	1212.8	1487.3
	54	22%	210.7	975.0	16%	1576.2	1836.0
	54	19%	264.3	1428.5	13%	1878.4	2114.0
	54	17%	318.8	1928.2	10%	2202.6	2428.5
	54	12%	497	4263.4	6%	3207.4	3390.6

Subbasin	Change in Imperv	% Change in Volume	Historic Volume (AC-FT)	Ult Volume (AC-FT)	% Change in Flow	Historic Flow (cfs)	Ult Flow (cfs)
B_WHT_130	59	41%	56.9	139.3	54%	664.9	1025.2
	59	28%	134.8	489.8	25%	1451.9	1809.6
	59	23%	182.6	791.7	18%	1913.4	2256.6
	59	20%	232.2	1172.3	14%	2305.2	2619.8
	59	18%	283	1595.4	11%	2716.1	3019.2
	59	13%	450.7	3588.1	6%	4344.9	4614.9

Appendix H

SENSITIVITY ANALYSES RESPONSE MATRIX



Scenario	Title	Description		Return Interval	% Change in Peak Flow for Subbasins			% Change in Peak Flow at junctions			Notes
					Average	Min	Max	Average	Min	Max	
1	Land Use & Percent Imperviousness	Applied Ultimate Land Use and % Impervious Cover from Existing Conditions Model to Historic Baseline Model		2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)	59%	13%	125%	82%	40%	125%	Increases in impervious cover increases runoff from sub-basins and at junction downstream. More frequent events are impacted more significantly than less frequent events. A relationship was noted between the CN value, % change in peak flow, and % change in rainfall volume. Estimated detention rating curves were developed for Sub-basins with CN value less than 77, and greater than or equal to 77. See Scenario 4 - Detention for more notes.
					27%	6%	53%	34%	18%	52%	
					19%	4%	39%	25%	13%	38%	
					15%	3%	30%	19%	10%	29%	
					12%	3%	24%	15%	8%	24%	
					7%	1%	14%	9%	5%	13%	
2	Change in Drainage Area & Lag Time	Applied Existing condition DA's and Lag times to Historic Baseline Model		2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)	6%	-63%	156%	10%	-27%	156%	General relationship between % change in DA and Lag times and % change in peak flow.
					6%	-62%	145%	9%	-27%	145%	
					5%	-61%	142%	9%	-27%	142%	
					5%	-61%	141%	9%	-27%	141%	
					5%	-61%	138%	8%	-27%	138%	
					7%	-64%	161%	9%	-27%	161%	
3	Valley Storage	Developed rating tables for Modified Puls routing using the Historic Baseline HEC-RAS model that reflected topographic data from 1955. Produced rating tables that reduced valley storage in each modeled routing reach by 10% up to 50% reduction.		2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)				4%	0%	12%	It was noted that the existing condition valley storage reduction (compared to the base model) falls within this range. Impacts were noted at junctions only as sub-basin run-off is not impacted by changes to the routing reaches. Impacts to peak flows at junctions increase as valley storage is reduced. The impacts are greater for more frequent events. There is a general trend for impacts to be cumulative as contributing drainage area increases.
								3%	0%	9%	
								3%	0%	9%	
								3%	0%	8%	
								2%	0%	8%	
								3%	0%	11%	
				2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)				9%	0%	26%	
								6%	0%	21%	
								6%	0%	21%	
								6%	0%	20%	
								5%	0%	19%	
								6%	0%	21%	
				2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)				14%	0%	44%	
								10%	0%	34%	
								9%	0%	0%	
								9%	0%	33%	
								8%	0%	30%	
								9%	0%	31%	
				2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)				19%	0%	67%	
								14%	0%	52%	
								13%	0%	51%	
								12%	0%	49%	
								11%	0%	43%	
								12%	0%	49%	
				2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)				25%	0%	98%	
								18%	0%	74%	
								16%	0%	73%	
								15%	0%	67%	
								14%	0%	69%	
								15%	0%	70%	
4	Detention/Retention	Reservoir routing was added to each test the impact of detention due to increased % Imperviousness.		2-yr (0.5 ACE) 10-yr (0.1 ACE) 25-yr (0.04 ACE) 50-yr (0.02 ACE) 100-yr (0.01 ACE) 500-yr (0.002 ACE)	-6%	-19%	31%	21%	-11%	90%	As noted for Scenario 1, a relationship was observed between the CN value, % change in flow, and % change in volume. Separate detention rating curves were developed for Sub-basins with CN value less than 77, and greater than or equal to 77. These rating curves estimated the required detention per frequency to mitigate peak flow increases due to increased % impervious cover. Results indicate that these rating tables generally mitigate increases in peak flow for Sub-basins and downstream within some exceptions.
					-9%	-21%	4%	-1%	-14%	29%	
					-6%	-23%	5%	-3%	-15%	21%	
					-5%	-23%	4%	-5%	-15%	14%	
					-5%	-23%	4%	-5%	-15%	10%	
					0%	-21%	5%	-6%	-20%	4%	

Appendix I

REVISED EXISTING CONDITIONS HYDROLOGIC MODEL PARAMETERS



HMS ALPHA ORDER	HMS Basin Name	Sub-basin	Existing Model CN	Existing Model % Impervious	Percent Impervious Updated?	Revised % Impervious
1	B_WB1A_010	29	73.7	56		
2	B_WB1A_015	56	80	66		
3	B_WB1A_020	58	80	41	Y	58
4	B_WB1B_010	38	79.8	48		
5	B_WB1B_020	27	79.9	52		
6	B_WB1B_030	28	78.2	59		
7	B_WB1B_040	36	80	48		
8	B_WB1B_050	57	80	51		
9	B_WB1_010	54	80	9	Y	22
10	B_WB1_015	30	80	14	Y	28
11	B_WB1_020	31	79.7	54		
12	B_WB1_030	39	80	61	Y	65
13	B_WB1_040	37	80	49		
14	B_WB1_050	41	80	56		
15	B_WB1_060	40	80	16		
16	B_WB1_070	35	80	53		
17	B_WB1_080	33	80	36		
18	B_WB2_010	47	73.1	53		
19	B_WB2_020	49	80	25		
20	B_WB2_030	48	80	39		
21	B_WB2_040	46	80	58		
22	B_WB2_050	3	80	71		
23	B_WB3A_010	11	80	58		
24	B_WB3A_020	61	80	51		
25	B_WB3B_010	18	77.7	53		
26	B_WB3B_020	19	80	47		
27	B_WB3B_030	5	80	54		
28	B_WB3C_010	21	80	55		
29	B_WB3C_020	20	80	50		
30	B_WB3D_010	17	80	88		
31	B_WB3D_020	16	80	48		
32	B_WB3D_030	14	75.7	68		
33	B_WB3D_040	6	80	39		
34	B_WB3D_050	62	80	27		
35	B_WB3D_070	8	79.9	71		
36	B_WB3_010	26	71.5	52		
37	B_WB3_020	55	78.9	65		
38	B_WB3_030	1	73.3	65		
39	B_WB3_040	2	76	70		
40	B_WB3_050	22	78.9	47		
41	B_WB3_060	4	79.9	36		
42	B_WB3_070	7	80	28		
43	B_WB3_080	23	80	71		
44	B_WB3_090	60	80	49		
45	B_WB3_100	15	80	52		
46	B_WB3_110	9	79.5	71		
47	B_WB3_120	59	77	34		
48	B_WHT_010	32	79.9	58	Y	62
49	B_WHT_015	52	80	79		
50	B_WHT_020	44	78.6	57		
51	B_WHT_040	34	80	15	Y	41
52	B_WHT_045	53	80	3		
53	B_WHT_050	45	79.9	48		
54	B_WHT_055	51	80	43	Y	48
55	B_WHT_060	50	80	49		
56	B_WHT_070	43	80	58		
57	B_WHT_080	42	79.1	64		
58	B_WHT_090	10	78.7	42		
59	B_WHT_100	12	79.2	47		
60	B_WHT_110	25	78.4	55		
61	B_WHT_120	13	78.6	54		
62	B_WHT_130	24	74.9	51	Y	53

Appendix J

DETENTION BASIN RATING TABLES FOR REVISED HYDROLOGIC MODEL



B_WB1_015						From Whites_Branch.hms model (existing conditions) B_WB1_015					
Detention Basin HMS Basin		1									
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)	Storm Event	Q (cfs)	Sub-Basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
740	858	1	28571	28571	0.66	0.5/50%	189	23.4	3.62	15.48%	29.3
741	56284		80901	109472	2.51	0.1/10%	359.9	47.9	3.62	7.56%	27.2
742	105518		118806	118806	2.73	0.04/4%	458.5	62.4	3.62	5.81%	26.6
743	132093		141551	260356	5.98	0.02/2%	539.3	77.1	3.62	4.70%	25.3
744	151008		157812	157812	3.62	0.01/1%	626.7	92.1	3.62	3.93%	24.7
745	164616					0.002/0.2%	898.2	140.8	3.62	2.57%	23.1
											26.0
AVG											
B_WB1_020						From Whites_Branch.hms model (existing conditions) B_WB1_020					
Detention Basin HMS Basin		4									
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)	Storm Event	Q (cfs)	Sub-Basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
743	8972	1	8972	8972	0.21	0.5/50%	280.3	20.7	2.29	11.08%	31.1
744	8972					0.1/10%	441.9	37.3	2.29	6.15%	27.2
						0.04/4%	534.6	46.7	2.29	4.91%	26.3
						0.02/2%	609.5	56.3	2.29	4.07%	24.8
						0.01/1%	687.7	66	2.29	3.48%	23.9
						0.002/0.2%	1092.2	97.1	2.29	2.36%	25.8
											26.5
AVG											
B_WB1_020											
Detention Basin HMS Basin		5									
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)	Storm Event	Q (cfs)	Sub-Basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
755	2667	1	7759	7759	0.18	0.5/50%	280.3	20.7	2.29	11.08%	31.1
756	12851		15768	23527	0.54	0.1/10%	441.9	37.3	2.29	6.15%	27.2
757	18685		20583	20583	0.47	0.04/4%	534.6	46.7	2.29	4.91%	26.3
758	22481		24080	44663	1.03	0.02/2%	609.5	56.3	2.29	4.07%	24.8
759	25680		27197	27197	0.62	0.01/1%	687.7	66	2.29	3.48%	23.9
760	28715		30260	57457	1.32	0.002/0.2%	1092.2	97.1	2.29	2.36%	25.8
761	31805		33488	90945	2.09						
762	35171										

B_WB1B_010						From Whites_Branch.hms model (existing conditions) B_WB1B_010						
Detention Basin HMS Basin		6				Storm Event	Sub-basin Runoff Volume (AF)		Detention Basin Vol (AF)		Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)		Q (cfs)					
753	325	1	1468	1468	0.03	0.5/50%	169.8	13.2	2.17	16.45%	27.9	
754	2612		4686	6154	0.14	0.1/10%	273.8	24.1	2.17	9.01%	24.7	
755	6759		9435	15589	0.36	0.04/4%	333.6	30.3	2.17	7.16%	23.9	
756	12111		14209	29798	0.68	0.02/2%	381.7	36.7	2.17	5.92%	22.6	
757	16306		18159	47956	1.10	0.01/1%	432.4	43.1	2.17	5.04%	21.8	
758	20011		21640	69596	1.60	0.002/0.2%	675.6	63.7	2.17	3.41%	23.0	
759	23268		24967	94563	2.17						24.0	
760	26665										AVG	
B_WB3_010						From Whites_Branch.hms model (existing conditions) B_WB3_010						
Detention Basin HMS Basin		7				Storm Event	Sub-basin Runoff Volume (AF)		Detention Basin Vol (AF)		Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)		Q (cfs)					
743	2163	1	4281	4281	0.10	0.5/50%	261.4	14.1	1.34	9.50%	24.8	
744	6398		7408	11688	0.27	0.1/10%	414.4	26	1.34	5.15%	21.4	
745	8417		9242	20930	0.48	0.04/4%	499.8	33	1.34	4.06%	20.3	
746	10066		10857	31786	0.73	0.02/2%	577.6	40	1.34	3.35%	19.3	
747	11647		12448	44234	1.02	0.01/1%	648.6	47.2	1.34	2.84%	18.4	
748	13249		14123	58357	1.34	0.002/0.2%	1238.8	70.7	1.34	1.89%	23.5	
749	14996										21.3	
B_WB3_060						From Whites_Branch.hms model (existing conditions) B_WB3_060						
Detention Basin HMS Basin		10				Storm Event	Sub-basin Runoff Volume (AF)		Detention Basin Vol (AF)		Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)		Q (cfs)					
691.5	28790	0.5	28790	14395	0.33	0.5/50%	170.4	23.8	0.33	1.39%	2.4	
692	28790					0.1/10%	300.6	45.1	0.33	0.73%	2.2	
						0.04/4%	376	57.4	0.33	0.58%	2.2	
						0.02/2%	436.8	69.9	0.33	0.47%	2.1	
						0.01/1%	503.5	82.5	0.33	0.40%	2.0	
						0.002/0.2%	701.9	123.5	0.33	0.27%	1.9	
											2.1	
											AVG	

B_WB3_080						From Whites_Branch.hms model (existing conditions) B_WB3_080					
Detention Basin HMS Basin		11 B_WB3_080				Storm Event		Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)						
661.2	24400	0.8	30216	24173	0.55	0.5/50%					
662	36032					0.1/10%					
						0.04/4%					
						0.02/2%					
						0.01/1%					
						0.002/0.2%					
											7.2
											AVG

B_WB2_010						From Whites_Branch.hms model (existing conditions) B_WB2_010					
Detention Basin HMS Basin		13 B_WB2_010				Storm Event		Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)						
721	38579	1	40624	40624	0.93	0.5/50%					
722	42669					0.1/10%					
						0.04/4%					
						0.02/2%					
						0.01/1%					
						0.002/0.2%					
											12.6
											AVG

B_WB1A_015						From Whites_Branch.hms model (existing conditions) B_WB1A_015					
Detention Basin HMS Basin		16 B_WB1A_015				Storm Event		Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)						
721	73	1	3902	3902	0.09	0.5/50%					
722	7731					0.1/10%					
						0.04/4%					
						0.02/2%					
						0.01/1%					
						0.002/0.2%					
											3.4
											AVG

B_WB2_040						From Whites_Branch.hms model (existing conditions) B_WB2_040					
Detention Basin HMS Basin		20 B_WB2_040				Storm Event		Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)						
655.3	22632	1	22632	22632	0.52	0.5/50%					
656.3	22632					0.1/10%					
						0.04/4%					
						0.02/2%					
						0.01/1%					
						0.002/0.2%					
											6.2
											AVG

B_WB2_050						From Whites_Branch.hms model (existing conditions) B_WB2_050					
Detention Basin HMS Basin		B_WB2_050									
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)	Storm Event	Q (cfs)	Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
653.5	17932	1	17932	17932	0.41	0.5/50%	276.1	21.7	0.41	1.90%	5.2
654.5	17932					0.1/10%	418	37.6	0.41	1.09%	4.6
						0.04/4%	500.1	46.5	0.41	0.89%	4.4
						0.02/2%	565.3	55.5	0.41	0.74%	4.2
						0.01/1%	634.5	64.6	0.41	0.64%	4.0
						0.002/0.2%	981.2	93.8	0.41	0.44%	4.3
										4.5	AVG

B_WB2_080						From Whites_Branch.hms model (existing conditions) B_WB2_080					
Detention Basin HMS Basin		B_WHT_080									
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)	Storm Event	Q (cfs)	Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
653.5	8412	1	8412	8412	0.19	0.5/50%	130.4	9.3	0.19	2.08%	2.7
654.5	8412					0.1/10%	199.6	16.3	0.19	1.18%	2.4
						0.04/4%	239.3	20.3	0.19	0.95%	2.3
						0.02/2%	271.6	24.4	0.19	0.79%	2.1
						0.01/1%	304.9	28.4	0.19	0.68%	2.1
						0.002/0.2%	491.2	41.5	0.19	0.47%	2.3
										2.3	AVG

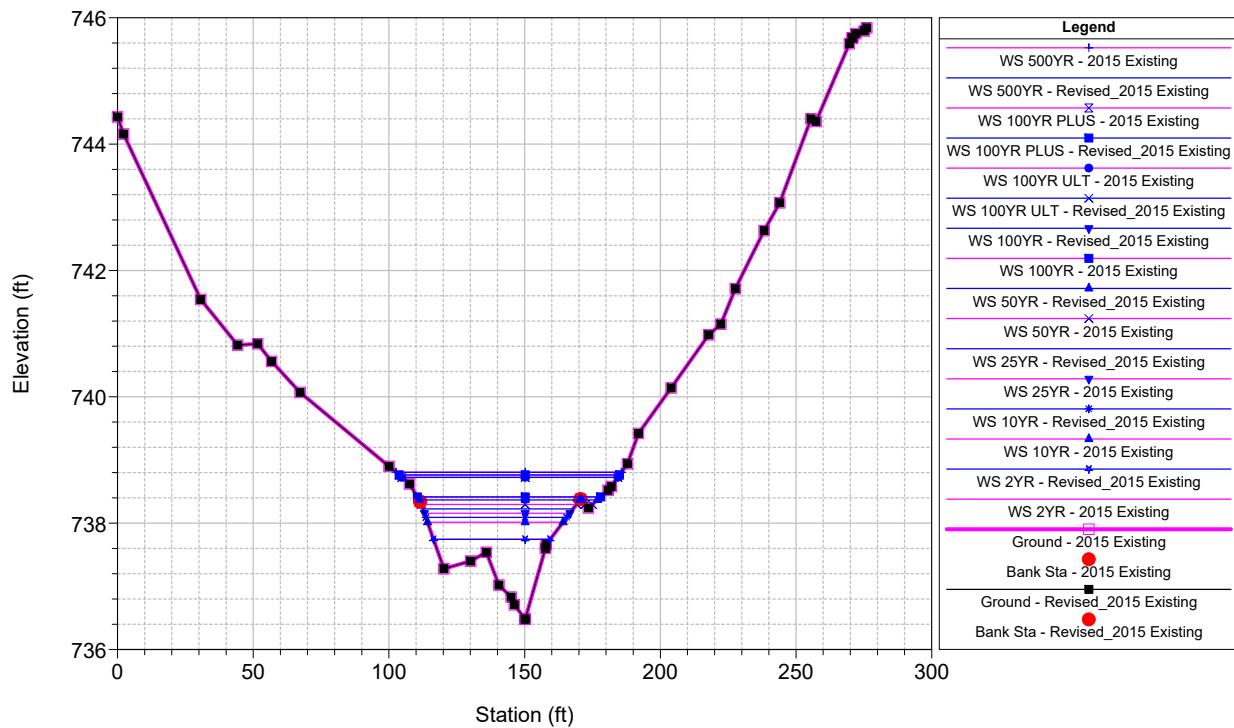
B_WB2_070						From Whites_Branch.hms model (existing conditions) B_WB2_070					
Detention Basin HMS Basin		B_WHT_070									
Elevation	Area (ft ²)	Depth (ft)	Ave Area (ft ²)	Cumulative Volume (ft ³)	Cumulative Volume (AF)	Storm Event	Q (cfs)	Sub-basin Runoff Volume (AF)	Detention Basin Vol (AF)	Percent Volume	Estimated Diverted Q (cfs)
651.5	28662	1.5	37026	55539	1.28	0.5/50%	314	27.1	1.28	4.70%	14.8
653	45390					0.1/10%	496.3	48.2	1.28	2.65%	13.1
						0.04/4%	601.7	60.2	1.28	2.12%	12.7
						0.02/2%	685.5	72.4	1.28	1.76%	12.1
						0.01/1%	775.3	84.6	1.28	1.51%	11.7
						0.002/0.2%	1172.5	124.1	1.28	1.03%	12.0
										12.7	AVG

Appendix K

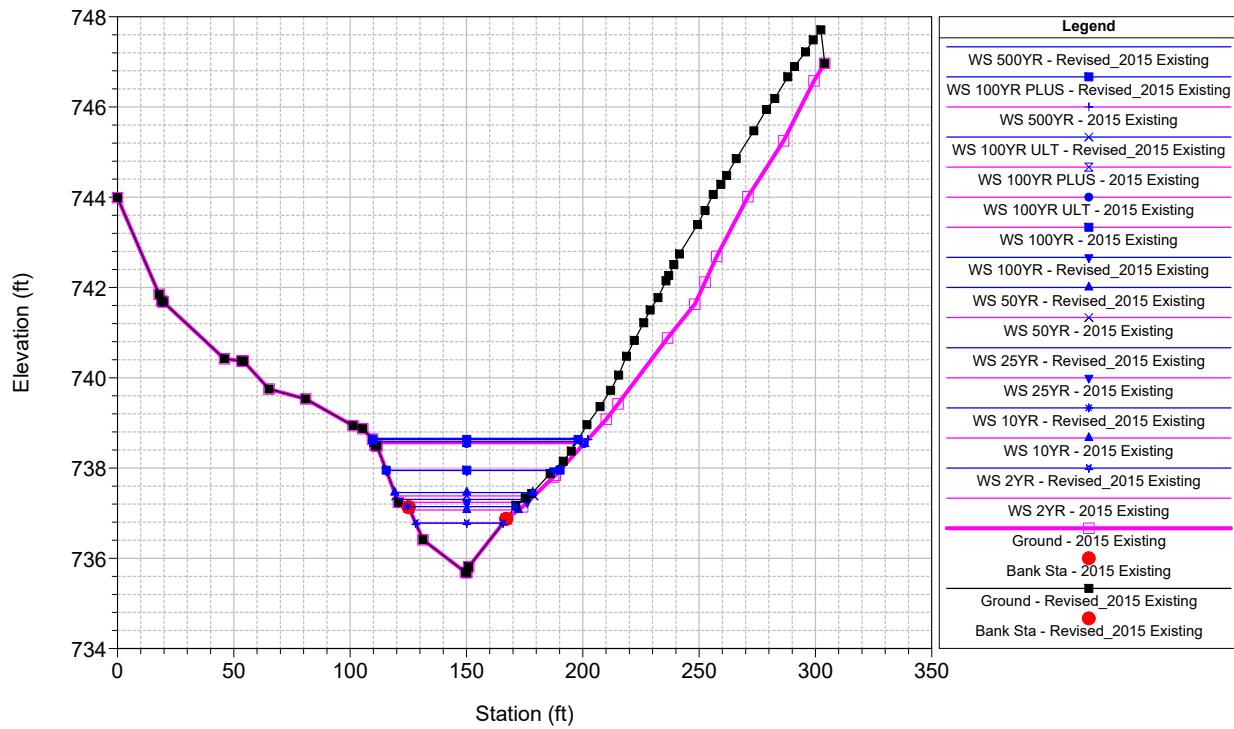
REVISED EXISTING CONDITIONS HEC-RAS CROSS-SECTION PLOTS



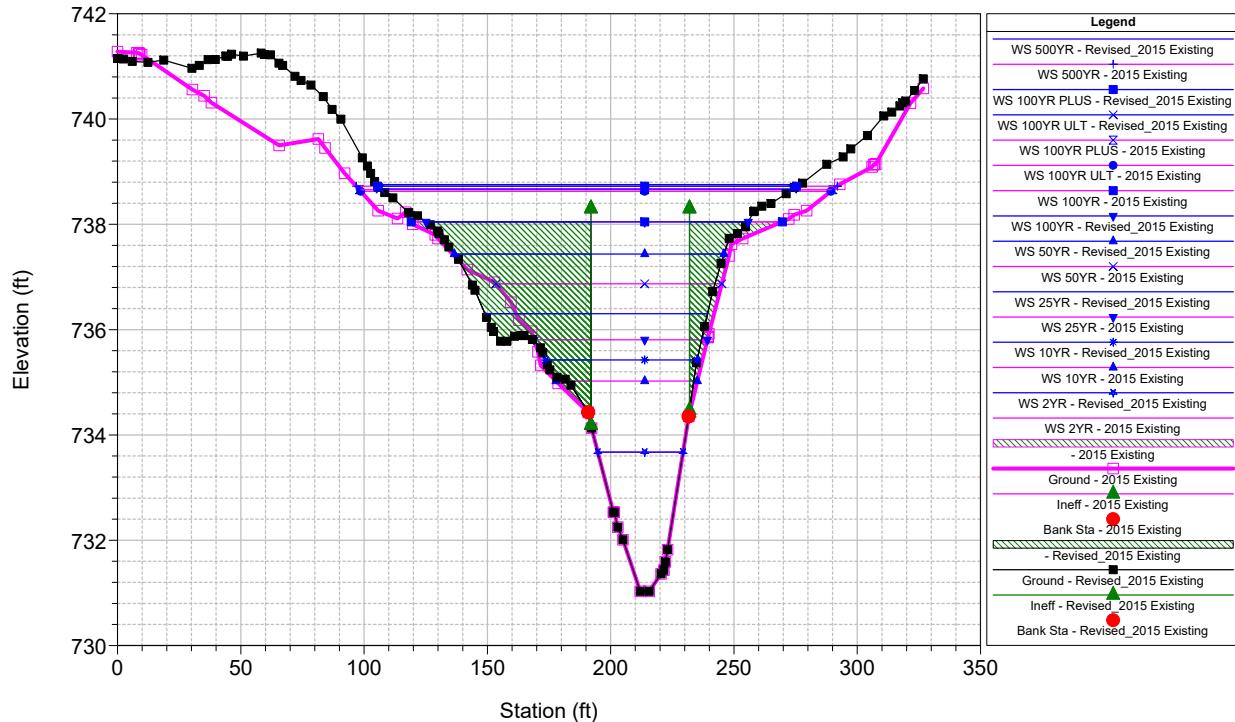
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 15081



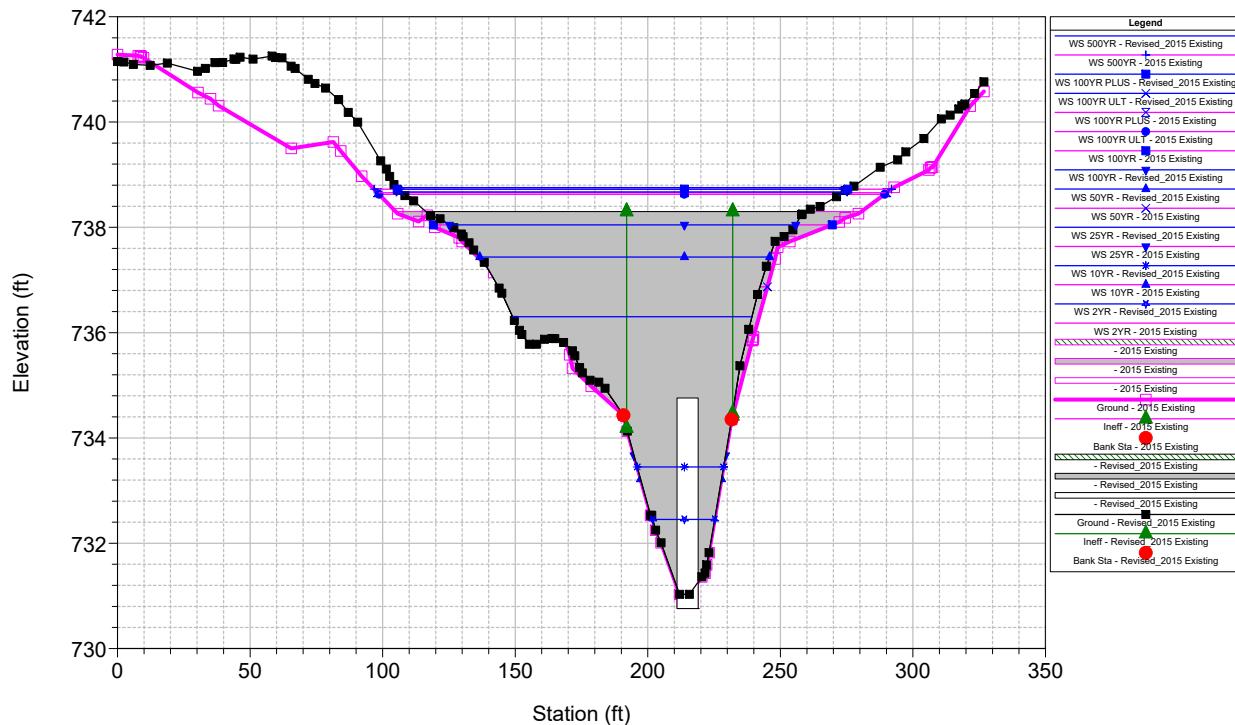
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 15059



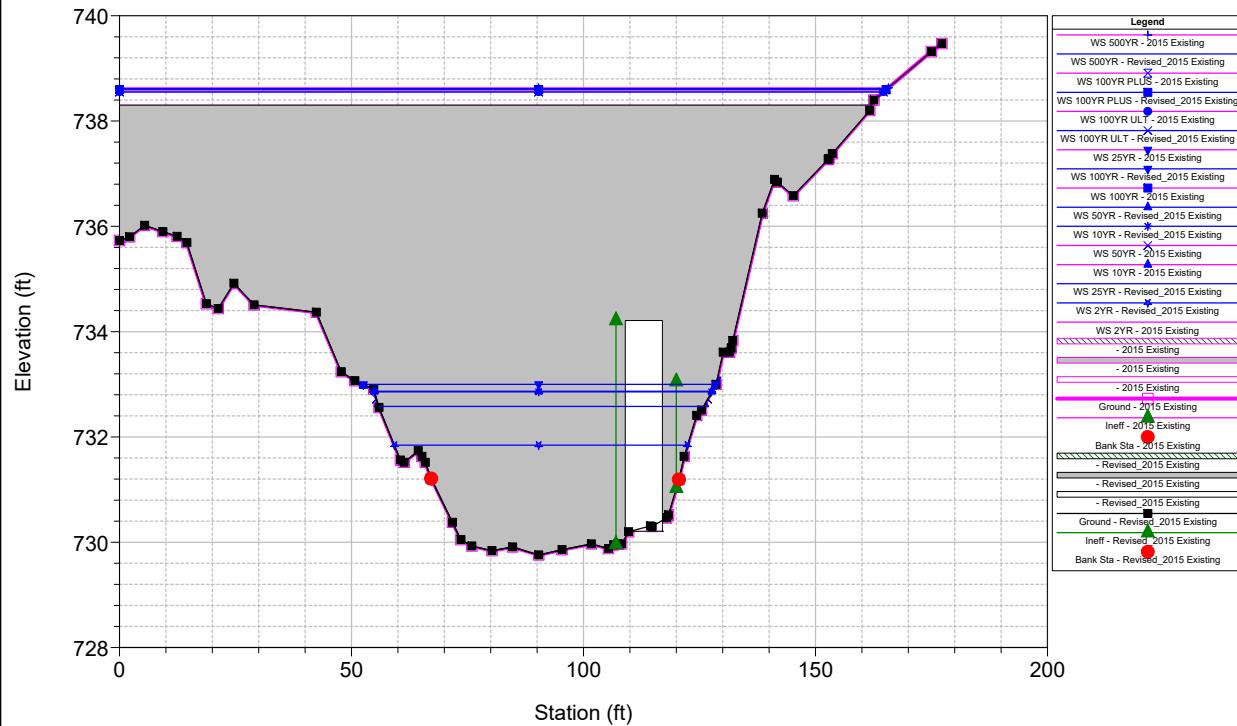
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 15005 Upstream of Old Denton Rd



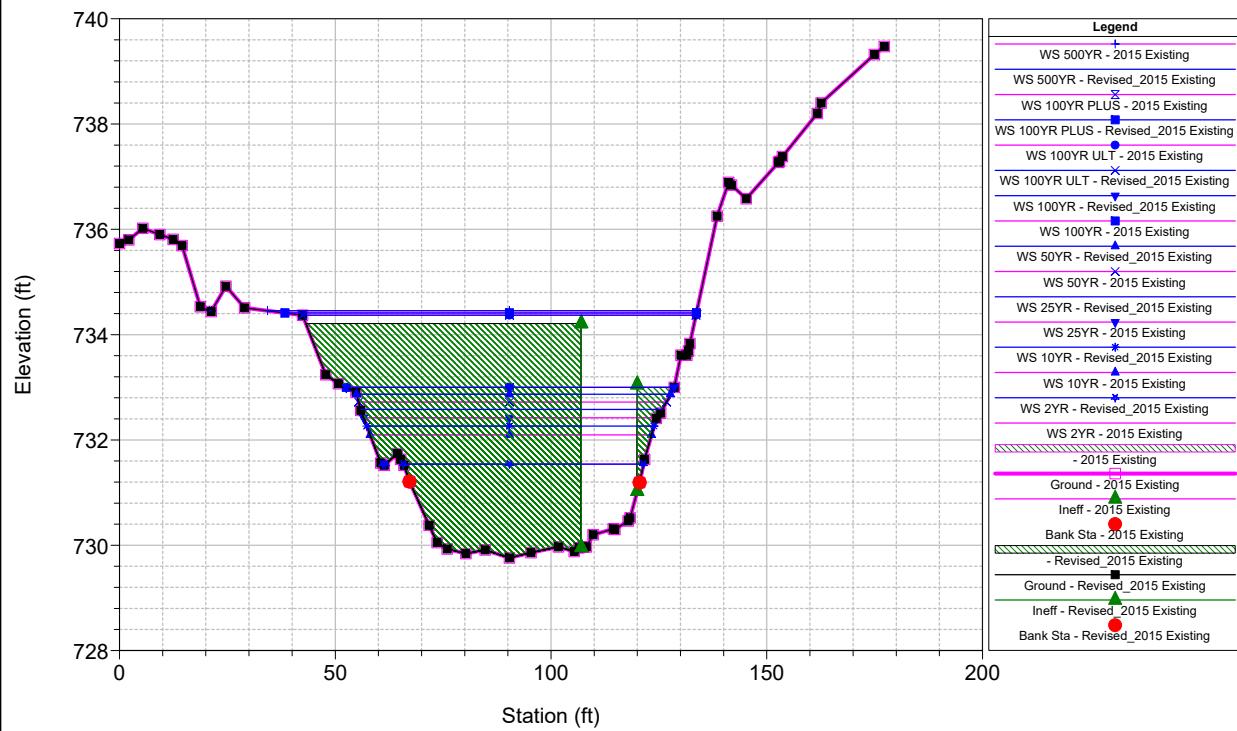
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14932 Culv Old Denton Rd



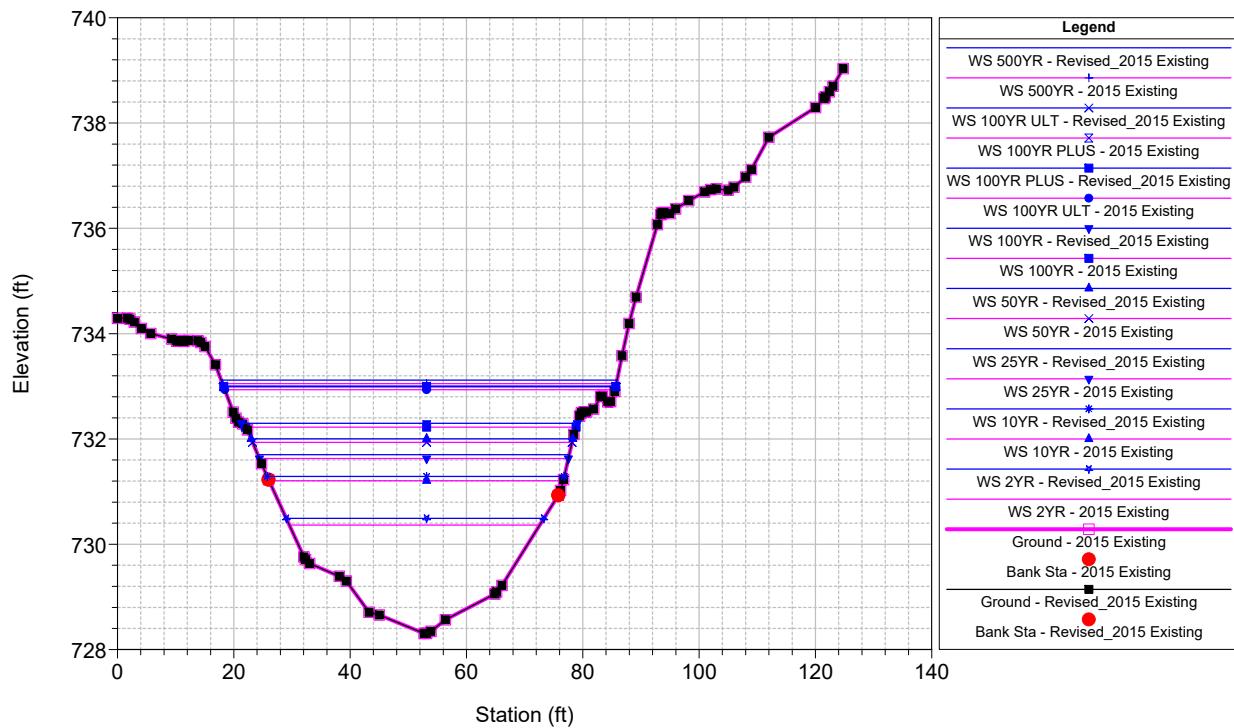
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14932 Culv Old Denton Rd



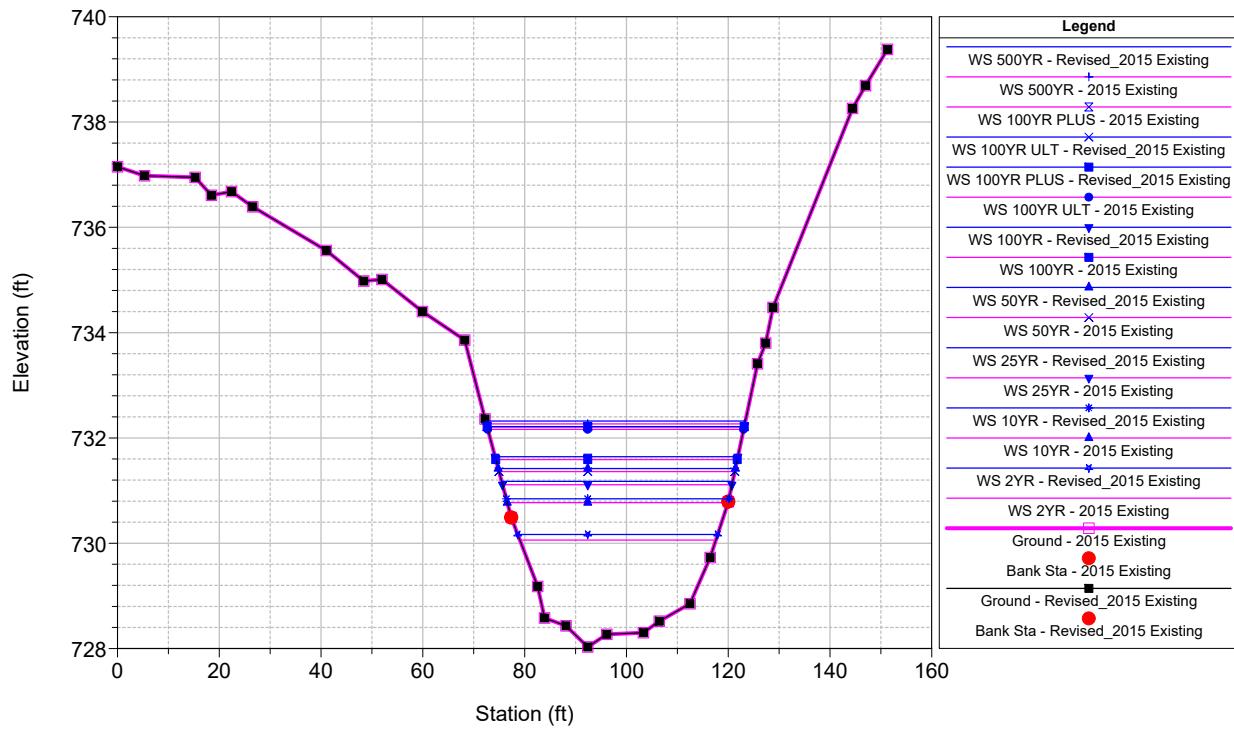
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14839 Downstream of Old Denton Rd, Effective Cross Section 15857



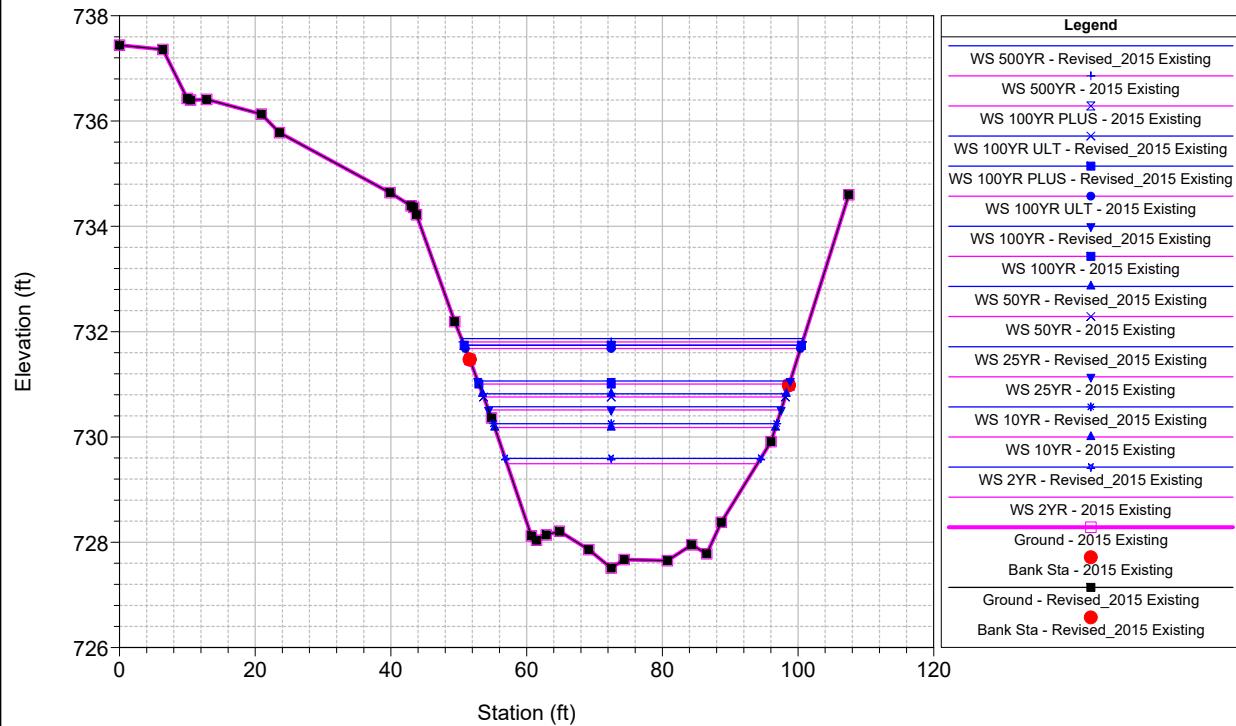
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14816



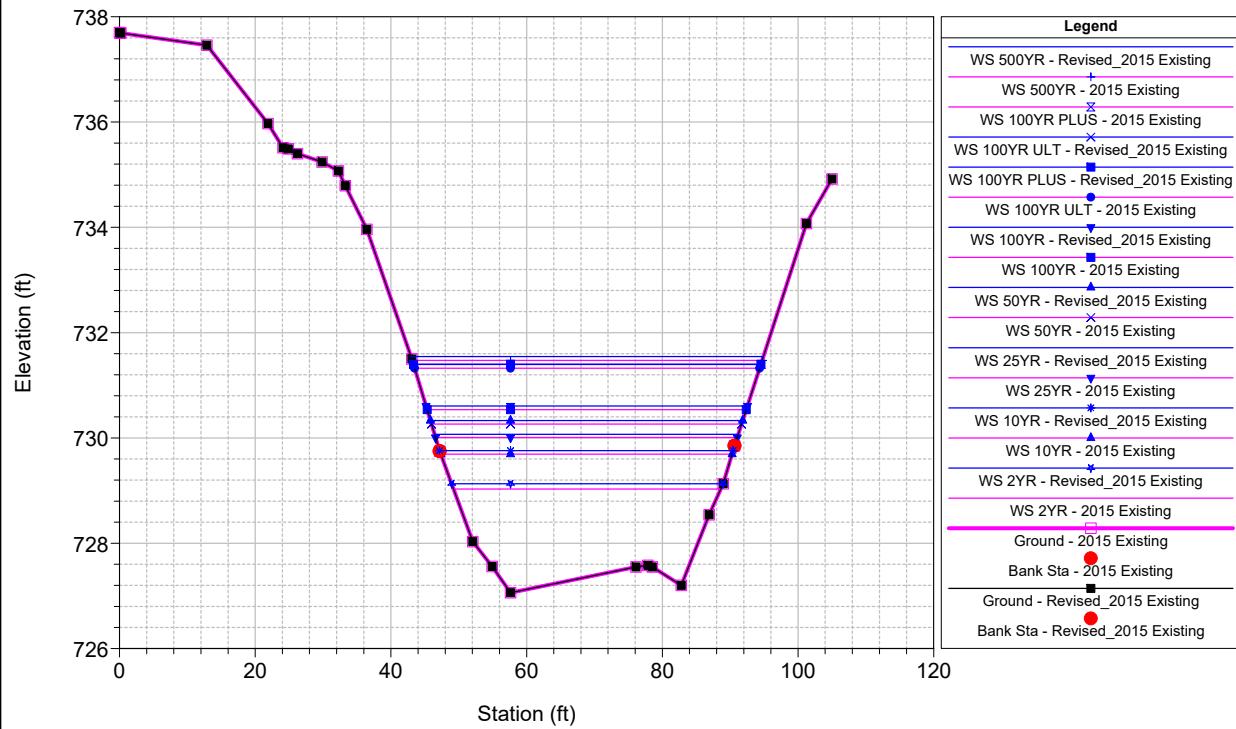
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14786



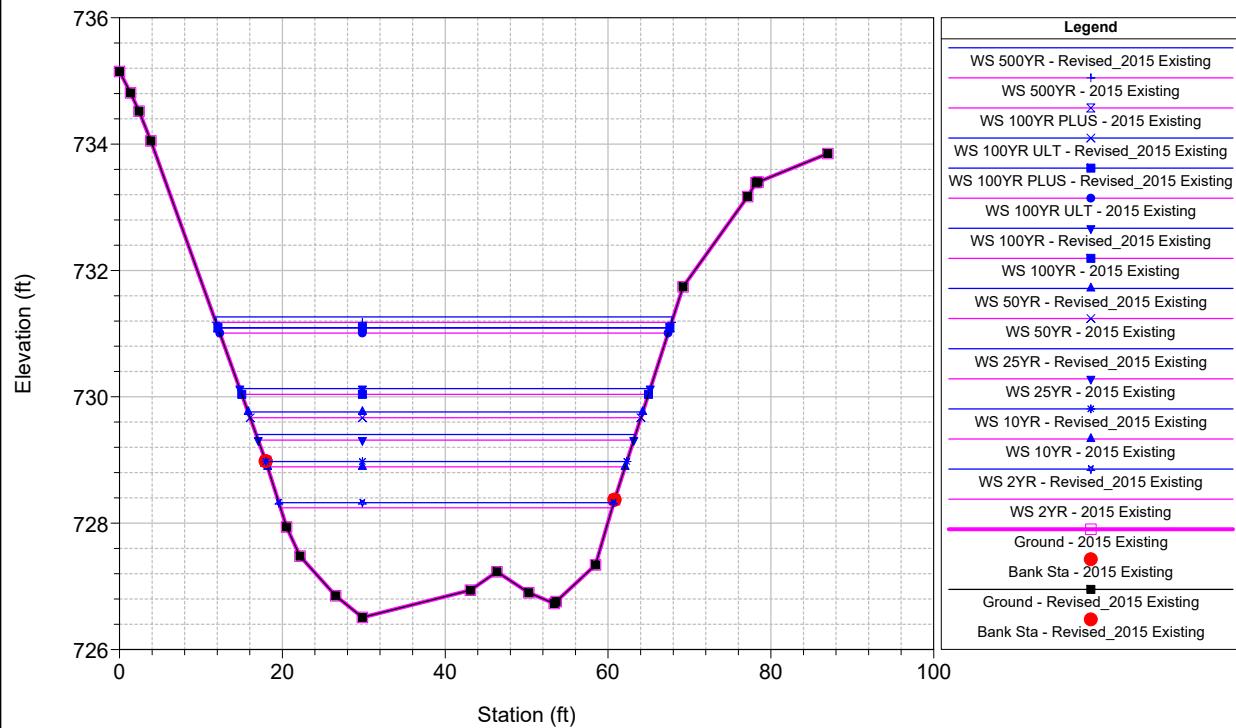
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14736 Effective Cross Section 15721



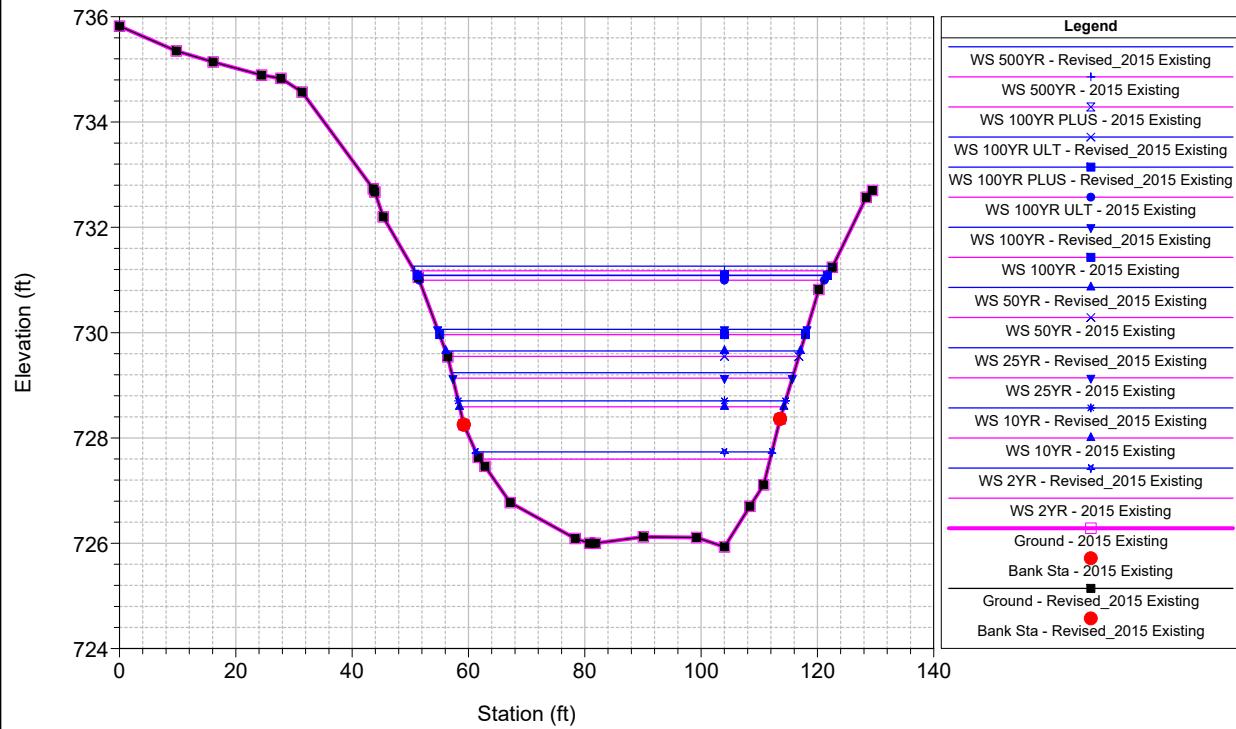
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14686 Effective Cross Section 15682

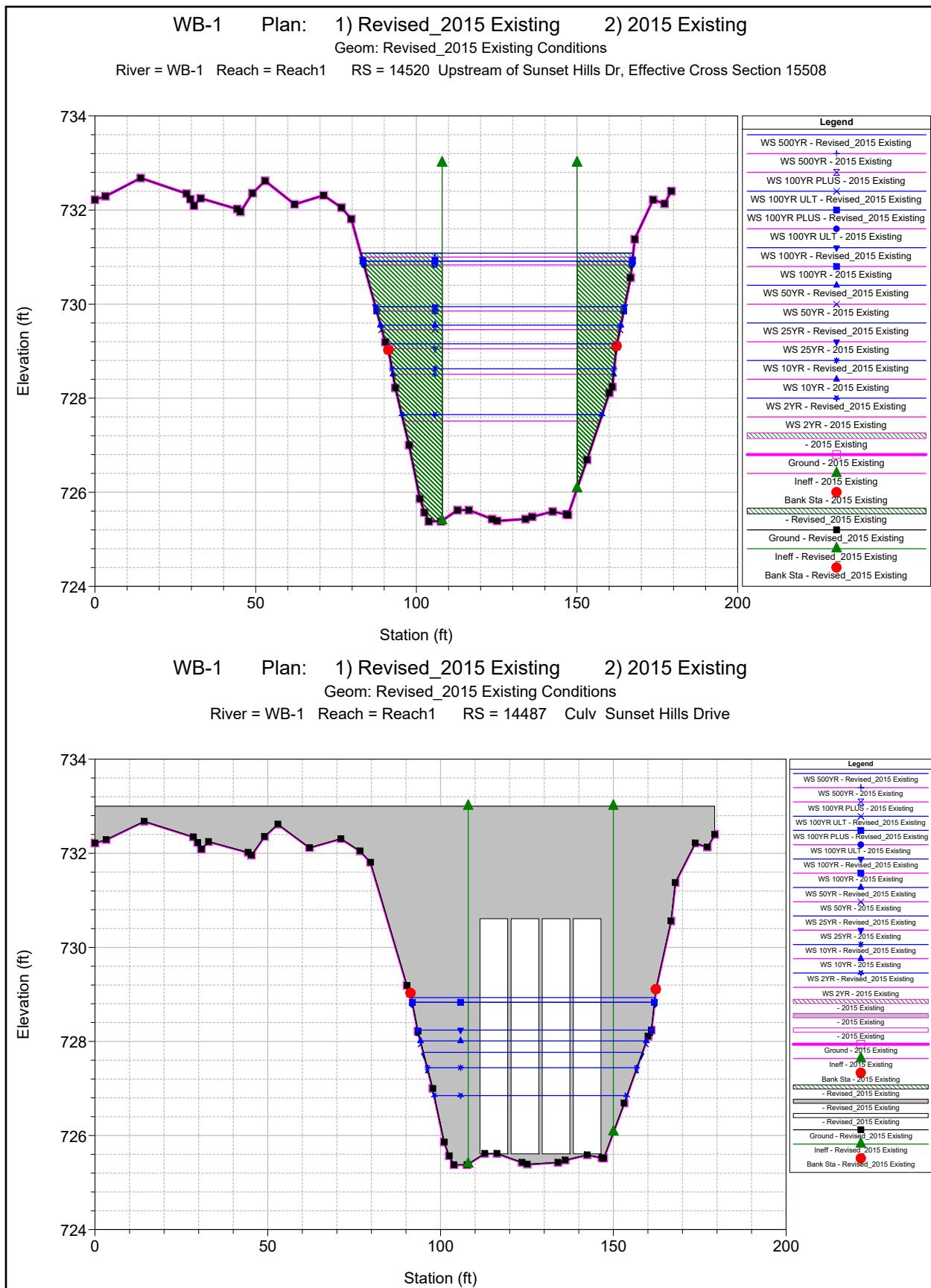


WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14620 Effective Cross Section 15615

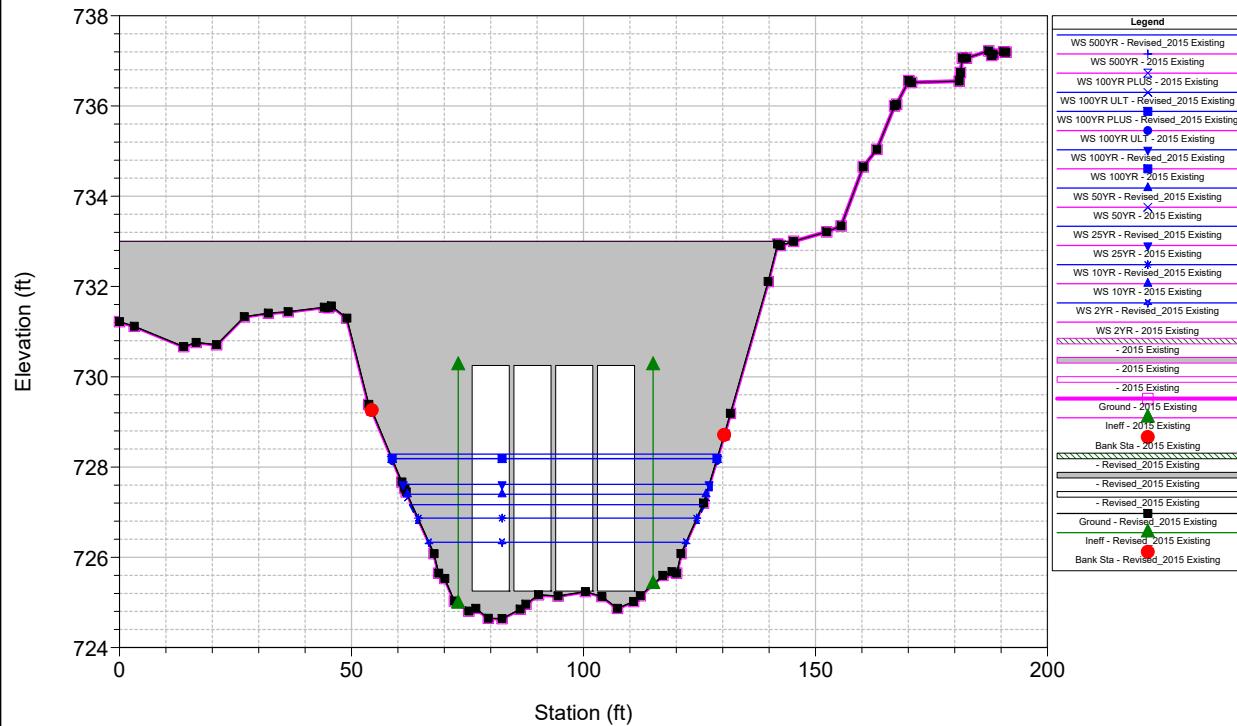


WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14554

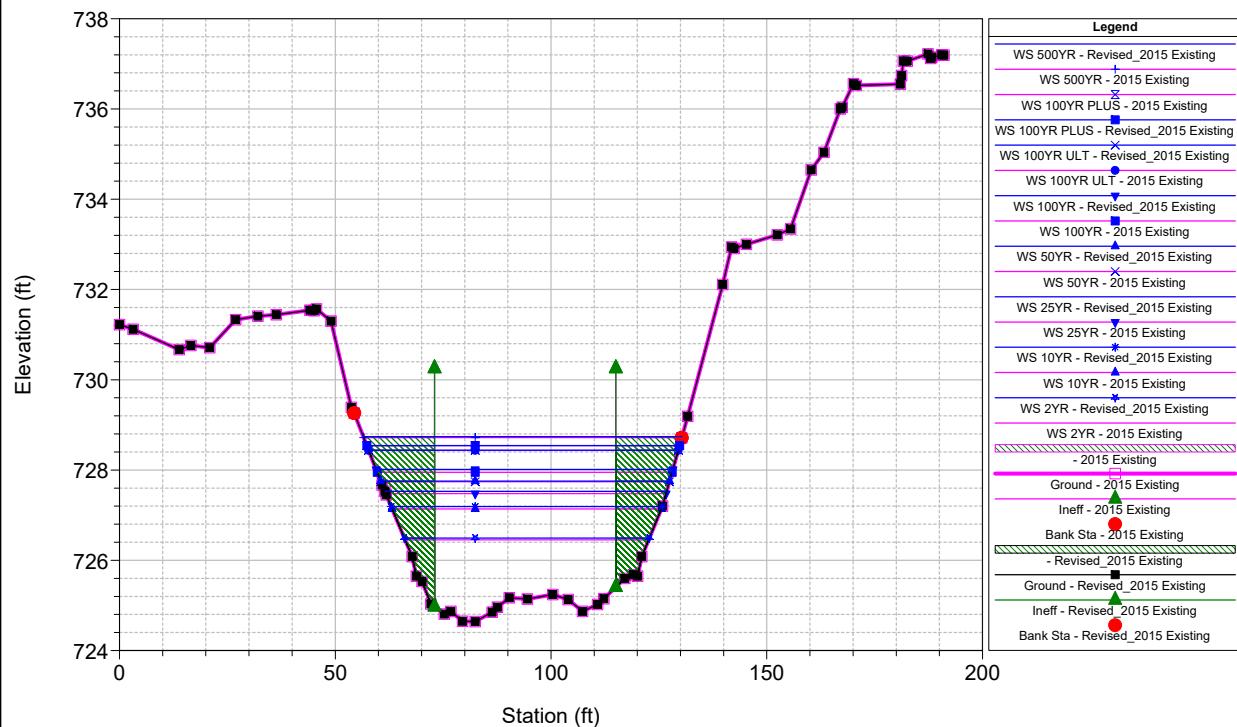




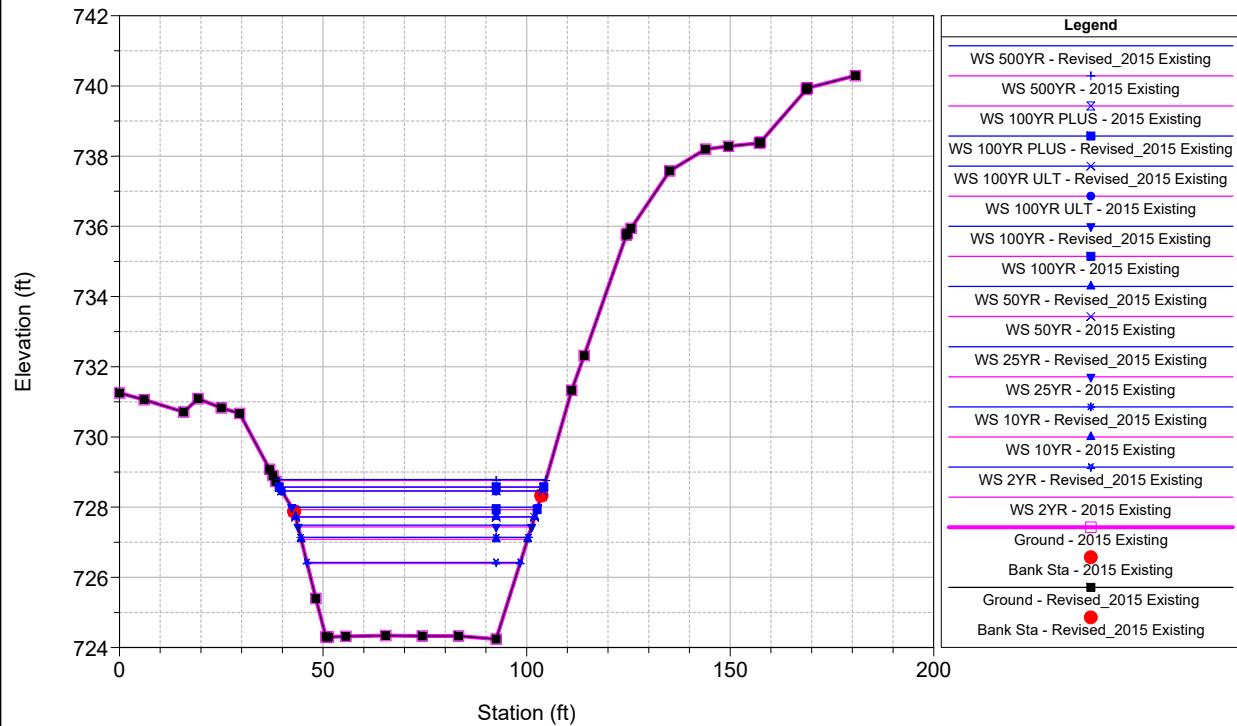
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14487 Culv Sunset Hills Drive



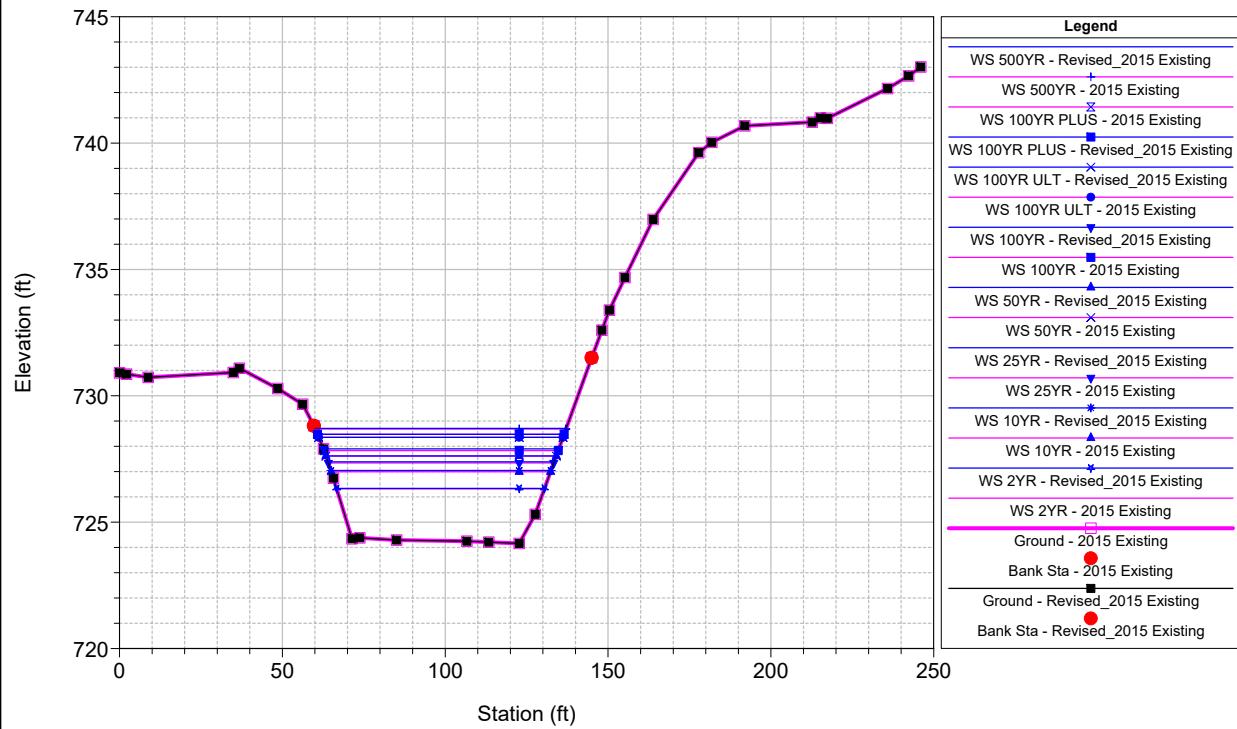
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14445 Downstream of Sunset Hills Dr, Effective Cross Section 15437



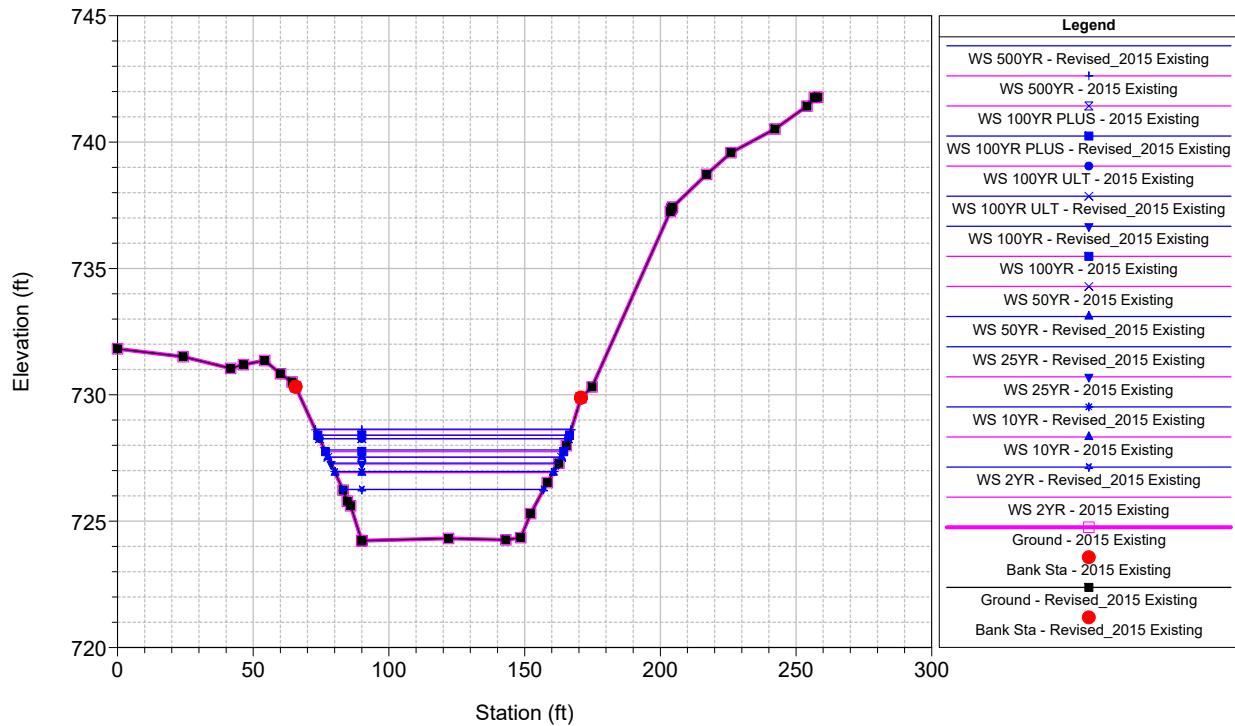
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14394



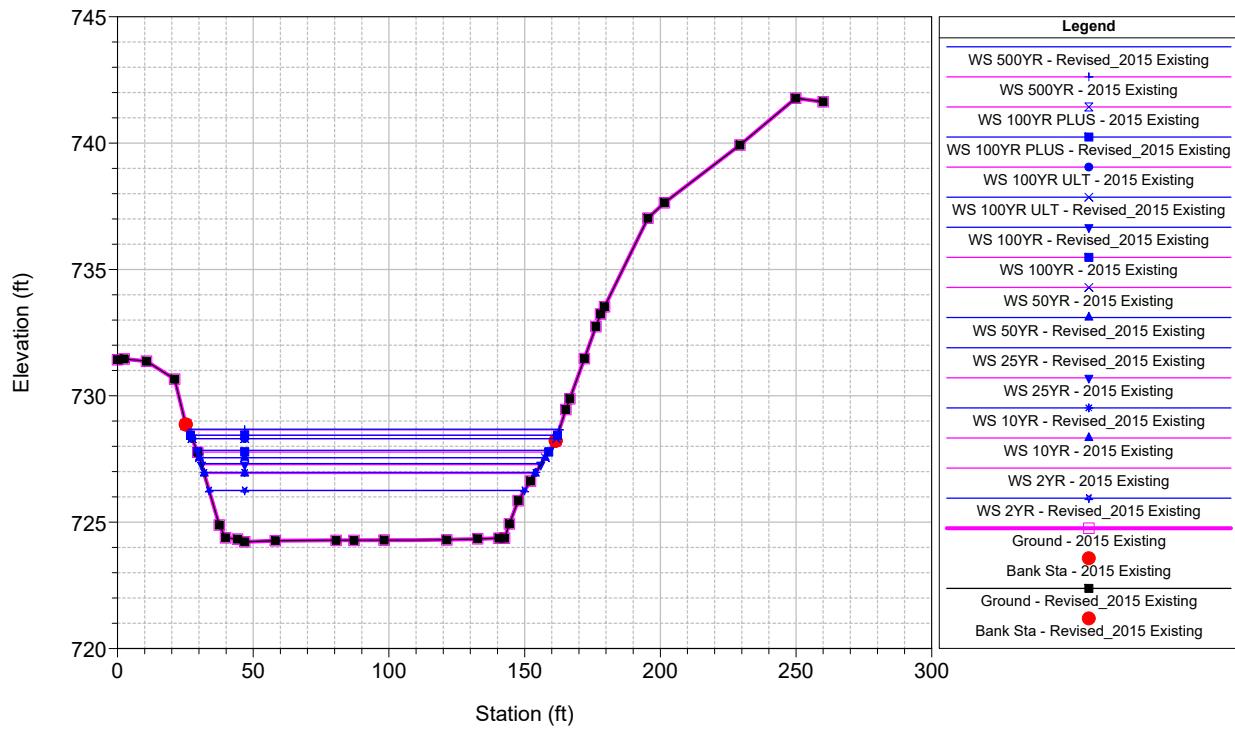
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14305 Effective Cross Section 15294



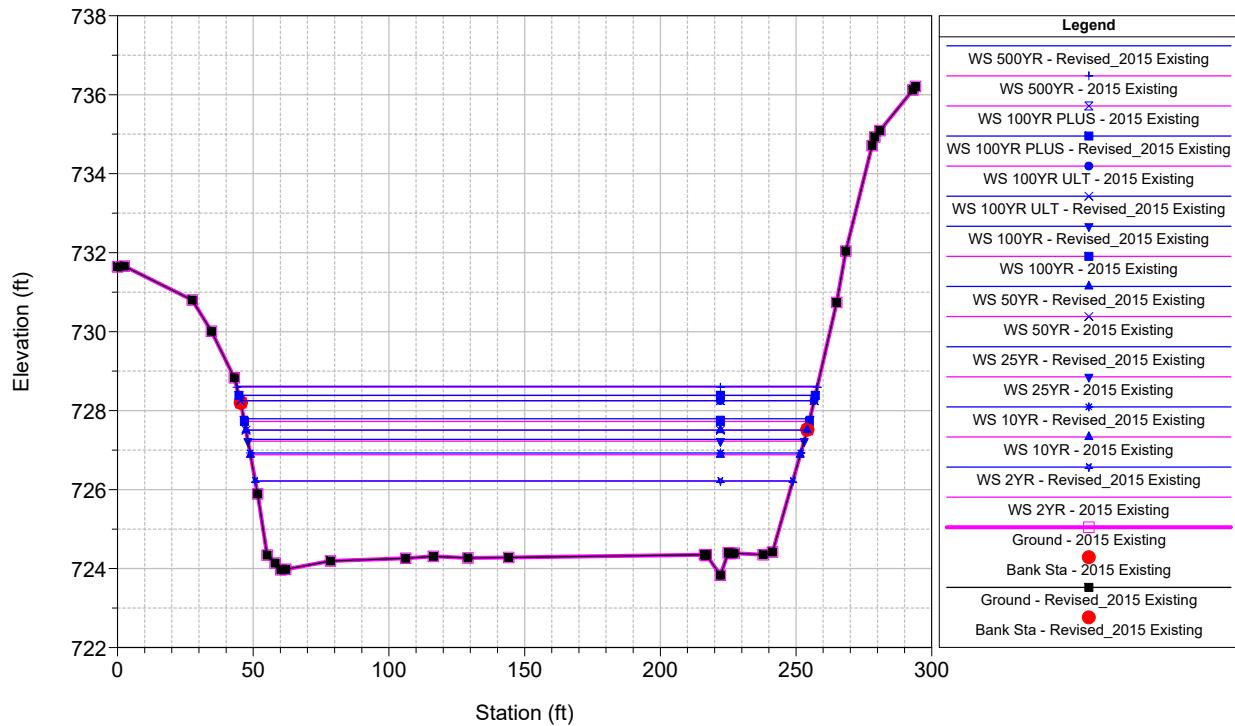
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14221 Effective Cross Section 15210



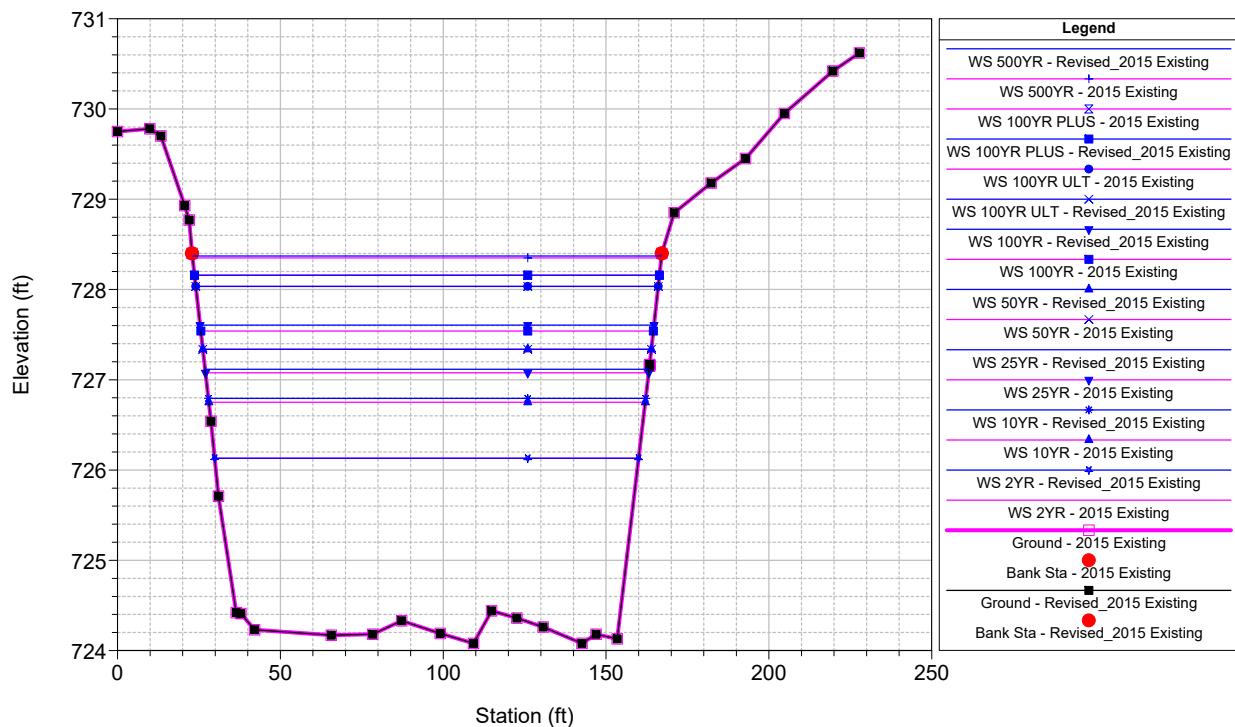
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14171 Effective Cross Section 15160



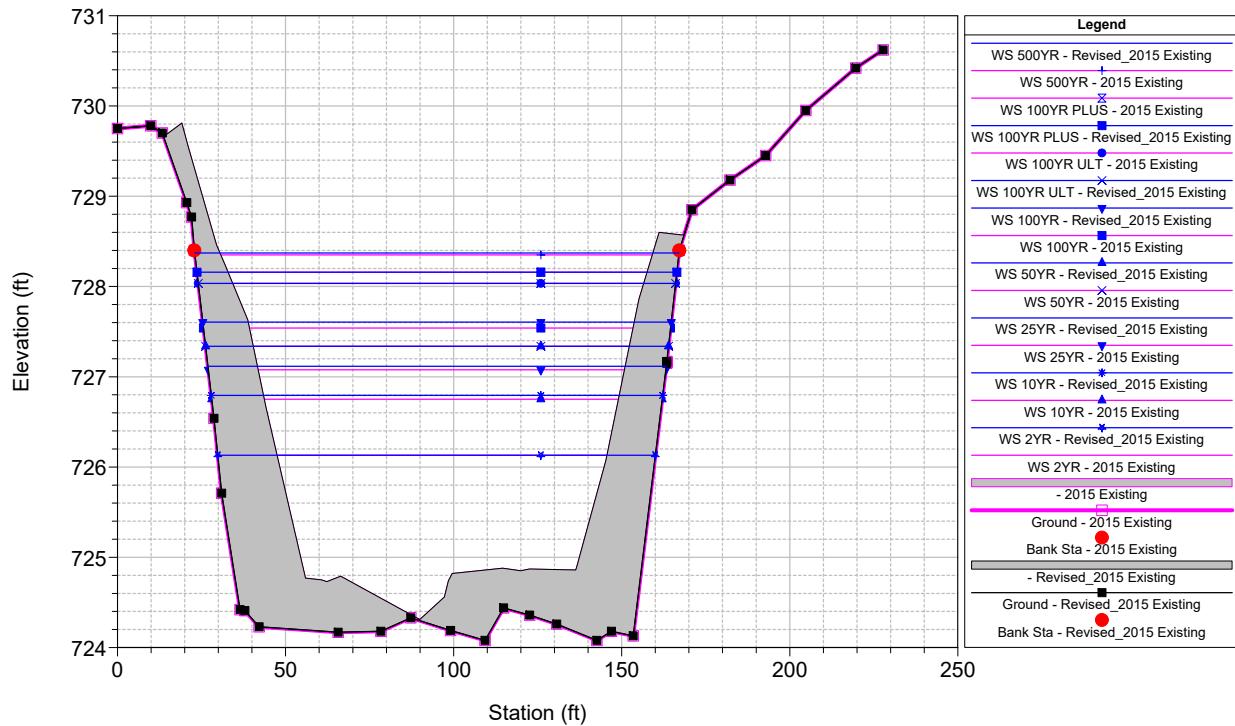
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 14044 Effective Cross Section 15033



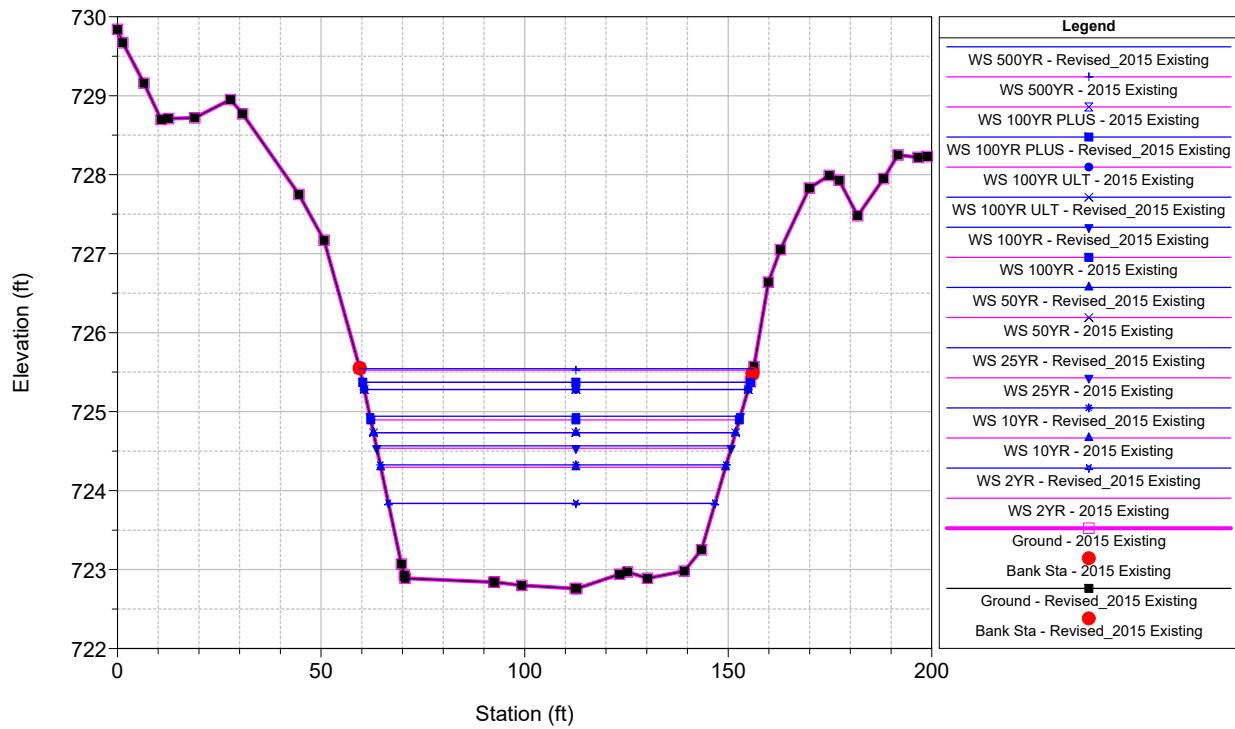
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13918 Effective Cross Section 14906



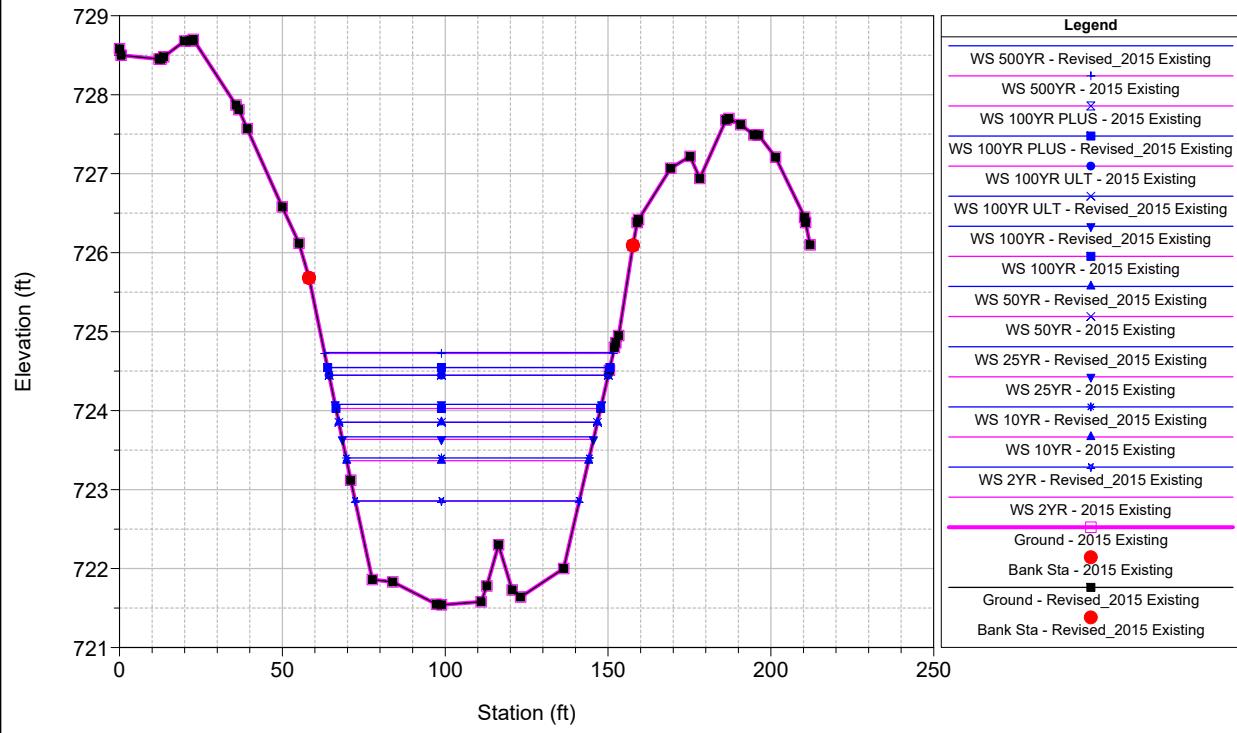
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13887 IS



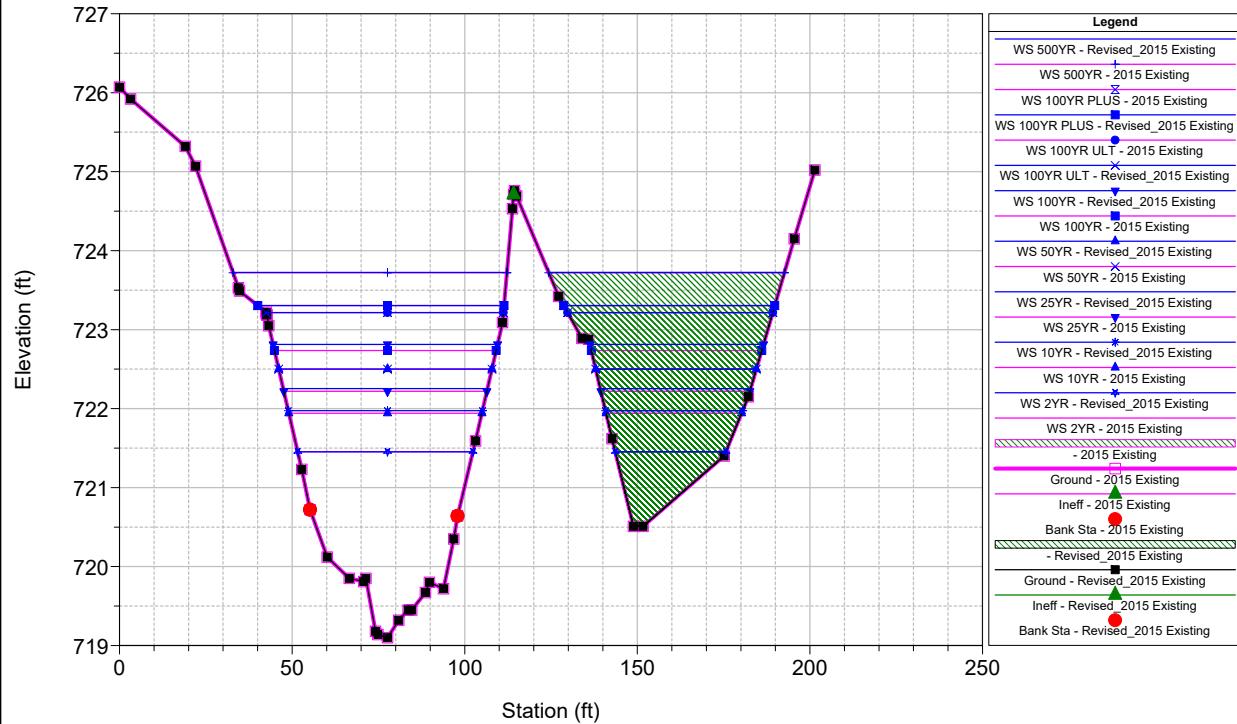
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13864 Effective Cross Section 14849



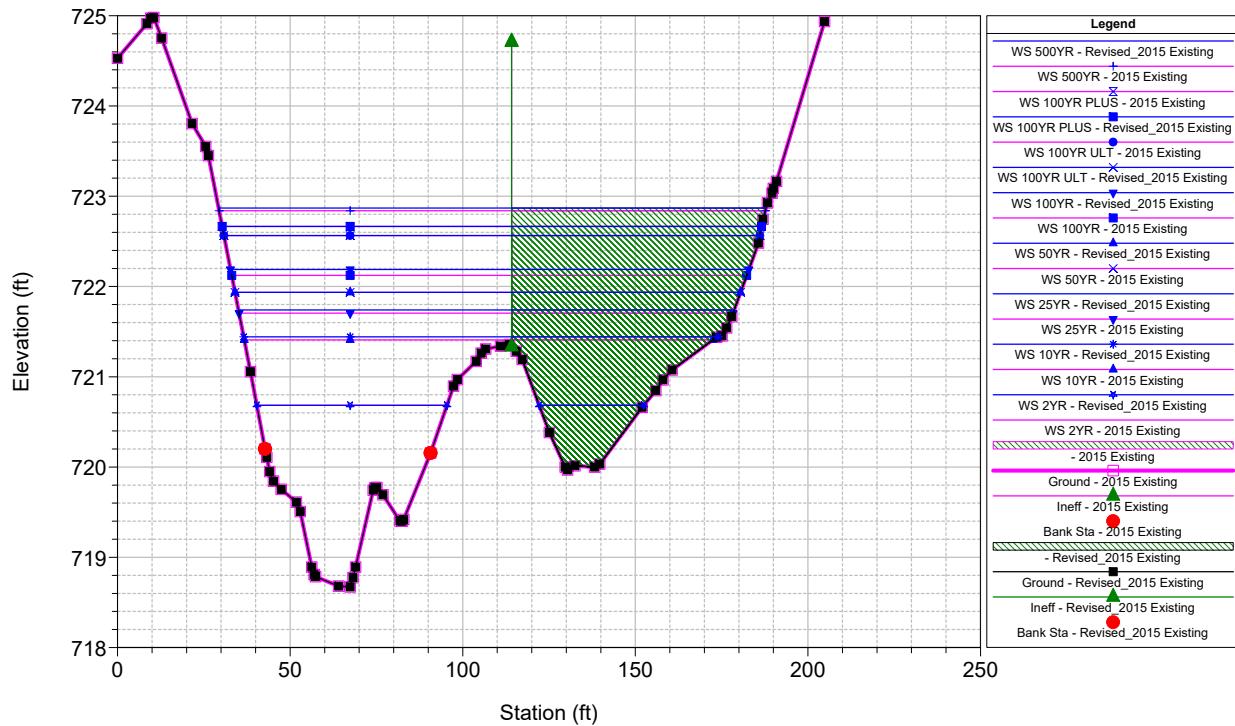
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13851 Effective Cross Section 14839



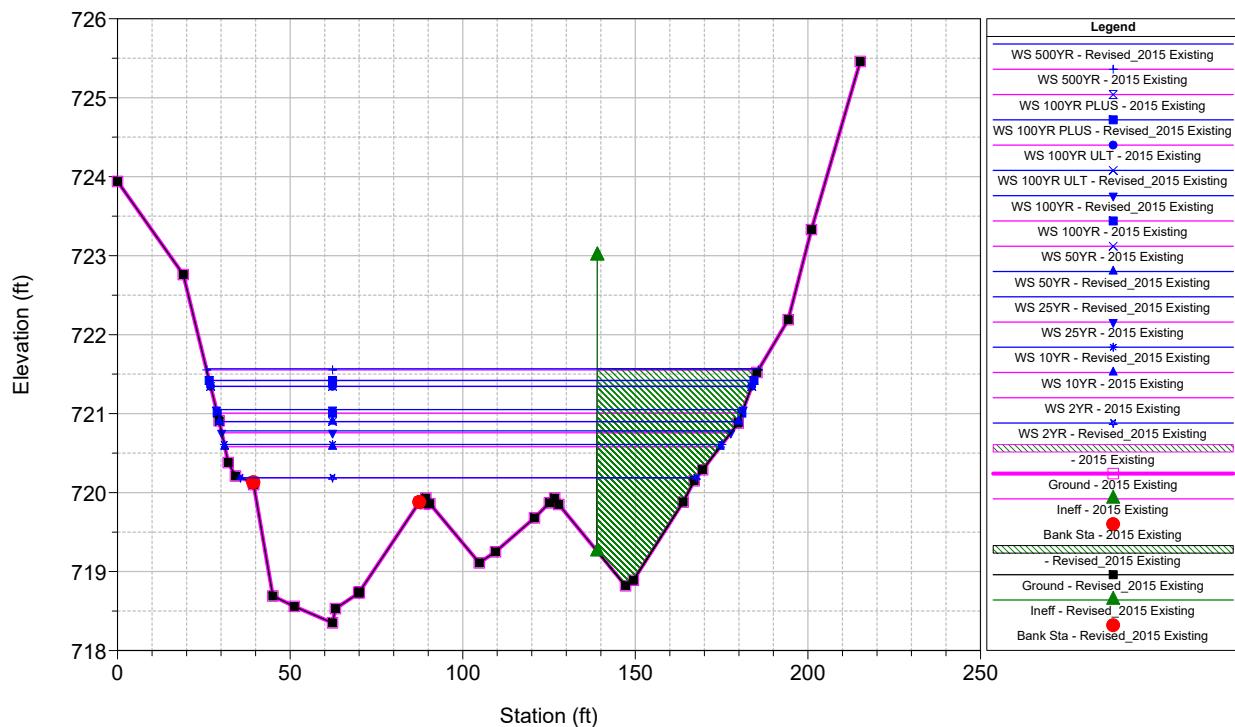
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13793 Effective Cross Section 14781



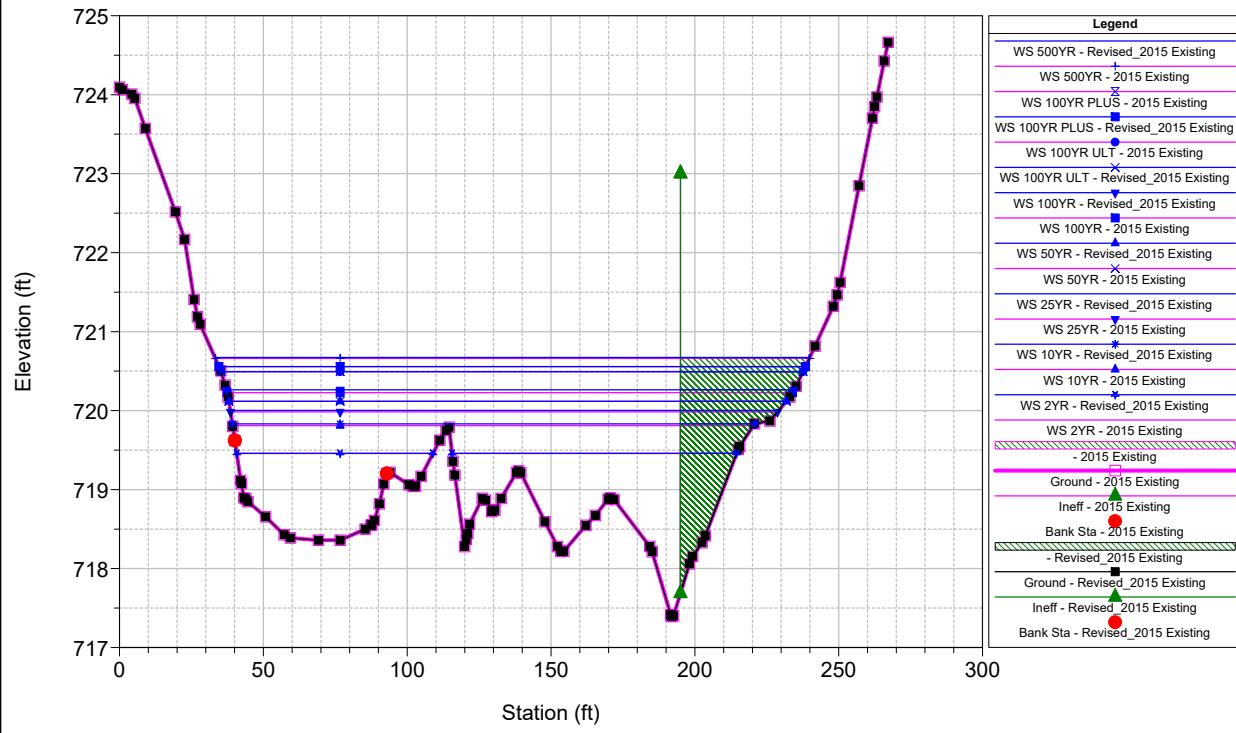
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13752



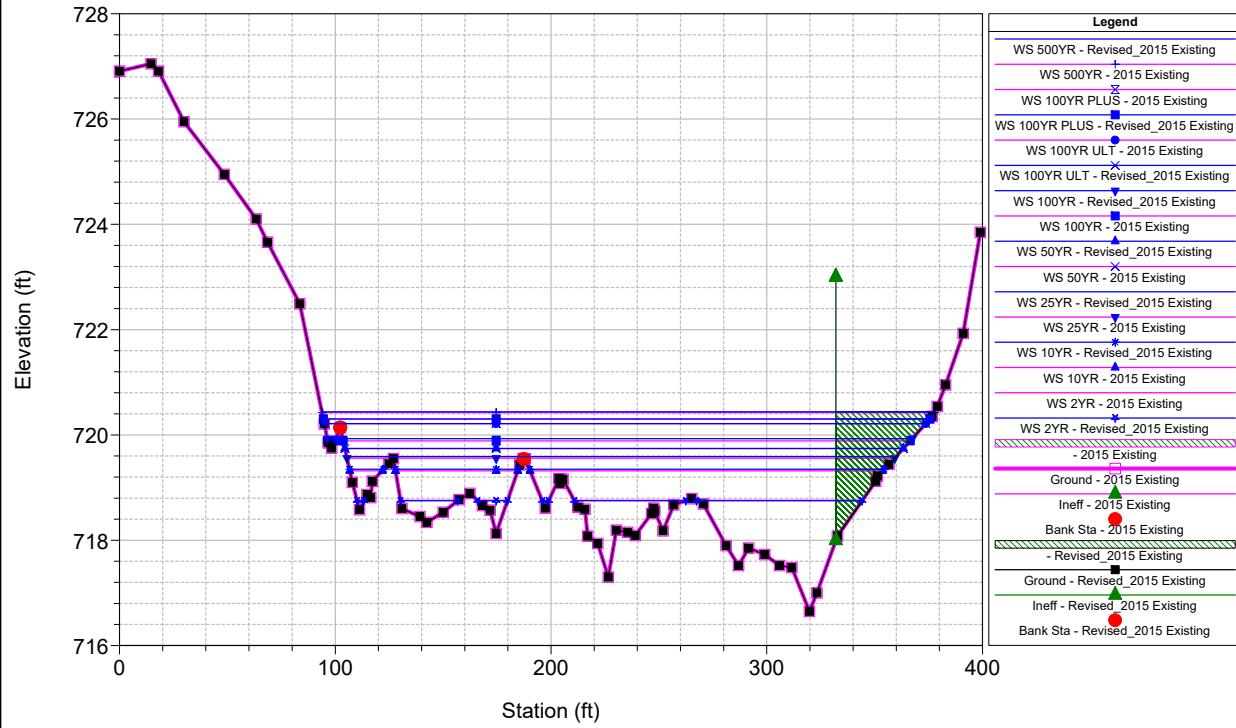
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13716 Effective Cross Section 14705



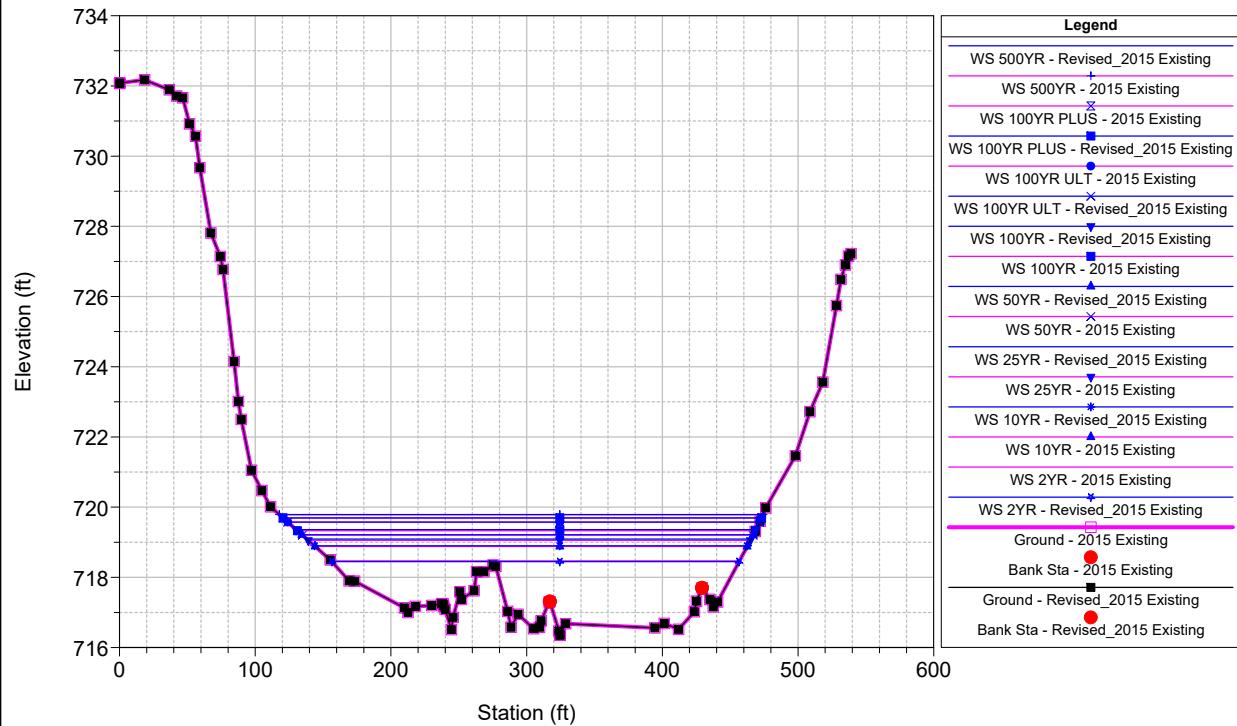
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13662



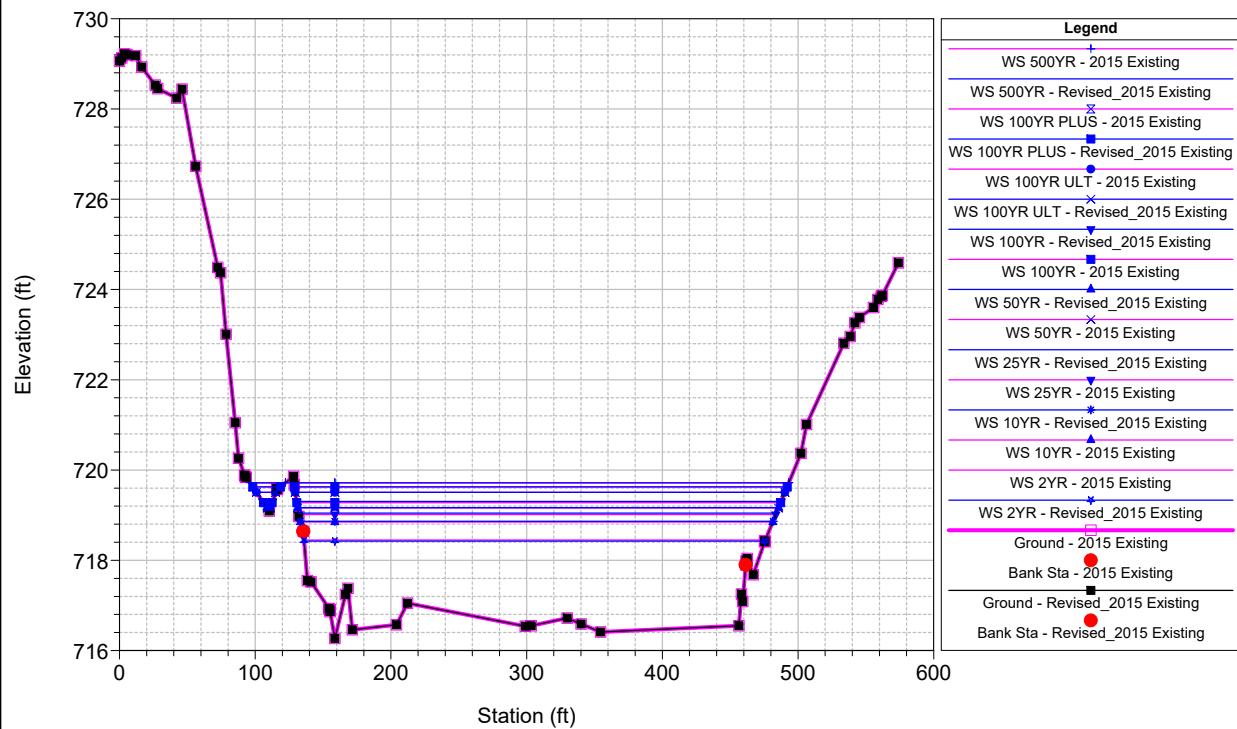
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13560



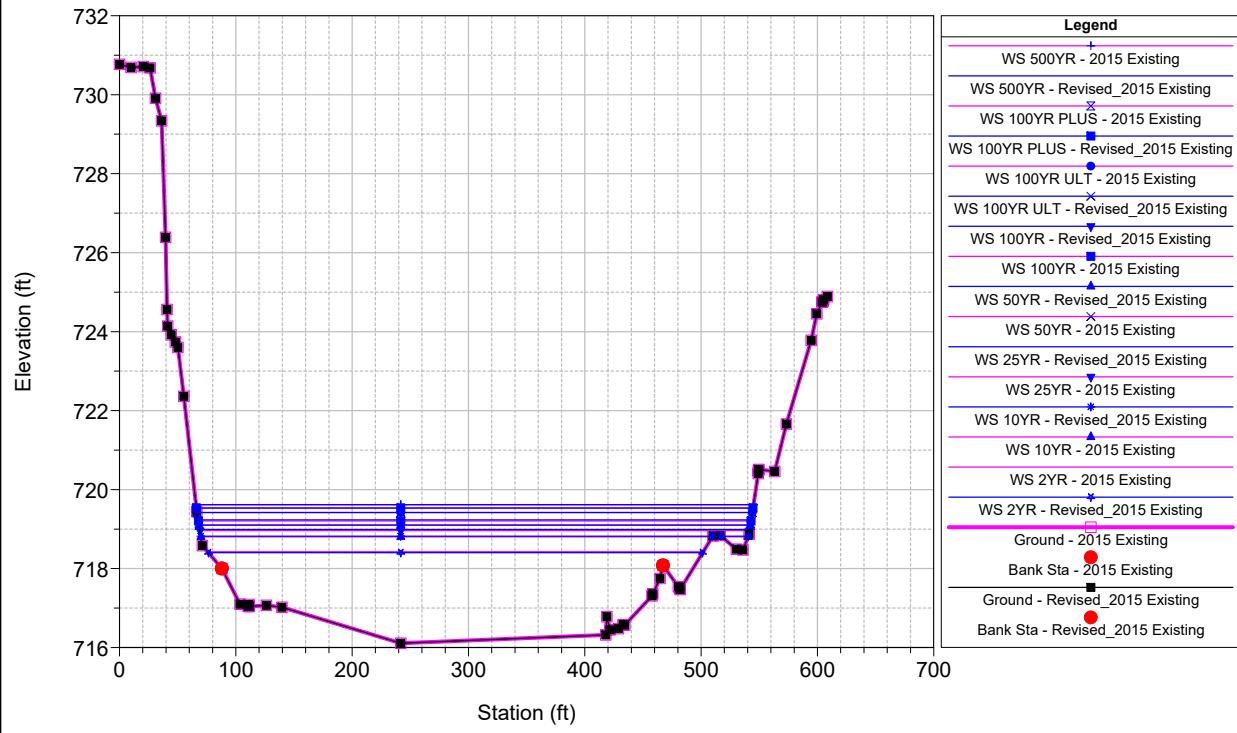
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13224 Effective Cross Section 14200



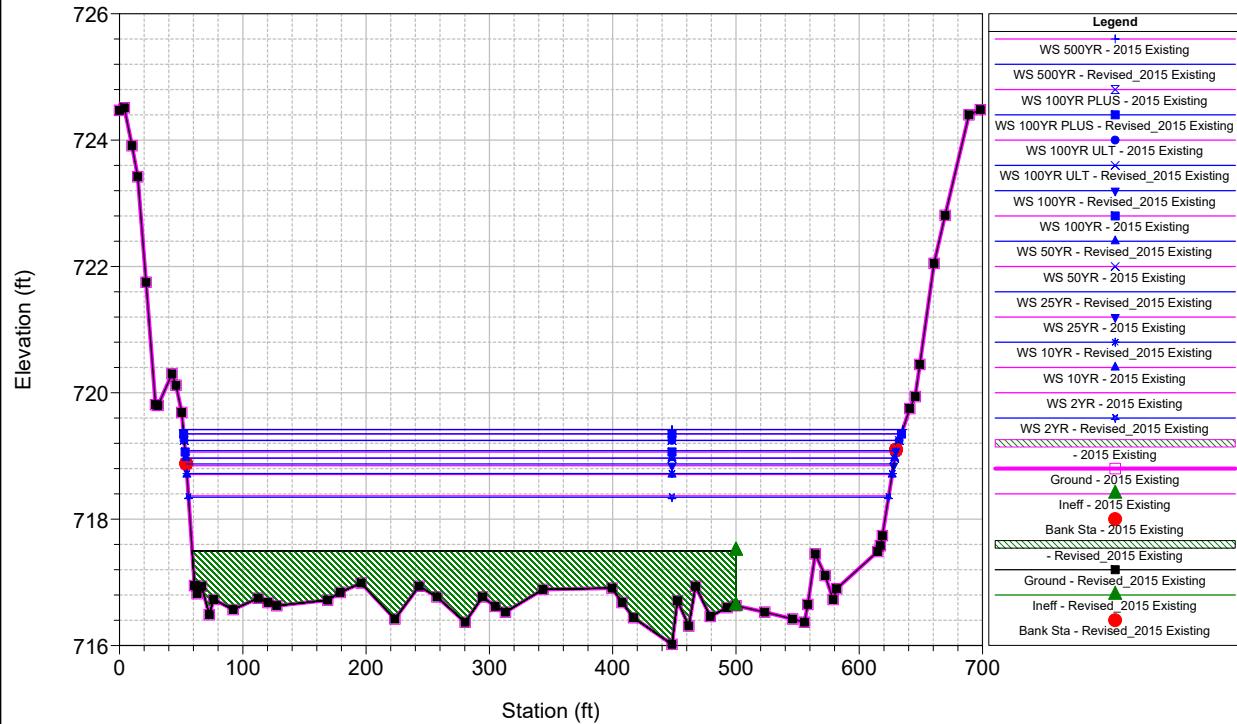
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 13090



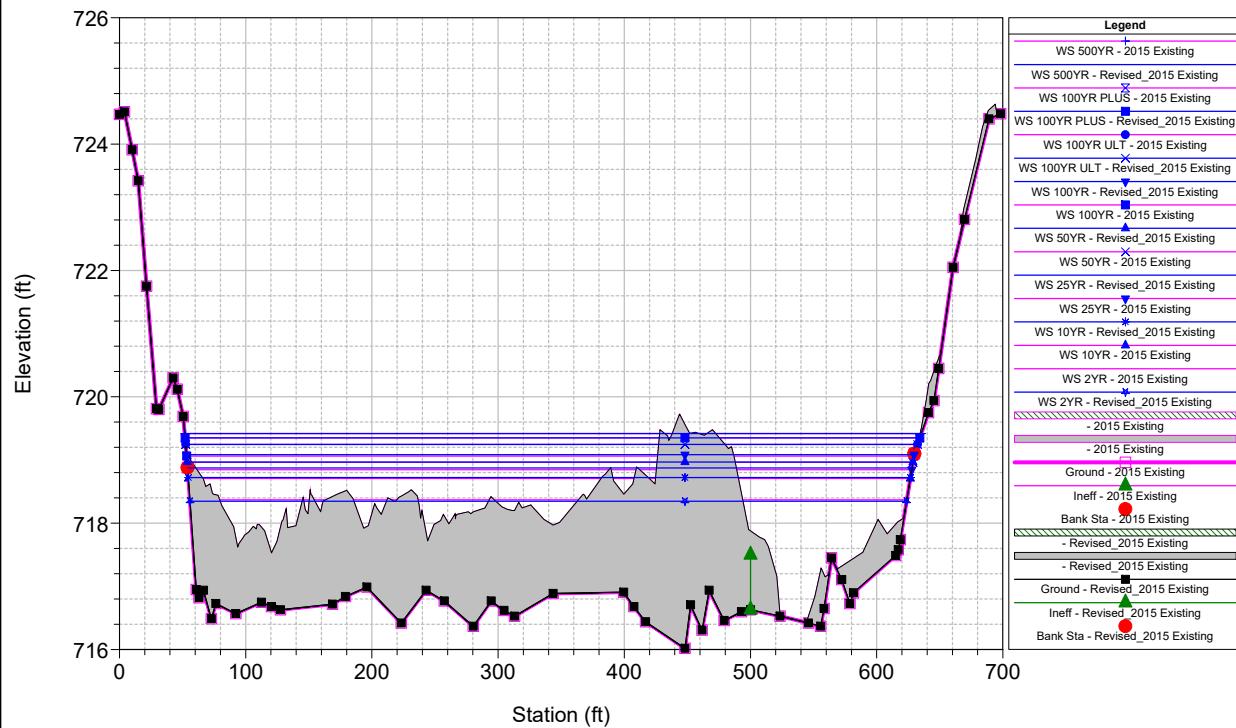
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 12883



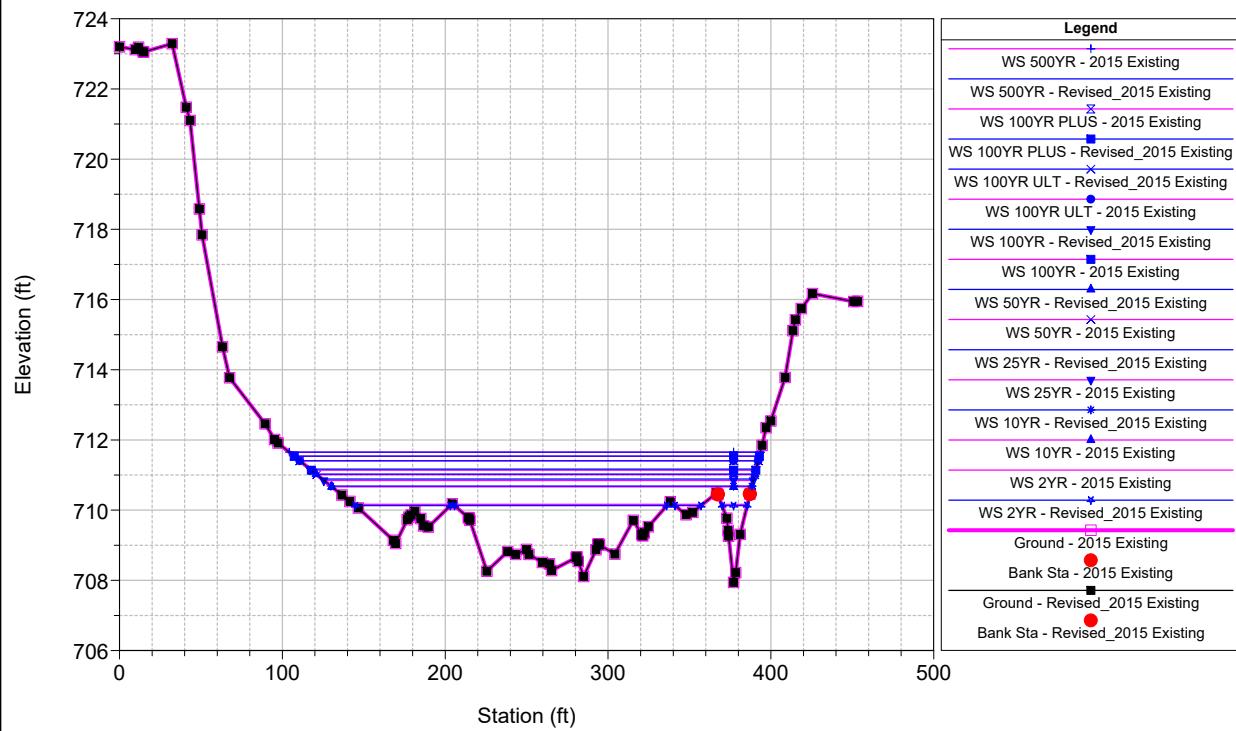
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 12589



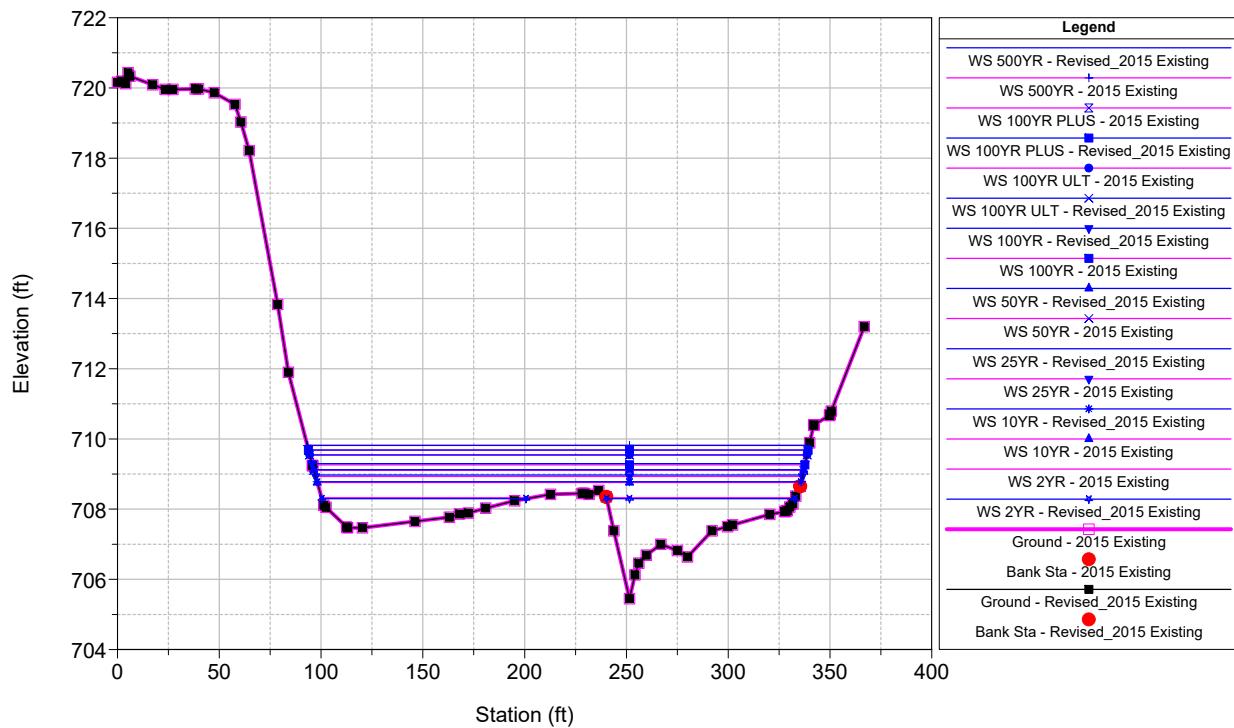
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 12549 IS



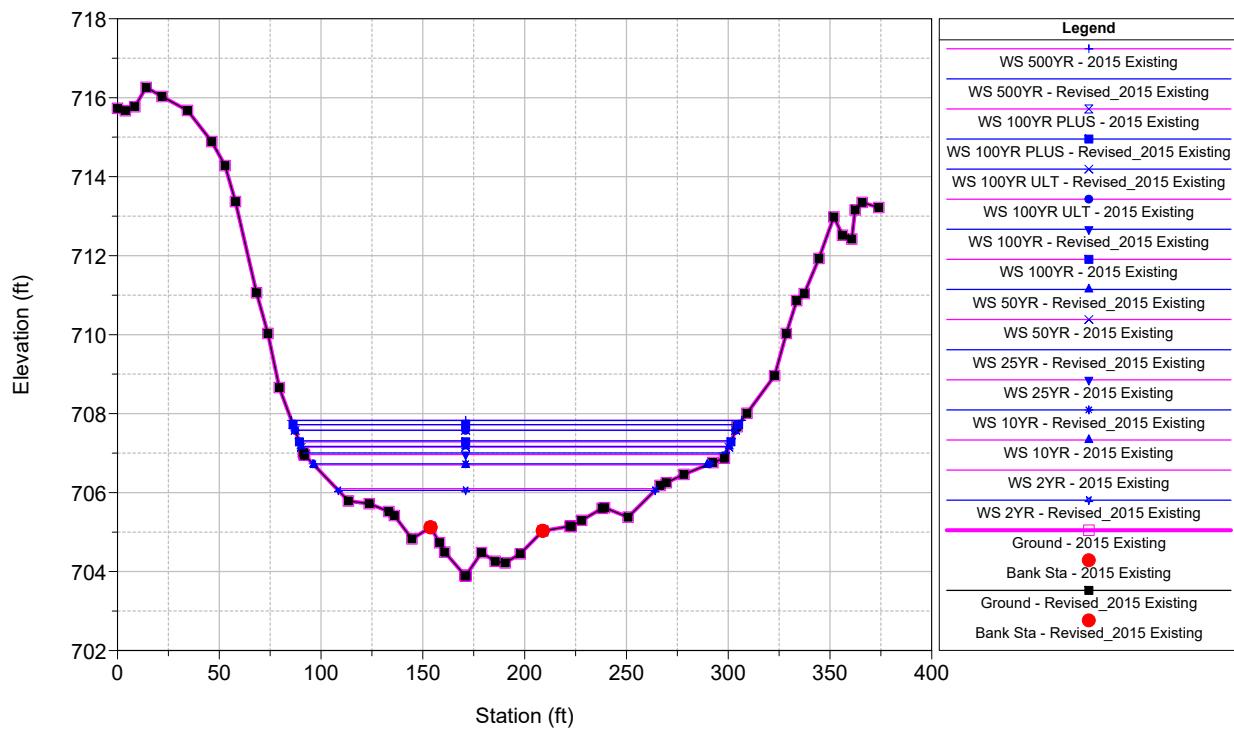
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 12223 Effective Cross Section 13200



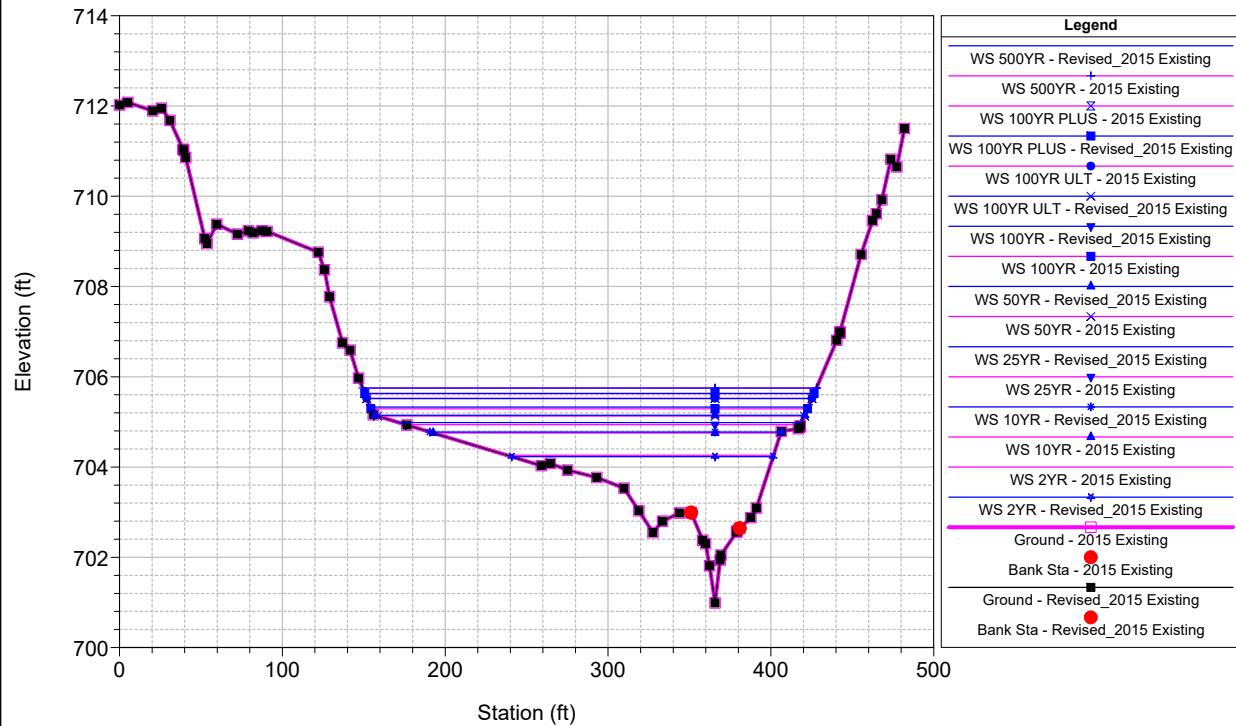
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 11952



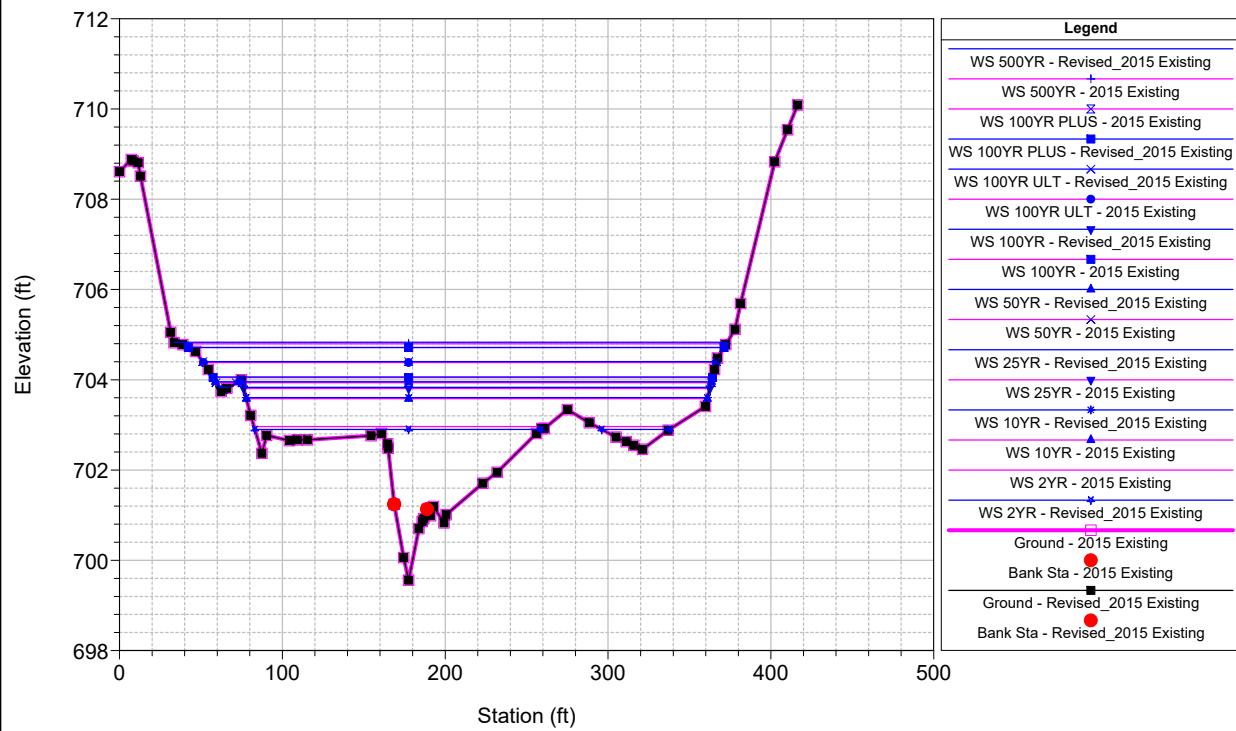
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 11661



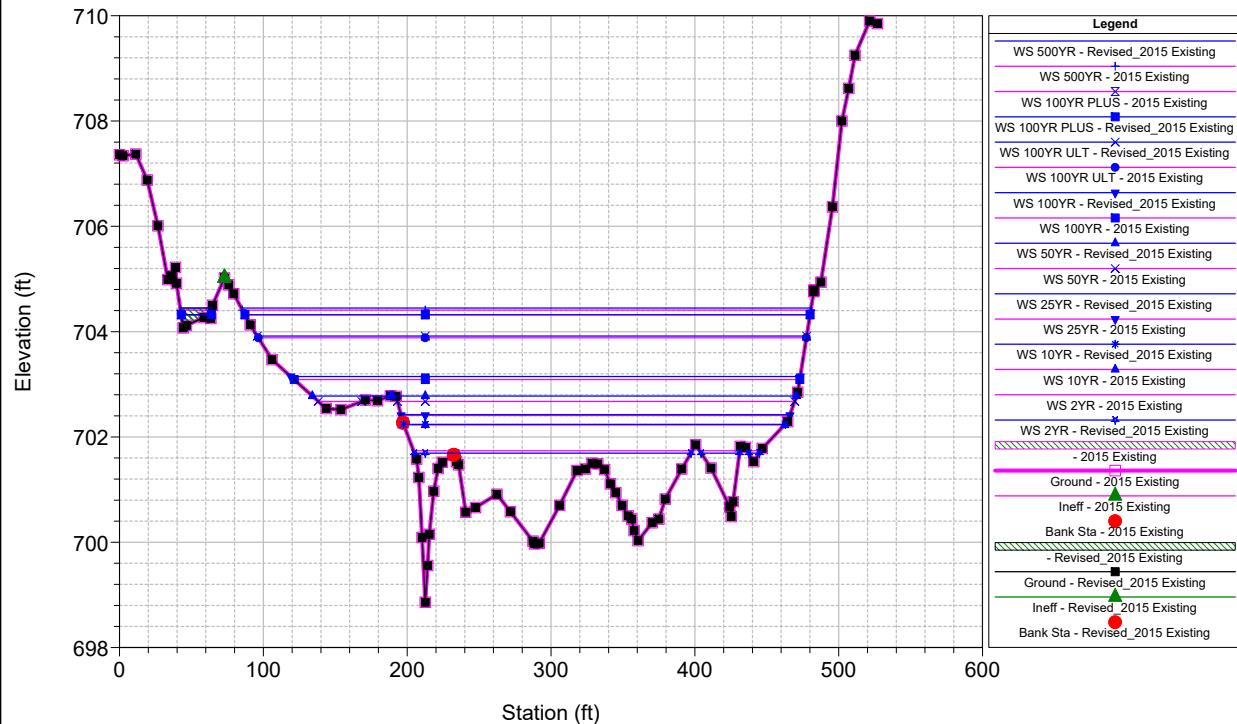
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 11376 Effective Cross Section 12400



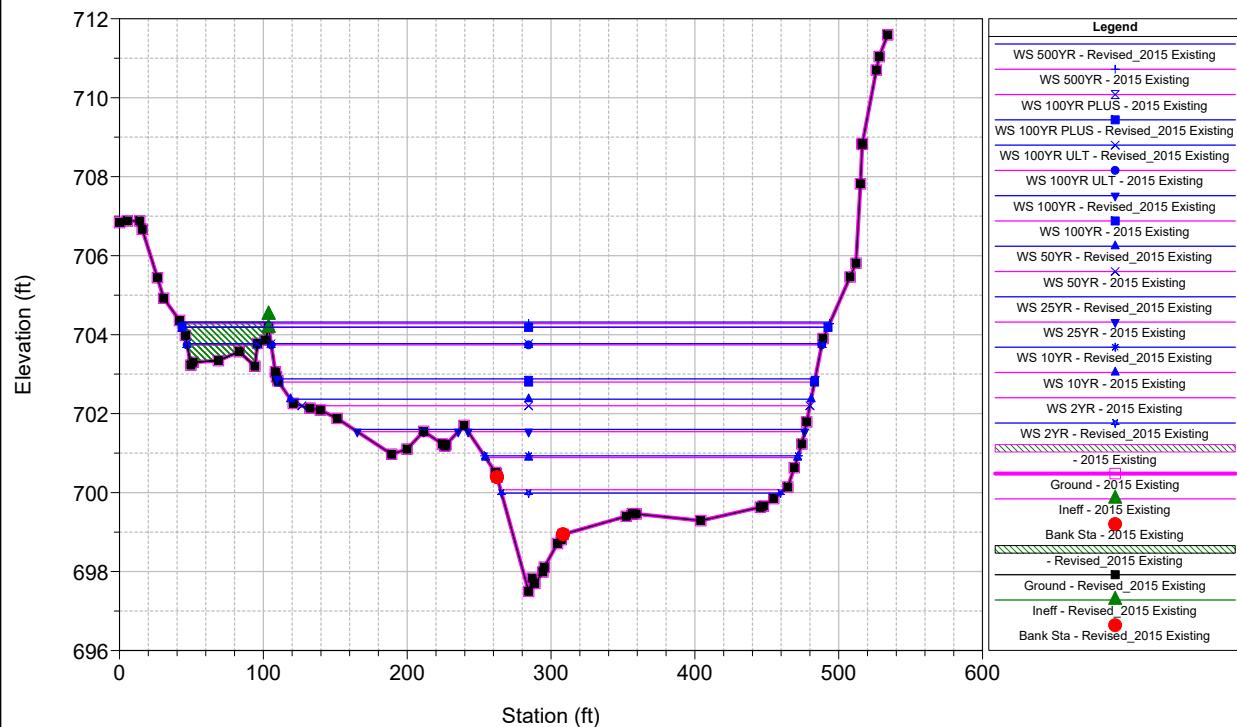
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 11126



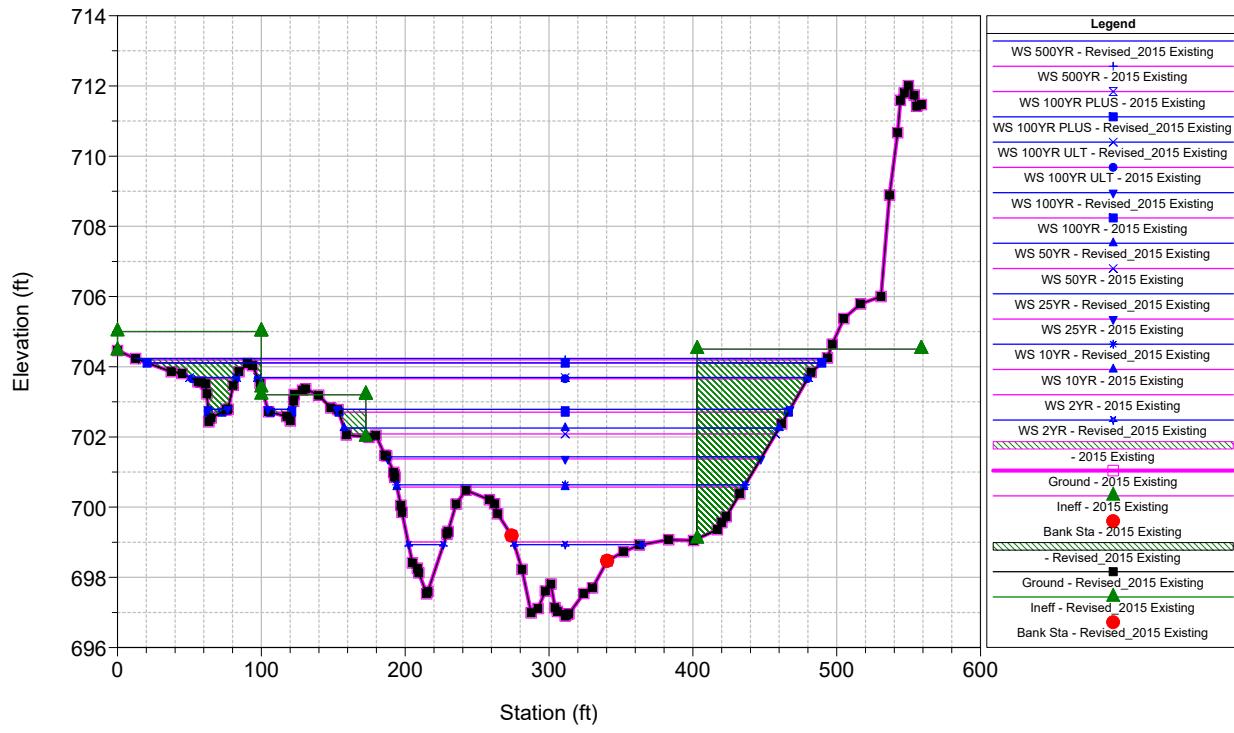
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10945 Effective Cross Section 12000



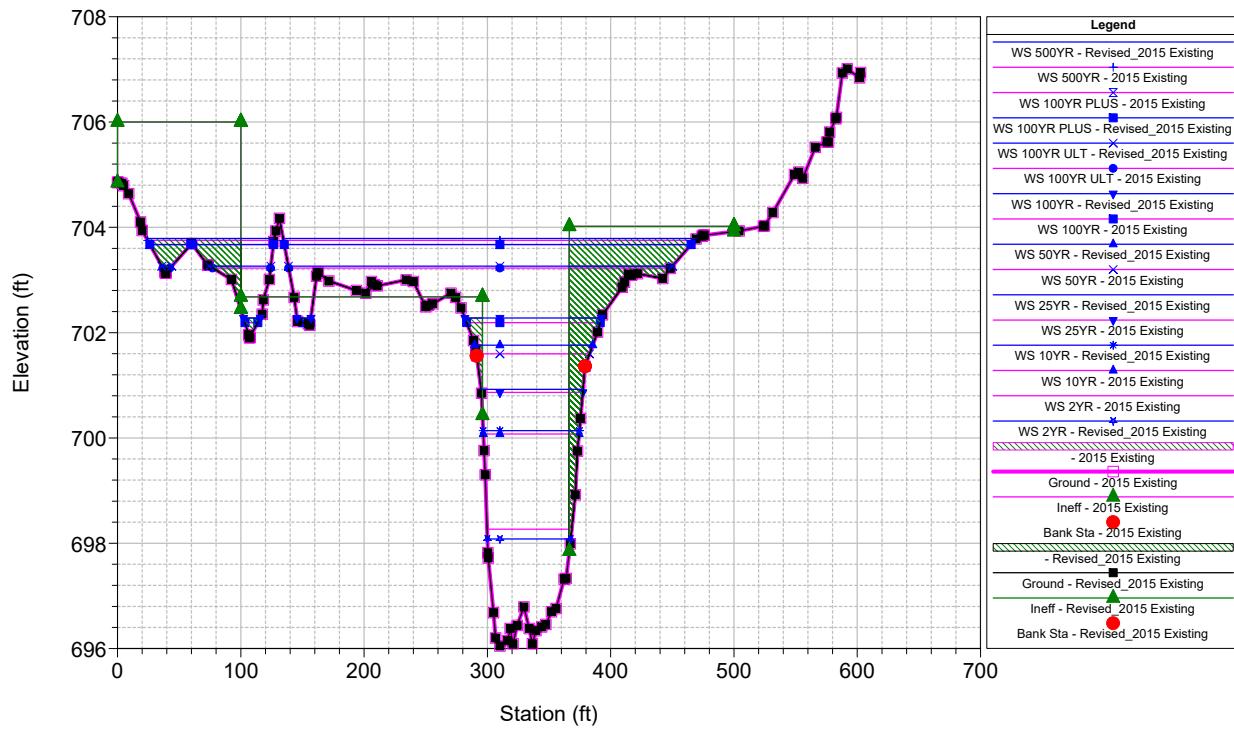
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10750 Effective Cross Section 11600

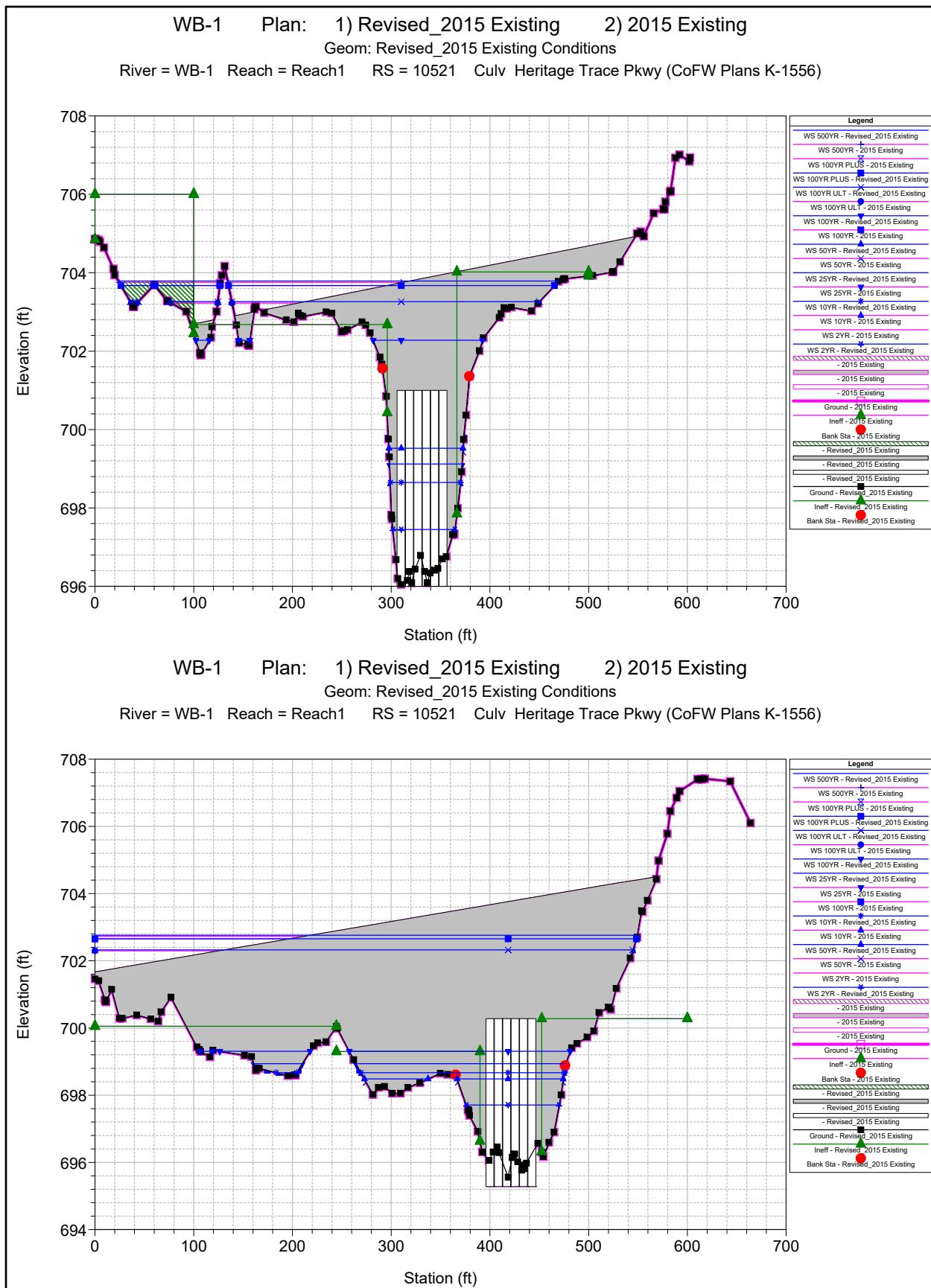


WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10667

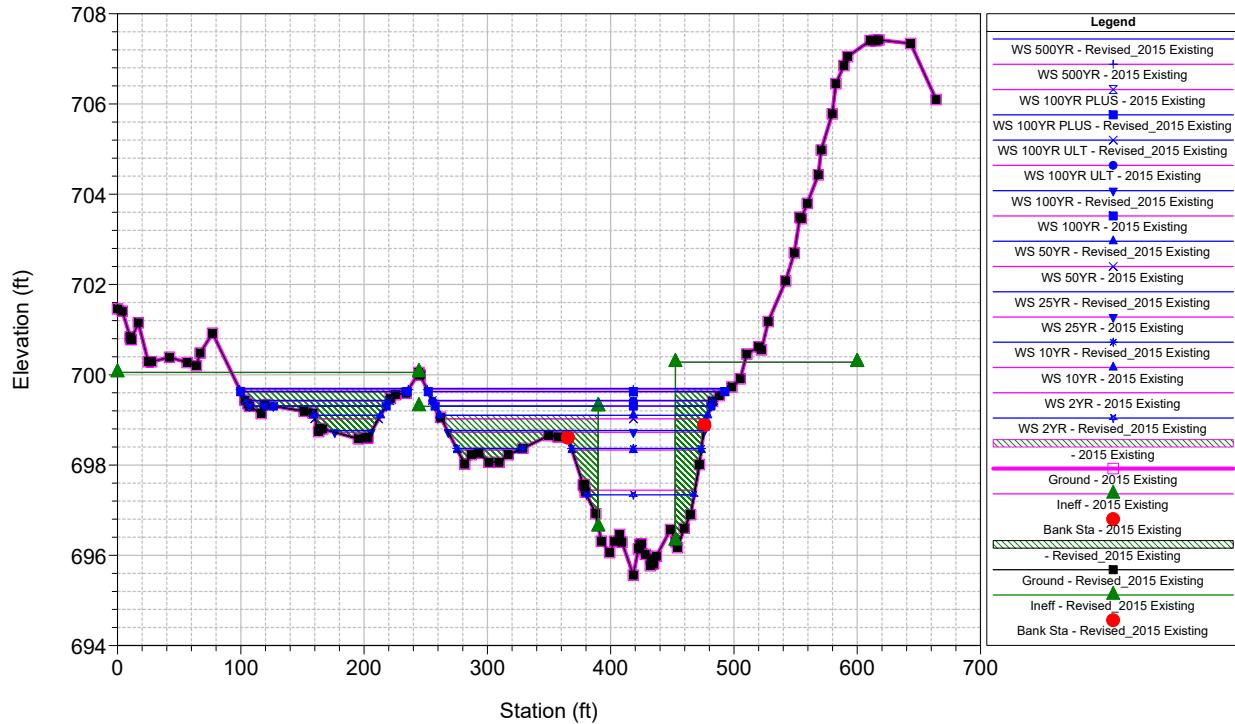


WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10604 Upstream of Heritage Trace Pkwy

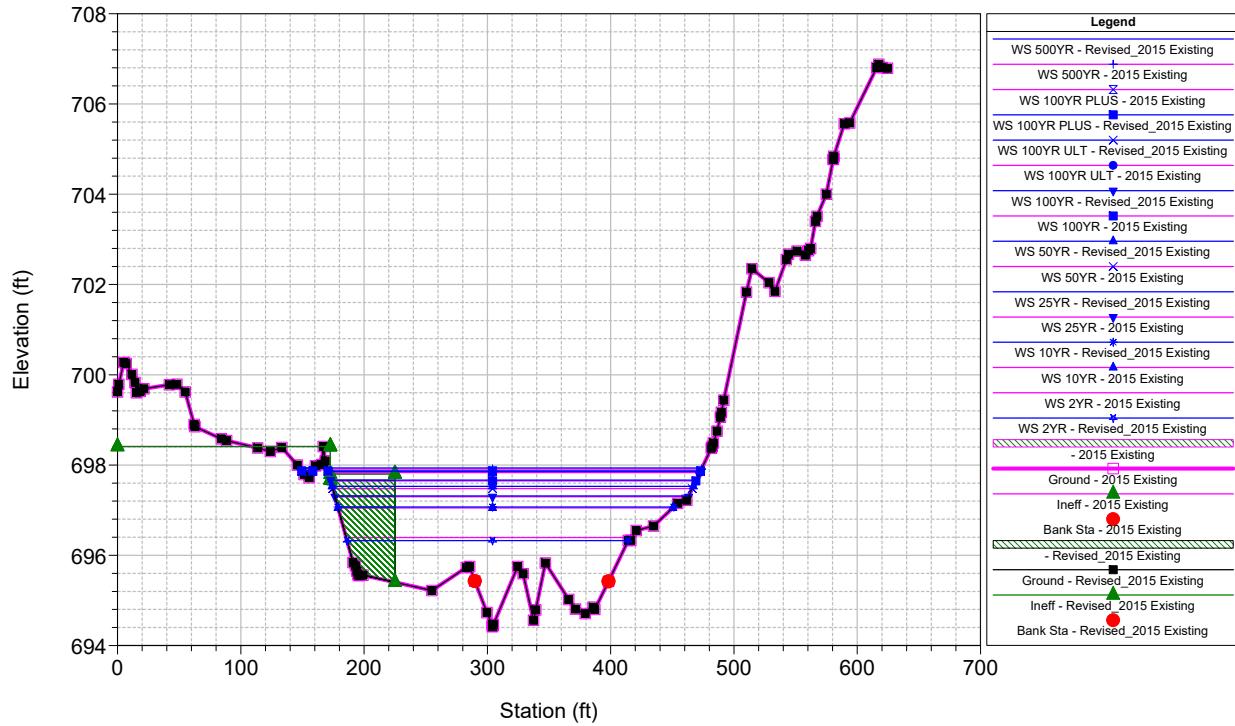




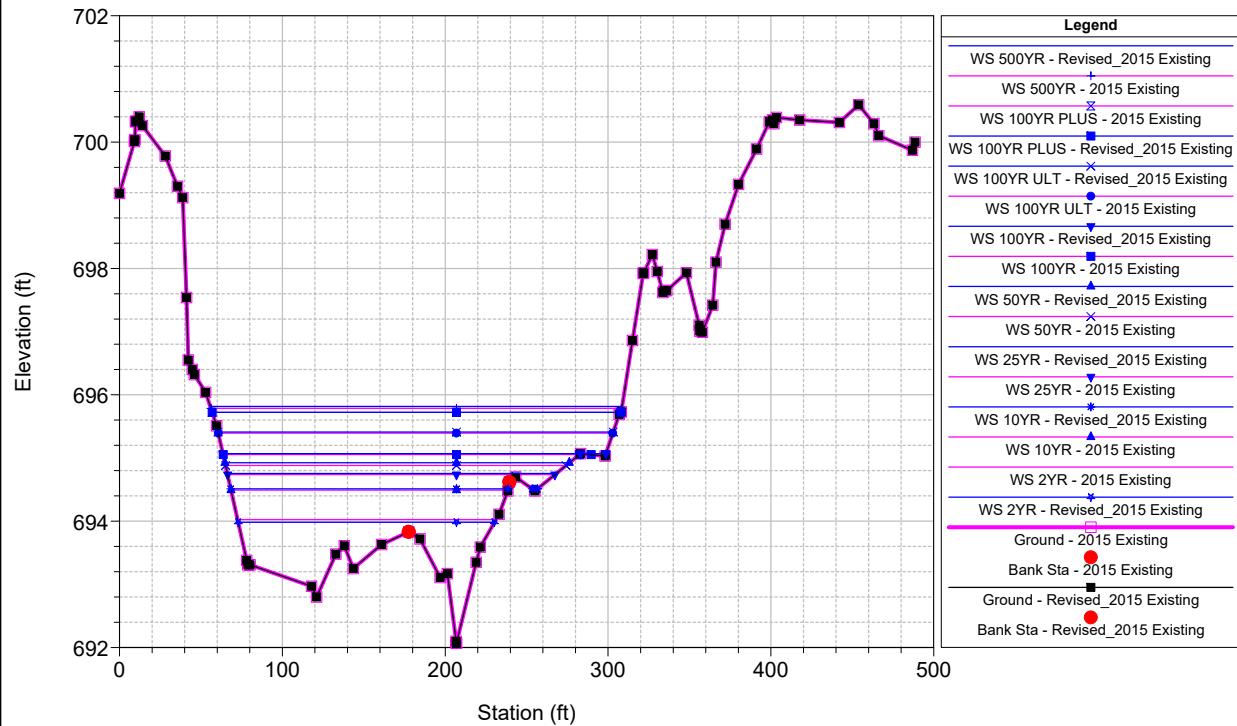
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10435 Downstream of Heritage Trace Pkwy



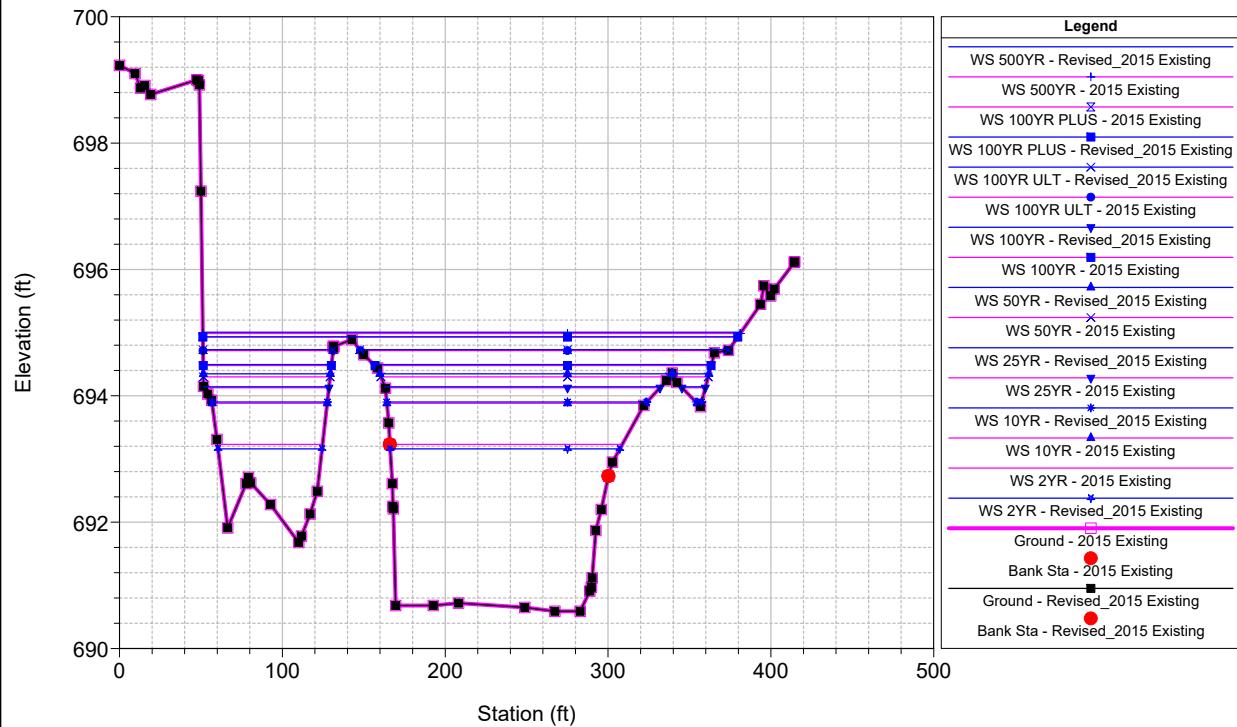
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10311



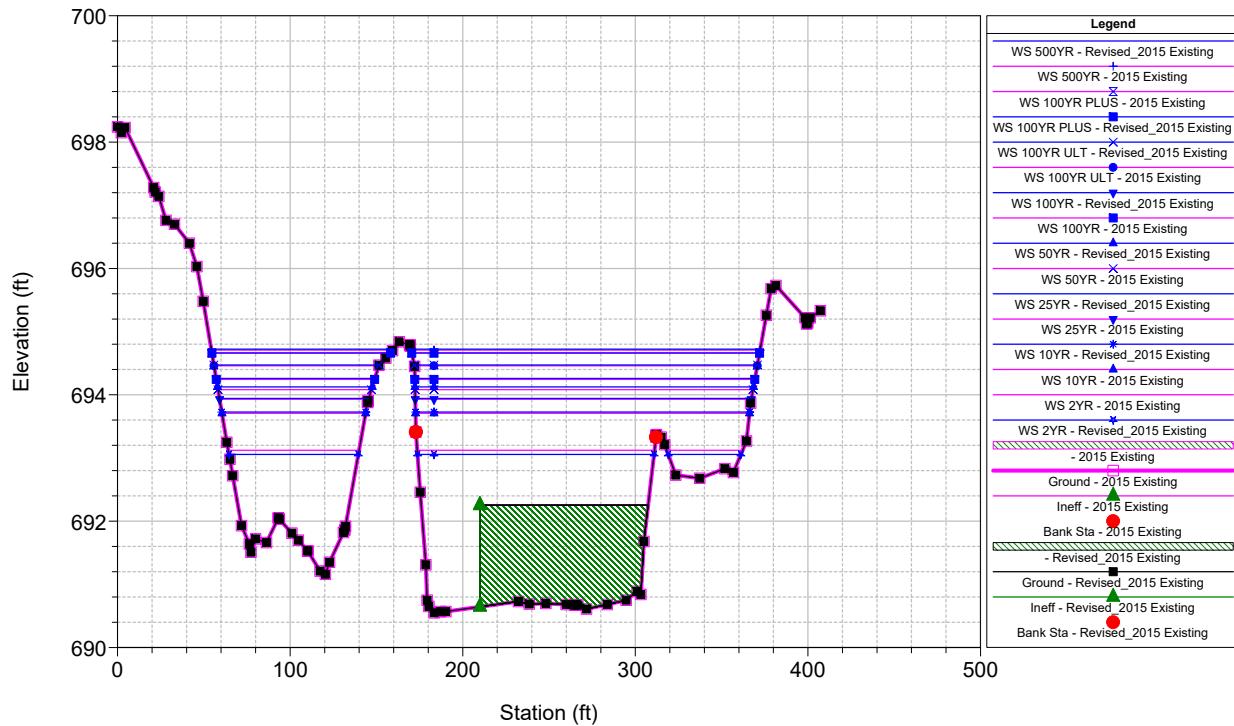
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 10083 Effective Cross Section 10735



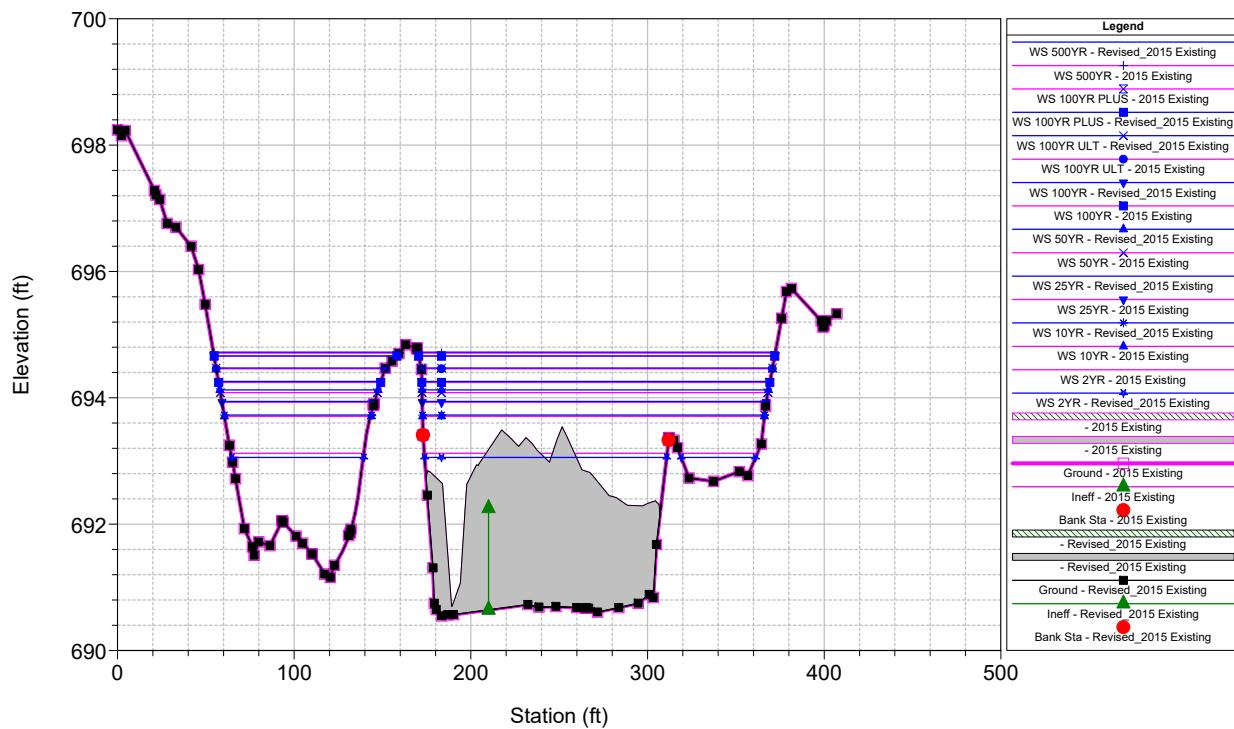
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 9779



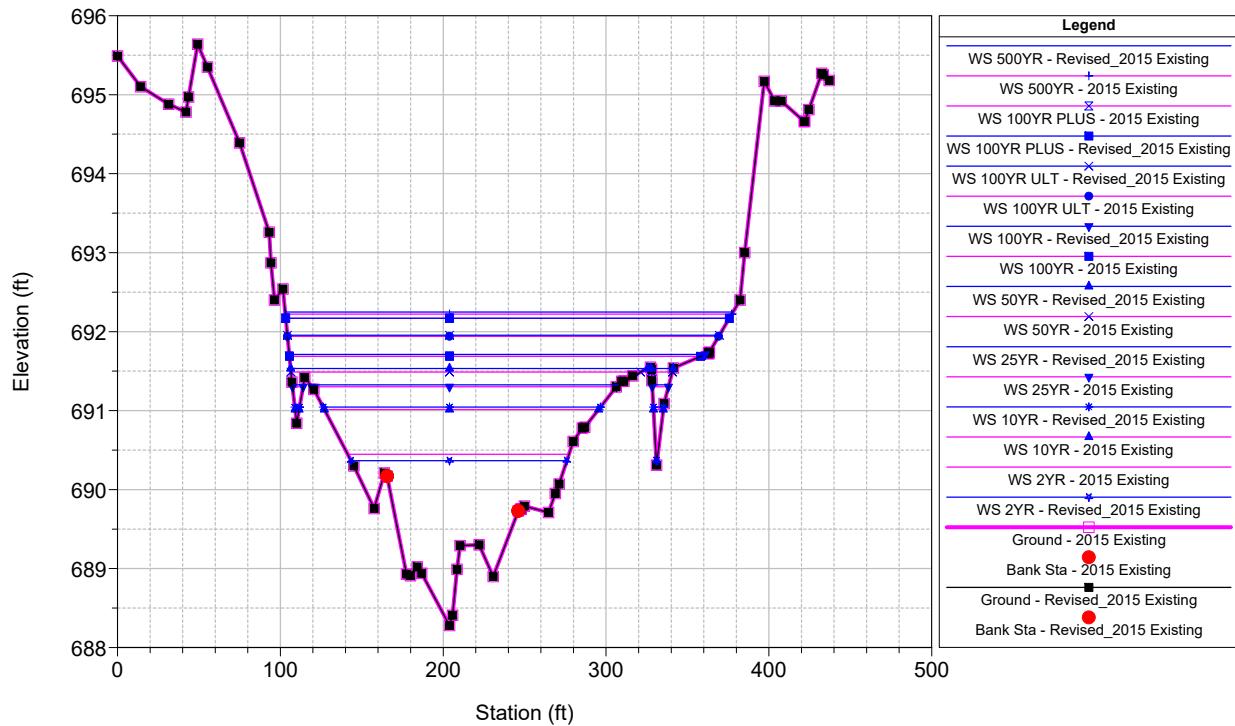
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 9676 Effective Cross Section 10365



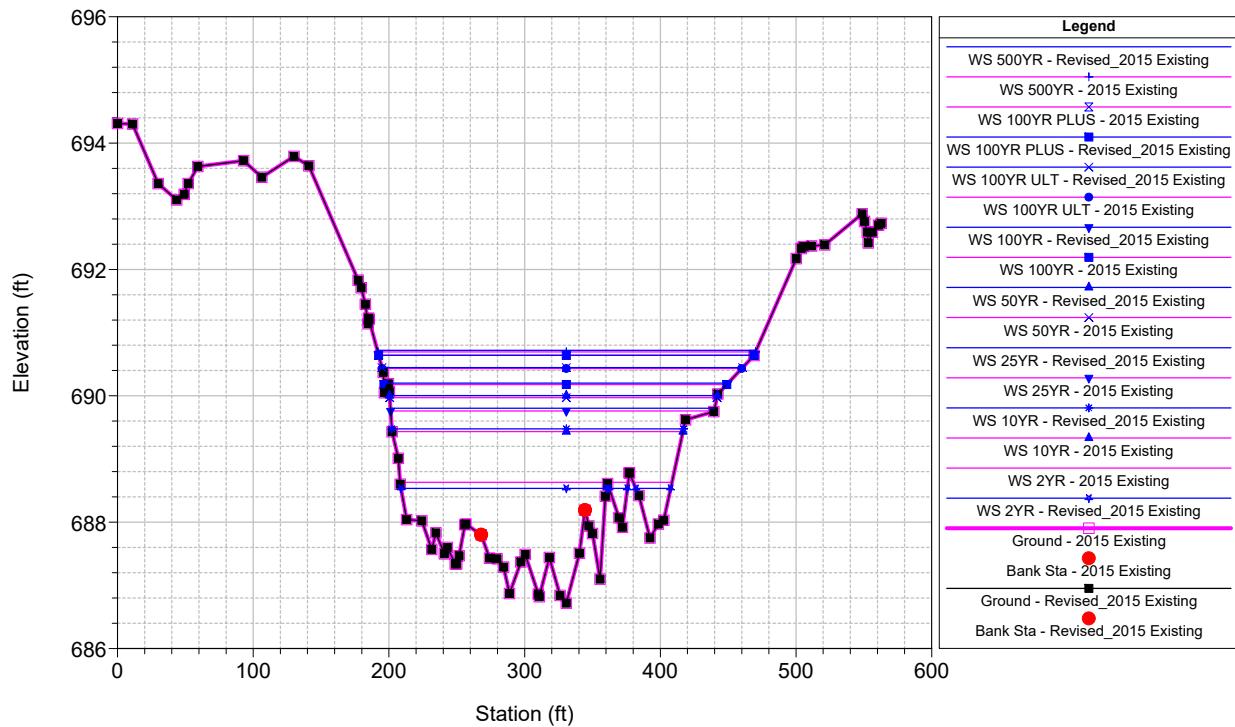
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 9641 IS



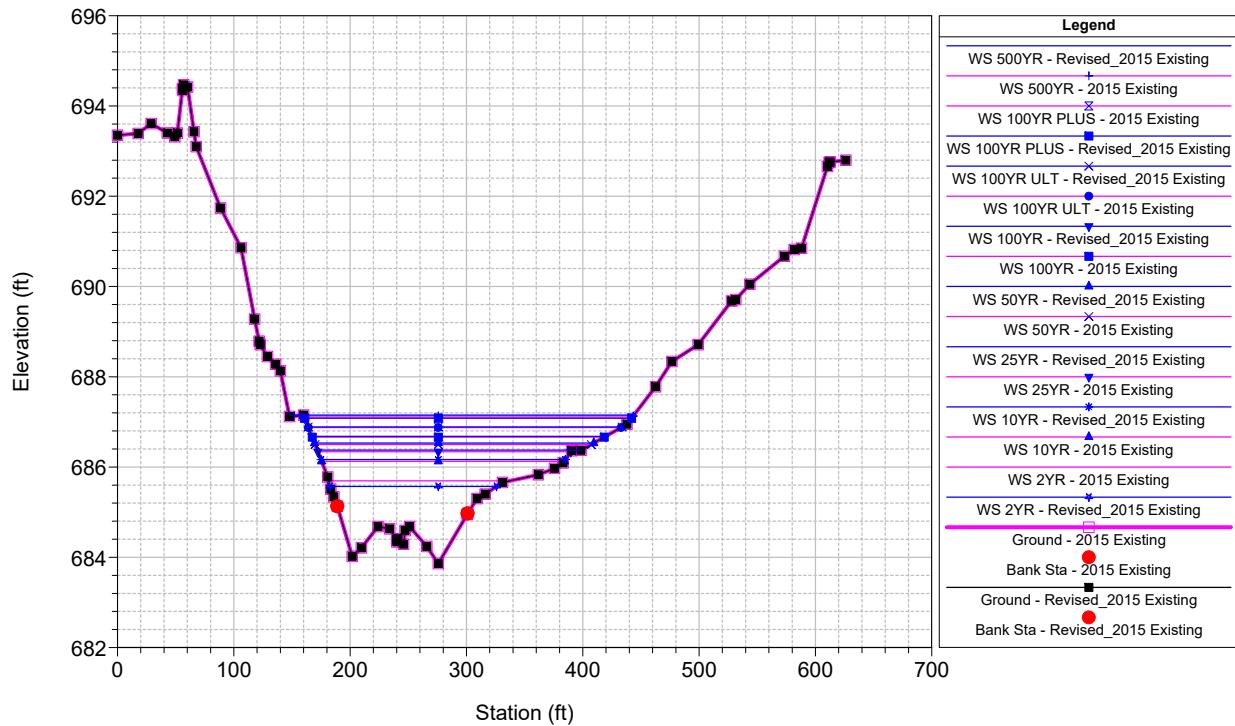
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 9558



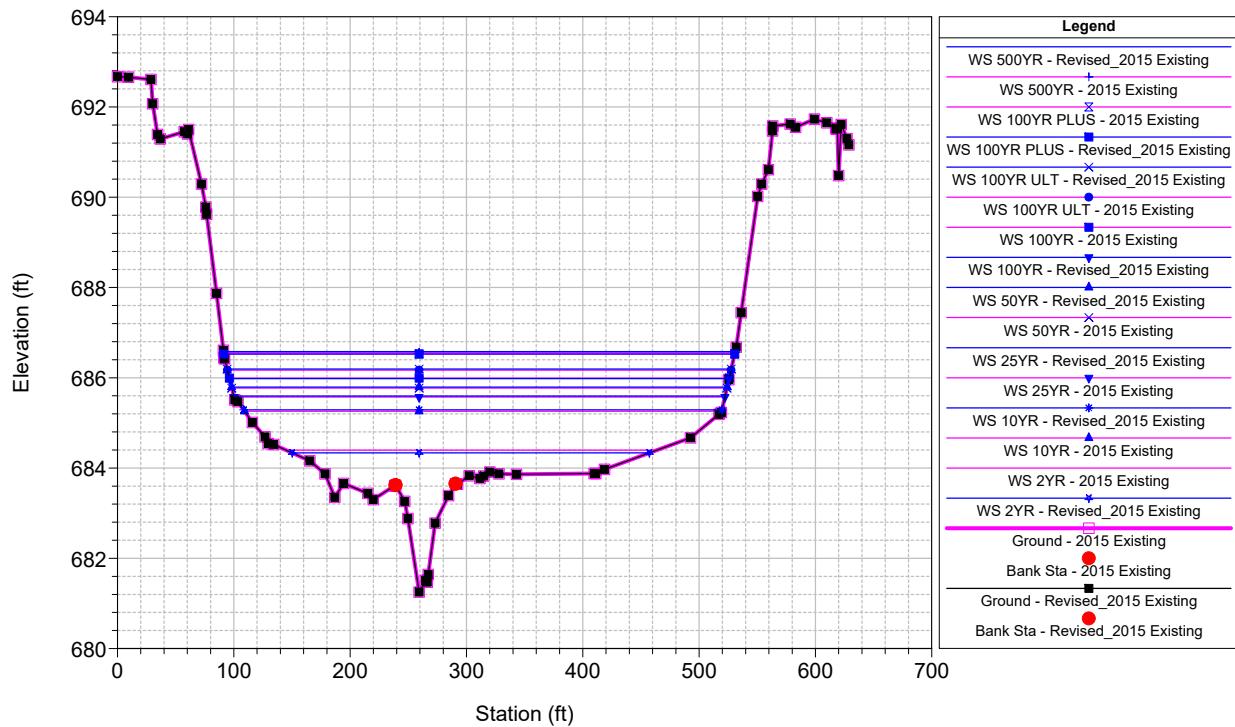
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 9338 Effective Cross Section 10070



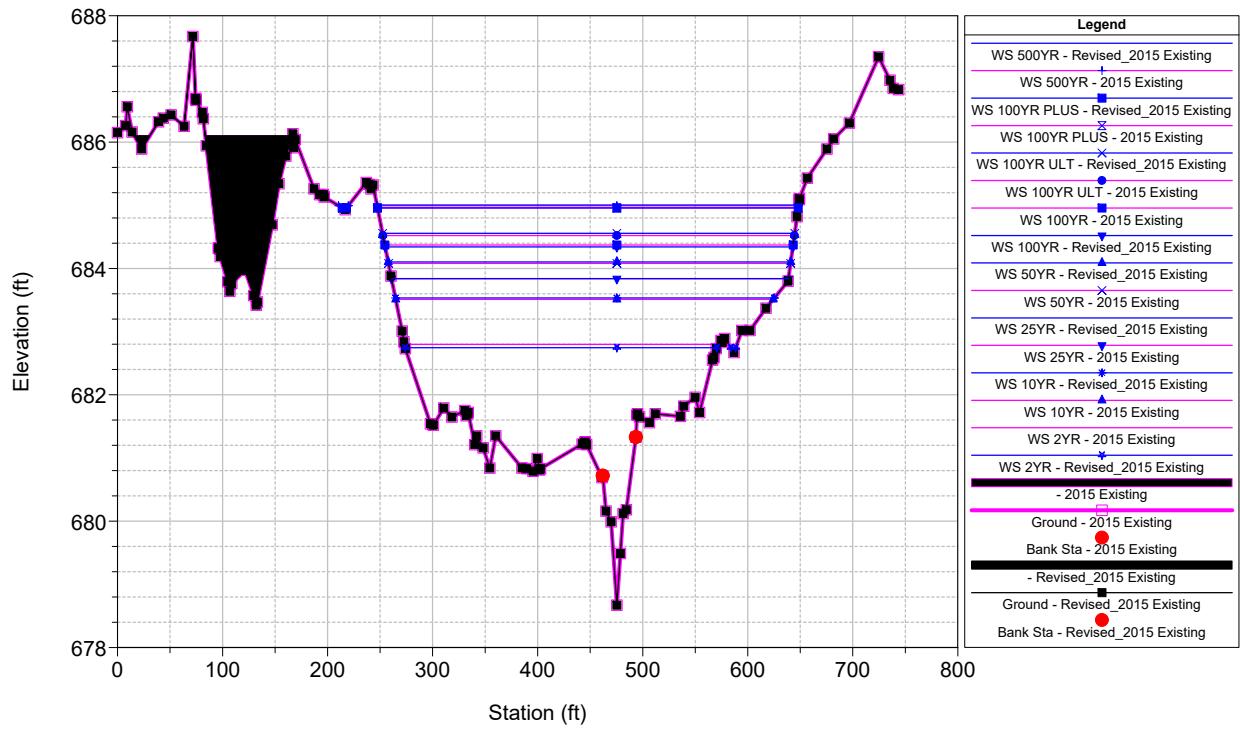
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 8947 Effective Cross Section 9905



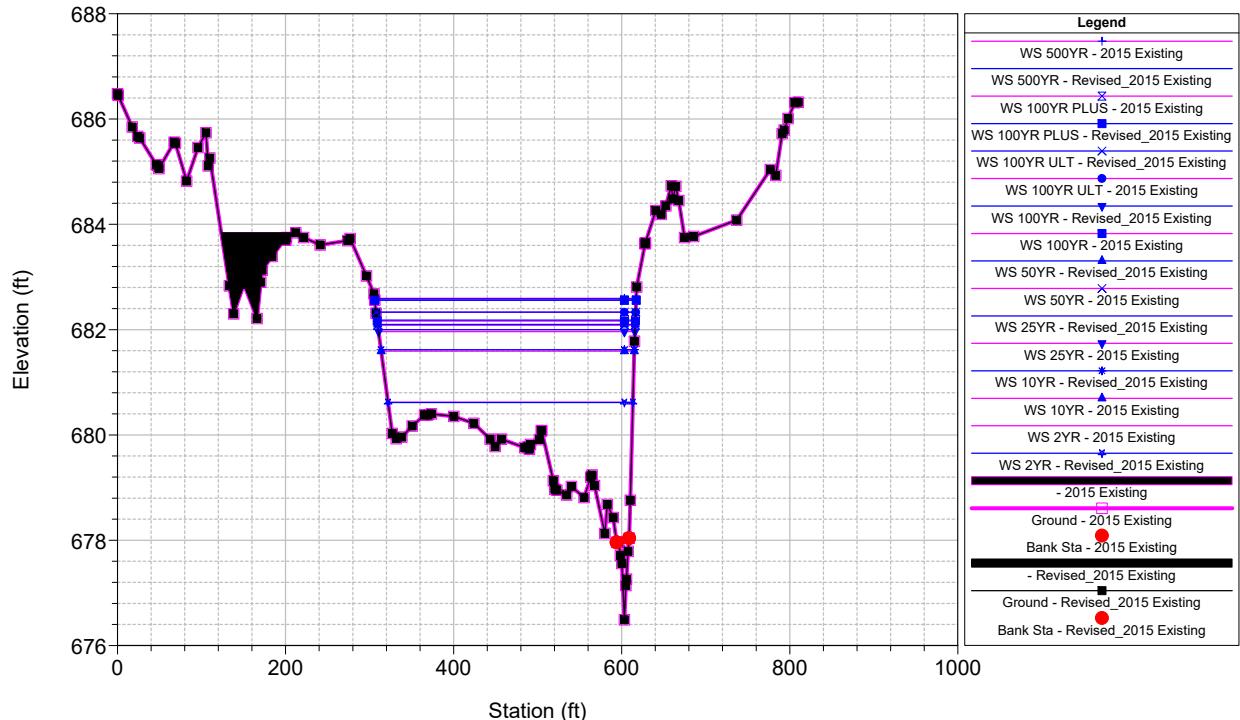
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 8750 Effective Cross Section 9550



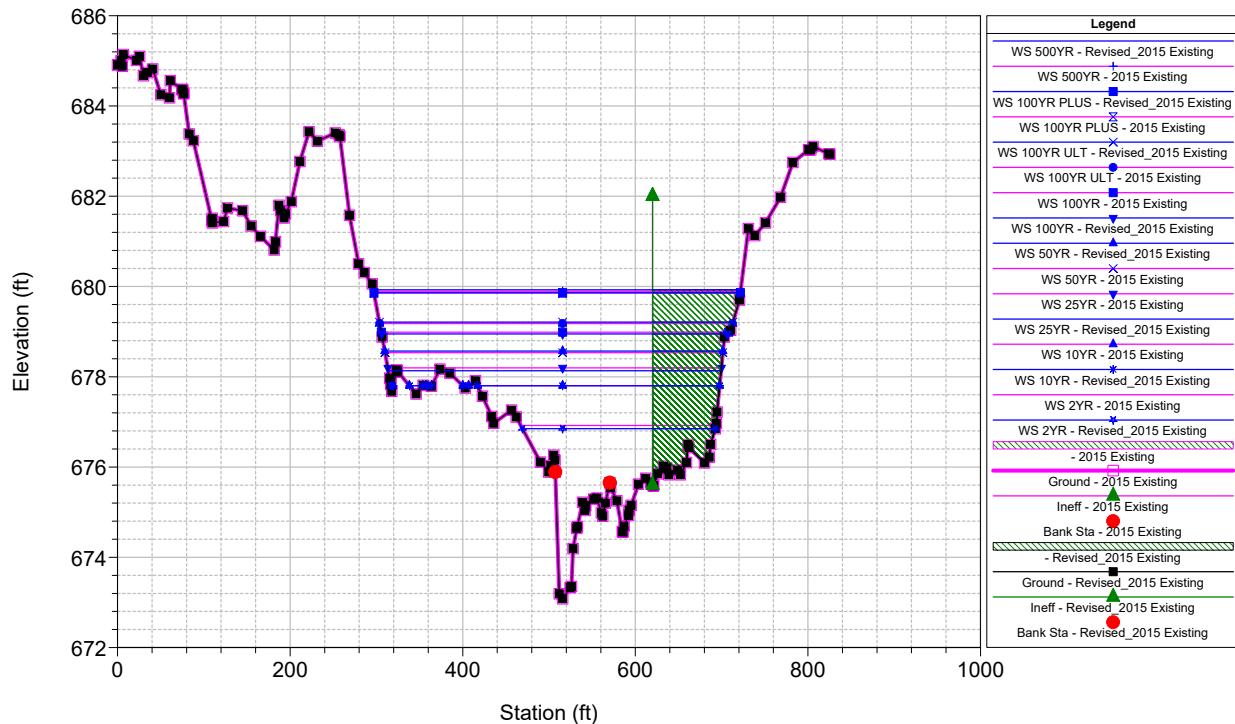
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 8382 Effective Cross Section 9165



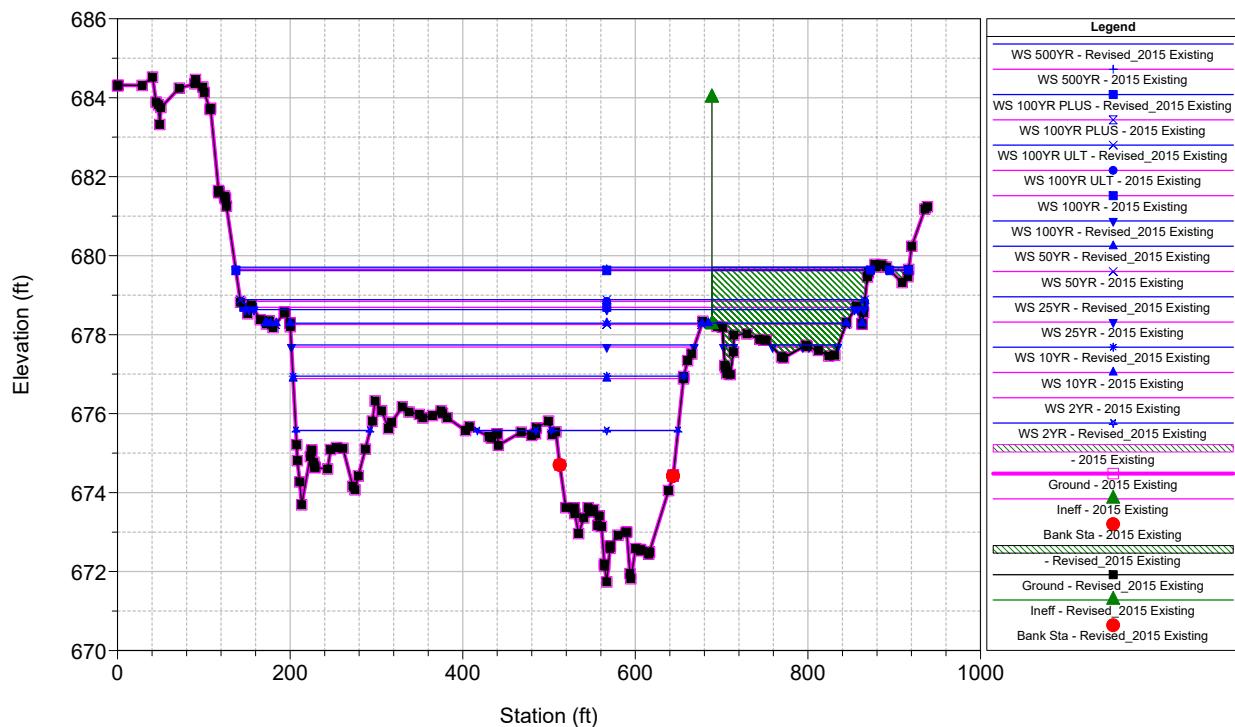
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 7966



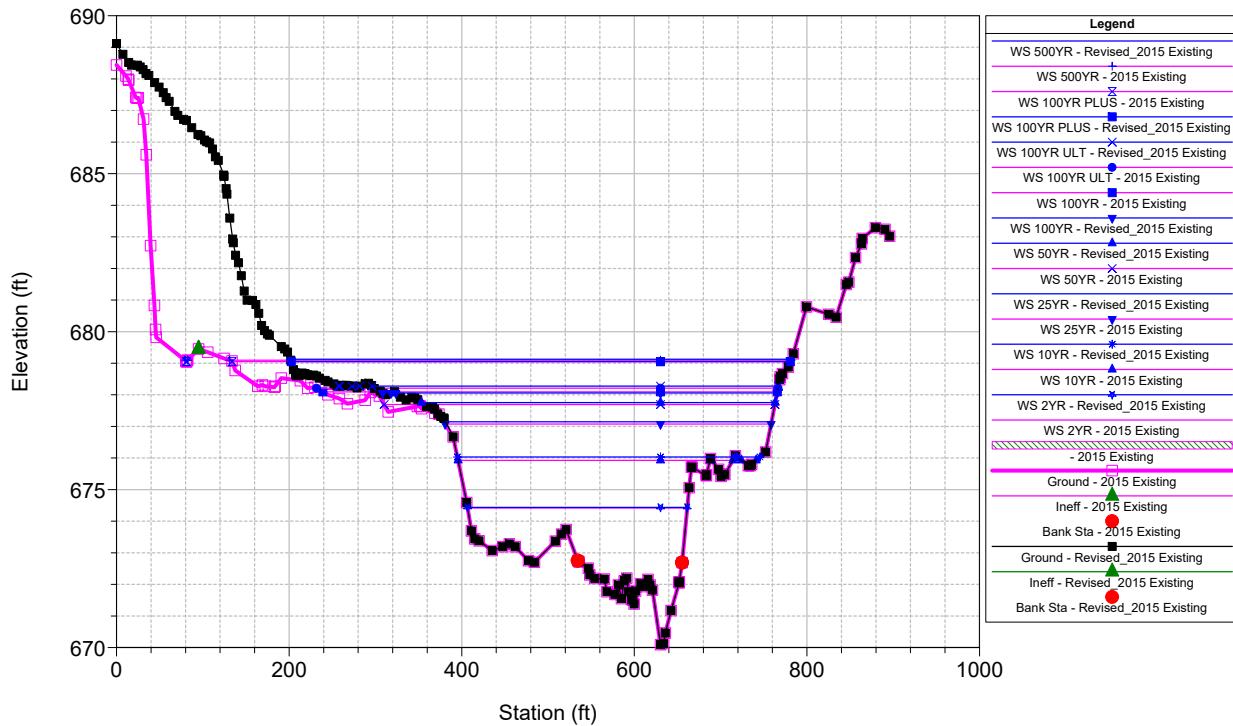
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 7579 Effective Cross Section 8350



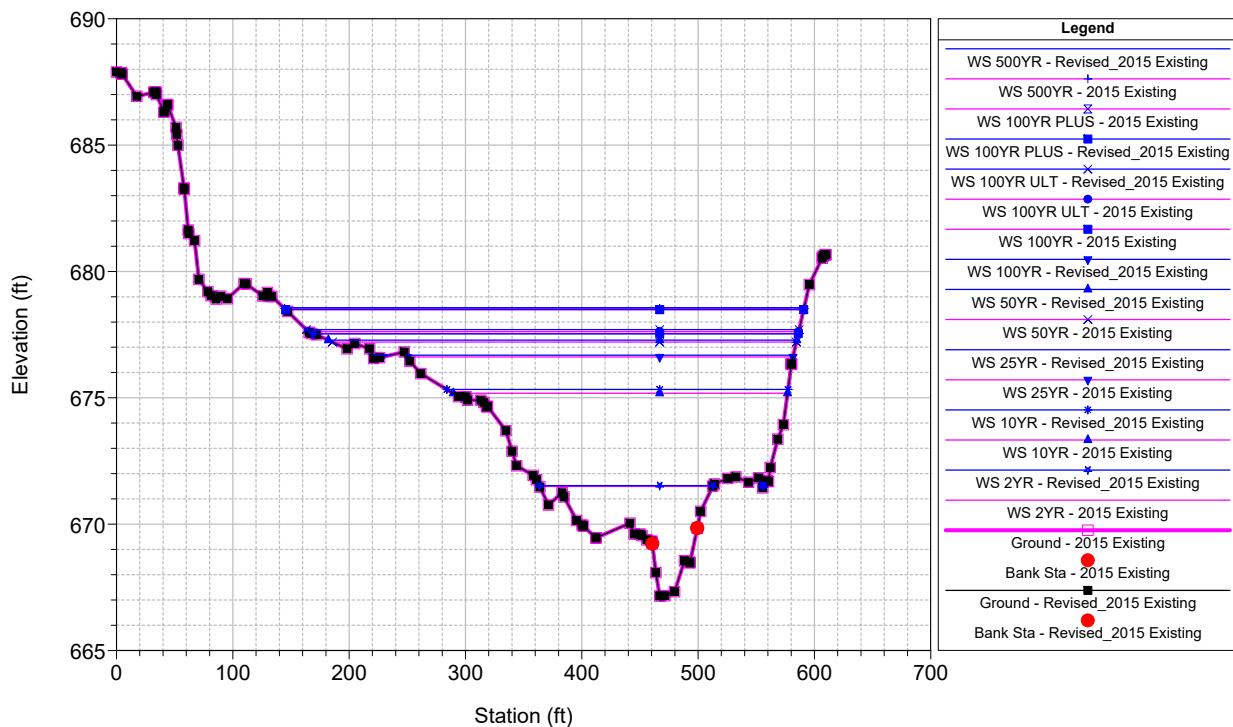
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 7244 Effective Cross Section 7450



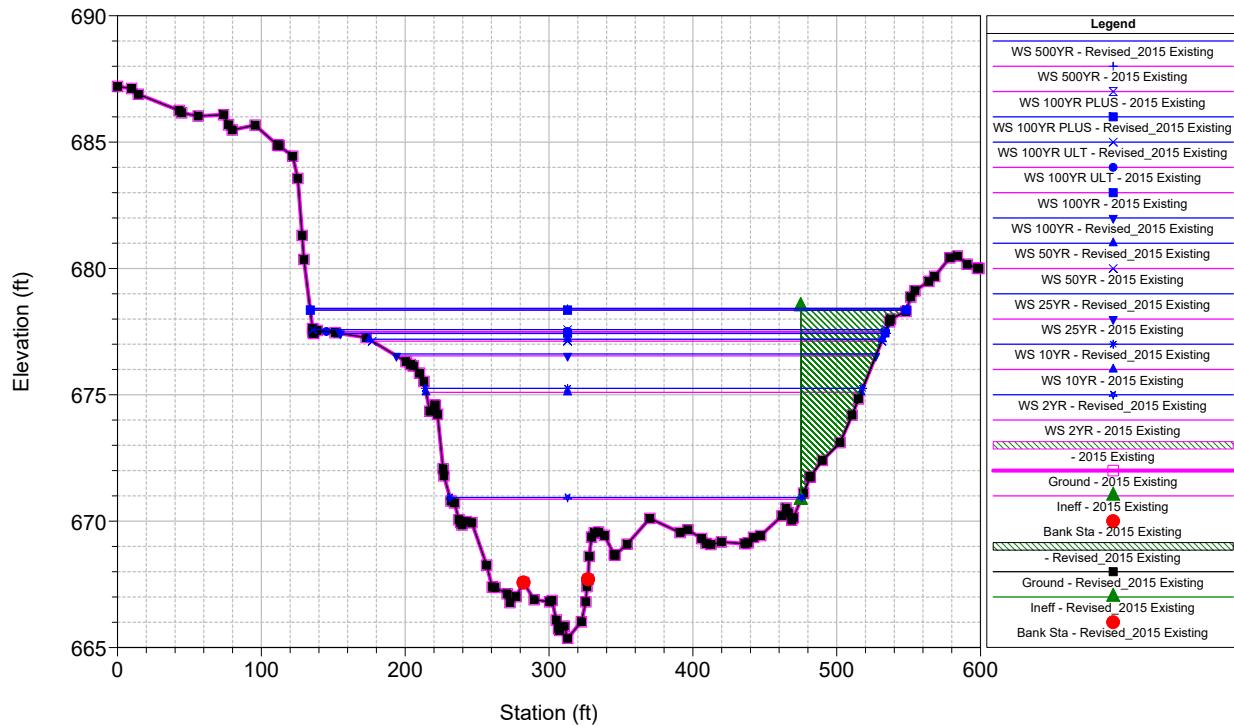
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 6899 Effective Cross Section 7050



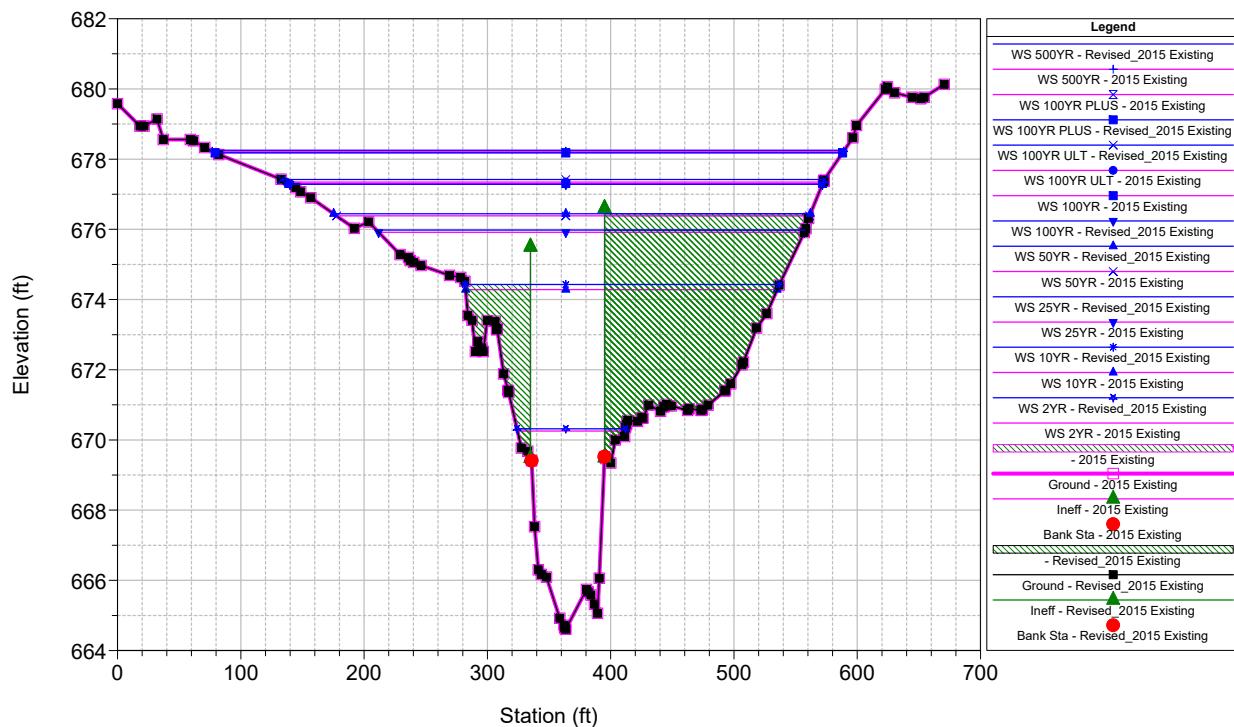
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 6410 Effective Cross Section 6520

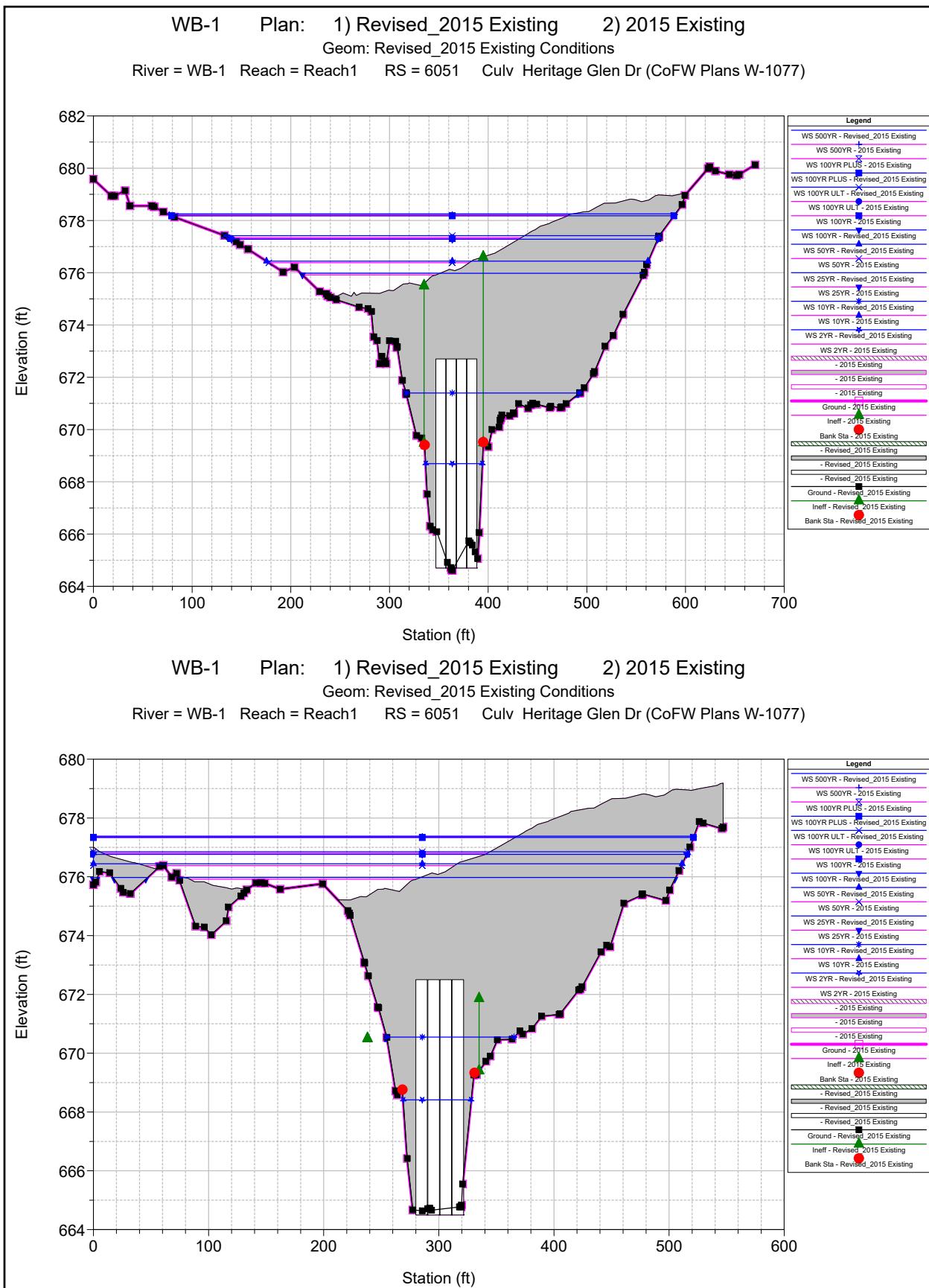


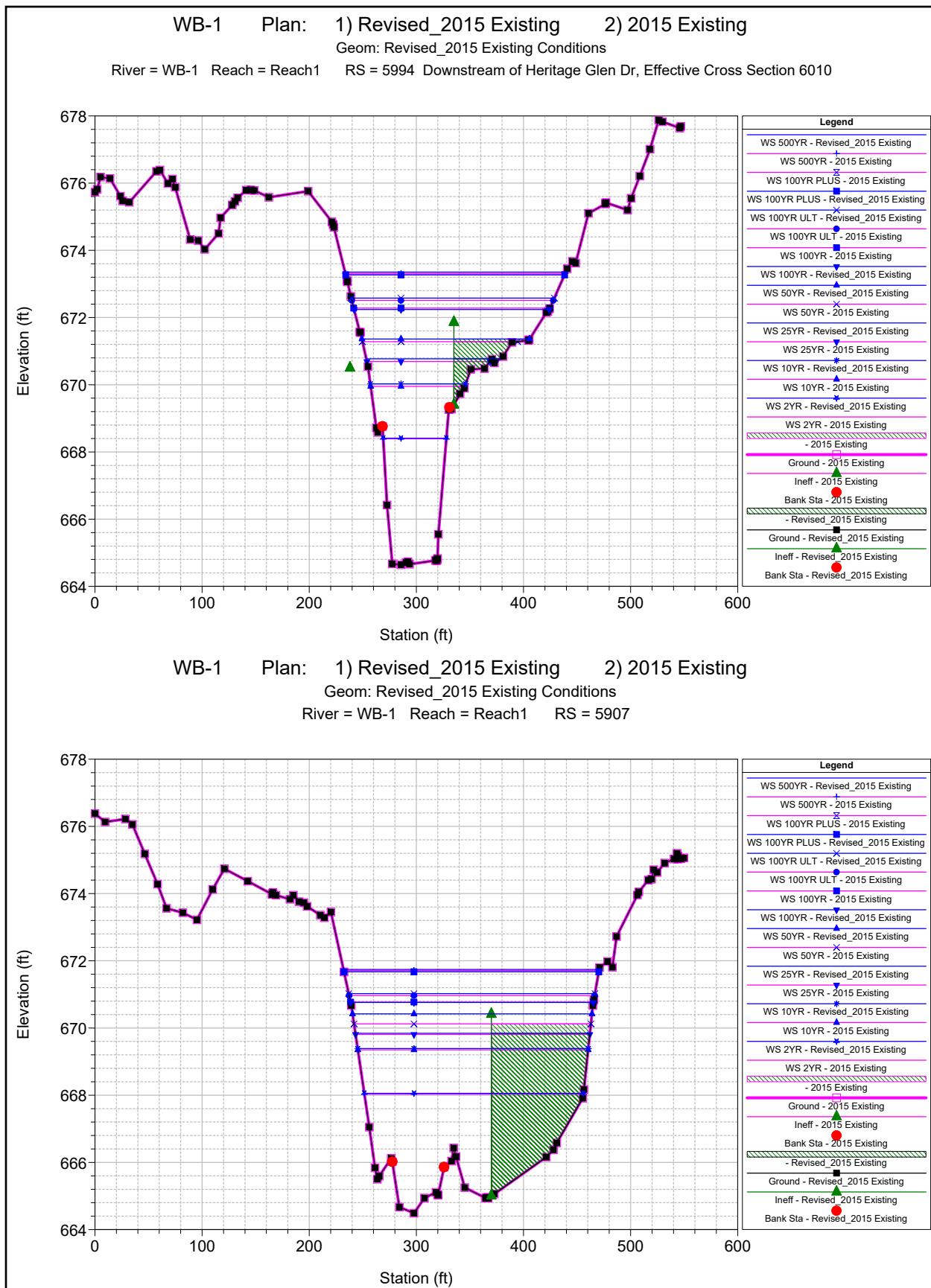
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 6180 Effective Cross Section 6200



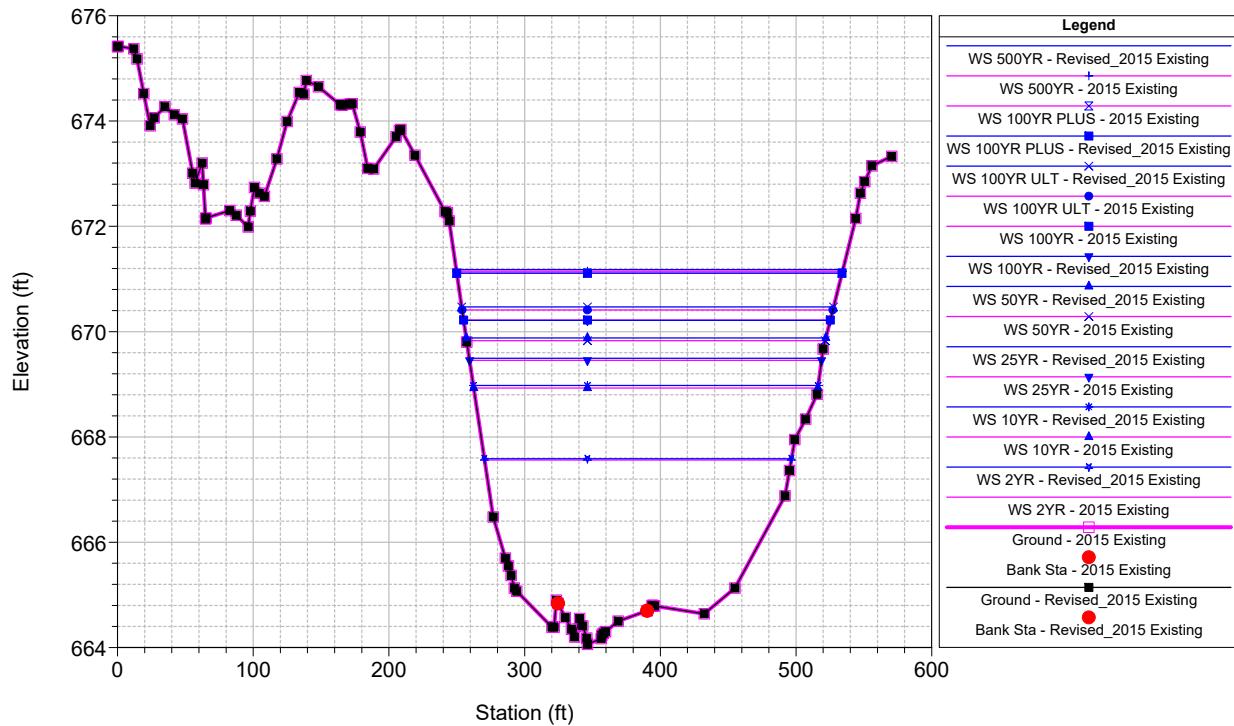
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 6101 Upstream of Heritage Glen Dr, Effective Cross Section 6080



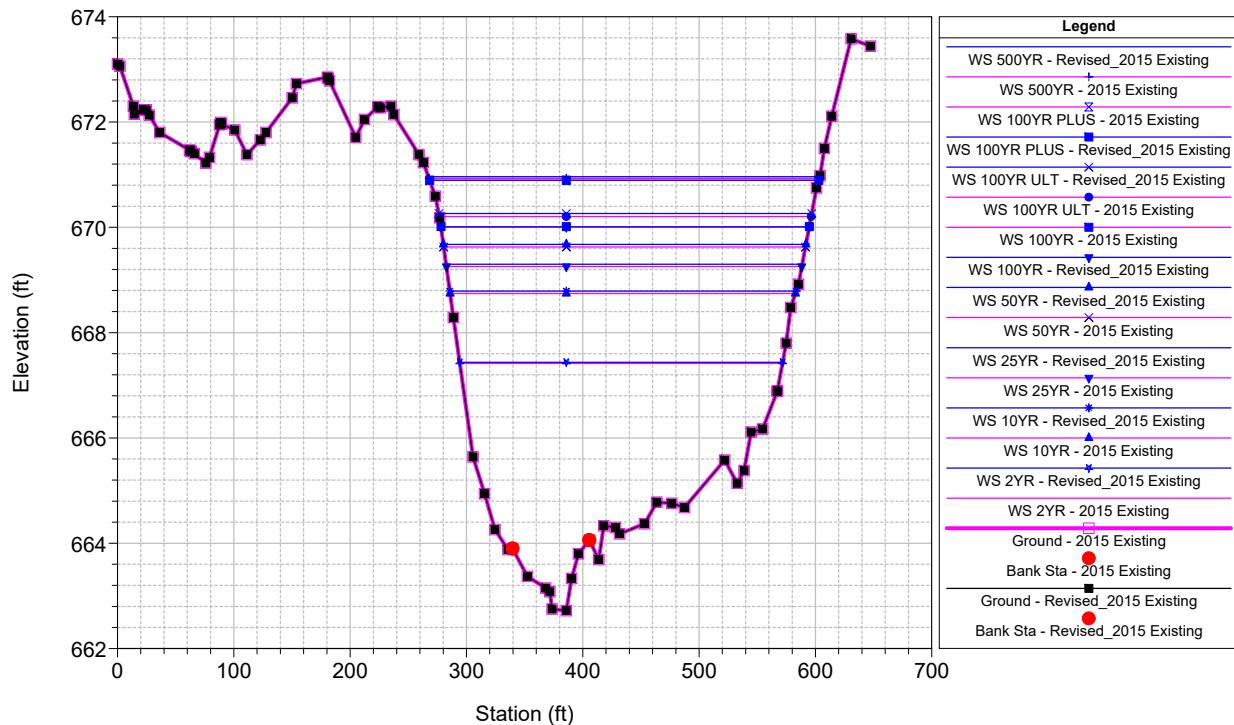




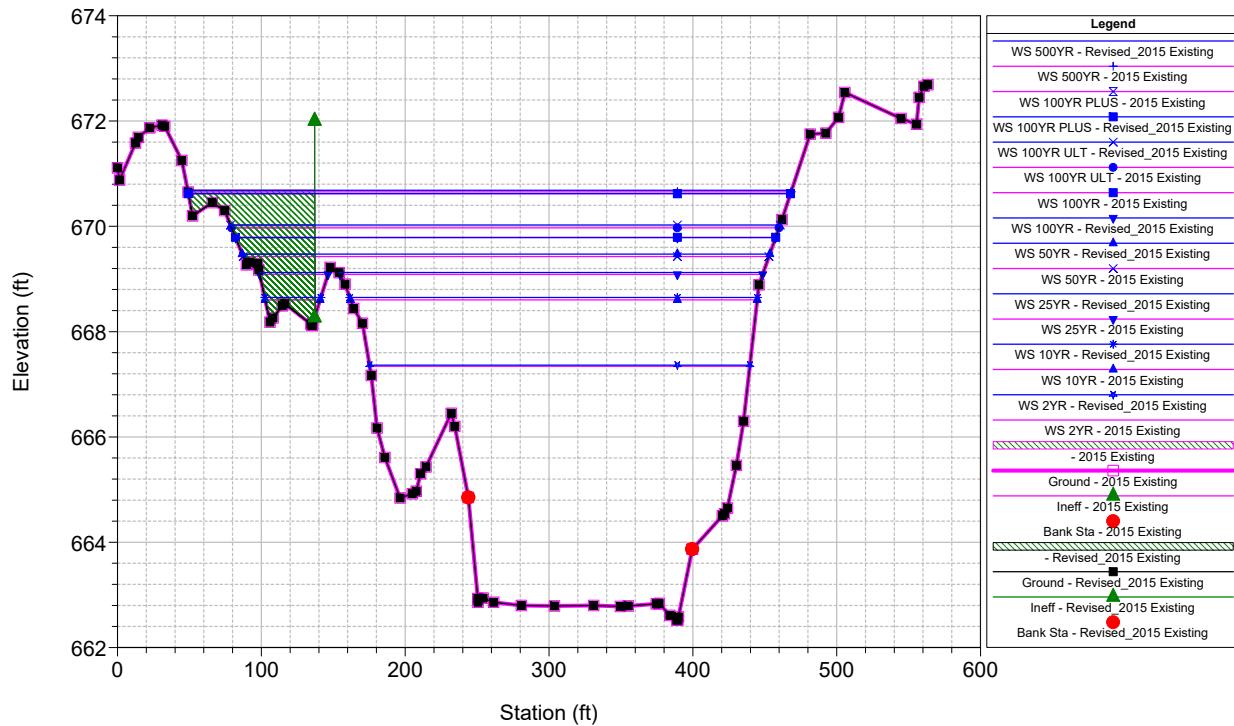
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5694 Effective Cross Section 5690



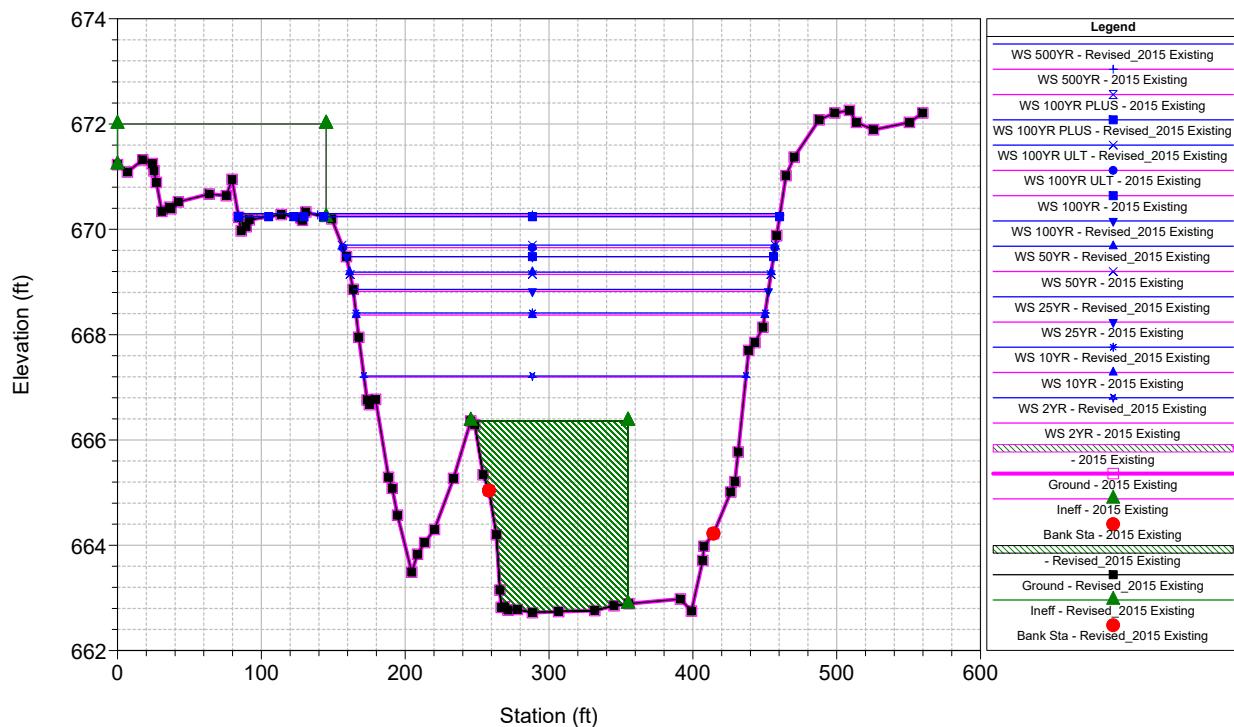
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5549



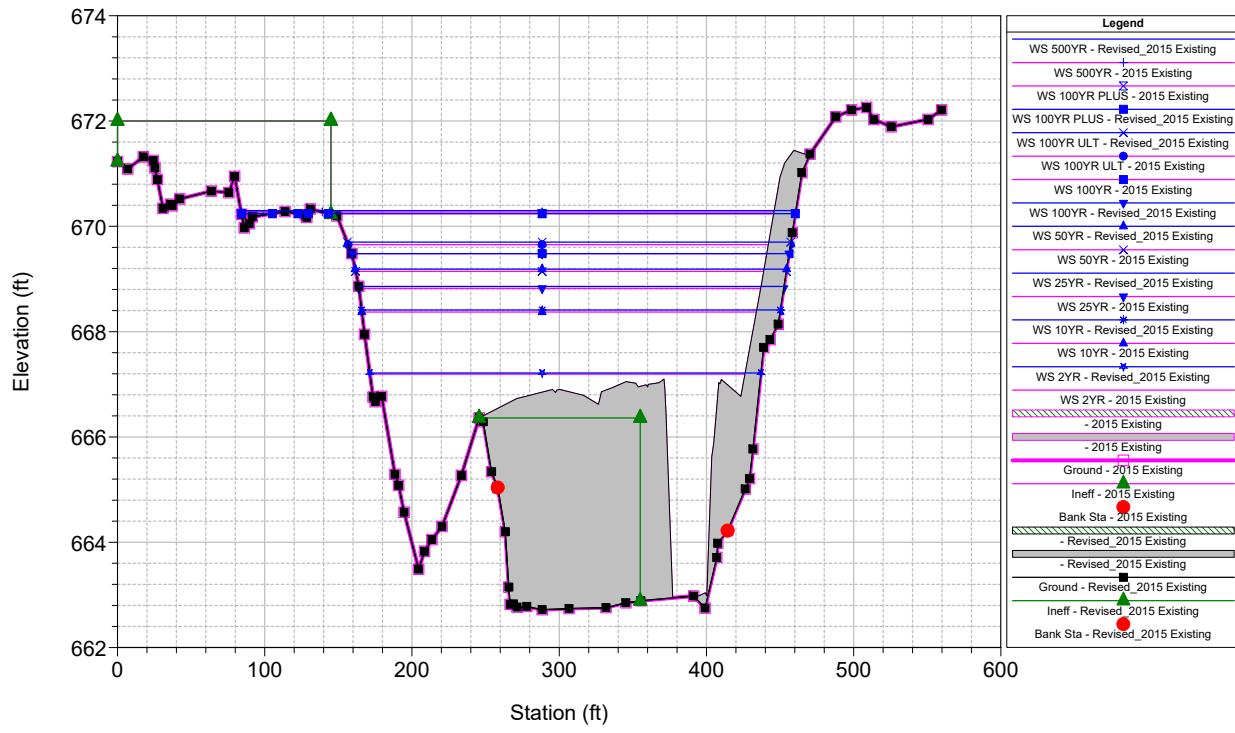
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5356



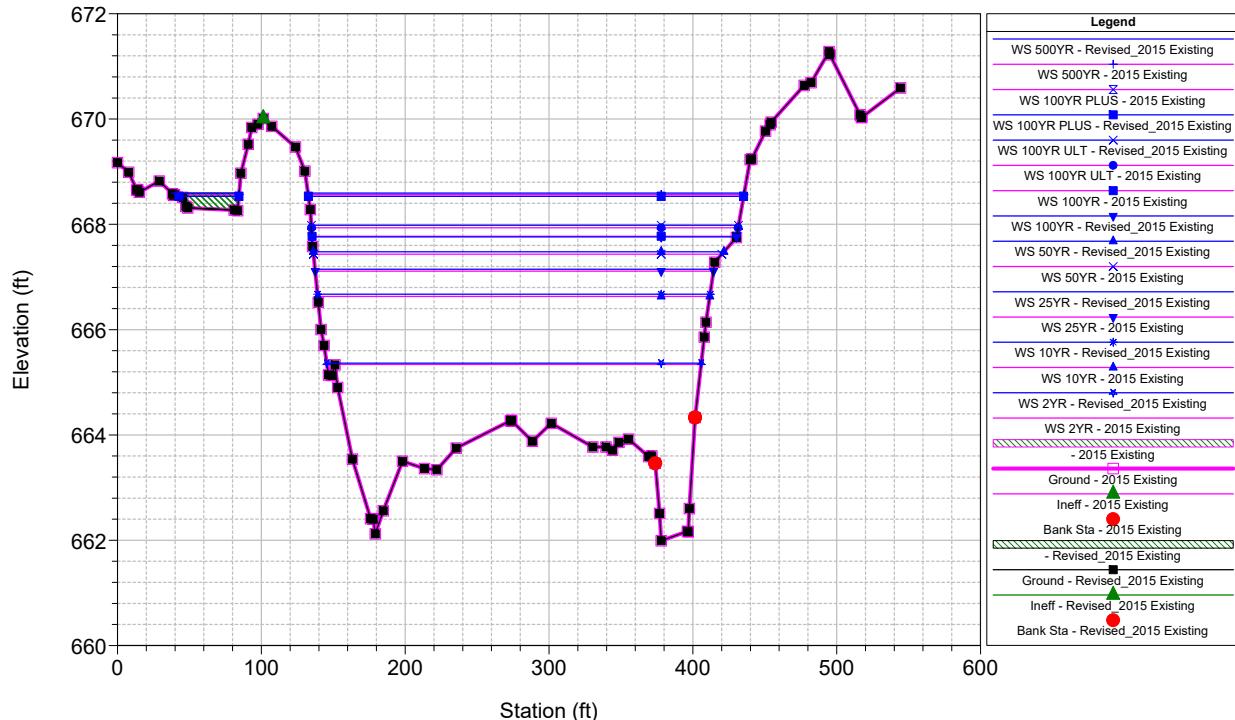
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5288



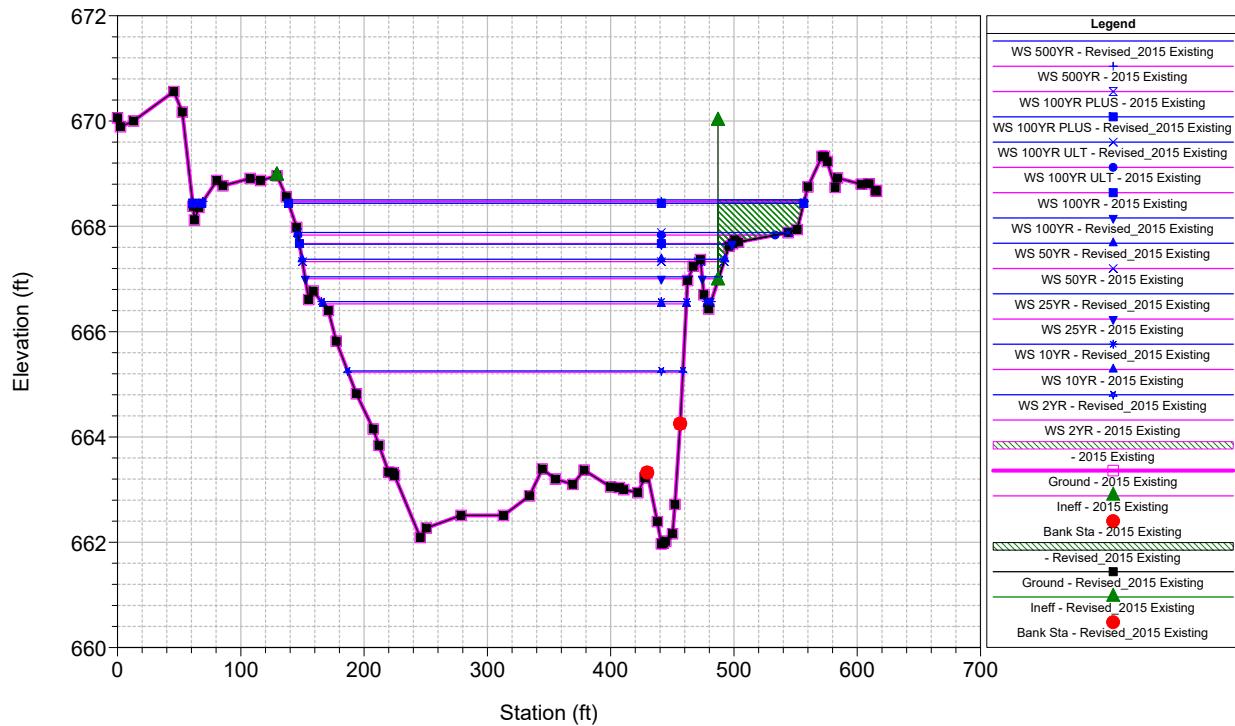
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5238 IS



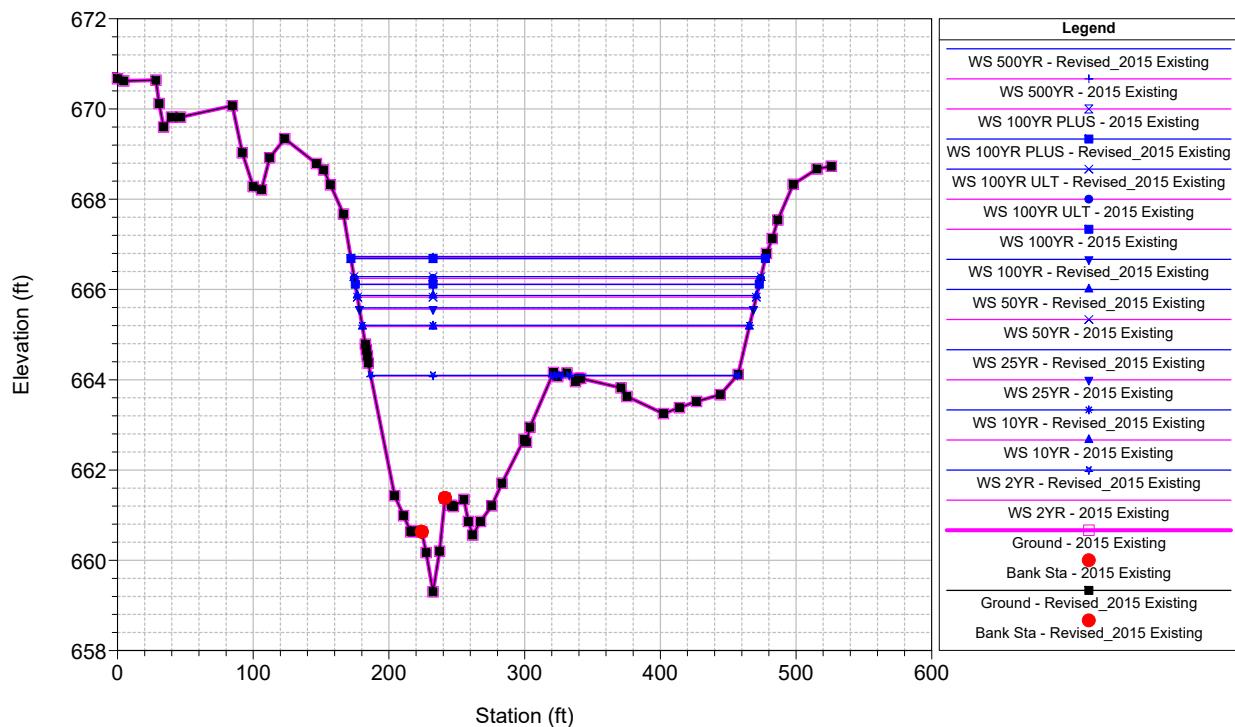
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5194



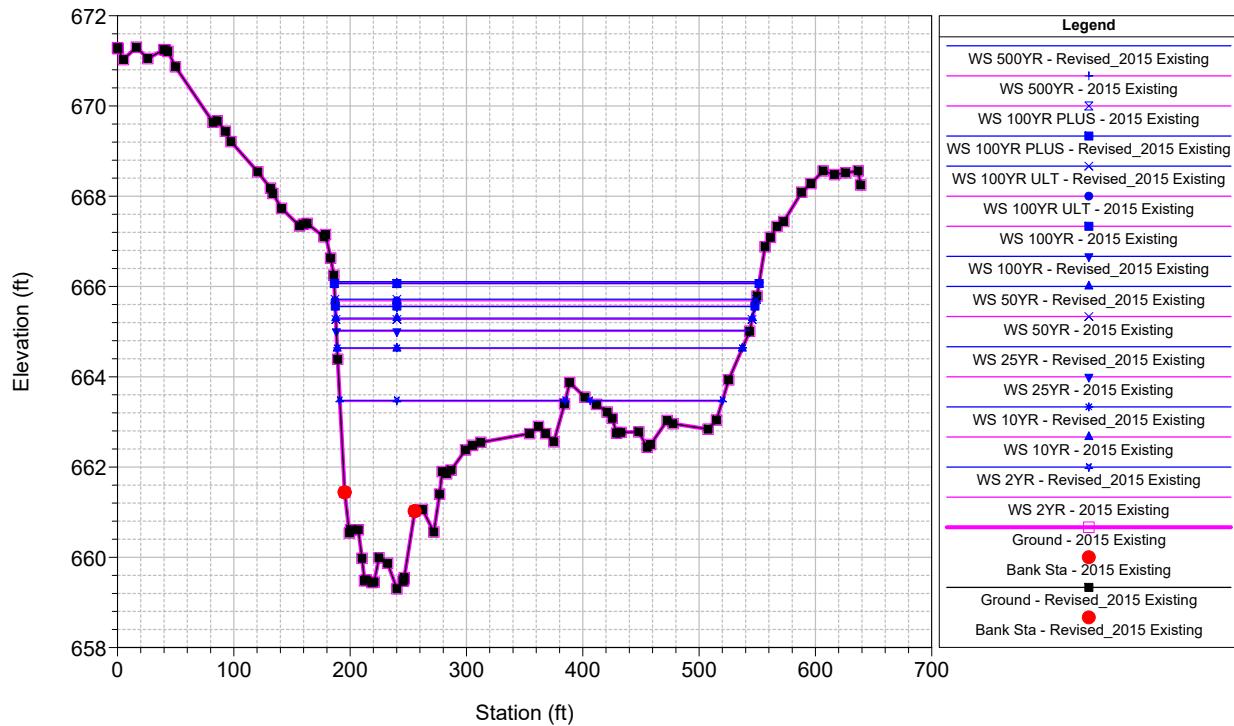
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 5142 Effective Cross Section 5190



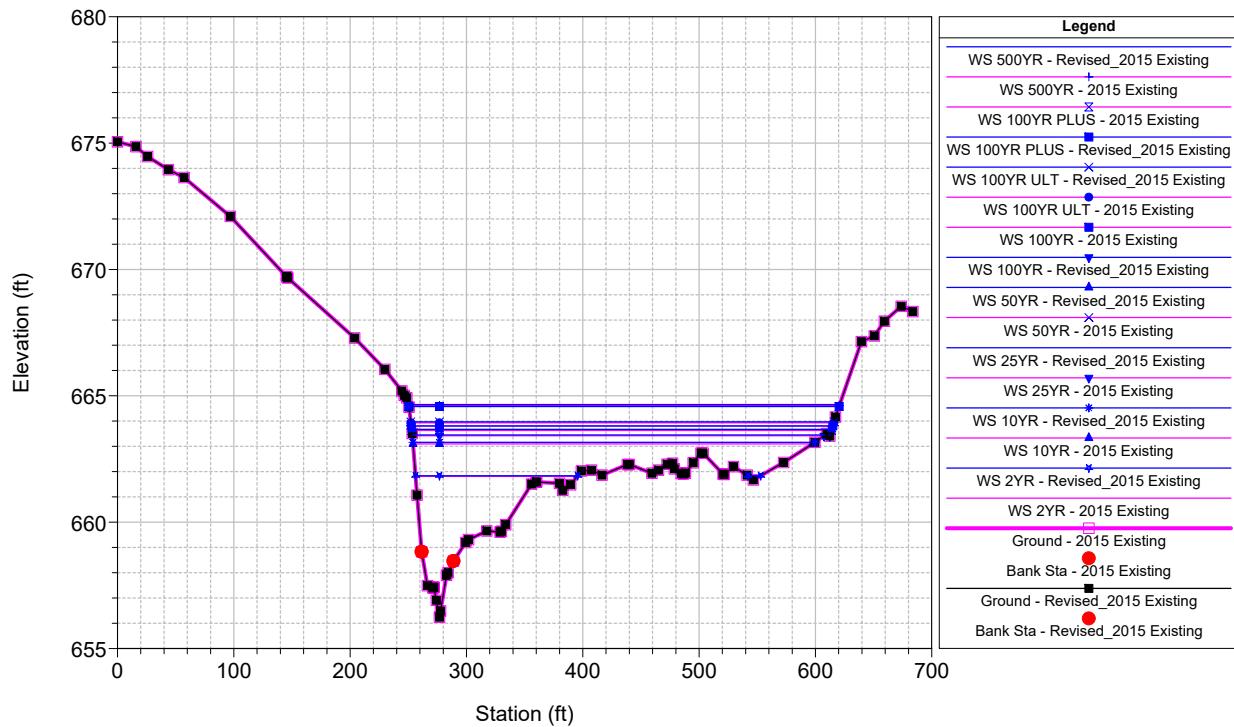
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 4816 Effective Cross Section 5000



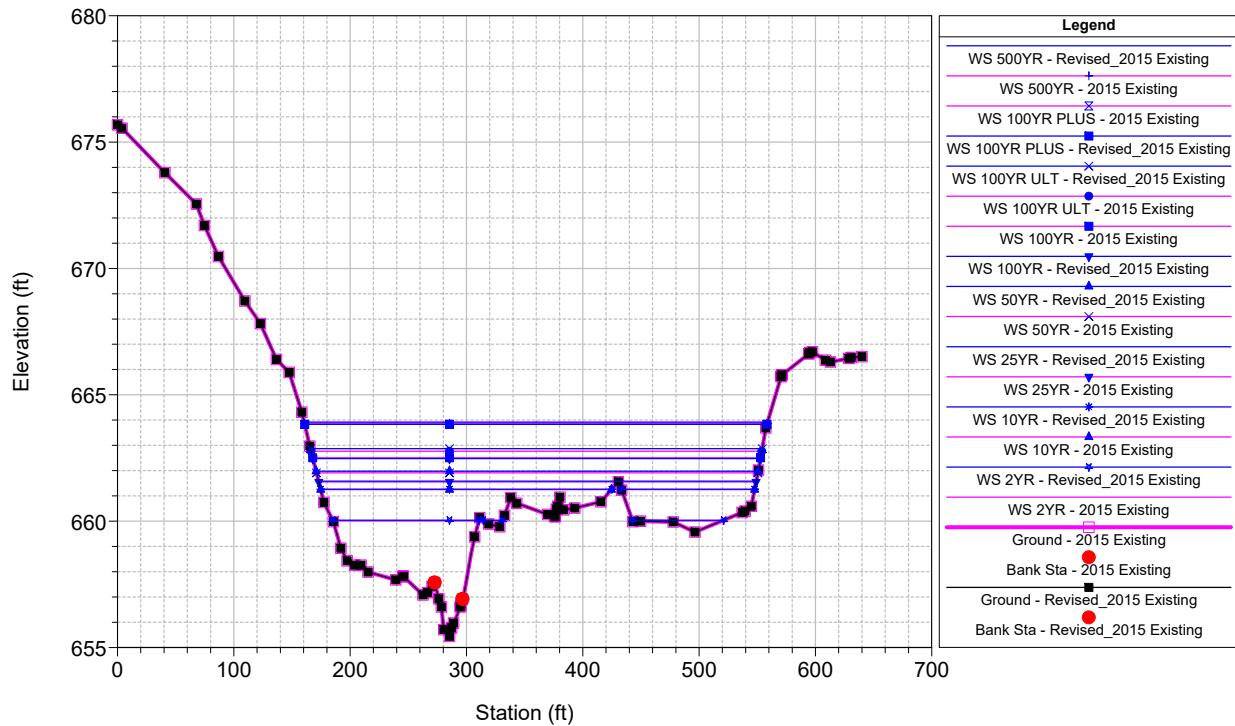
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 4673 Effective Cross Section 4326



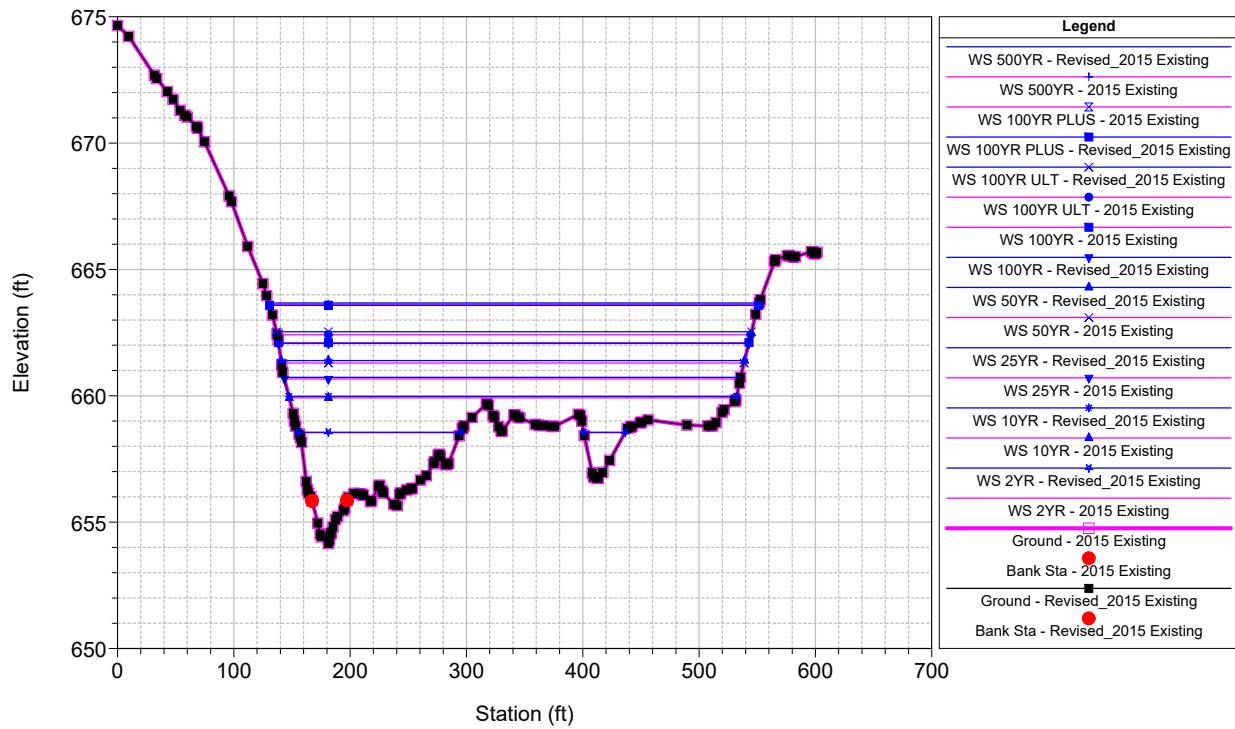
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 4475 Effective Cross Section 4176



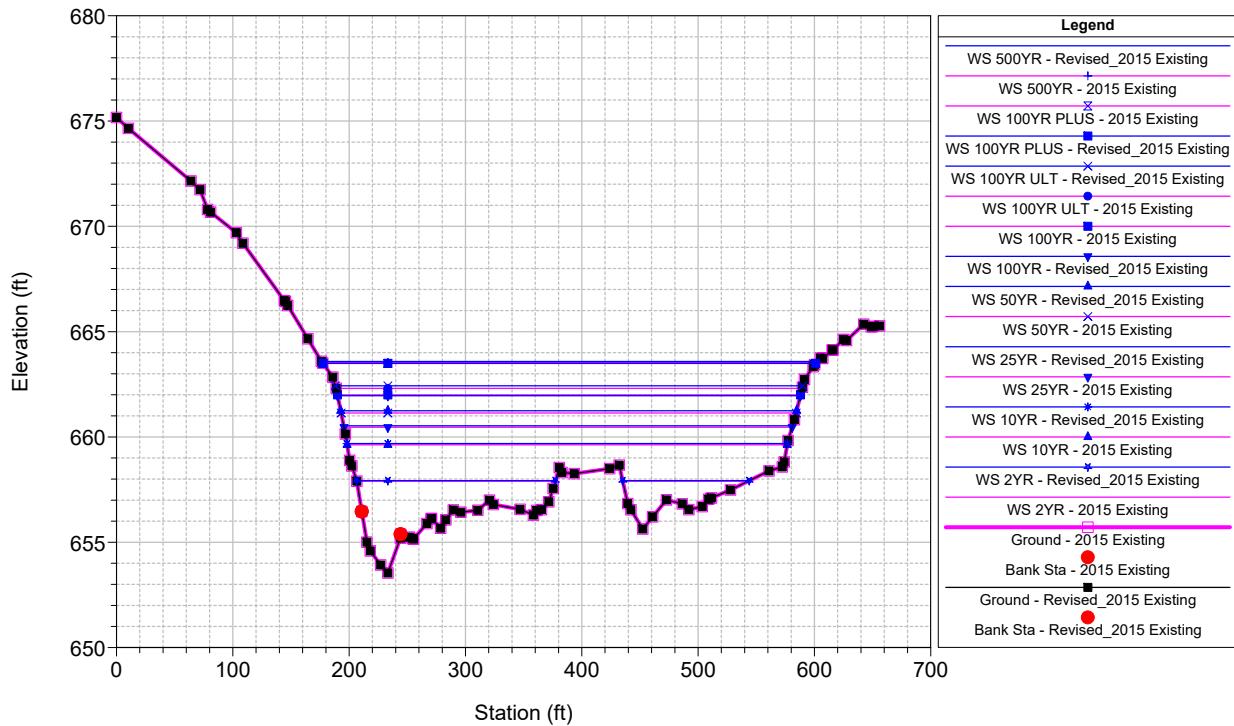
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 4239 Effective Cross Section 3910



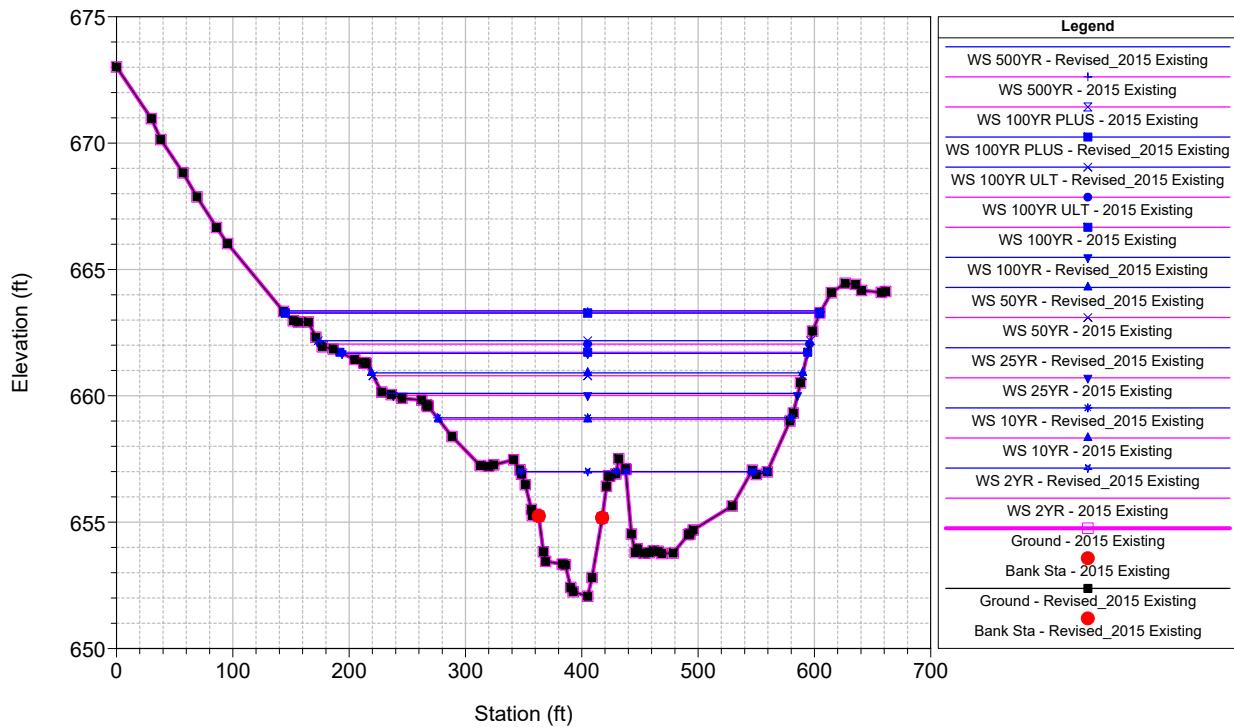
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 3962 Effective Cross Section 3910



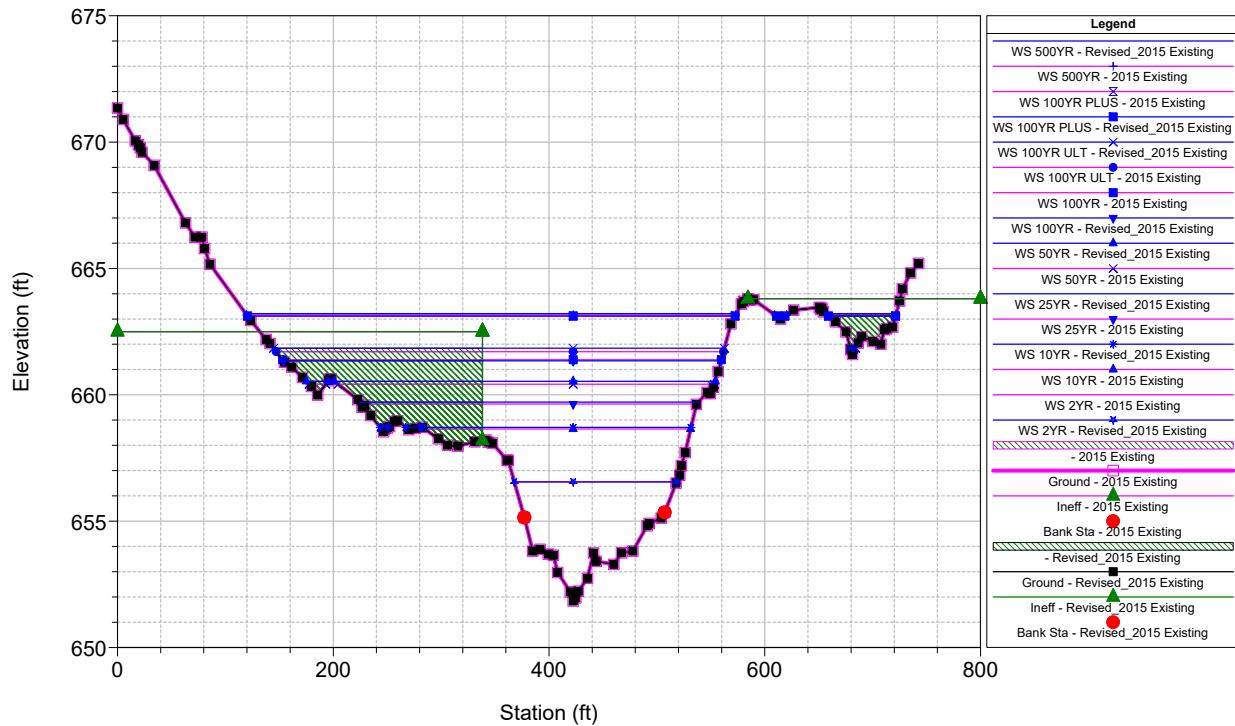
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 3831 Effective Cross Section 3598



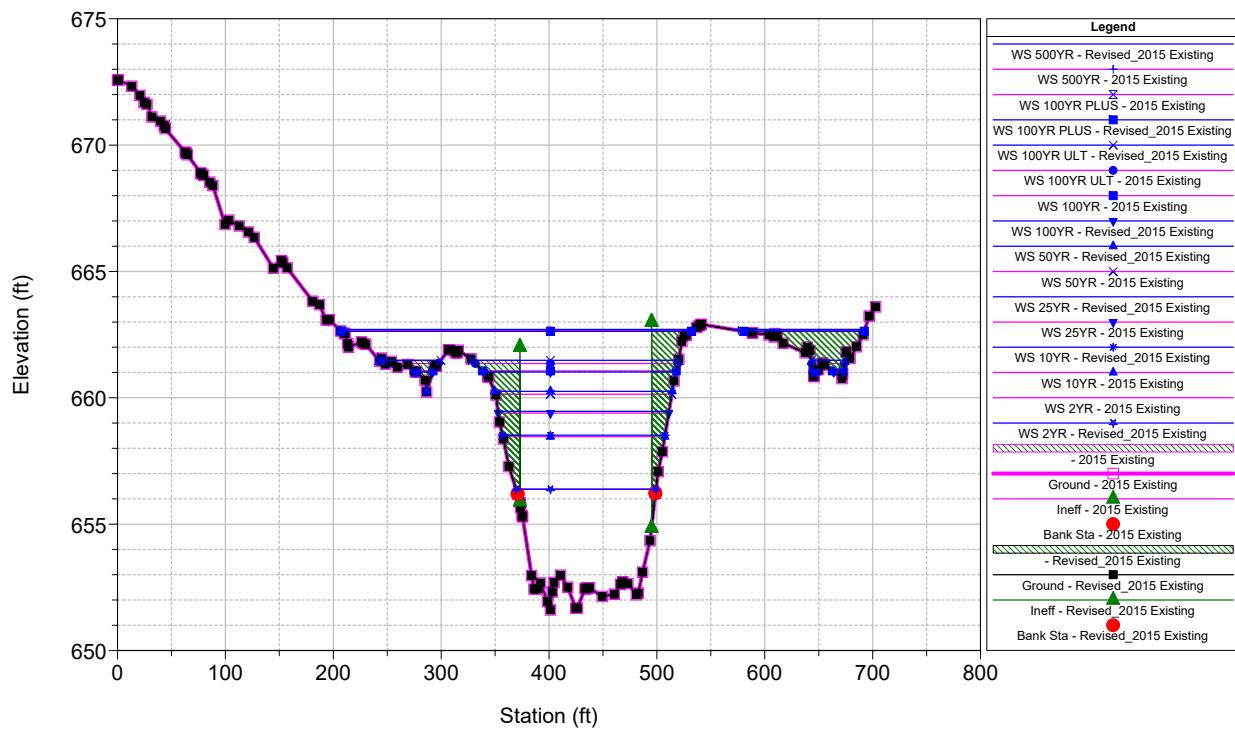
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 3533 Effective Cross Section 3320

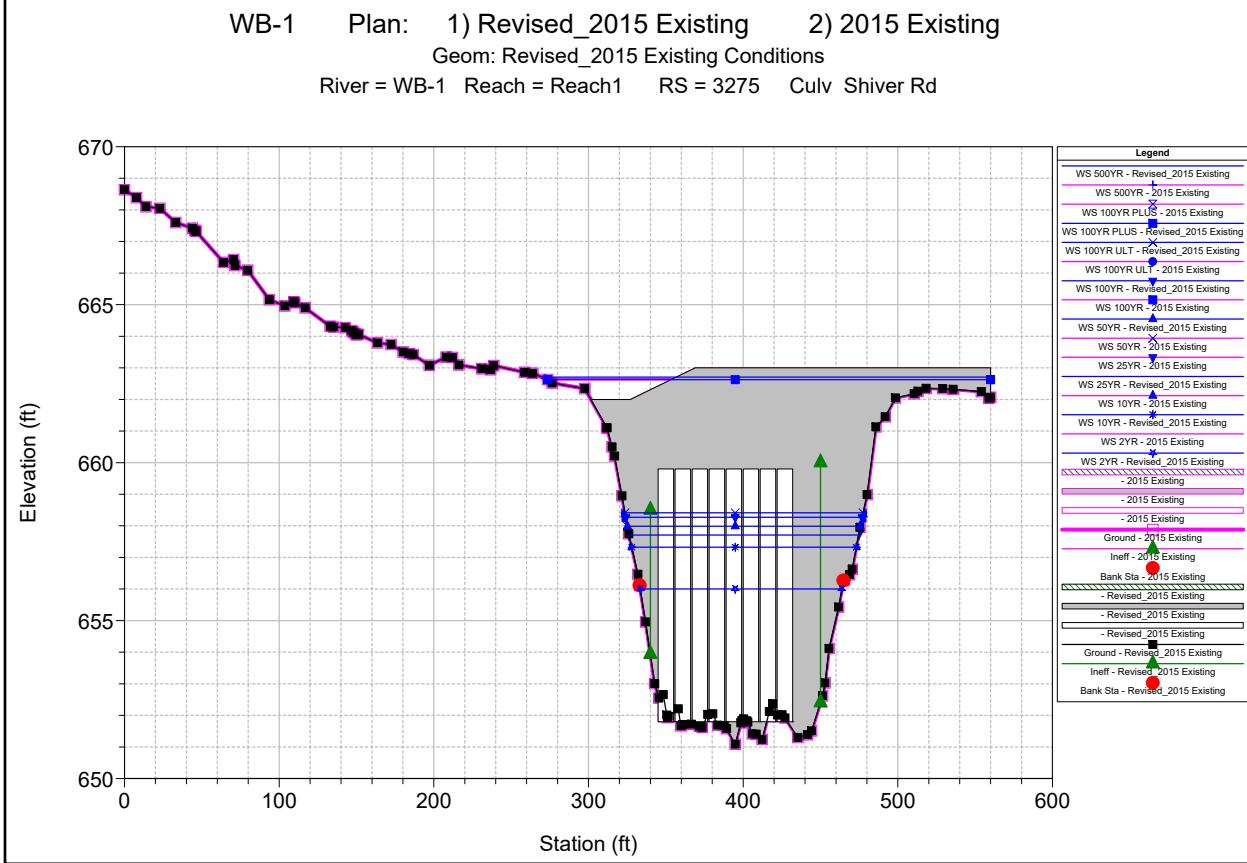
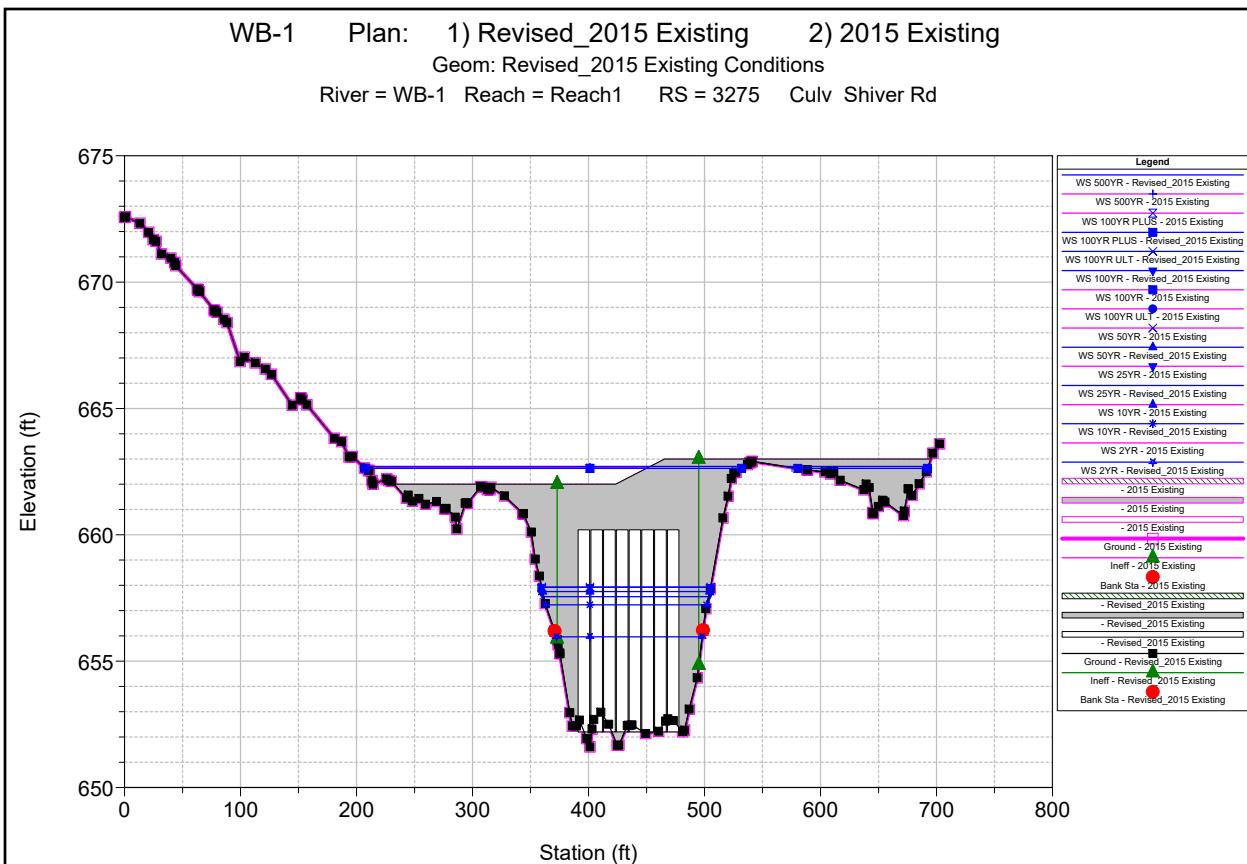


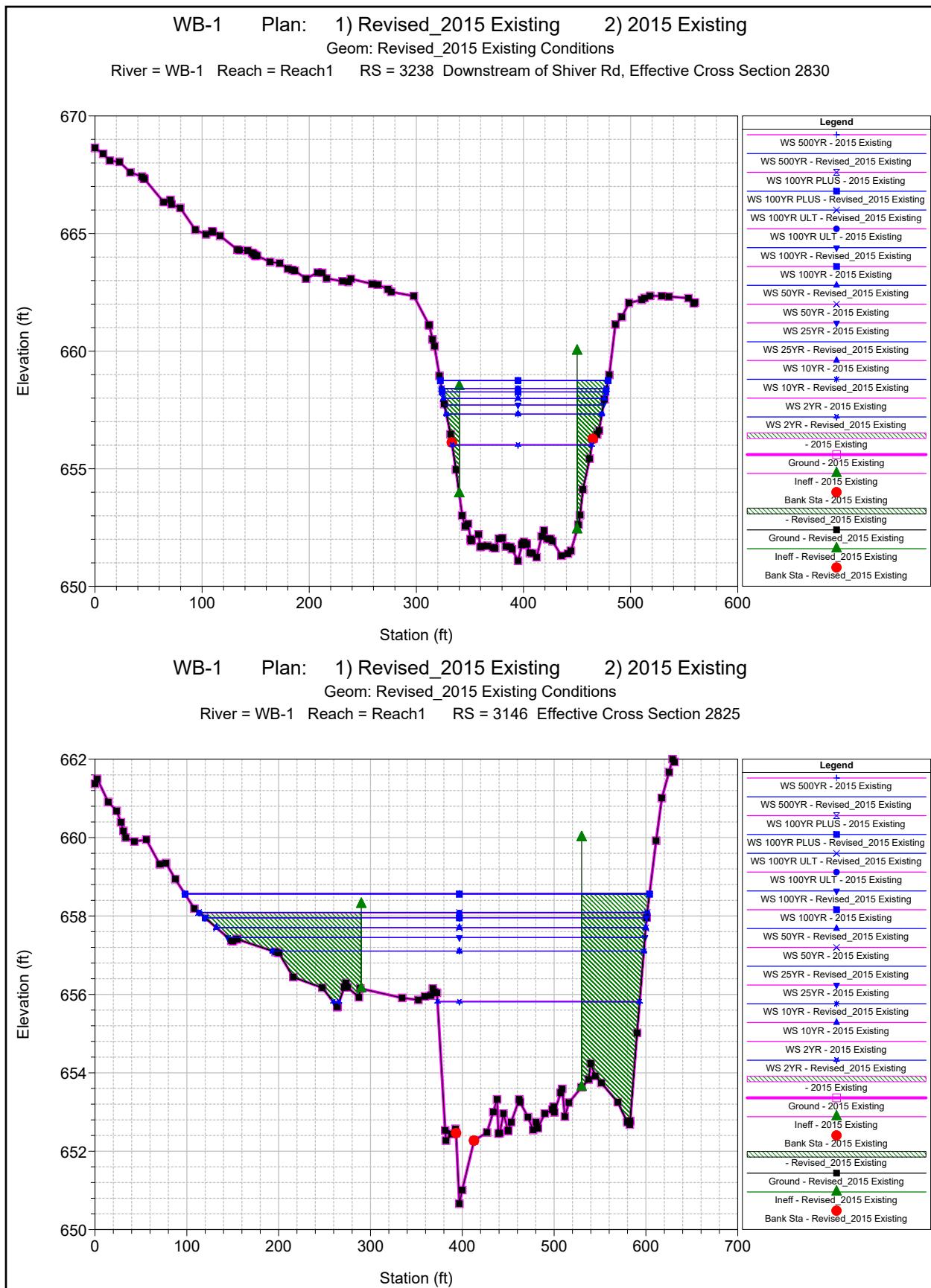
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 3403



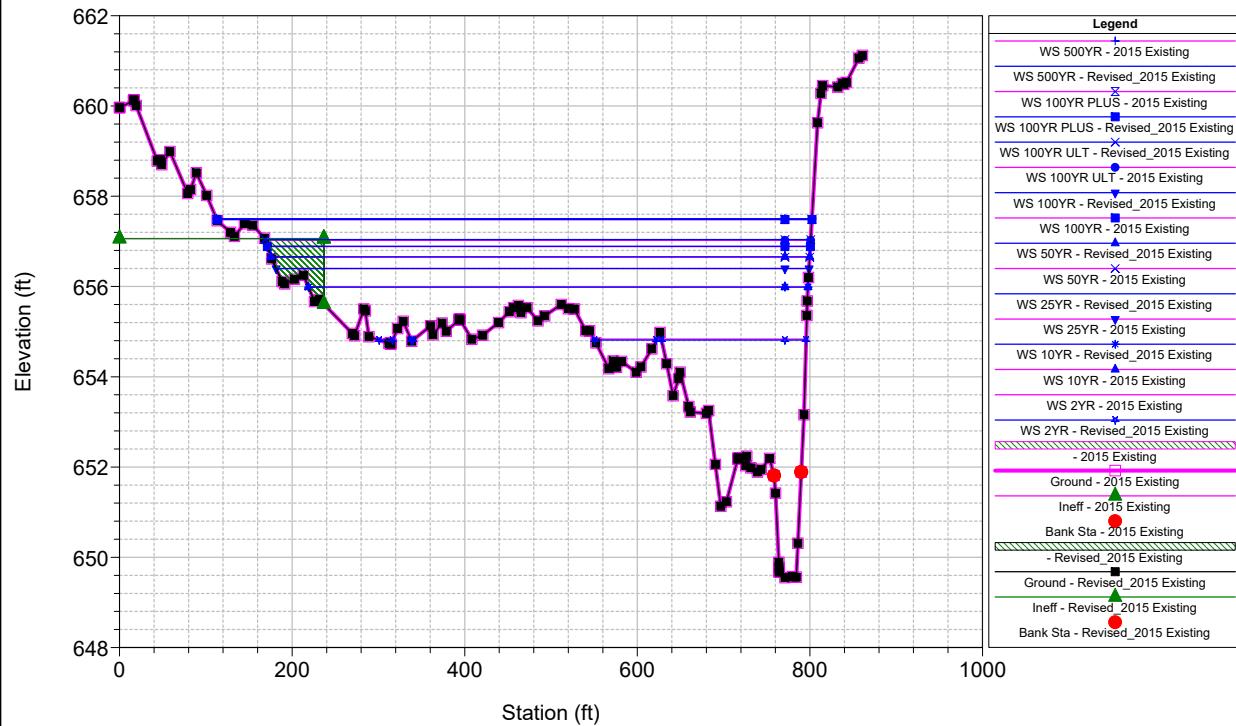
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 3319 Upstream of Shiver Rd



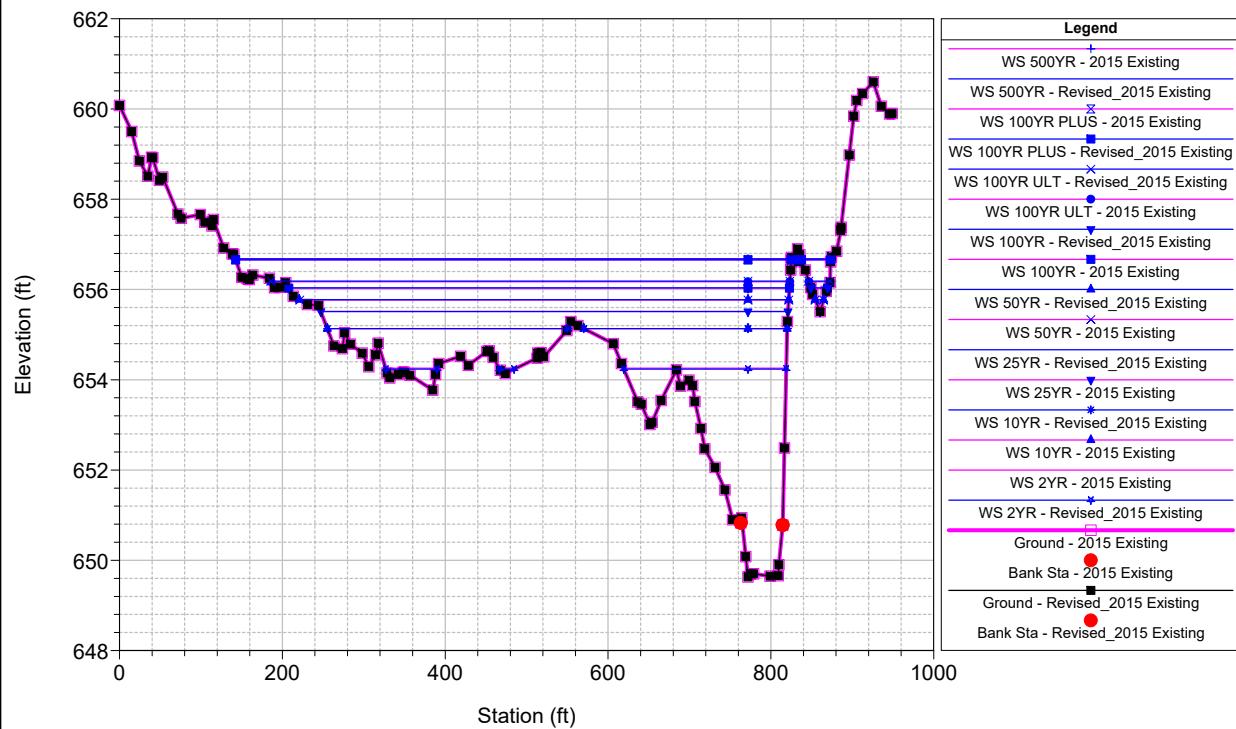




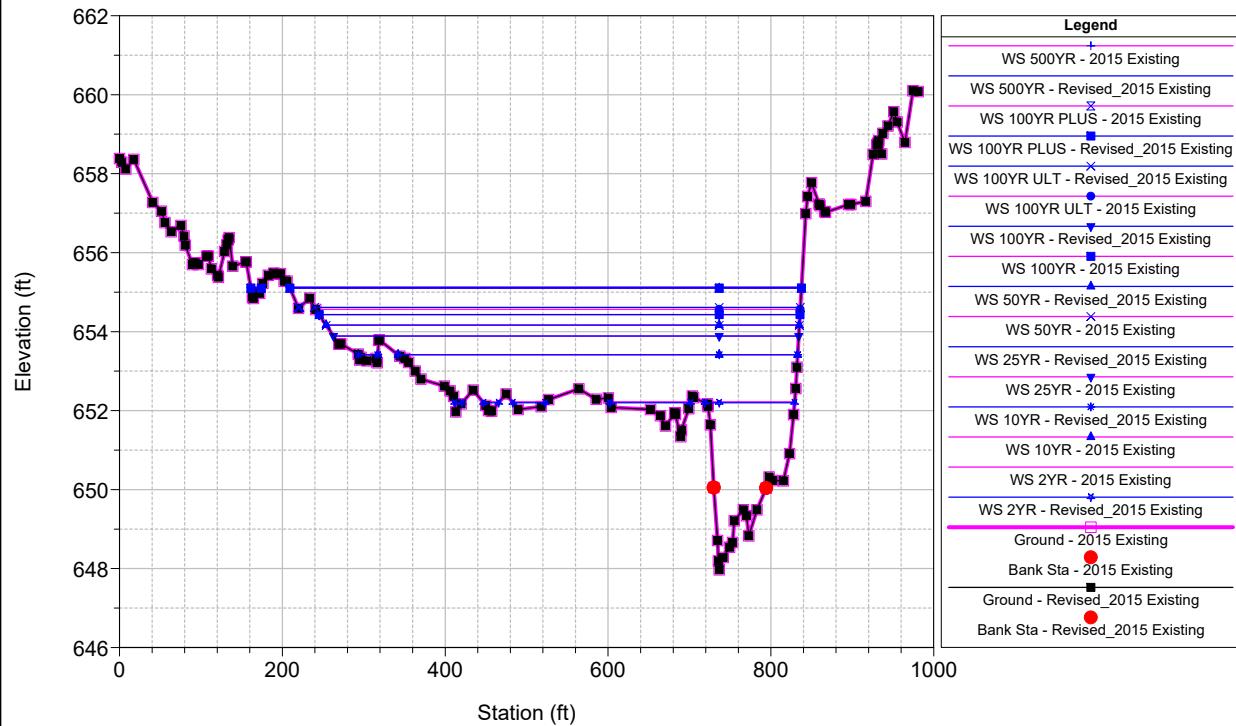
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 2680 Effective Cross Section 2538



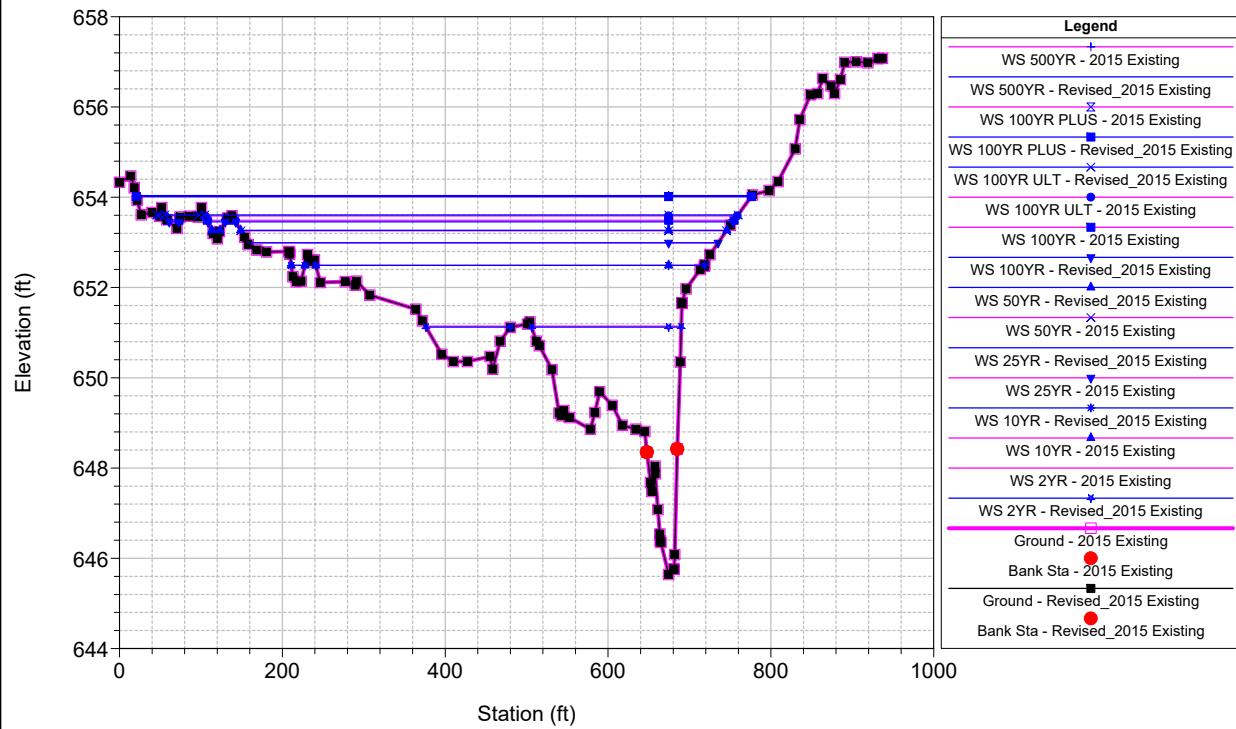
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 2524 Effective Cross Section 2380



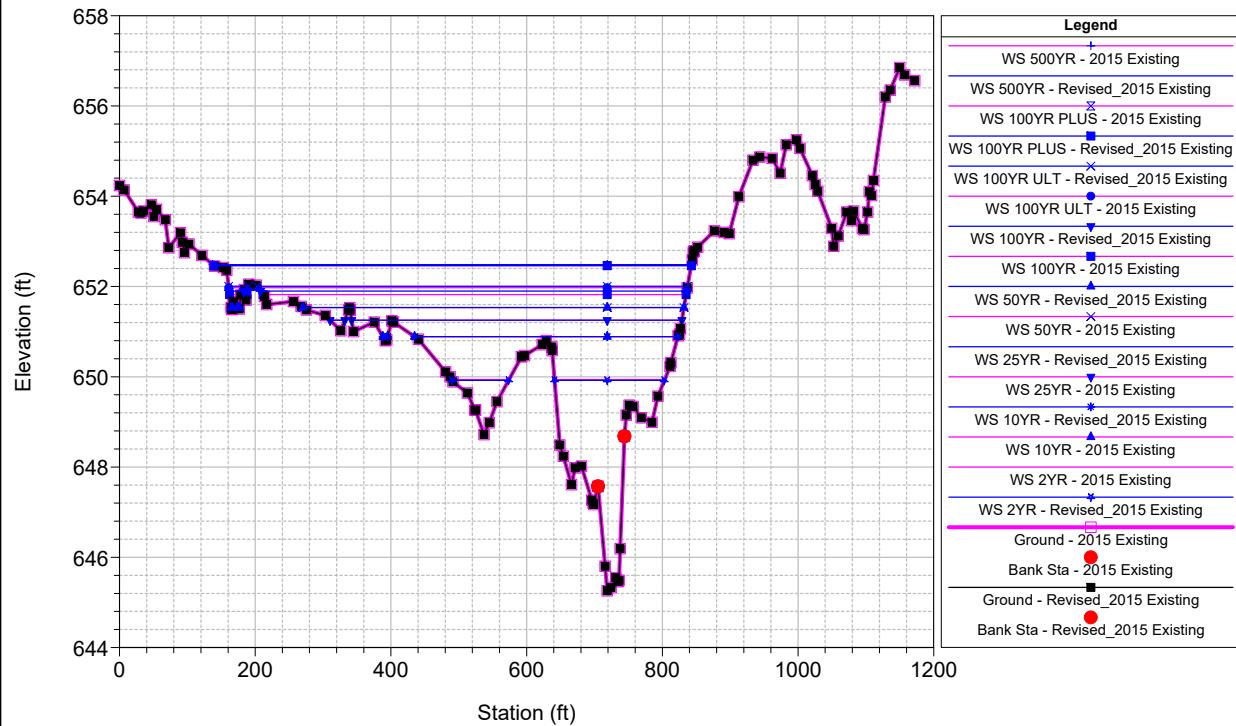
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 2196 Effective Cross Section 2045



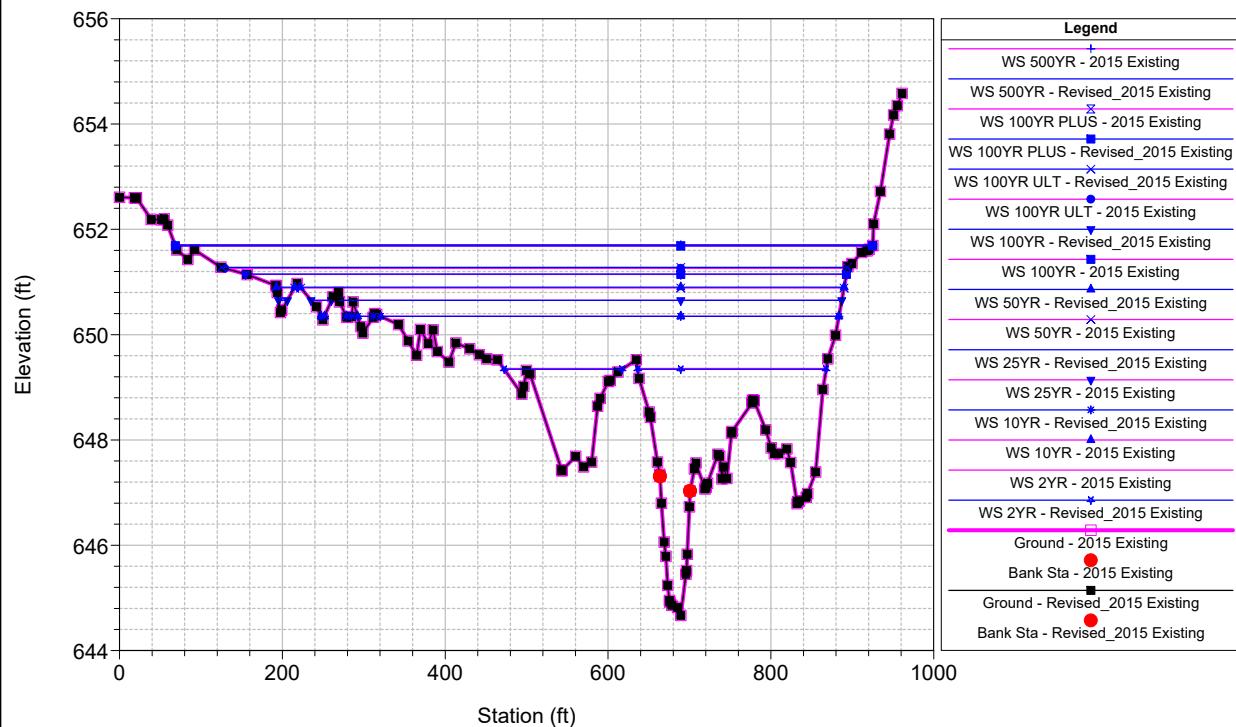
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 1958 Effective Cross Section 1813



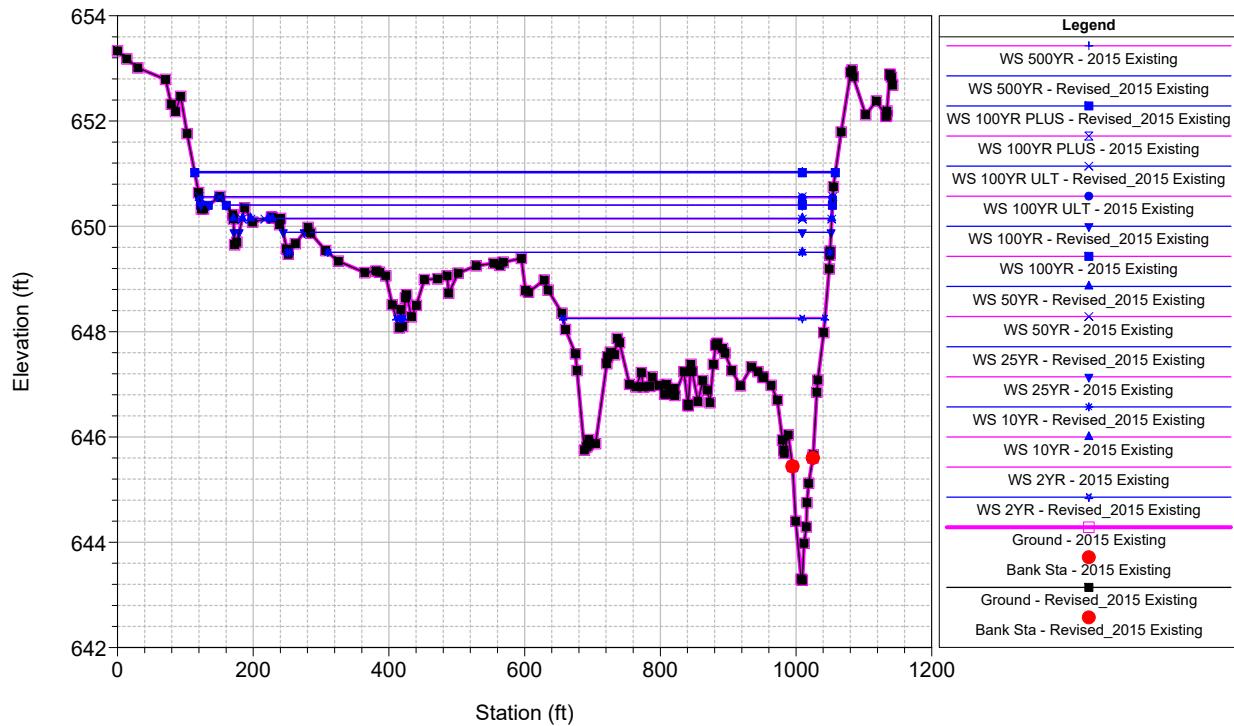
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 1762 Effective Cross Section 1610



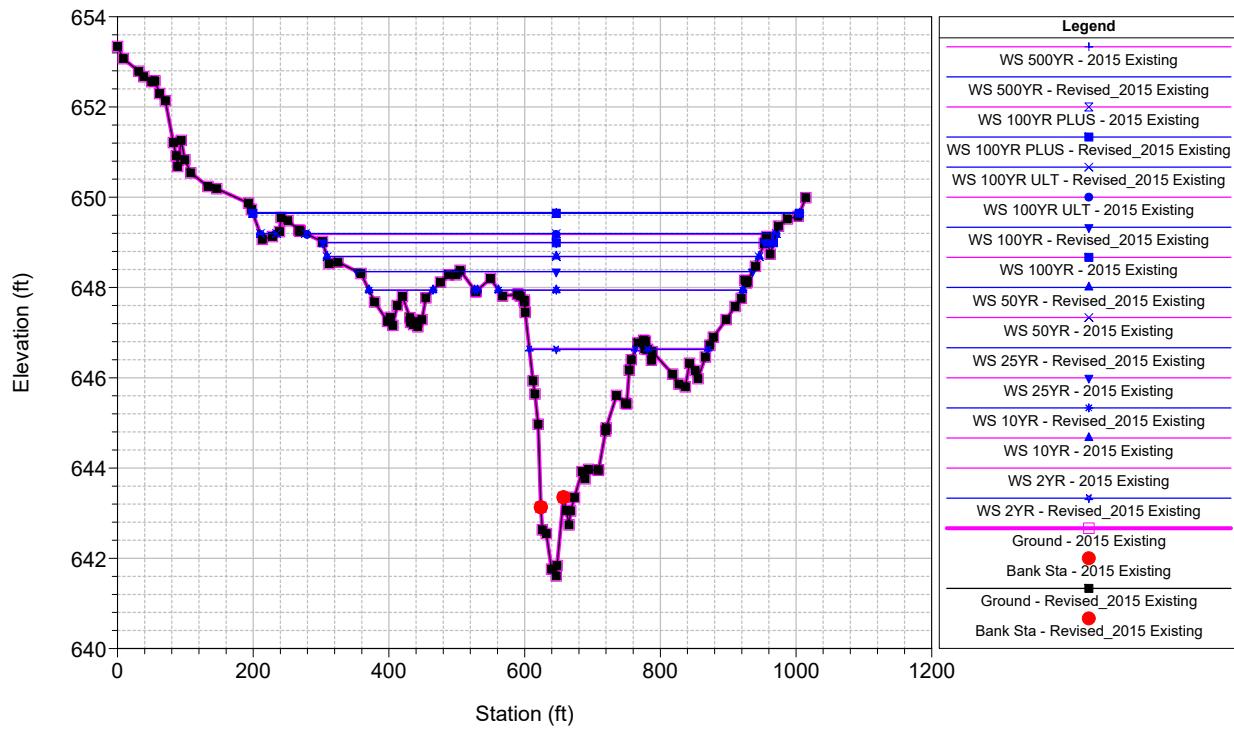
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 1601



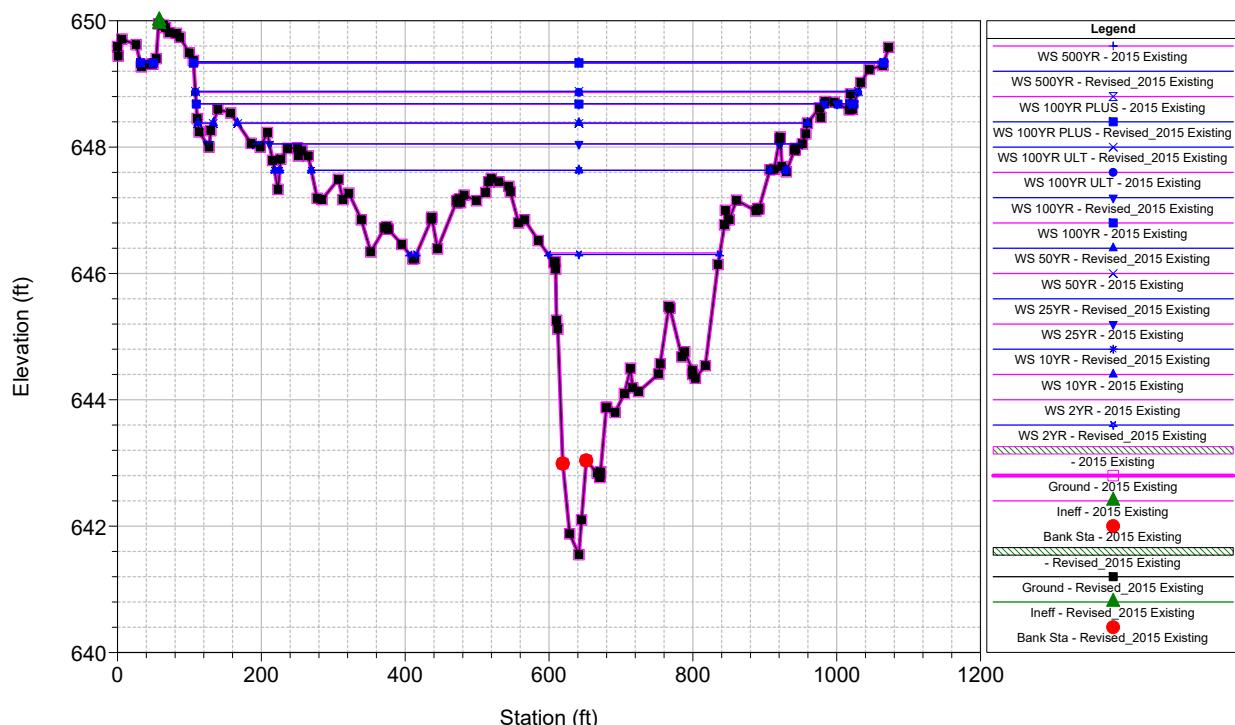
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 1163



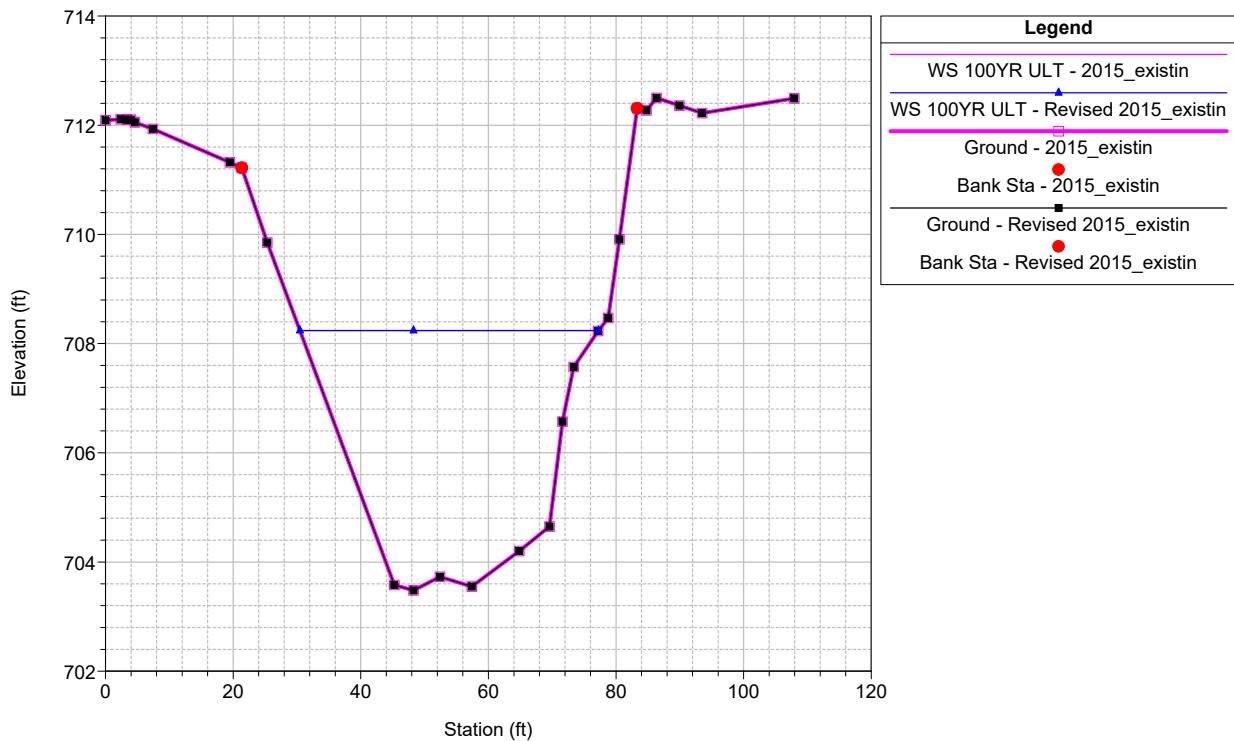
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 667



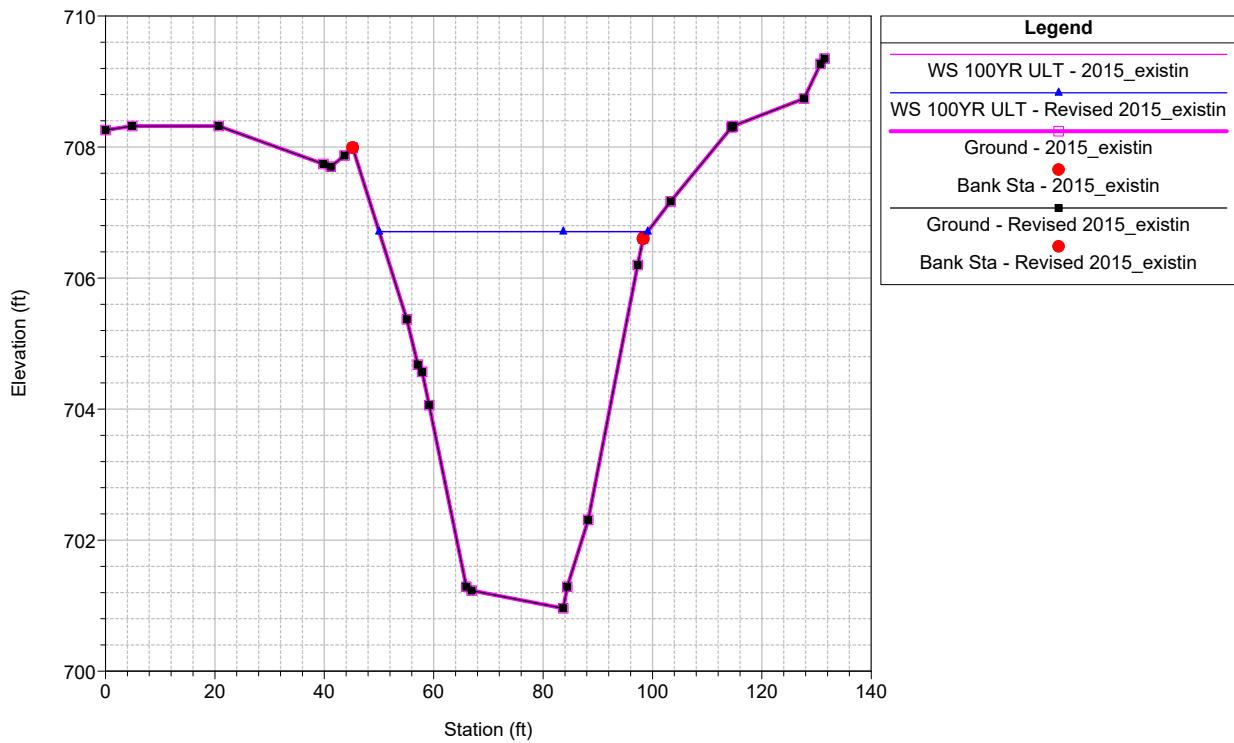
WB-1 Plan: 1) Revised_2015 Existing 2) 2015 Existing
 Geom: Revised_2015 Existing Conditions
 River = WB-1 Reach = Reach1 RS = 541 Effective Cross Section 481?

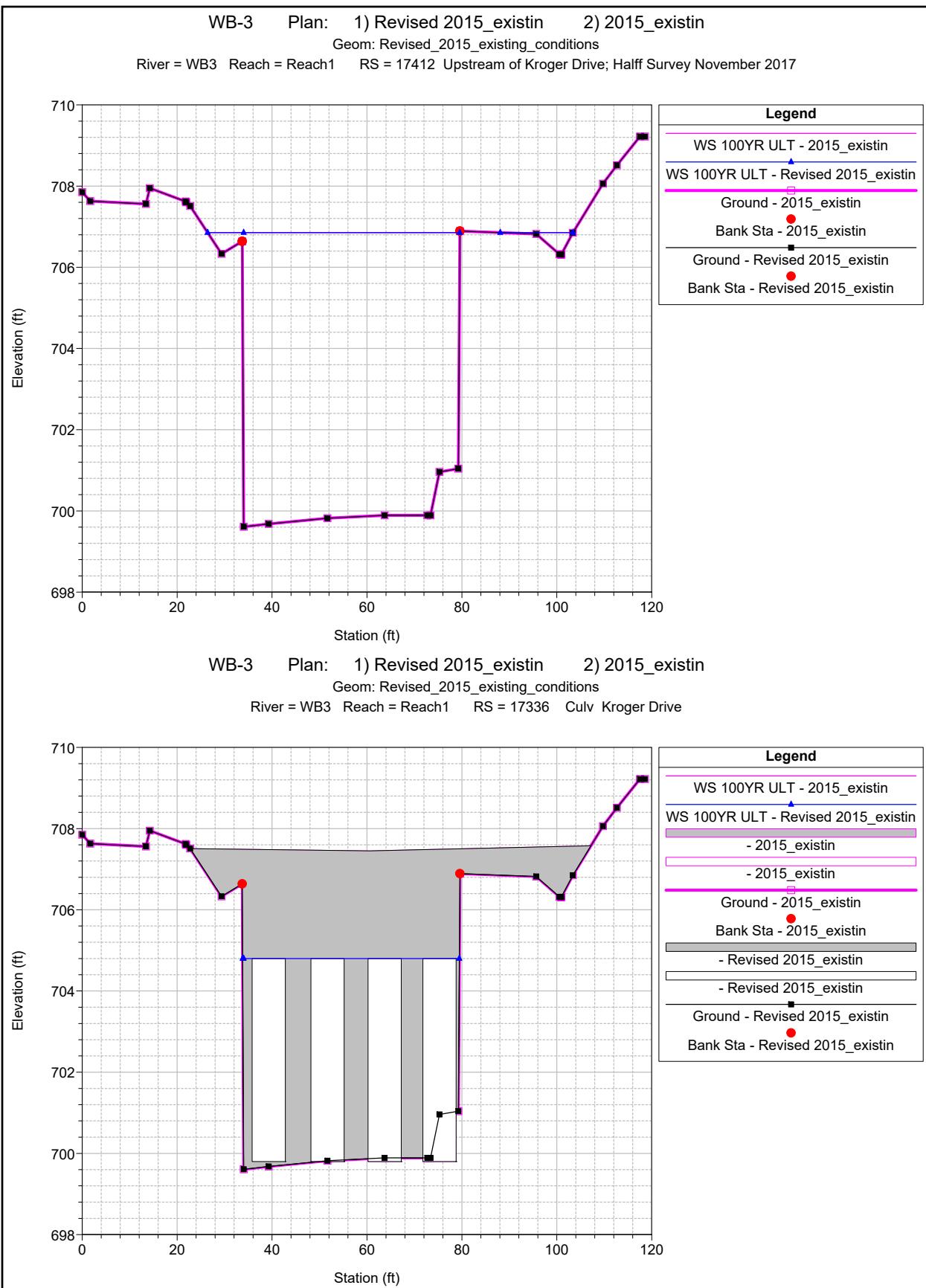


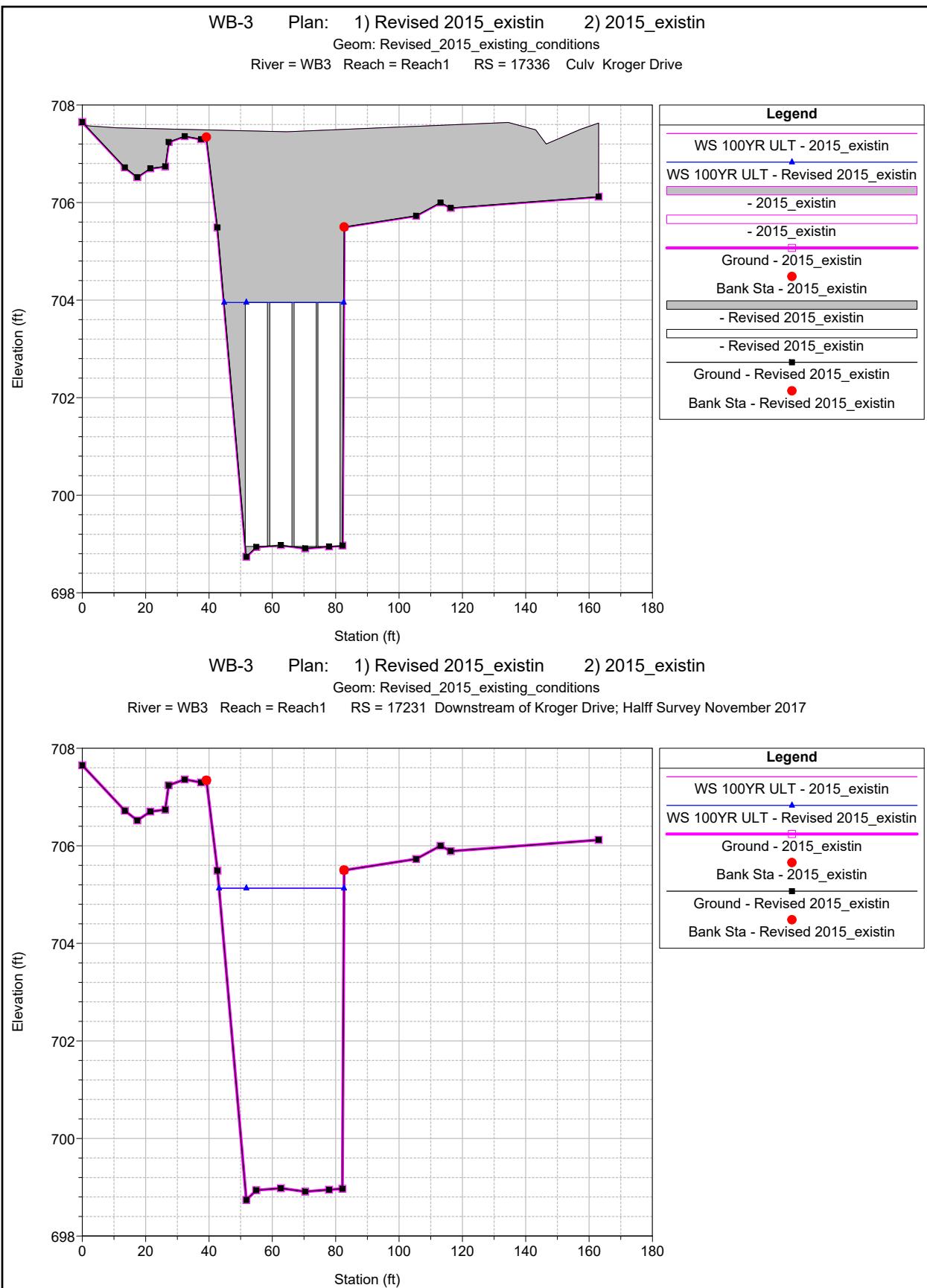
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 17645

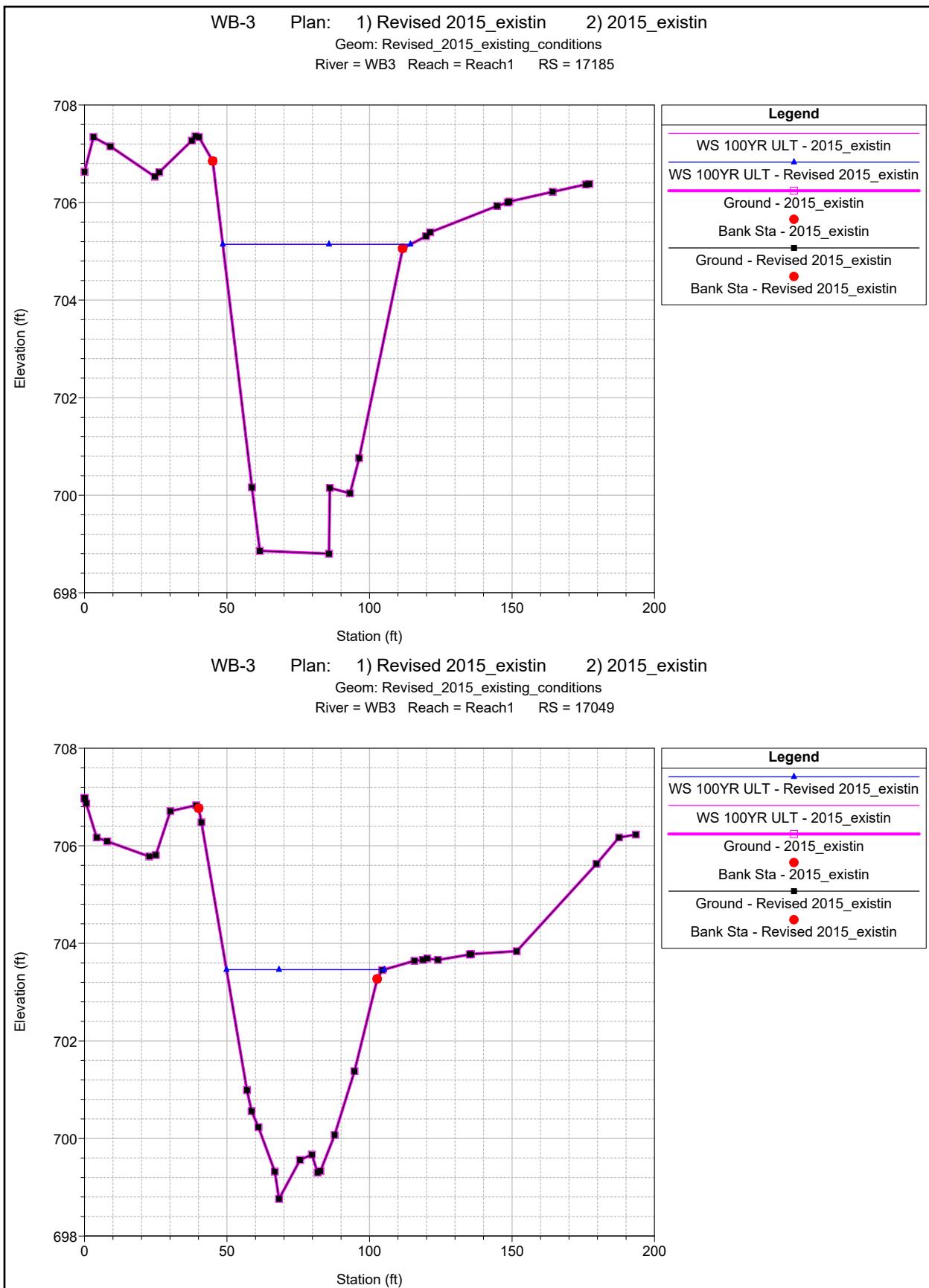


WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 17433

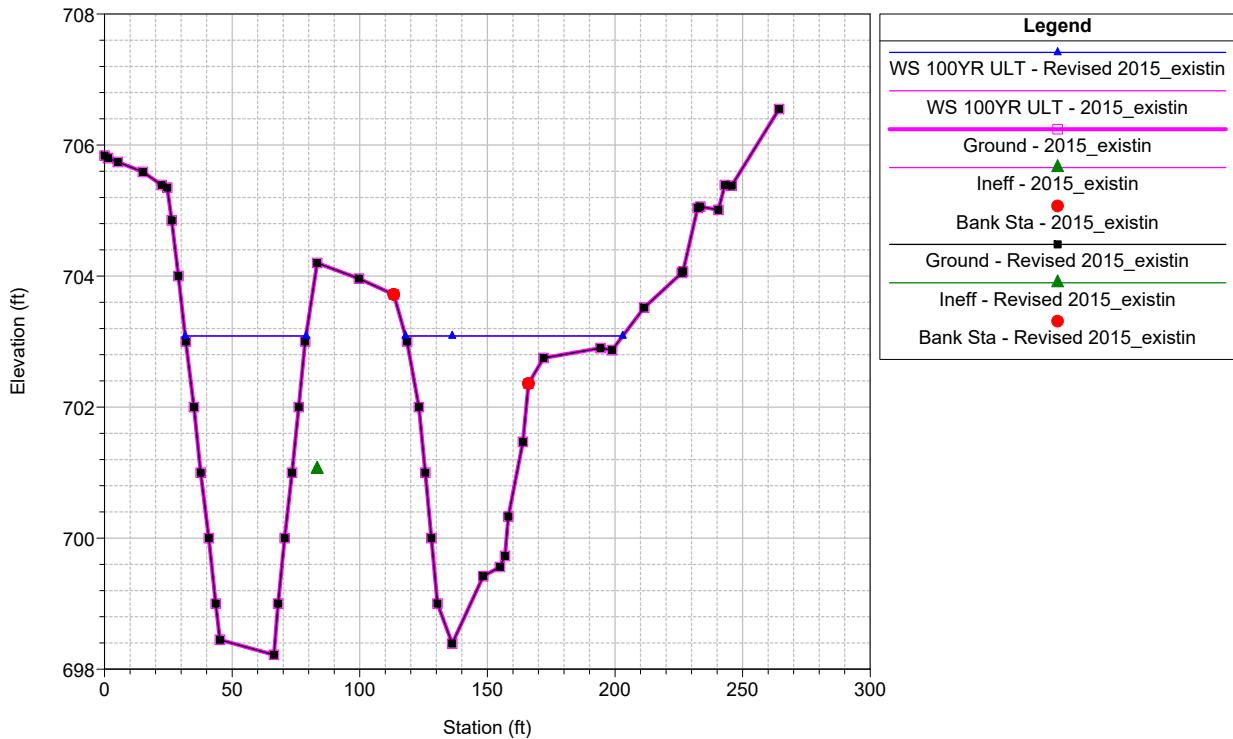




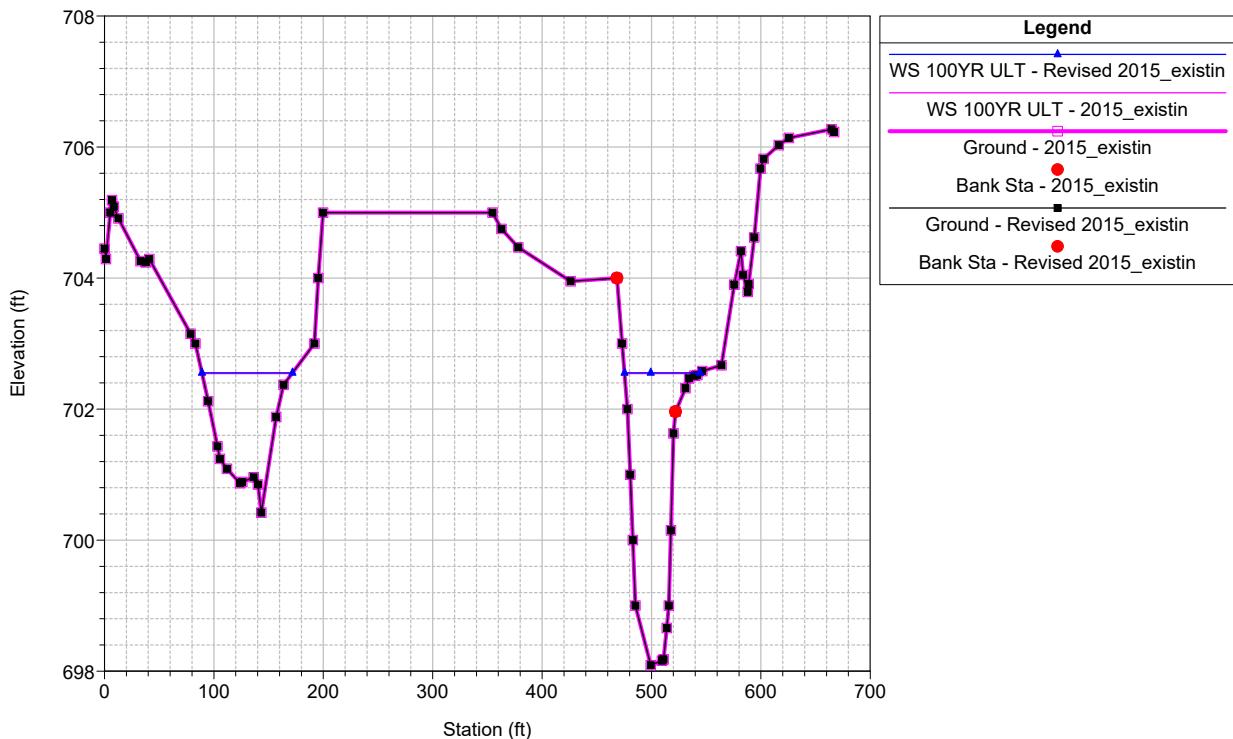




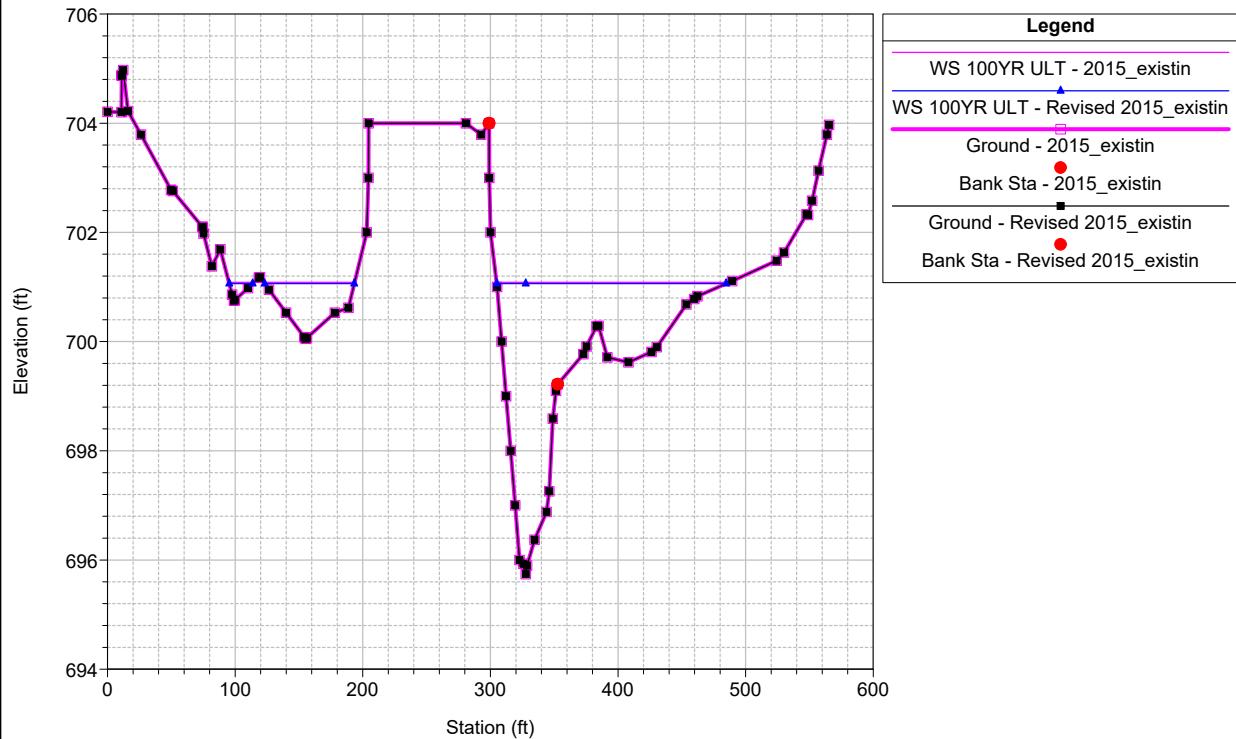
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 16934 November 2017 Half Survey



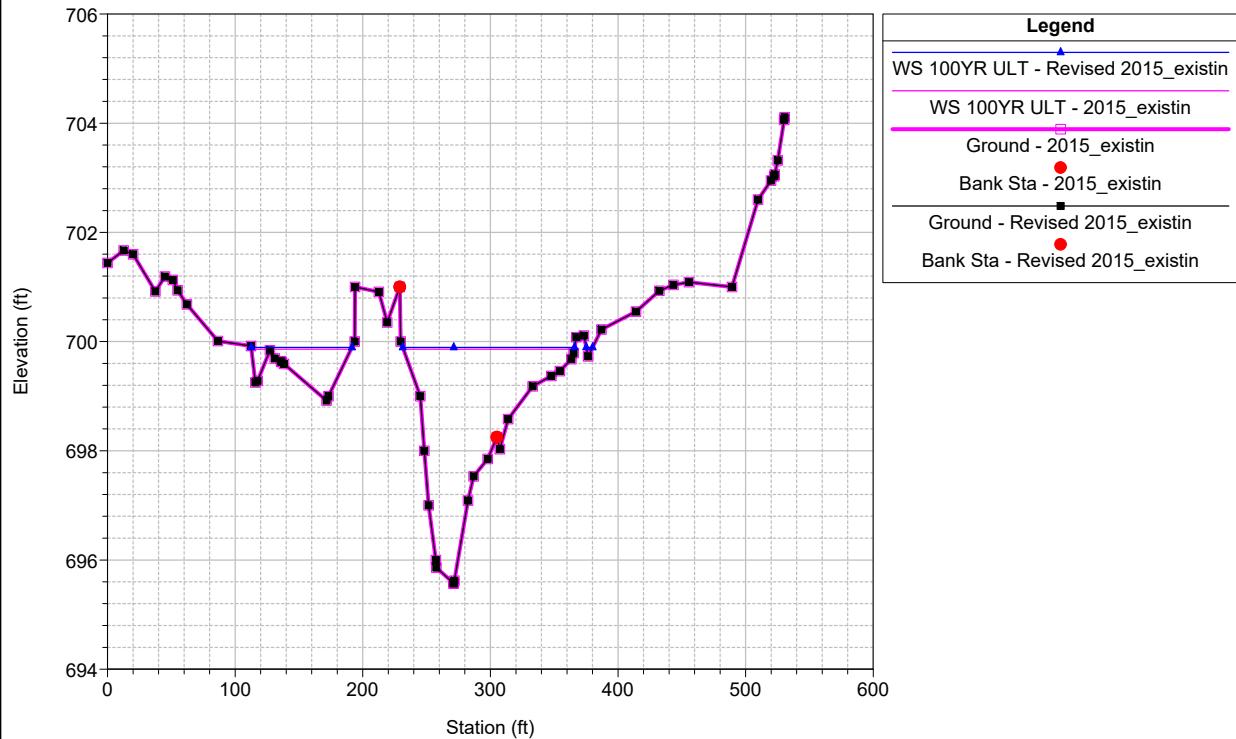
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 16881 Effective Cross Section 16881; November 2017 Half Survey

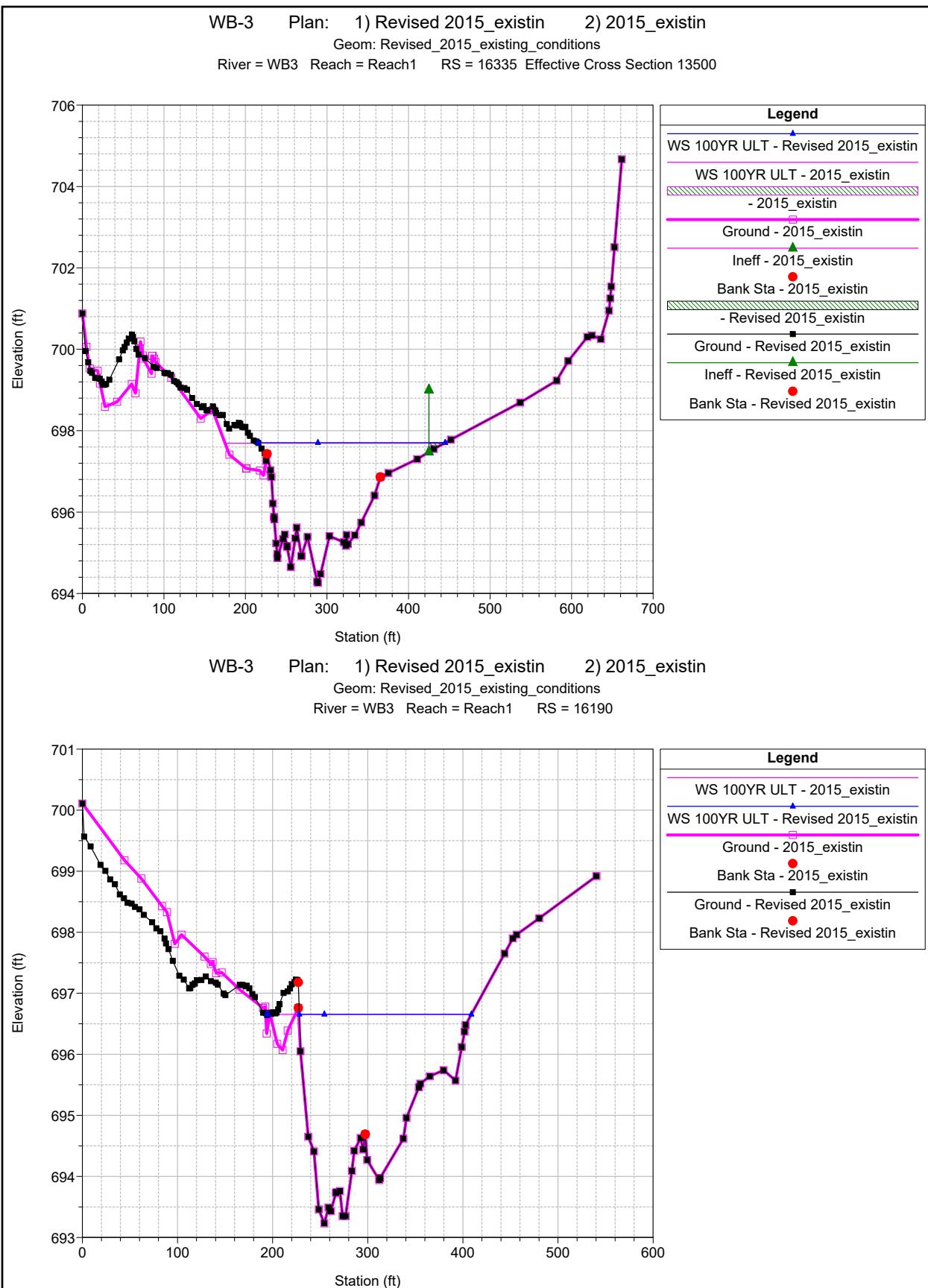


WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 16682 November 2017 Half Topo Survey

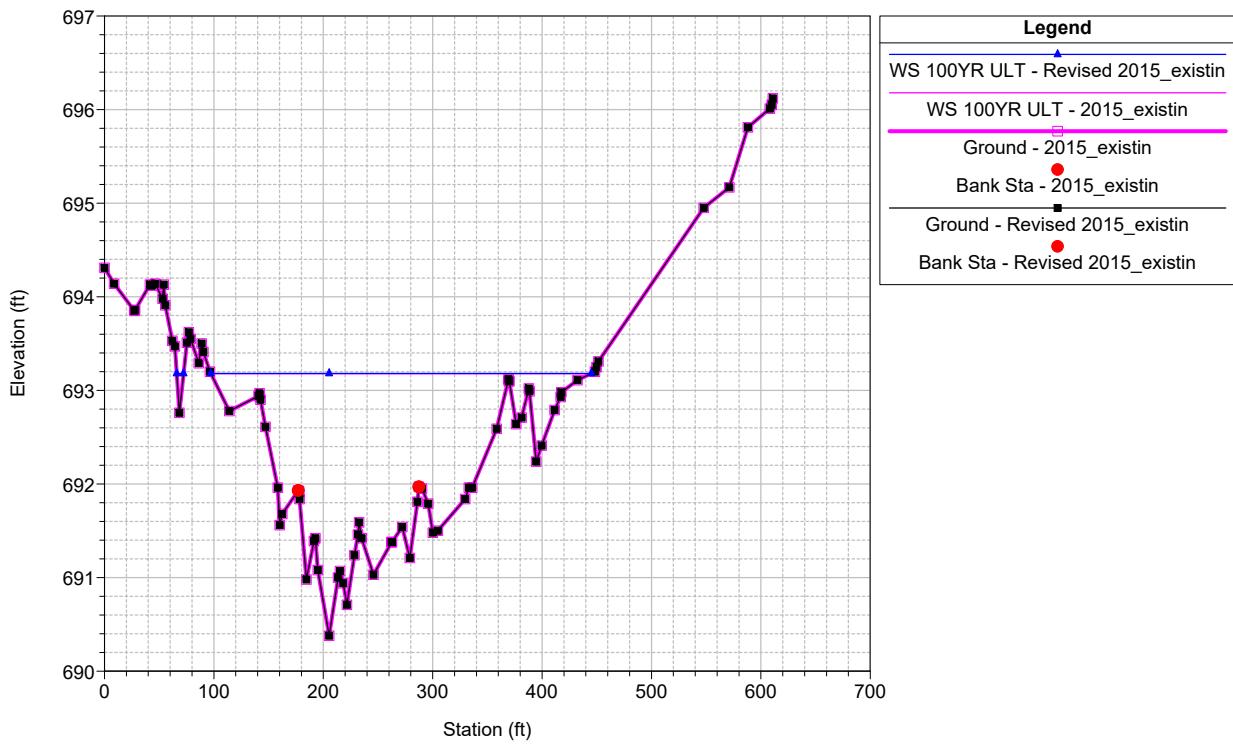


WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 16578 November 2017 Half Topo Survey

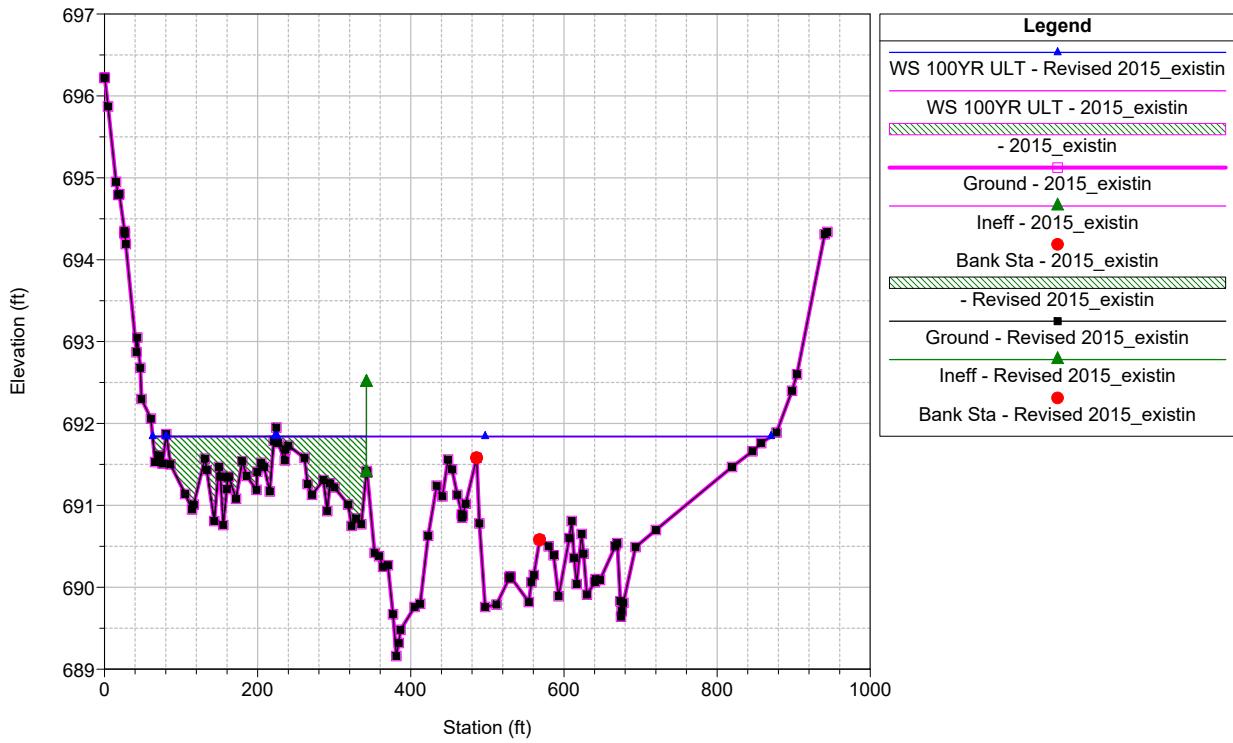


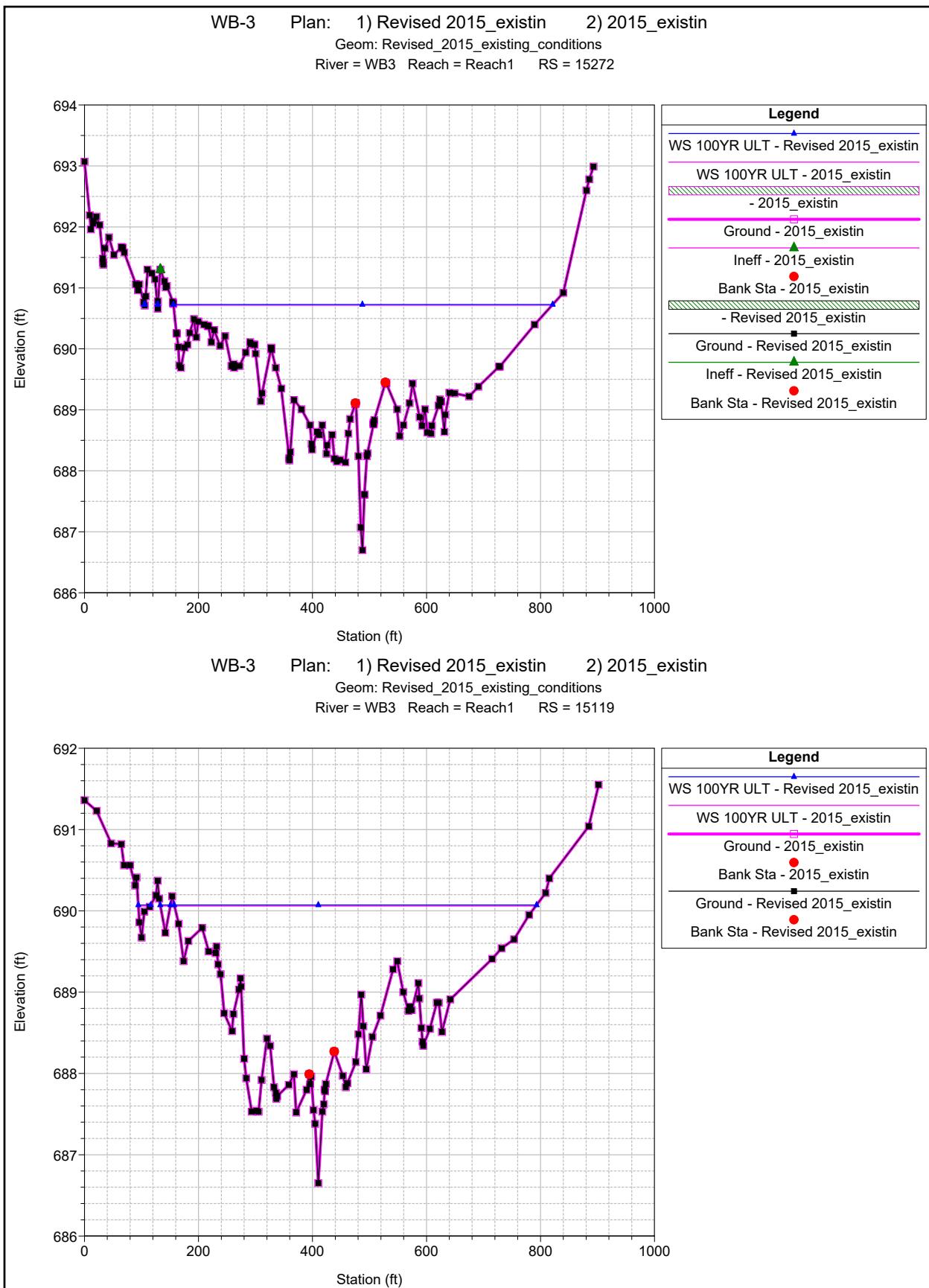


WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 15722 Effective Cross Section 12950

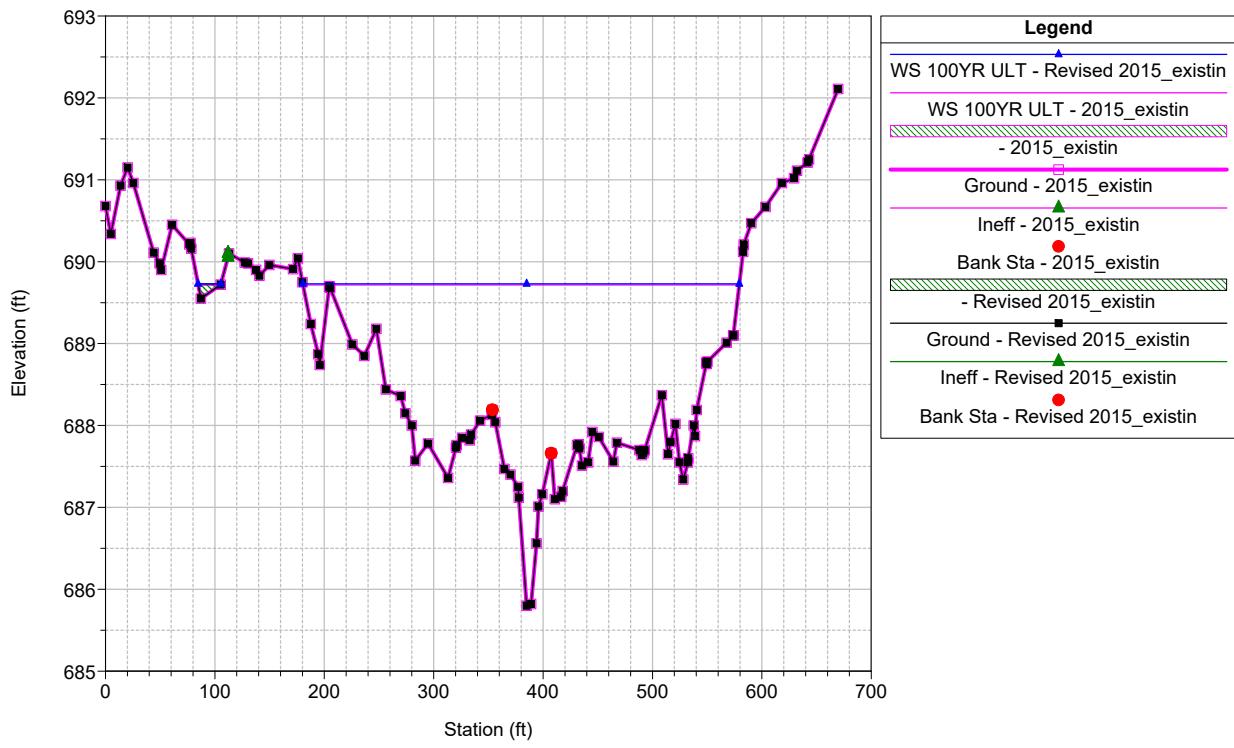


WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 15531

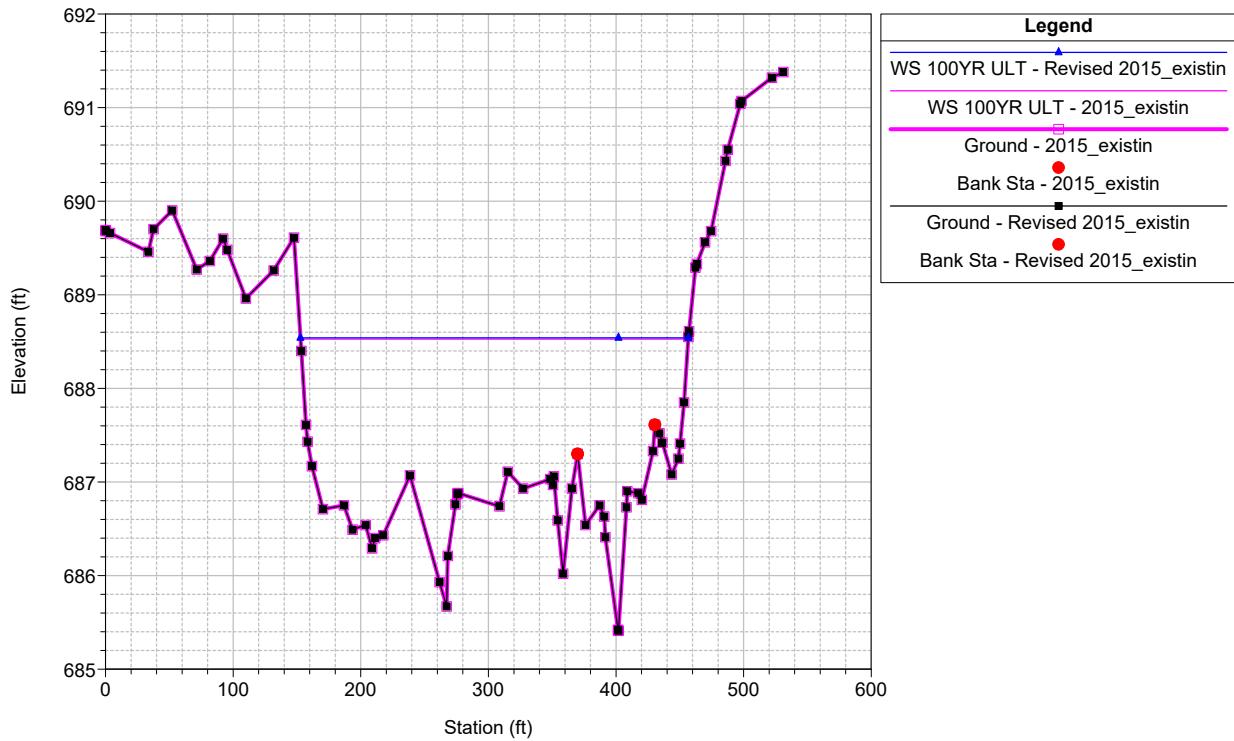




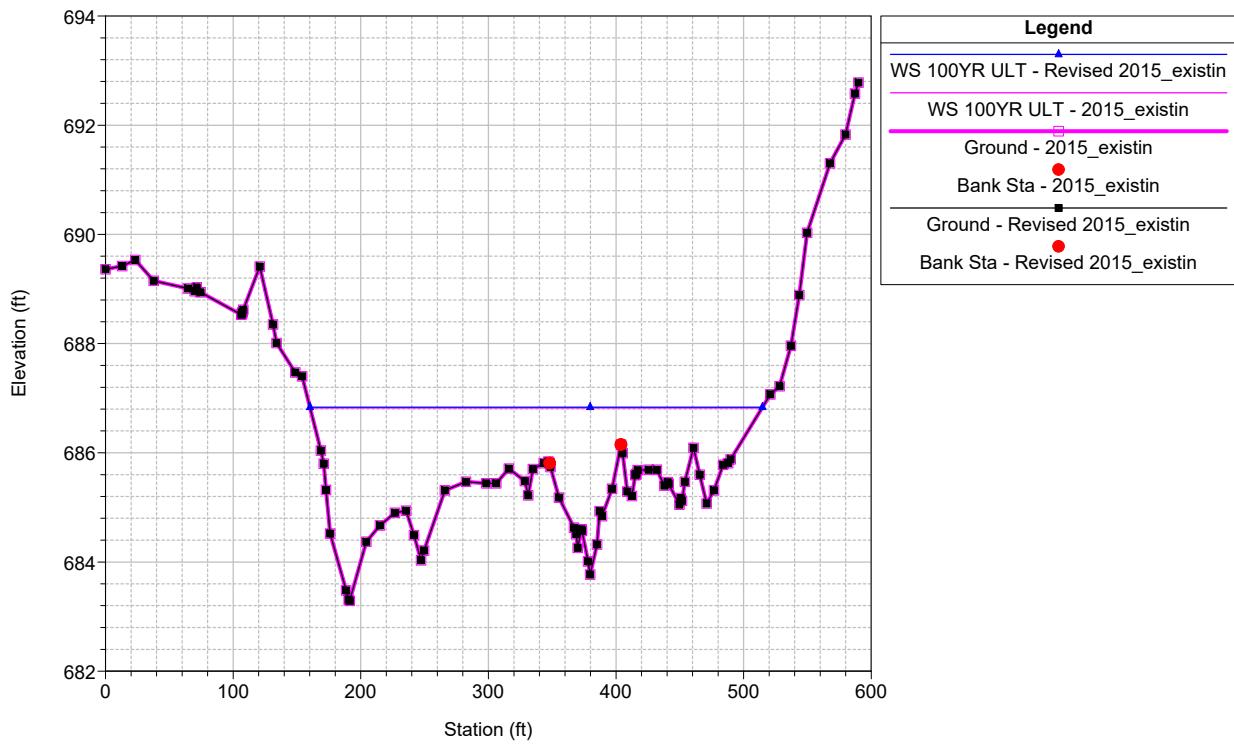
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 15068 Effective Cross Section 12325



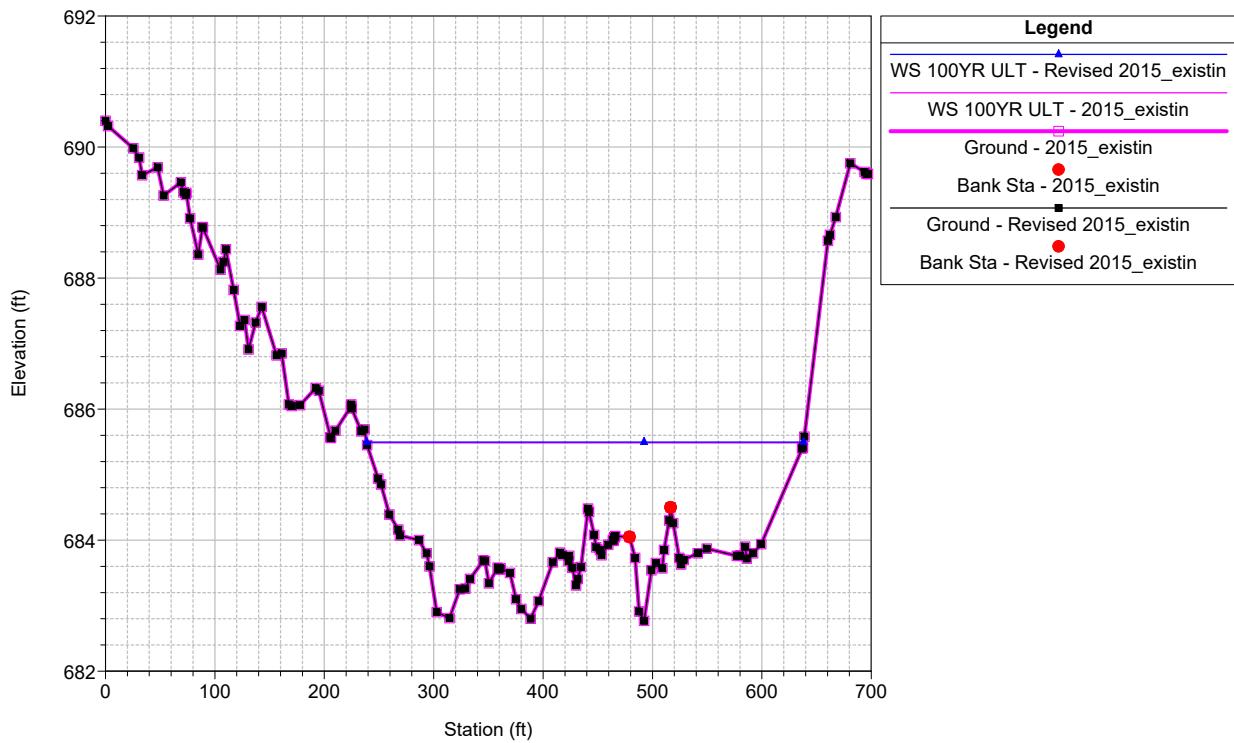
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 14868 Effective Cross Section 12135



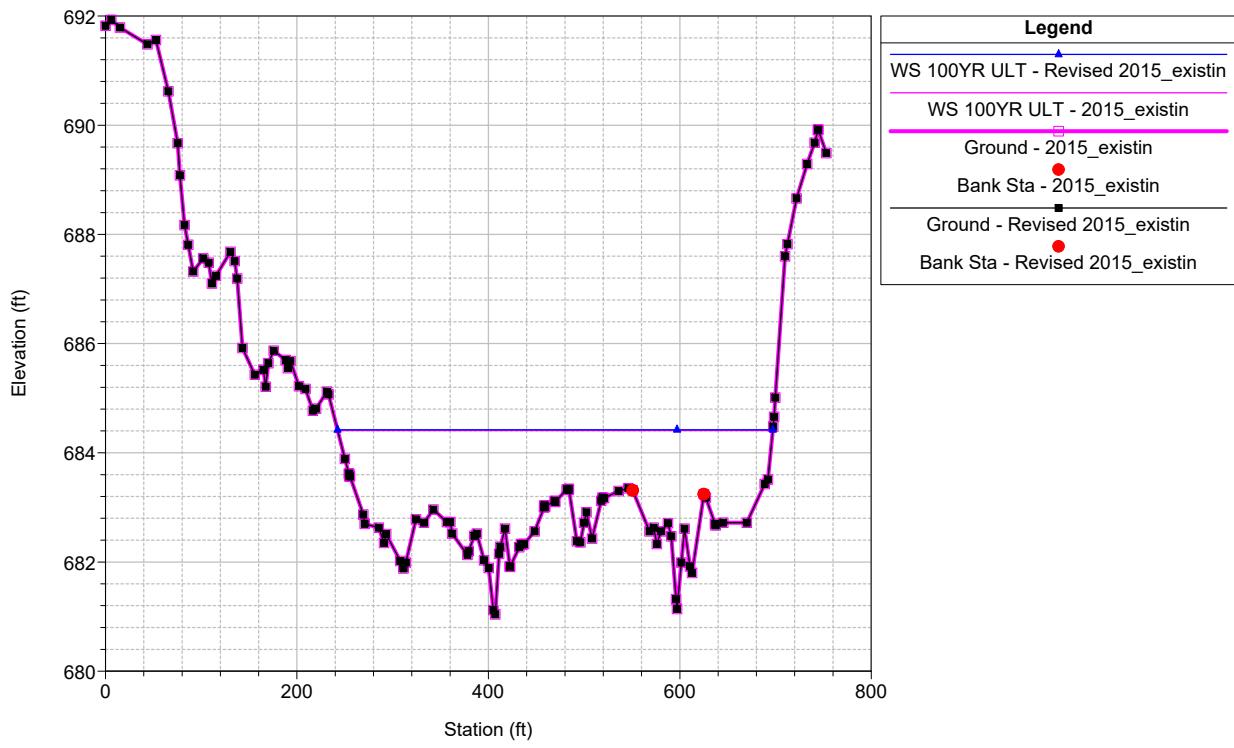
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 14619 Effective Cross Section 11947



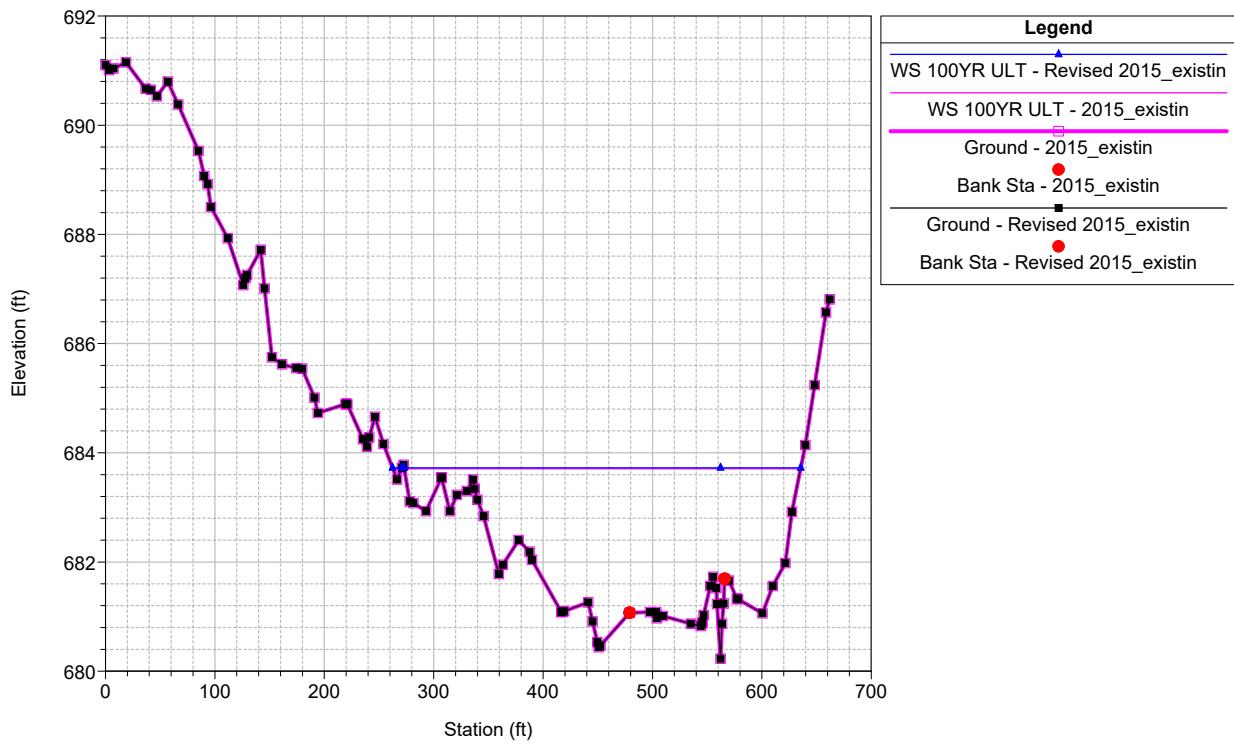
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 14397 Effective Cross Section 11732

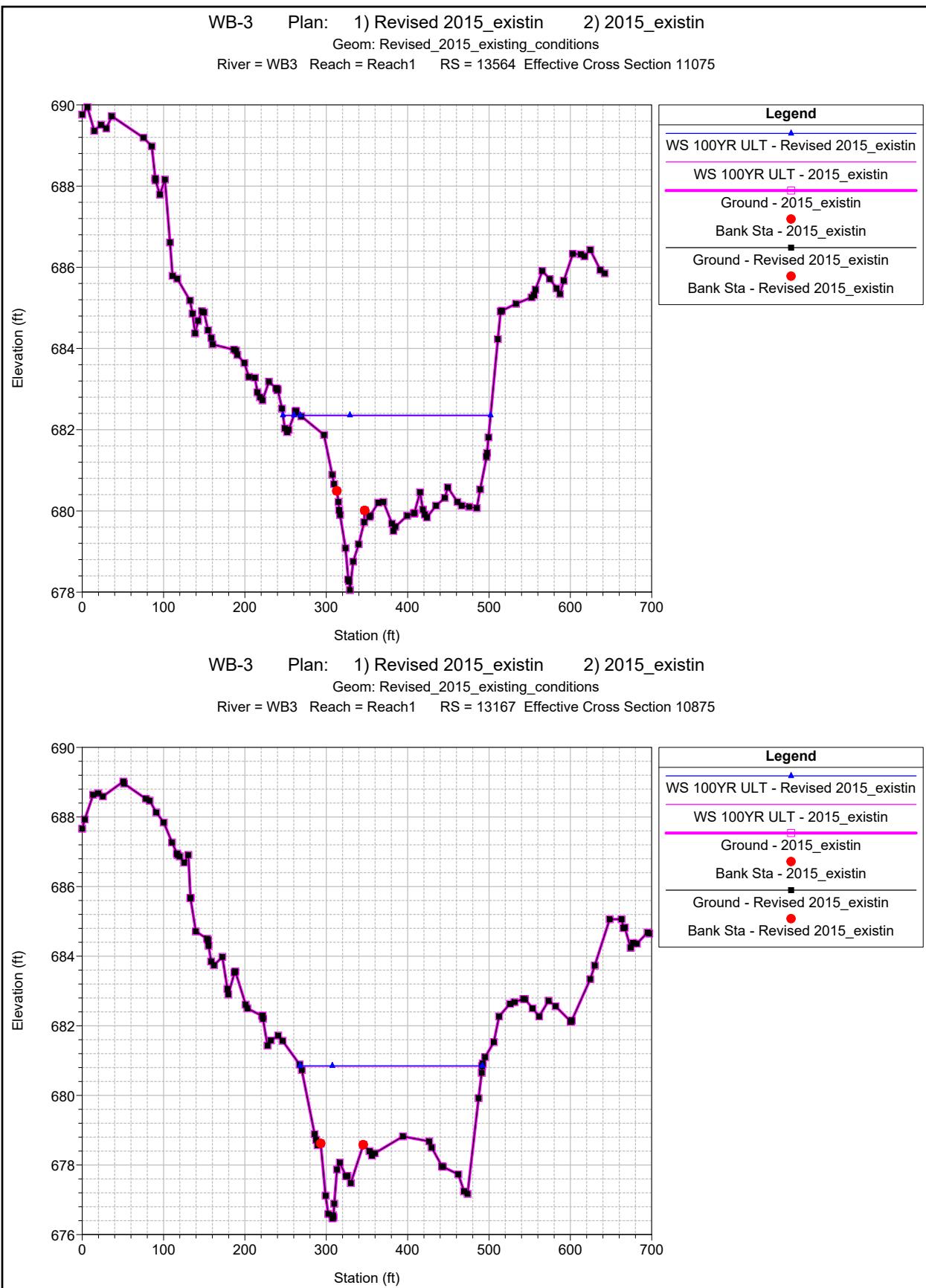


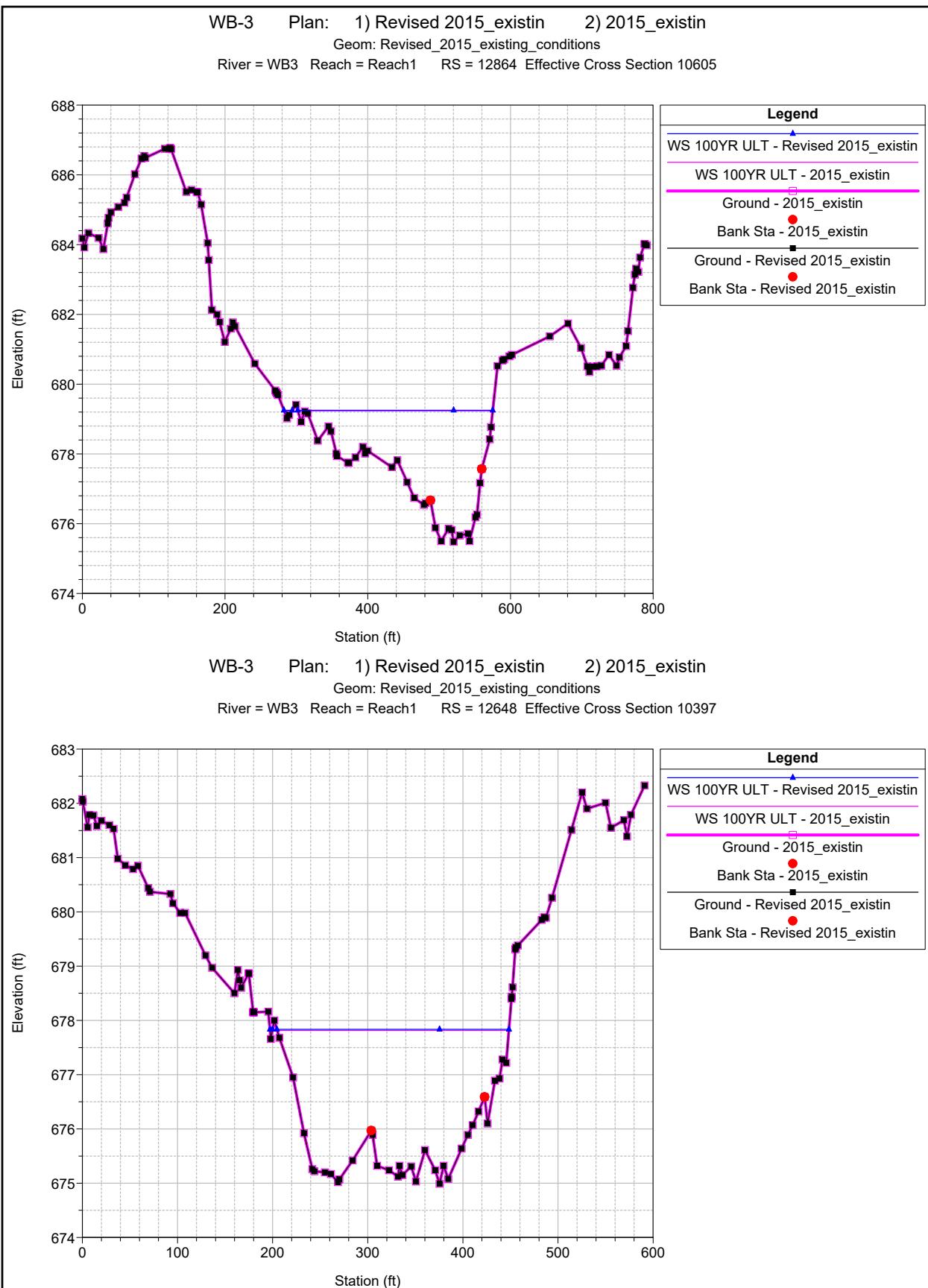
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 14114 Effective Cross Section 11474



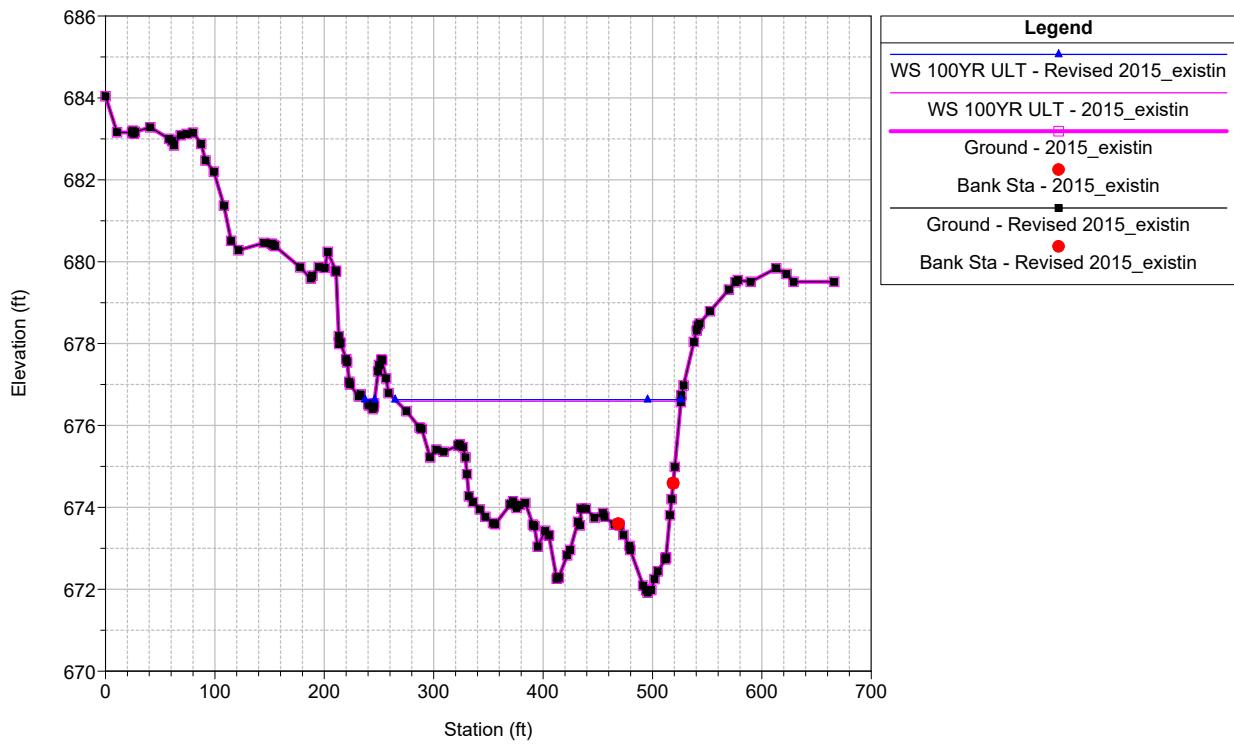
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 13931 Effective Cross Section 11295



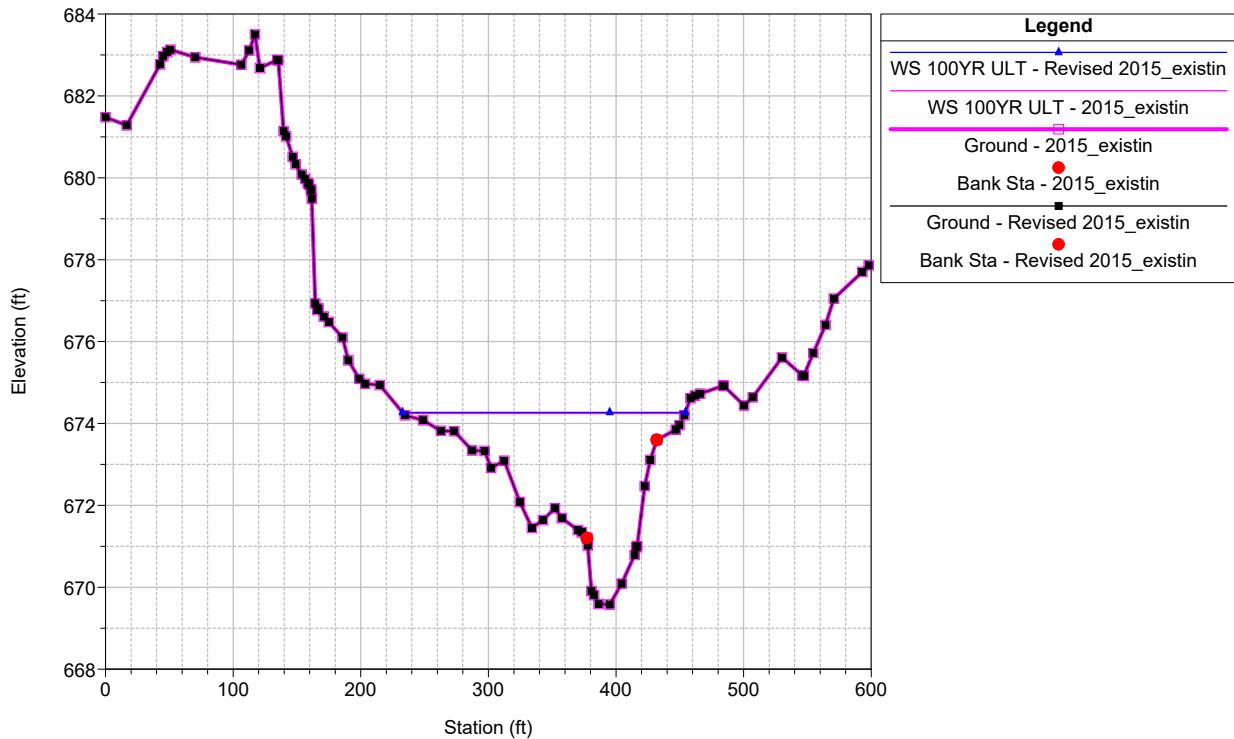


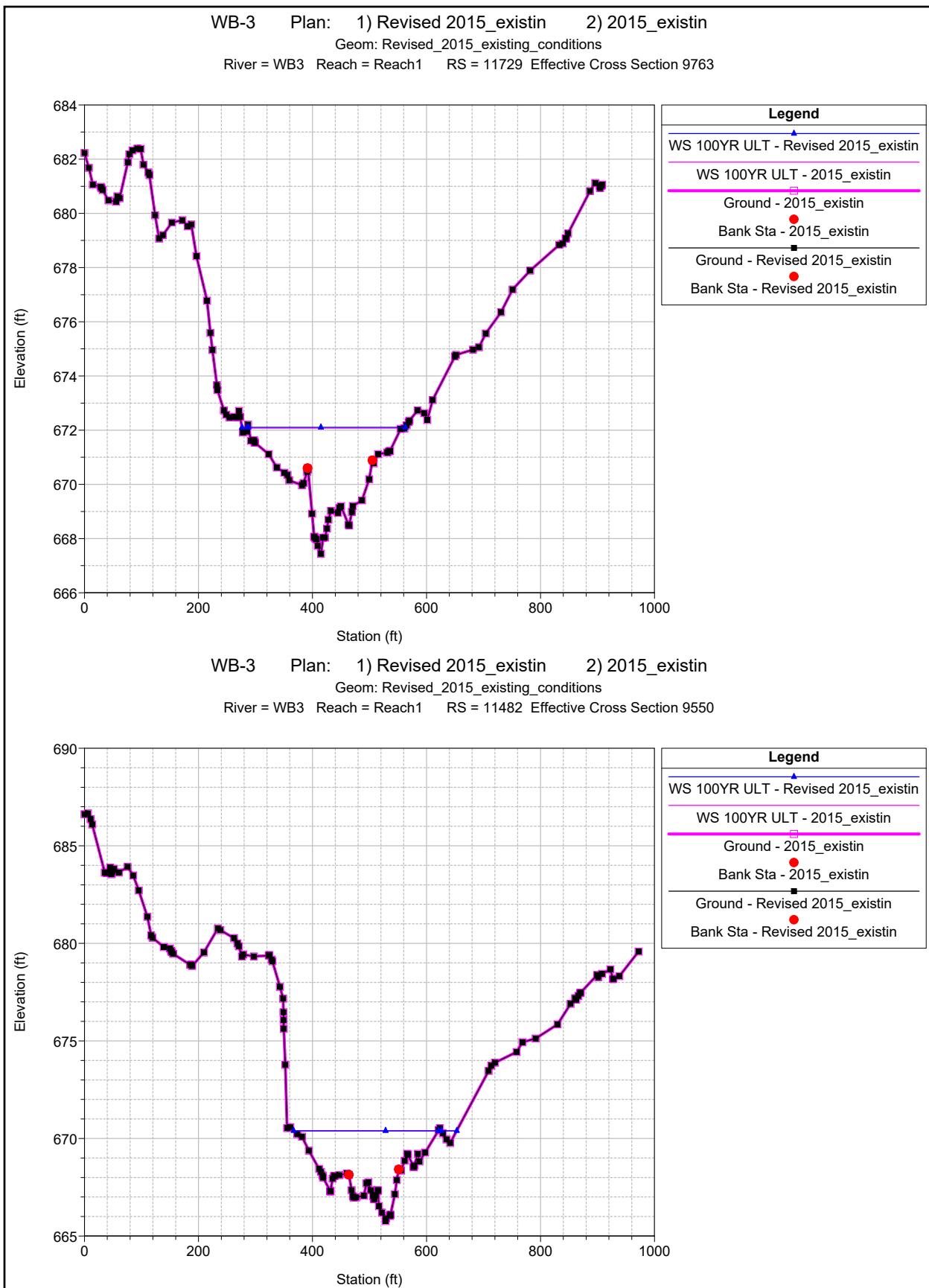


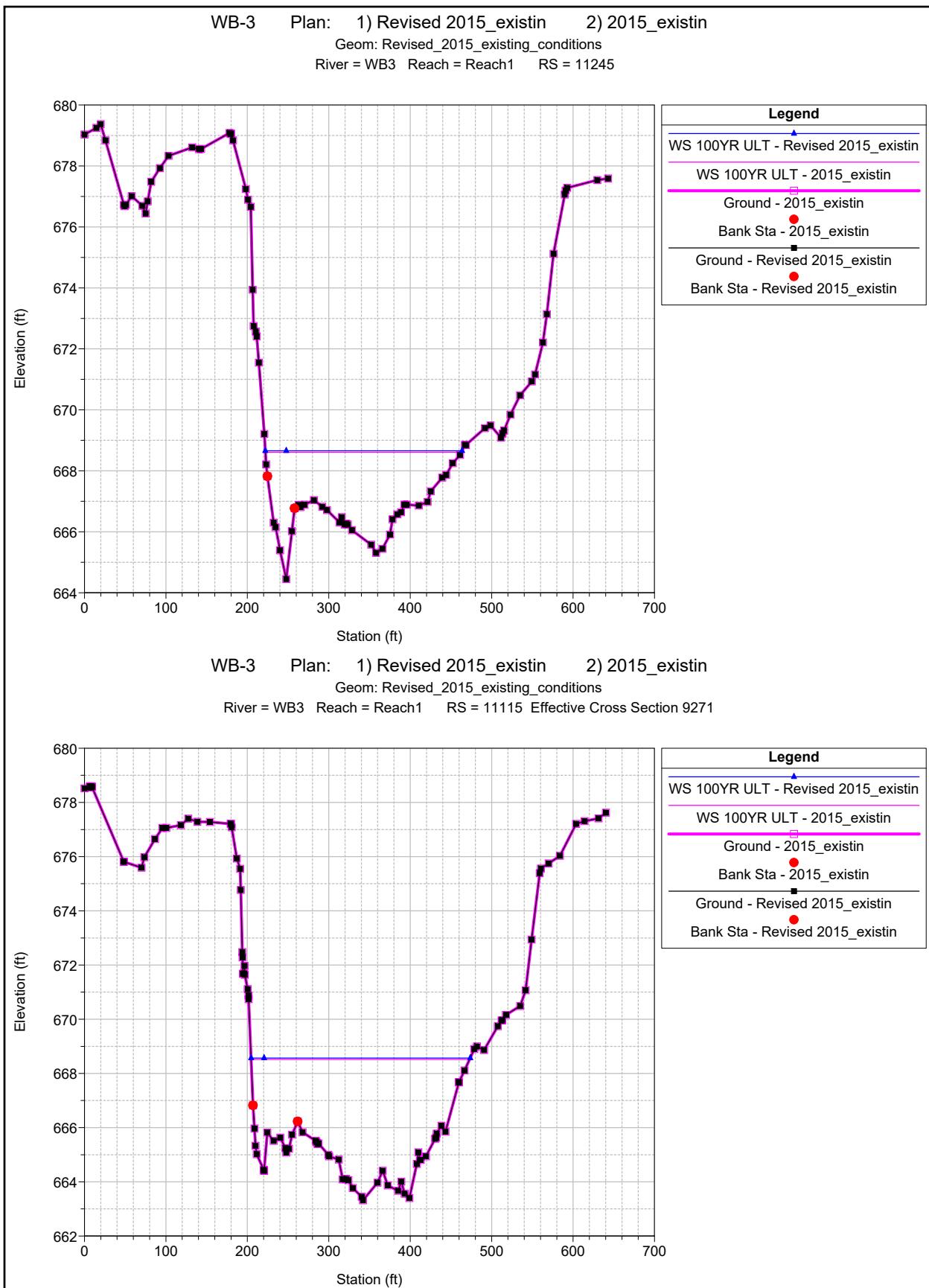
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 12281 Effective Cross Section 10173

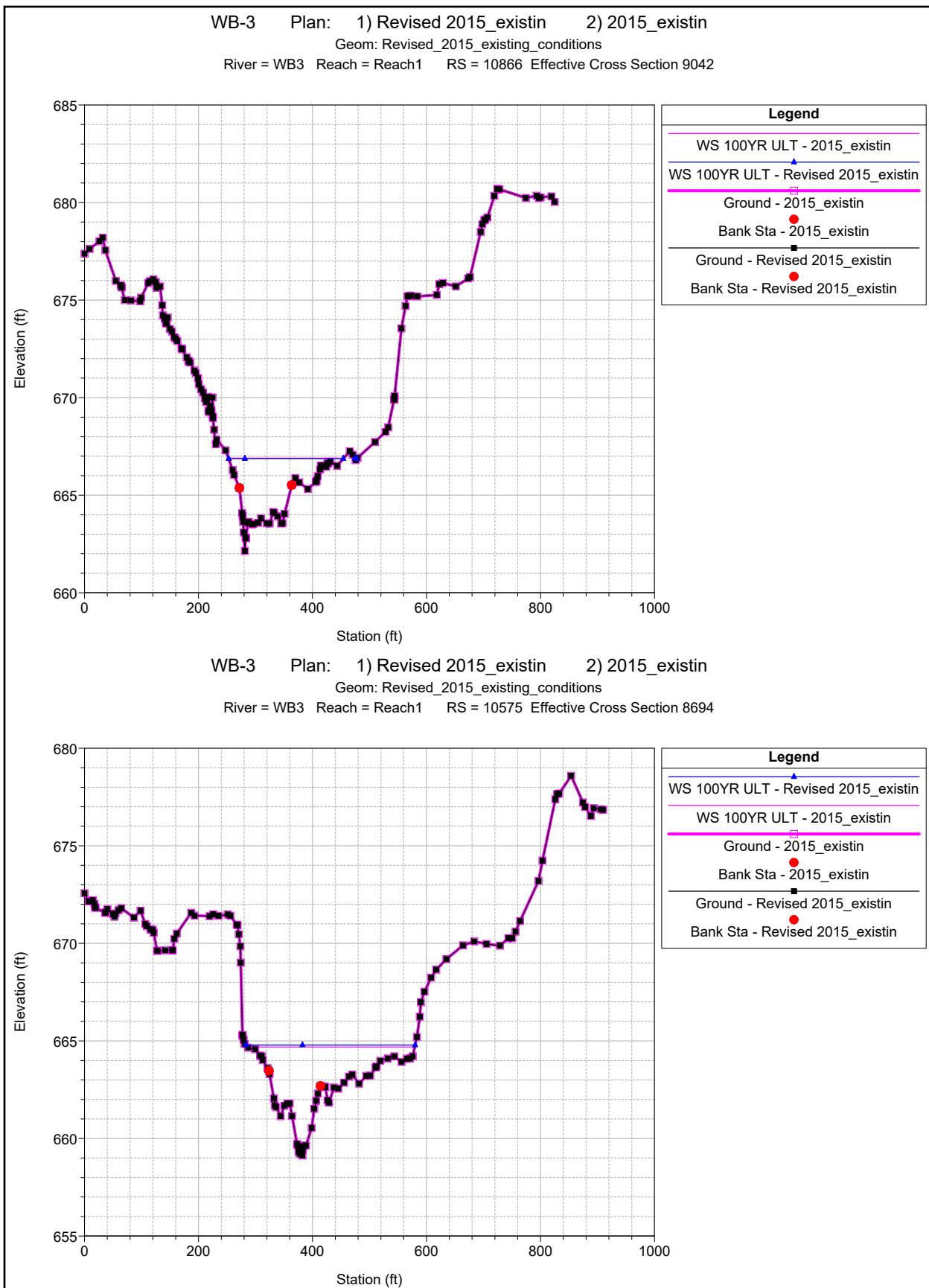


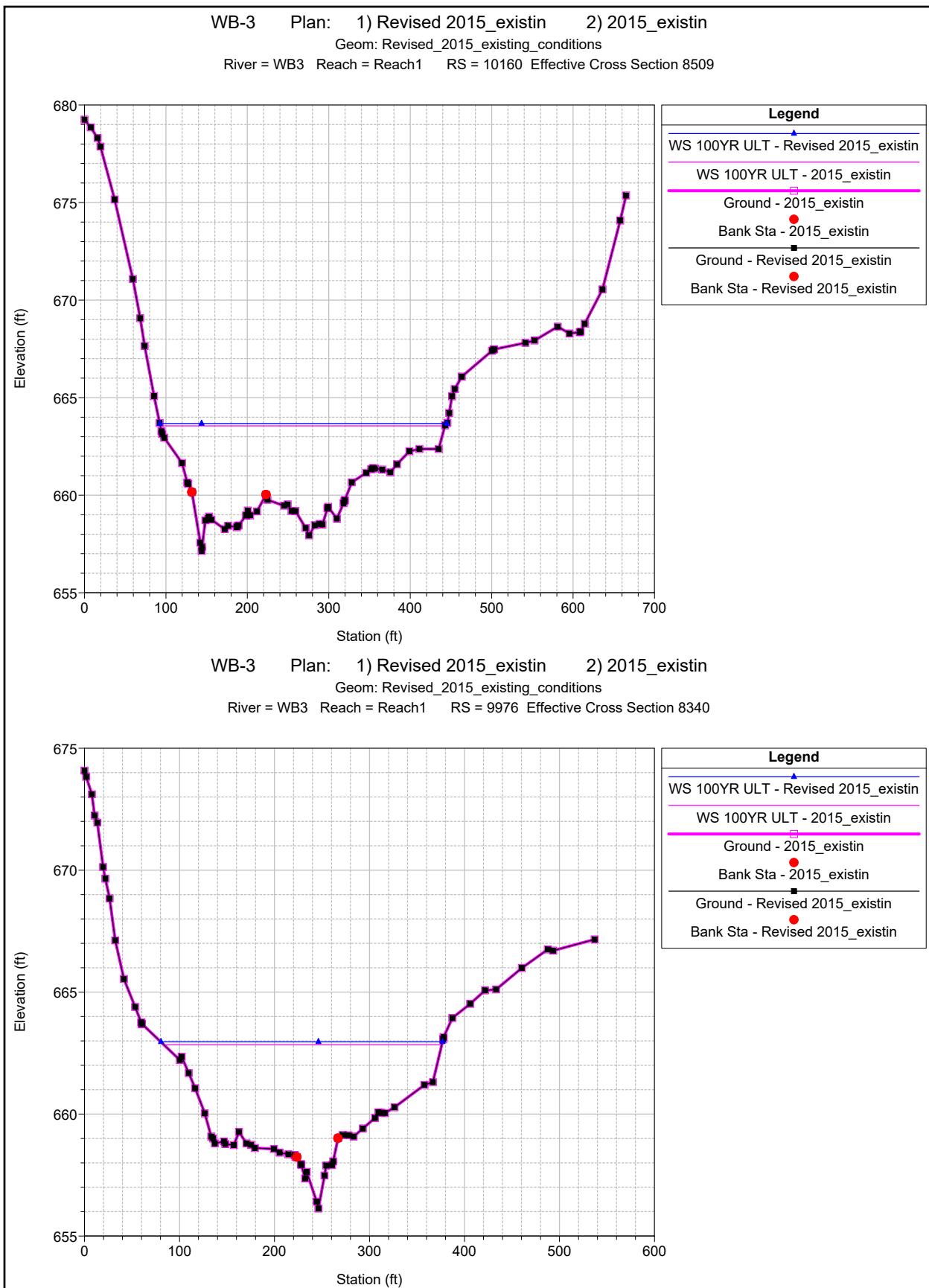
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 11981 Effective Cross Section 9967



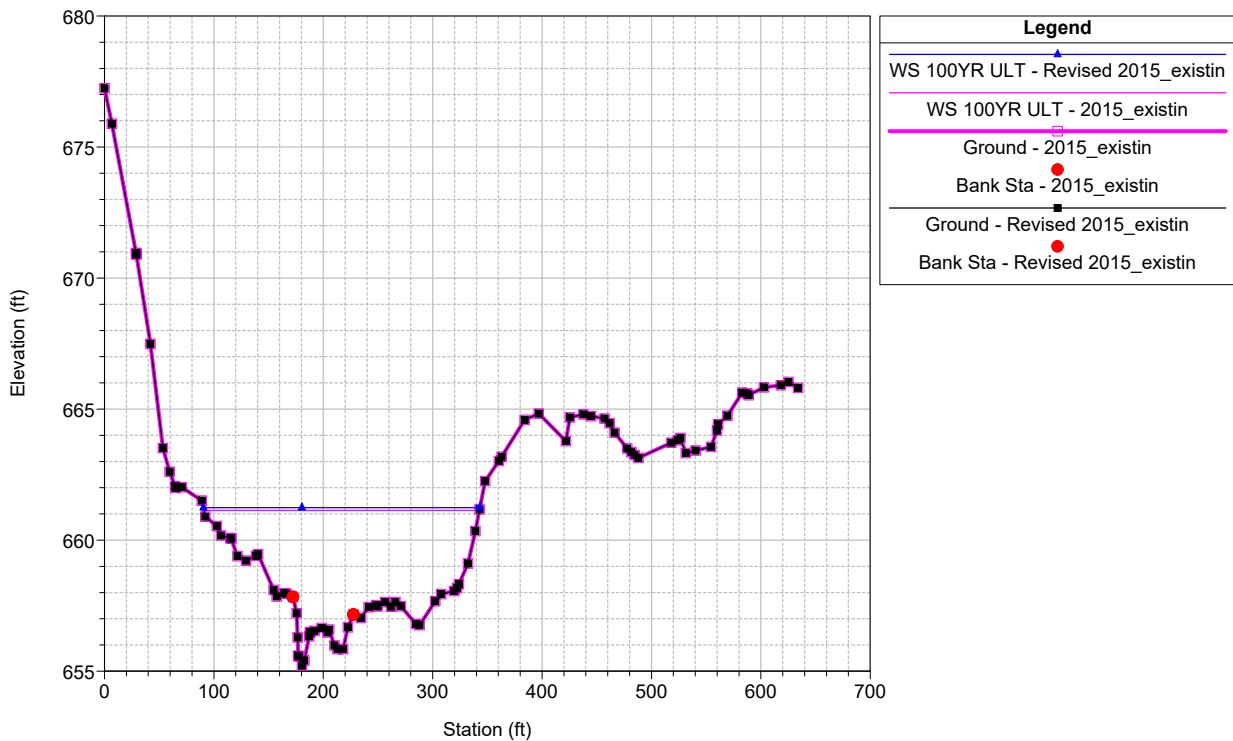




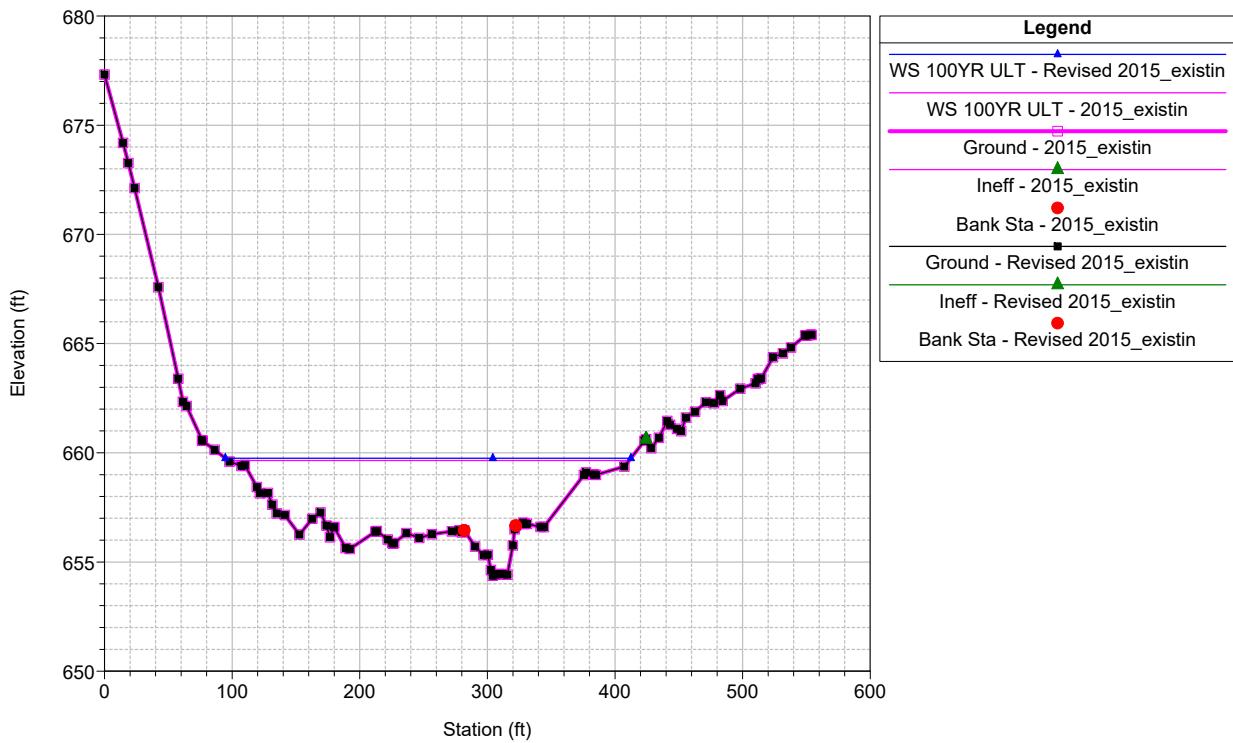


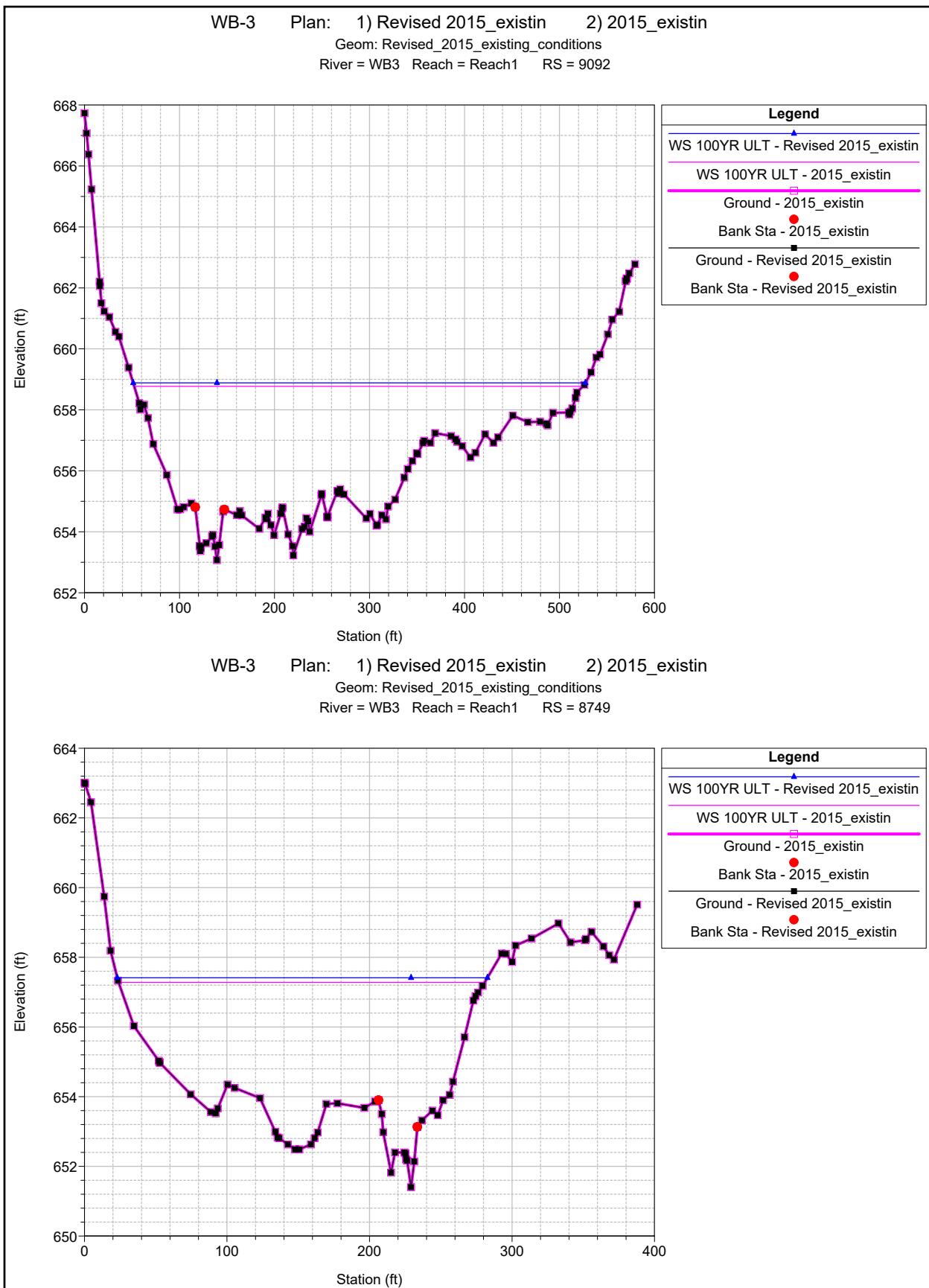


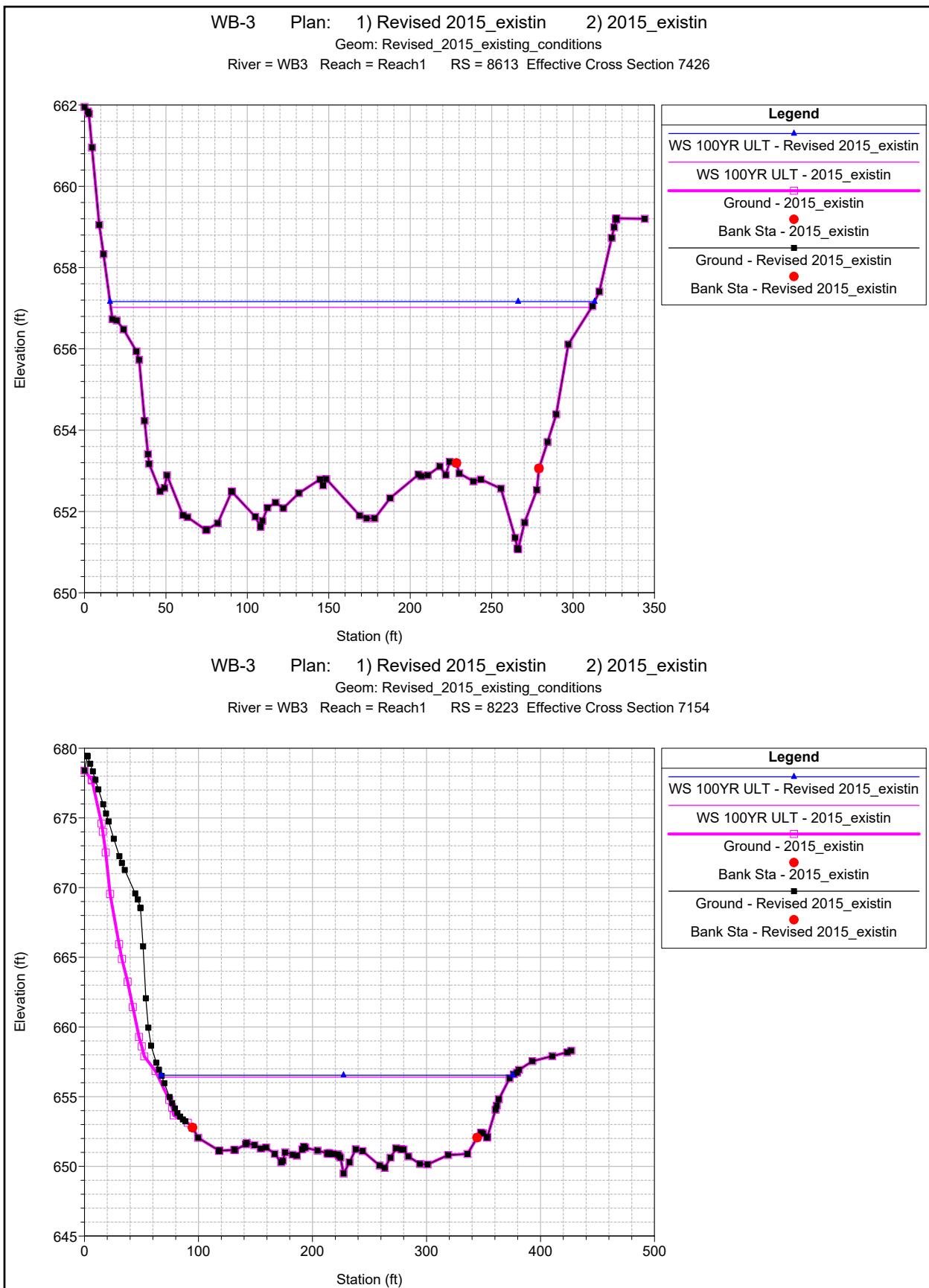
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 9701 Effective Cross Section 8104

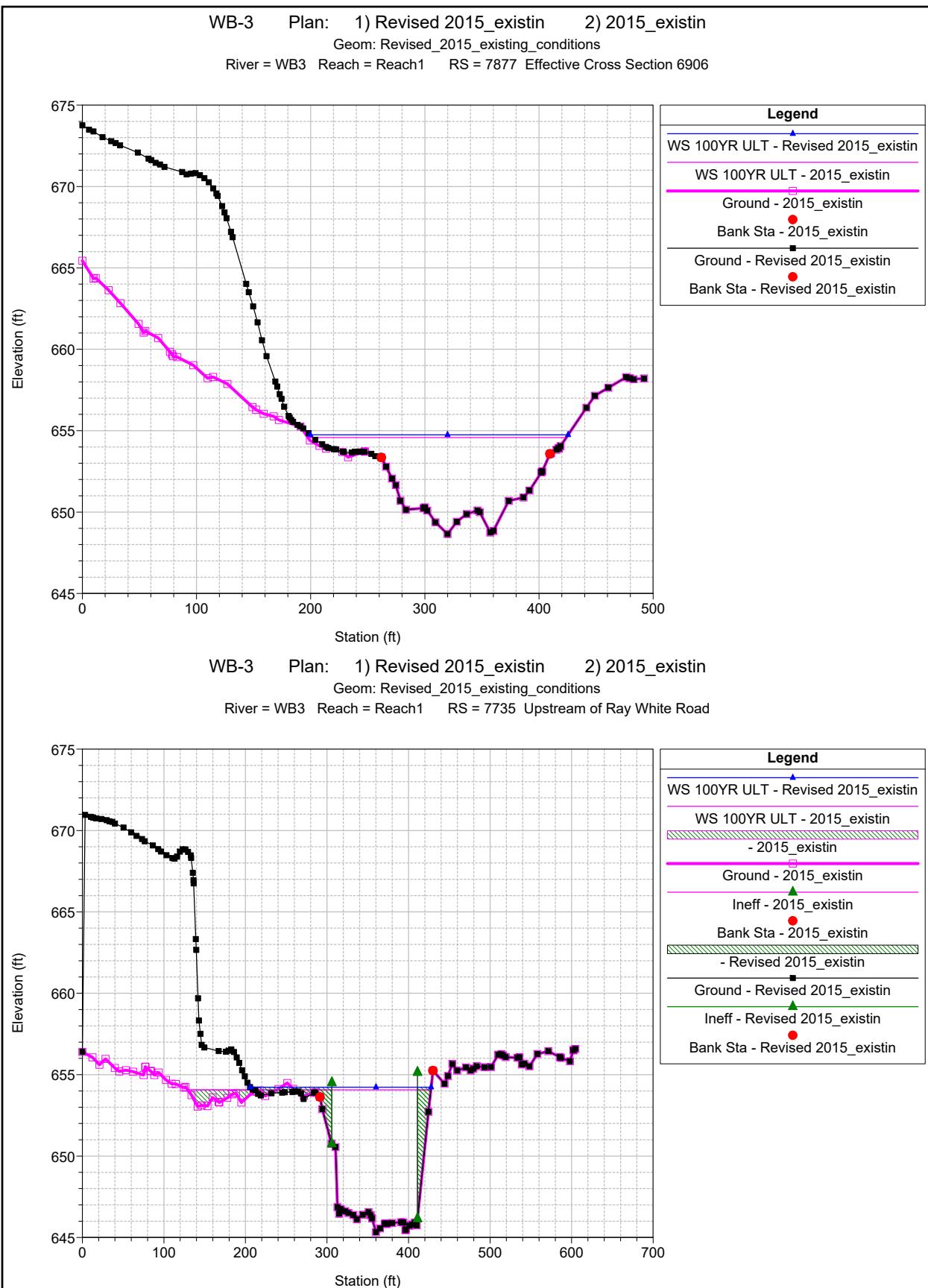


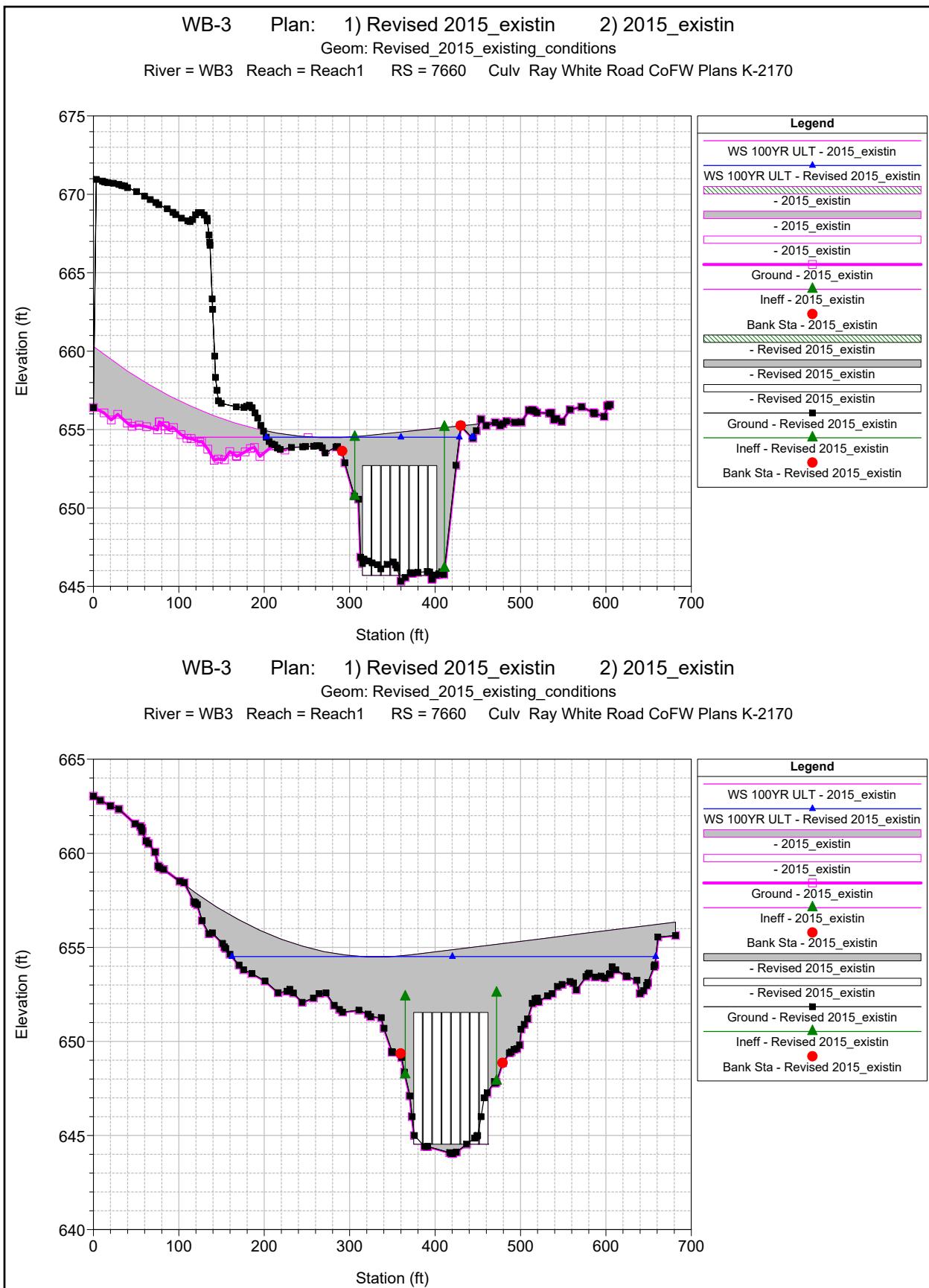
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 9477 Effective Cross Section 7892

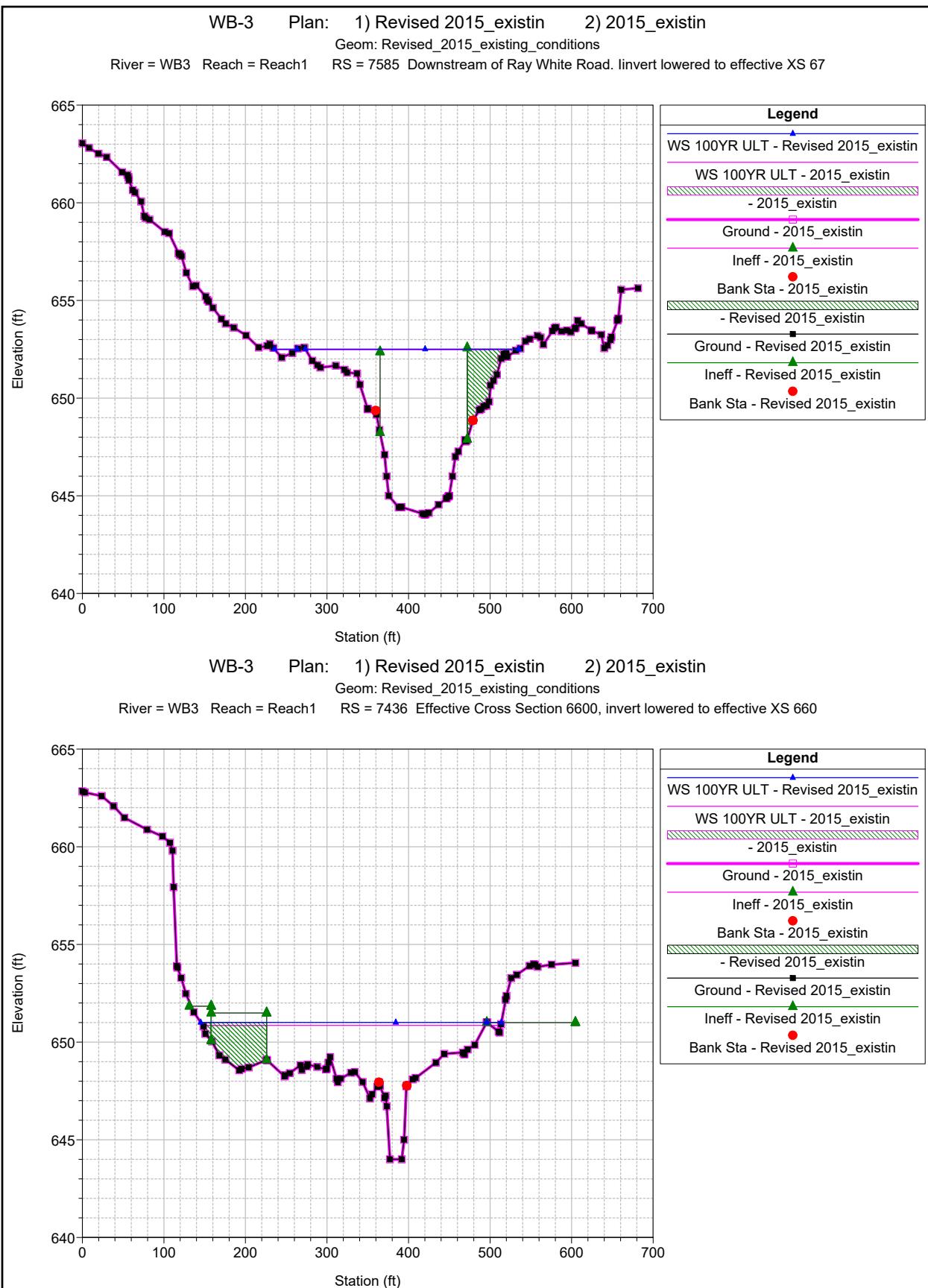




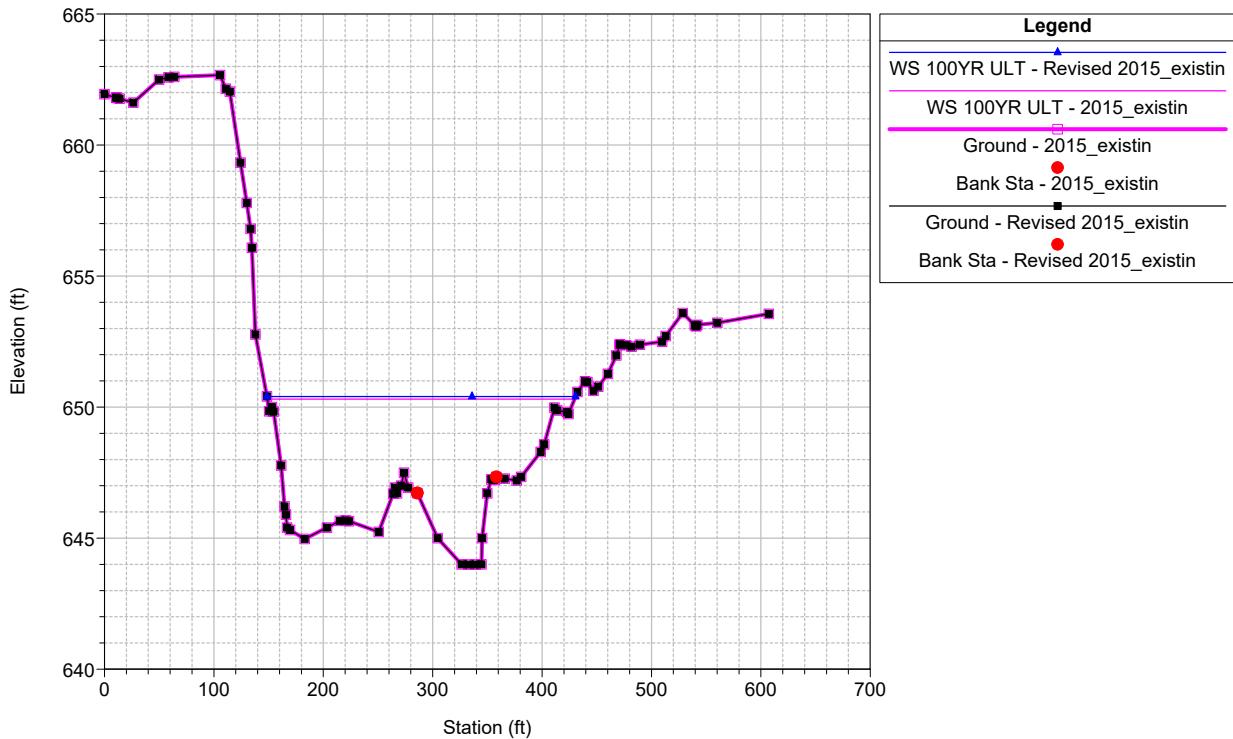




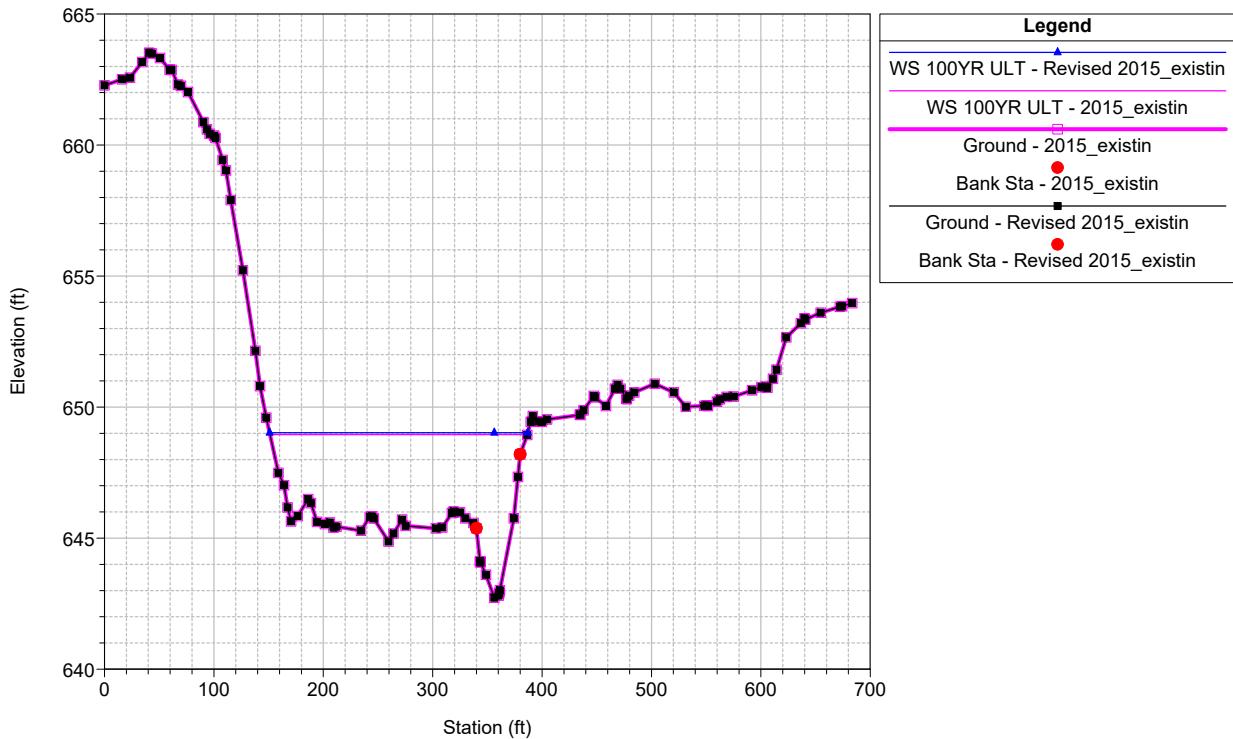




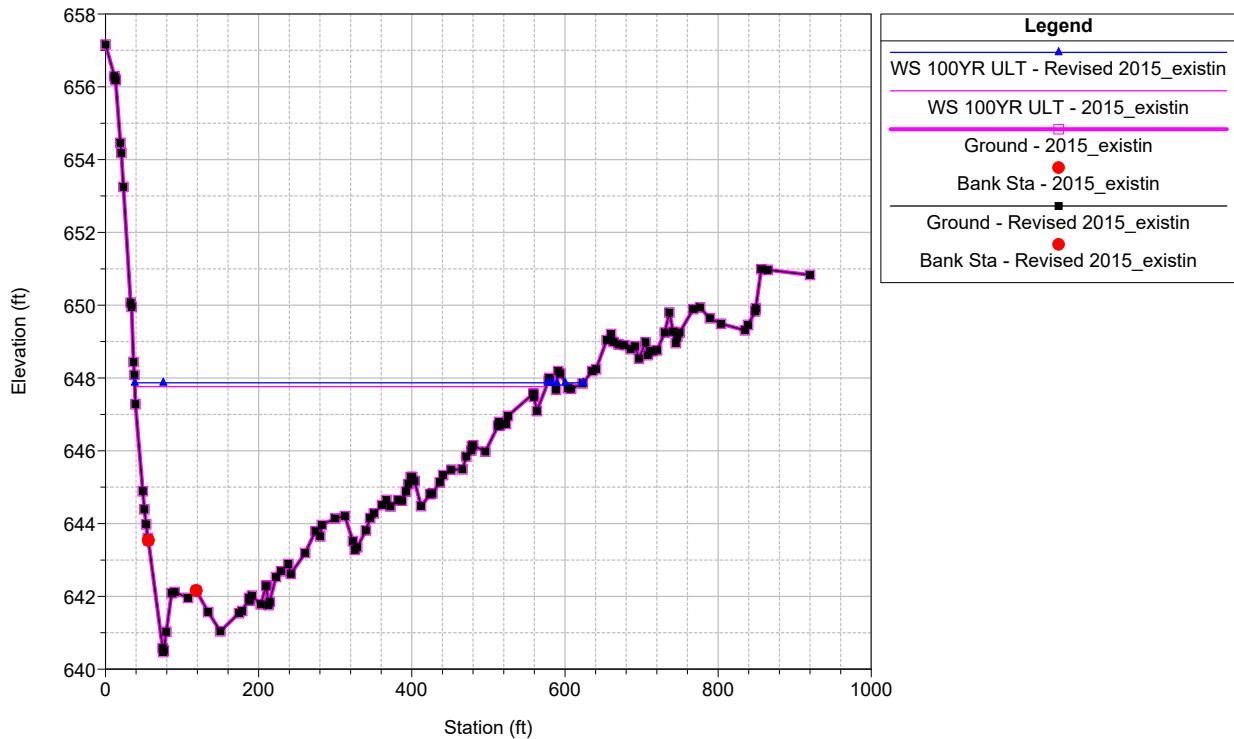
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 7263 Effective Cross Section 6354, invert lowered to effective sectio



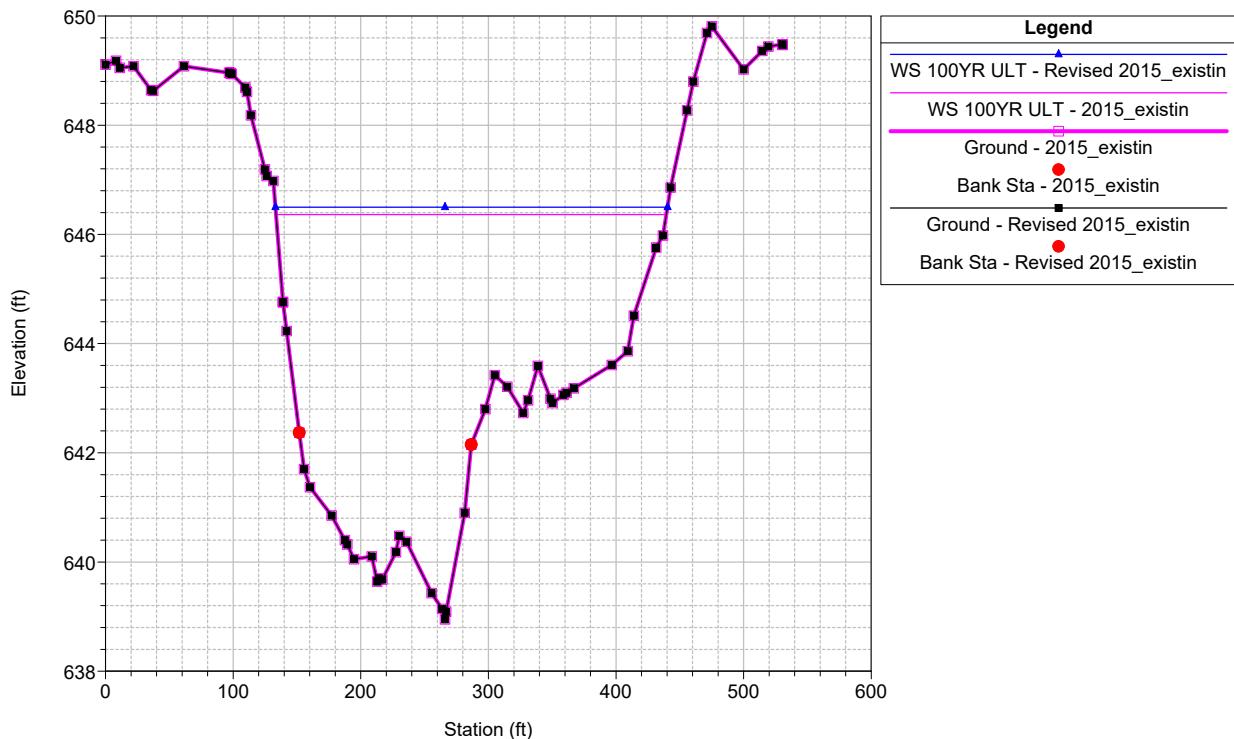
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 6908 Effective Cross Section 6057

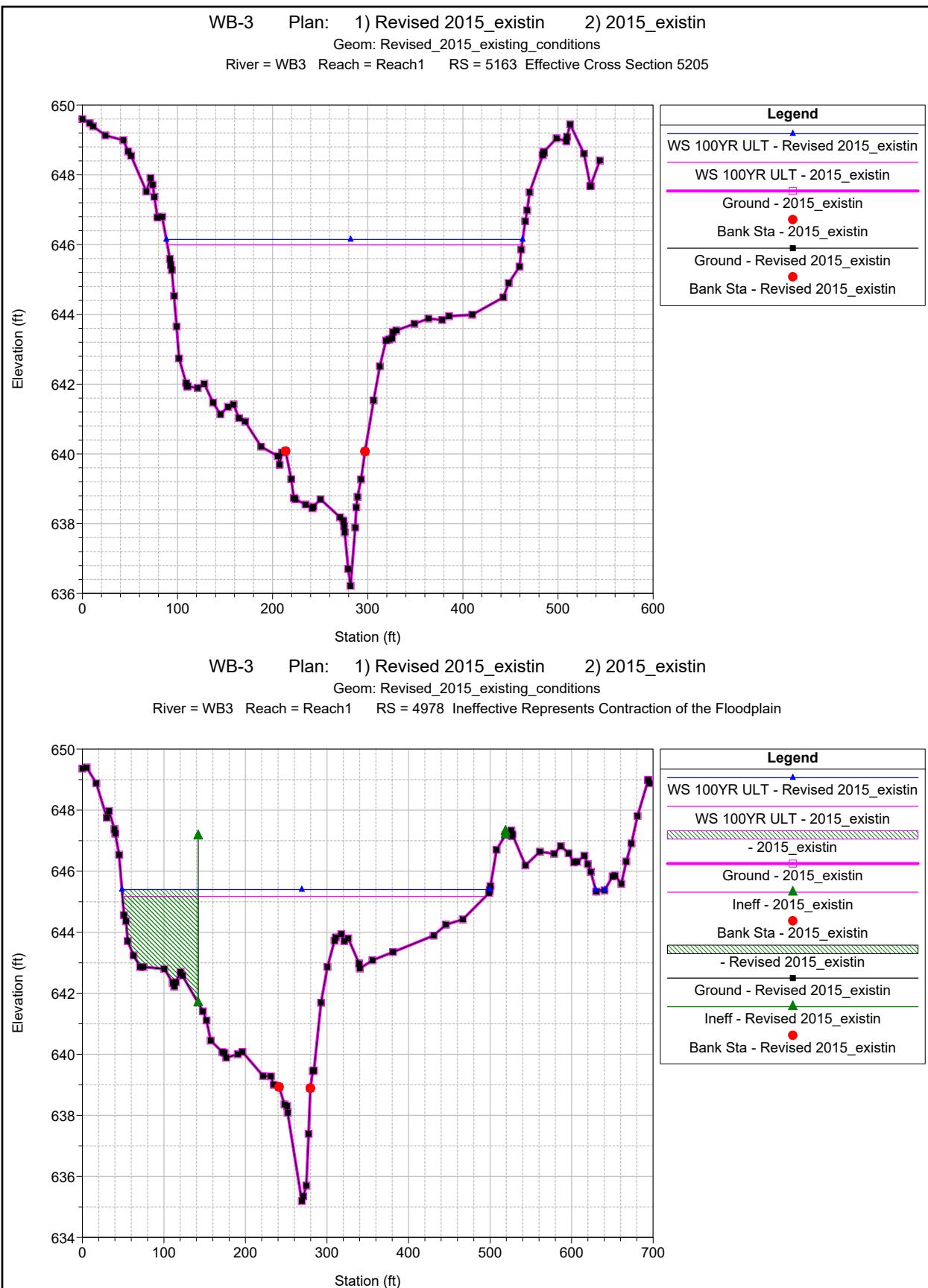


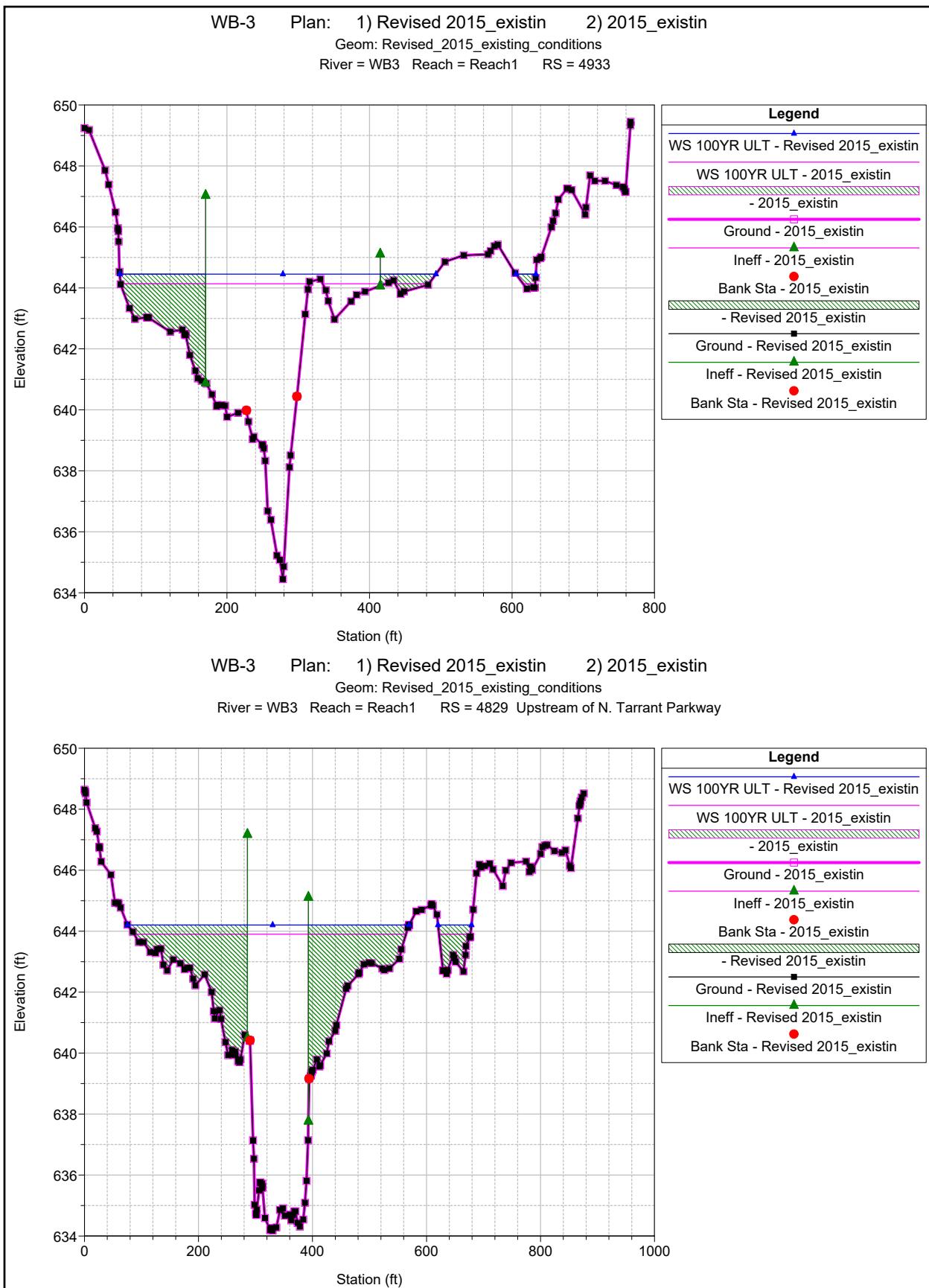
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 5949 Effective Cross Section 5695

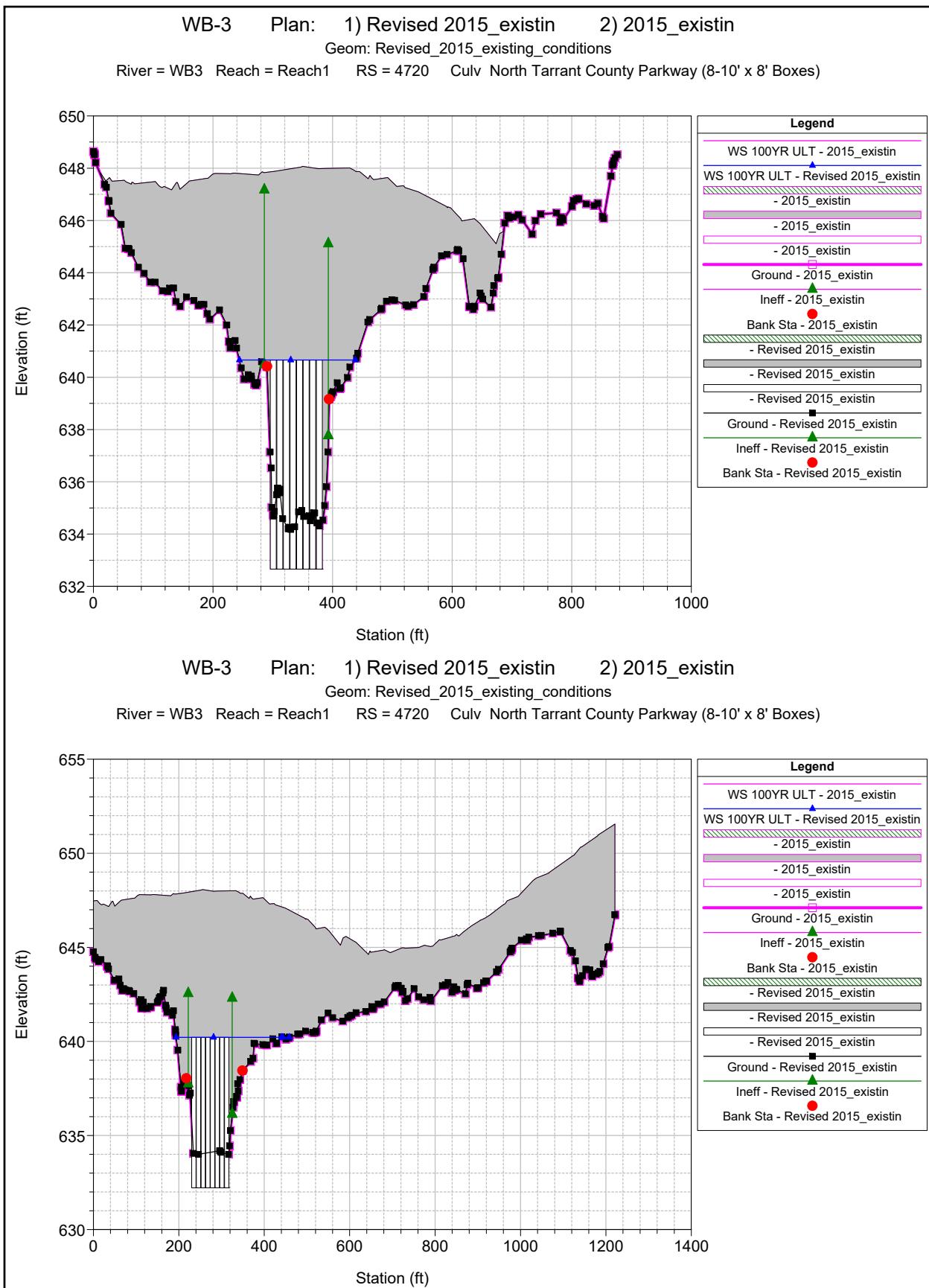


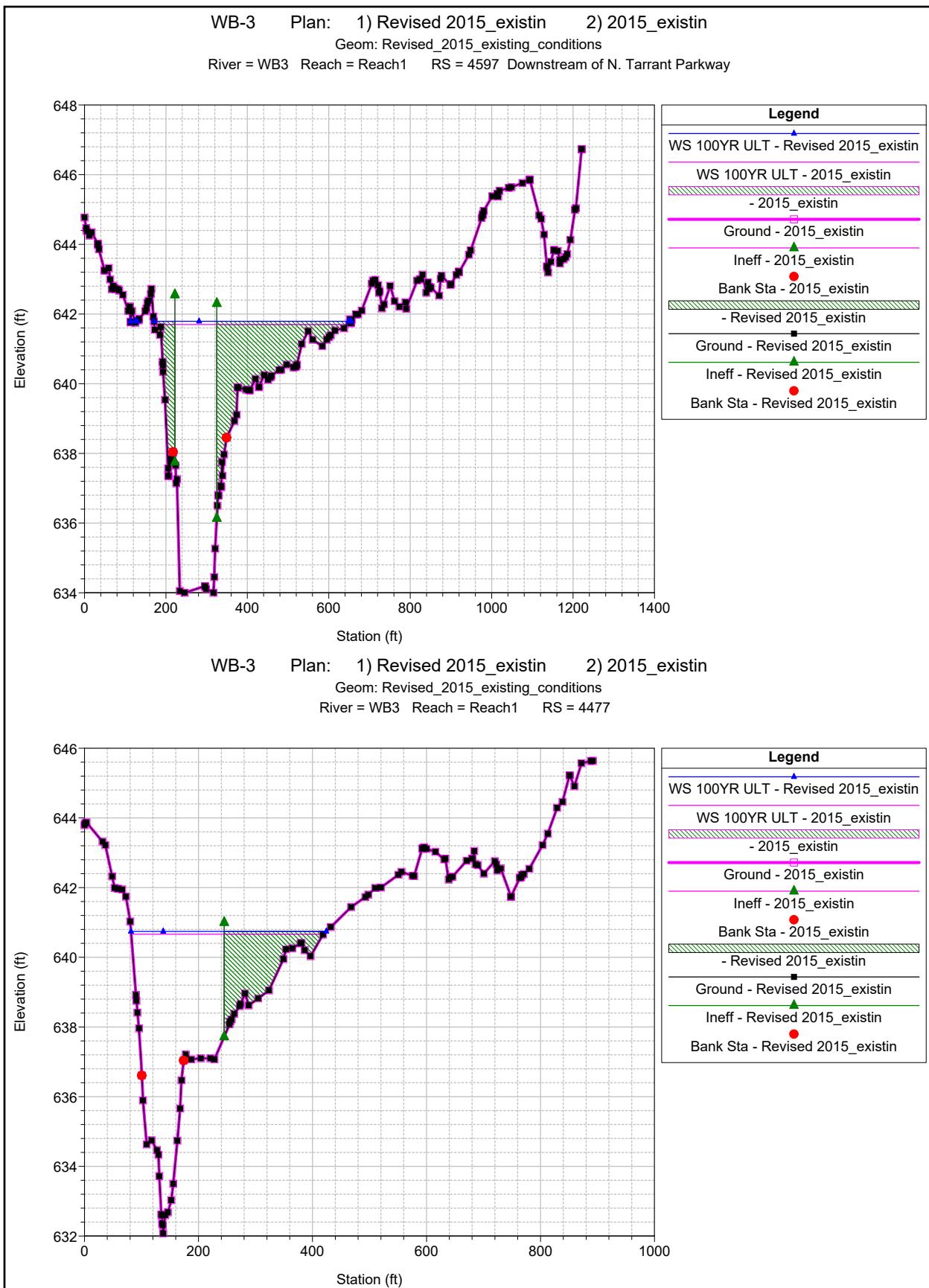
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 5340

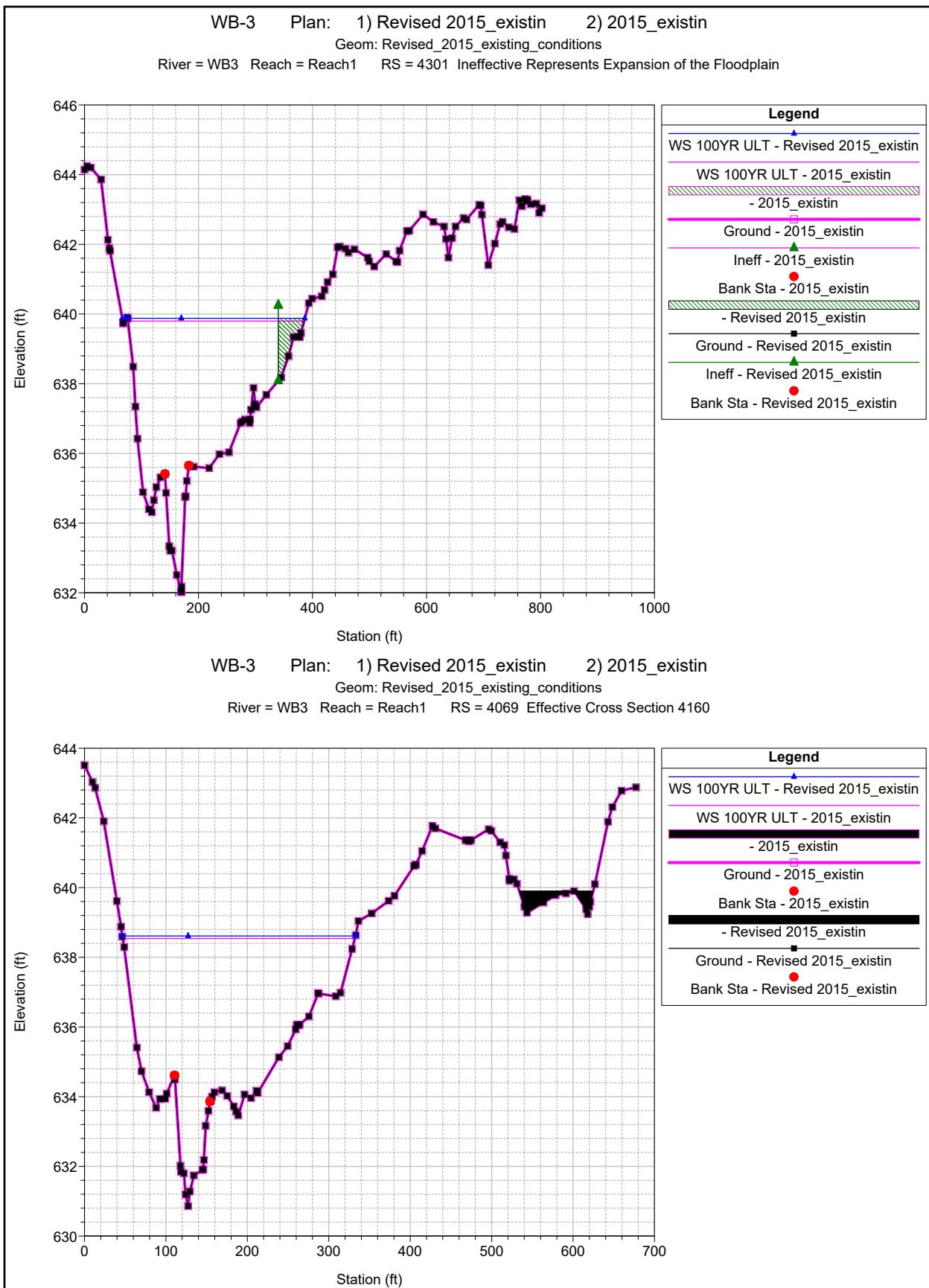




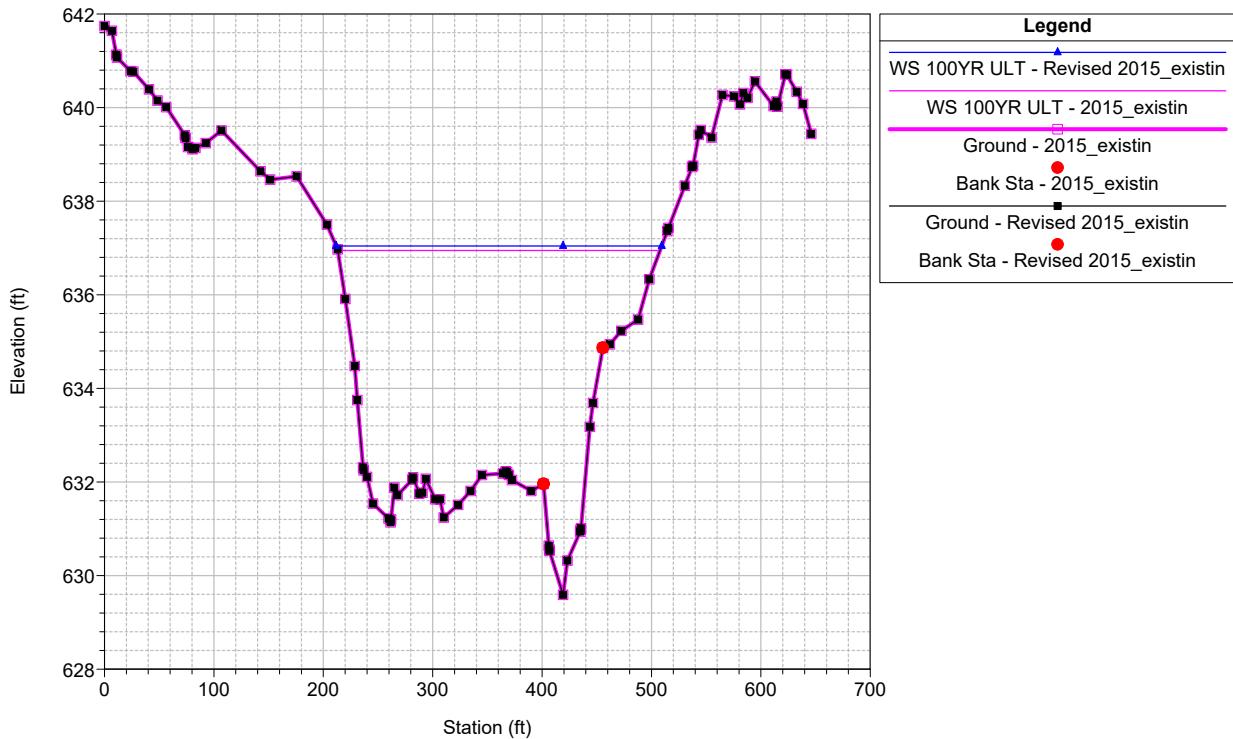




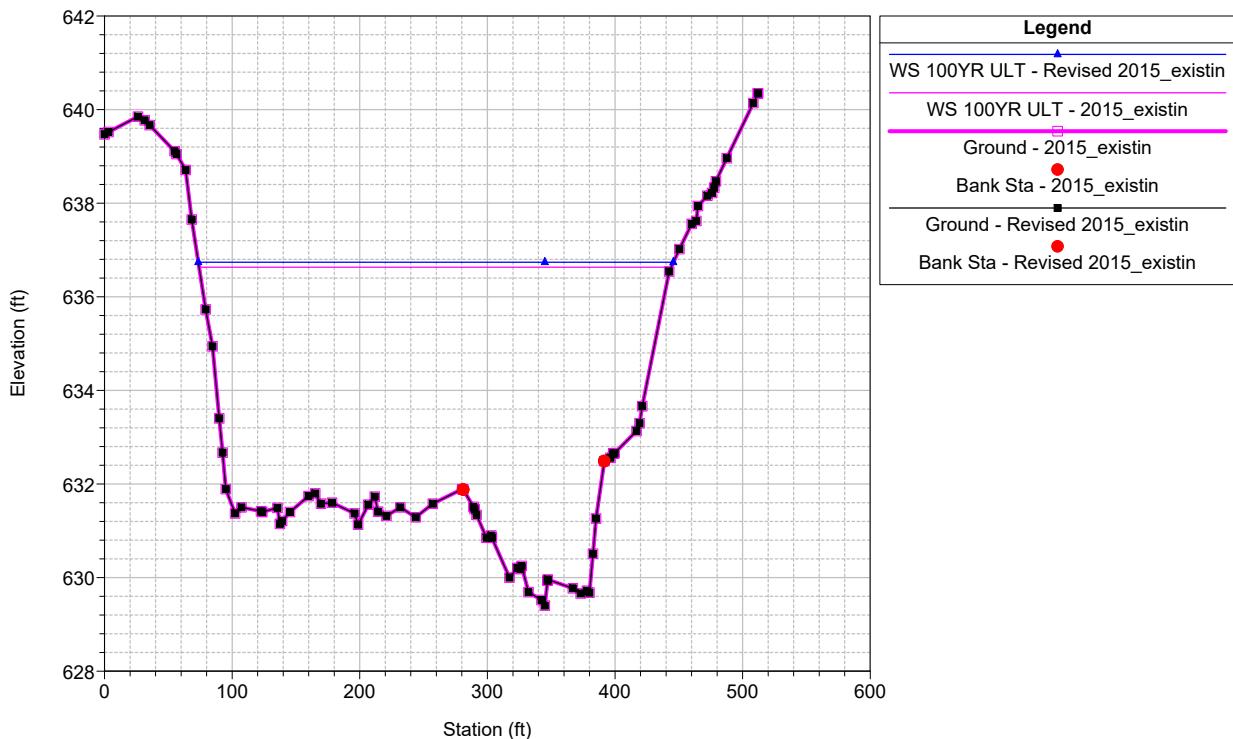


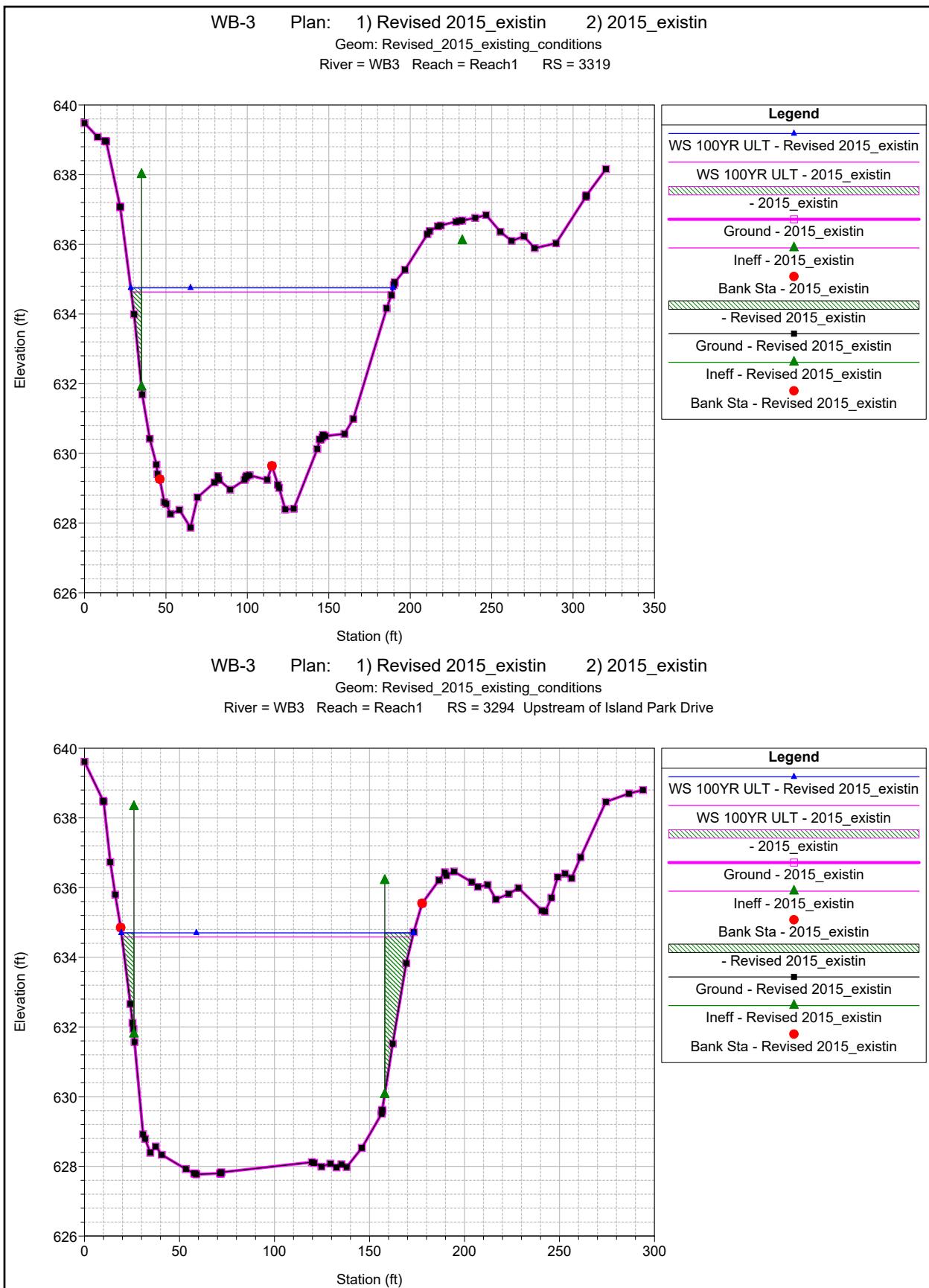


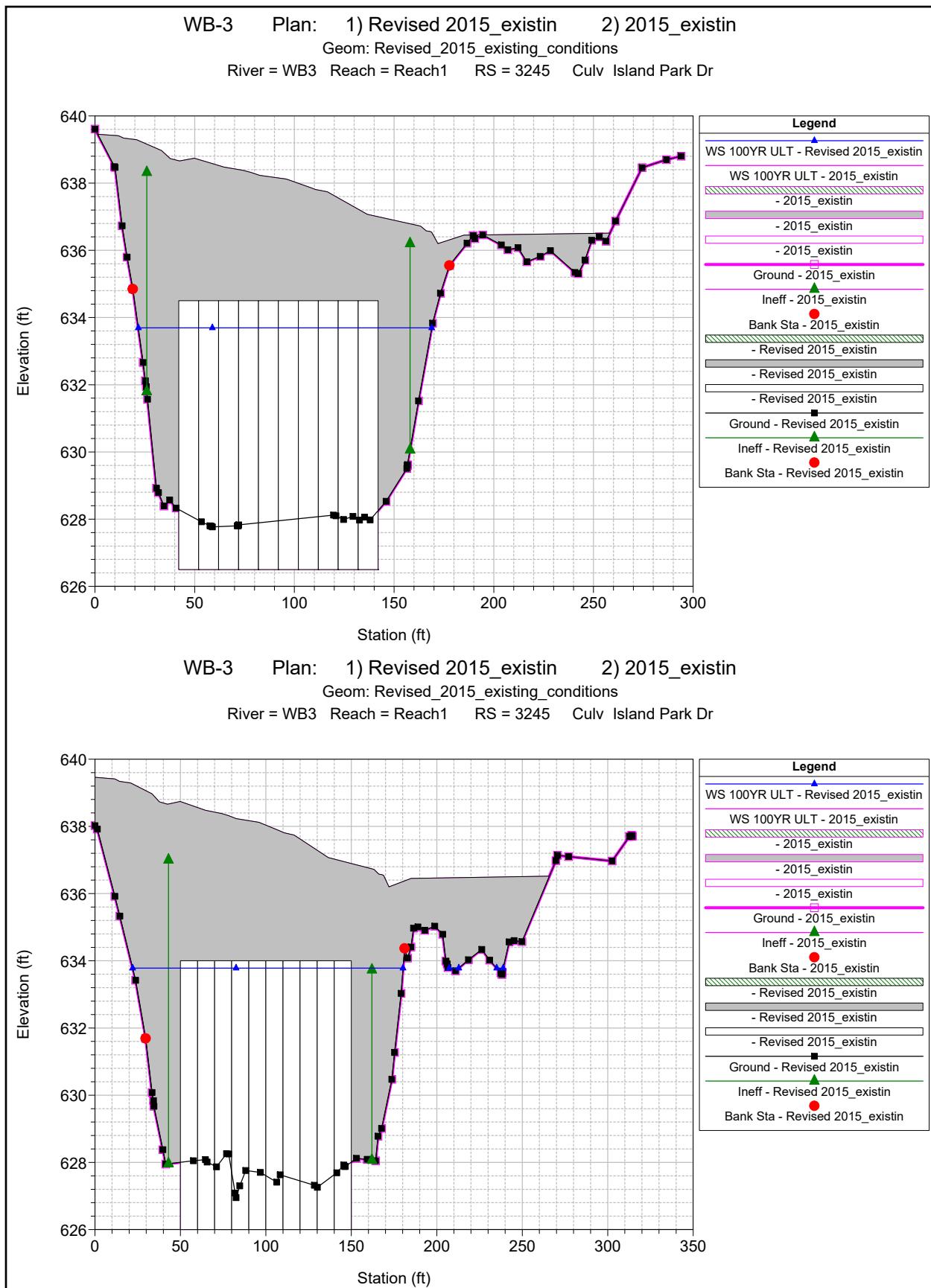
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 3736 Effective Cross Section 3830

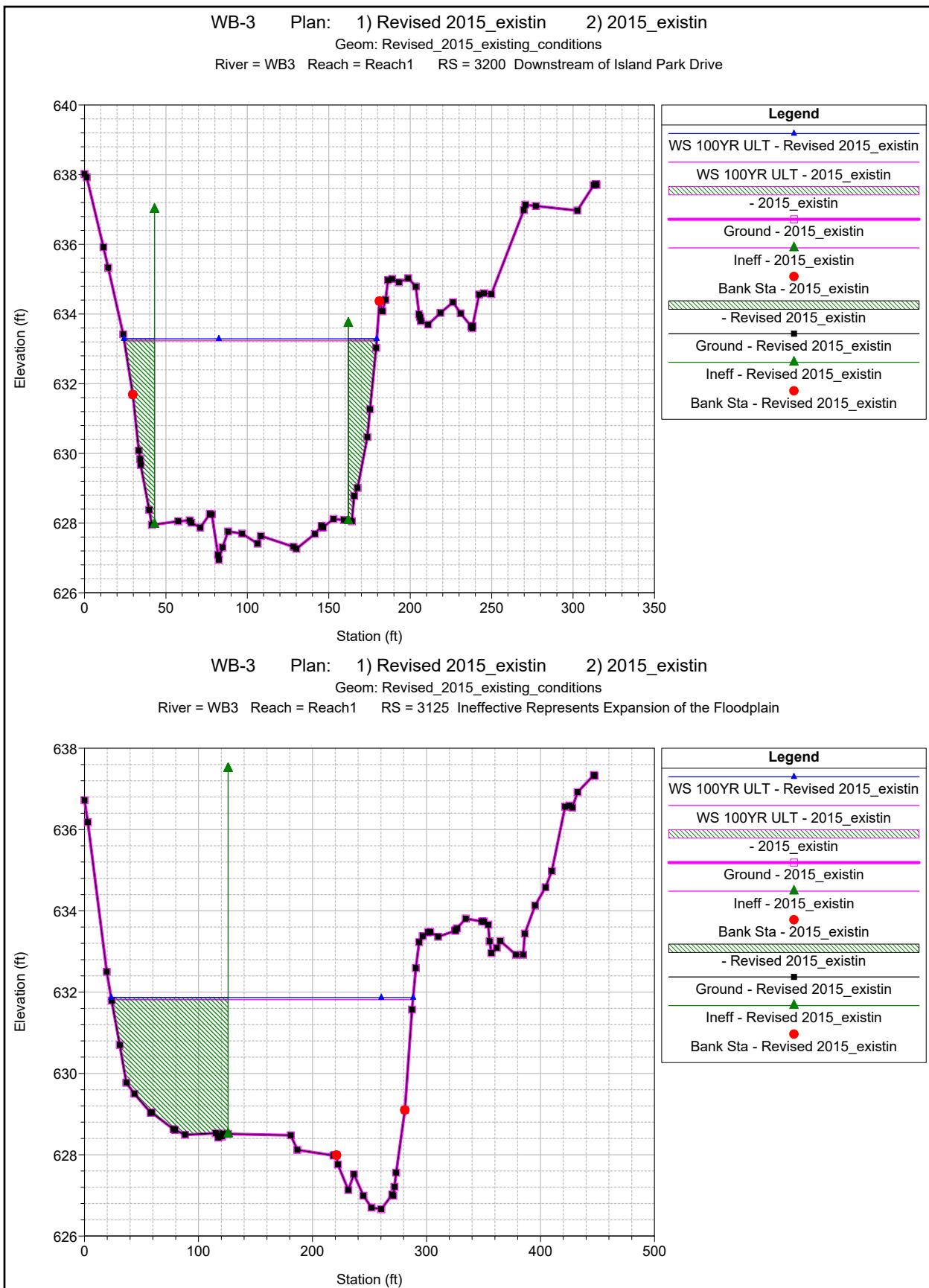


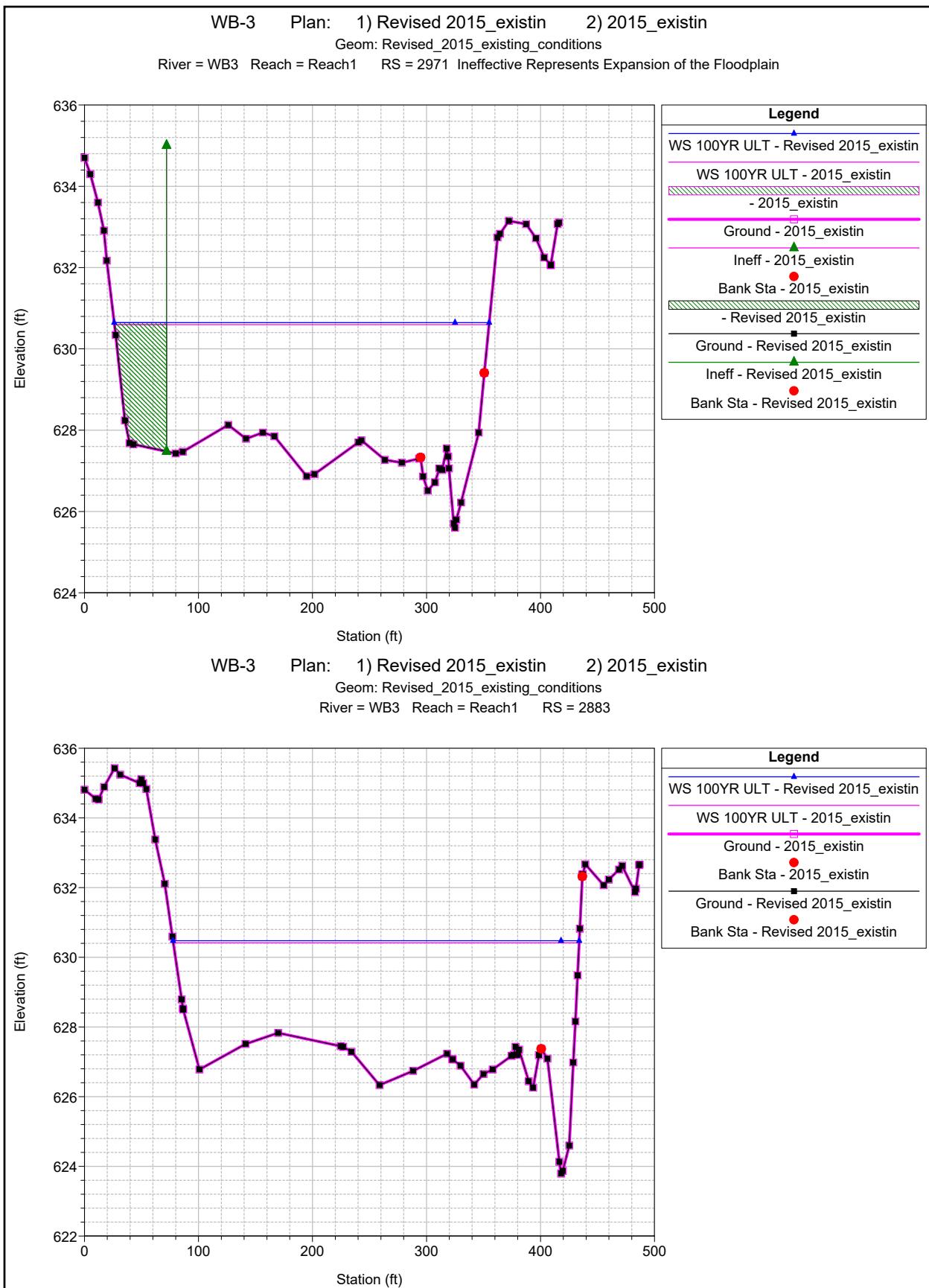
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
 Geom: Revised_2015_existing_conditions
 River = WB3 Reach = Reach1 RS = 3500 Effective Cross Section 3590

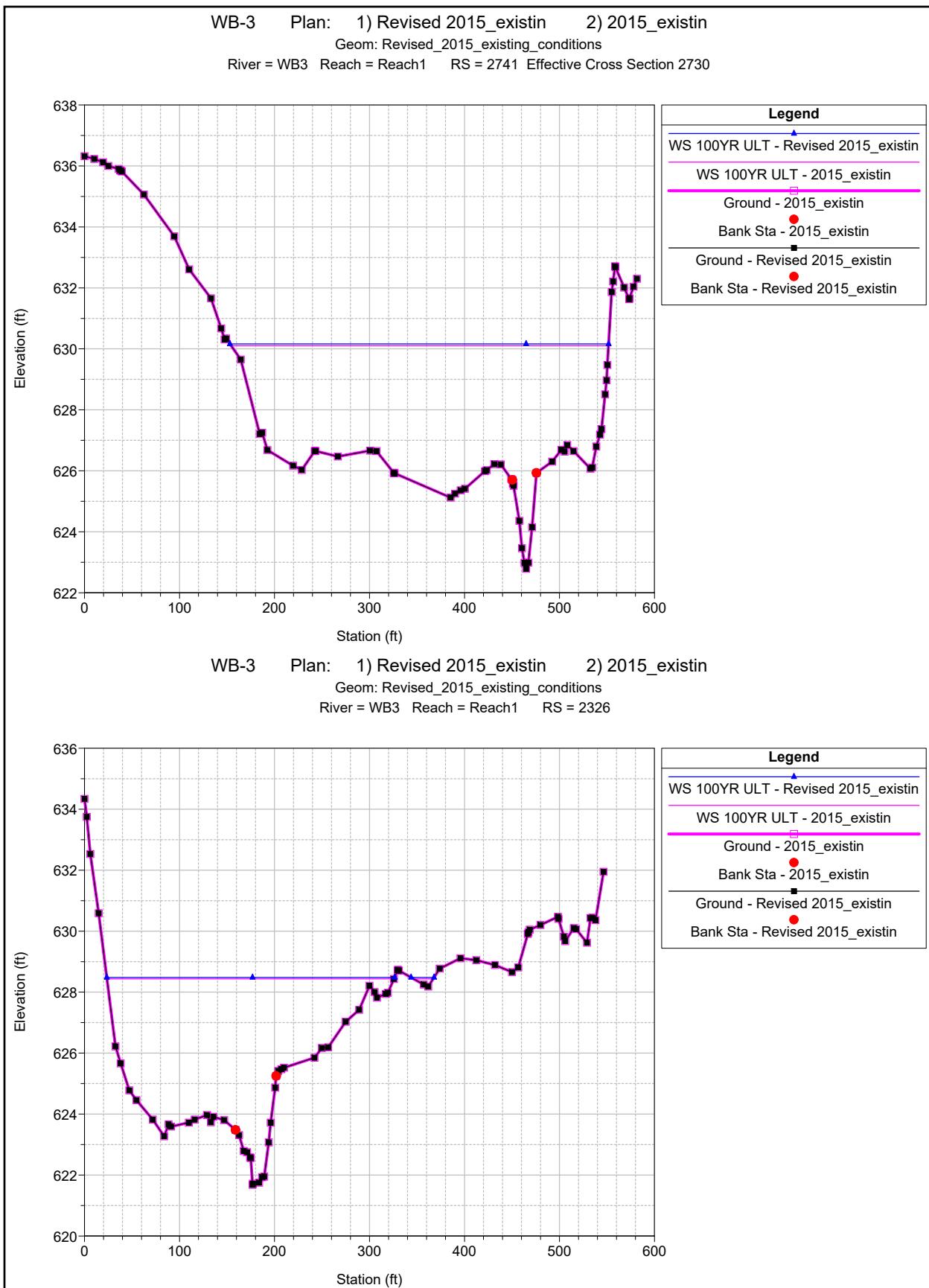




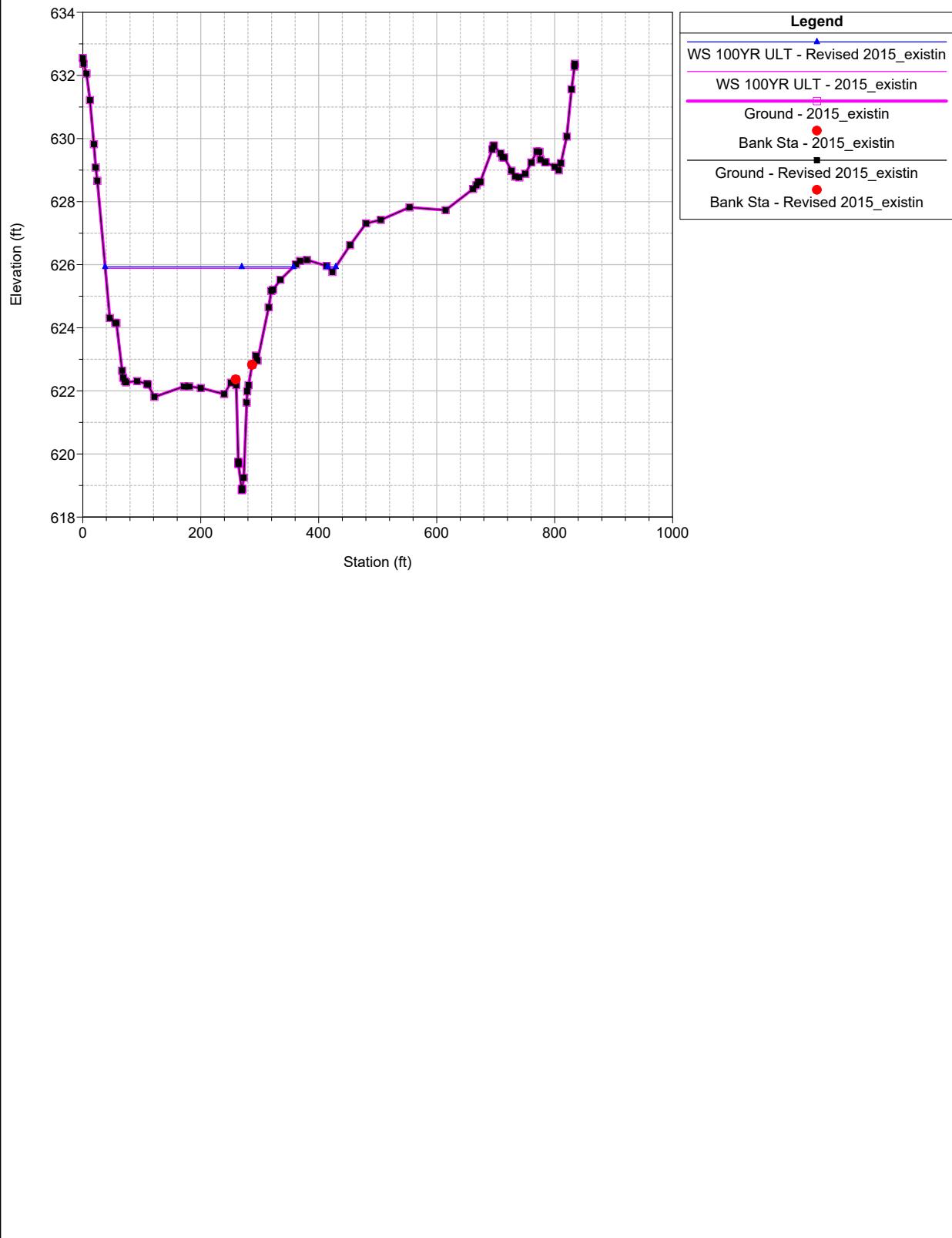


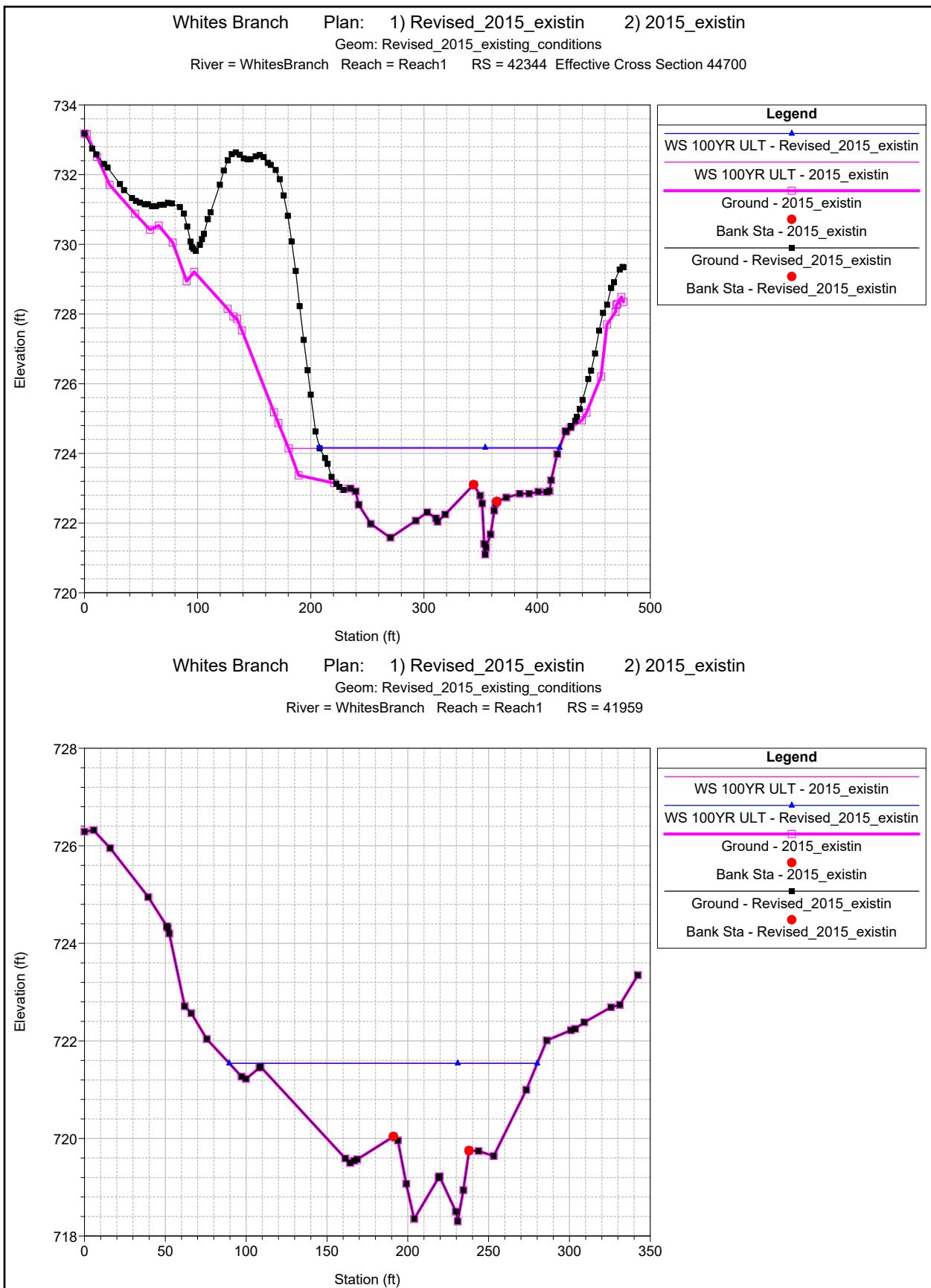


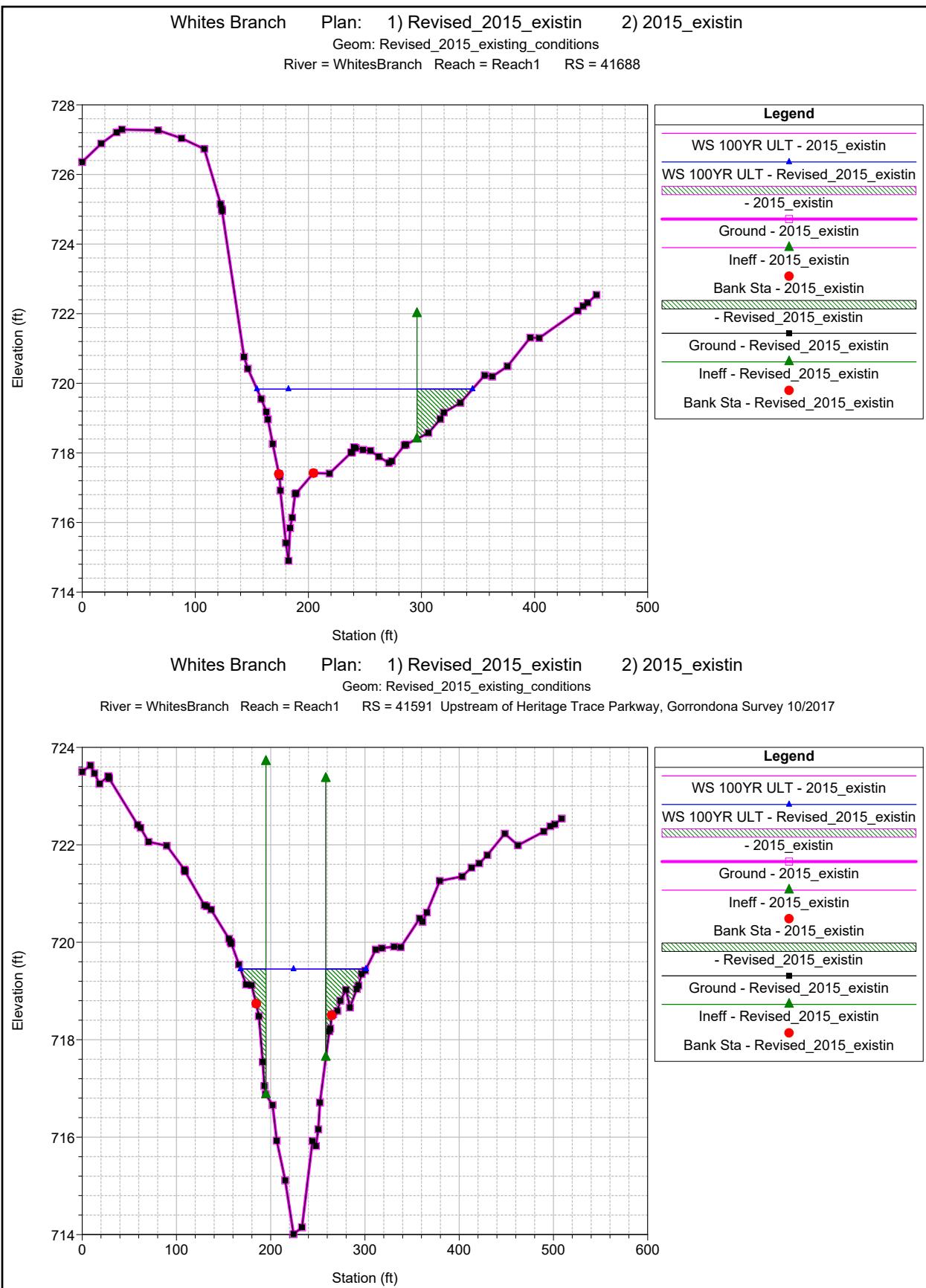


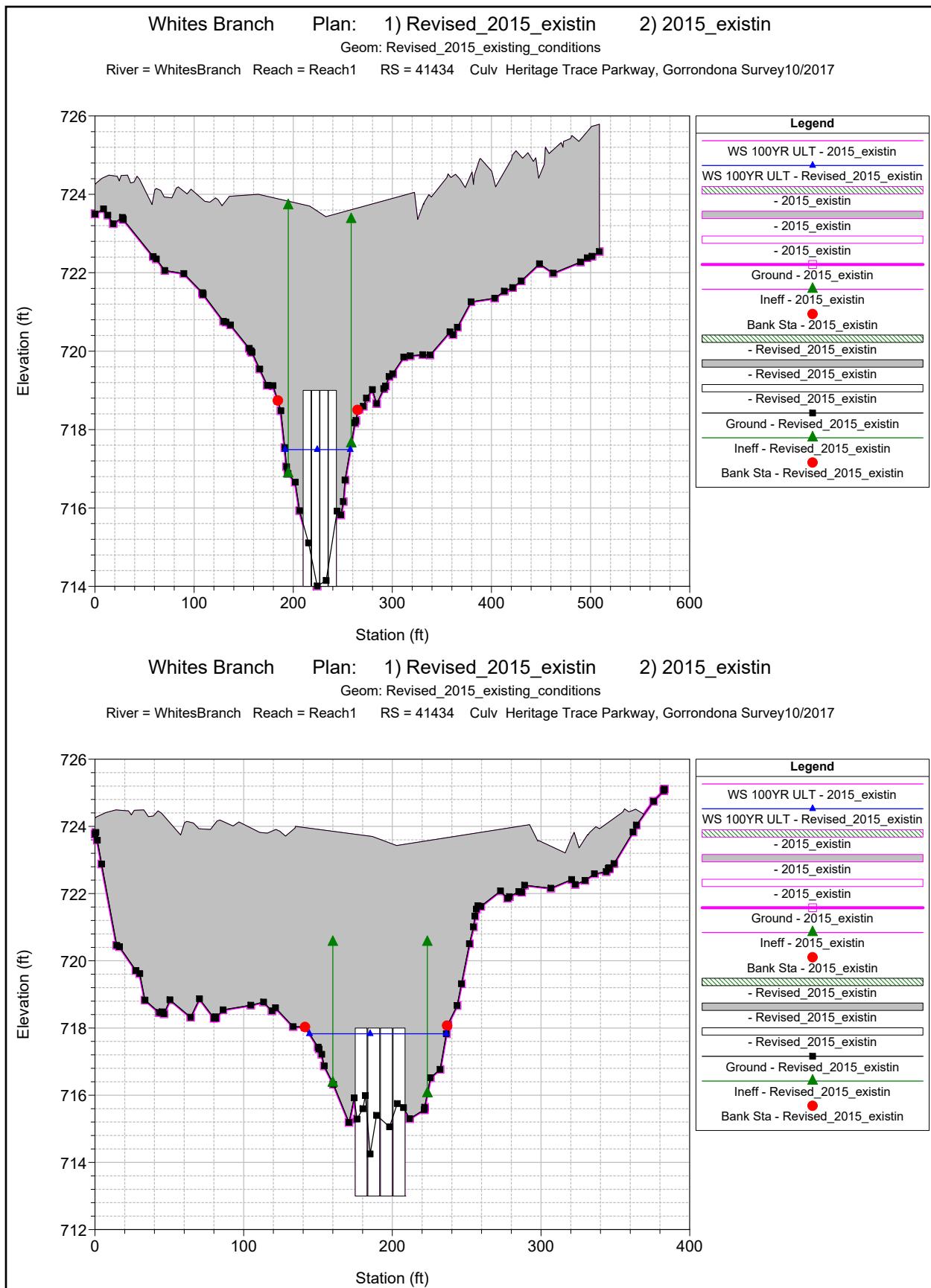


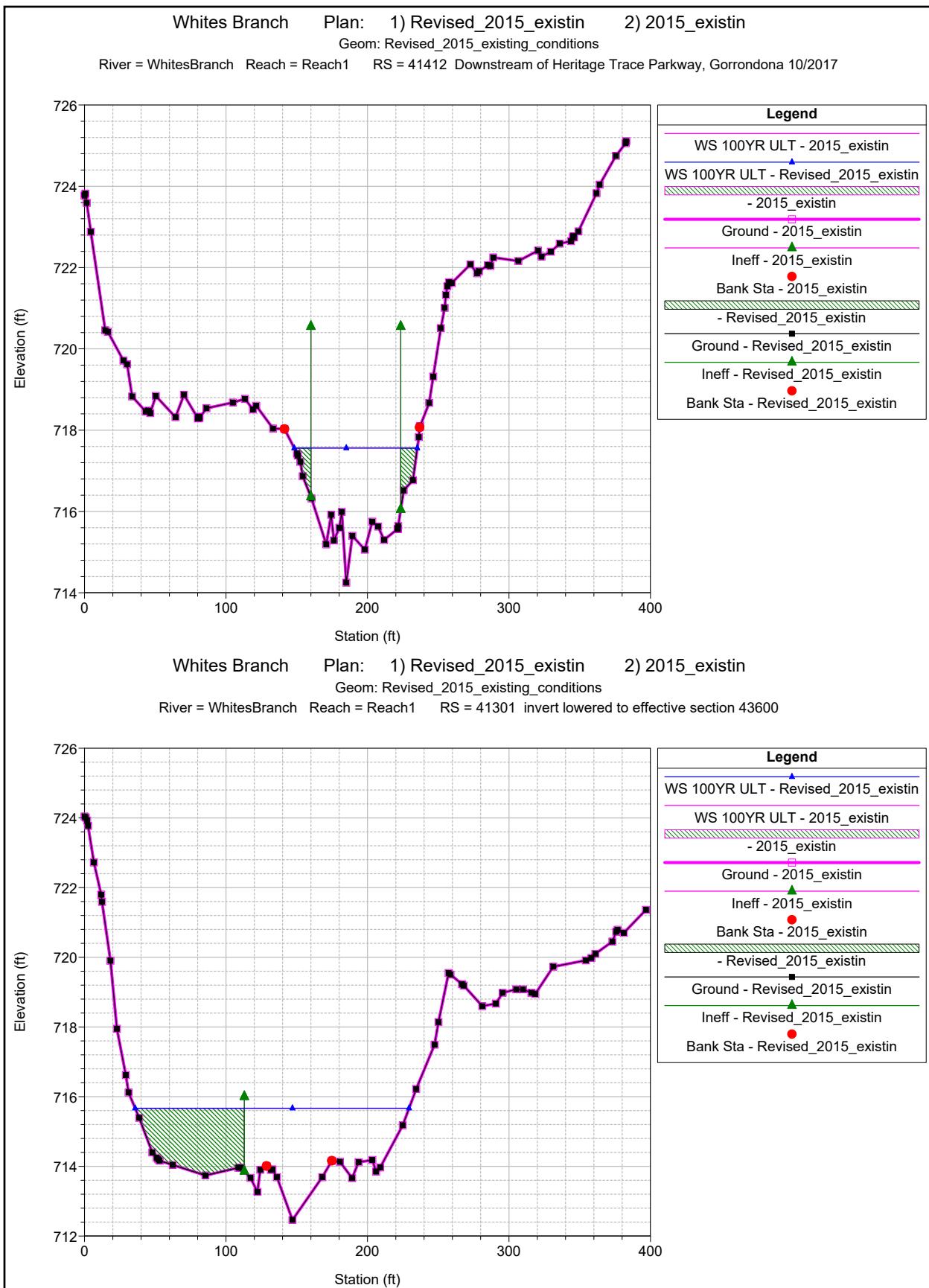
WB-3 Plan: 1) Revised 2015_existin 2) 2015_existin
Geom: Revised_2015_existing_conditions
River = WB3 Reach = Reach1 RS = 1920 Effective Cross Section 1910

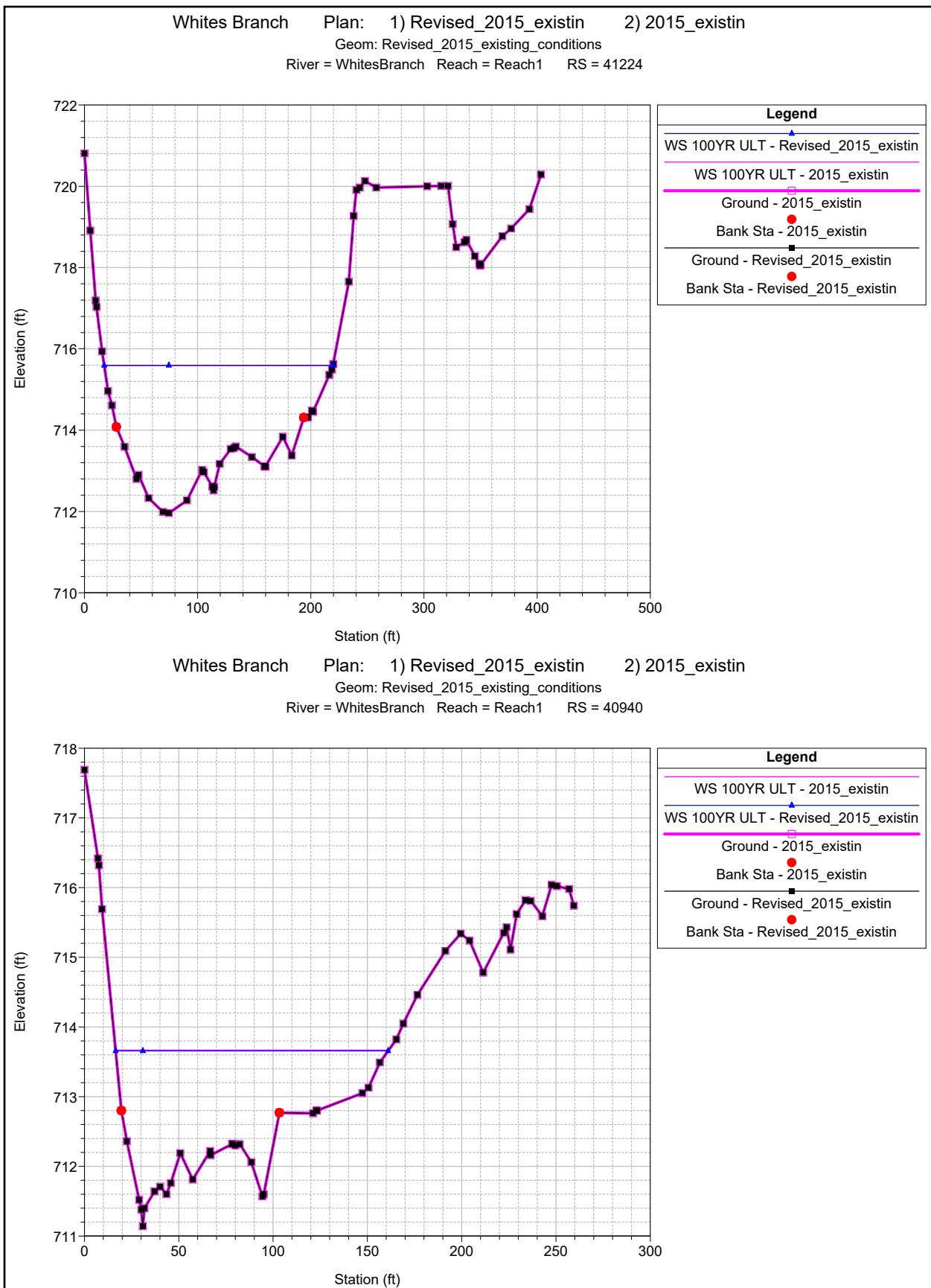


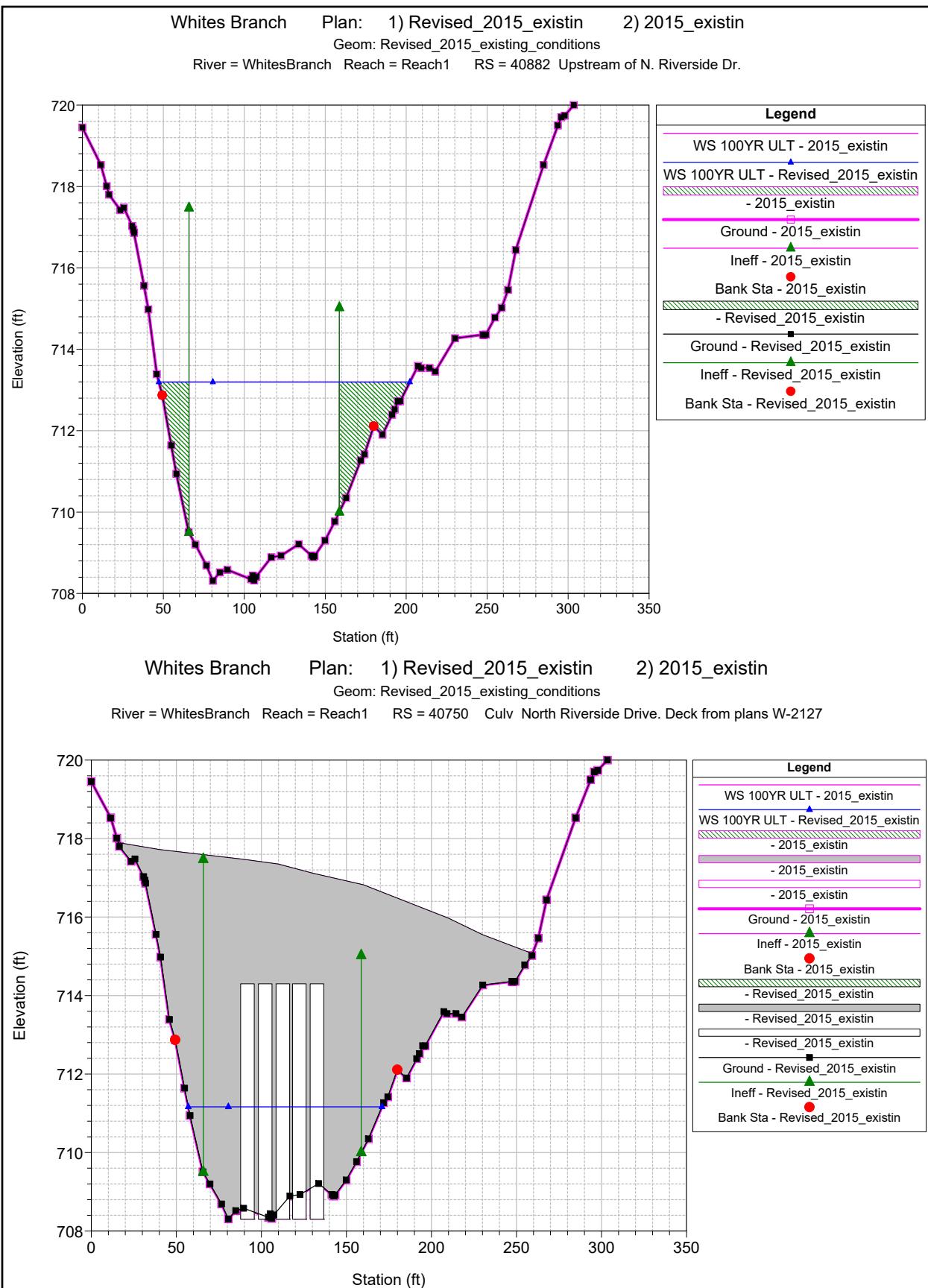


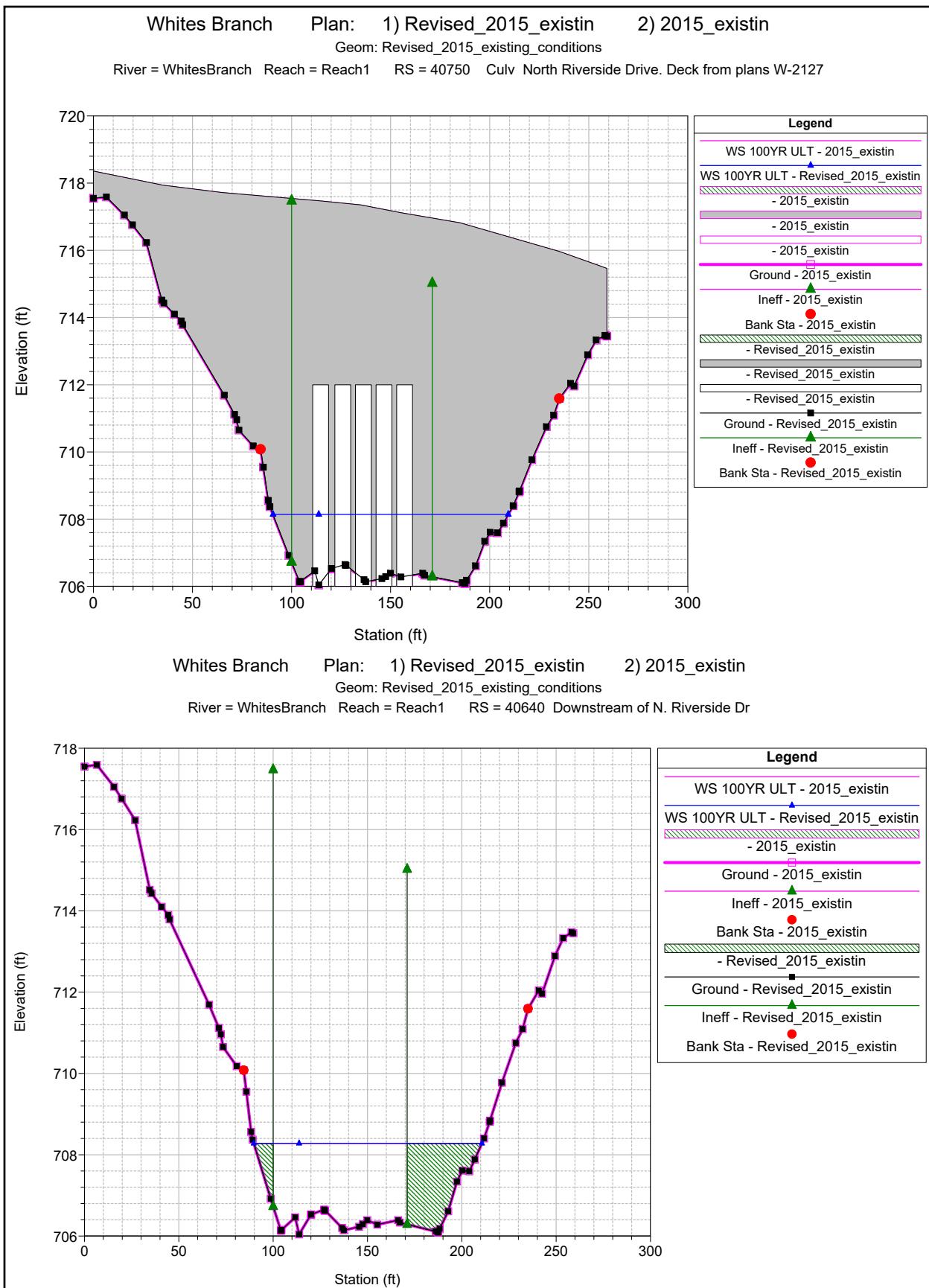


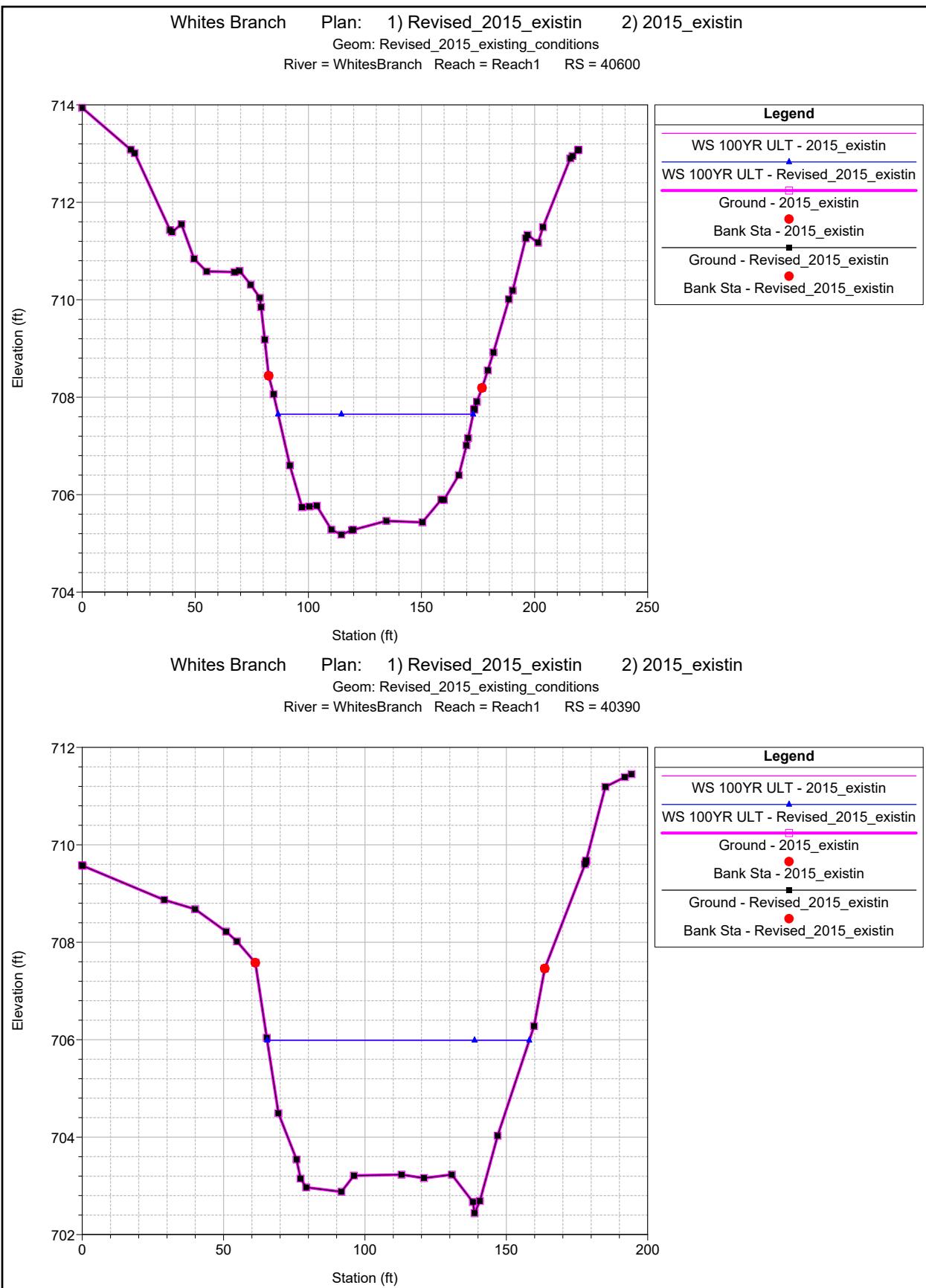


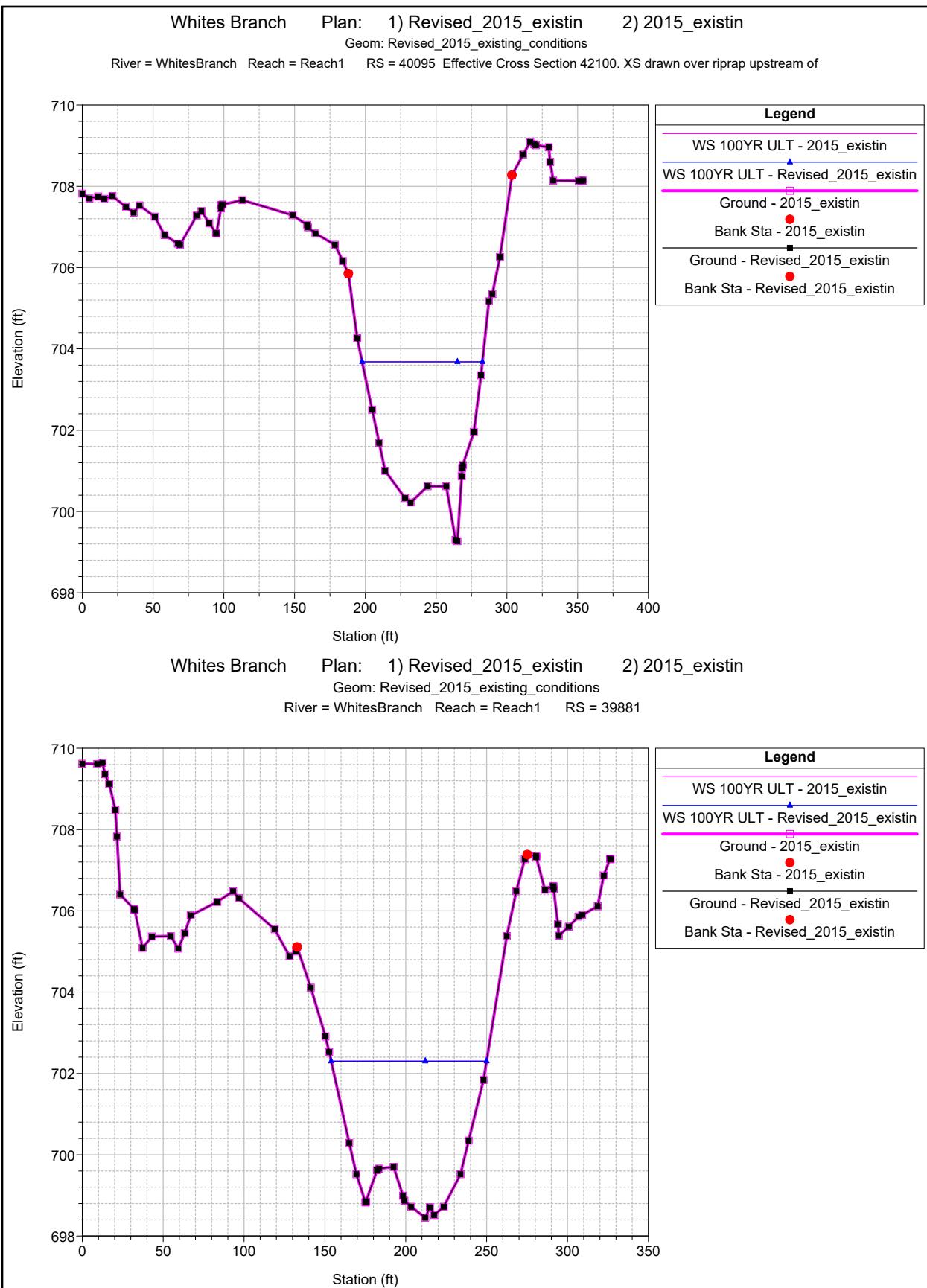


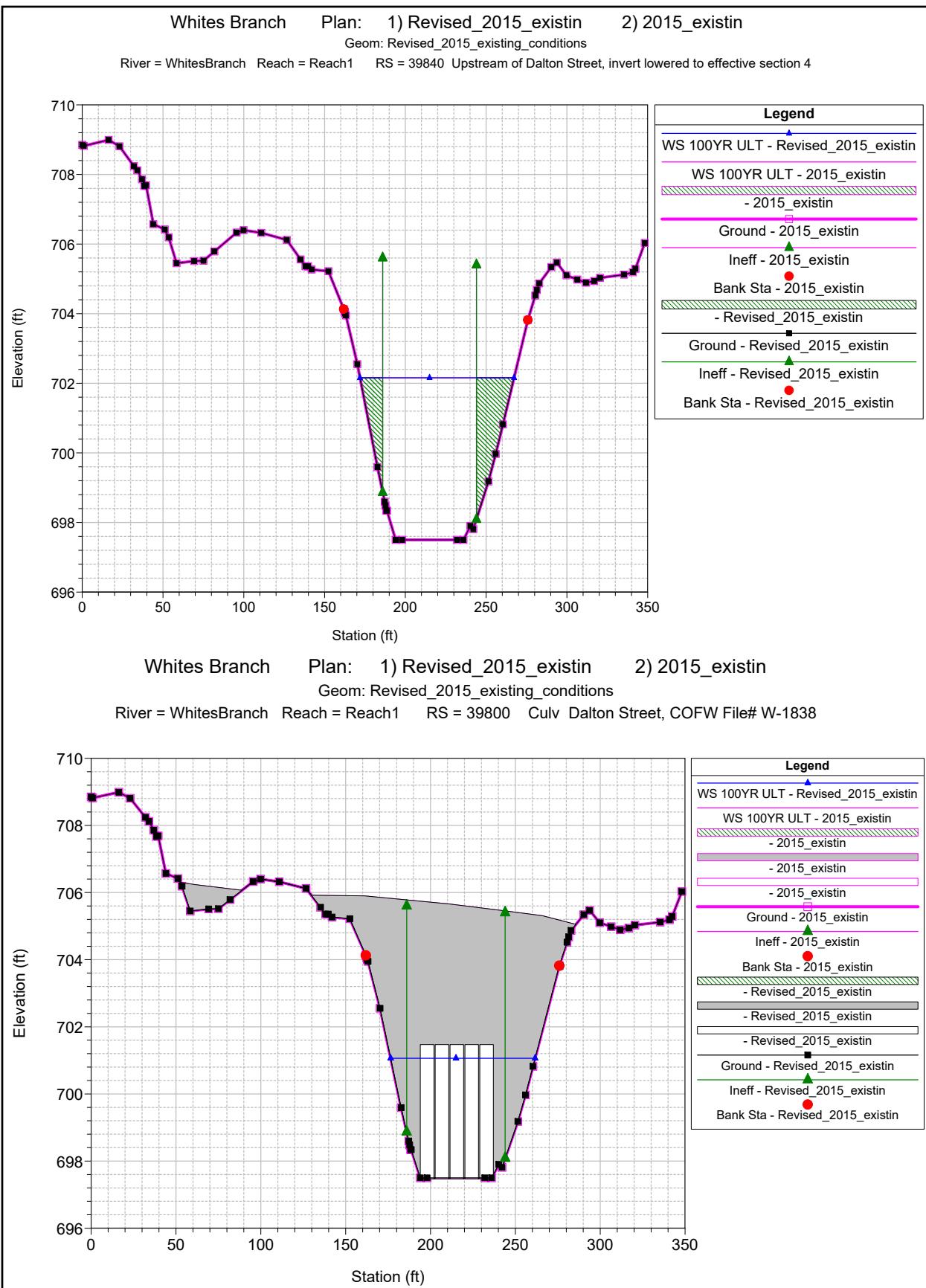


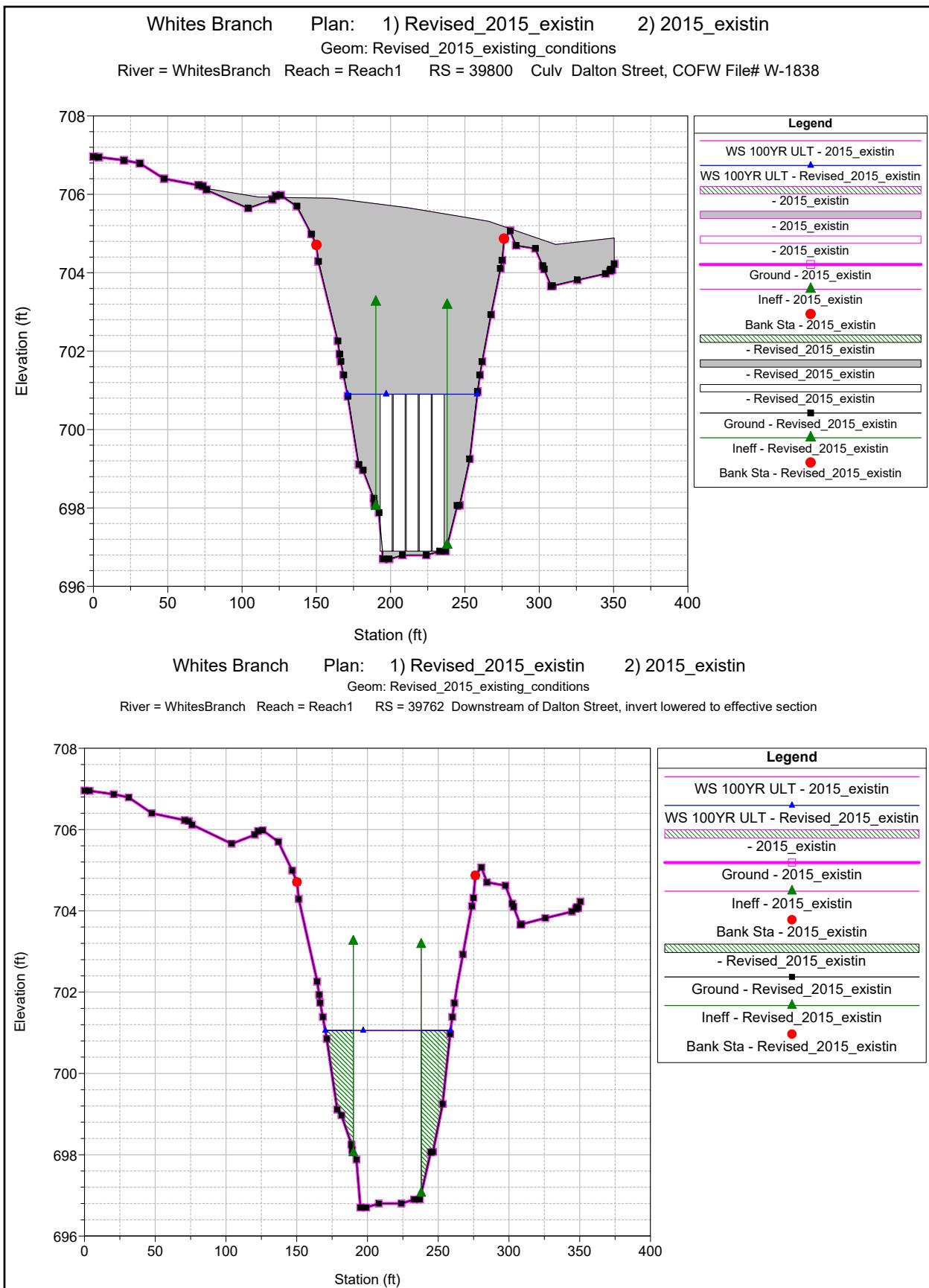


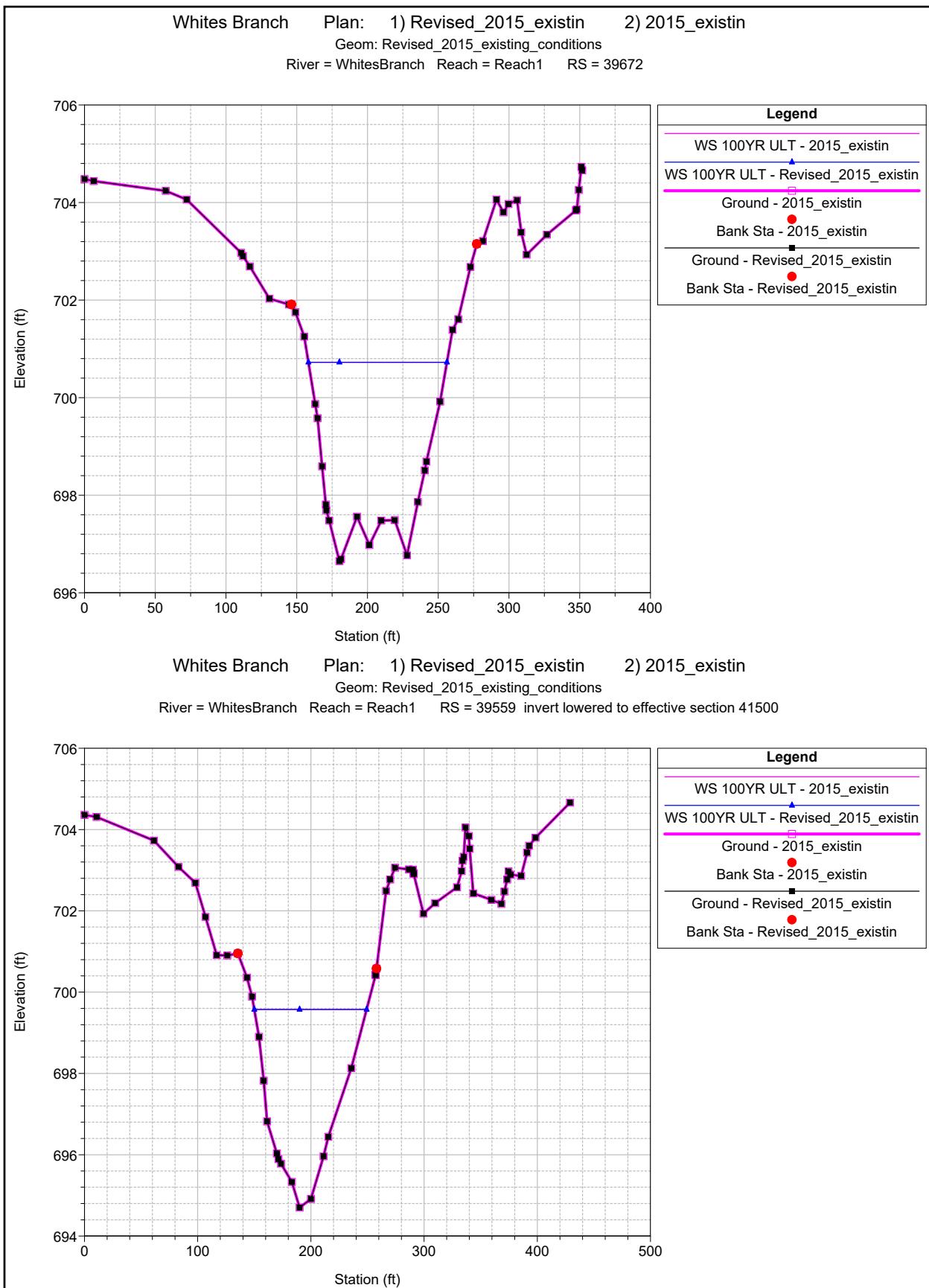


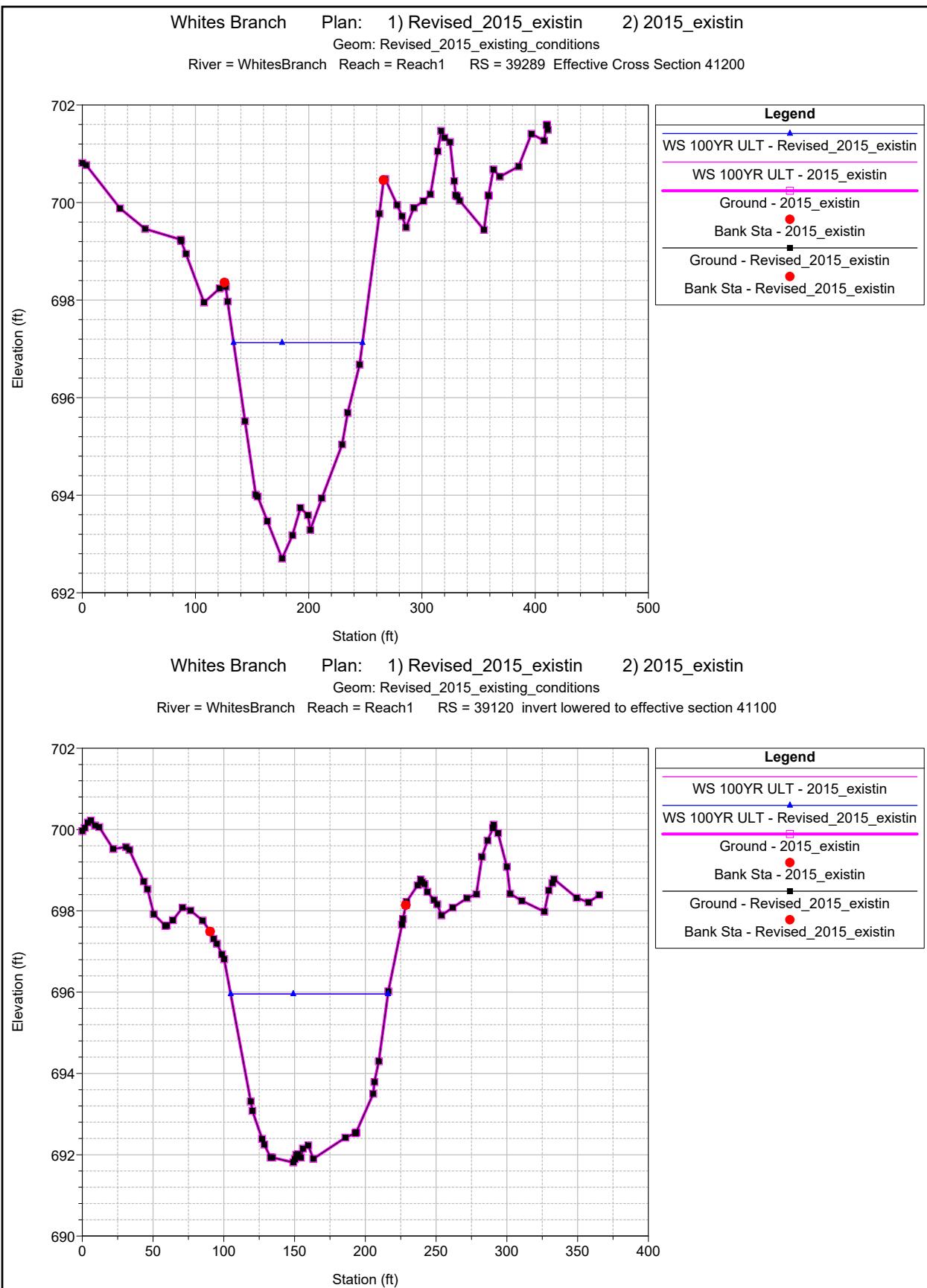


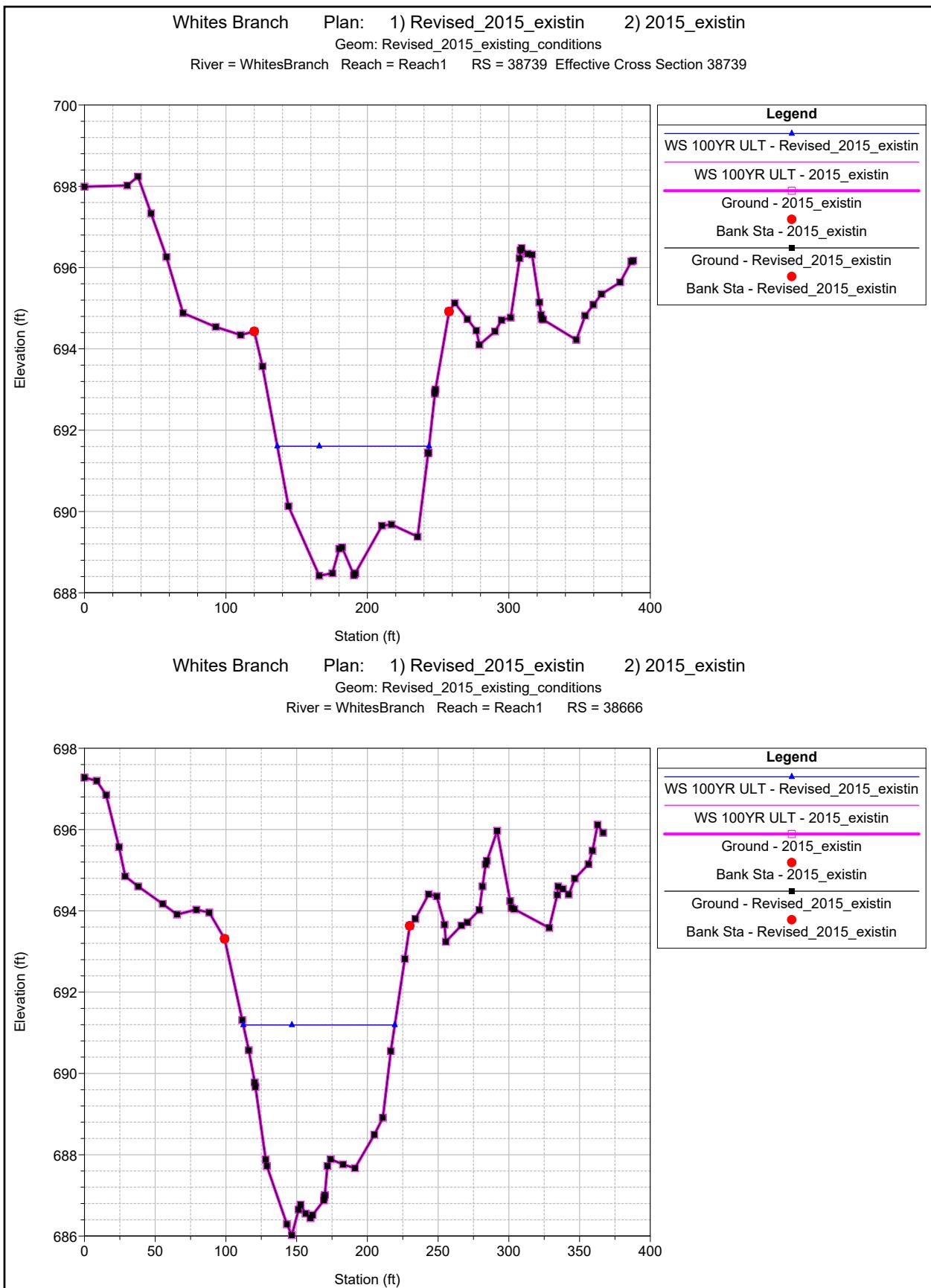


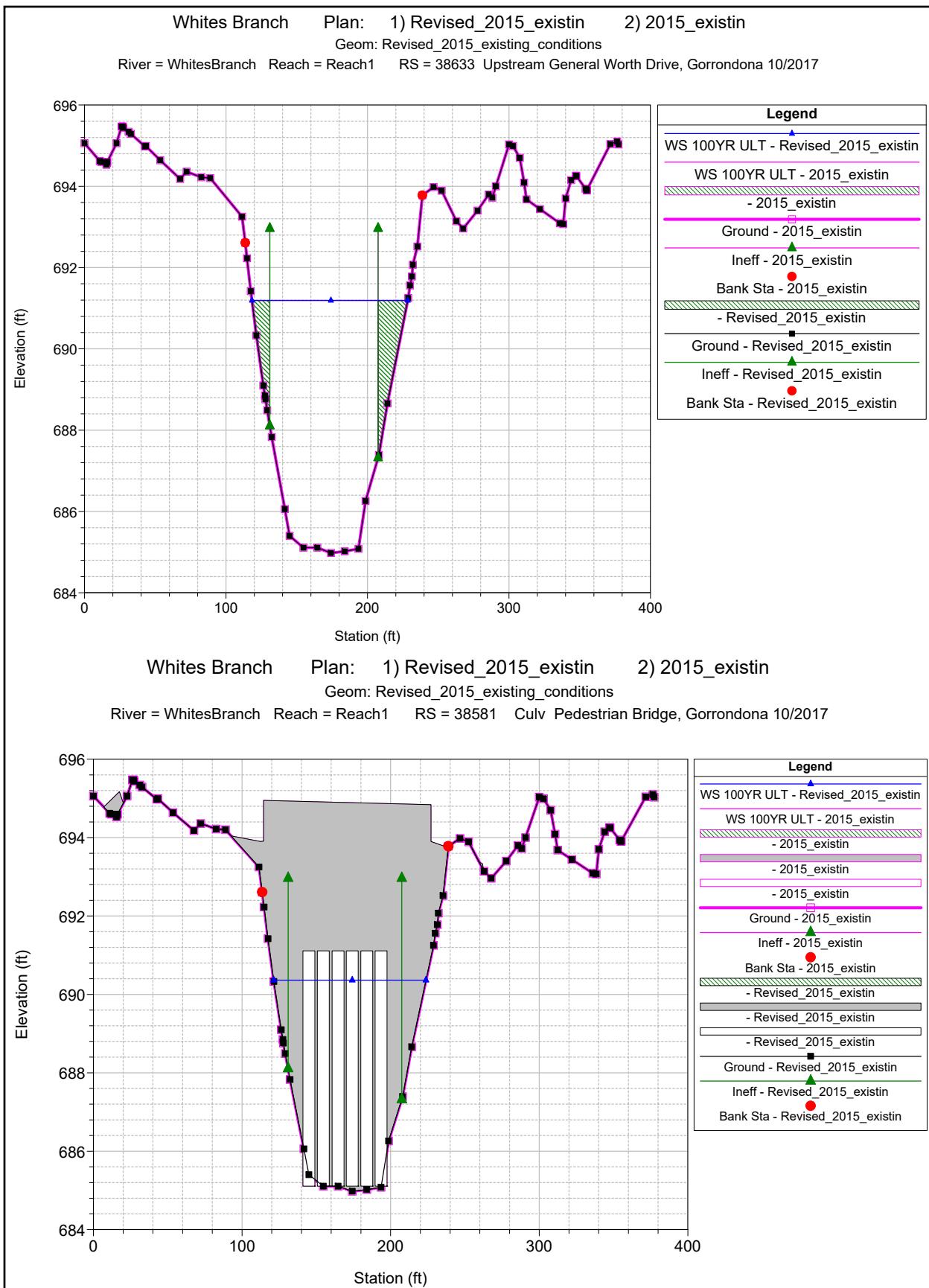


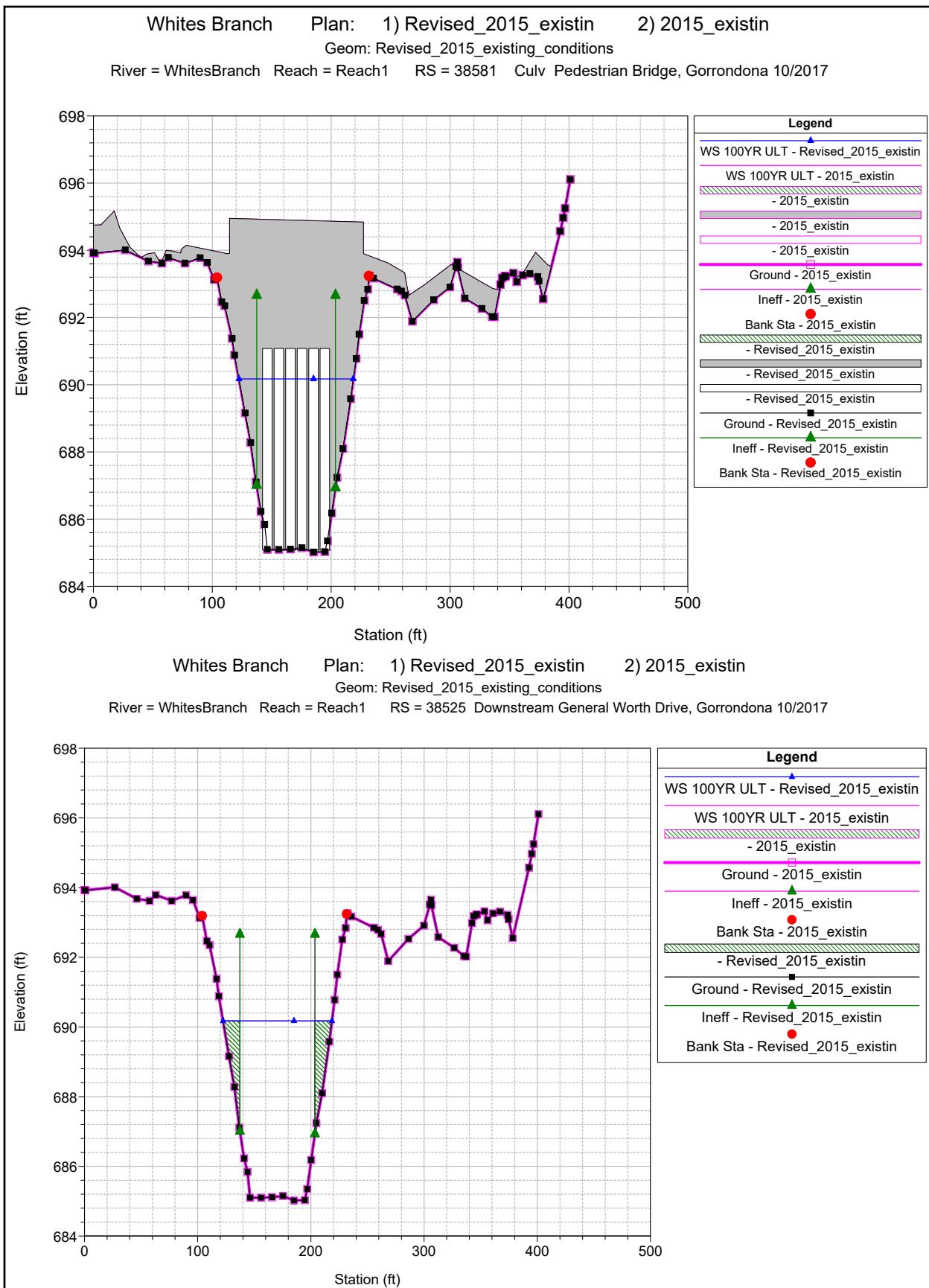


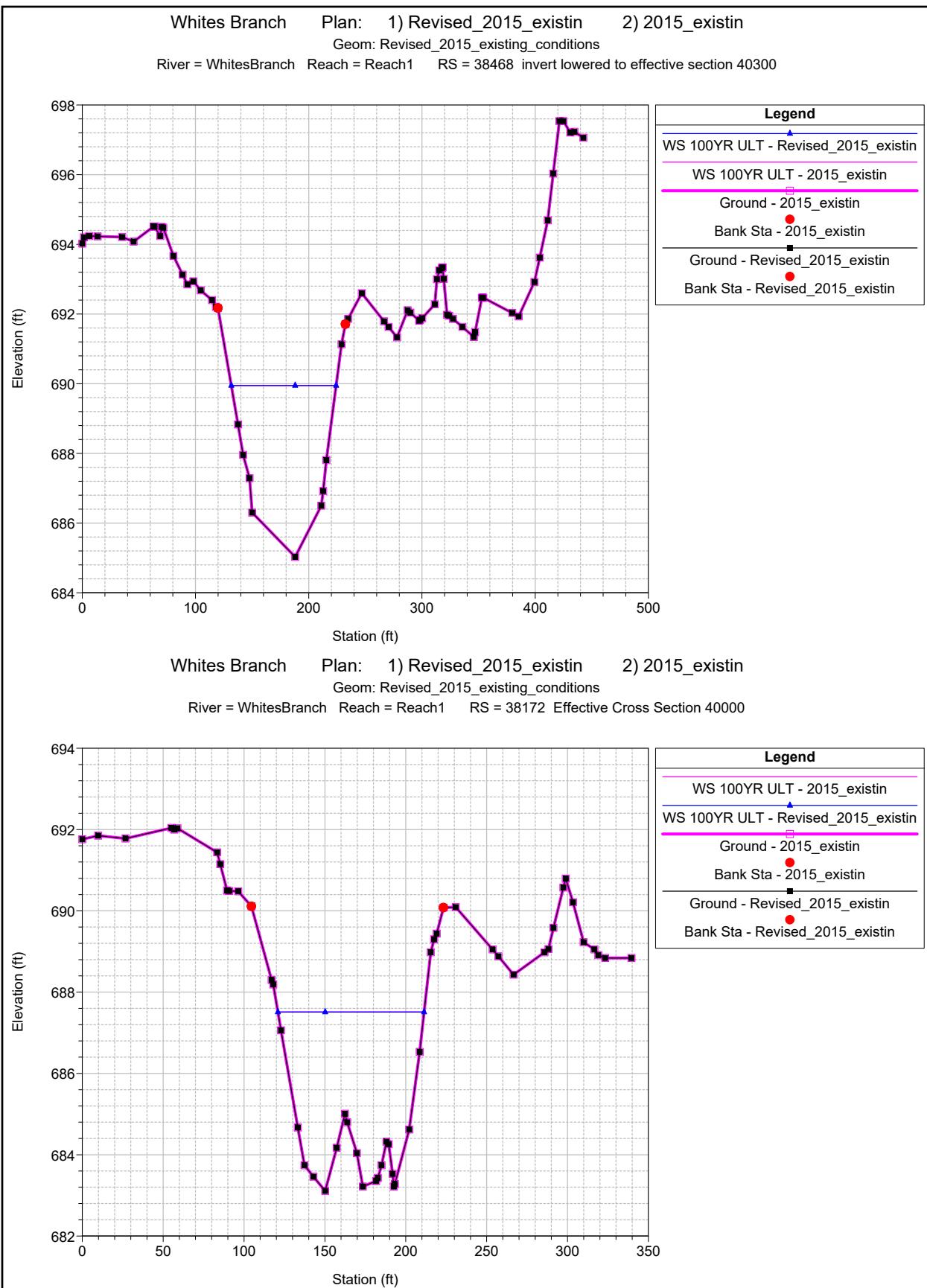


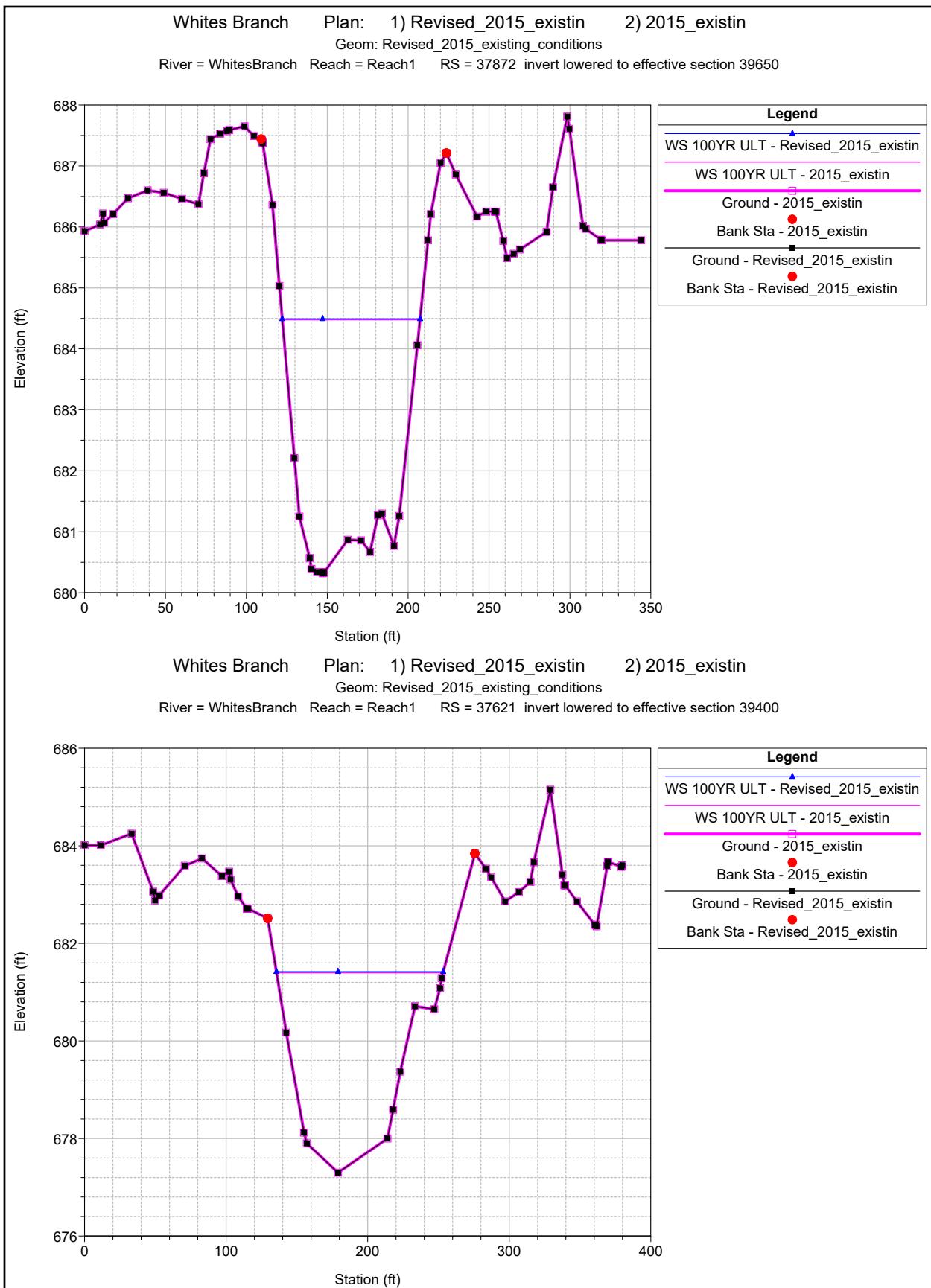


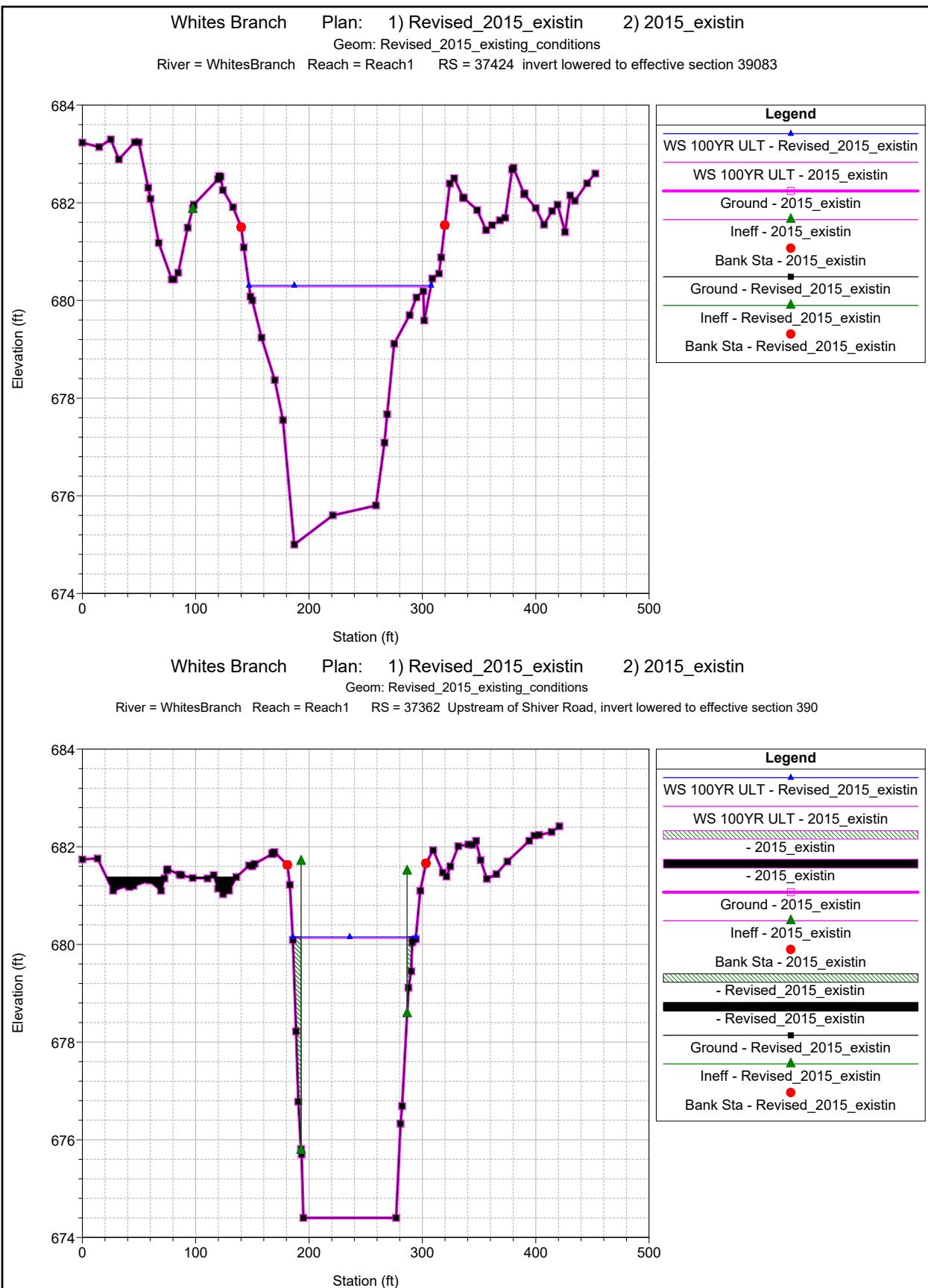


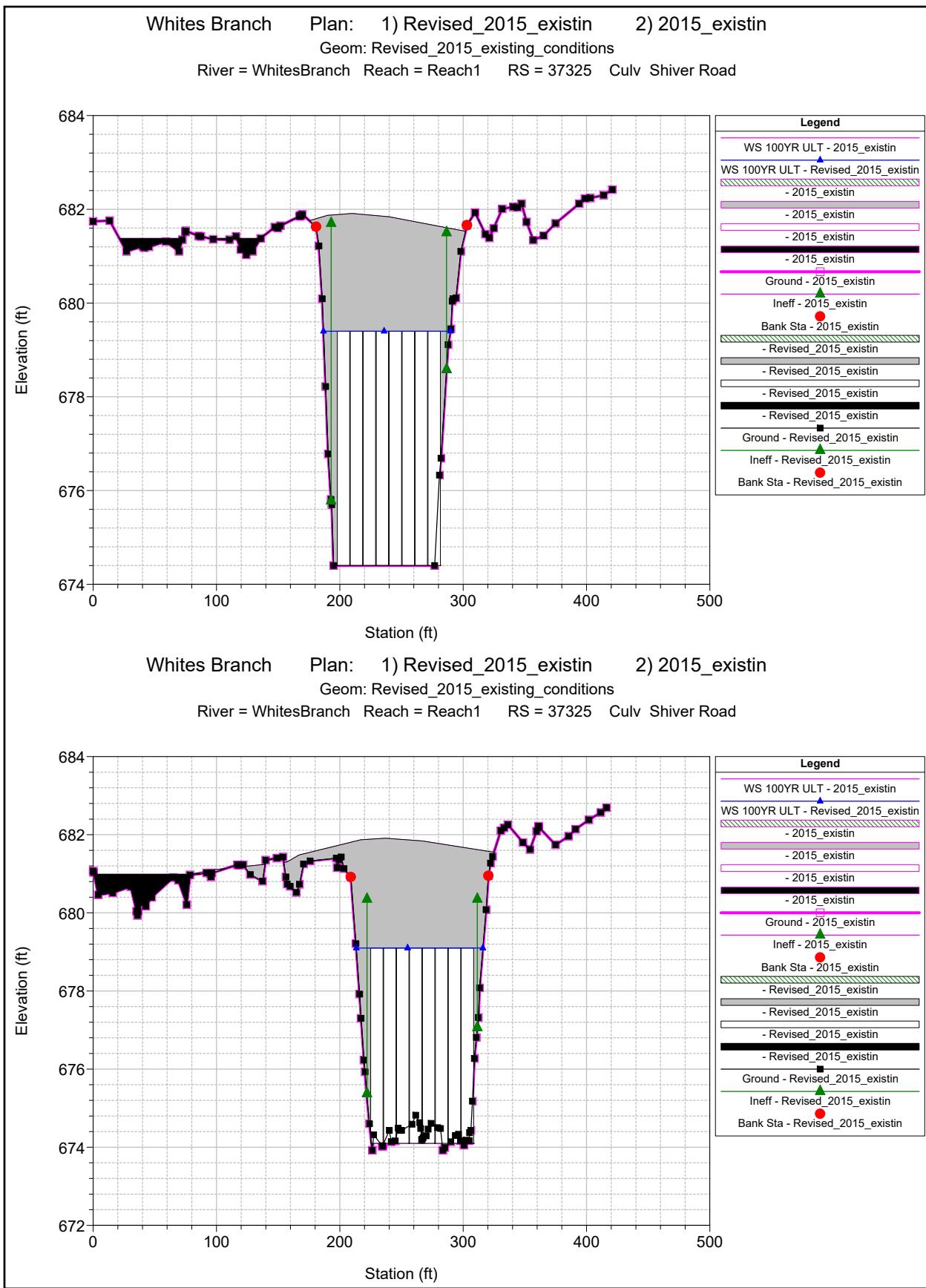


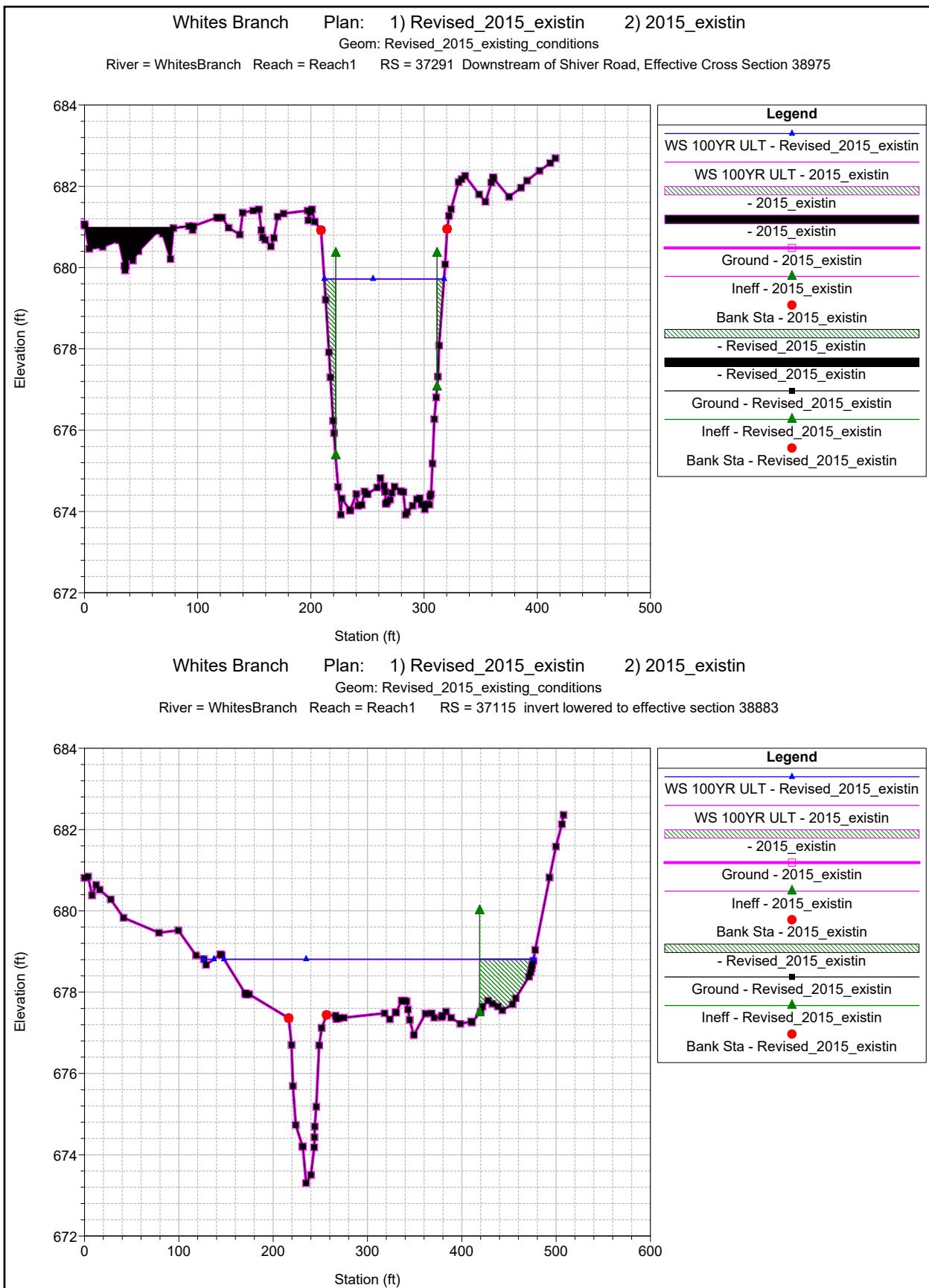


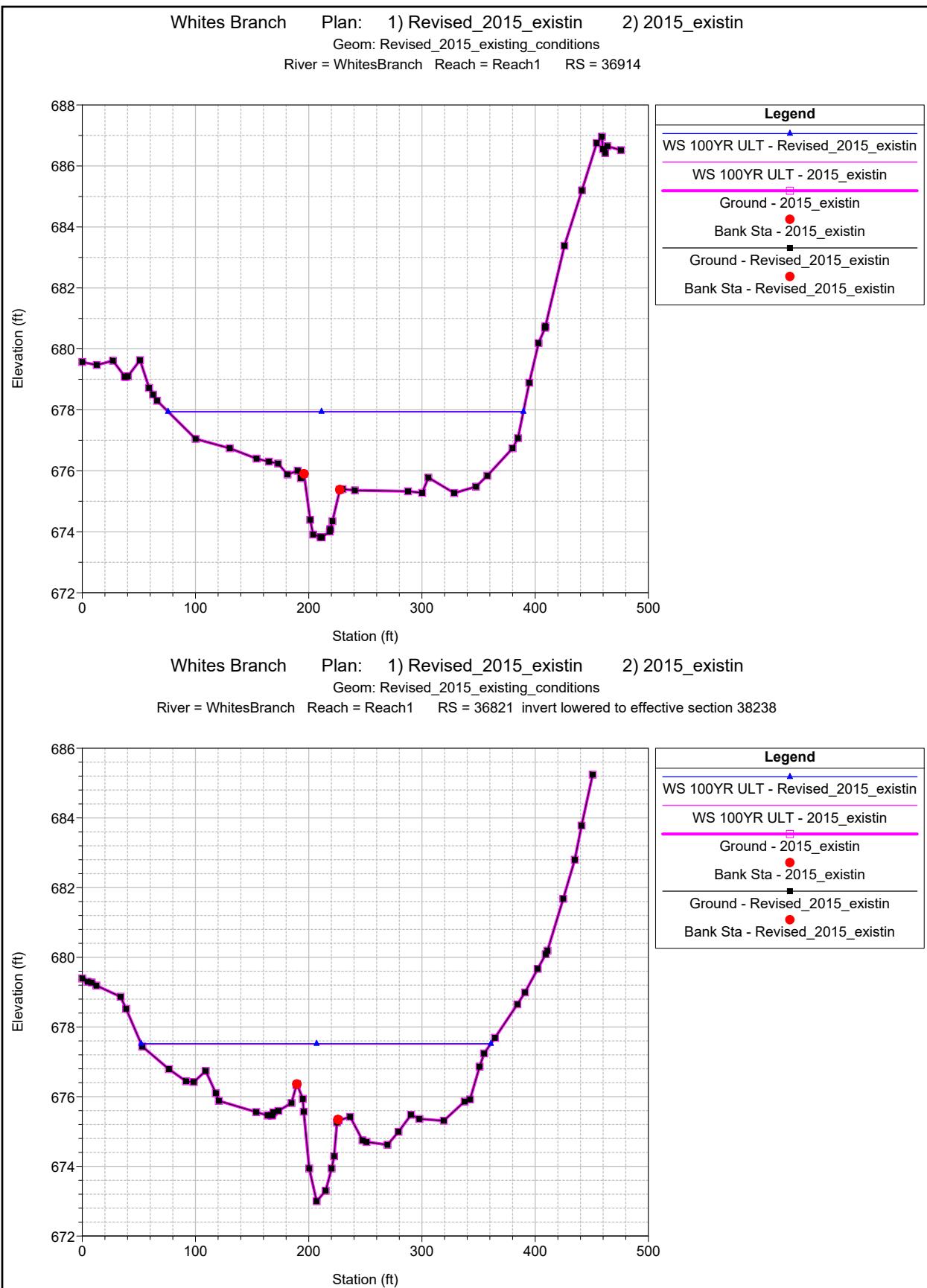


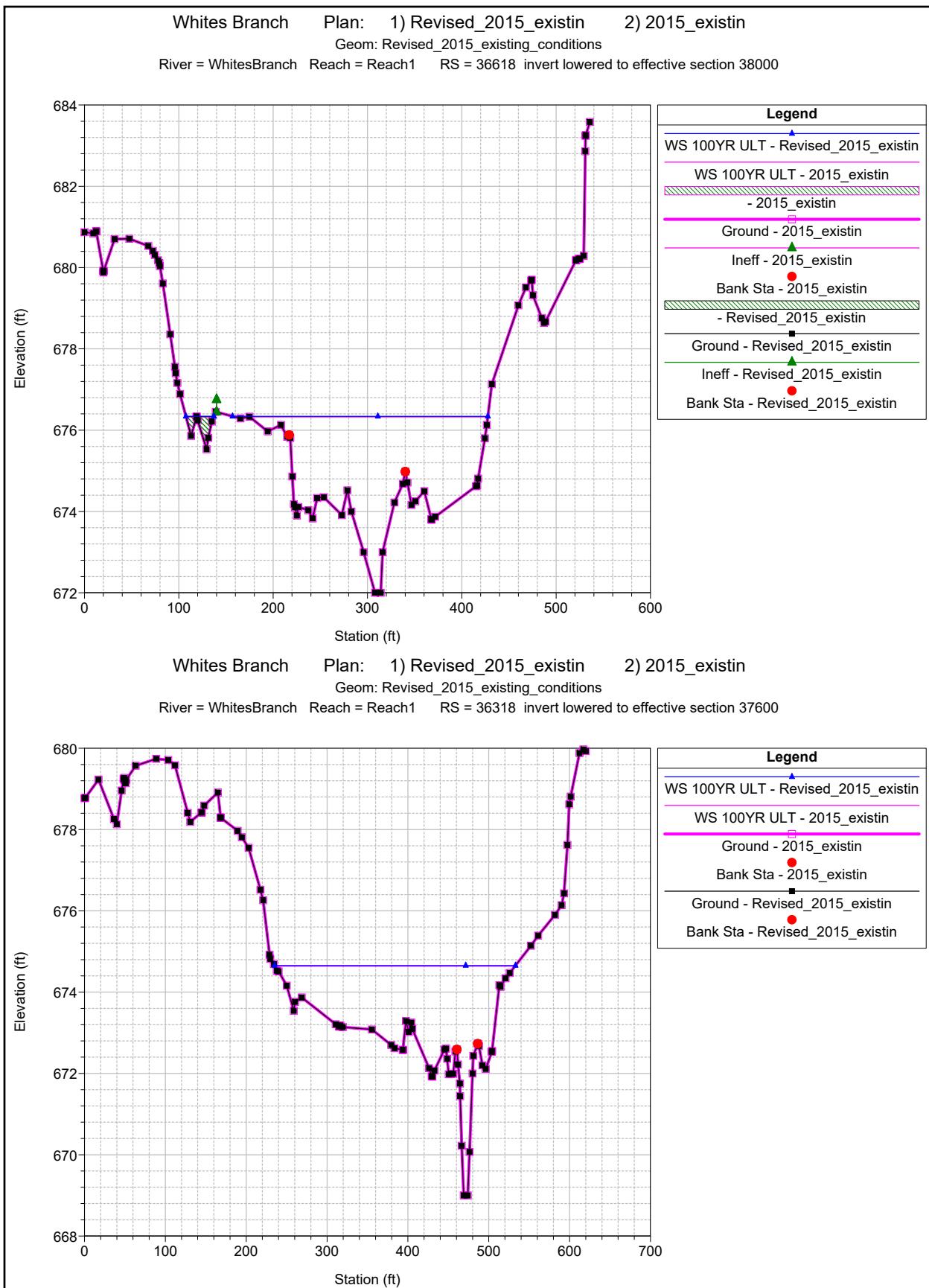


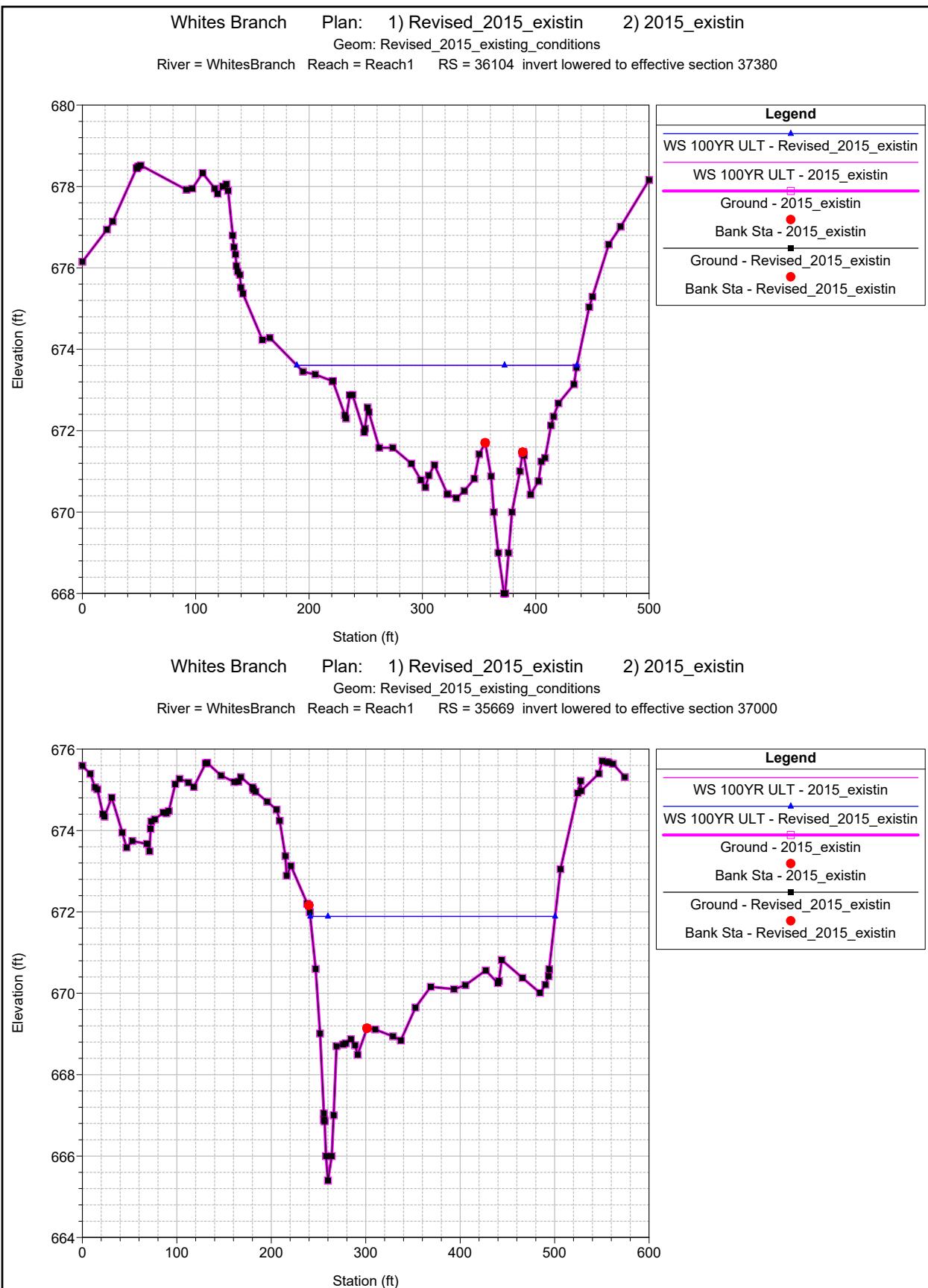


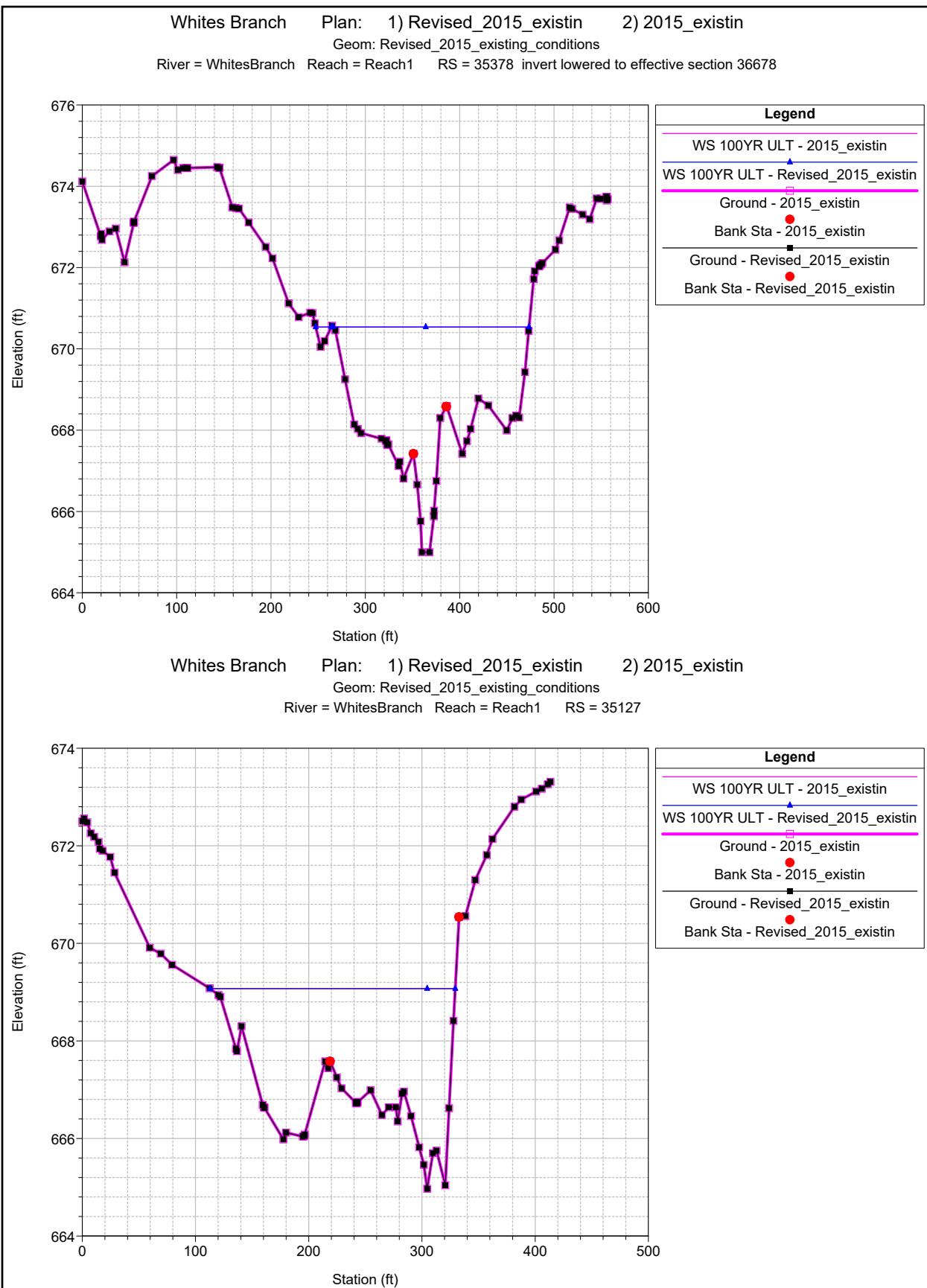


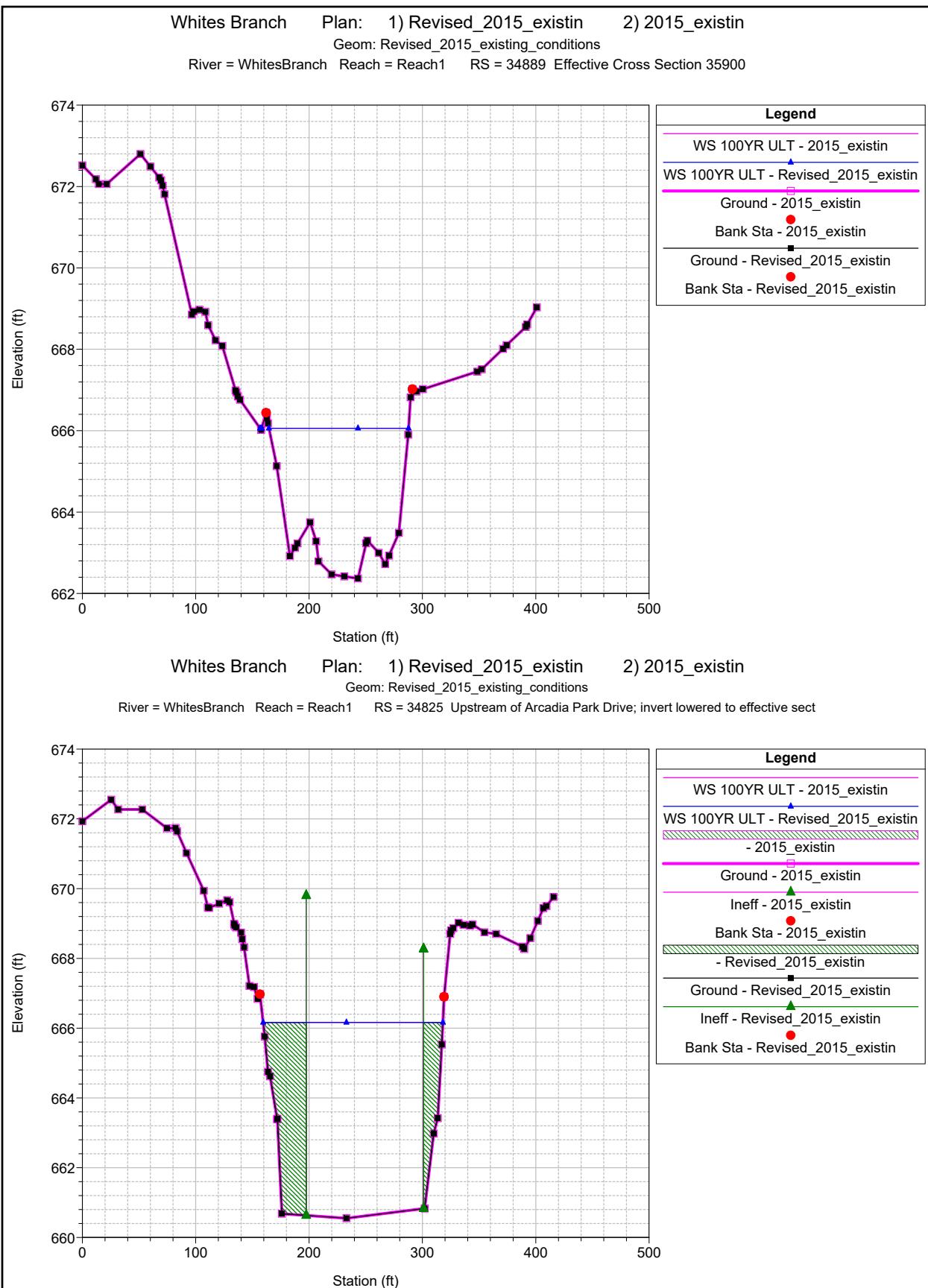


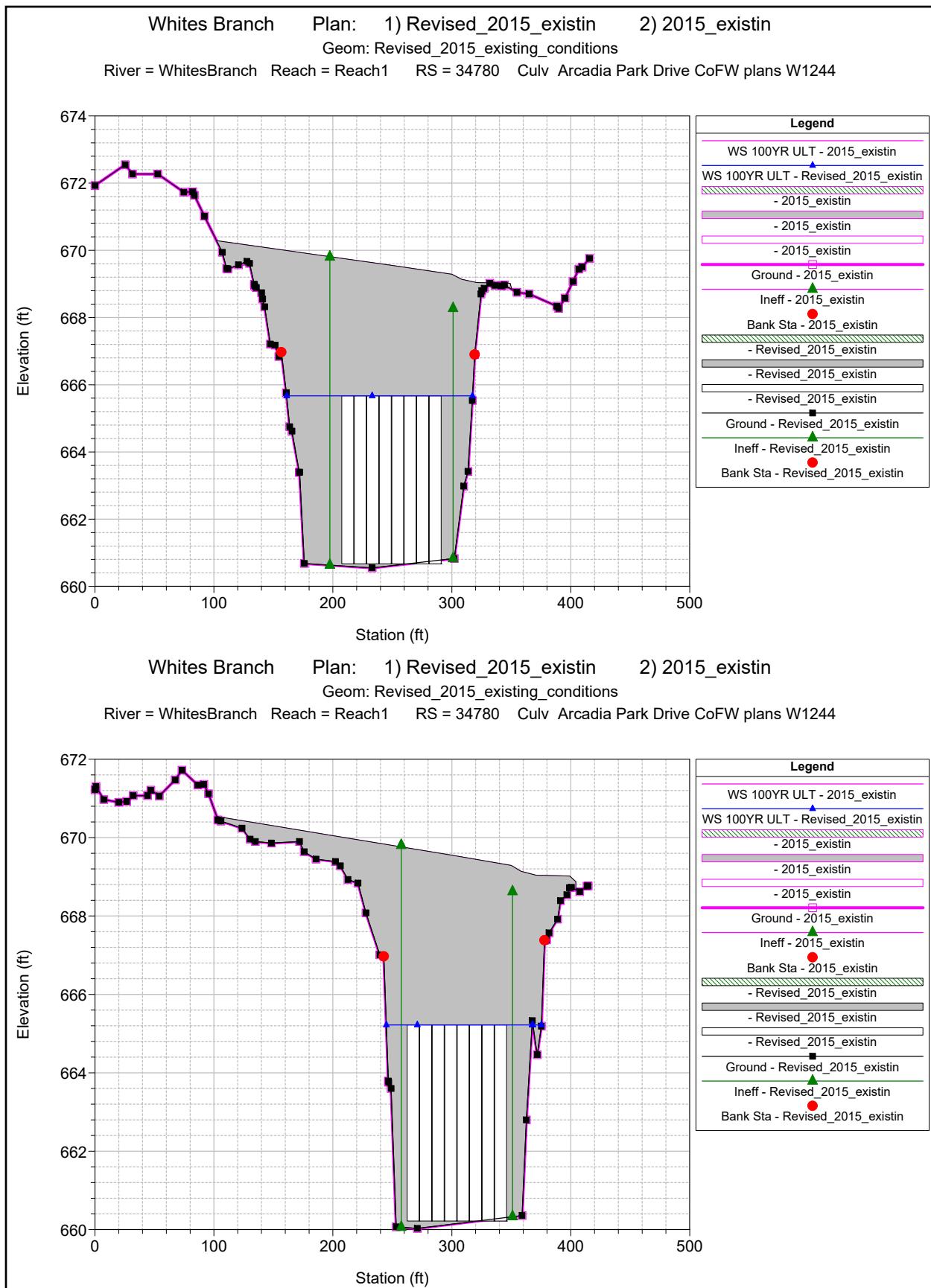


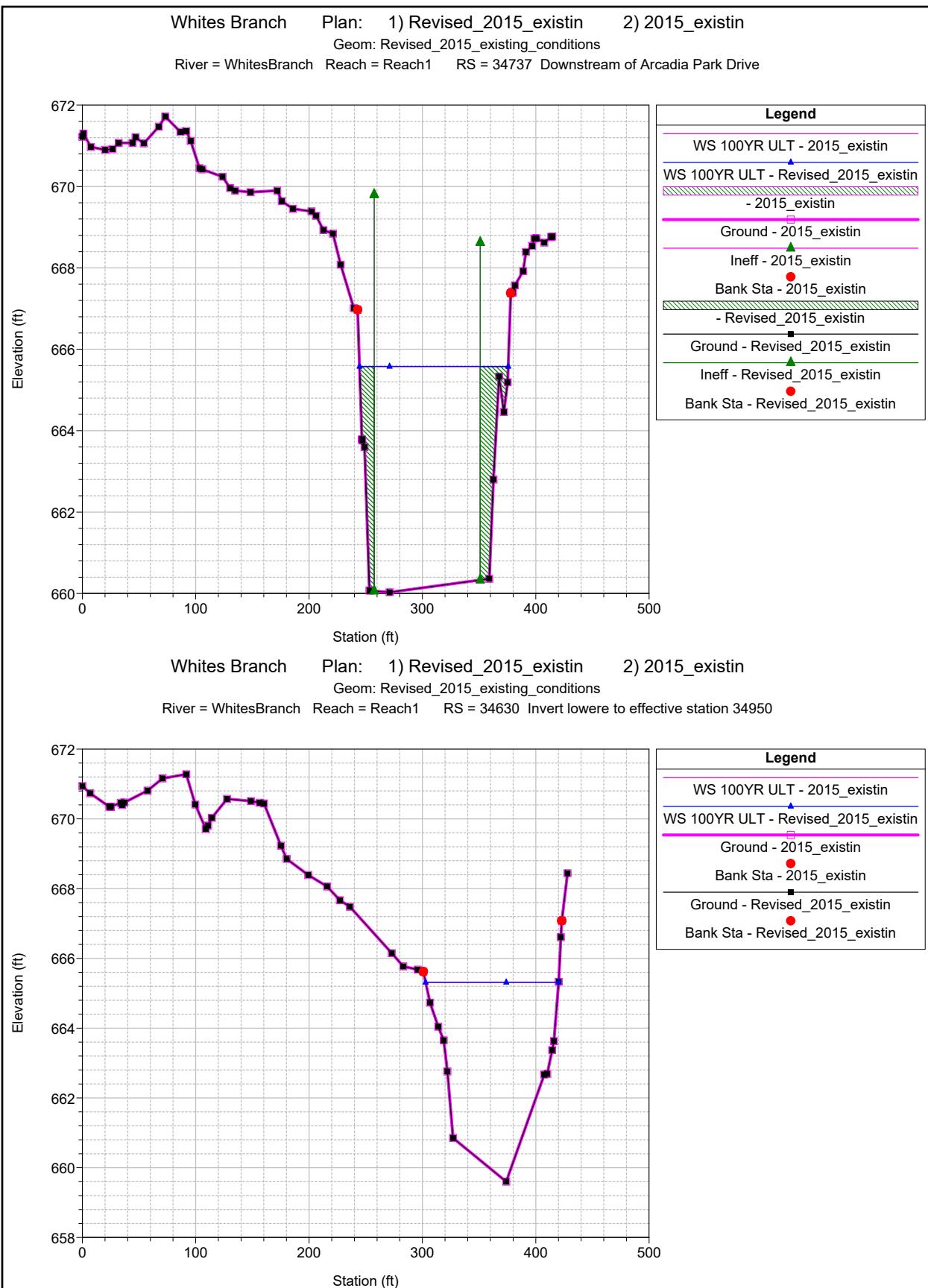


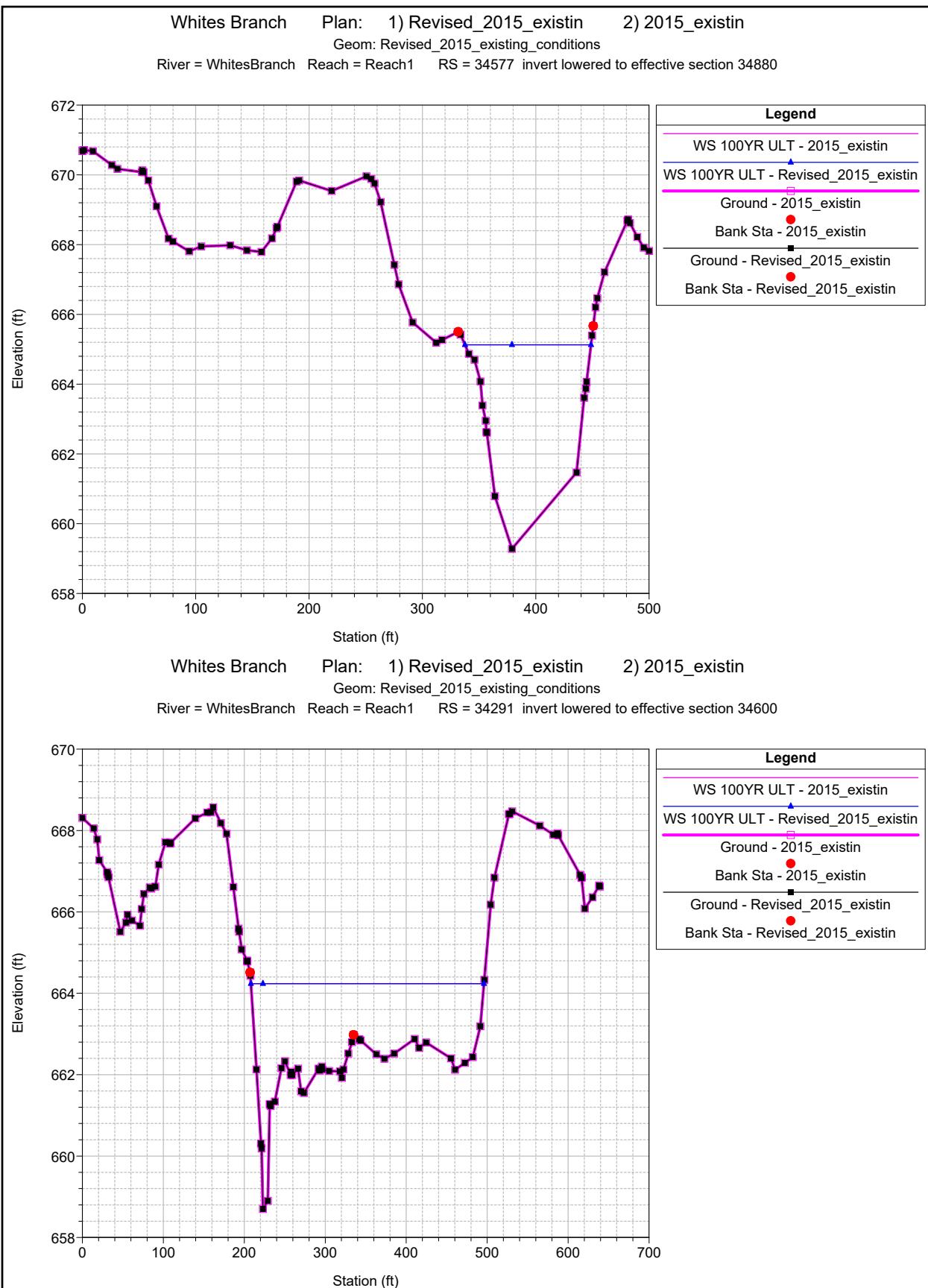


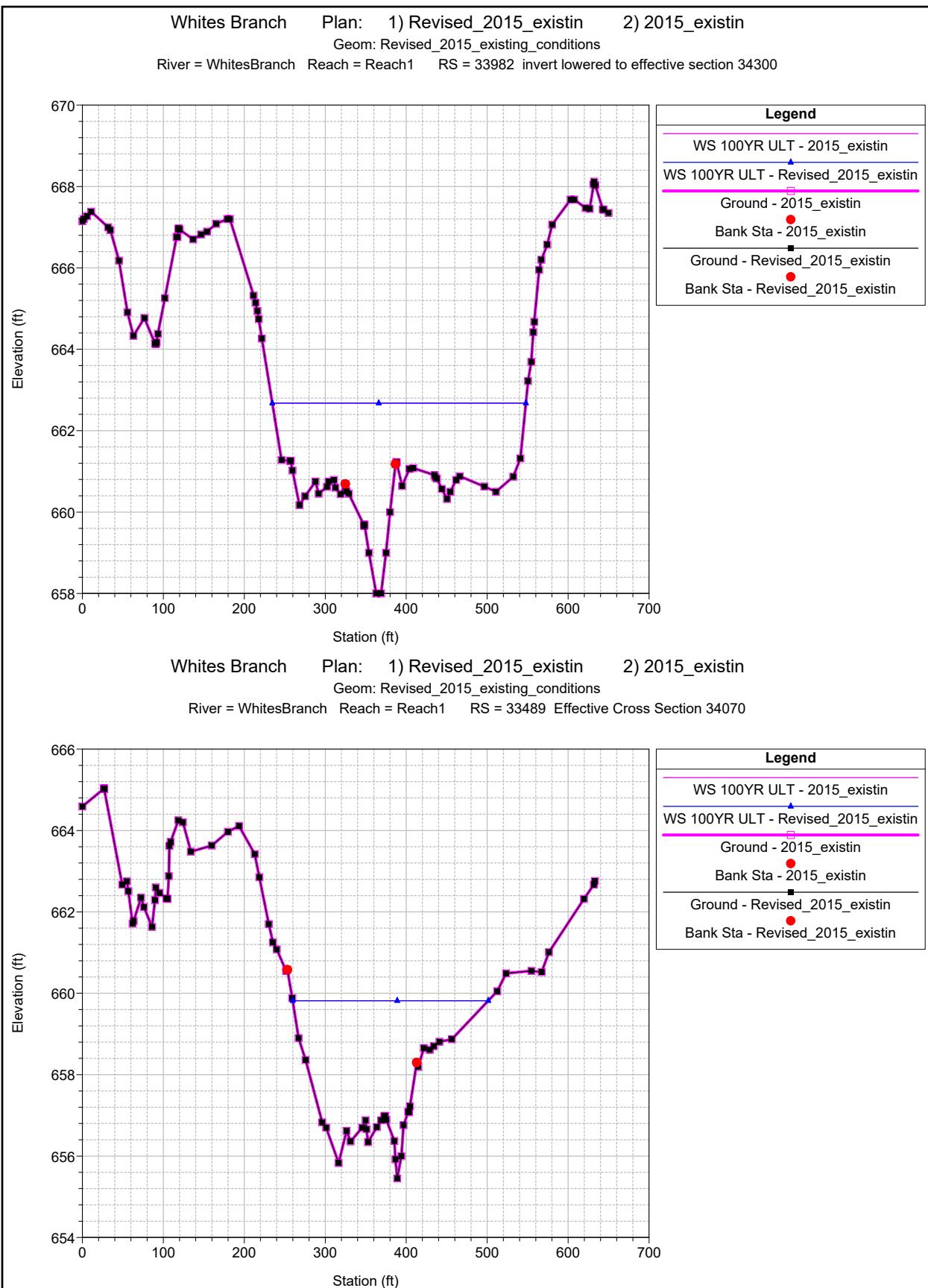


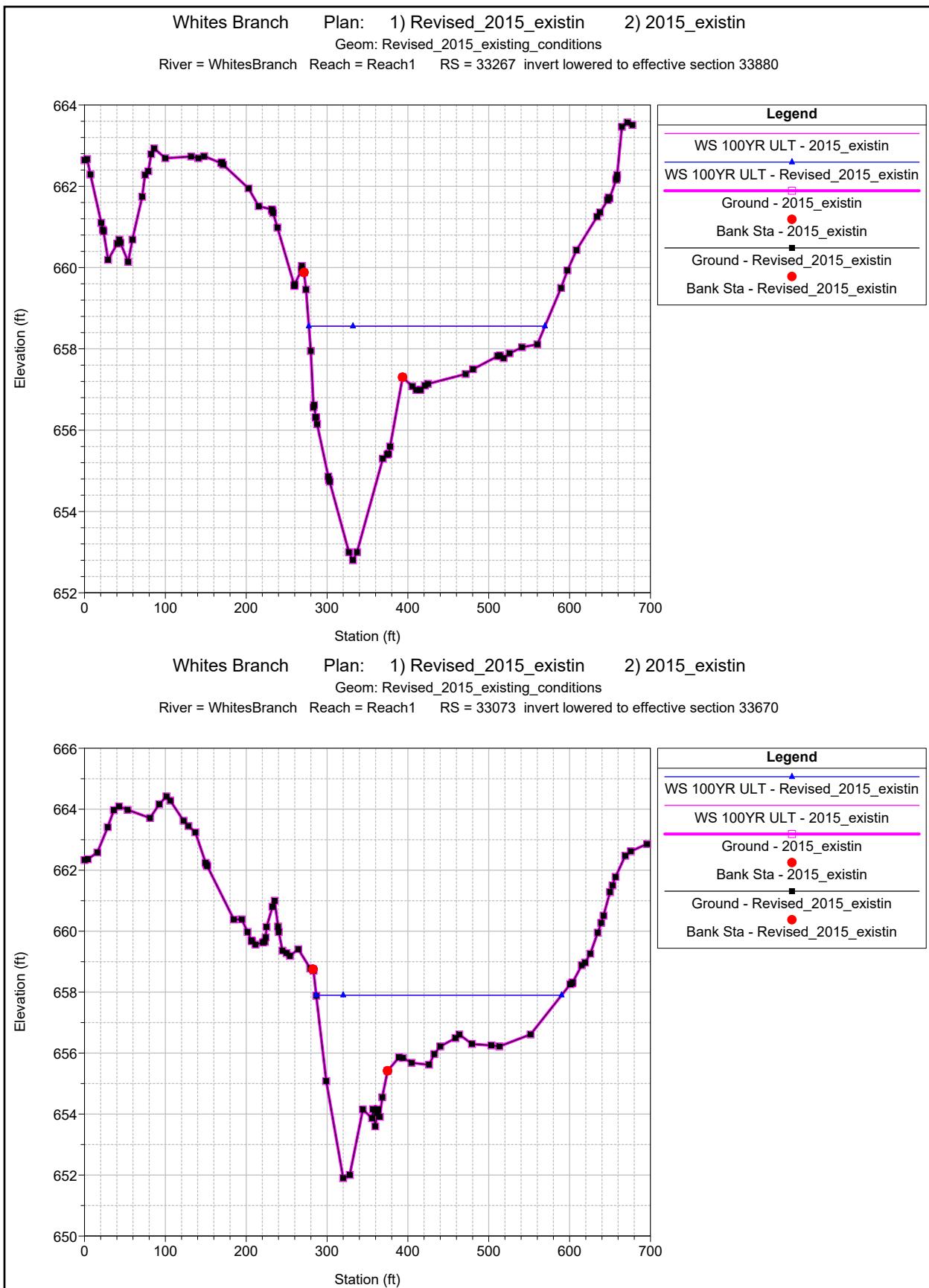


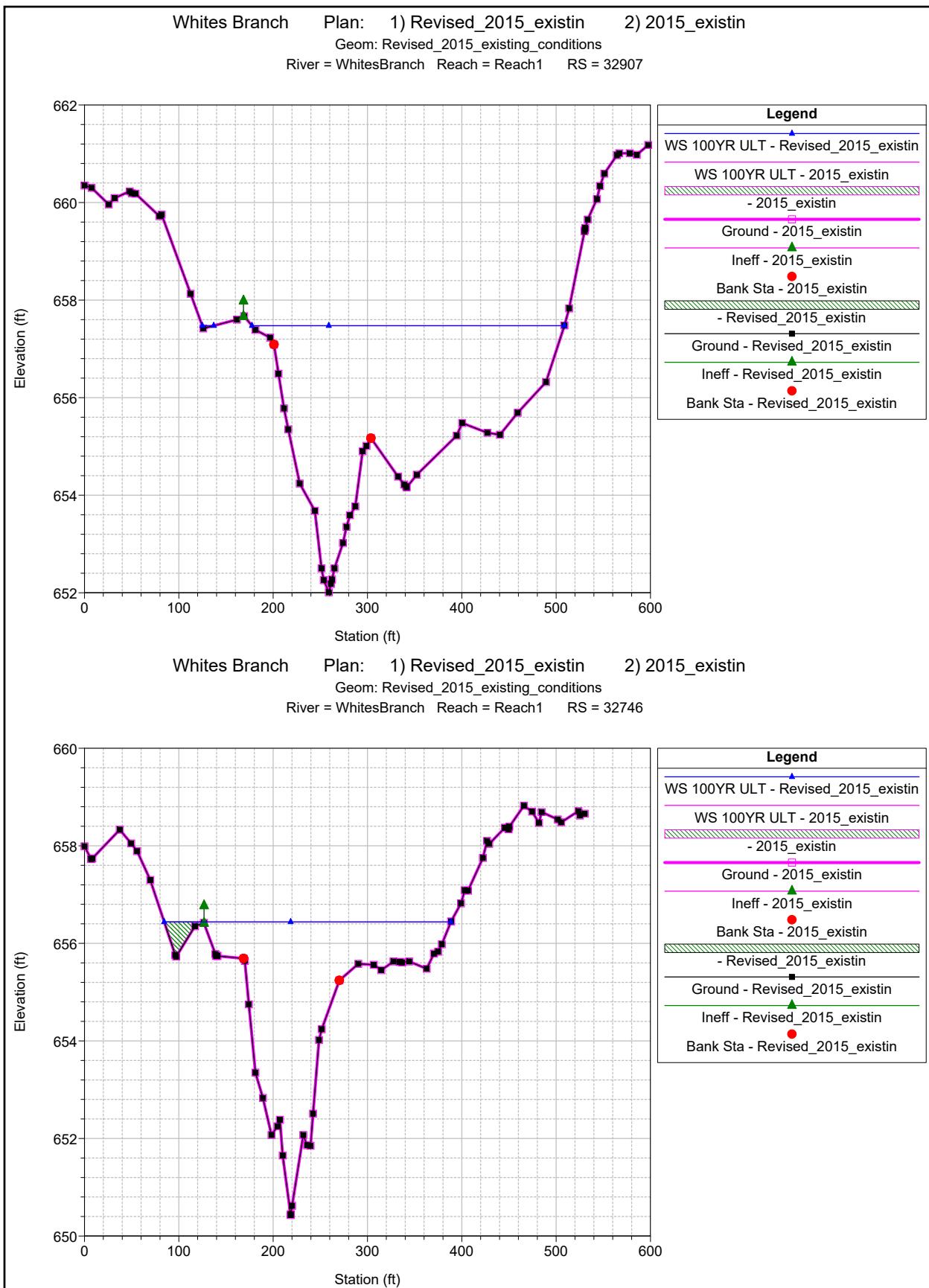


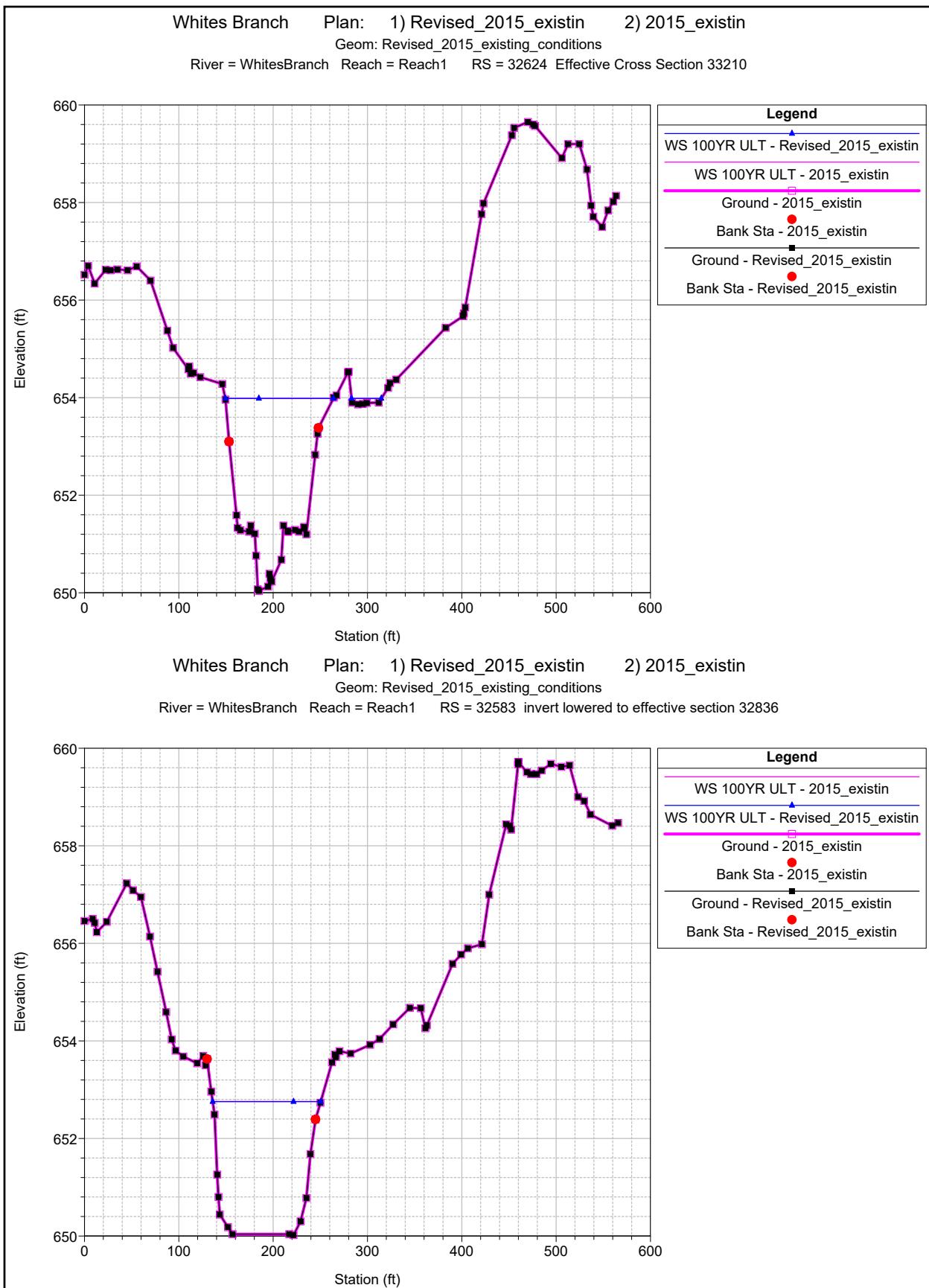


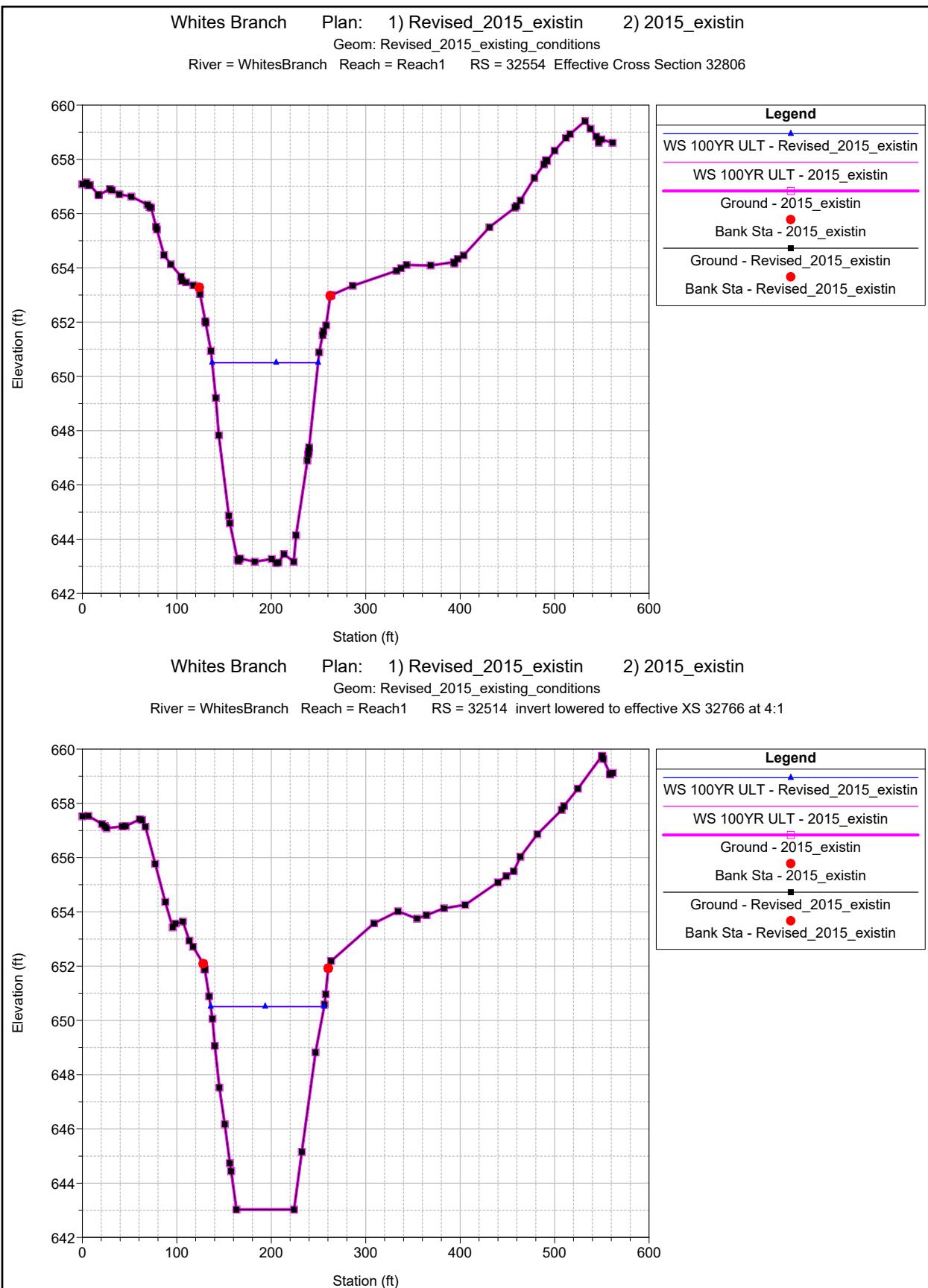


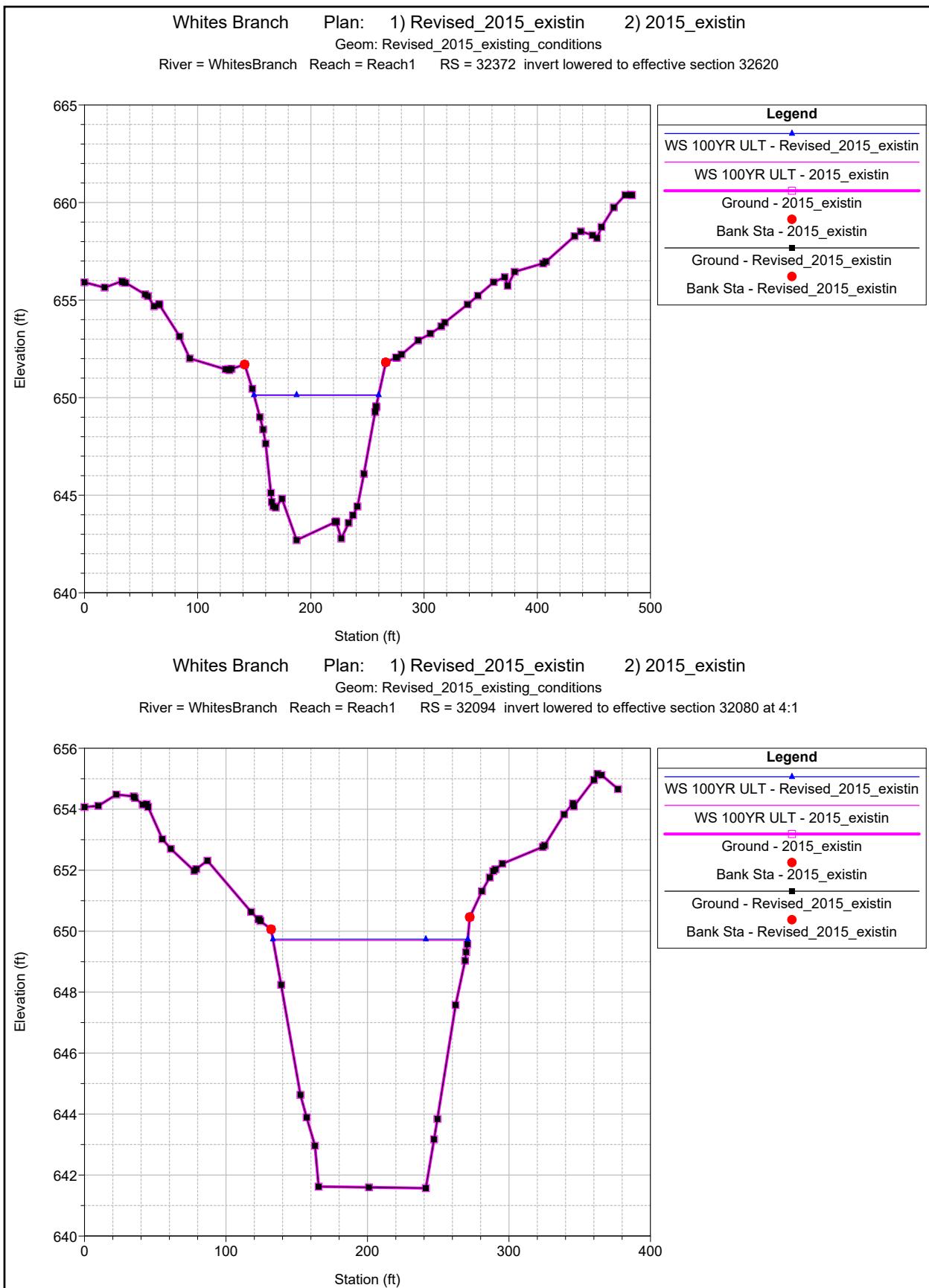


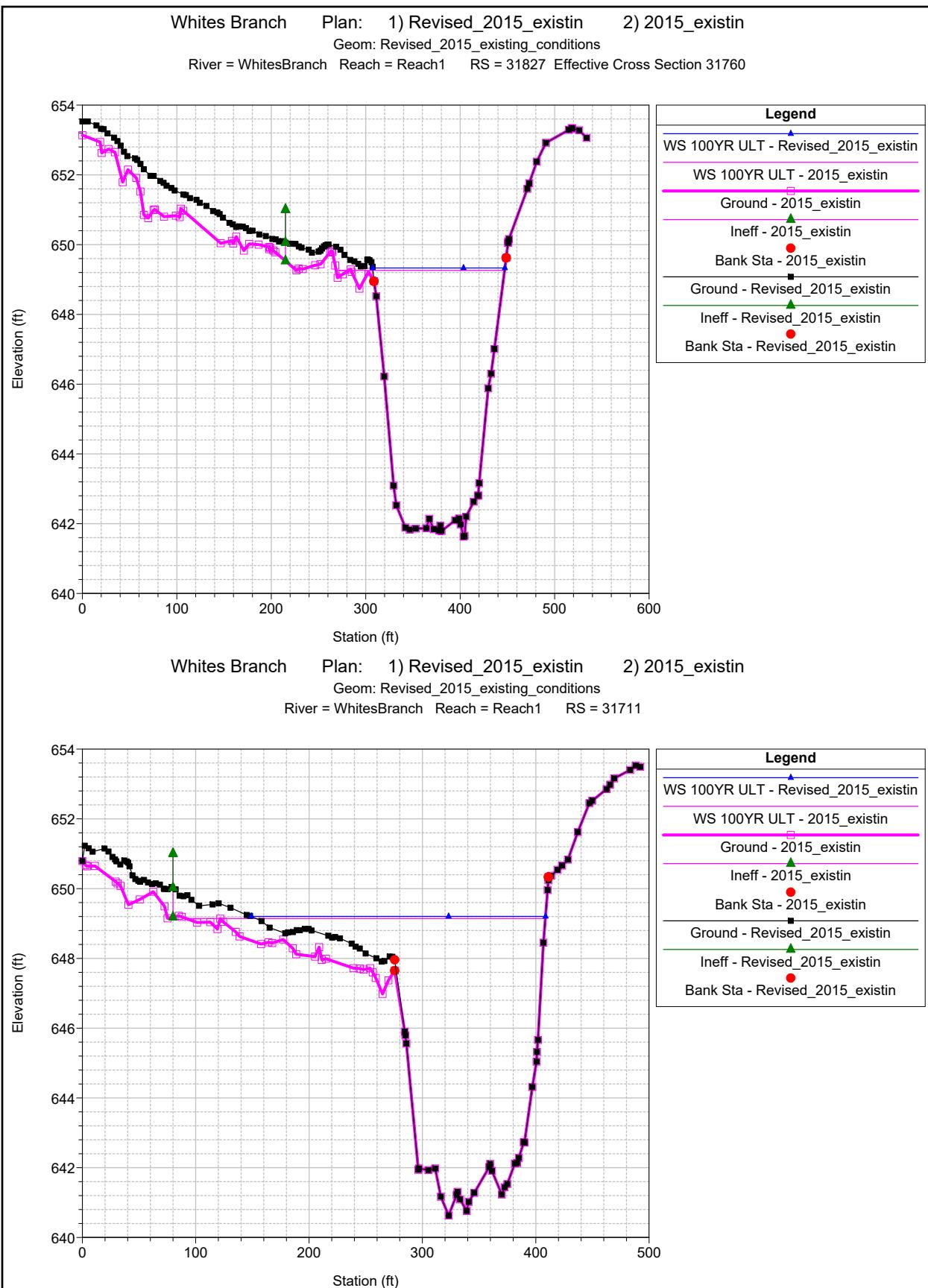


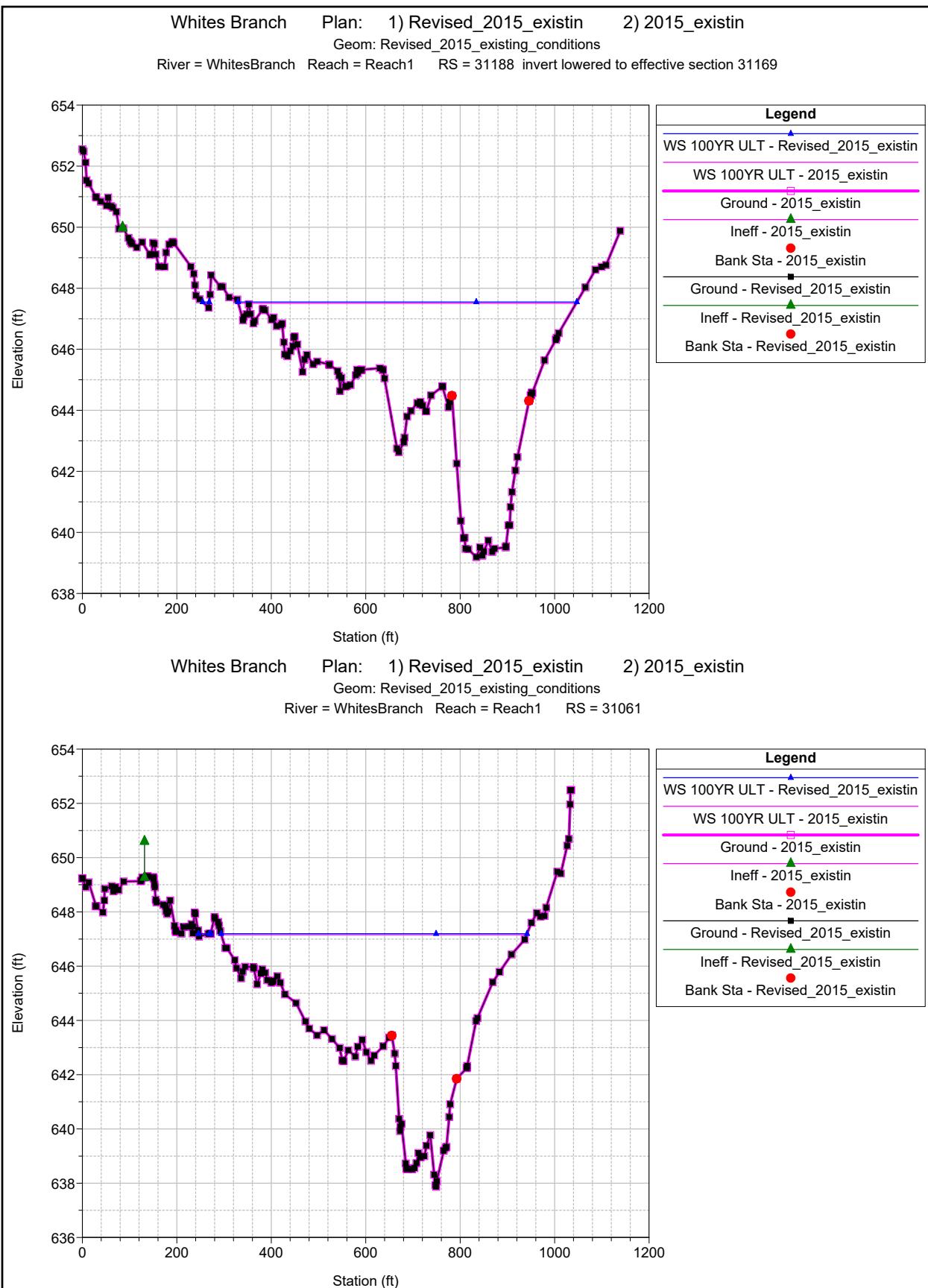


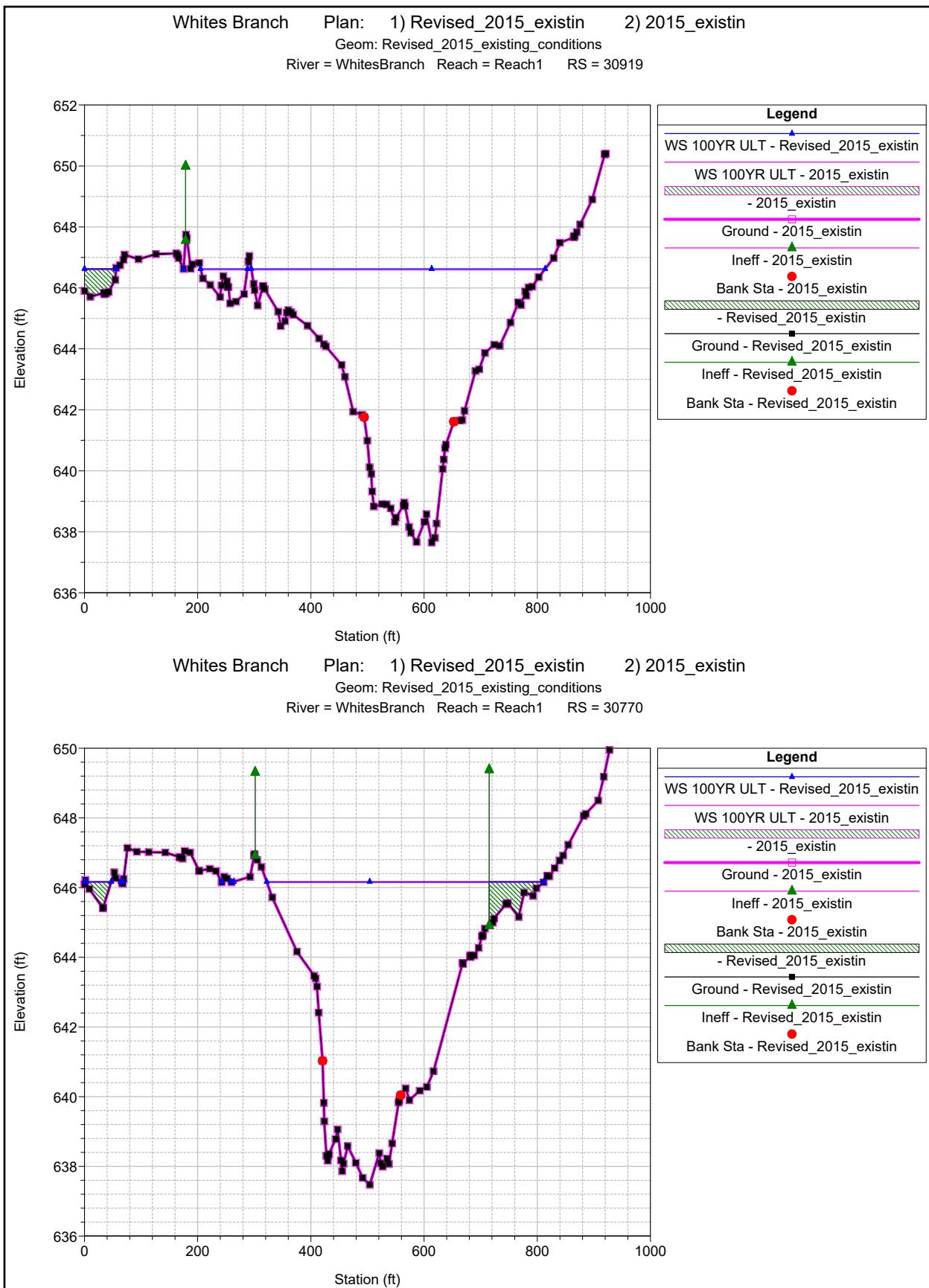


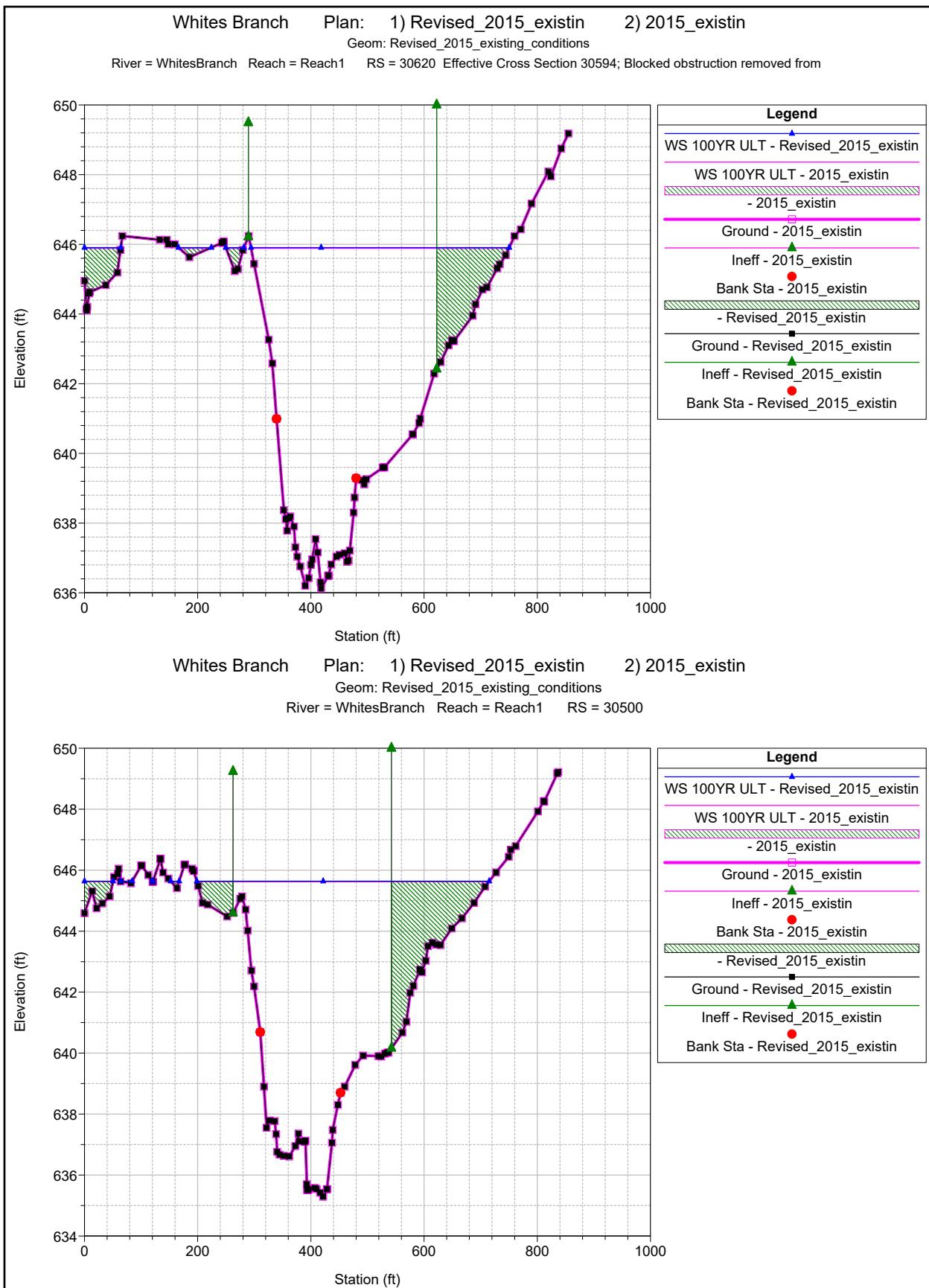


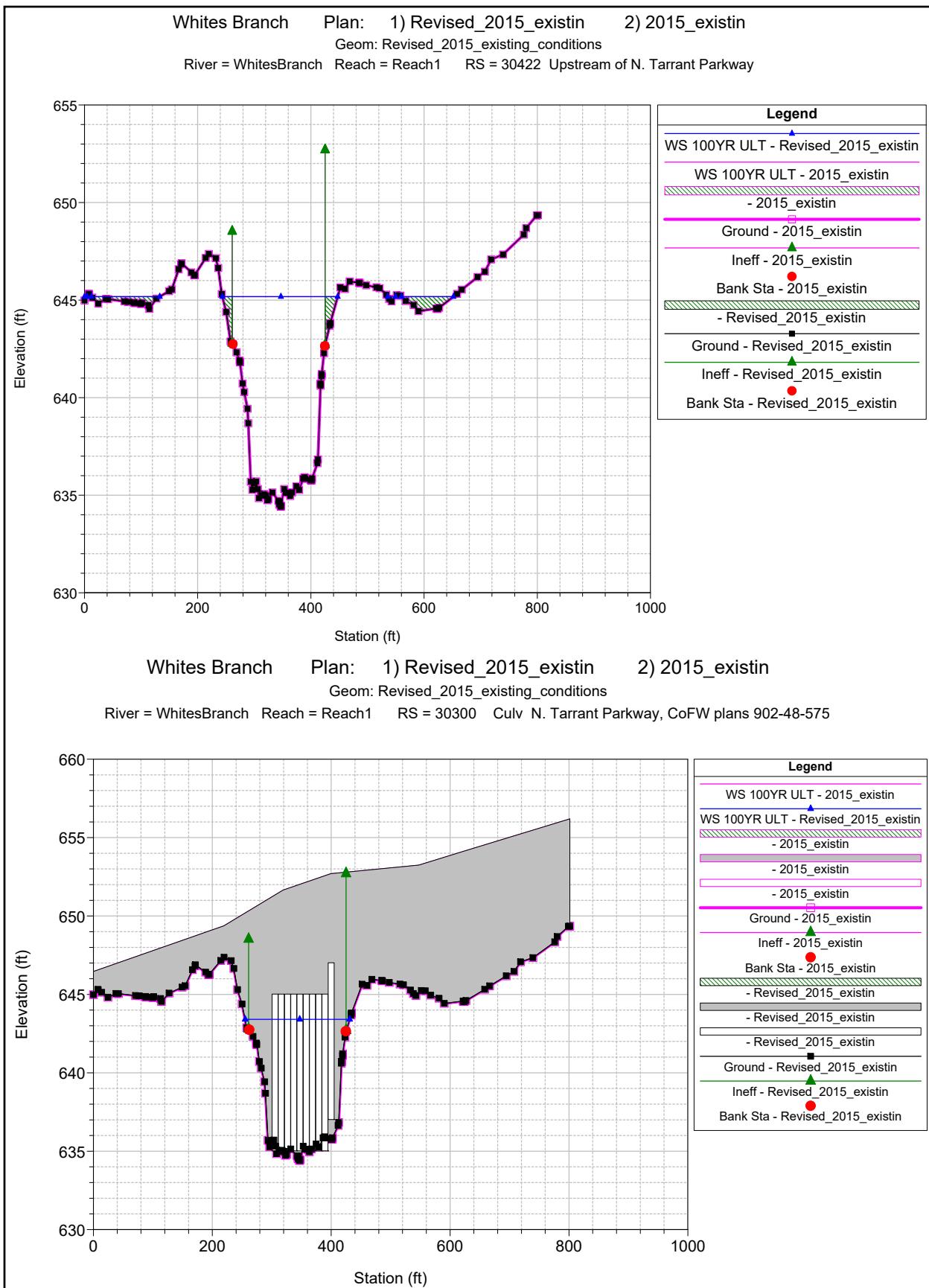


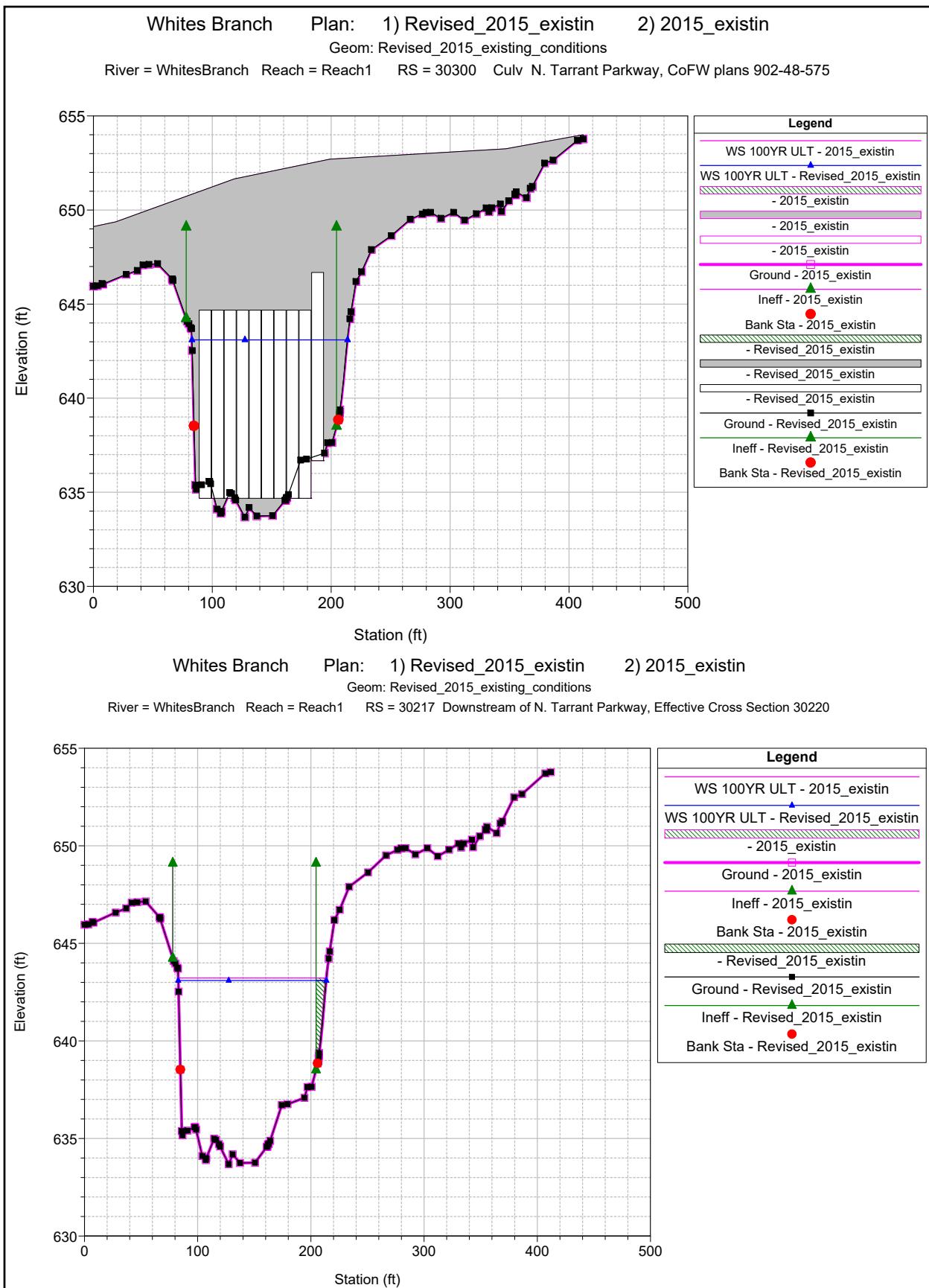


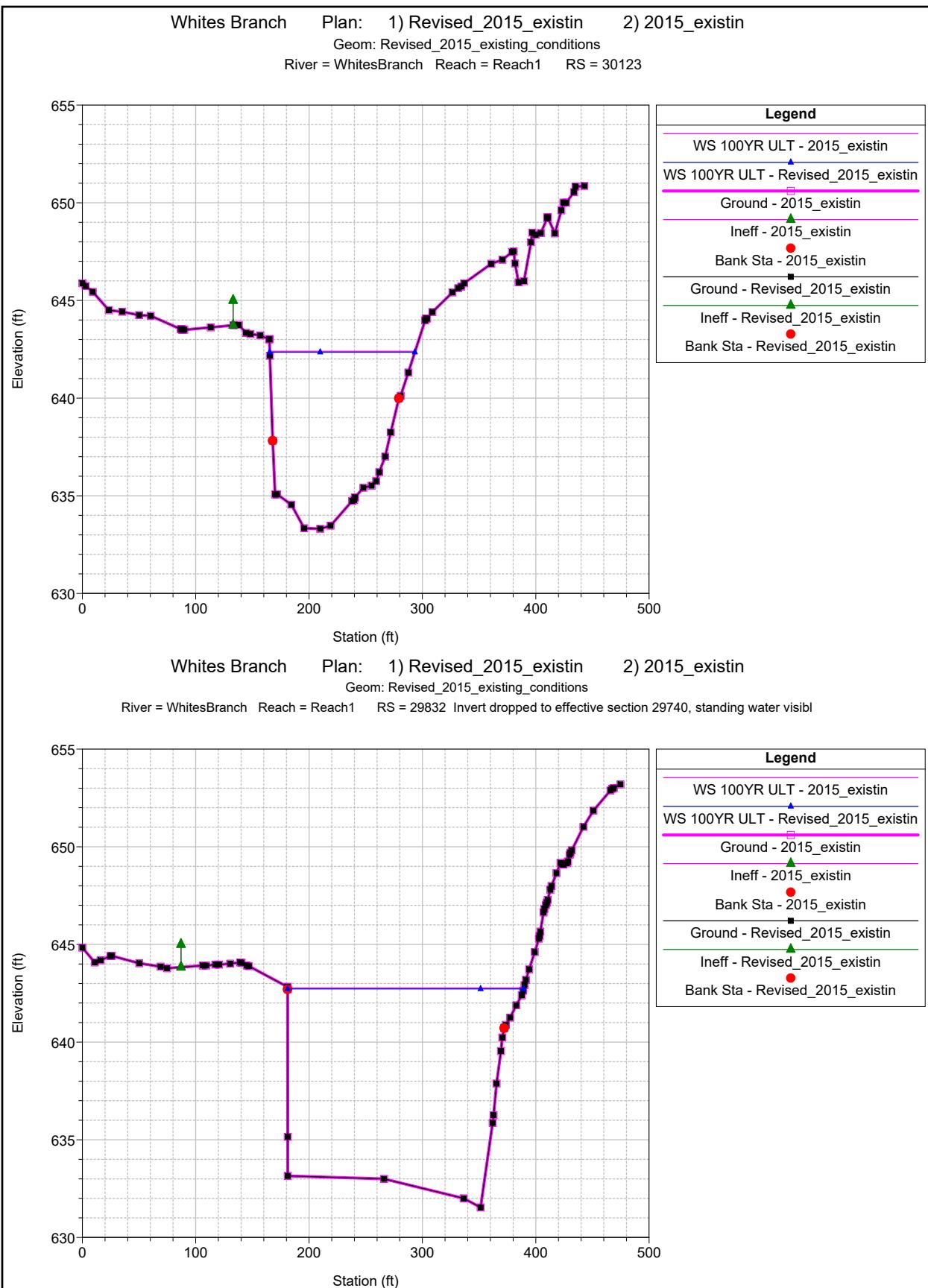


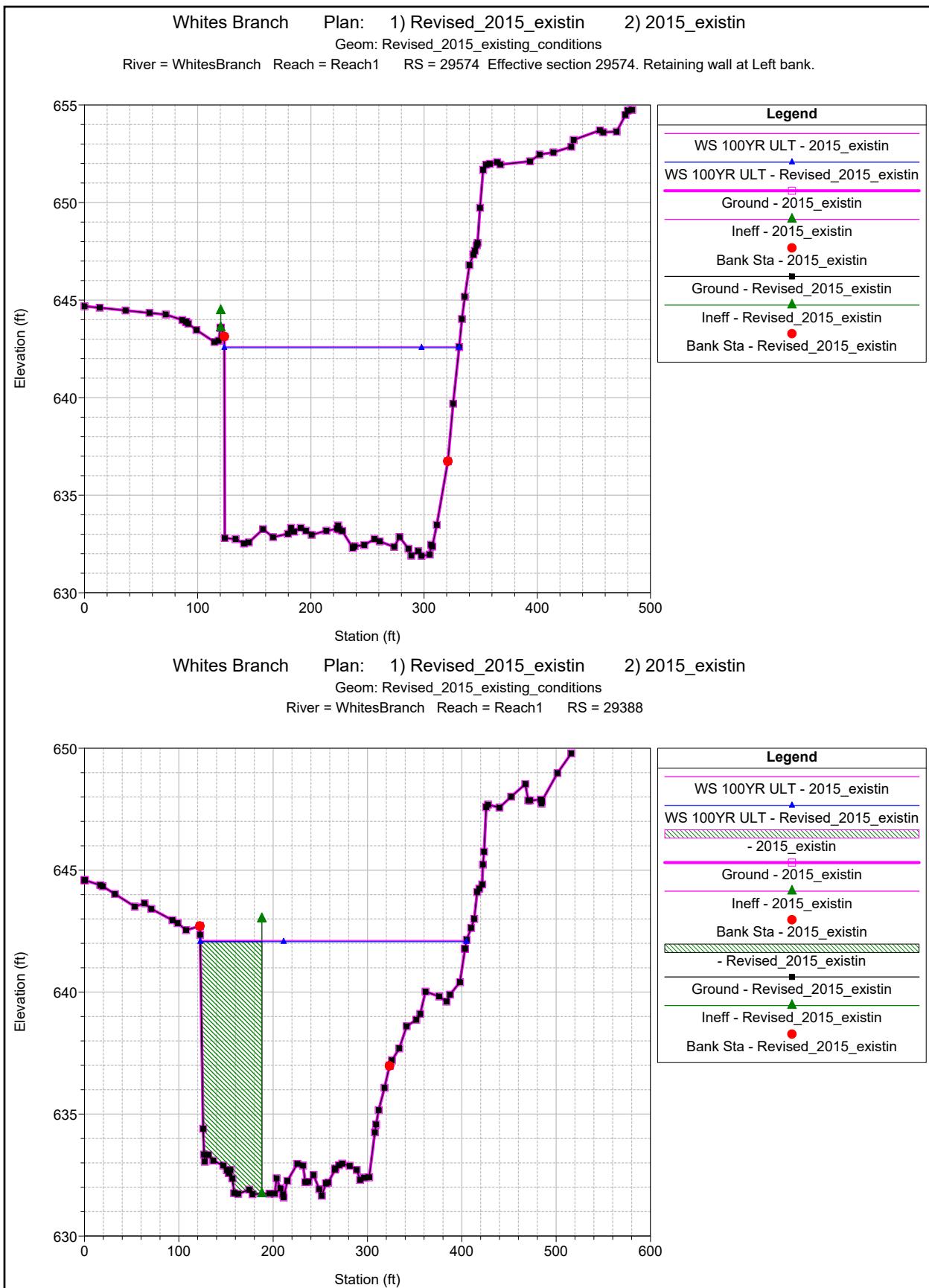


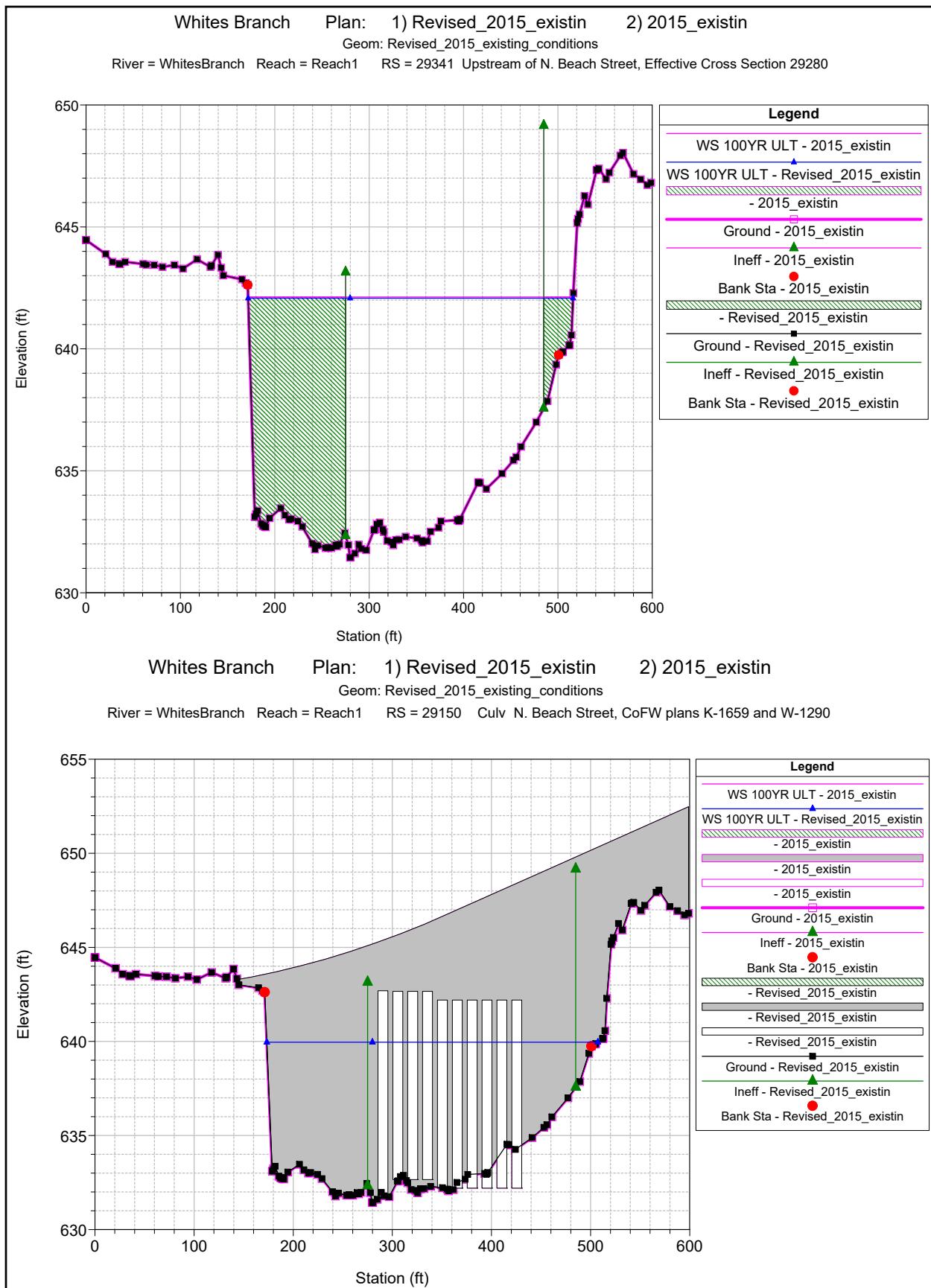


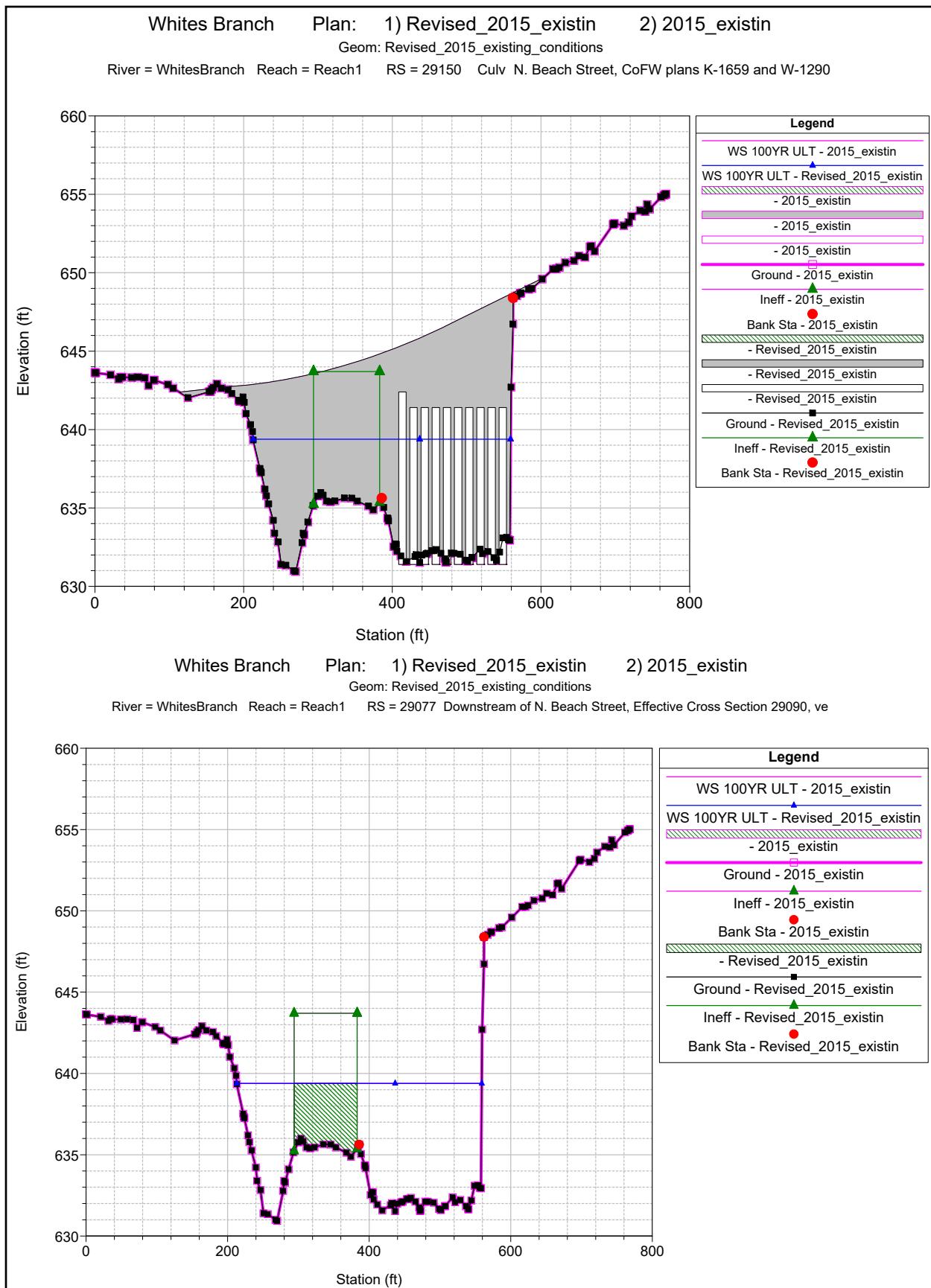


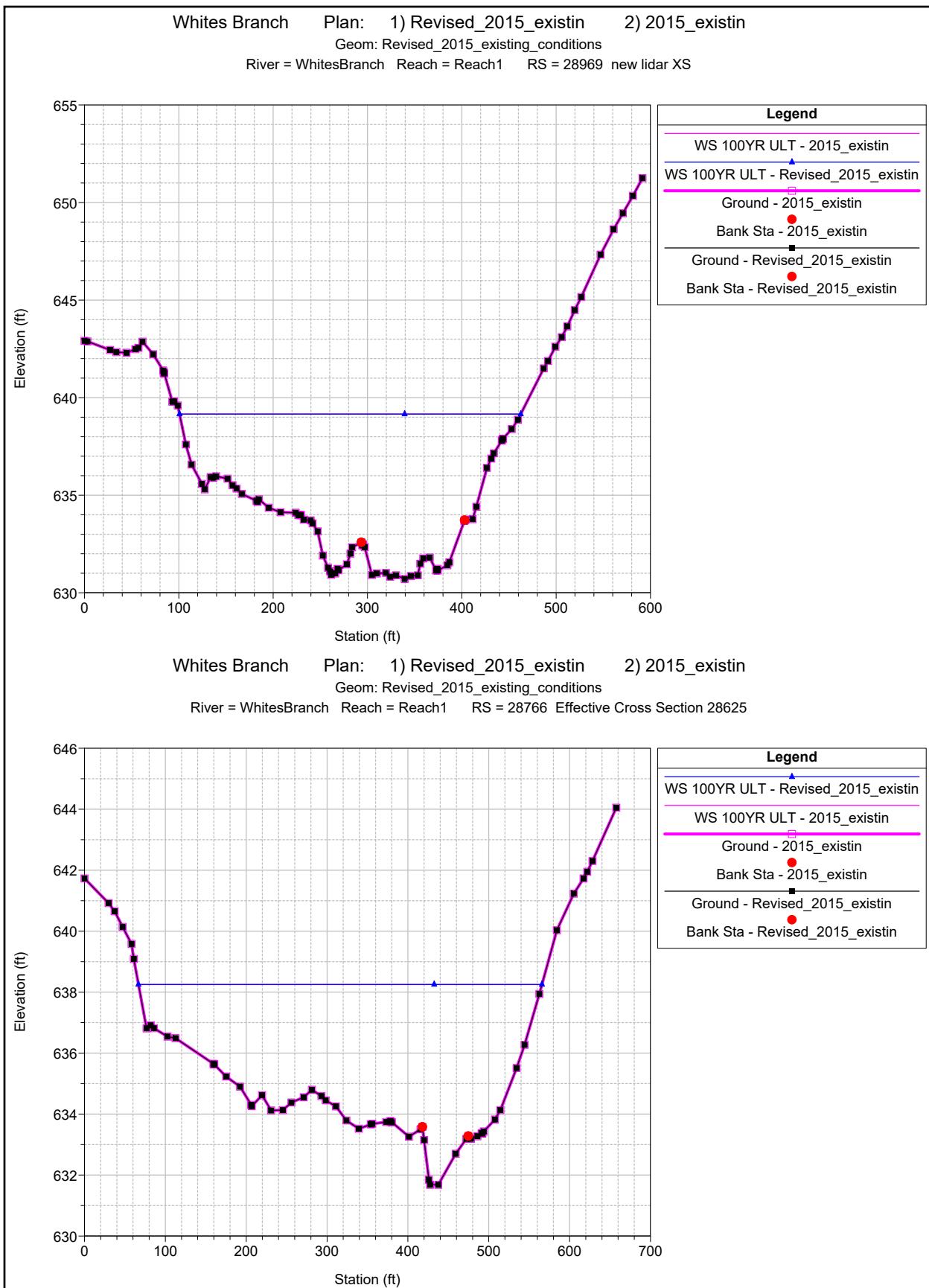


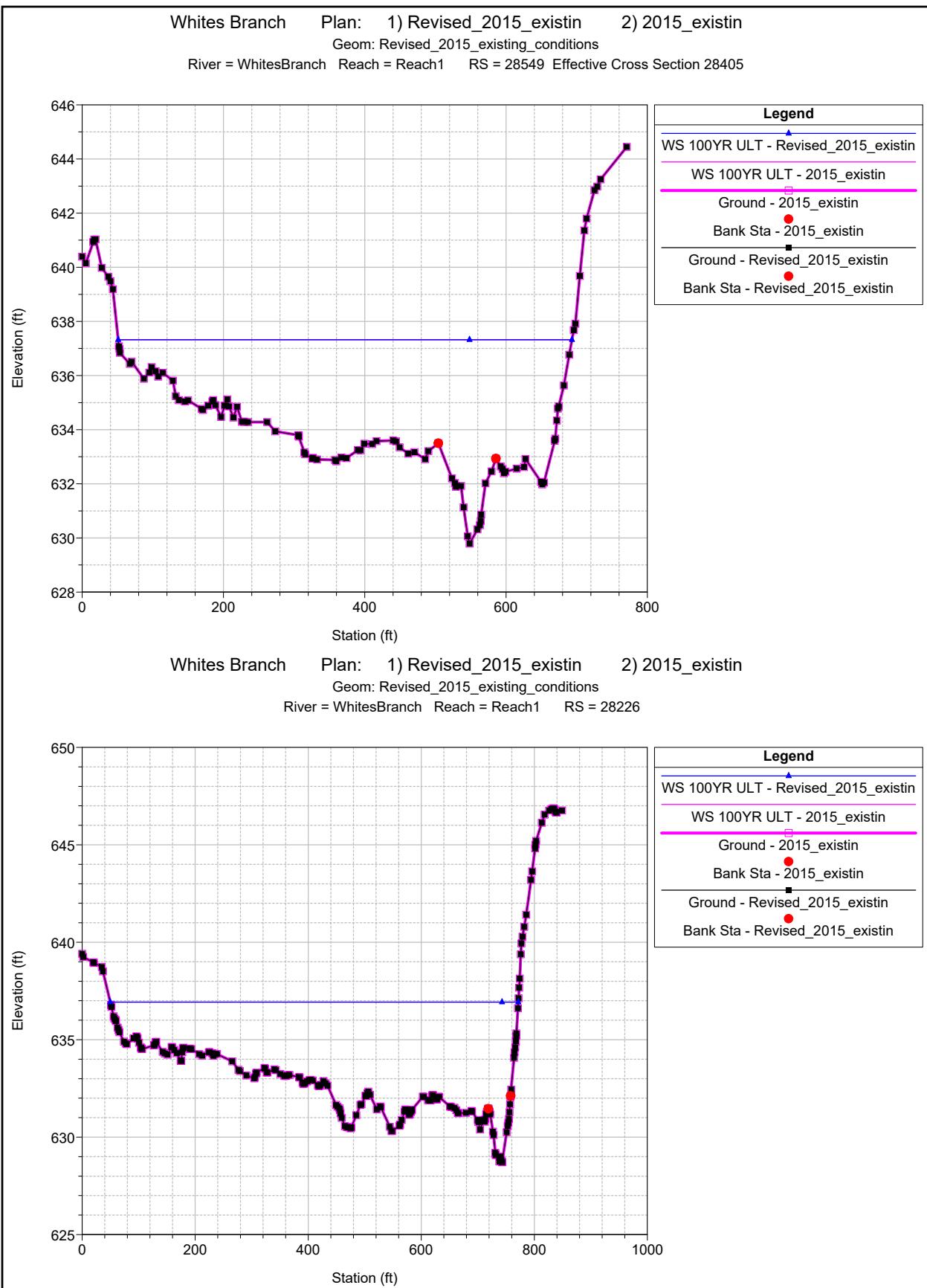


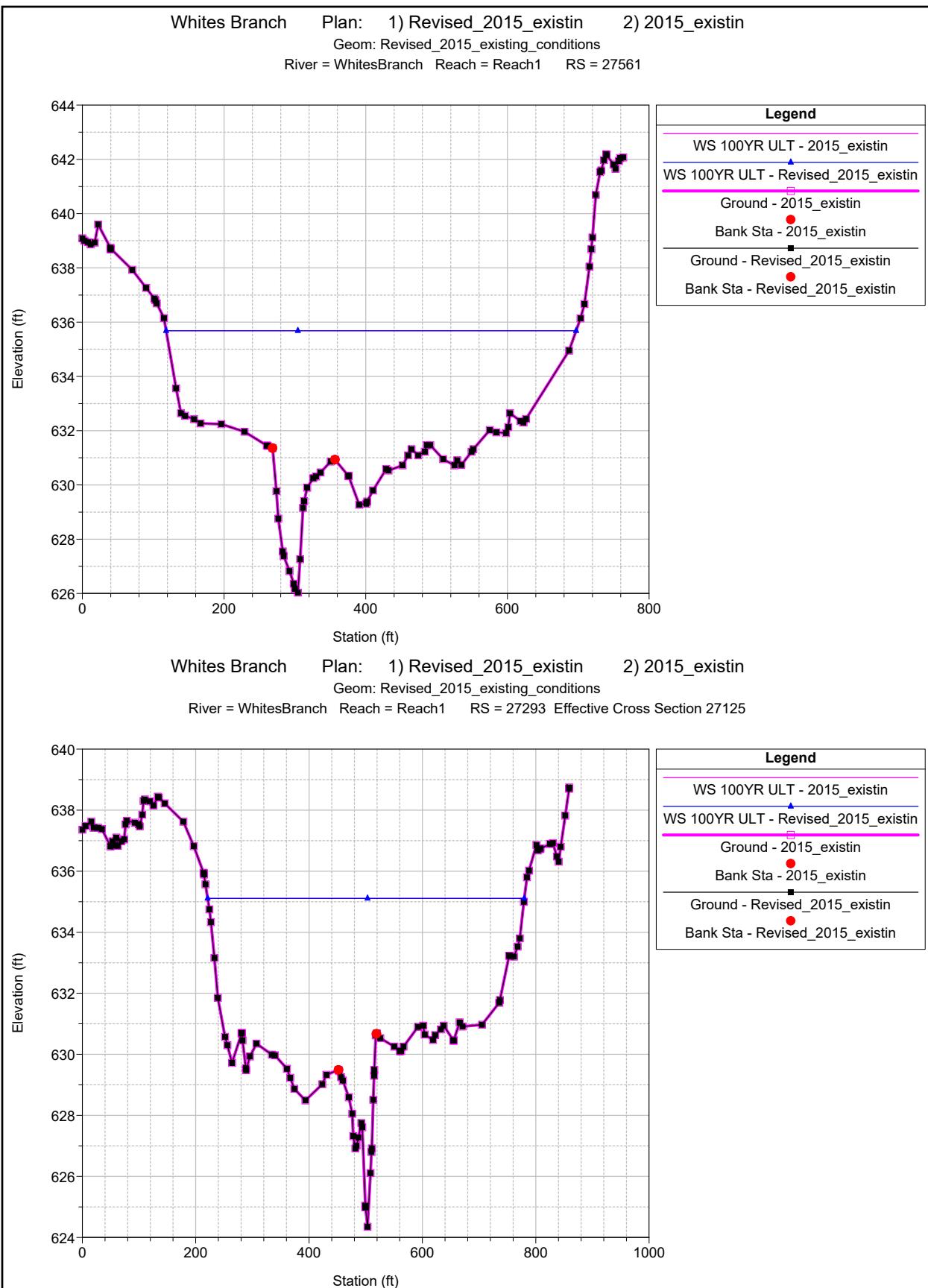


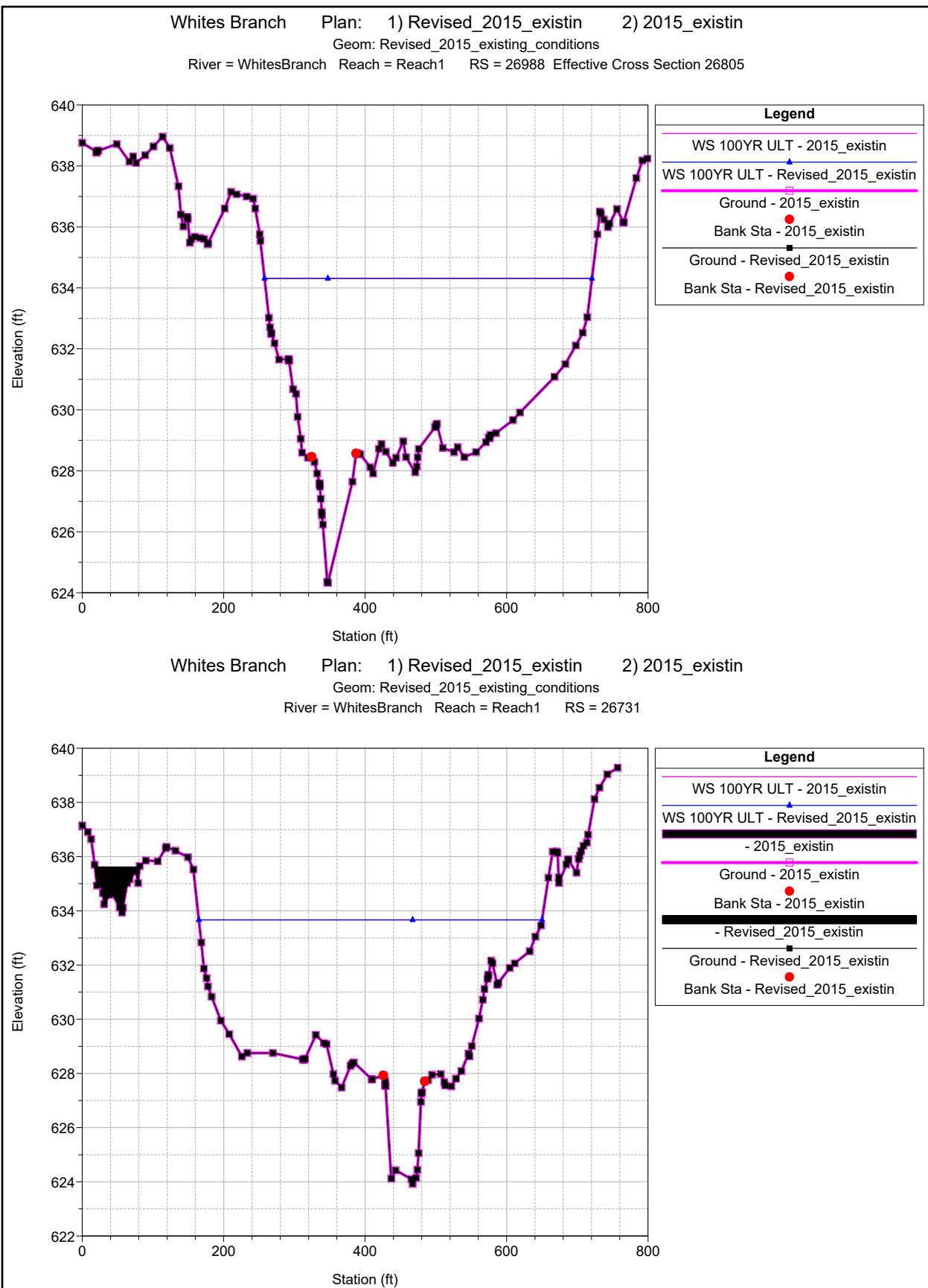


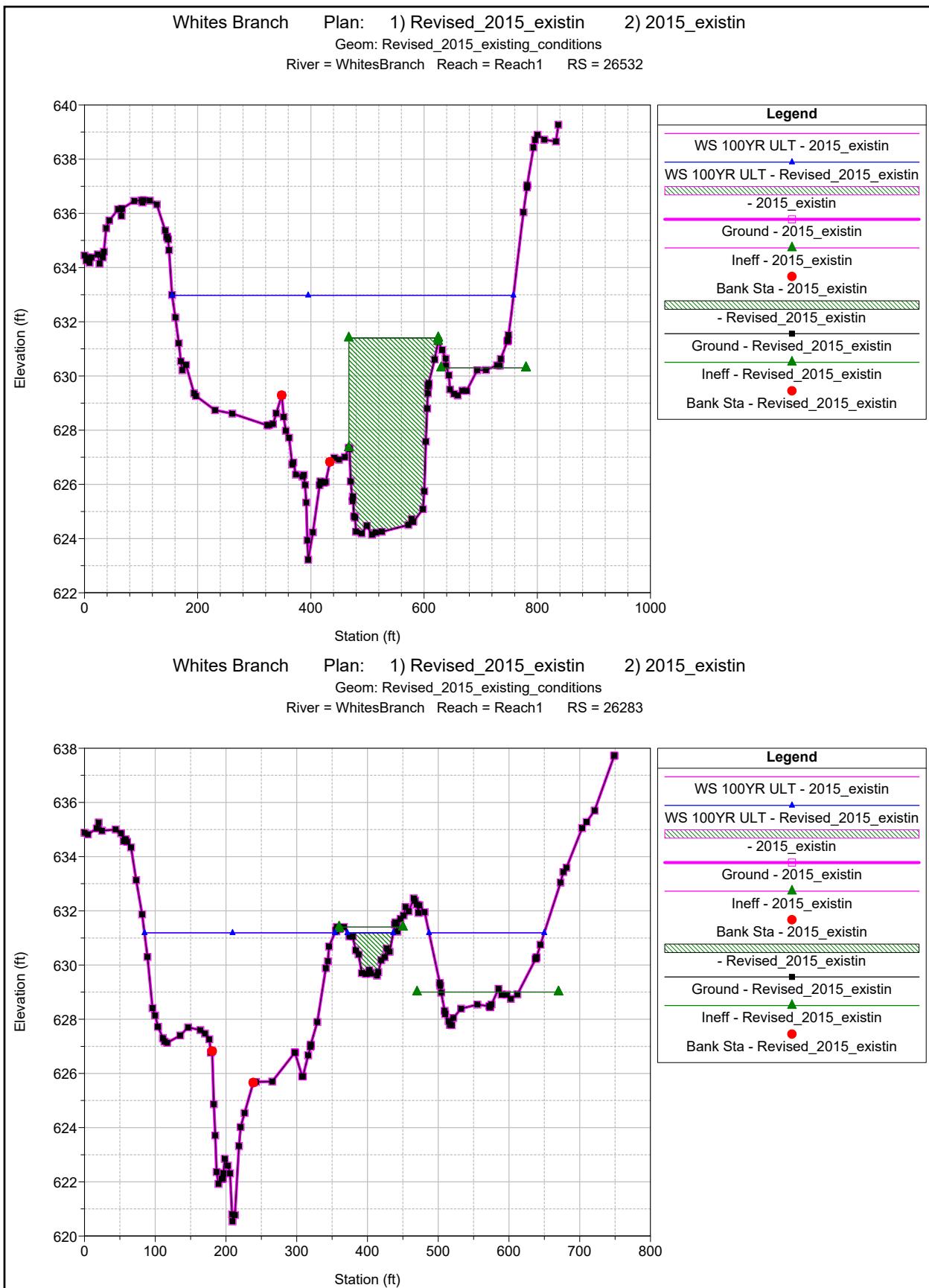


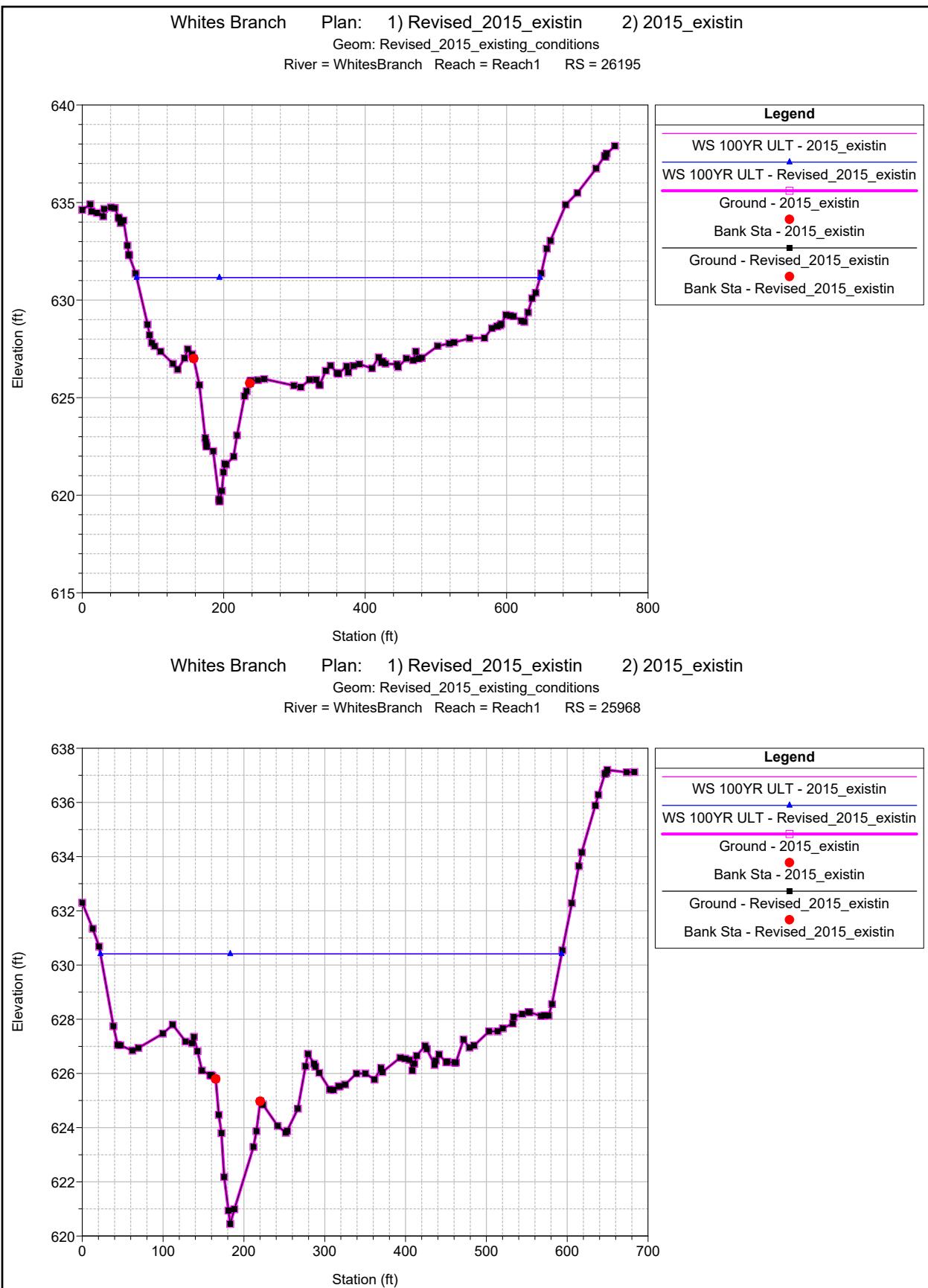


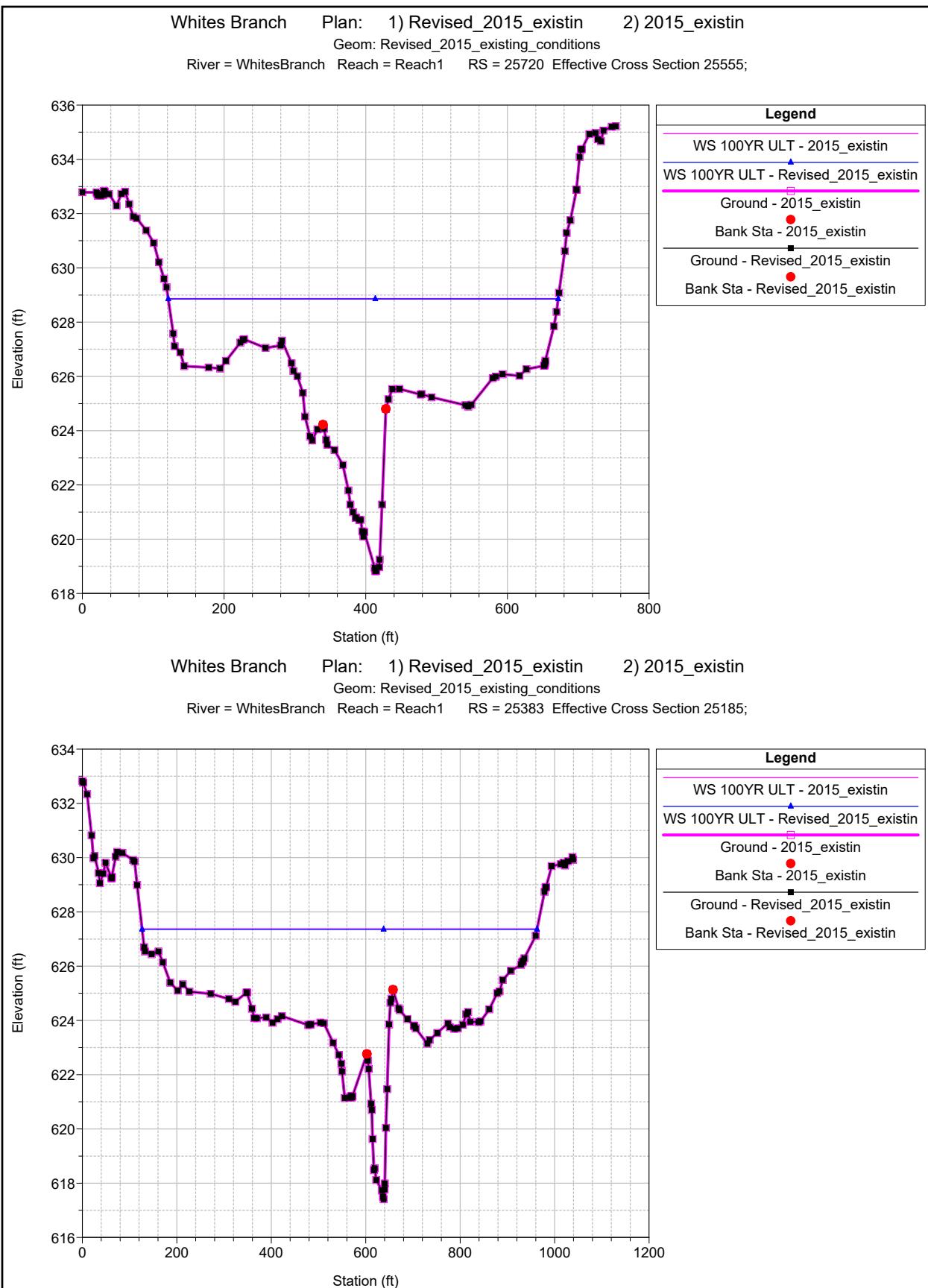


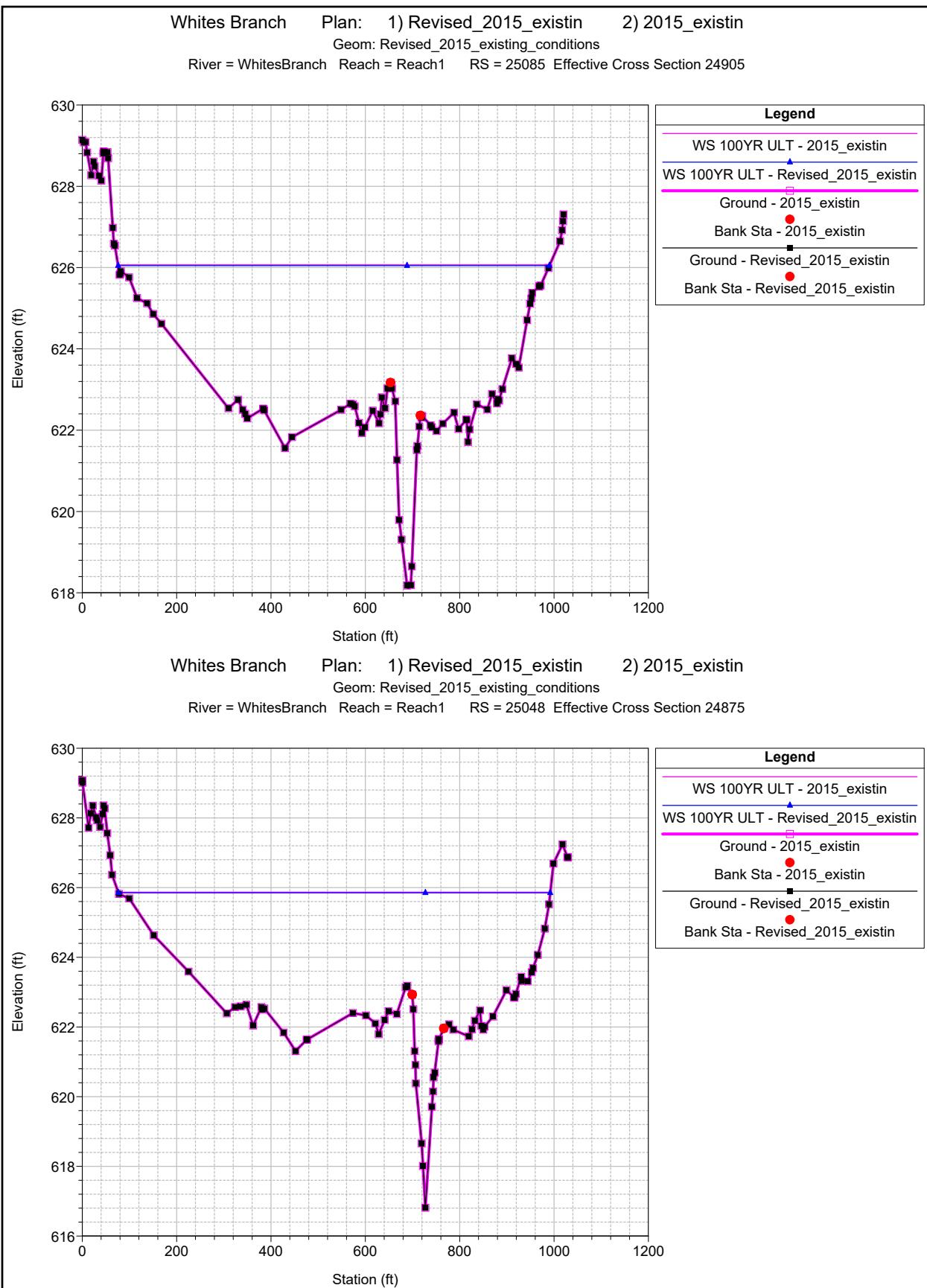


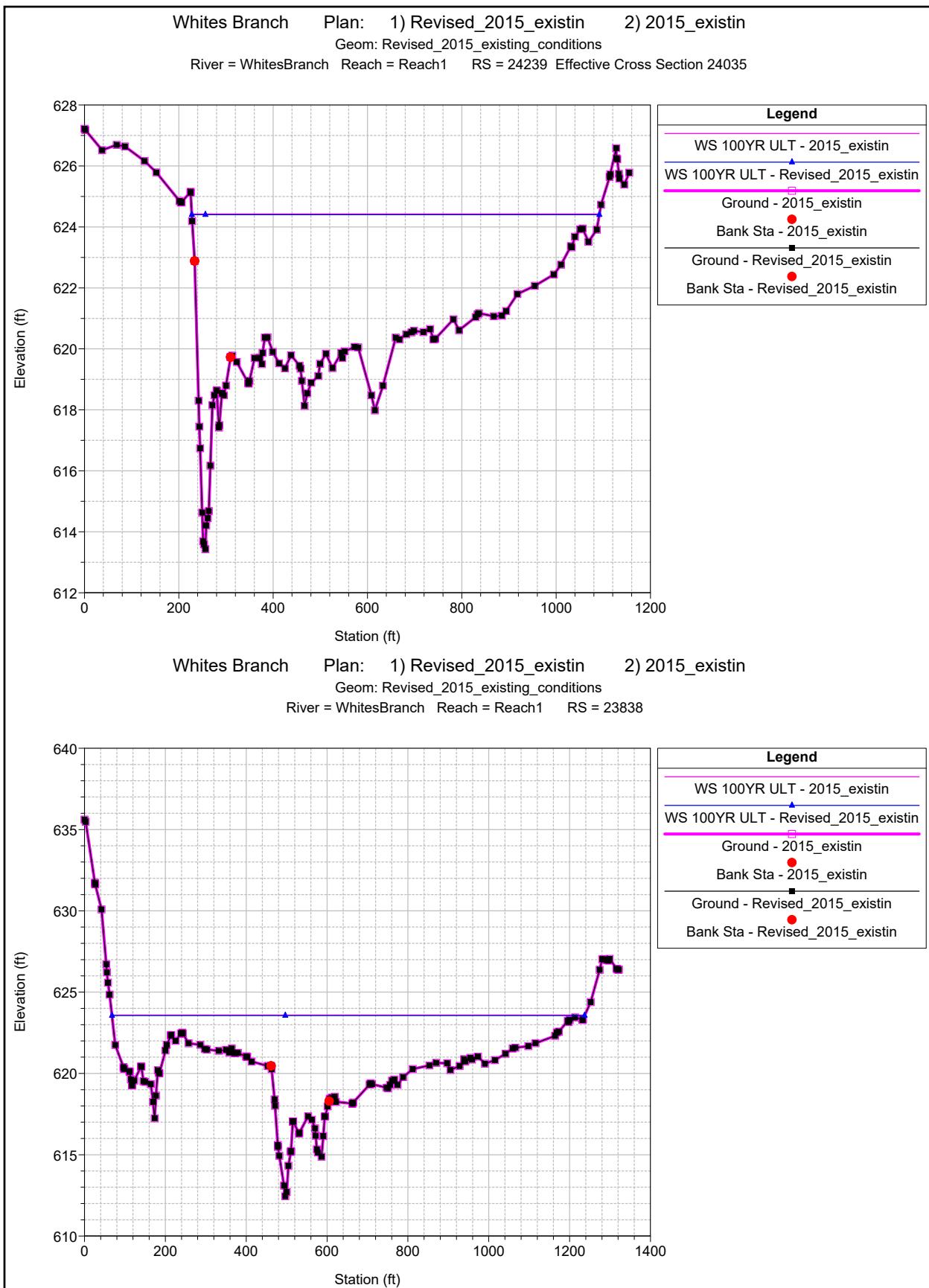


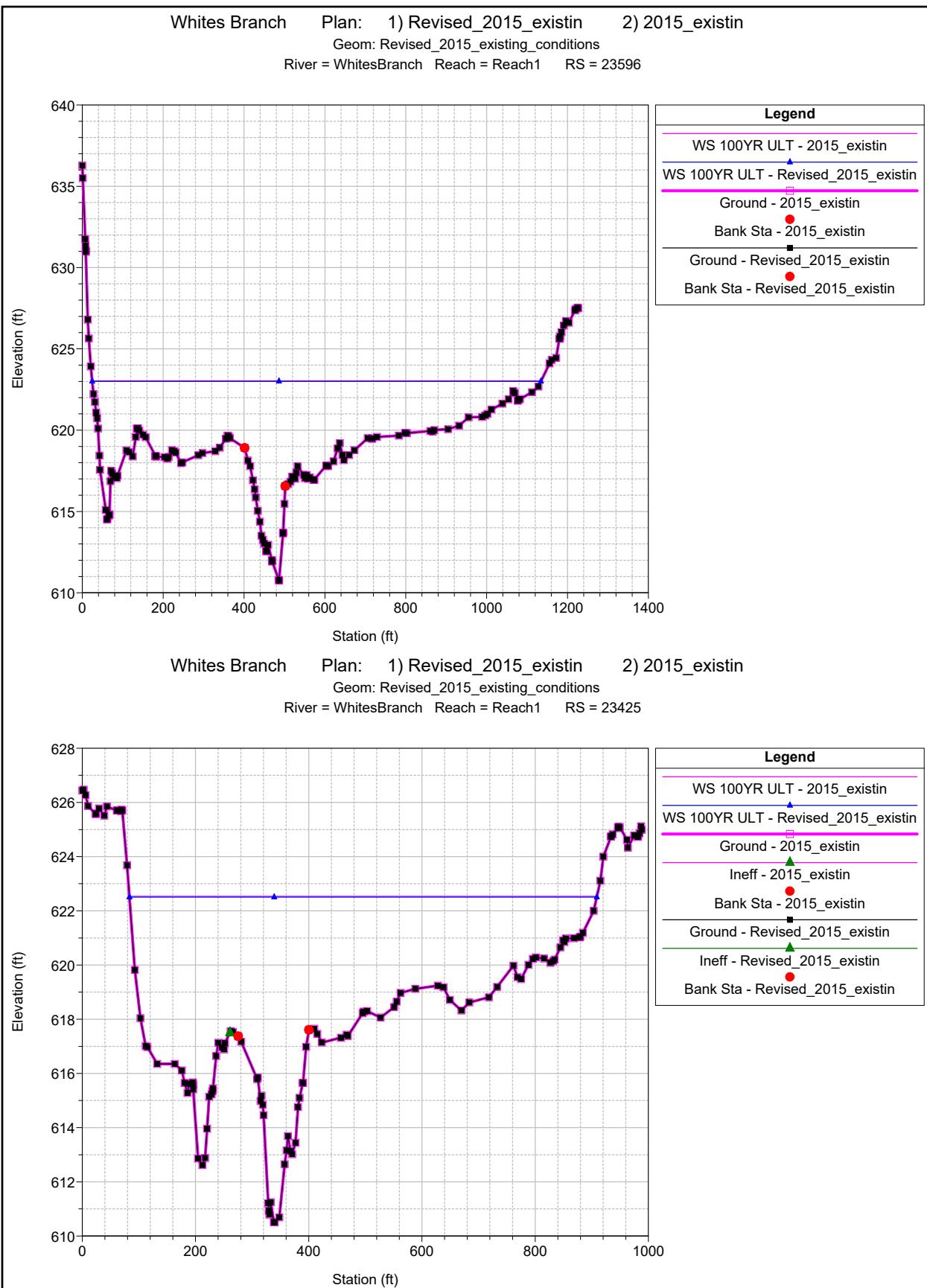


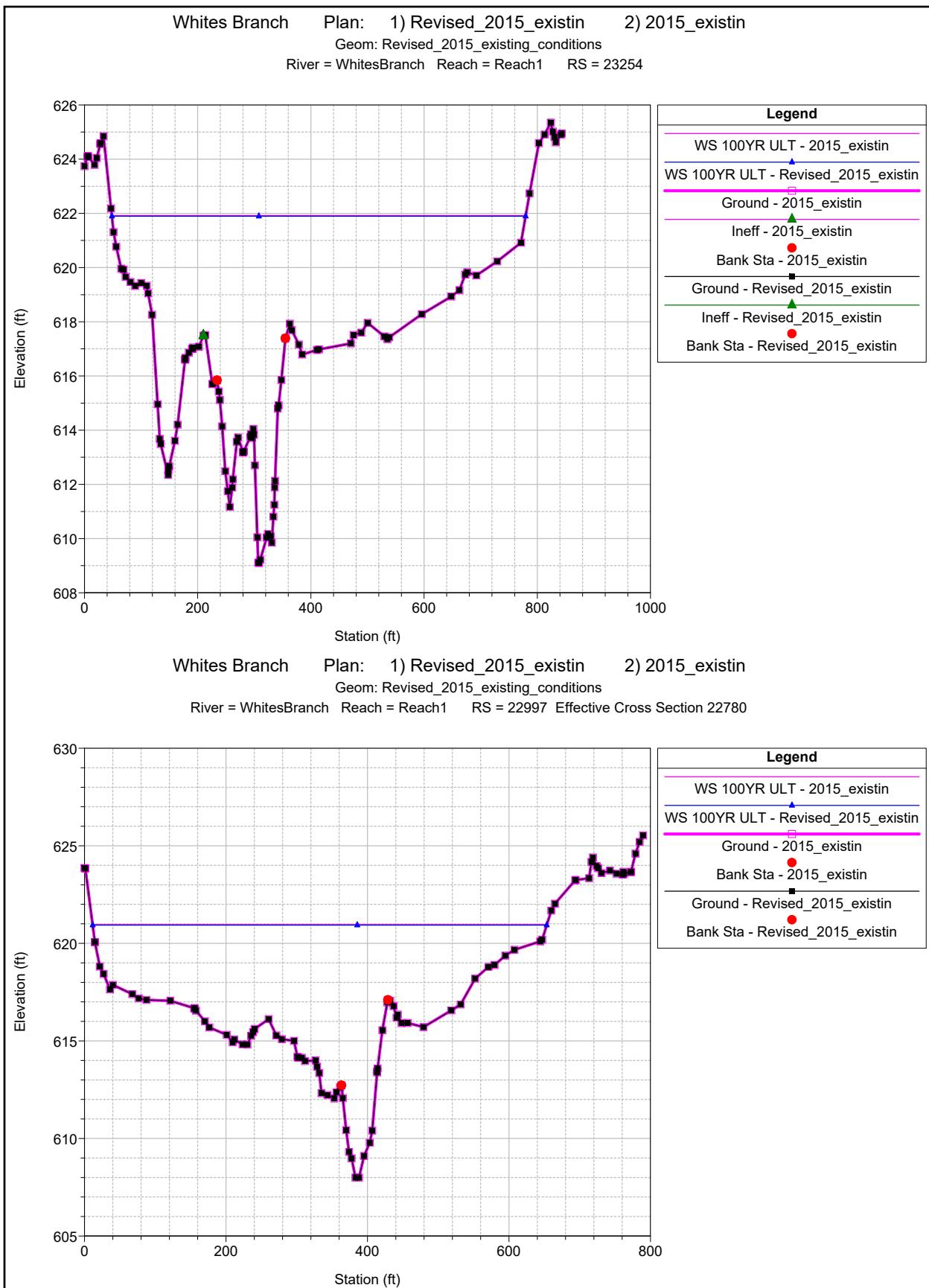


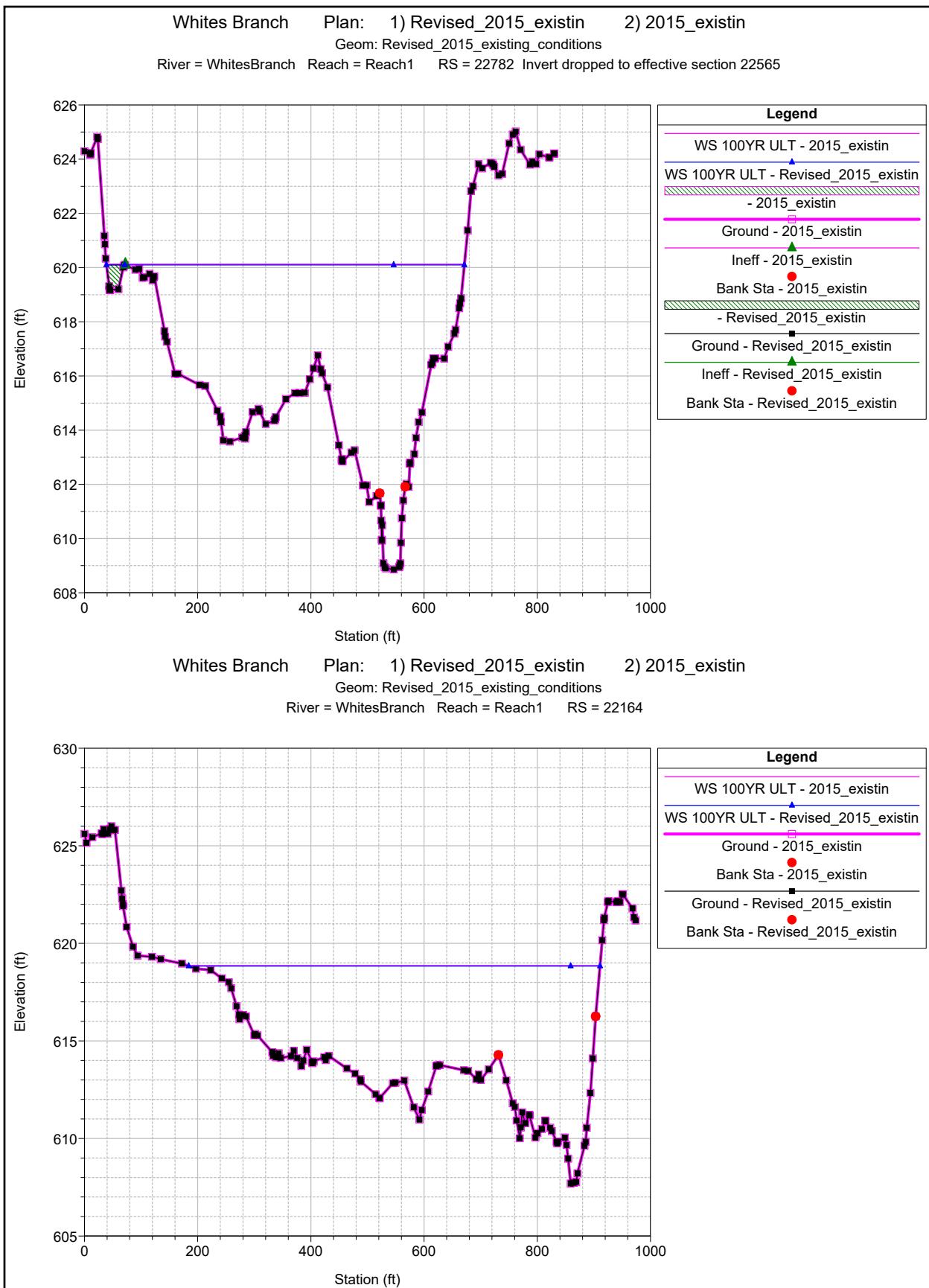


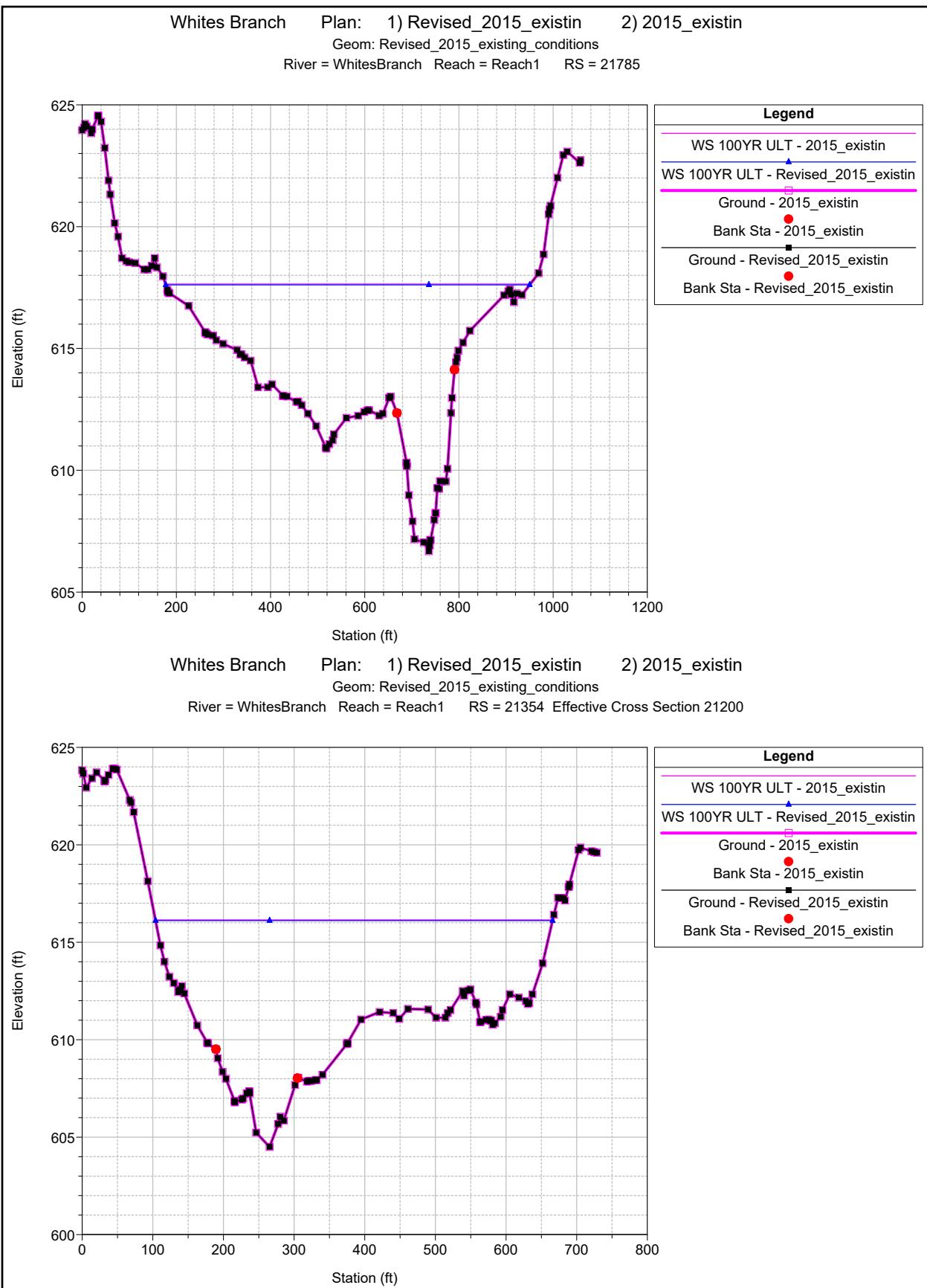


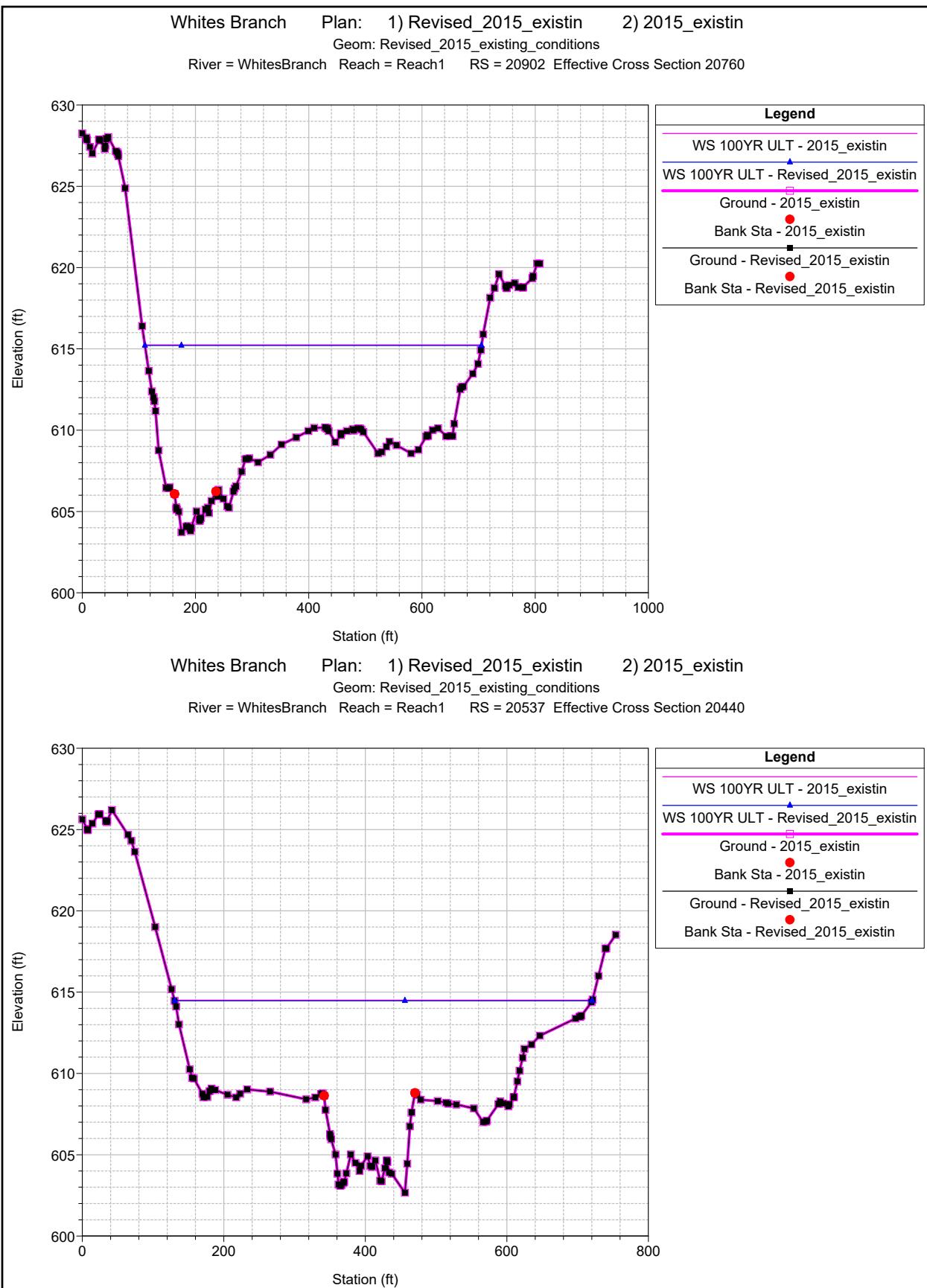


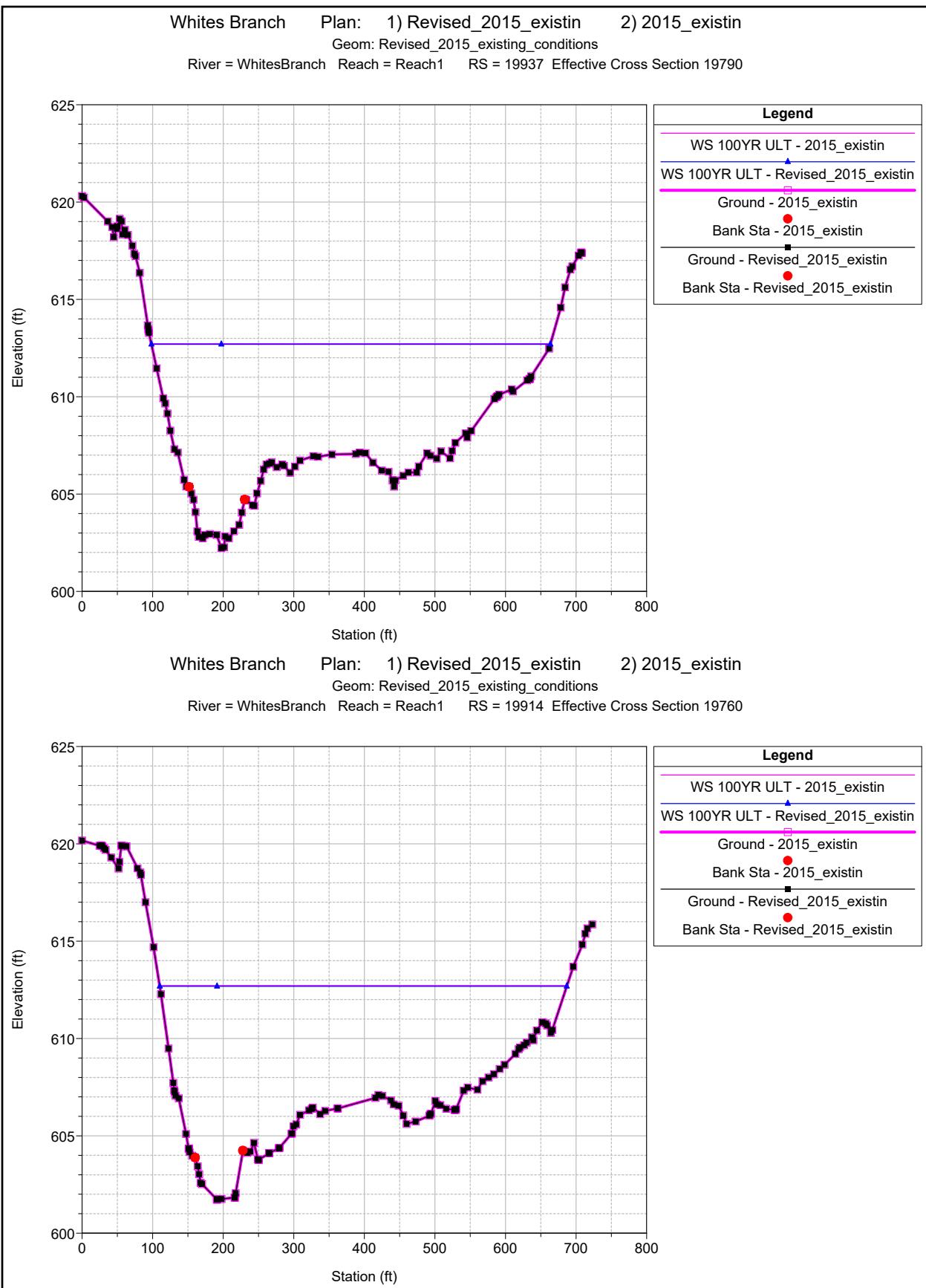


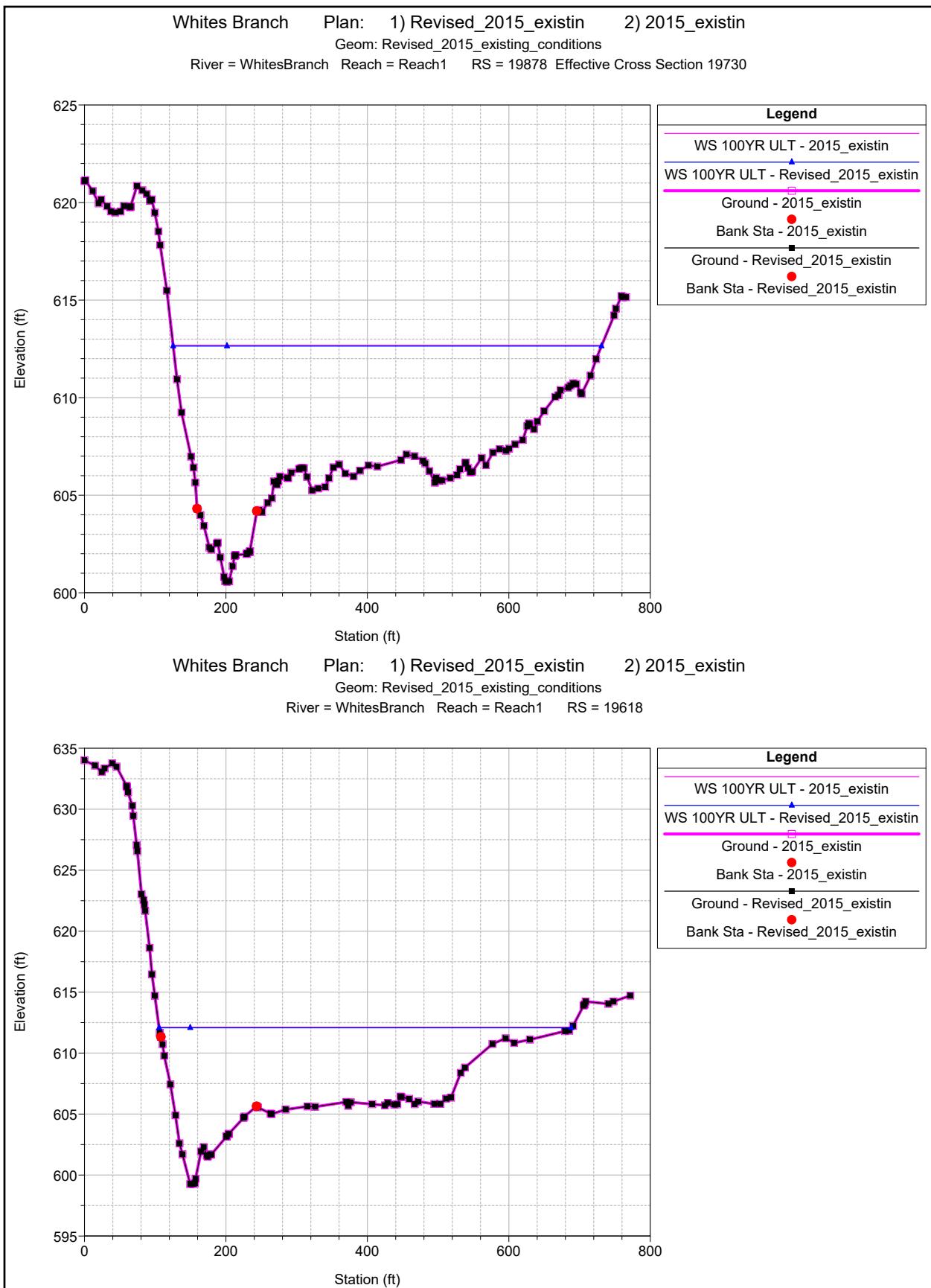


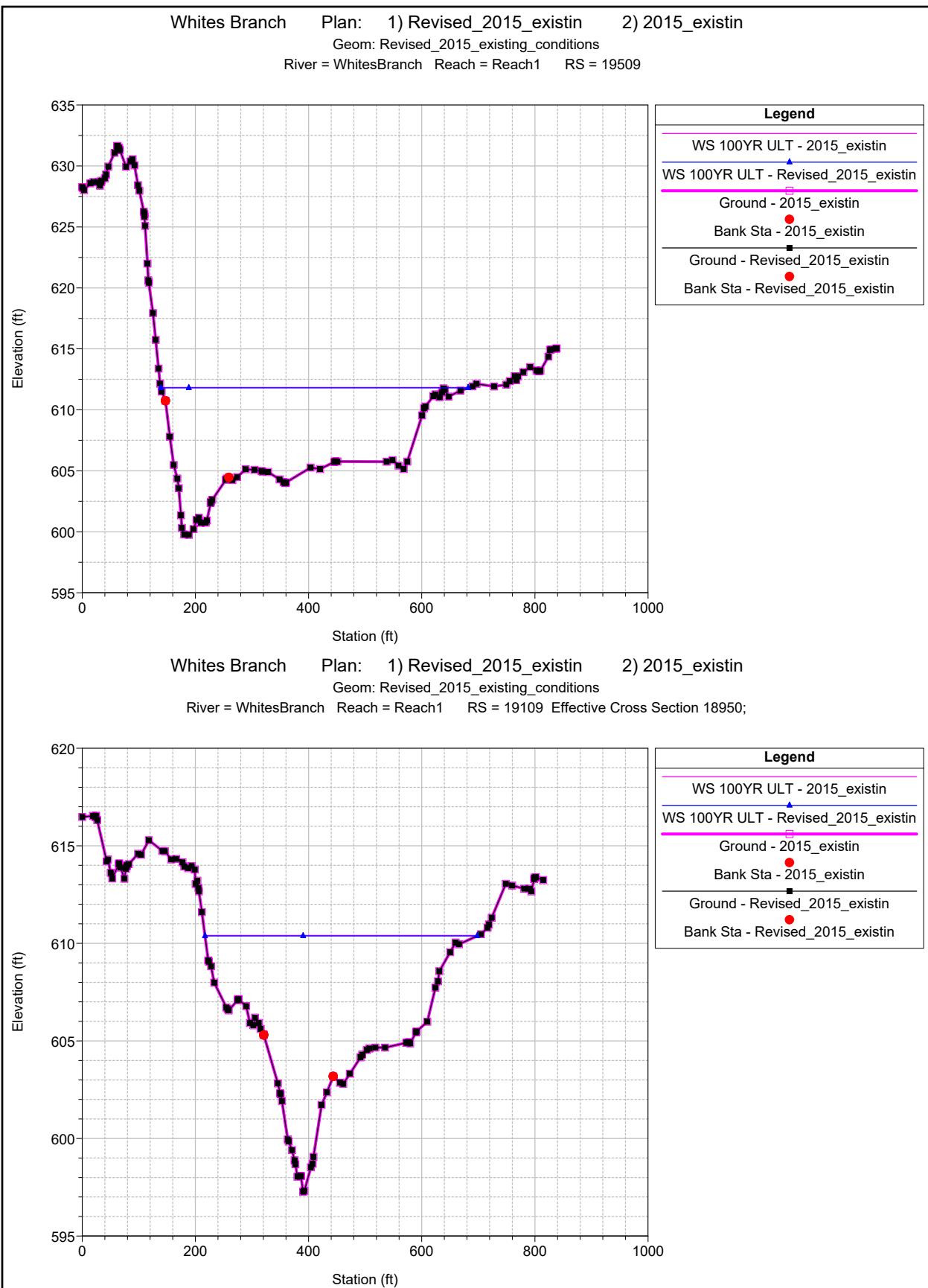


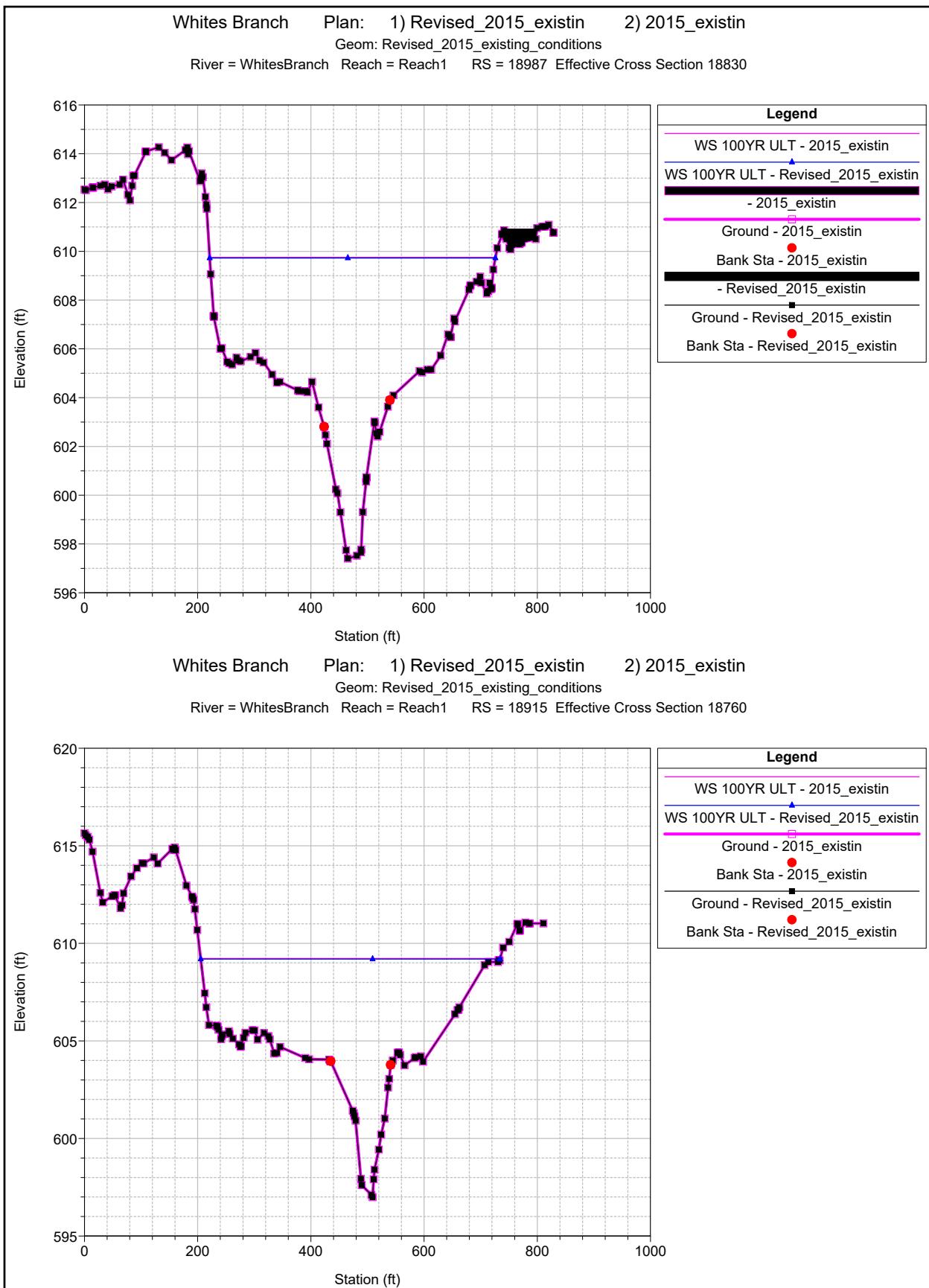


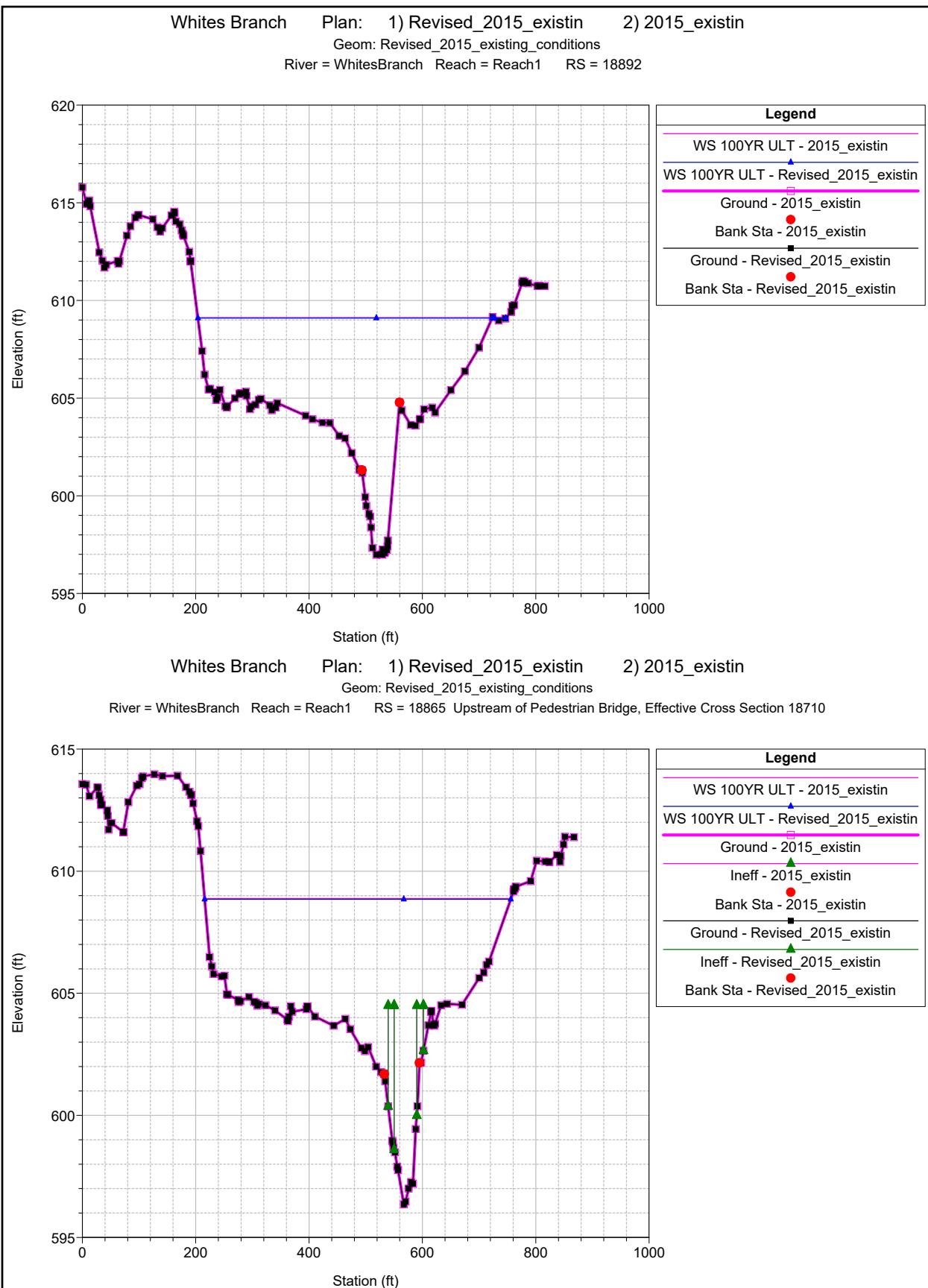


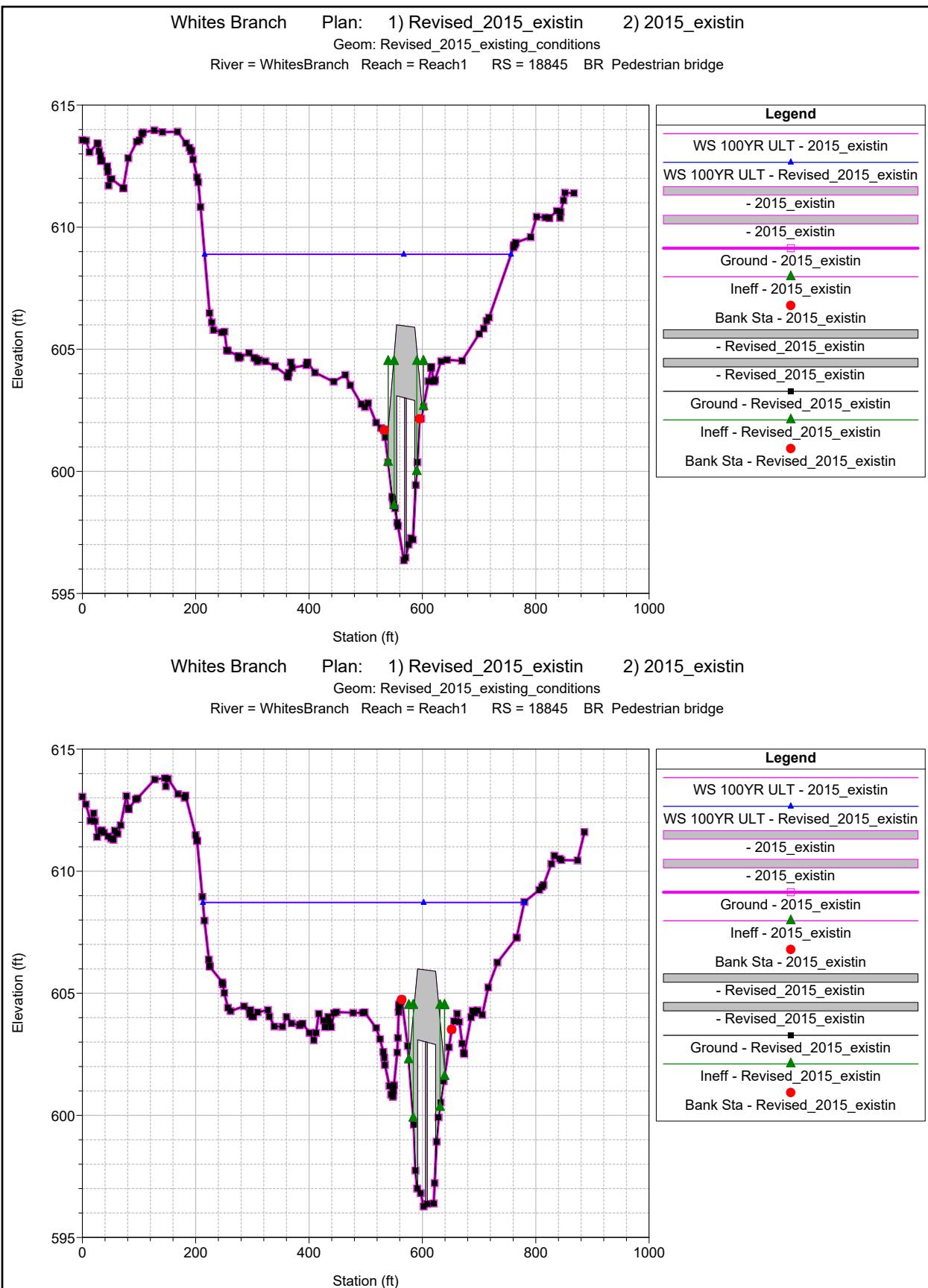


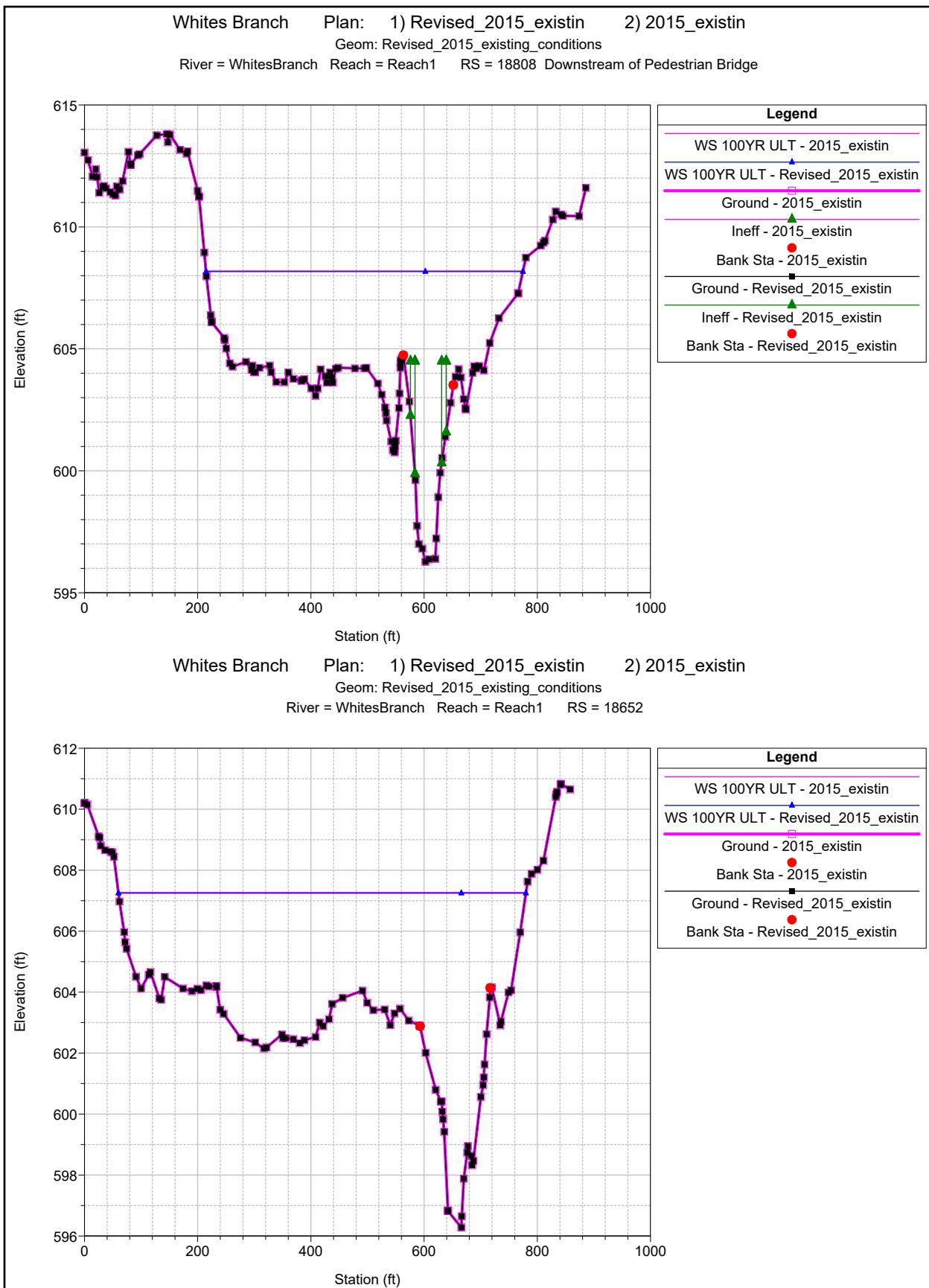


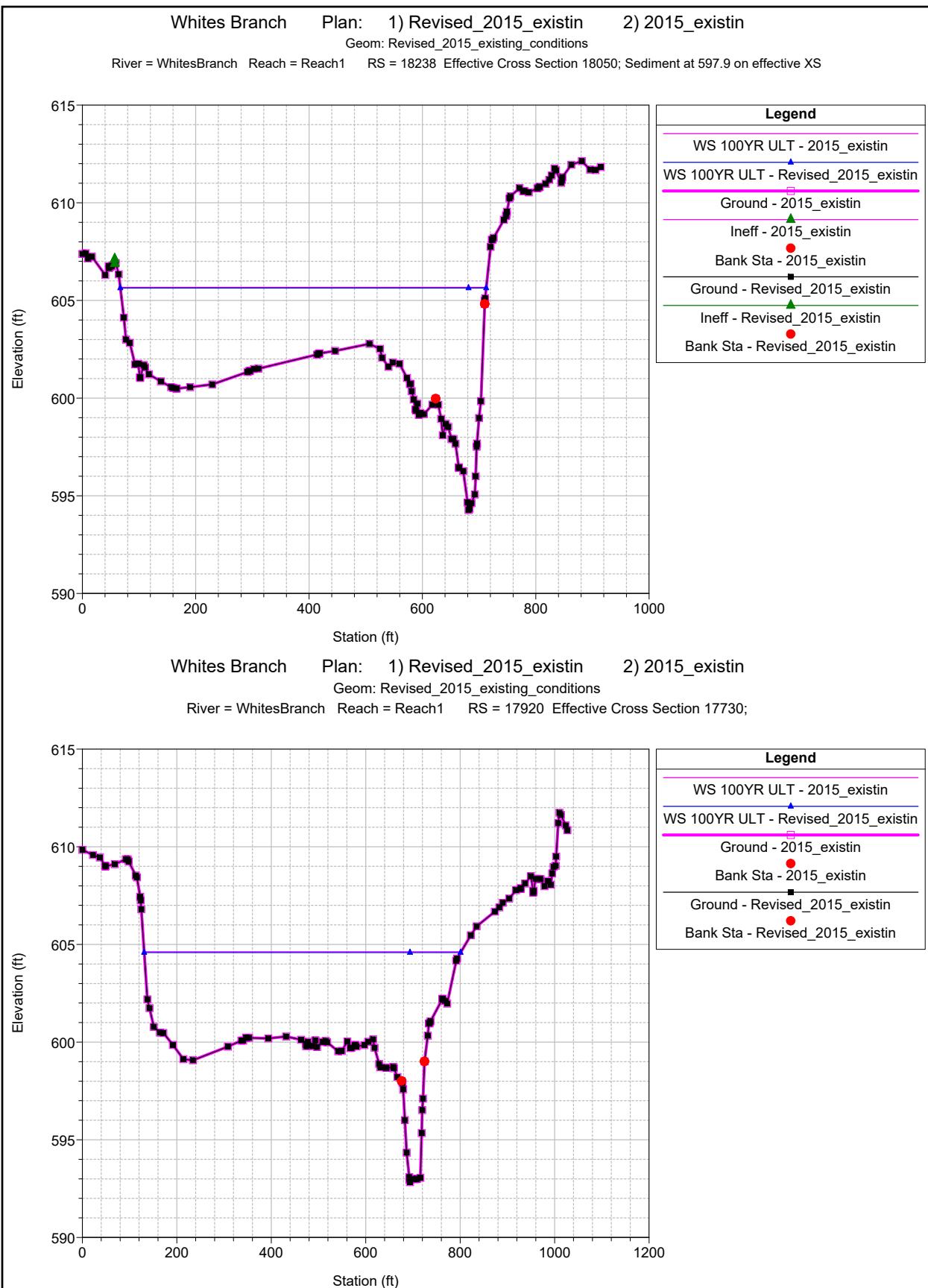


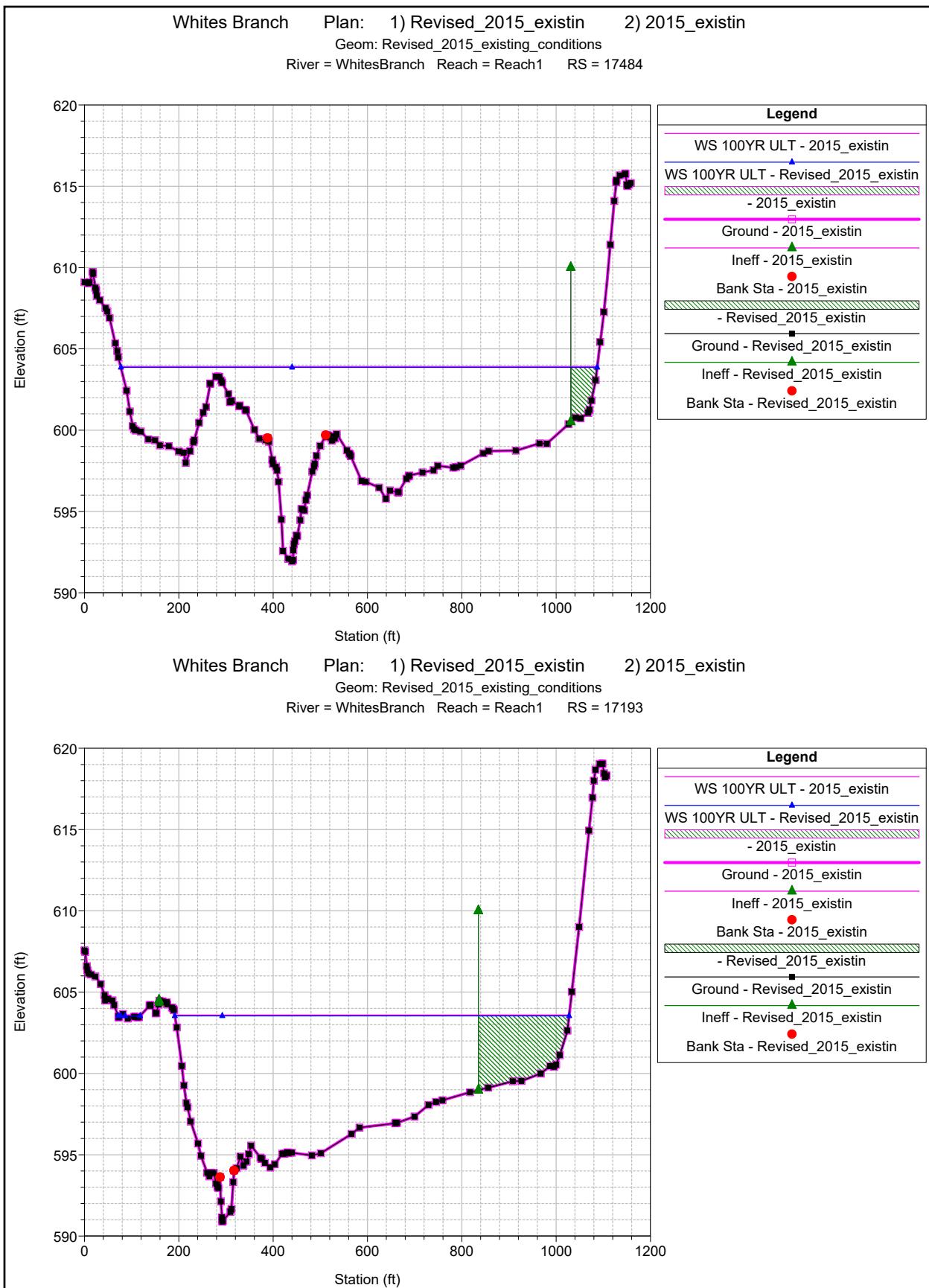


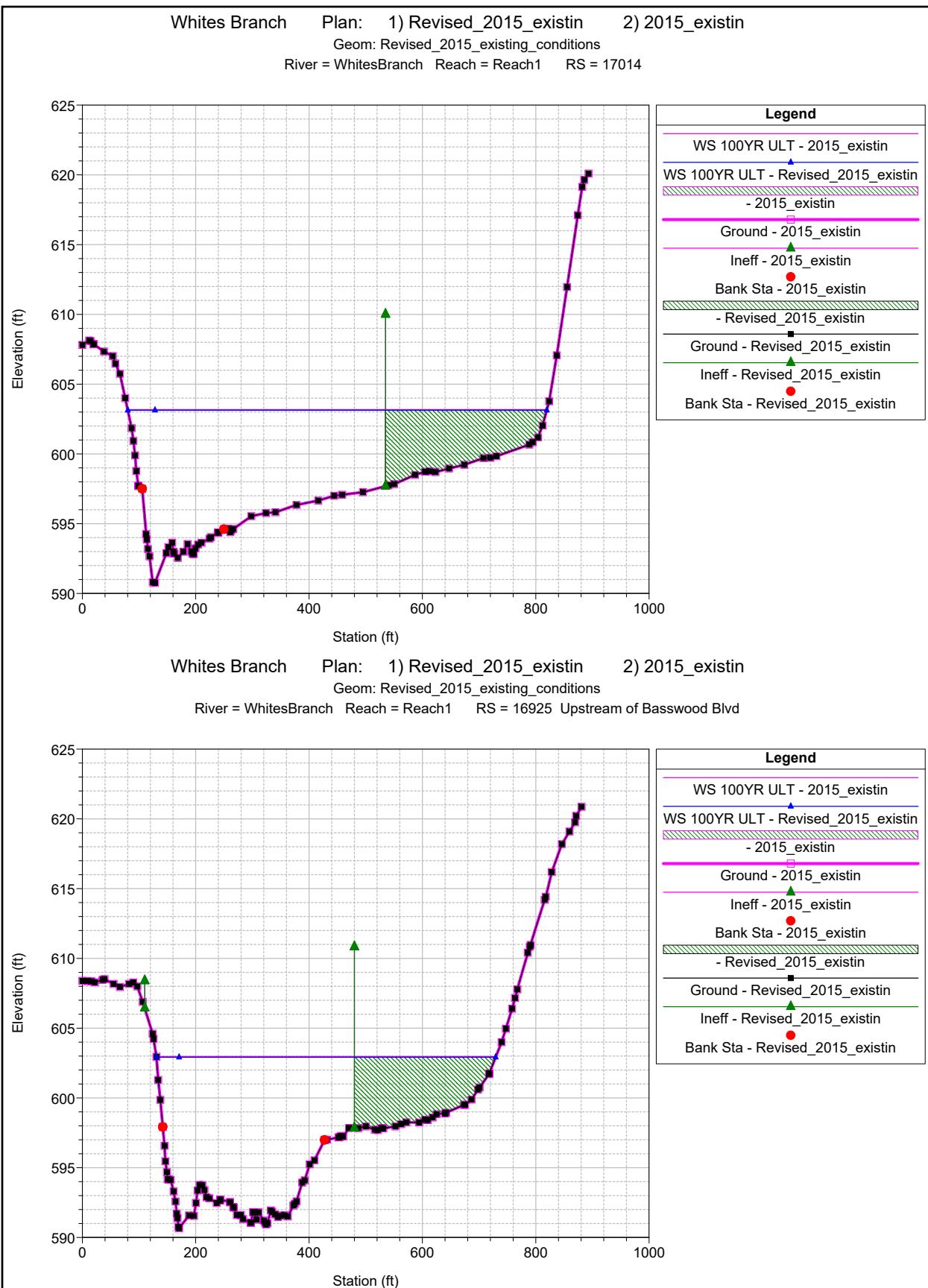


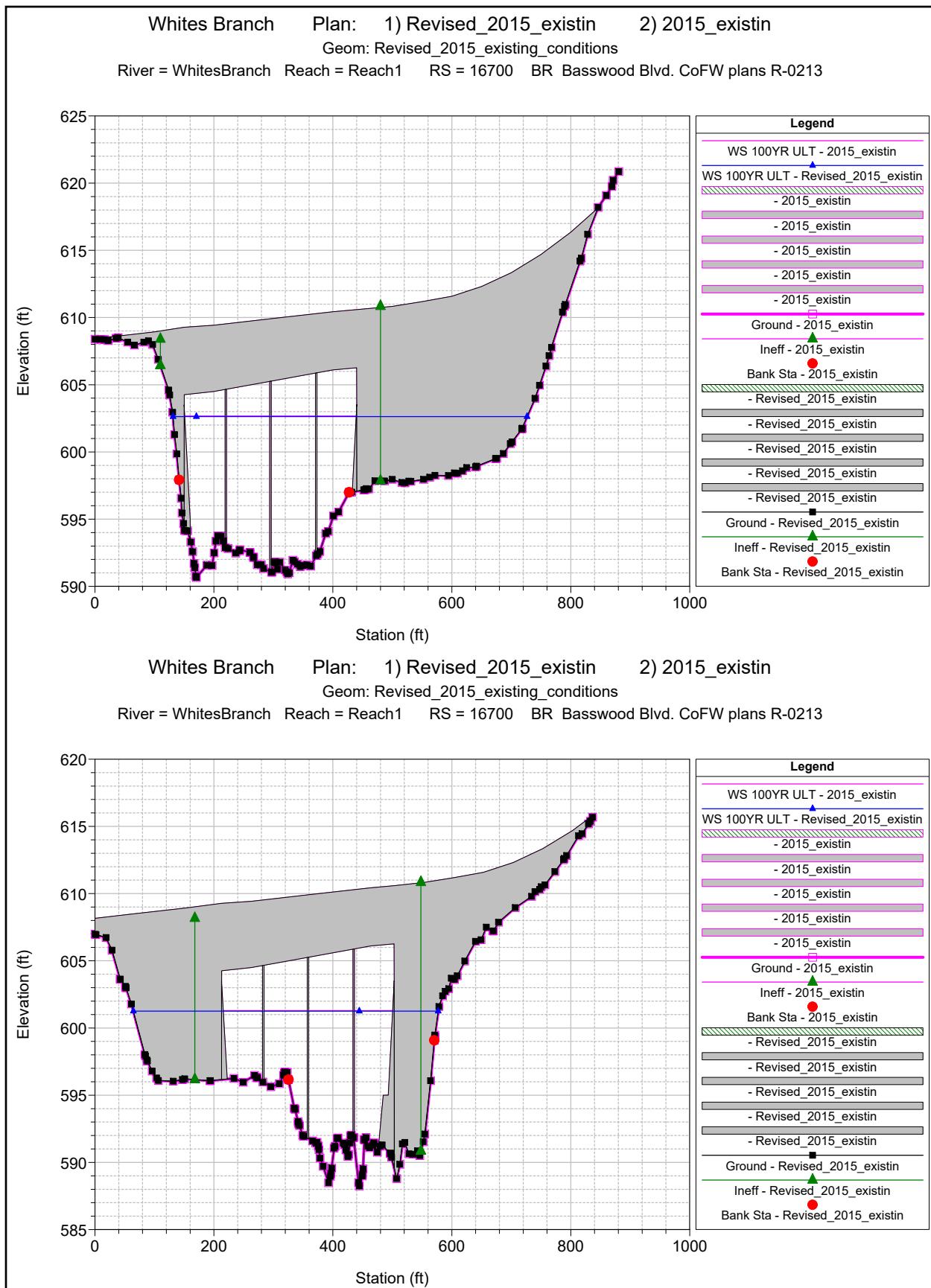


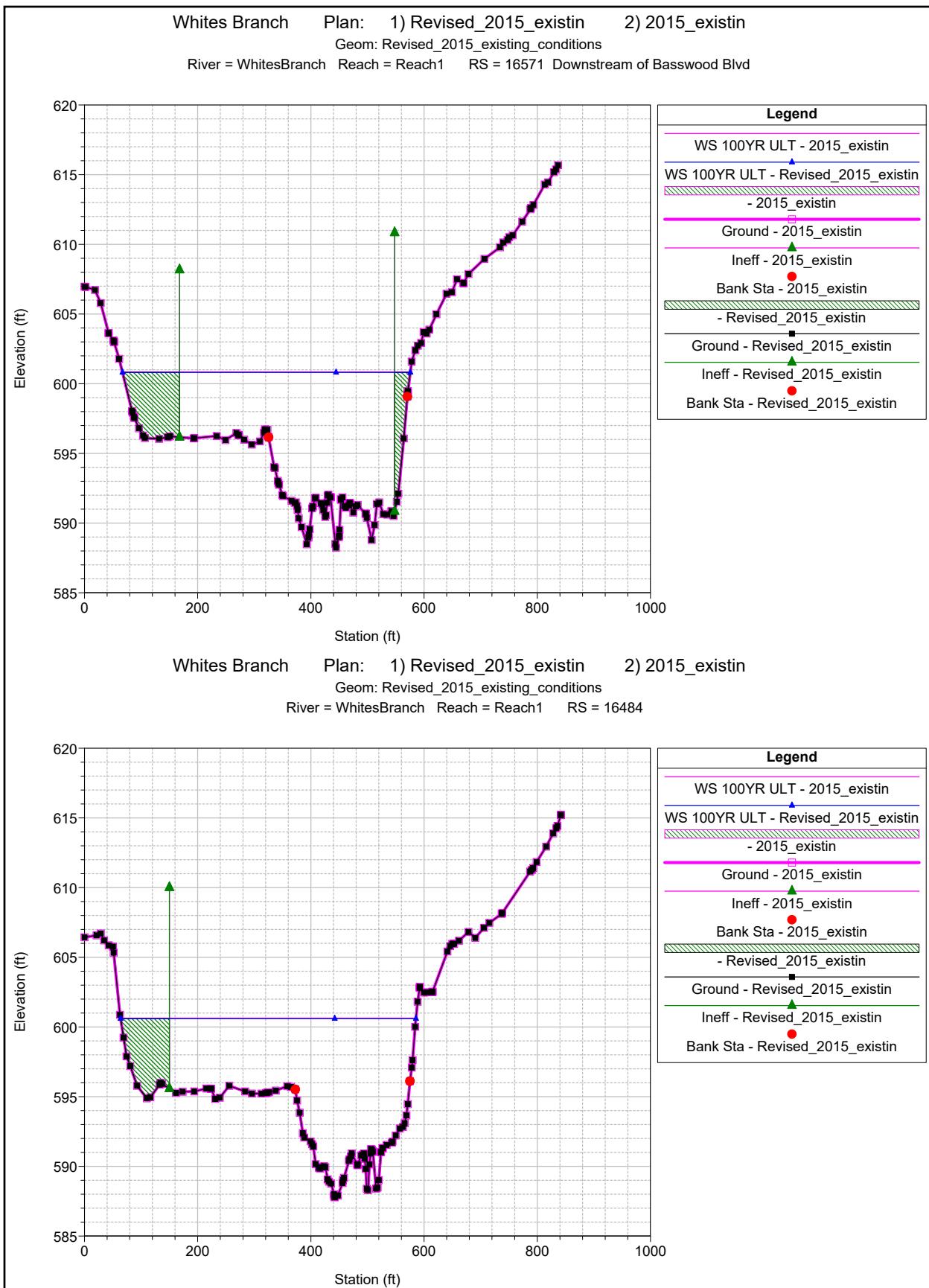


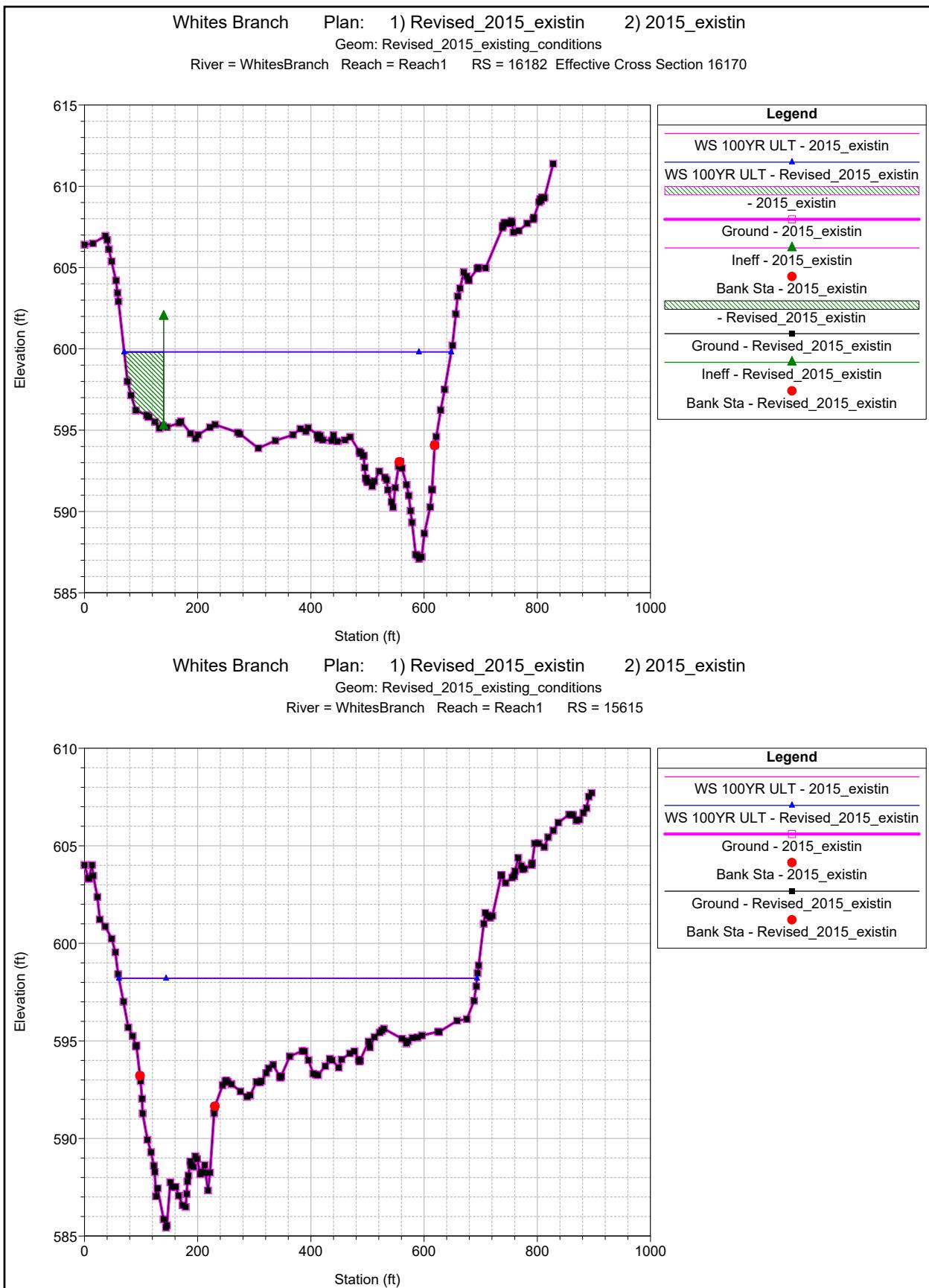


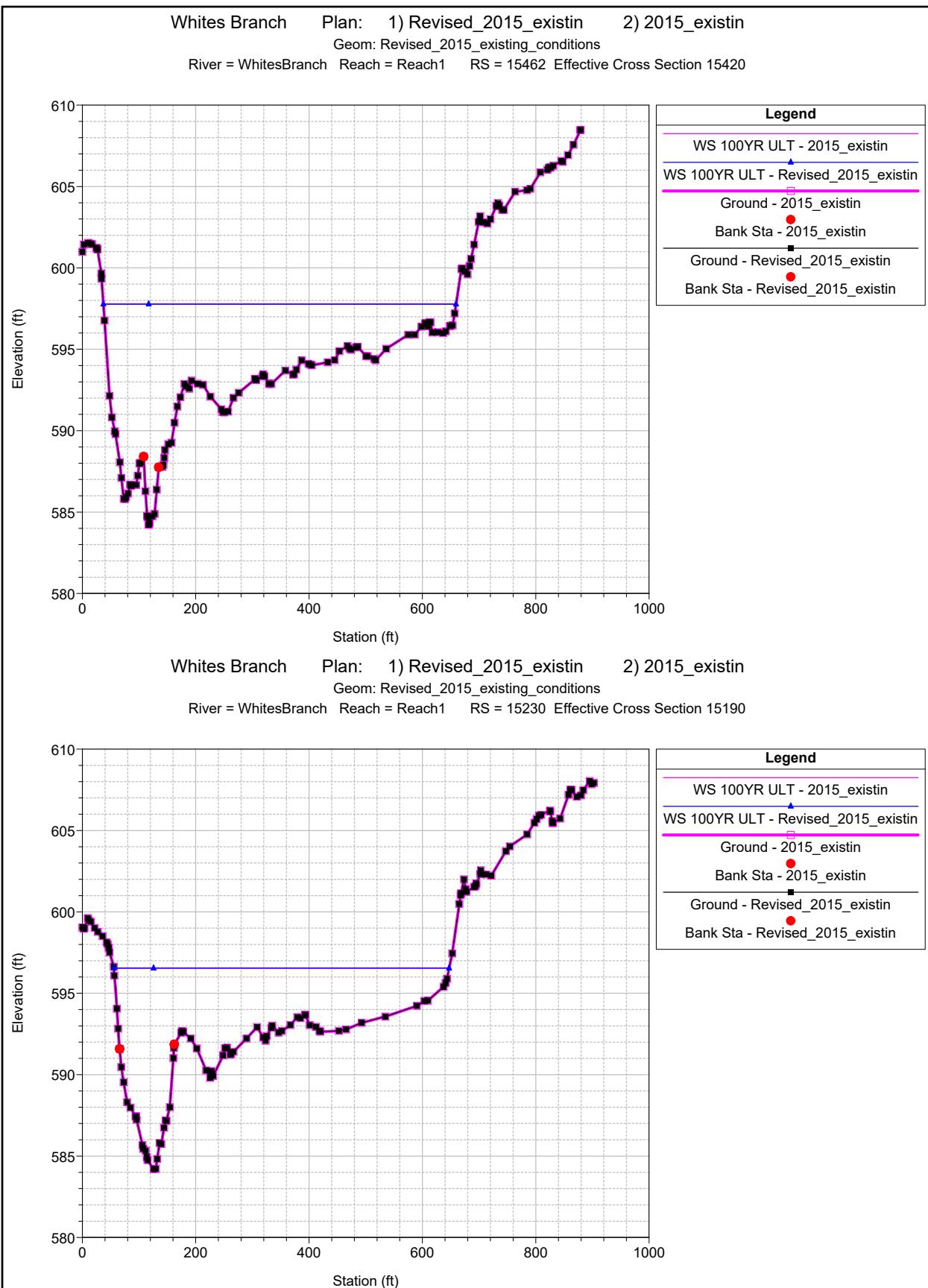


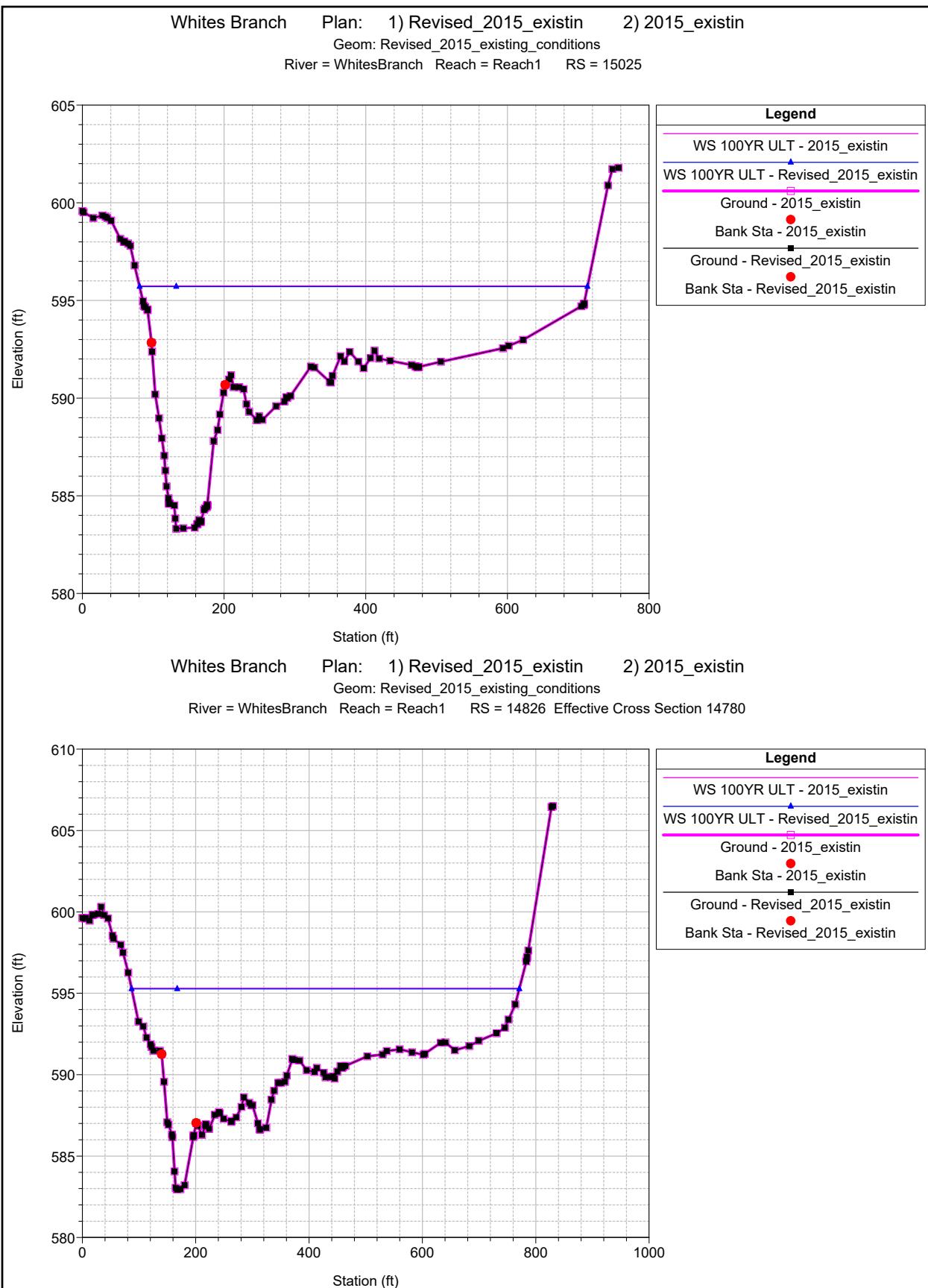


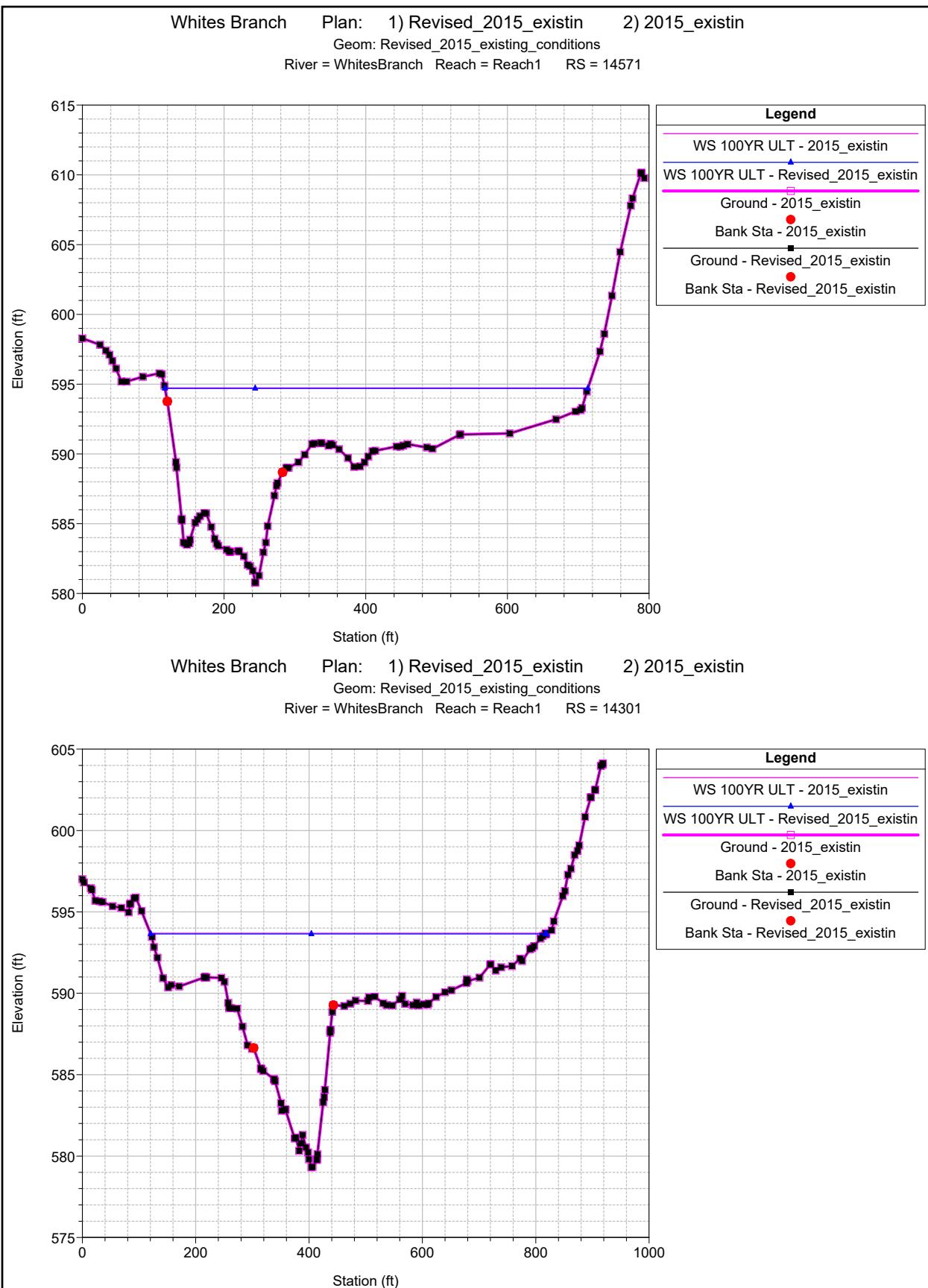


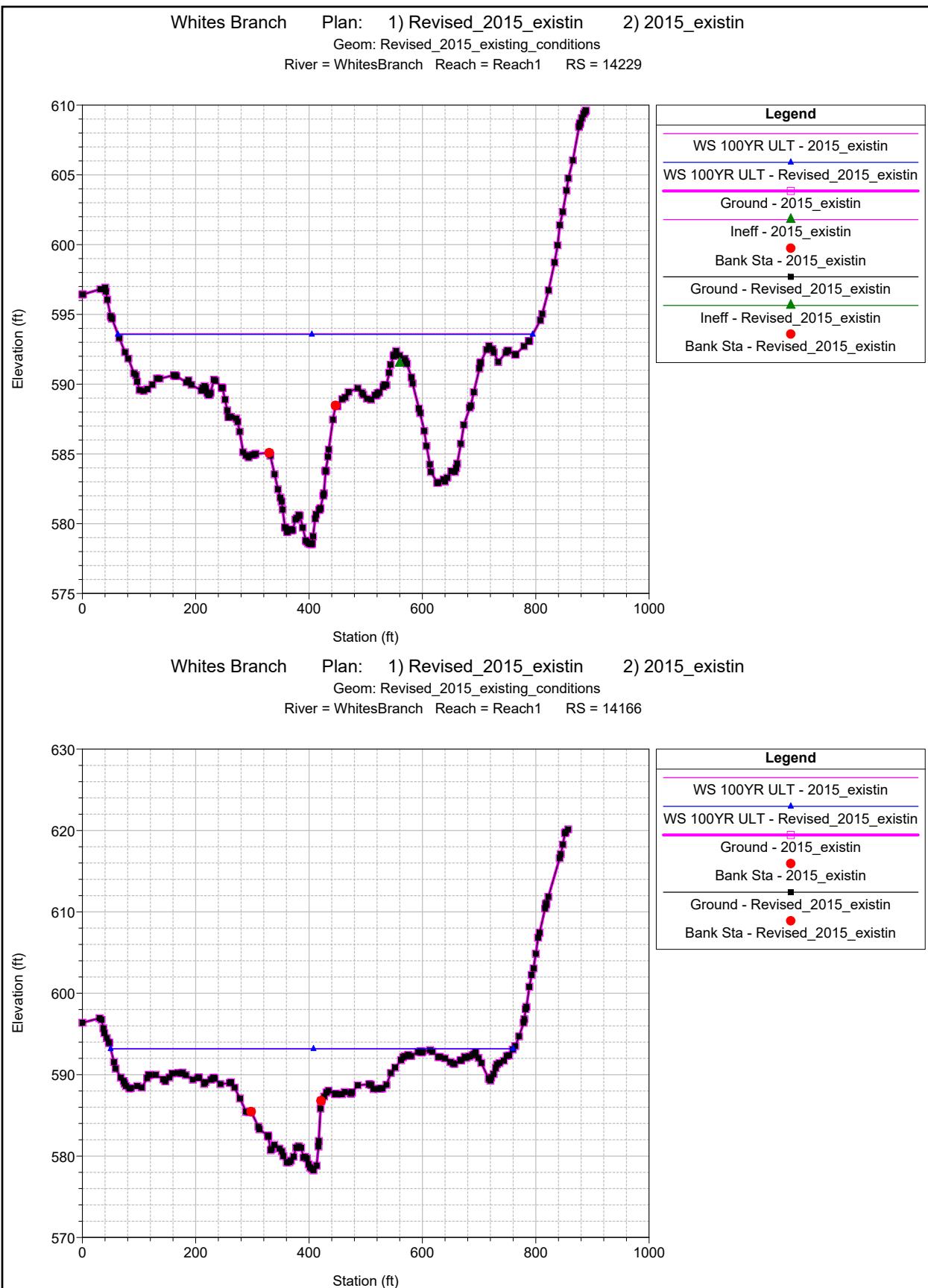


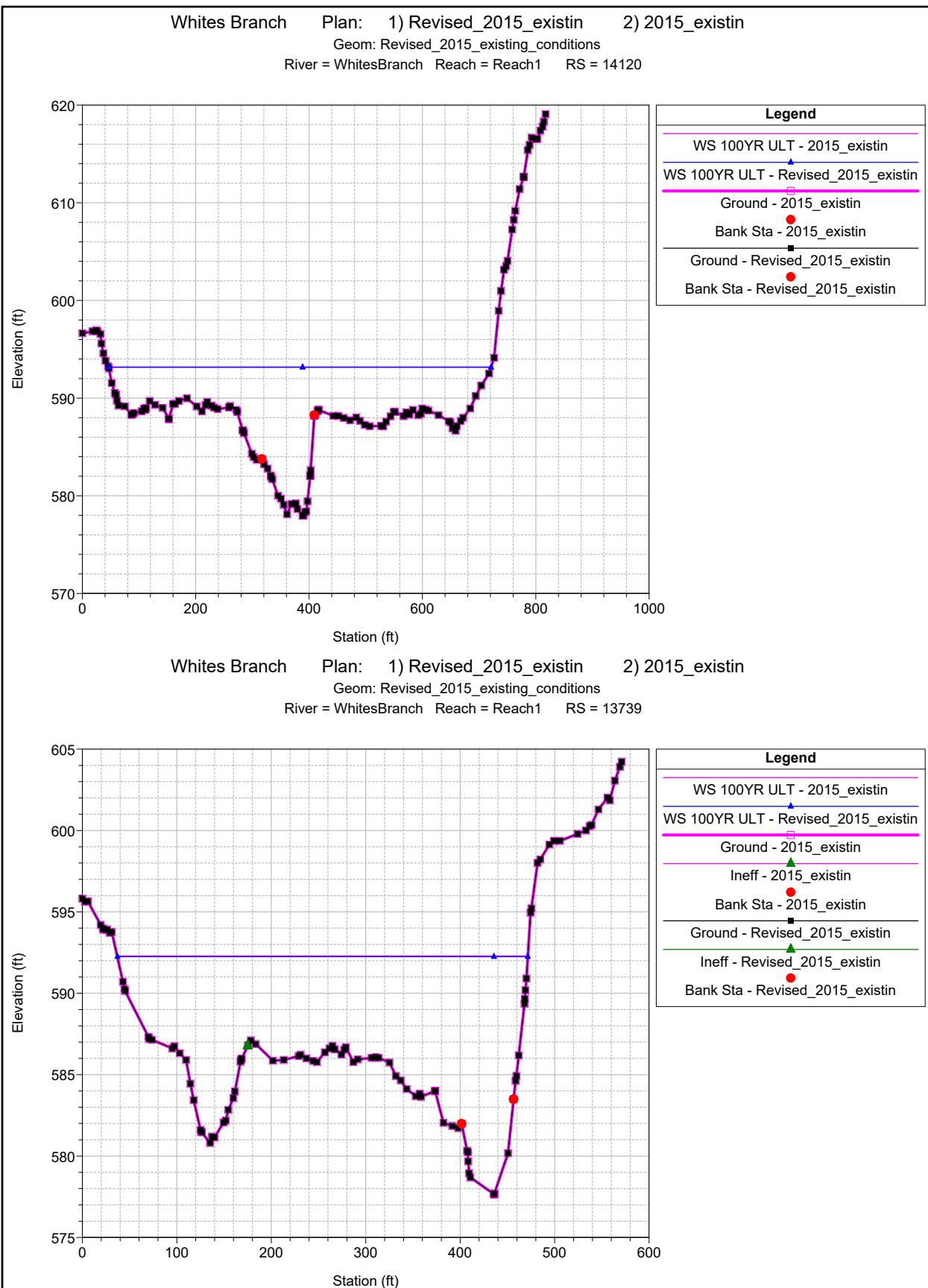


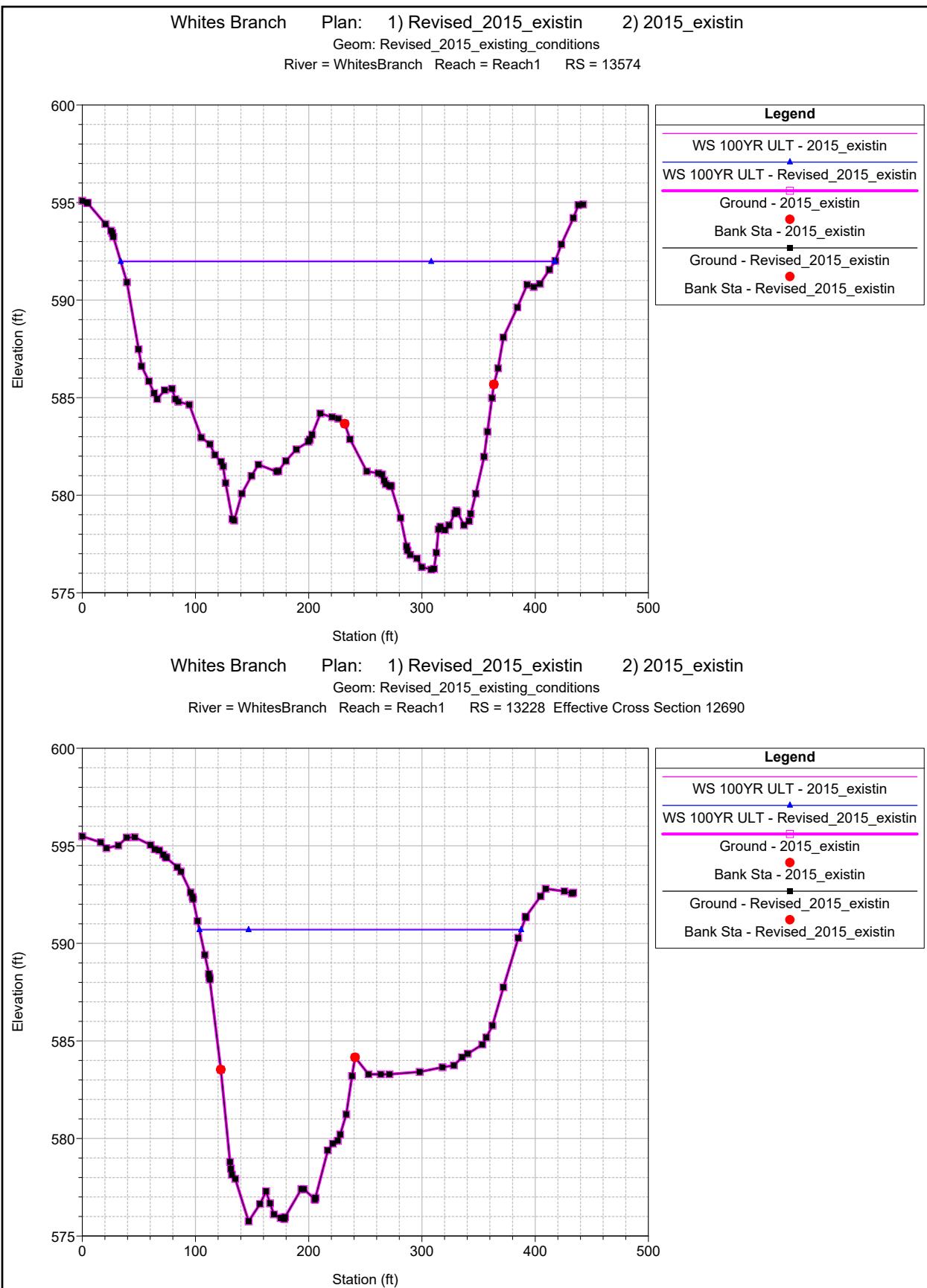


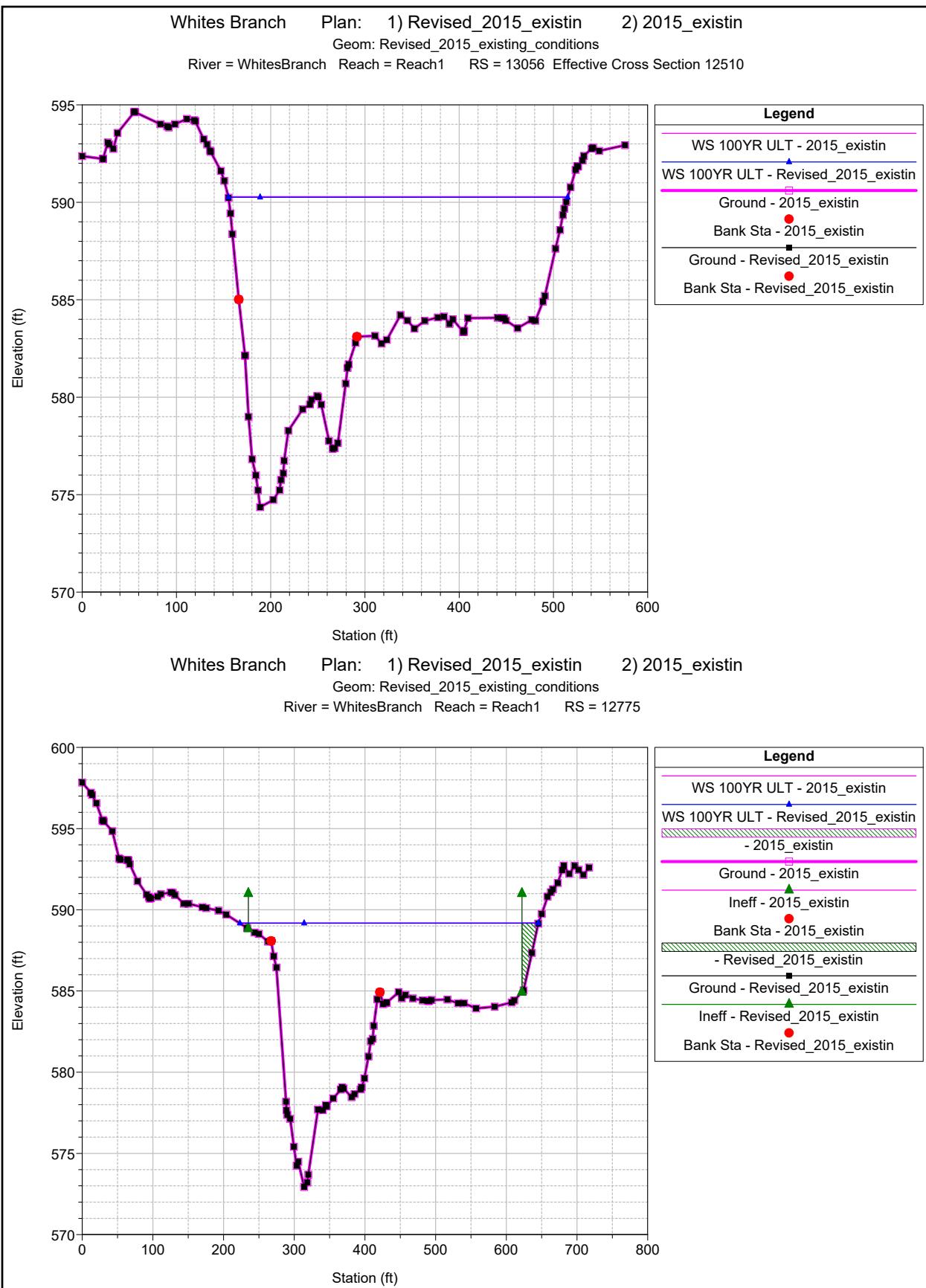


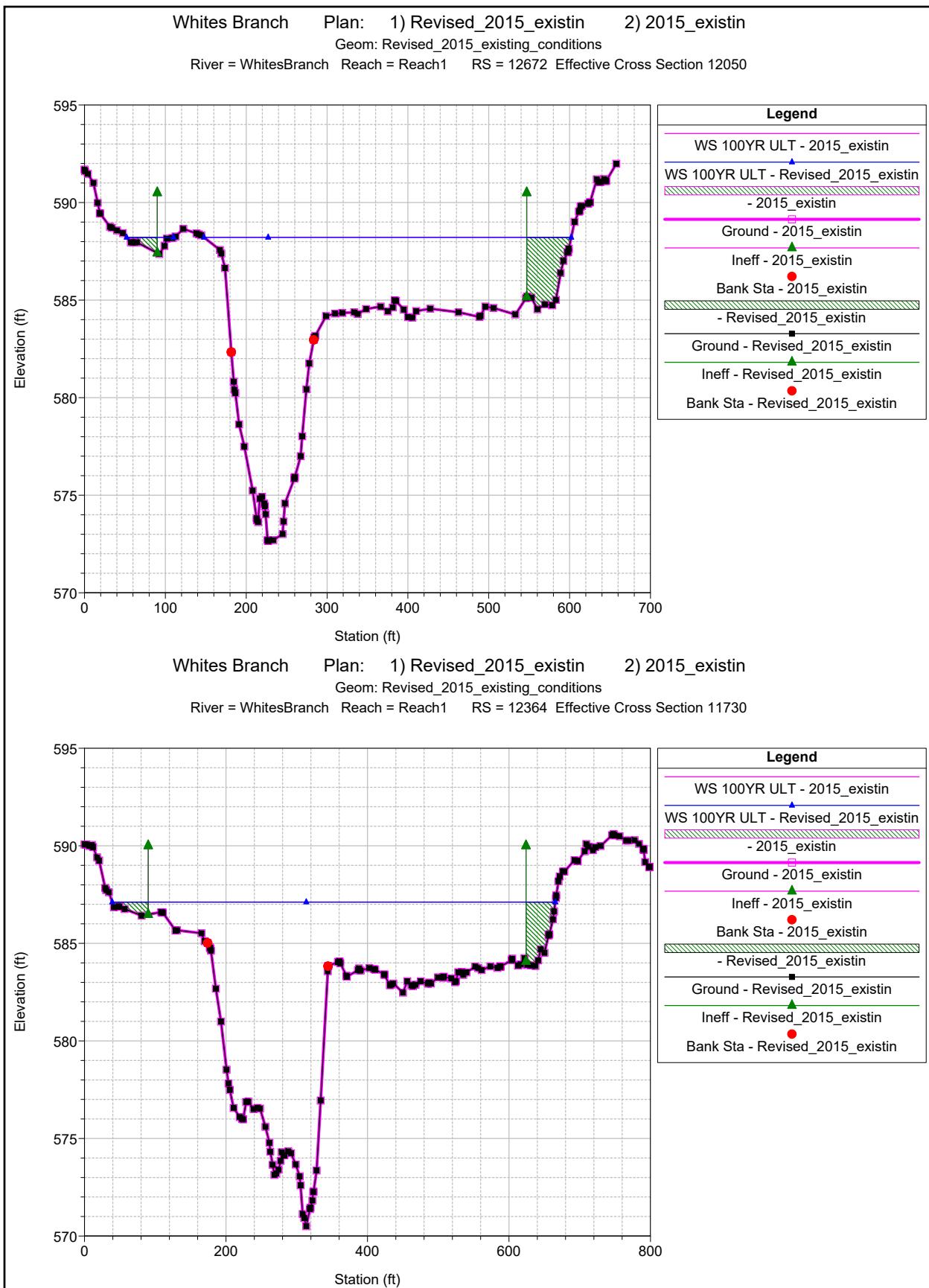


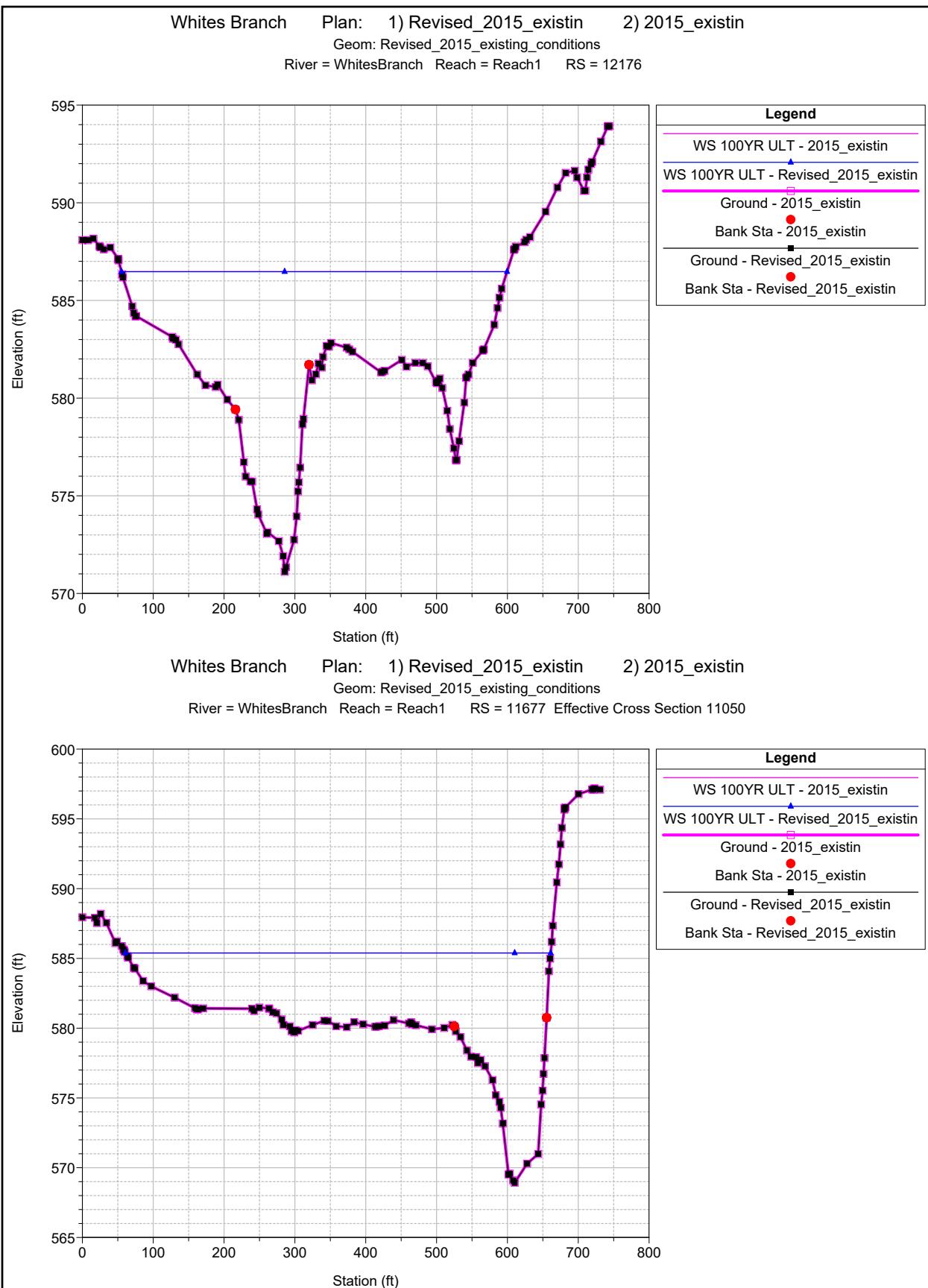




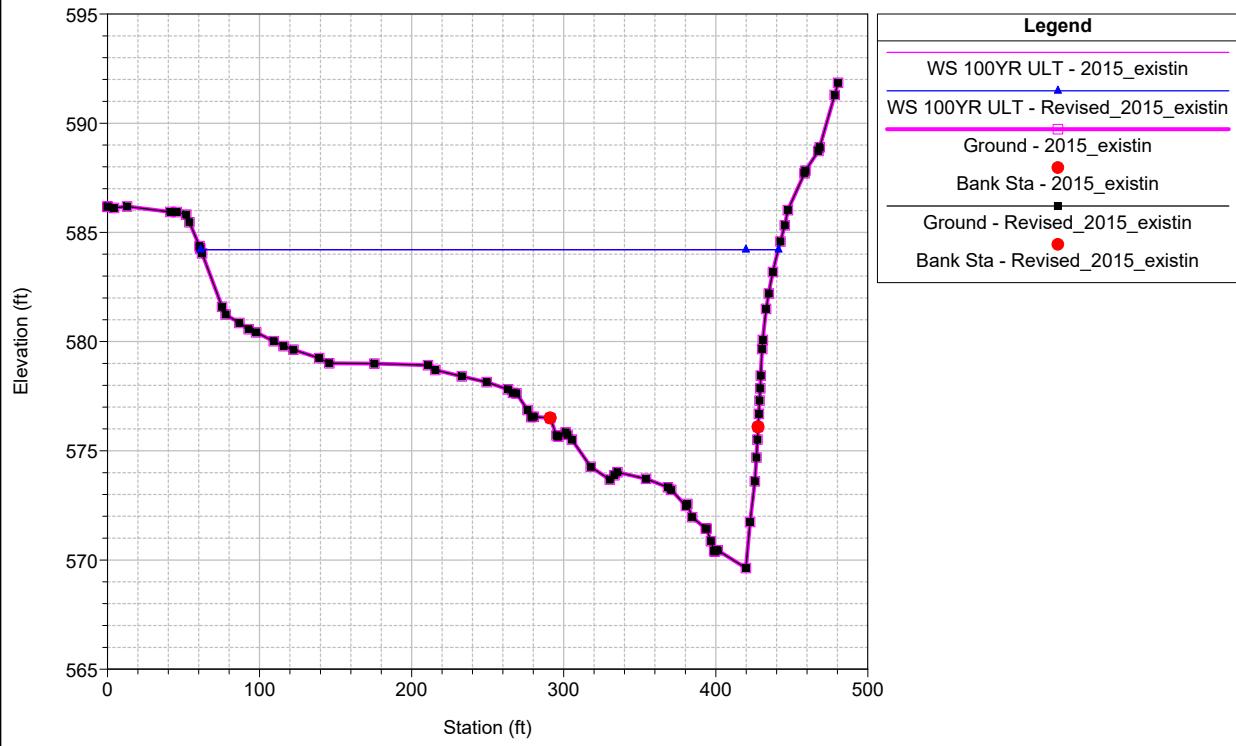








Whites Branch Plan: 1) Revised_2015_existin 2) 2015_existin
Geom: Revised_2015_existing_conditions
River = WhitesBranch Reach = Reach1 RS = 11381 Effective Cross Section 11780



Appendix L

REVISED EXISTING CONDITIONS HEC-RAS FLOW DATA



River	Reach	HMS Node	RS	Revised_MultiProfile Flow File							
				2YR	10YR	25YR	50YR	100YR	100YR ULT	100YR PLUS	500YR
WB-1	Reach1	J_WB1_010	15081	100	200	250	300	325	475	500	525
WB-1	Reach1	J_WB1_015	14786	250	450	575	675	775	1050	1050	1100
WB-1	Reach1	J_WB1_020	14044	400	750	950	1100	1300	1650	1750	1950
WB-1	Reach1	J_WB1_030	12883	450	925	1175	1375	1600	1975	2200	2400
WB-1	Reach1	J_WB1_040	10945	475	1175	1500	1800	2025	2425	2800	2950
WB-1	Reach1	J_WB1_050	9338	450	1225	1575	1850	2125	2525	2900	3050
WB-1	Reach1	J_WB1_WB1B	8382	1100	2550	3225	3750	4250	4775	5800	5925
WB-1	Reach1	J_WB1_060	7579	1100	2625	3325	3875	4400	4925	6000	6100
WB-1	Reach1	J_WB1_WB1A	6899	1525	3375	4275	5000	5675	6225	7700	7875
WB-1	Reach1	J_WB1_080	3146	1600	3400	4400	5225	6125	6675	8500	8600

River	Reach	HMS Node	RS	Revised_MultiProfile Flow File							
				2YR	10YR	25YR	50YR	100YR	100YR ULT	100YR PLUS	500YR
WB3	Reach1	J_WB3_020	17645	475	750	900	1000	1125	1125	1450	1775
WB3	Reach1	J_WB3_040	17049	550	875	1075	1200	1375	1425	1800	2075
WB3	Reach1	J_WB3_050	15531	750	1225	1500	1725	1950	2025	2600	2925
WB3	Reach1	J_WB3_060	11981	850	1450	1800	2100	2375	2450	3300	3450
WB3	Reach1	J_WB3_WB3D	10160	1525	2750	3375	3900	4450	4625	6200	6400
WB3	Reach1	J_WB3_070	9477	1525	2750	3400	3900	4450	4650	6200	6425
WB3	Reach1	J_WB3_WB3C	8749	1625	2925	3600	4175	4775	5025	6700	6825
WB3	Reach1	J_WB3_080	7877	1625	2950	3625	4225	4825	5100	6700	6875
WB3	Reach1	J_WB3_090	5949	1625	2975	3675	4250	4900	5175	6900	6925
WB3	Reach1	J_WB3_WB3B	5340	1900	3600	4475	5250	6050	6400	8500	8625
WB3	Reach1	J_WB3_100	4978	1925	3625	4525	5325	6150	6525	8600	8725
WB3	Reach1	J_WB3_110	3736	1950	3700	4625	5425	6275	6650	8700	8850
WB3	Reach1	J_WB3_WB3A	3319	2000	3825	4800	5650	6550	6975	9000	9175
WB3	Reach1	J_WB3_120	2326	2025	3850	4850	5700	6625	7050	9100	9250

River	Reach	HMS Node	RS	Revised_MultiProfile Flow File							
				2YR	10YR	25YR	50YR	100YR	100YR ULT	100YR PLUS	500YR
WhitesBranch	Reach1	J_WHT_010	42344	375	625	750	875	975	1100	1300	1375
WhitesBranch	Reach1	J_WHT_020	39559	600	1000	1225	1375	1575	1725	2000	2050
WhitesBranch	Reach1	J_WHT_050	37621	675	1125	1400	1600	1825	2025	2300	2400
WhitesBranch	Reach1	J_WHT_055	35669	725	1250	1575	1800	2075	2300	2700	2750
WhitesBranch	Reach1	J_WHT_060	32372	800	1450	1825	2150	2525	2775	3500	3475
WhitesBranch	Reach1	J_WHT_WB1	31188	2425	4800	6175	7300	8575	9350	11600	11800
WhitesBranch	Reach1	J_WHT_070	30123	2450	4850	6225	7350	8450	9175	11400	11625
WhitesBranch	Reach1	J_WHT_080	28549	2450	4850	6250	7400	8500	9225	11400	11650
WhitesBranch	Reach1	J_WHT_WB2	27561	2725	5300	6800	8075	9175	9900	12300	12475
WhitesBranch	Reach1	J_WHT_090	25383	2700	5325	6875	8150	9325	10000	12500	12625
WhitesBranch	Reach1	J_WHT_WB3	23838	4050	7750	10250	12125	14175	14575	19300	19325
WhitesBranch	Reach1	J_WHT_100	19109	4125	8125	10725	12775	14975	15450	20200	20350
WhitesBranch	Reach1	J_WHT_120	12364	4200	8350	11050	13200	15500	16050	21000	21100

Appendix M

REVISED EXISTING CONDITIONS HEC-HMS RESULTS



Existing Conditions			Revised Existing Conditions			Change	
ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	Basin Area (sq. mi.)	Peak Flow (CFS)
B_WB1_010	0.075	518.1	B_WB1_010	0.075	524.8	0	6.7
B_WB1_015	0.246	898.2	B_WB1_015	0.246	911.4	0	13.2
B_WB1_020	0.155	1092.2	B_WB1_020	0.155	1092.2	0	0
B_WB1_030	0.08	527.3	B_WB1_030	0.08	529.3	0	2
B_WB1_040	0.16	999.2	B_WB1_040	0.16	999.2	0	0
B_WB1_050	0.065	508.5	B_WB1_050	0.065	508.5	0	0
B_WB1_060	0.017	103.7	B_WB1_060	0.017	103.7	0	0
B_WB1_070	0.074	486.2	B_WB1_070	0.074	486.2	0	0
B_WB1_080	0.392	1317.8	B_WB1_080	0.392	1317.8	0	0
B_WB1A_010	0.284	1696	B_WB1A_010	0.284	1696	0	0
B_WB1A_015	0.057	471.5	B_WB1A_015	0.057	471.5	0	0
B_WB1A_020	0.083	629.8	B_WB1A_020	0.083	640.1	0	10.3
B_WB1B_010	0.103	675.6	B_WB1B_010	0.103	675.6	0	0
B_WB1B_020	0.286	1273.2	B_WB1B_020	0.286	1273.2	0	0
B_WB1B_030	0.149	837.3	B_WB1B_030	0.149	837.3	0	0
B_WB1B_040	0.126	722.7	B_WB1B_040	0.126	722.7	0	0
B_WB1B_050	0.012	102.7	B_WB1B_050	0.012	102.7	0	0
B_WB2_010	0.09	756.4	B_WB2_010	0.09	756.4	0	0
B_WB2_020	0.154	856.7	B_WB2_020	0.154	856.7	0	0
B_WB2_030	0.148	958.9	B_WB2_030	0.148	958.9	0	0
B_WB2_040	0.148	1107.7	B_WB2_040	0.148	1107.7	0	0
B_WB2_050	0.144	981.2	B_WB2_050	0.144	981.2	0	0
B_WB3_010	0.119	1238.8	B_WB3_010	0.119	1238.8	0	0
B_WB3_020	0.031	195.3	B_WB3_020	0.031	195.3	0	0
B_WB3_030	0.178	1355.5	B_WB3_030	0.178	1355.5	0	0
B_WB3_040	0.161	599.1	B_WB3_040	0.161	599.1	0	0
B_WB3_050	0.175	977.4	B_WB3_050	0.175	977.4	0	0
B_WB3_060	0.205	701.9	B_WB3_060	0.205	701.9	0	0
B_WB3_070	0.026	263.3	B_WB3_070	0.026	263.3	0	0
B_WB3_080	0.062	528.5	B_WB3_080	0.062	528.5	0	0
B_WB3_090	0.044	273.9	B_WB3_090	0.044	273.9	0	0
B_WB3_100	0.092	612.4	B_WB3_100	0.092	612.4	0	0
B_WB3_110	0.107	655.3	B_WB3_110	0.107	655.3	0	0
B_WB3_120	0.072	427.3	B_WB3_120	0.072	427.3	0	0
B_WB3A_010	0.187	1260.7	B_WB3A_010	0.187	1260.7	0	0
B_WB3A_020	0.0351	250	B_WB3A_020	0.0351	250	0	0
B_WB3B_010	0.164	1137.3	B_WB3B_010	0.164	1137.3	0	0
B_WB3B_020	0.088	634.1	B_WB3B_020	0.088	634.1	0	0
B_WB3B_030	0.153	790.2	B_WB3B_030	0.153	790.2	0	0
B_WB3C_010	0.084	623.2	B_WB3C_010	0.084	623.2	0	0
B_WB3C_020	0.103	760.4	B_WB3C_020	0.103	760.4	0	0
B_WB3D_010	0.075	416	B_WB3D_010	0.075	416	0	0
B_WB3D_020	0.116	865.5	B_WB3D_020	0.116	865.5	0	0
B_WB3D_030	0.241	1429.7	B_WB3D_030	0.241	1429.7	0	0
B_WB3D_040	0.051	222.8	B_WB3D_040	0.051	222.8	0	0
B_WB3D_050	0.054	223.2	B_WB3D_050	0.054	223.2	0	0
B_WB3D_070	0.158	960.8	B_WB3D_070	0.158	960.8	0	0
B_WHT_010	0.332	1373.2	B_WHT_010	0.332	1378.7	0	5.5
B_WHT_015	0.203	1253.4	B_WHT_015	0.203	1253.4	0	0
B_WHT_020	0.132	815.7	B_WHT_020	0.132	815.7	0	0
B_WHT_040	0.119	516.9	B_WHT_040	0.119	530.8	0	13.9
B_WHT_045	0.033	170.9	B_WHT_045	0.033	170.9	0	0
B_WHT_050	0.038	247.3	B_WHT_050	0.038	247.3	0	0
B_WHT_055	0.139	661.2	B_WHT_055	0.139	664.5	0	3.3
B_WHT_060	0.307	1643.2	B_WHT_060	0.307	1643.2	0	0

Existing Conditions			Revised Existing Conditions			Change	
ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	Basin Area (sq. mi.)	Peak Flow (CFS)
B_WHT_070	0.196	1172.5	B_WHT_070	0.196	1172.5	0	0
B_WHT_080	0.065	491.2	B_WHT_080	0.065	491.2	0	0
B_WHT_090	0.276	1243.3	B_WHT_090	0.276	1243.3	0	0
B_WHT_100	0.615	2593.5	B_WHT_100	0.615	2593.5	0	0
B_WHT_110	0.418	2345.8	B_WHT_110	0.418	2345.8	0	0
B_WHT_120	0.9	4138.8	B_WHT_120	0.9	4138.8	0	0
B_WHT_130	0.786	3227.4	B_WHT_130	0.786	3237.4	0	10
--	--	--	DB-1	0.246	911.4	--	--
--	--	--	DB-10	0.205	701.9	--	--
--	--	--	DB-11	0.062	528.5	--	--
--	--	--	DB-13	0.09	756.4	--	--
--	--	--	DB-16	0.057	471.5	--	--
--	--	--	DB-20	0.148	1107.7	--	--
--	--	--	DB-23	0.144	981.2	--	--
--	--	--	DB-24	0.065	491.2	--	--
--	--	--	DB-25	0.196	1172.5	--	--
--	--	--	DB-4 and DB-5	0.155	1092.2	--	--
--	--	--	DB-6	0.075	524.8	--	--
--	--	--	DB-7	0.119	1238.8	--	--
J_WB1_010	0.075	518.1	J_WB1_010	0.075	524.8	0	6.7
J_WB1_015	0.321	1065	J_WB1_015	0.321	1080.4	0	15.4
J_WB1_020	0.476	1896.2	J_WB1_020	0.476	1934.3	0	38.1
J_WB1_030	0.556	2362	J_WB1_030	0.556	2399.6	0	37.6
J_WB1_040	0.716	2910.5	J_WB1_040	0.716	2933	0	22.5
J_WB1_050	0.781	3015.7	J_WB1_050	0.781	3031.8	0	16.1
J_WB1_060	1.548	6070.4	J_WB1_060	1.548	6093.2	0	22.8
J_WB1_070	0.074	486.2	J_WB1_070	0.074	486.2	0	0
J_WB1_080	2.364	8567.4	J_WB1_080	2.364	8592.3	0	24.9
J_WB1_WB1A	1.972	7853.4	J_WB1_WB1A	1.972	7874.5	0	21.1
J_WB1_WB1B	1.457	5904.2	J_WB1_WB1B	1.457	5929.3	0	25.1
J_WB1A_010	0.284	1696	J_WB1A_010	0.284	1696	0	0
J_WB1A_015	0.341	1726.7	J_WB1A_015	0.341	1762.4	0	35.7
J_WB1A_020	0.424	1947.9	J_WB1A_020	0.424	1941.9	0	-6
J_WB1B_010	0.103	675.6	J_WB1B_010	0.103	675.6	0	0
J_WB1B_020	0.538	2666.3	J_WB1B_020	0.538	2666.3	0	0
J_WB1B_040	0.664	2923.2	J_WB1B_040	0.664	2923.2	0	0
J_WB1B_050	0.676	2932	J_WB1B_050	0.676	2932	0	0
J_WB2_010	0.09	756.4	J_WB2_010	0.09	756.4	0	0
J_WB2_020	0.244	1509.3	J_WB2_020	0.244	1509.3	0	0
J_WB2_030	0.392	1825.9	J_WB2_030	0.392	1825.9	0	0
J_WB2_040	0.54	2191.6	J_WB2_040	0.54	2191.6	0	0
J_WB2_050	0.684	2923	J_WB2_050	0.684	2923	0	0
J_WB3_010	0.119	282.8	J_WB3_010	0.119	282.8	0	0
J_WB3_020	0.328	1785.8	J_WB3_020	0.328	1785.8	0	0
J_WB3_030	0.178	1355.5	J_WB3_030	0.178	1355.5	0	0
J_WB3_040	0.489	2067.2	J_WB3_040	0.489	2067.2	0	0
J_WB3_050	0.664	2928	J_WB3_050	0.664	2929.3	0	1.3
J_WB3_060	0.869	3440.4	J_WB3_060	0.869	3444.4	0	4
J_WB3_070	1.59	6407.6	J_WB3_070	1.59	6415.2	0	7.6
J_WB3_080	1.839	6872.9	J_WB3_080	1.839	6883.7	0	10.8
J_WB3_090	1.883	6917.3	J_WB3_090	1.883	6929.8	0	12.5
J_WB3_100	2.38	8653.4	J_WB3_100	2.38	8731	0	77.6
J_WB3_110	2.487	8760.9	J_WB3_110	2.487	8843.1	0	82.2
J_WB3_120	2.7811	9153	J_WB3_120	2.7811	9238.8	0	85.8
J_WB3_WB3A	2.7091	9076.7	J_WB3_WB3A	2.7091	9173.8	0	97.1

Existing Conditions			Revised Existing Conditions			Change	
ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	Basin Area (sq. mi.)	Peak Flow (CFS)
J_WB3_WB3B	2.288	8575.3	J_WB3_WB3B	2.288	8617	0	41.7
J_WB3_WB3C	1.777	6809.8	J_WB3_WB3C	1.777	6821.9	0	12.1
J_WB3_WB3D	1.564	6398.2	J_WB3_WB3D	1.564	6406.8	0	8.6
J_WB3A_010	0.187	1260.7	J_WB3A_010	0.187	1260.7	0	0
J_WB3A_020	0.2221	1373	J_WB3A_020	0.2221	1373	0	0
J_WB3B_010	0.164	1137.3	J_WB3B_010	0.164	1137.3	0	0
J_WB3B_020	0.252	1428.5	J_WB3B_020	0.252	1428.5	0	0
J_WB3B_030	0.405	1897.1	J_WB3B_030	0.405	1897.1	0	0
J_WB3C_010	0.084	623.2	J_WB3C_010	0.084	623.2	0	0
J_WB3C_020	0.187	1349.2	J_WB3C_020	0.187	1349.2	0	0
J_WB3D_010	0.075	416	J_WB3D_010	0.075	416	0	0
J_WB3D_020	0.191	1003.8	J_WB3D_020	0.191	1003.8	0	0
J_WB3D_030	0.241	1429.7	J_WB3D_030	0.241	1429.7	0	0
J_WB3D_040	0.292	1620	J_WB3D_040	0.292	1620	0	0
J_WB3D_070	0.695	3407.3	J_WB3D_070	0.695	3407.3	0	0
J_WB3D_WB3D_040	0.537	2633.4	J_WB3D_WB3D_040	0.537	2633.4	0	0
J_WHT_010	0.332	1373.2	J_WHT_010	0.332	1378.7	0	5.5
J_WHT_020	0.667	2056.2	J_WHT_020	0.667	2062.1	0	5.9
J_WHT_050	0.857	2390.4	J_WHT_050	0.857	2402.7	0	12.3
J_WHT_055	0.996	2796.8	J_WHT_055	0.996	2758.8	0	-38
J_WHT_060	1.303	3605.7	J_WHT_060	1.303	3465.5	0	-140.2
J_WHT_070	3.863	11586.2	J_WHT_070	3.863	11616.4	0	30.2
J_WHT_080	3.928	11628.1	J_WHT_080	3.928	11658.9	0	30.8
J_WHT_090	4.888	12607.1	J_WHT_090	4.888	12637.1	0	30
J_WHT_100	8.7021	20425.9	J_WHT_100	8.7021	20342.6	0	-83.3
J_WHT_110	0.418	2345.8	J_WHT_110	0.418	2345.8	0	0
J_WHT_120	9.6021	21182.2	J_WHT_120	9.6021	21104.1	0	-78.1
J_WHT_130	10.3881	21368.7	J_WHT_130	10.3881	21293.5	0	-75.2
J_WHT_WB1	3.667	11777.7	J_WHT_WB1	3.667	11799.4	0	21.7
J_WHT_WB2	4.612	12443.9	J_WHT_WB2	4.612	12473.5	0	29.6
J_WHT_WB3	7.6691	19469.1	J_WHT_WB3	7.6691	19326.6	0	-142.5
Merwick Pond	0.119	282.8	Merwick Pond	0.119	282.8	0	0
R_WB1_020	0.321	1062.1	R_WB1_020	0.321	1077.7	0	15.6
R_WB1_030	0.476	1886.2	R_WB1_030	0.476	1922.3	0	36.1
R_WB1_040	0.556	2279.7	R_WB1_040	0.556	2311.9	0	32.2
R_WB1_050	0.716	2887	R_WB1_050	0.716	2906.3	0	19.3
R_WB1_060	1.457	5876.5	R_WB1_060	1.457	5901.8	0	25.3
R_WB1_080	1.972	7407.8	R_WB1_080	1.972	7428.4	0	20.6
R_WB1A_015	0.284	1563.1	R_WB1A_015	0.284	1586.5	0	23.4
R_WB1A_020	0.341	1712.3	R_WB1A_020	0.341	1736.6	0	24.3
R_WB1B_020	0.103	659.5	R_WB1B_020	0.103	659.5	0	0
R_WB1B_040	0.538	2539.5	R_WB1B_040	0.538	2539.5	0	0
R_WB1B_050	0.664	2915.4	R_WB1B_050	0.664	2915.4	0	0
R_WB2_020	0.09	656.5	R_WB2_020	0.09	656.5	0	0
R_WB2_030	0.244	1392.1	R_WB2_030	0.244	1392.1	0	0
R_WB2_040	0.392	1820.2	R_WB2_040	0.392	1820.2	0	0
R_WB2_050	0.54	2171	R_WB2_050	0.54	2171	0	0
R_WB3_020	0.119	282.8	R_WB3_020	0.119	282.8	0	0
R_WB3_050	0.489	1973	R_WB3_050	0.489	1973.8	0	0.8
R_WB3_060	0.664	2762.9	R_WB3_060	0.664	2766.8	0	3.9
R_WB3_070	1.564	6377.7	R_WB3_070	1.564	6385.3	0	7.6
R_WB3_080	1.777	6787.8	R_WB3_080	1.777	6798.7	0	10.9
R_WB3_090	1.839	6835.6	R_WB3_090	1.839	6848.1	0	12.5
R_WB3_100	2.288	8516.8	R_WB3_100	2.288	8587.8	0	71
R_WB3_110	2.38	8599.7	R_WB3_110	2.38	8674.5	0	74.8

Existing Conditions			Revised Existing Conditions			Change	
ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	ArcGIS Sub-basin Name	Basin Area (sq. mi.)	Peak Flow (CFS)	Basin Area (sq. mi.)	Peak Flow (CFS)
R_WB3_120	2.7091	9060.3	R_WB3_120	2.7091	9146.1	0	85.8
R_WB3A_001	0.187	1200.7	R_WB3A_001	0.187	1200.7	0	0
R_WB3B_020	0.164	1059.8	R_WB3B_020	0.164	1059.8	0	0
R_WB3B_030	0.252	1323.6	R_WB3B_030	0.252	1323.6	0	0
R_WB3C_020	0.084	607.6	R_WB3C_020	0.084	607.6	0	0
R_WB3D_020	0.075	400.9	R_WB3D_020	0.075	400.9	0	0
R_WB3D_040	0.241	1416.8	R_WB3D_040	0.241	1416.8	0	0
R_WB3D_070	0.537	2614.8	R_WB3D_070	0.537	2614.8	0	0
R_WHT_020	0.332	1347.2	R_WHT_020	0.332	1352.8	0	5.6
R_WHT_050	0.667	2053.8	R_WHT_050	0.667	2059.6	0	5.8
R_WHT_055	0.857	2386.2	R_WHT_055	0.857	2395.1	0	8.9
R_WHT_060	0.996	2787.5	R_WHT_060	0.996	2752.2	0	-35.3
R_WHT_070	3.667	11417.1	R_WHT_070	3.667	11447.4	0	30.3
R_WHT_080	3.863	11582.3	R_WHT_080	3.863	11613.2	0	30.9
R_WHT_090	4.612	12342.7	R_WHT_090	4.612	12372.7	0	30
R_WHT_100	7.6691	19120.9	R_WHT_100	7.6691	19002.7	0	-118.2
R_WHT_120	8.7021	20364.2	R_WHT_120	8.7021	20271.9	0	-92.3
R_WHT_130	9.6021	20822.5	R_WHT_130	9.6021	20744.2	0	-78.3
Sagestone	0.203	453.4	Sagestone	0.203	453.4	0	0
Weekly Residential N.	0.119	380.8	Weekly Residential N.	0.119	394	0	13.2
Weekly Residential S.	0.152	309.9	Weekly Residential S.	0.152	316.3	0	6.4

Appendix N

REVISED EXISTING CONDITIONS HEC-RAS RESULTS



River Sta	Profile	2015		Revised		Change	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
15081	100YR ULT	475	738.72	475	738.72	0	0.00
15059	100YR ULT	475	738.54	475	738.59	0	0.05
15005	100YR ULT	475	738.63	475	738.67	0	0.04
14932	Culvert		Culvert				0.00
14839	100YR ULT	475	734.37	475	734.37		0.00
14816	100YR ULT	475	732.93	475	733.00	0	0.07
14786	100YR ULT	1025	732.16	1050	732.21		0.05
14736	100YR ULT	1025	731.68	1050	731.74	25	0.06
14686	100YR ULT	1025	731.32	1050	731.40	25	0.08
14620	100YR ULT	1025	731.01	1050	731.09	25	0.08
14554	100YR ULT	1025	731.00	1050	731.09		0.09
14520	100YR ULT	1025	730.83	1050	730.92	25	0.09
14487	Culvert		Culvert				0.00
14445	100YR ULT	1025	728.43	1050	728.44	25	0.01
14394	100YR ULT	1025	728.46	1050	728.46	25	0.00
14305	100YR ULT	1025	728.35	1050	728.36	25	0.01
14221	100YR ULT	1025	728.27	1050	728.26	25	-0.01
14171	100YR ULT	1025	728.30	1050	728.30		0.00
14044	100YR ULT	1650	728.25	1650	728.25	0	0.00
13918	100YR ULT	1650	728.03	1650	728.03	0	0.00
13887	Inl Struct		Inl Struct				0.00
13864	100YR ULT	1650	725.28	1650	725.28	0	0.00
13851	100YR ULT	1650	724.45	1650	724.45		0.00
13793	100YR ULT	1650	723.22	1650	723.22	0	0.00
13752	100YR ULT	1650	722.56	1650	722.56	0	0.00
13716	100YR ULT	1650	721.34	1650	721.34	0	0.00
13662	100YR ULT	1650	720.49	1650	720.49	0	0.00
13560	100YR ULT	1650	720.21	1650	720.21	0	0.00
13224	100YR ULT	1650	719.57	1650	719.57	0	0.00
13090	100YR ULT	1650	719.51	1650	719.51	0	0.00
12883	100YR ULT	1975	719.42	1975	719.42	0	0.00
12589	100YR ULT	1975	719.25	1975	719.25	0	0.00
12549	Inl Struct		Inl Struct				0.00
12223	100YR ULT	1975	711.40	1975	711.40	0	0.00
11952	100YR ULT	1975	709.55	1975	709.54	0	-0.01
11661	100YR ULT	1975	707.57	1975	707.58	0	0.01
11376	100YR ULT	1975	705.52	1975	705.52	0	0.00
11126	100YR ULT	1975	704.38	1975	704.40	0	0.02
10945	100YR ULT	2400	703.88	2425	703.92	25	0.04
10750	100YR ULT	2400	703.74	2425	703.77	25	0.03
10667	100YR ULT	2400	703.66	2425	703.69	25	0.03
10604	100YR ULT	2400	703.23	2425	703.26	25	0.03
10521	Culvert		Culvert				0.00
10435	100YR ULT	2400	699.42	2425	699.43	25	0.01
10311	100YR ULT	2400	697.83	2425	697.86	25	0.03
10083	100YR ULT	2400	695.39	2425	695.41	25	0.02
9779	100YR ULT	2400	694.72	2425	694.73	25	0.01
9676	100YR ULT	2400	694.46	2425	694.47	25	0.01
9641	Inl Struct		Inl Struct				0.00
9558	100YR ULT	2400	691.94	2425	691.95	25	0.01
9338	100YR ULT	2500	690.43	2525	690.45	25	0.02
8947	100YR ULT	2500	686.88	2525	686.89	25	0.01
8750	100YR ULT	2500	686.17	2525	686.19	25	0.02
8382	100YR ULT	4700	684.52	4775	684.56	75	0.04
7966	100YR ULT	4700	682.33	4775	682.33	75	0.00
7579	100YR ULT	4900	679.18	4925	679.21	25	0.03
7244	100YR ULT	4900	678.84	4925	678.89	25	0.05
6899	100YR ULT	6100	678.21	6225	678.27	125	0.06
6410	100YR ULT	6100	677.62	6225	677.70	125	0.08
6180	100YR ULT	6100	677.50	6225	677.58	125	0.08

River Sta	Profile	2015		Revised		Change	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
6101	100YR ULT	6100	677.34	6225	677.42	125	0.08
6051		Culvert		Culvert			0.00
5994	100YR ULT	6100	672.51	6225	672.58	125	0.07
5907	100YR ULT	6100	670.96	6225	671.02	125	0.06
5694	100YR ULT	6100	670.41	6225	670.47	125	0.06
5549	100YR ULT	6100	670.21	6225	670.26	125	0.05
5356	100YR ULT	6100	669.97	6225	670.02	125	0.05
5288	100YR ULT	6100	669.65	6225	669.70	125	0.05
5238		Inl Struct		Inl Struct			0.00
5194	100YR ULT	6100	667.93	6225	667.98	125	0.05
5142	100YR ULT	6100	667.83	6225	667.88	125	0.05
4816	100YR ULT	6100	666.25	6225	666.28	125	0.03
4673	100YR ULT	6100	665.68	6225	665.72	125	0.04
4475	100YR ULT	6100	663.93	6225	663.97	125	0.04
4239	100YR ULT	6100	662.77	6225	662.87	125	0.10
3962	100YR ULT	6100	662.41	6225	662.53	125	0.12
3831	100YR ULT	6100	662.31	6225	662.43	125	0.12
3533	100YR ULT	6100	662.05	6225	662.18	125	0.13
3403	100YR ULT	6100	661.71	6225	661.84	125	0.13
3319	100YR ULT	6100	661.36	6225	661.48	125	0.12
3275		Culvert		Culvert			0.00
3238	100YR ULT	6100	658.40	6225	658.41	125	0.01
3146	100YR ULT	6600	658.07	6675	658.09	75	0.02
2680	100YR ULT	6600	657.02	6675	657.04	75	0.02
2524	100YR ULT	6600	656.17	6675	656.18	75	0.01
2196	100YR ULT	6600	654.57	6675	654.61	75	0.04
1958	100YR ULT	6600	653.59	6675	653.61	75	0.02
1762	100YR ULT	6600	651.97	6675	652.00	75	0.03
1601	100YR ULT	6600	651.26	6675	651.28	75	0.02
1163	100YR ULT	6600	650.54	6675	650.56	75	0.02
667	100YR ULT	6600	649.18	6675	649.19	75	0.01
541	100YR ULT	6600	648.87	6675	648.88	75	0.01

River Sta	Profile	2015		Revised		Change	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
17645	100YR ULT	1125	708.24	1125	708.24	0	0.00
17433	100YR ULT	1125	706.71	1125	706.71	0	0.00
17431		Lat Struct		Lat Struct			0.00
17412	100YR ULT	1125	706.85	1125	706.85	0	0.00
17336		Culvert		Culvert			0.00
17231	100YR ULT	1125	705.13	1125	705.13	0	0.00
17185	100YR ULT	1125	705.14	1125	705.14	0	0.00
17049	100YR ULT	1425	703.46	1425	703.46	0	0.00
16934	100YR ULT	1425	703.08	1425	703.09	0	0.01
16881	100YR ULT	1425	702.54	1425	702.55	0	0.01
16682	100YR ULT	1425	701.09	1425	701.06	0	-0.03
16578	100YR ULT	1425	699.86	1425	699.89	0	0.03
16335	100YR ULT	1425	697.69	1425	697.70	0	0.01
16190	100YR ULT	1425	696.66	1425	696.65	0	-0.01
15722	100YR ULT	1425	693.18	1425	693.18	0	0.00
15531	100YR ULT	2000	691.83	2025	691.84	25	0.01
15272	100YR ULT	2000	690.72	2025	690.73	25	0.01
15119	100YR ULT	2000	690.06	2025	690.07	25	0.01
15068	100YR ULT	2000	689.72	2025	689.73	25	0.01
14868	100YR ULT	2000	688.53	2025	688.54	25	0.01
14619	100YR ULT	2000	686.82	2025	686.83	25	0.01
14397	100YR ULT	2000	685.48	2025	685.50	25	0.02
14114	100YR ULT	2000	684.41	2025	684.42	25	0.01
13931	100YR ULT	2000	683.71	2025	683.72	25	0.01
13564	100YR ULT	2000	682.34	2025	682.36	25	0.02
13167	100YR ULT	2000	680.83	2025	680.85	25	0.02
12864	100YR ULT	2000	679.23	2025	679.25	25	0.02
12648	100YR ULT	2000	677.81	2025	677.83	25	0.02
12281	100YR ULT	2000	676.59	2025	676.63	25	0.04
11981	100YR ULT	2400	674.24	2450	674.27	50	0.03
11729	100YR ULT	2400	672.07	2450	672.11	50	0.04
11482	100YR ULT	2400	670.38	2450	670.40	50	0.02
11245	100YR ULT	2400	668.61	2450	668.66	50	0.05
11115	100YR ULT	2400	668.51	2450	668.57	50	0.06
10866	100YR ULT	2400	666.90	2450	666.87	50	-0.03
10575	100YR ULT	2400	664.69	2450	664.78	50	0.09
10160	100YR ULT	4400	663.56	4625	663.68	225	0.12
9976	100YR ULT	4400	662.84	4625	662.96	225	0.12
9701	100YR ULT	4400	661.14	4625	661.24	225	0.10
9477	100YR ULT	4400	659.65	4650	659.75	250	0.10
9092	100YR ULT	4400	658.77	4650	658.88	250	0.11
8749	100YR ULT	4800	657.28	5025	657.41	225	0.13
8613	100YR ULT	4800	657.02	5025	657.16	225	0.14
8223	100YR ULT	4800	656.40	5025	656.54	225	0.14
7877	100YR ULT	4900	654.57	5100	654.74	200	0.17
7735	100YR ULT	4900	654.07	5100	654.23	200	0.16
7660	Ray White Road		Culvert		Culvert		0.00
7585	100YR ULT	4900	652.47	5100	652.51	200	0.04
7436	100YR ULT	4900	650.86	5100	651.01	200	0.15
7263	100YR ULT	4900	650.30	5100	650.40	200	0.10
6908	100YR ULT	4900	648.95	5100	649.02	200	0.07
5949	100YR ULT	5000	647.76	5175	647.87	175	0.11
5340	100YR ULT	6200	646.36	6400	646.50	200	0.14
5163	100YR ULT	6200	645.99	6400	646.15	200	0.16
4978	100YR ULT	6300	645.18	6525	645.40	225	0.22
4933	100YR ULT	6300	644.14	6525	644.45	225	0.31
4829	100YR ULT	6300	643.90	6525	644.20	225	0.30
4720	N. Tarrant Parkw		Culvert		Culvert		0.00
4597	100YR ULT	6300	641.70	6525	641.79	225	0.09
4477	100YR ULT	6300	640.66	6525	640.74	225	0.08

River Sta	Profile	2015		Revised		<i>Change</i>	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
4301	100YR ULT	6300	639.80	6525	639.88	225	0.08
4069	100YR ULT	6300	638.54	6525	638.61	225	0.07
3736	100YR ULT	6500	636.95	6650	637.04	150	0.09
3500	100YR ULT	6500	636.63	6650	636.74	150	0.11
3319	100YR ULT	6800	634.63	6975	634.75	175	0.12
3294	100YR ULT	6800	634.59	6975	634.70	175	0.11
3245	Island Park Driv	Culvert		Culvert			0.00
3200	100YR ULT	6800	633.23	6975	633.29	175	0.06
3125	100YR ULT	6800	631.81	6975	631.87	175	0.06
2971	100YR ULT	6800	630.60	6975	630.65	175	0.05
2883	100YR ULT	6800	630.42	6975	630.47	175	0.05
2741	100YR ULT	6800	630.11	6975	630.16	175	0.05
2326	100YR ULT	6900	628.43	7050	628.48	150	0.05
1920	100YR ULT	6900	625.89	7050	625.93	150	0.04

River Sta	Profile	2015		Revised		Change	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
42344	100YR ULT	1100	724.15	1100	724.17	0	0.02
41959	100YR ULT	1100	721.54	1100	721.54	0	0.00
41688	100YR ULT	1100	719.83	1100	719.83	0	0.00
41591	100YR ULT	1100	719.45	1100	719.45	0	0.00
41434	Heritage Trace P	Culvert		Culvert			0.00
41412	100YR ULT	1100	717.56	1100	717.56	0	0.00
41301	100YR ULT	1100	715.67	1100	715.67	0	0.00
41224	100YR ULT	1100	715.59	1100	715.60	0	0.01
40940	100YR ULT	1100	713.67	1100	713.66	0	-0.01
40882	100YR ULT	1100	713.19	1100	713.19	0	0.00
40750	Riverside Drive	Culvert		Culvert			0.00
40640	100YR ULT	1100	708.28	1100	708.28	0	0.00
40600	100YR ULT	1100	707.65	1100	707.65	0	0.00
40390	100YR ULT	1100	705.99	1100	705.99	0	0.00
40095	100YR ULT	1100	703.68	1100	703.68	0	0.00
39881	100YR ULT	1100	702.30	1100	702.30	0	0.00
39840	100YR ULT	1100	702.16	1100	702.16	0	0.00
39800	Dalton Street	Culvert		Culvert			0.00
39762	100YR ULT	1100	701.06	1100	701.06	0	0.00
39672	100YR ULT	1100	700.72	1100	700.72	0	0.00
39559	100YR ULT	1725	699.57	1725	699.57	0	0.00
39289	100YR ULT	1725	697.13	1725	697.13	0	0.00
39120	100YR ULT	1725	695.95	1725	695.95	0	0.00
38739	100YR ULT	1725	691.61	1725	691.61	0	0.00
38666	100YR ULT	1725	691.19	1725	691.19	0	0.00
38633	100YR ULT	1725	691.19	1725	691.19	0	0.00
38581	Pedestrian Cross	Culvert		Culvert			0.00
38525	100YR ULT	1725	690.17	1725	690.17	0	0.00
38468	100YR ULT	1725	689.95	1725	689.95	0	0.00
38172	100YR ULT	1725	687.52	1725	687.51	0	-0.01
37872	100YR ULT	1725	684.48	1725	684.49	0	0.01
37621	100YR ULT	2000	681.40	2025	681.42	25	0.02
37424	100YR ULT	2000	680.28	2025	680.31	25	0.03
37362	100YR ULT	2000	680.13	2025	680.15	25	0.02
37325	Shiver Rd.	Culvert		Culvert			0.00
37291	100YR ULT	2000	679.71	2025	679.72	25	0.01
37115	100YR ULT	2000	678.80	2025	678.81	25	0.01
36914	100YR ULT	2000	677.93	2025	677.94	25	0.01
36821	100YR ULT	2000	677.50	2025	677.52	25	0.02
36618	100YR ULT	2000	676.33	2025	676.34	25	0.01
36318	100YR ULT	2000	674.64	2025	674.65	25	0.01
36104	100YR ULT	2000	673.60	2025	673.61	25	0.01
35669	100YR ULT	2300	671.89	2300	671.89	0	0.00
35378	100YR ULT	2300	670.54	2300	670.54	0	0.00
35127	100YR ULT	2300	669.07	2300	669.07	0	0.00
34889	100YR ULT	2300	666.06	2300	666.06	0	0.00
34825	100YR ULT	2300	666.17	2300	666.17	0	0.00
34780	Arcadia Park Dr.	Culvert		Culvert			0.00
34737	100YR ULT	2300	665.58	2300	665.58	0	0.00
34630	100YR ULT	2300	665.31	2300	665.31	0	0.00
34577	100YR ULT	2300	665.13	2300	665.13	0	0.00
34291	100YR ULT	2300	664.24	2300	664.24	0	0.00
33982	100YR ULT	2300	662.68	2300	662.68	0	0.00
33489	100YR ULT	2300	659.82	2300	659.82	0	0.00
33267	100YR ULT	2300	658.56	2300	658.56	0	0.00
33073	100YR ULT	2300	657.90	2300	657.90	0	0.00
32907	100YR ULT	2300	657.48	2300	657.48	0	0.00
32746	100YR ULT	2300	656.44	2300	656.44	0	0.00
32624	100YR ULT	2300	653.98	2300	653.98	0	0.00
32583	100YR ULT	2300	652.76	2300	652.75	0	-0.01

Revised Existing Conditions HEC-RAS Results
Whites Branch Main Stem

River Sta	Profile	2015		Revised		Change	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
32554	100YR ULT	2300	650.50	2300	650.51	0	0.01
32514	100YR ULT	2300	650.50	2300	650.52	0	0.02
32372	100YR ULT	2800	650.11	2775	650.14	-25	0.03
32094	100YR ULT	2800	649.69	2775	649.74	-25	0.05
31827	100YR ULT	2800	649.26	2775	649.33	-25	0.07
31711	100YR ULT	2800	649.15	2775	649.20	-25	0.05
31188	100YR ULT	9200	647.51	9350	647.55	150	0.04
31187		Lat Struct		Lat Struct			0.00
31061	100YR ULT	9200	647.16	9350	647.20	150	0.04
30919	100YR ULT	9024.31	646.59	9160.56	646.63	136.25	0.04
30770	100YR ULT	8950.97	646.14	9084.11	646.17	133.14	0.03
30620	100YR ULT	8689.33	645.89	8811.38	645.91	122.05	0.02
30500	100YR ULT	8315.62	645.62	8422.46	645.64	106.84	0.02
30422	100YR ULT	8118.94	645.18	8226.88	645.18	107.94	0.00
30300	N. Tarrant Pkwy	Culvert		Culvert			0.00
30217	100YR ULT	8118.94	643.22	8226.88	643.10	107.94	-0.12
30123	100YR ULT	8118.94	642.40	8051.88	642.35	-67.06	-0.05
29832	100YR ULT	8118.94	642.77	8051.88	642.72	-67.06	-0.05
29574	100YR ULT	8118.94	642.61	8051.88	642.56	-67.06	-0.05
29388	100YR ULT	8118.94	642.12	8051.88	642.07	-67.06	-0.05
29341	100YR ULT	8118.94	642.13	8051.88	642.08	-67.06	-0.05
29150	N. Beach St.	Culvert		Culvert			0.00
29077	100YR ULT	8118.94	639.39	8051.88	639.39	-67.06	0.00
28969	100YR ULT	8118.94	639.16	8051.88	639.16	-67.06	0.00
28766	100YR ULT	9200	638.25	9175	638.25	-25	0.00
28549	100YR ULT	9200	637.32	9225	637.32	25	0.00
28226	100YR ULT	9200	636.93	9225	636.93	25	0.00
27561	100YR ULT	9900	635.68	9900	635.68	0	0.00
27293	100YR ULT	9900	635.11	9900	635.11	0	0.00
26988	100YR ULT	9900	634.31	9900	634.31	0	0.00
26731	100YR ULT	9900	633.67	9900	633.67	0	0.00
26532	100YR ULT	9900	632.98	9900	632.98	0	0.00
26283	100YR ULT	9900	631.19	9900	631.19	0	0.00
26195	100YR ULT	9900	631.15	9900	631.15	0	0.00
25968	100YR ULT	9900	630.41	9900	630.41	0	0.00
25720	100YR ULT	9900	628.87	9900	628.85	0	-0.02
25383	100YR ULT	10100	627.37	10000	627.35	-100	-0.02
25085	100YR ULT	10100	626.07	10000	626.05	-100	-0.02
25048	100YR ULT	10100	625.87	10000	625.85	-100	-0.02
24239	100YR ULT	10100	624.42	10000	624.40	-100	-0.02
23838	100YR ULT	14700	623.59	14575	623.56	-125	-0.03
23596	100YR ULT	14700	623.03	14575	623.00	-125	-0.03
23425	100YR ULT	14700	622.54	14575	622.51	-125	-0.03
23254	100YR ULT	14700	621.92	14575	621.89	-125	-0.03
22997	100YR ULT	14700	620.97	14575	620.94	-125	-0.03
22782	100YR ULT	14700	620.13	14575	620.10	-125	-0.03
22164	100YR ULT	14700	618.86	14575	618.83	-125	-0.03
21785	100YR ULT	14700	617.64	14575	617.61	-125	-0.03
21354	100YR ULT	14700	616.15	14575	616.11	-125	-0.04
20902	100YR ULT	14700	615.24	14575	615.21	-125	-0.03
20537	100YR ULT	14700	614.50	14575	614.47	-125	-0.03
19937	100YR ULT	14700	612.73	14575	612.69	-125	-0.04
19914	100YR ULT	14700	612.72	14575	612.68	-125	-0.04
19878	100YR ULT	14700	612.68	14575	612.65	-125	-0.03
19618	100YR ULT	14700	612.11	14575	612.07	-125	-0.04
19509	100YR ULT	14700	611.84	14575	611.80	-125	-0.04
19109	100YR ULT	15600	610.41	15450	610.38	-150	-0.03
18987	100YR ULT	15600	609.75	15450	609.72	-150	-0.03
18915	100YR ULT	15600	609.23	15450	609.20	-150	-0.03
18892	100YR ULT	15600	609.12	15450	609.09	-150	-0.03

Revised Existing Conditions HEC-RAS Results
Whites Branch Main Stem

River Sta	Profile	2015		Revised		Change	
		Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)	Q Total (cfs)	W.S. Elev (ft)
18865	100YR ULT	15600	608.88	15450	608.85	-150	-0.03
18845		Bridge		Bridge			0.00
18808	100YR ULT	15600	608.20	15450	608.17	-150	-0.03
18652	100YR ULT	15600	607.27	15450	607.24	-150	-0.03
18238	100YR ULT	15600	605.67	15450	605.63	-150	-0.04
17920	100YR ULT	15600	604.63	15450	604.59	-150	-0.04
17484	100YR ULT	15600	603.91	15450	603.86	-150	-0.05
17193	100YR ULT	15600	603.59	15450	603.54	-150	-0.05
17014	100YR ULT	15600	603.18	15450	603.13	-150	-0.05
16925	100YR ULT	15600	602.96	15450	602.91	-150	-0.05
16700	Basswood Blvd.		Bridge		Bridge		0.00
16571	100YR ULT	15600	600.84	15450	600.81	-150	-0.03
16484	100YR ULT	15600	600.63	15450	600.60	-150	-0.03
16182	100YR ULT	15600	599.83	15450	599.80	-150	-0.03
15615	100YR ULT	15600	598.23	15450	598.20	-150	-0.03
15462	100YR ULT	15600	597.80	15450	597.76	-150	-0.04
15230	100YR ULT	15600	596.57	15450	596.53	-150	-0.04
15025	100YR ULT	15600	595.74	15450	595.71	-150	-0.03
14826	100YR ULT	15600	595.31	15450	595.27	-150	-0.04
14571	100YR ULT	15600	594.73	15450	594.69	-150	-0.04
14301	100YR ULT	15600	593.69	15450	593.64	-150	-0.05
14229	100YR ULT	15600	593.61	15450	593.57	-150	-0.04
14166	100YR ULT	15600	593.21	15450	593.17	-150	-0.04
14120	100YR ULT	15600	593.20	15450	593.15	-150	-0.05
13739	100YR ULT	15600	592.29	15450	592.25	-150	-0.04
13574	100YR ULT	15600	592.01	15450	591.97	-150	-0.04
13228	100YR ULT	15600	590.73	15450	590.69	-150	-0.04
13056	100YR ULT	15600	590.29	15450	590.26	-150	-0.03
12775	100YR ULT	15600	589.20	15450	589.17	-150	-0.03
12672	100YR ULT	15600	588.22	15450	588.21	-150	-0.01
12364	100YR ULT	16100	587.12	16050	587.11	-50	-0.01
12176	100YR ULT	16100	586.48	16050	586.47	-50	-0.01
11677	100YR ULT	16100	585.39	16050	585.38	-50	-0.01
11381	100YR ULT	16100	584.21	16050	584.21	-50	0.00

Appendix O

DIGITAL DATA (FTP)

