

ATTACHMENT A: 2013 Full River Reconnaissance – 2015 Addendum: Riverbank Segment QA Comparison

On 1/22/2015, FERC issued a letter to FirstLight requesting an addendum to the 2013 Full River Reconnaissance (FRR) report. One of the requirements of the FERC letter was for FirstLight to conduct a comparison of the specific riverbank features and characteristics from data logging files collected during the field surveys to a photograph of that segment of riverbank captured from the digital geo-referenced video in accordance with the methodology discussed in the FRR Quality Assurance Project Plan (QAPP). The results of these comparisons are enclosed within.

During the 2013 FRR, Turners Falls Impoundment (TFI) riverbanks were subdivided into approximately 600 segments based on their individual features and characteristics in accordance with the methodology outlined in the Revised Study Plan (RSP). As part of the 2013 FRR field work, geo-tagged photographs were taken along the length of the TFI to visually document riverbank conditions at the time of the field survey. The segments delineated during the survey combined with the photographs collected in the field were used to conduct a Quality Assurance (QA) comparison consistent with the approach discussed in the 2013 FRR QAPP (p.13):

“The process of comparing the data logging files to video/still images of a selected percentage of segments, or any segment of particular interest, provides a high level of quality assurance and control on the field data collected. This approach also provides a method for reference checking any subsequent interpretation of the field survey data after the survey has been completed.”

Riverbank Segment QA Comparison Site Selection

This Attachment was developed in accordance with the QAPP to provide a comparison of the data logging files to images of a “*selected percentage of segments*.” In order to cover the length of the TFI and to avoid bias in the selection process, every tenth riverbank segment was selected for inclusion in the addendum. Using this approach, 59 segments were identified for comparison. Once the initial set of segments were determined, the riverbank features and characteristics observed at each location were examined. Based on this review, it was found that the majority of the riverbank features and characteristics identified in the RSP were represented; however, several data gaps were identified. In order to fill these gaps, and to complement the original 59 segments with additional segments of interest, 6 supplemental segments were identified. Supplemental segments included: 12, 89, 182, 279, 332, and 403. This systematic selection process ensured an unbiased, representative coverage of not only the geographic extent of the TFI but also of the features and characteristics observed during the 2013 FRR.

Table 1 provides a summary of the features and characteristics present at the riverbank segments selected for QA (i.e. every tenth segment plus supplemental segments). As observed in the table, all features and characteristics are present except for:

- Upper Riverbank Sediment – Clay
- Upper Riverbank Sediment – Gravel
- Upper Riverbank Sediment – Cobbles

- Potential Erosion Indicator – Tension Cracks

These characteristics were not included in this addendum because they were found to be either uncommon or non-existent during the field survey.

Table 1 - Summary of riverbank features and characteristics: Every tenth segment plus supplemental segments

Riverbank Features	Characteristics					
Upper Riverbank Slope	Overhanging Yes	Vertical Yes	Steep Yes	Moderate Yes	Flat Yes	
Upper Riverbank Height	Low Yes	Medium Yes	High Yes			
Upper Riverbank Sediment	Clay No	Silt/Sand Yes	Gravel No	Cobbles No	Boulders Yes	Bedrock Yes
Upper Riverbank Vegetation	None to Very Sparse Yes	Sparse Yes	Moderate Yes	Heavy Yes		
Lower Riverbank Slope	Vertical Yes	Steep Yes	Moderate Yes	Flat/Beach Yes		
Lower Riverbank Sediment	Clay Yes	Silt/Sand Yes	Gravel Yes	Cobbles Yes	Boulders Yes	Bedrock Yes
Lower Riverbank Vegetation	None to Very Sparse Yes	Sparse Yes	Moderate Yes	Heavy Yes		
Type of Erosion	Falls-Undercut Yes	Falls-Gullies Yes	Topples Yes	Slide or Flow Yes	Planar Slip Yes	Rotational Slump Yes
Potential Erosion Indicators	Tension Cracks No	Exposed Roots Yes	Creep/Leaning Trees Yes	Overhanging Bank Yes	Notch Yes	Other Yes
Stage of Erosion	Potential Future Erosion Yes	Active Erosion Yes	Eroded Yes	Stable Yes		
Extent of Erosion	None/Little Yes	Some Yes	Some to Extensive Yes	Extensive Yes		

Riverbank Segment QA Comparison Methodology

During the development of the 2013 FRR report, riverbank features and characteristics identified in the field and recorded on the datalogger were cross-checked with the geo-tagged photographs as a means of data QA. This QA process was completed in accordance with the QAPP (pg. 13, see quote on previous page). The QAPP also states that, “A discussion will be presented in the FRR report based on this comparison.”

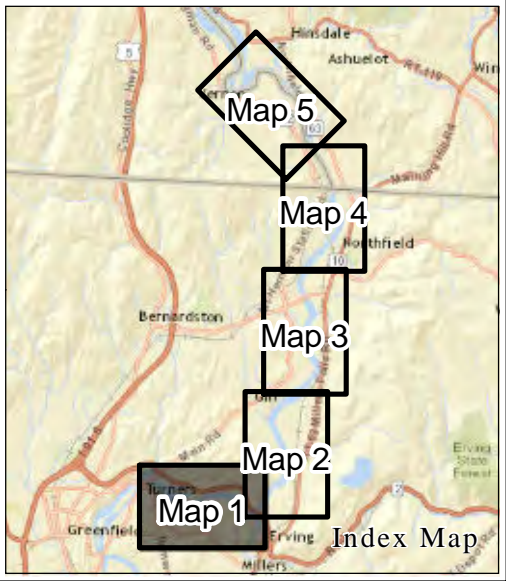
Geo-tagged riverbank photographs taken during the 2013 FRR were reviewed for the riverbank segments to compare, verify, and modify (if appropriate) riverbank features and characteristics that were recorded in the field. The first step in this process was to associate geo-tagged photographs with riverbank segments. This was conducted by comparing the riverbank segment maps with the location where the photographs were taken from the boat and the characteristics found at each segment. The riverbank segments selected for comparison are presented in Figures 1 through 5. The riverbank segments were delineated using the process and equipment described in the RSP. This process included shooting the endpoints of each segment from the boat to the riverbank with a laser rangefinder linked to the GPS antenna. The geotagged photo then used another GPS antenna location linked to the camera to provide the approximate location where the photograph was taken from the boat.

Material provided in this attachment for each selected segment includes:

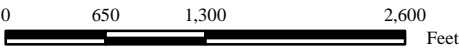
- (1) All photographs for each selected segment (due to the size of many of the segments, multiple photographs were required to capture the entire segment);
- (2) One photograph per segment labeled to demonstrate the identification of various riverbank features and characteristics;
- (3) A table of riverbank features and characteristics found at that segment;
- (4) A Google Earth screenshot depicting the approximate location of the photograph created from Red Hen Systems software (IsWhere);
- (5) A brief sentence detailing any QA observations.

Legend

— Riverbank Survey Segment



FIRSTLIGHT POWER RESOURCES
RELICENSING STUDY 3.1.1
NORTHFIELD MOUNTAIN/TURNERS FALLS
2013 FULL RIVER RECONNAISSANCE



2015 FRR Addendum
Selected Riverbank Segments for QA
Map 1

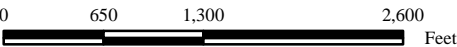
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Legend

Riverbank Survey Segment



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RELICENSING STUDY 3.1.1
NORTHFIELD MOUNTAIN/TURNERS FALLS
2013 FULL RIVER RECONNAISSANCE

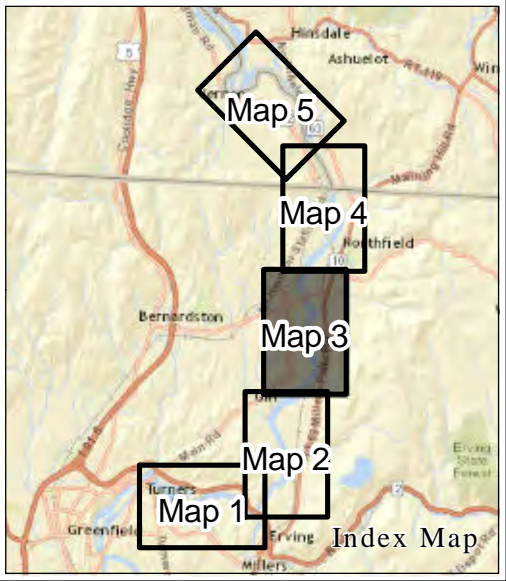


2015 FRR Addendum
Selected Riverbank Segments for QA
Map 2

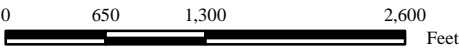
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Legend

— Riverbank Survey Segment



FIRSTLIGHT POWER RESOURCES
RELICENSING STUDY 3.1.1
NORTHFIELD MOUNTAIN/TURNERS FALLS
2013 FULL RIVER RECONNAISSANCE

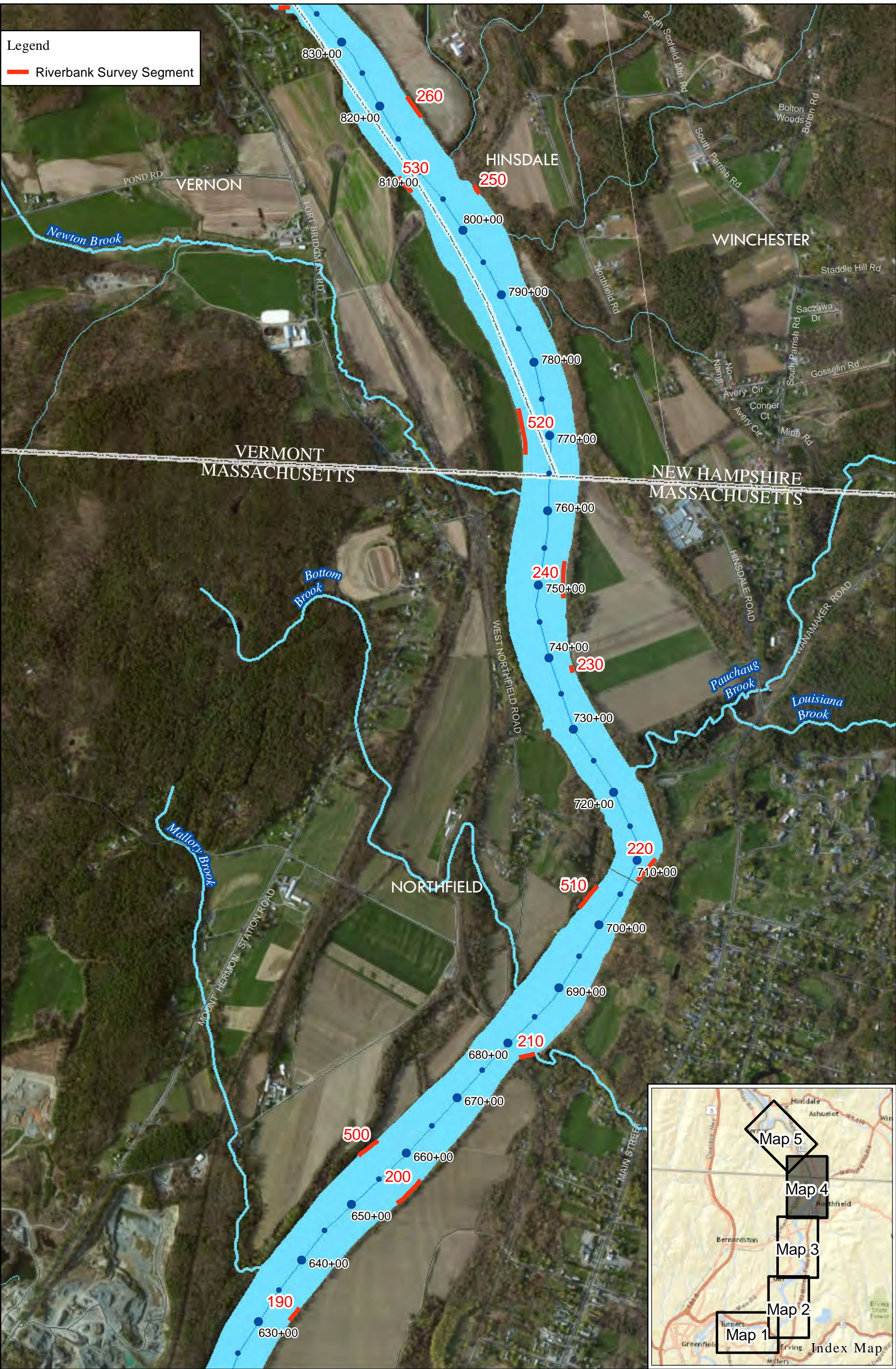


2015 FRR Addendum
Selected Riverbank Segments for QA
Map 3

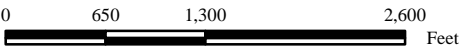
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Legend

— Riverbank Survey Segment



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RELICENSING STUDY 3.1.1
NORTHFIELD MOUNTAIN/TURNERS FALLS
2013 FULL RIVER RECONNAISSANCE



2015 FRR Addendum
Selected Riverbank Segments for QA
Map 4

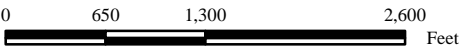
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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Legend

— Riverbank Survey Segment



FIRSTLIGHT POWER RESOURCES
RELICENSING STUDY 3.1.1
NORTHFIELD MOUNTAIN/TURNERS FALLS
2013 FULL RIVER RECONNAISSANCE



2015 FRR Addendum
Selected Riverbank Segments for QA
Map 5

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Segment 10 – Left Bank



Photo ID 259 (right, D/S portion of segment)



Photo ID 260 (D/S)

Segment 10 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Flat
Upper Riverbank Height	Low
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Flat/Beach
Lower Riverbank Sediment	Silt/Sand
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	
Potential Erosion Indicators	Creep/leaning trees
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 259 Location



Photo ID 231 (right, D/S portion of segment)



Photo ID 232 (D/S and includes next segment(s) farther D/S)

Segment 20 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Moderate
Upper Riverbank Height	Low
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Flat/Beach
Lower Riverbank Sediment	Silt/Sand
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	Undercut
Potential Erosion Indicators	None
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 231 Location



Photo ID 208 (mid-segment)



Photo ID 209 (D/S and includes next segment farther D/S)

Segment 30 –Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Moderate
Upper Riverbank Height	High
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Flat/Beach
Lower Riverbank Sediment	Silt/Sand
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	Undercut
Potential Erosion Indicators	Creep/leaning trees
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 208 Location



Photo ID 193 (mid-segment)



Photo ID 192 (U/S)

Segment 40 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Moderate
Upper Riverbank Height	High
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Flat/Beach
Lower Riverbank Sediment	Silt/Sand
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	Undercut
Potential Erosion Indicators	None
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 193 Location



Photo ID 170 (mid-segment)



Photo ID 169 (U/S and includes part of next segment U/S)

Segment 50 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Moderate
Upper Riverbank Height	High
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Flat/Beach
Lower Riverbank Sediment	Gravel
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	Undercut
Potential Erosion Indicators	None
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 170 Location



Photo ID 144 (includes entire segment)

Segment 60 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Moderate
Upper Riverbank Height	High
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Moderate
Lower Riverbank Sediment	Bedrock
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	
Potential Erosion Indicators	None
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 144 Location



Photo ID 122 (segment is the high, eroded slope as indicated by the labels. Dashed line represents approximate end of segment)

Segment 70 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Steep
Upper Riverbank Height	High
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Sparse
Lower Riverbank Slope	Flat/Beach
Lower Riverbank Sediment	Gravel
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	Slide
Potential Erosion Indicators	Creep/leaning trees, Overhanging bank, Exposed roots
Stage of Erosion	Active Erosion
Extent of Erosion	Extensive

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed and additional indicators of potential future erosion were included.



Photo 122 Location



Photo ID 112 (mid-segment)



Photo ID 111 (U/S and includes portions of next U/S segments)



Photo ID 113 (middle)



Photo ID 114 (middle)



Photo ID 115 (D/S)

Segment 80 – Left Bank

Riverbank Features	Characteristics
Upper Riverbank Slope	Moderate
Upper Riverbank Height	High
Upper Riverbank Sediment	Silt/Sand
Upper Riverbank Vegetation	Heavy
Lower Riverbank Slope	Moderate
Lower Riverbank Sediment	Boulders
Lower Riverbank Vegetation	None to very sparse
Type of Erosion	
Potential Erosion Indicators	None
Stage of Erosion	Stable
Extent of Erosion	None/Little

QA Observations: Upon review of the photos for this segment, classification made in the field was confirmed.



Photo 112 Location



Photo ID 613 (left, U/S portion of segment)



Photo ID 614 (middle)