Year 5 Monitoring Report
FINAL
Hudson Property

DMS Project ID #: 95361
DMS Contract #: 004638
DWR #: 20140422
USACE Action ID# SAW-2012-01394
Beaufort County, North Carolina

Submitted: December 2020

Submitted to/Prepared for:
NC Department of Environment and Natural Resources
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Prepared by:
ALBEMARLE RESTORATIONS, LLC
P.O. Box 176
Fairfield, NC 27826
Tel (252) 333-0249 Fax (252) 926-9983

Mitigation Project Name	**Hudson Property**	**USACE Action ID**	**2012-01394**
DMS ID	**95361**	**DWR Permit**	**2014-0422**
River Basin	**Tar-Pamlico**	**Date Project Instituted**	**6/7/2020**
Cataloging Unit	**03020104**	**Date Prepared**	**4/20/2020**
County	**Beaufort**	**Stream/Wet. Service Area**	**Tar-Pamlico 03020104**

Signature & Date of Official Approving Credit Release

1 - For NCDMS, no credits are released during the first milestone

2 - For NCDMS projects, the inital credit release milestone occurs automatically when the as-built report (baseline monitoring report) has been made available to the IRT by posting it to the DMS portal, provided the following have been met:

1) Approved of Final Mitigation Plan

2) Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.

3) Completion of all physical and biological improvements to the mitigation site pursuant to the mitigation plan.

4) Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

3 - A 10% reserve of credits is to be held back until the bankfull event performance standard has been met.

Credit Release Milestone	**Warm Stream Credits**						
Project Credits	**Scheduled Releases %**	**Proposed Releases %**	**Proposed Released #**	**Not Approved # Releases**	**Approved Credits**	**Anticipated Release Year**	**Actual Release Date**
1 - Site Establishment	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2 - Year 0 / As-Built	30.00%	30.00%	867.300	0.000	867.300	2016	11/30/2016
3 - Year 1 Monitoring	10.00%	10.00%	289.100	0.000	289.100	2017	8/8/2017
4 - Year 2 Monitoring	10.00%	10.00%	289.100	0.000	289.100	2018	8/10/2018
5 - Year 3 Monitoring	10.00%	10.00%	289.100	0.000	289.100	2019	4/26/2019
6 - Year 4 Monitoring	5.00%	5.00%	144.550	0.000	144.550	2020	4/20/2020
7 - Year 5 Monitoring	10.00%					2021	
8 - Year 6 Monitoring	5.00%					2022	
9 - Year 7 Monitoring	10.00%					2023	
Stream Bankfull Standard	10.00%	10.00%	289.100	0.000	289.100	2018	8/10/2018
			Totals	0.000	2,168.250		

Total Gross Credits	2,891.000
Total Unrealized Credits to Date	0.000
Total Released Credits to Date	2,168.250
Total Percentage Released	75.00%
Remaining Unreleased Credits	722.750

Project Quantities

Mitigation Type	**Restoration Type**	**Physical Quantity**
Warm Stream	Restoration	2,891.000

Notes

Contingencies (if any)

Mitigation Project Name	**Hudson Property**	**USACE Action ID**	**2012-01394**
DMS ID	**95361**	**DWR Permit**	**2014-0422**
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Cataloging Unit	**03020104**	**Date Prepared**	**4/20/2020**
County	**Beaufort**	**Stream/Wet. Service Area**	**Tar-Pamlico 03020104**

Debits

							Stream Restoration Credits
Beginning Balance (mitigation credits)							**2,891.000**
Released Credits							**2,168.250**
Unrealized Credits							**0.000**
Owning Program	**Req. Id**	**TIP #**	**Project Name**	**USACE Permit #**	**DCM Permit #**	**DWR Permit #**	
Statewide Stream & Wetland ILF Program	REQ-003055	R-2510	DOT - US 17 (Washington Bypass): Second Request	1999-301143	2005-0785	2005-0785	289.100
Statewide Stream & Wetland ILF Program	REQ-003055	R-2510	DOT - US 17 (Washington Bypass): Second Request	1999-301143	2005-0785	2005-0785	578.200
Statewide Stream & Wetland ILF Program	REQ-003055	R-2510	DOT - US 17 (Washington Bypass): Second Request	1999-301143	2005-0785	2005-0785	867.300
Statewide Stream & Wetland ILF Program	REQ-003055	R-2510	DOT - US 17 (Washington Bypass): Second Request	1999-301143	2005-0785	2005-0785	289.100
Total Credits Debited							**2,023.700**
Remaining Available balance (Released credits)							**144.500**
Remaining balance (Unreleased credits)							**722.750**

ecotone
ecological restoration

Ecotone, Inc.
410.420.2600 (P)
410.420.6983 (F)

December 14, 2020

Mr. Jeremiah Dow
North Carolina Department of Environmental Quality
217 West Jones Street
1601 Mail Service Center
Raleigh, NC 27699

RE: Draft Year 5 Monitoring Report for Hudson Property Stream Restoration Project (95361)
Tar-Pamlico River Basin; CU 03020105; Beaufort County, NC
Contract No. 004638

Dear Mr. Dow,

Ecotone has received comments from NCDEQ dated December 11, 2020 pertaining to the Draft Monitoring Year 5 Report for the Hudson Property. The accompanying submittal has been revised to reflect our responses to all comments and all information requested. Below are Ecotone's responses below to the received comments.

1. Appendix C, Table 7
a. In the Stems per Acre row, some numbers are taken to the nearest tenth, while other are shown as whole numbers. Please display all numbers to the nearest whole number. *ECOTONE RESPONSE: Table has been updated.*

2. Appendix D, Table 11a
a. Please verify geomorphic data for cross section 6. LTOB Cross Sectional Area changed from 2.66 ft^2 in MY3 to 13.89 ft^2 in MY5. Also BHR went from 0.74 in MY3 to 1.60 in MY5. We recommend consideration be given to adding a line or point identifying the current monitoring year LTOB on the Cross Sections with Annual Overlays charts. This is useful for us when reviewing cross section data. *ECOTONE RESPONSE: A revision was needed in the "omit bankful" checkbox of the survey overlay file. This slightly decreased BHR and LTOB Cross Sectional Area, though they are still higher than previous years. This is likely because after a few years of aggradation, the channel has degraded slightly. An arrow indicating the Year 5 LTOB has been added to the cross section 6 chart.*

Thank you very much for your continued attention to this project. If you have any questions, please contact me at 410-420-2600.

Respectfully,

Marie V. Brady

Marie Brady
Ecologist
Ecotone, Inc.

cc : Ed Temple, Albemarle Restorations, LLC

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1.0 PROJECT SUMMARY

The mitigation area is 13.49 acres located within a larger 106-acre property owned by Charles Hudson. It is located in Beaufort County, NC and the Tar-Pamlico River Basin. Mitigation components include five stream reaches totalling 2,891 linear feet contained within a Conservation Easement. Construction was completed in 2015 and planting completed in 2016. The first of seven monitoring years was initiated in 2016. Year 5 monitoring was completed in October 2020.

2.0 PROJECT GOALS AND OBJECTIVES

The project goals of the Hudson property per the approved mitigation plan are as follows:

- Improve and sustain hydrologic connectivity/interaction and storm flow/flood attenuation.
- Reduce nutrient and sediment stressors to the reach and receiving watershed.
- Provide uplift in water quality functions.
- Improve aquatic and terrestrial habitats (complexity, quality).
- Improve and maintain riparian buffer habitat.

The project goals will be addressed through the following project objectives:

- Implement a sustainable, reference-based, rehabilitation of the reach dimension, pattern, and profile to provide needed capacity and competency.
- Support the removal of barriers to anadromous fish movement and to help improve nursery and spawning habitats.
- Strategically install stream structures and plantings designed to maintain vertical and lateral stability and improve habitat diversity/complexity.
- Provide a sustainable and functional bankfull floodplain feature.
- Enhance and maintain hydrologic connection between stream and adjacent floodplain/riparian corridors.
- Utilize the additional width of the swamp runs to provide natural filters for sediment and nutrients and diffuse flow from upstream runoff.
- Install, augment, and maintain appropriate riparian buffer with sufficient density and robustness to support native forest succession.
- Water quality enhancement through riparian forest planting and woody material installation, and increased floodplain interaction/overbank flooding.
- Restore the existing ditched streams to single and multi-thread headwater systems with forested riparian buffers.
- Provide ecologically sound construction techniques that will require minimal grading and disturbance.

3.0 PROJECT SUCCESS CRITERIA

3.1 Stream Restoration Performance Standards

Single Thread Channels (Reaches 1 - 4) and Swamp Run (Reach 5)

Groundwater monitoring wells are installed in and near the thalweg of all five reaches. The wells are equipped with continuous–reading gauges capable of documenting sustained flow. Per the approved Mitigation Plan, each reach must exhibit water flow for at least 30 consecutive days during years with normal rainfall (demonstrating at least intermittent stream status). All restored channels shall receive sufficient flow through the

monitoring period to maintain an Ordinary High-Water Mark (OHWM). Field indicators of flow events include a natural line impressed on the bank; shelving; changes in soil characteristics; destruction of terrestrial vegetation; presence of litter and debris; wracking; vegetation matted down, bent or absent; sediment sorting; leaf litter disturbed or washed away; scour; deposition; bed and bank formation; water staining; or change in plant community. In addition, two overbank flows shall be documented for each reach during the monitoring period using continuously monitored pressure transducers and crest gauges. All collected data and field indicators of water flow shall be documented in each monitoring report. Seven flow monitoring stations are located on Reaches 1 – 4, three are located on Reach 5.

3.2 Stream Channel Restoration Stability Performance Standards

Headwater System (Reach 5)

All stream areas shall remain stable with no areas of excessive erosion such as evidence of bank sloughing or actively eroding banks due to the exceedance in critical bank height and lack of deep-rooted stream bank vegetation.

Single Thread Channels (Reaches 1 - 4)

1. Bank Height Ratio (BHR) shall not exceed 1.2 within restored reaches of the stream channel.
2. Entrenchment Ratio (ER) shall be no less than 2.2 within restored reaches of the stream channel.
3. The stream project shall remain stable and all other performance standards shall be met through two separate bankfull events, occurring in separate years, during the 7-year post construction monitoring period.
4. Three bank pin arrays and 11 cross sections are located on Reaches 1 - 4

3.3 Planted Vegetation Performance Standards

1. At least 320 three-year-old planted stems/acre must be present after year three. At year five, density must be no less than 260 five-year-old planted stems/acre. At year 7, density must be no less than 210 seven-year-old planted stems/acre.
2. If this performance standard is met by year 5 and stem density is trending toward success (i.e., no less than 260 five-year-old stems/acre) monitoring of vegetation on the site may be terminated provided written approval is provided by the USACE in consultation with the North Carolina Interagency Review Team (NCIRT).
3. Thirteen vegetation plot samples are located within the project area.

4.0 SITE CONDITIONS AND DESCRIPTION

The Hudson property is 13.49 acres located in Beaufort County, NC and the Tar-Pamlico River Basin. The majority of the site is used for crop production, primarily corn, soybeans and wheat. As a result of the lowering of local water tables and in some cases the complete elimination of ground and surface water interaction, the degradation of water quality and downstream anadromous fish spawning and nursery habitat has occurred. Hydric soils are present on site, meaning that the pre-existing site conditions were appropriate for raising the water table and re-establishing normal base flow conditions (See Figure 1 -Vicinity Map).

5.0 MITIGATION COMPONENTS

Mitigation components are limited to five reaches: Reach 1: 833 lf; Reach 2: 532 lf; Reach 3: 445 lf; Reach 4: 437 lf; Reach 5: 644 lf, for a total restored stream footage of 2,891linear feet (Table 1).

6.0 DESIGN APPROACH

A natural design approach was used to restore the natural sinuosity and flow of the headwater streams which existed prior to channelization. Grading was done to decrease sediment load and erosion rate while allowing for floodplain connectivity and storage for overland flow. Banks were graded down to distribute flow velocity and the banks and riparian buffers were planted to stabilize the channel and create habitat. A combination of Priority 1 and Priority II restoration types were used. Where the proposed channels tie into the existing, non-restored channels, Priority II restoration was used.

7.0 CONSTRUCTION AND PLANTING TIMELINE

Construction commenced in December 2014 with the installation of recommended erosion control practices and was completed in May 2015. Planting was officially concluded in early January 2016. (Table 2 – Project History Table)

8.0 PLAN DEVIATIONS

There were no significant deviations between construction plans and the As-built conditions.

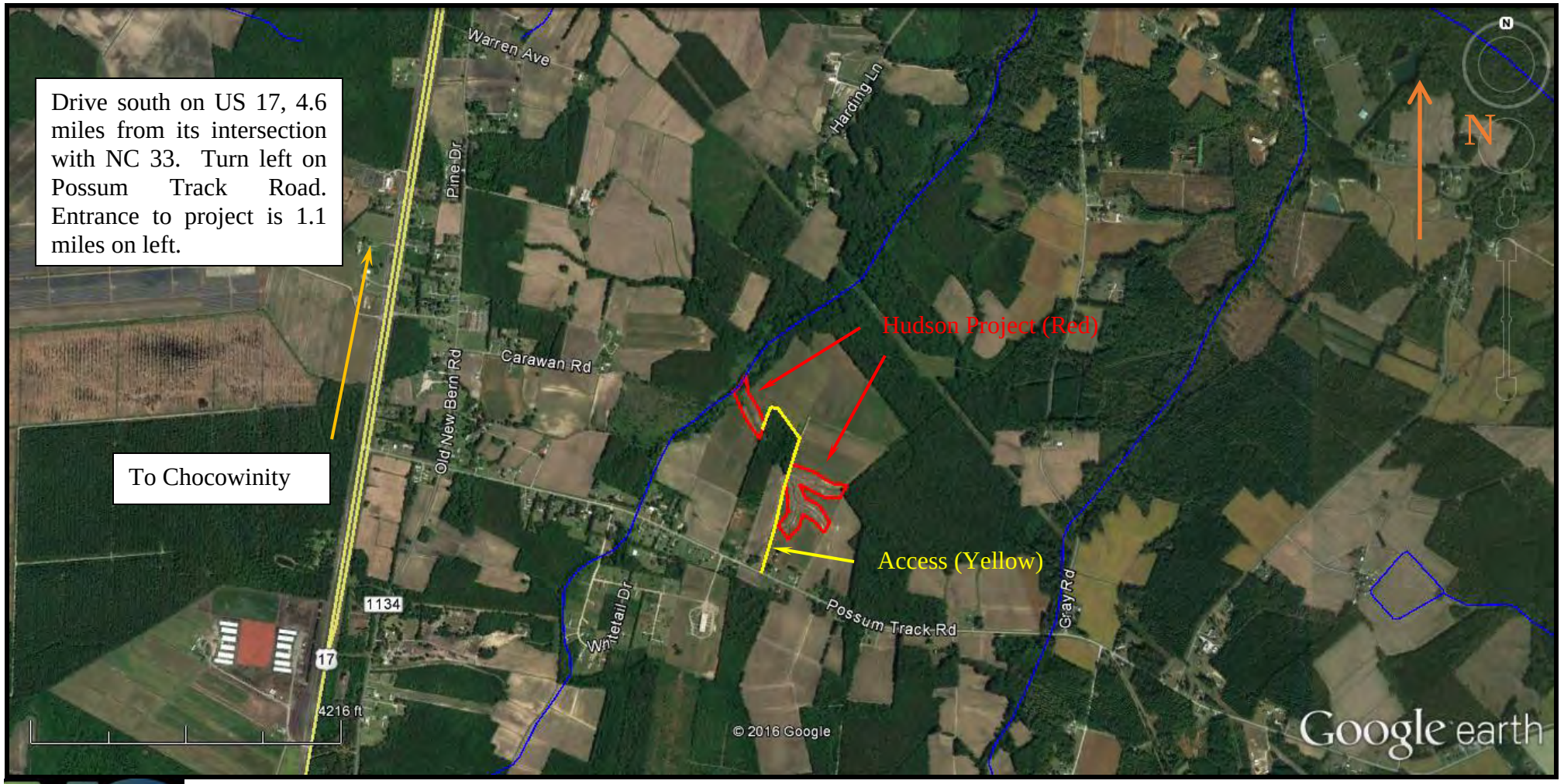
9.0 PROJECT PERFORMANCE

The Hudson stream restoration project is currently meeting functional goals and objectives. Annual monitoring took place in October and revealed the presence of bankfull events, floodplain connectivity, and lateral and vertical stability. In-stream structures were observed to be functioning as intended with minimal scouring of the channel's banks or bed. Bankfull events were observed for Years 1 through Year 5. The site is meeting the bankfull standard for success. The entire length of the project is currently exhibiting fully vegetated banks with both herbaceous and woody plants. Overall, woody plantings within the riparian buffer are meeting project goals with some dieback of planted stems and introduction of other woody vegetation in all monitoring plots. Tree heights range from 4-15 feet, with an approximate average of 10 feet. Stream gauges indicated base flow and bankfull events at 9 out of 10 locations. Baseflow and bankfull events could not be confirmed at Well 5 because of logger malfunction that didn't allow data download. The logger was replaced and we suspect that base flow and bankfull events occurred based on conditions seen during monitoring and information from adjacent wells. Bank pins could not be located due to dense vegetative growth; erosion is therefore assumed to be minimal given the vegetative stability of the reaches. Aggradation was noted on Reaches 2 and 3, though slightly less than in MY 3; both reaches remain stable. Stream cross sections are meeting objectives in 11 out of 11 locations.

Previous corrective measures included regrading Reach 5 to raise the stream invert to create a wider swamp run. This was identified during a field meeting with NC Division of Mitigation Services and the USACE in June 2017 and completed in October 2017. A field meeting with NC Division of Mitigation Services and the USACE in April 2018, identified two monitoring wells that required repair; repair was completed. Year 1 Monitoring identified some areas where woody survivability was low; these areas were spot planted in December 2017. In Year 3, Vegetation Plot 6 and other small areas on Reach 1 and 2 appeared to have slightly low woody survivability. These areas were spot planted in October 2019; areas were smaller than 0.1 acres and were not included in the CCPV. No additional corrective measures are necessary; monitoring will continue as scheduled.

10.0 METHODS AND REFERENCES

Monitoring methodology did not differ from the approved Mitigation Plan. Cross-section dimensions were collected using standard survey methods. Vegetation assessment was done according to the Level 2 protocol specified by the Carolina Vegetation Survey. Hydrology monitoring wells were installed per ERDC TN-WRAP-00-02 "Installing Monitoring Wells/Piezometers in Wetlands" dated 2000. Groundwater levels were recorded using the U20-001-01 water level data loggers manufactured by Onset Computer. The loggers were installed in the wells per the manufacturer's instructions.



Environmental Quality

Figure 1 - Vicinity Map
Hudson Stream Mitigation Project
DMS Project #95361
Beaufort County, NC

APPENDIX A: PROJECT BACKGROUND TABLES

Table 1. Project Components and Mitigation Credits

Table 2. Project Activity and Reporting History

Table 3. Project Contacts

Table 4. Project Information and Attributes

Table 1: Project Components and Mitigation Credits
Hudson Property, Beaufort County
EEP Project Number: 95361

Mitigation Credits

	Stream		Riparian wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	2,891								

Project Components

Project Component or Reach ID	Stationing/Location	Existing Footage/Acreage	Approach (PI, PII etc.)	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Reach 1		766 LF	PI		833 LF	1:1
Reach 2		516 LF	PI/PII		532 LF	1:1
Reach 3		611 LF	PI/PII		445 LF	1:1
Reach 4		503 LF	PI/PII		437 LF	1:1
Reach 5		689 LF	PI		644 LF	1:1
Total		3,085 LF			2,891 LF	

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration	2,891 LF					
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes
FB	Adjacent to stream	Buffer	100 feet on either side of stream centerline

Table 2: Project Activity and Reporting History Hudson Property- EEP Project Number 95361		
Activity, Deliverable, or Milestone	**Data Collection Complete**	**Actual Completion or Delivery**
Project Institution	N/A	June 2012
Mitigation Plan	July 2014	Oct 2014
Permits Issued	March 2013	May 2014
Final Design Construction	March 2013	May 2014
Construction	N/A	May 2015
Containerized, Bare Root, and B&B Planting	N/A	January 2016
Baseline Monitoring Document (Year 0 - Baseline)	January 2016	August 2016
Year 1 Monitoring	September 2016	Final: January 2017
Year 2 Monitoring	November 2017	Final: January 2018
Year 3 Monitoring	October 2018	Final: March 2019
Year 4 Monitoring	October 2019	Final: January 2020
Year 5 Monitoring	October 2020	Final: December 2020
Year 6 Monitoring		
Year 7 Monitoring		

Table 3: Project Contacts Hudson Property- EEP Project Number: 95361	
Primary Project Design POC	Ecotone, Inc. Scott McGill (410) 420-2600 129 Industry Lane, Forest Hill, MD 21050
Construction Contractor POC	Riverside Excavation, Inc. Car Baynor (252) 943-8633
Survey Contractor POC	True Line Surveying Curk Lane (919) 359-0427
Planting and Seeding Contractor POC	Carolina Silvics, Inc. Mary Margaret McKinney (252) 482-8491 908 Indian Trail Road, Edenton, NC 27932
Seed Mix Sources	Ernst Conservation Seeds, LLP, Meadville, PA
Nursery Stock Suppliers	Carolina Silvics, Inc.
Monitoring Performers Stream and Vegetation POC	Ecotone, Inc. Scott McGill (410) 420-2600 129 Industry Lane, Forest Hill, MD 21050

Table 4: Project information **Hudson Property- EEP Project Number: 95361**					
Project name	HUDSON PROPERTY				
County	BEAUFORT				
Project Area (ac)	13.4 AC				
Project Coordinates (Lat and Long)	77˚ 06" 13.62' W / 35˚ 26" 53.20' N				
4.1 Project Watershed Summary Information					
Physiographic province	INNER COASTAL PLAIN				
River basin	TAR-PAMLICO RIVER BASIN				
USGS Hydrologic Unit 8-digit	03020104	USGS Hydrologic Unit 14-digit	03020104010010		
DWQ Sub-basin	CHOCOWINITY CREEK – HORSE BRANCH				
Project Drainage Area (acres)	190.86				
Project Drainage Area Percentage of Impervious Area	1.2 % (2.24 acres)				
CGIA Land Use Classification	2.01.01.07 Annual Row Crop Rotation				
4.2 Reach Summary Information					
Parameters	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5
Length of reach (linear feet)	766	516	611	503	689
Valley classification	VIII	VIII	VIII	VIII	VIII
Drainage area (acres)	40.51	74.63	35.21	150.35	190.86
NCDWR stream identification score	20.75	20.75	20.75	20.75	28
NCDWR Water Quality Classification	C;NSW	C;NSW	C;NSW	C;NSW	C;NSW
Morphological Description (stream type)	G5-G6	G5-G6	G5-G6	G5-G6	G5-G6
Evolutionary trend	Early (CEM)	Early (CEM)	Early (CEM)	Early (CEM)	Early (CEM)
Underlying mapped soils	GoA & CrB	CrB & Ly	CrB & Ly	CrB	CrB & Me
Drainage class	MW	MW & SP	MW & SP	MW	MW & P
Soil Hydric status	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric	Hydric
Slope (ft/ft)	0.009	0.006	0.008	0.004	0.003
FEMA classification	N/A	N/A	N/A	N/A	AE/X
Native vegetation community	Pasture/Crop	Pasture/Crop	Pasture/Crop	Pasture/Crop	Pasture/Crop
Percent composition of exotic invasive vegetation	N/A	N/A	N/A	N/A	N/A
4.3 Regulatory Considerations					
Regulation	Applicable?	Resolved?	Supporting Documents		
Waters of the United States – Section 404	YES	YES	Supporting Documents		
Waters of the United States – Section 401	YES	YES	SAW-2012-01394		
Endangered Species Act	NO	YES	NA		
Historic Preservation Act	NO	YES	NA		
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	NO	YES	NA		
FEMA Floodplain Compliance	NO	YES	NA		
Essential Fisheries Habitat	NO	YES	NA		

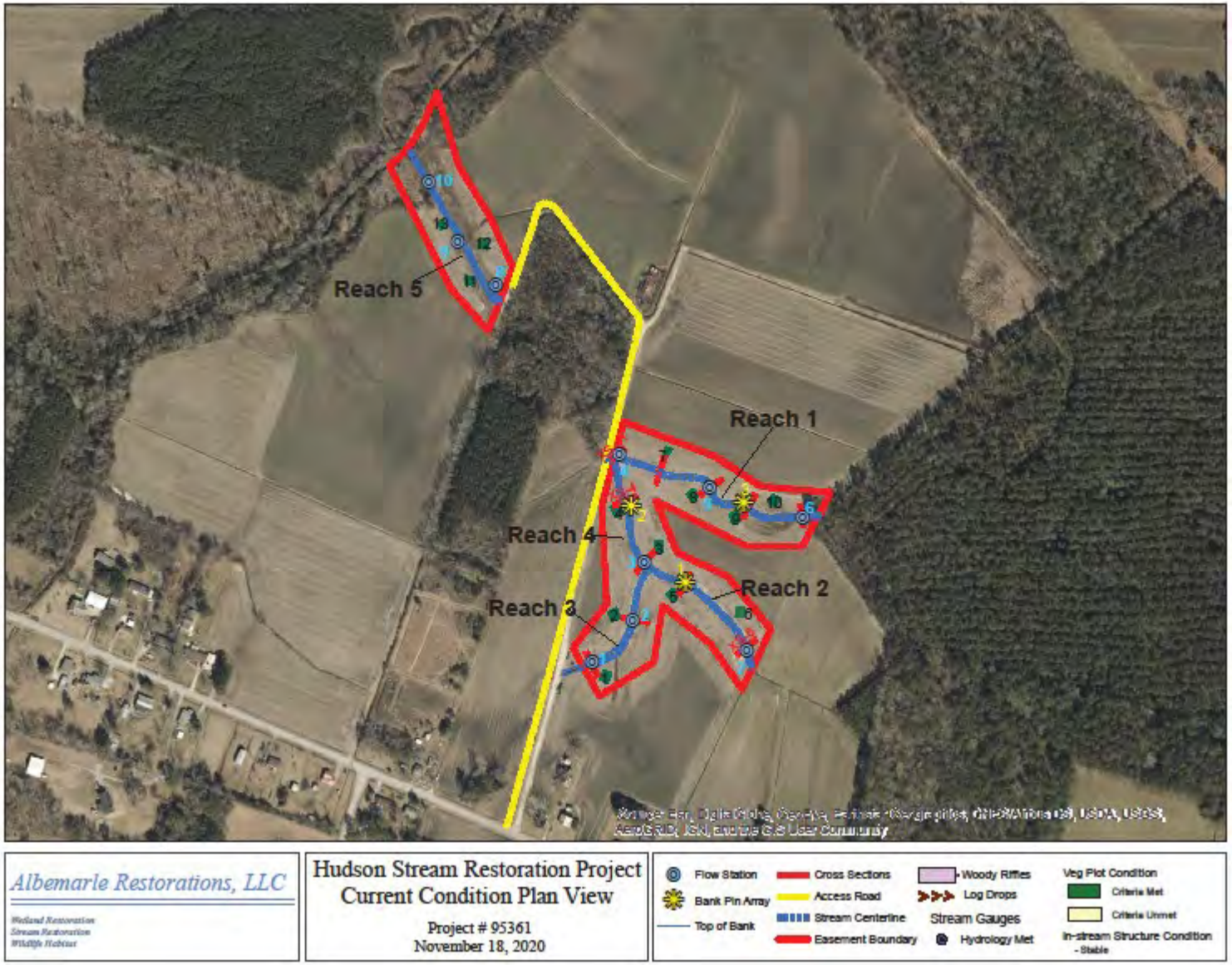
APPENDIX B: VISUAL ASSESSMENT DATA

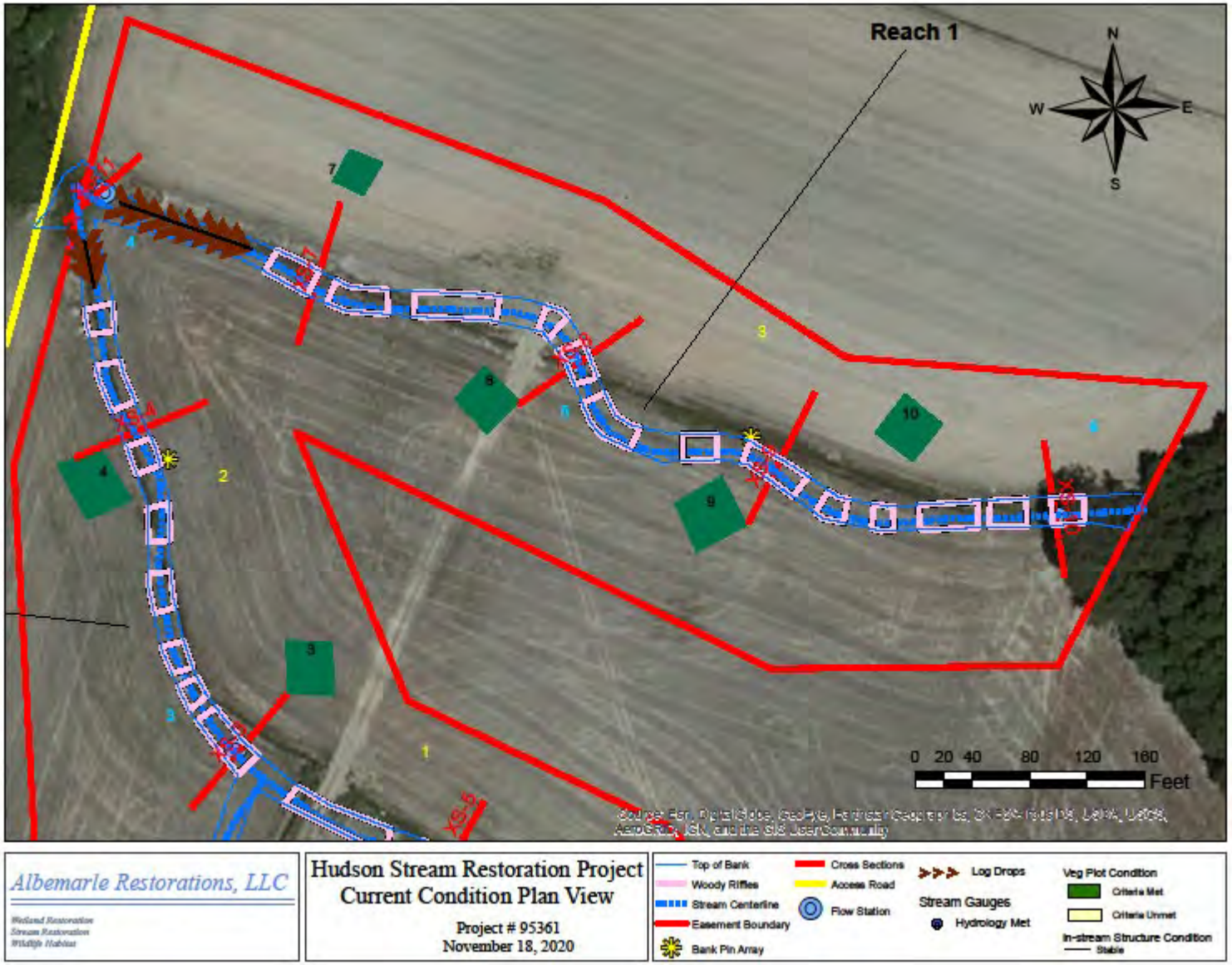
Current Condition Plan View

Table 5. Visual Stream Morphology Stability Assessment (Reach 1-4)

Table 6. Vegetation Condition Assessment Table

Site Photos


Reach 5
Reach 1
Reach 4
Reach 2
Reach 3
Albemarle Restorations, LLC
Wetland Restoration
Stream Restoration
Wildlife Habitat
Hudson Stream Restoration Project
Current Condition Plan View
Project # 95361
November 18, 2020
Flow Station
Bank Pin Array
Top of Bank
Cross Sections
Access Road
Stream Centerline
Easement Boundary
Woody Riffles
Log Drops
Stream Gauges
Hydrology Met
Veg Plot Condition
Criteria Met
Criteria Unmet
In-stream Structure Condition
- Stable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Feet
Albemarle Restorations, LLC
Wetland Restoration
Stream Restoration
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Current Condition Plan View
Project # 95361
November 18, 2020
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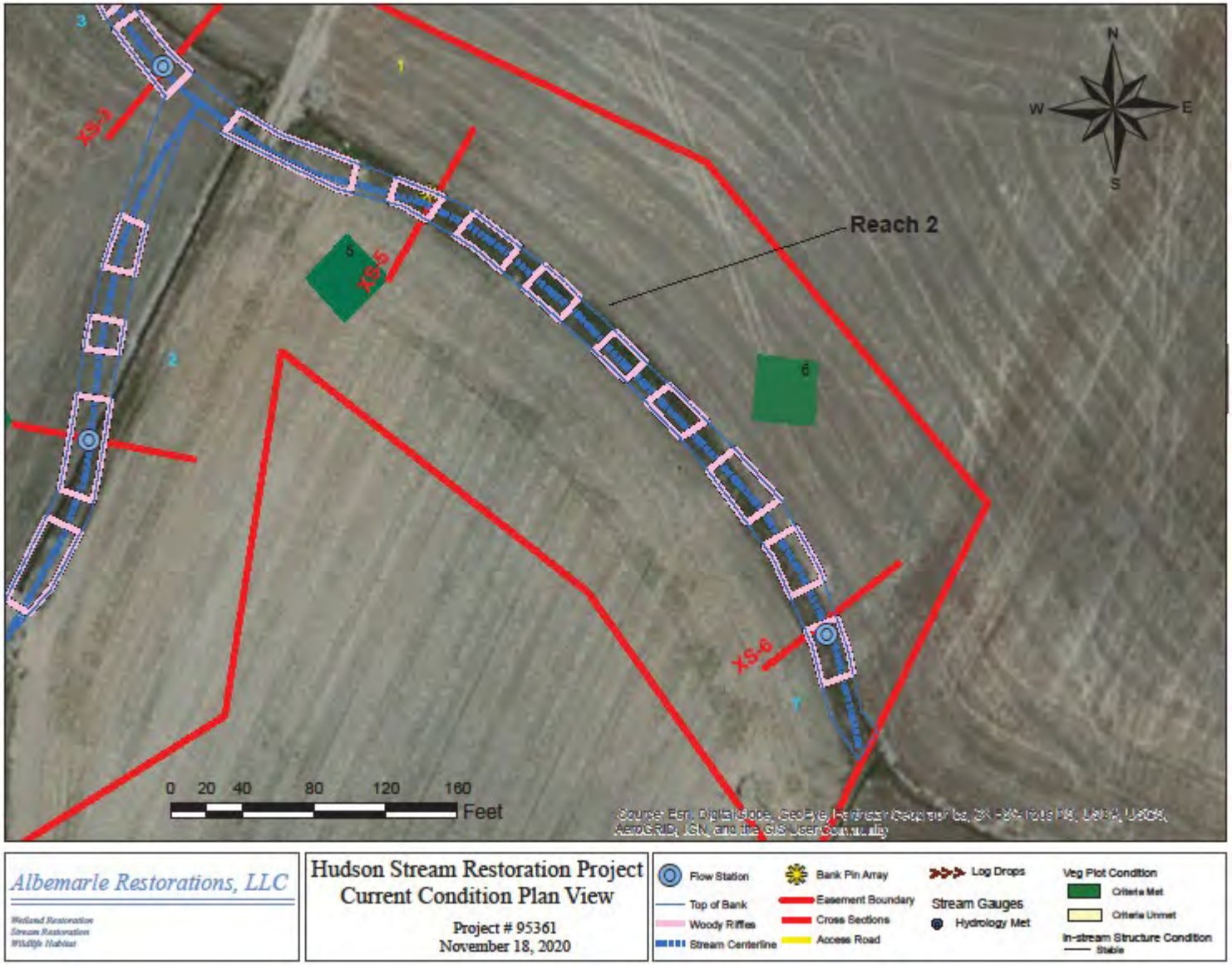
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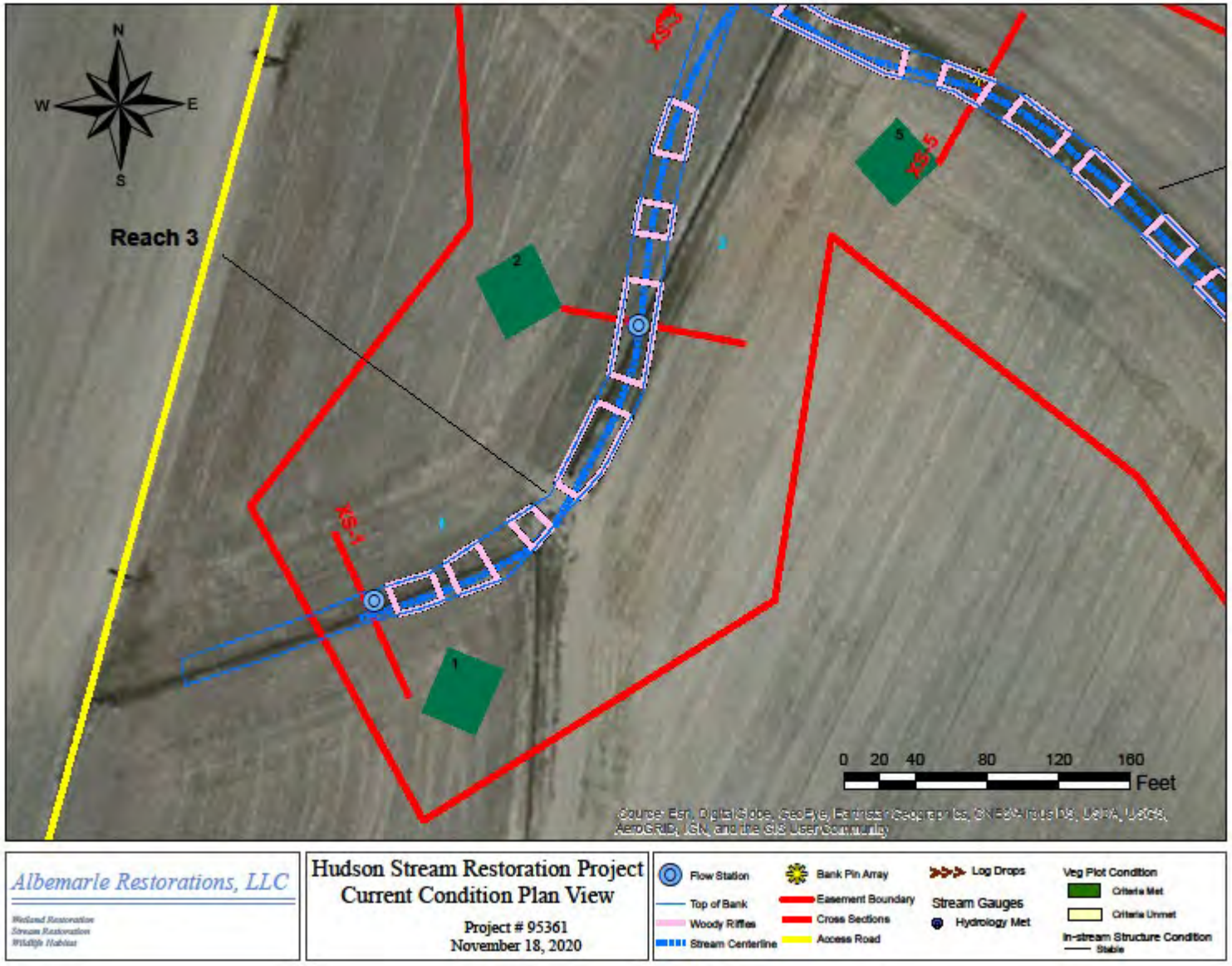

Albemarle Restorations, LLC

Wetland Restoration
Stream Restoration
Wildlife Habitat

Hudson Stream Restoration Project
Current Condition Plan View

Project # 95361
November 18, 2020

Flow Station
Top of Bank
Woody Riffles
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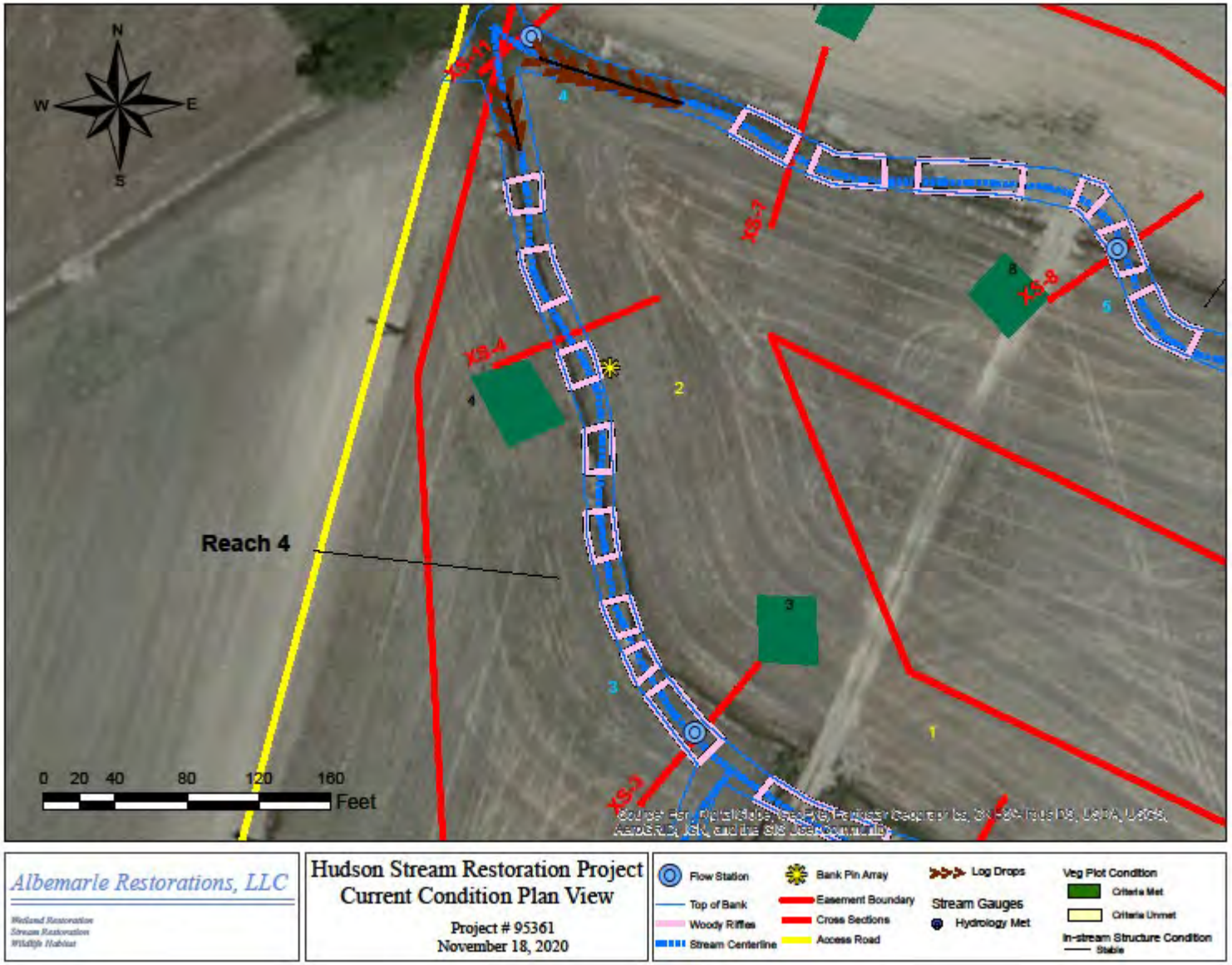
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XS-7
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XS-4
XS-3
Reach 4
1
2
3
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In-stream Structure Condition
Stable

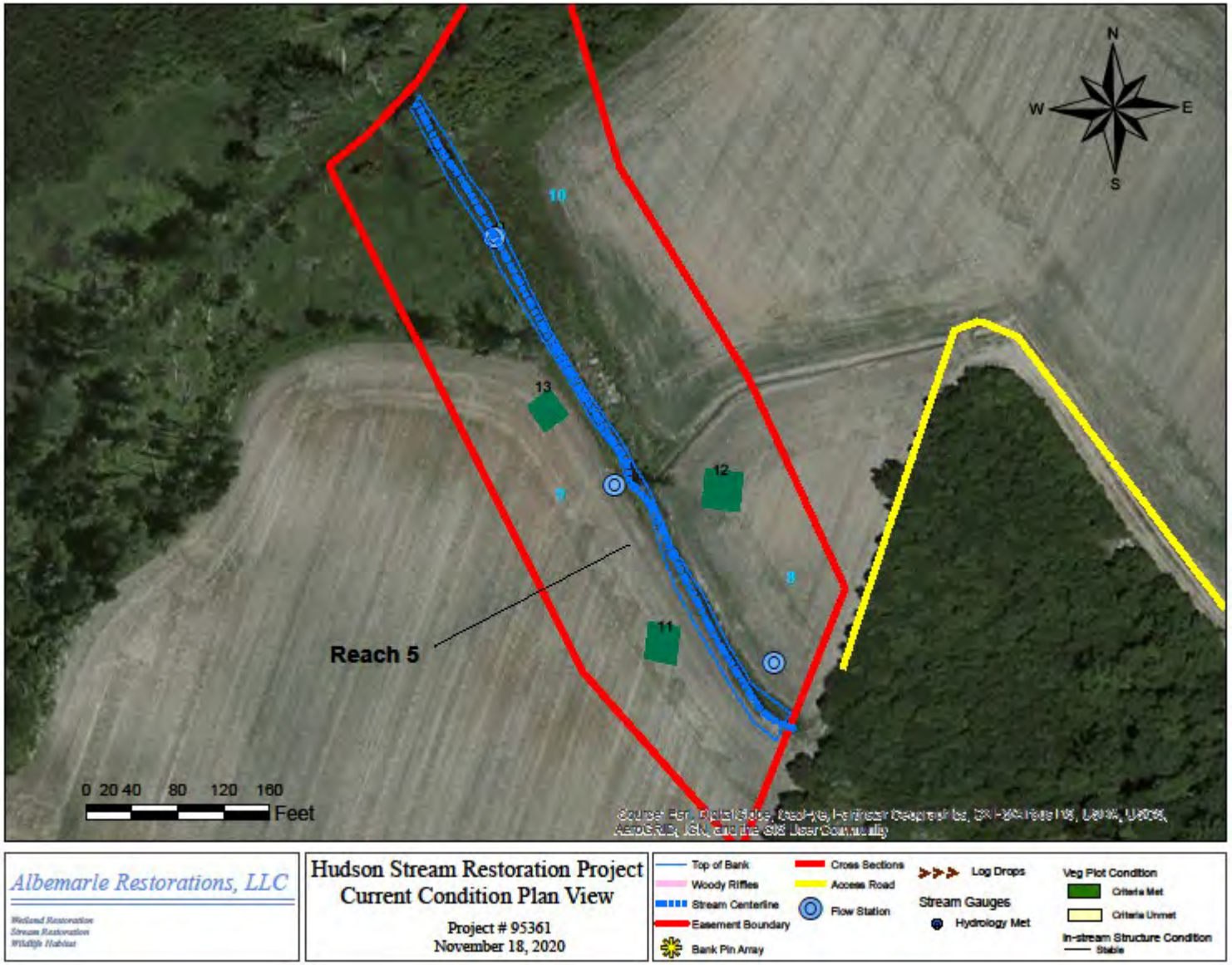

N
W
E
S
10
13
12
9
8
11
Reach 5
0 20 40 80 120 160
Feet
Albemarle Restorations, LLC
Wetland Restoration
Stream Restoration
Wildlife Habitat
Hudson Stream Restoration Project
Current Condition Plan View
Project # 95361
November 18, 2020
Top of Bank
Woody Riffles
Stream Centerline
Easement Boundary
Bank Pin Array
Cross Sections
Access Road
Flow Station
Log Drops
Stream Gauges
Hydrology Met
Veg Plot Condition
Criteria Met
Criteria Unmet
In-stream Structure Condition
Stable

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 1								
Assessed Length		766								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	13	13			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	5	5			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	5	5			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	8	8			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	8	8			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	8	8			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	8	8			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	8	8			100%			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 2								
Assessed Length		516								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	9	9			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	0	0			NA			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			NA			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	0	0			NA			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			NA			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 3								
Assessed Length		611								

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	7	7			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			100%			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA*			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA*			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	0	0			NA			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	0	0			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			NA			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	0	0			NA			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	0	0			NA			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 5		Visual Stream Morphology Stability Assessment								
Reach ID		Reach 4								
Assessed Length		503								

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
		2. Degradation - Evidence of downcutting			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	8	8			NA			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	3	3			NA			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	3	3			NA			
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	NA*	NA*			NA			
		2. Thalweg centering at downstream of meander (Glide)	NA*	NA*			NA			
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	3	3			NA			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	3	3			NA			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	3	3			NA			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	3	3			NA			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	3	3			NA			

* Stream's narrow width, layout, and heavily vegetated banks make this attribute not applicable.

Table 6	Vegetation Condition Assessment					
Planted Acreage	**12.42**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0	0.0%
2. Low Stem Density Areas*	Woody stem densities clearly below target levels based on MY 3, 4 or 5 stem count criteria	0.1 acres	Pattern and Color	0	0	0.0%
			Total:	**0**	**0**	**0.0%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	0.25 acres	Pattern and Color	0	0	0.0%
			Cumulative Total:	**0**	**0**	**0.0%**
Easement Acreage	**13.5**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale	1000 sf	Pattern and Color	0	0	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale	none	Pattern and Color	0	0	0.0%

No areas of concern are noted .

***Some small areas spot planted in 2019; these areas are smaller than 0.1 acres and not included in CCPV**

Photo 1: Highly vegetated stream area with wetland along Reach 1 - View South.

Photo 2: View of Cross Section 5 on Reach 2 – View Northwest.

Photo 3: View of Cross Section 1 on Reach 3 – View North.

Photo 4: View of Cross Section 3 on Reach 4 –View Northeast.

Photo 5: View downstream of Reach 5 Swamp Run.

Photo 6: View upstream on Reach 5 Swamp Run.

APPENDIX C: VEGETATION PLOT DATA

Table 7: Vegetation Plot Counts and Densities

Table 7: Vegetation Plot Counts and Densities

EEP Project Code 0004638. Project Name: Hudson

			Current Plot Data (MY5 2020)																									
			0004638-01-0001			0004638-01-0002			0004638-01-0003			0004638-01-0004			0004638-01-0005			0004638-01-0006			0004638-01-0007			0004638-01-0008		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																								
Baccharis halimifolia	eastern baccharis	Shrub			2									5						1			2			2
Betula nigra	river birch	Tree																								
Juniperus virginiana	eastern redcedar	Tree																								
Ligustrum vulgare	European privet	Exotic																								
Liquidambar styraciflua	sweetgum	Tree			1			1			2			1			2			1			1			2
Liriodendron tulipifera	tuliptree	Tree	1	1	1																					
Morella cerifera	wax myrtle	shrub			1			1						1												
Pinus echinata	shortleaf pine	Tree																								
Pinus taeda	loblolly pine	Tree			14			5			6			10			5			13						
Platanus occidentalis	American sycamore	Tree	3	3	6	4	4	4	4	4	5	3	3	3	2	2	2	2	2	2	6	6	6	5	5	5
Quercus alba	white oak	Tree	1	1	1	2	2	2				2	2	2												
Quercus bicolor	swamp white oak	Tree	4	4	4	1	1	1							1	1	1				2	2	2			
Quercus michauxii	swamp chestnut oak	Tree																								
Quercus nigra	water oak	Tree													2	2	2									
Quercus phellos	willow oak	Tree	2	2	2	1	1	3	3	3	3	5	5	5	4	4	4	4	4	4	3	3	6	6	6	6
Taxodium distichum	bald cypress	Tree													1	1	1	1	1	1						
Ulmus americana	American elm	Tree																								
		Stem count	11	11	32	8	8	17	7	7	16	10	10	27	10	10	17	7	7	22	11	11	17	11	11	15
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	5	5	9	4	4	7	2	2	4	3	3	7	5	5	7	3	3	6	3	3	5	2	2	4
		Stems per ACRE	445	445	1295	324	324	688	283	283	647	405	405	1093	405	405	688	283	283	890	445	445	688	445	445	607

EEP Project Code 0004638. Project Name: Hudson

			Annual Means																									
			0004638-01-0009			0004638-01-0010			0004638-01-0011			0004638-01-0012			0004638-01-0013			MY5 (2020)			MY3 (2018)			MY2 (2017)			MY1 (2016)			MY0 (2016)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree						2												2						9						
Baccharis halimifolia	eastern baccharis	Shrub			1						2			3						18			1								
Betula nigra	river birch	Tree										1	1	1				1	1	1											
Juniperus virginiana	eastern redcedar	Tree				1	1	1										1	1	1											
Ligustrum vulgare	European privet	Exotic																								1					
Liquidambar styraciflua	sweetgum	Tree						3						15			3			32			10			6					
Liriodendron tulipifera	tuliptree	Tree				2	2	2				1	1	1			1	4	4	5	14	14	15	15	15	18	12	12	12	31	31	31
Morella cerifera	wax myrtle	shrub																		3			4			2					
Pinus echinata	shortleaf pine	Tree			1															1			1								
Pinus taeda	loblolly pine	Tree			14			12						3			1			83			84			53					
Platanus occidentalis	American sycamore	Tree	5	5	5			1	10	10	10	1	1	1	4	4	4	49	49	54	49	49	50	46	46	50	44	44	47	54	54	54
Quercus alba	white oak	Tree										1	1	1	5	5	5	11	11	11	11	11	15	12	12	16	12	12	12	16	16	16
Quercus bicolor	swamp white oak	Tree							2	2	2	1	1	1				11	11	11	16	16	16	17	17	17	19	19	19	19	19	19
Quercus michauxii	swamp chestnut oak	Tree				1	1	1	1	1	1	3	3	3	1	1	1	6	6	6	8	8	8	11	11	12	8	8	8	13	13	13
Quercus nigra	water oak	Tree	3	3	3				3	3	3							8	8	8	13	13	13	14	14	15	11	11	11	18	18	18
Quercus phellos	willow oak	Tree	2	2	2	2	2	2			2							32	32	39	29	29	31	29	29	35	24	24	25	33	33	33
Taxodium distichum	bald cypress	Tree												2			3	2	2	7			6								
Ulmus americana	American elm	Tree				1	1	1										1	1	1											
		Stem count	10	10	26	7	7	25	16	16	20	8	8	31	10	10	18	126	126	283	140	140	254	144	144	234	130	130	134	184	184	184
		size (ares)	1			1			1			1			1			13			13			13			13			13		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.32			0.32			0.32			0.32			0.32		
		Species count	3	3	6	5	5	9	4	4	6	6	6	10	3	3	7	11	11	17	7	7	13	7	7	12	7	7	7	7	7	7
		Stems per ACRE	405	405	1052	283	283	1012	647	647	809	324	324	1255	405	405	728	392	392	881	436	436	791	448	448	728	405	405	417	573	573	573

Table 7: Vegetation Plot Counts and Densities (Continued)

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

APPENDIX D: STREAM MEASUREMENT AND GEOMORPHOLOGY DATA

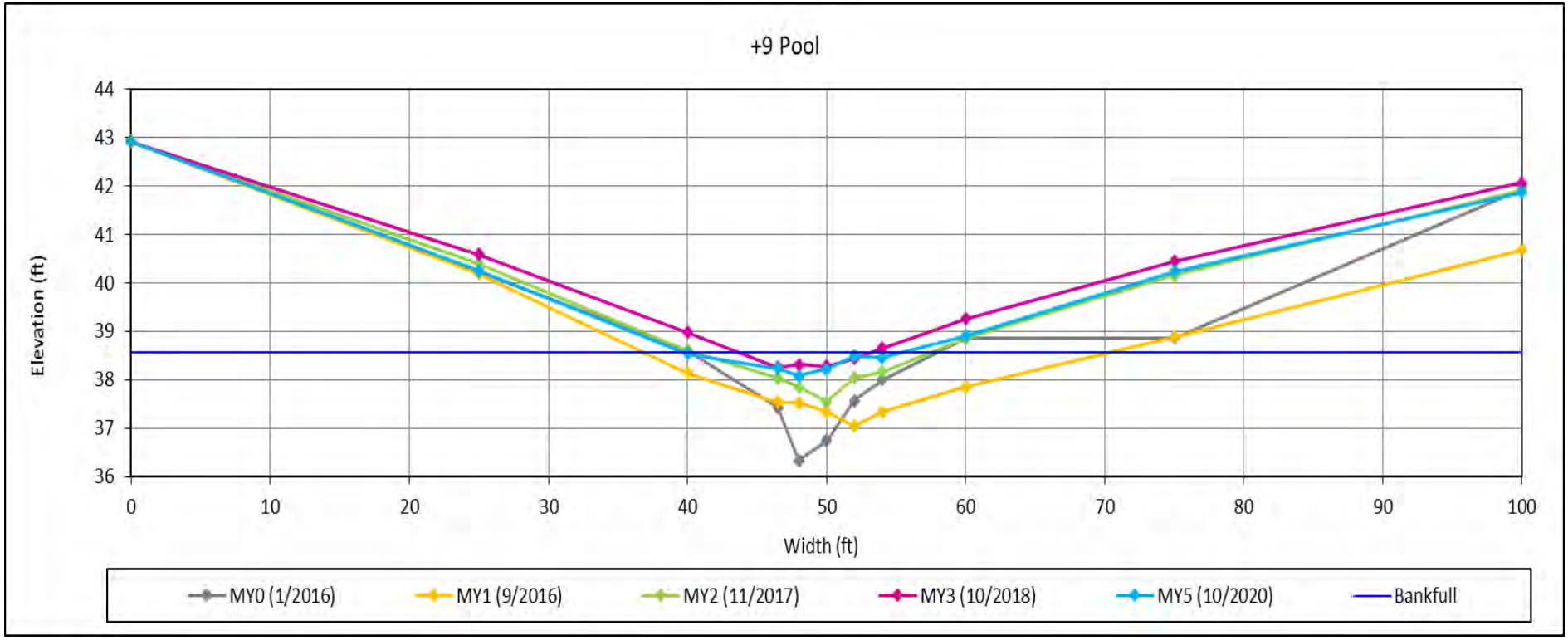
Cross Sections with Annual Overlays (XS 1-11)

Table 8: Bank Pin Data

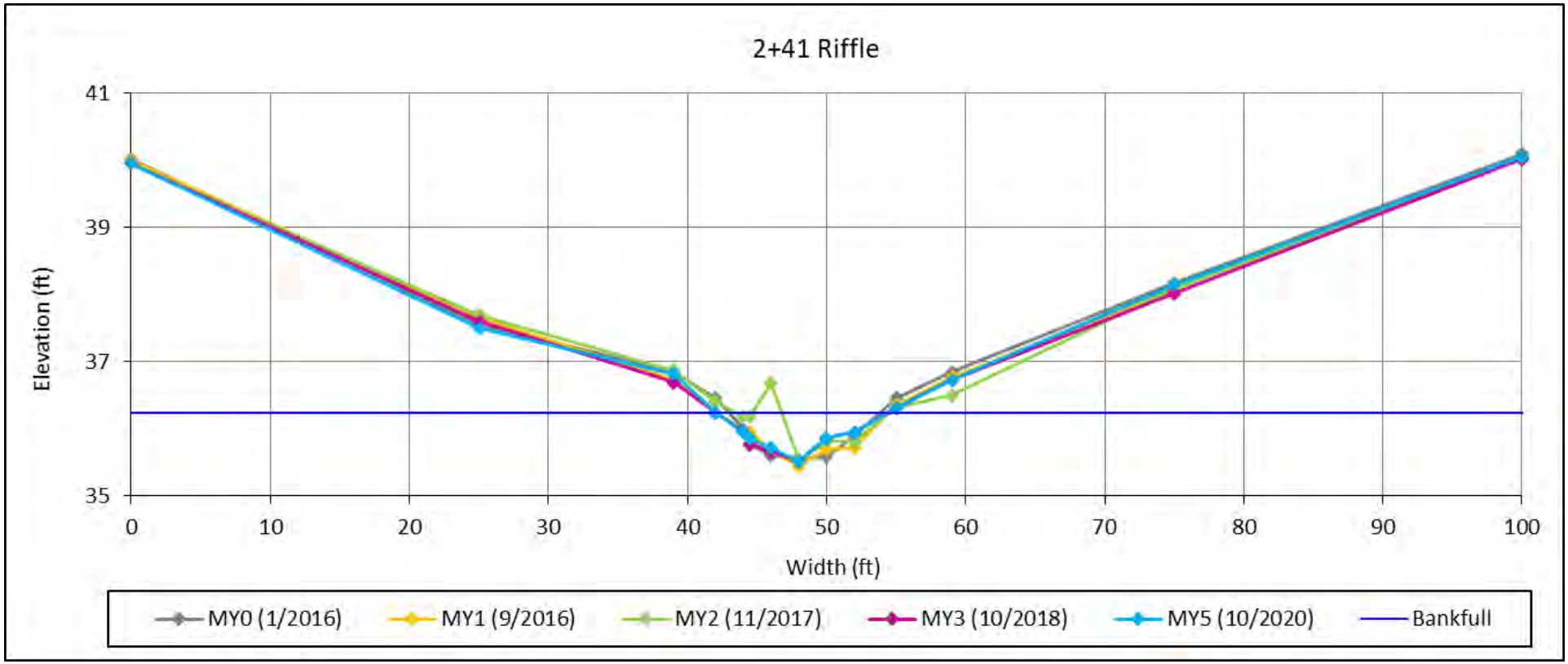
Table 10a. Baseline Stream Data Summary (Reach 1-4)

Table 11a. Monitoring Data – Dimensional Morphology Summary

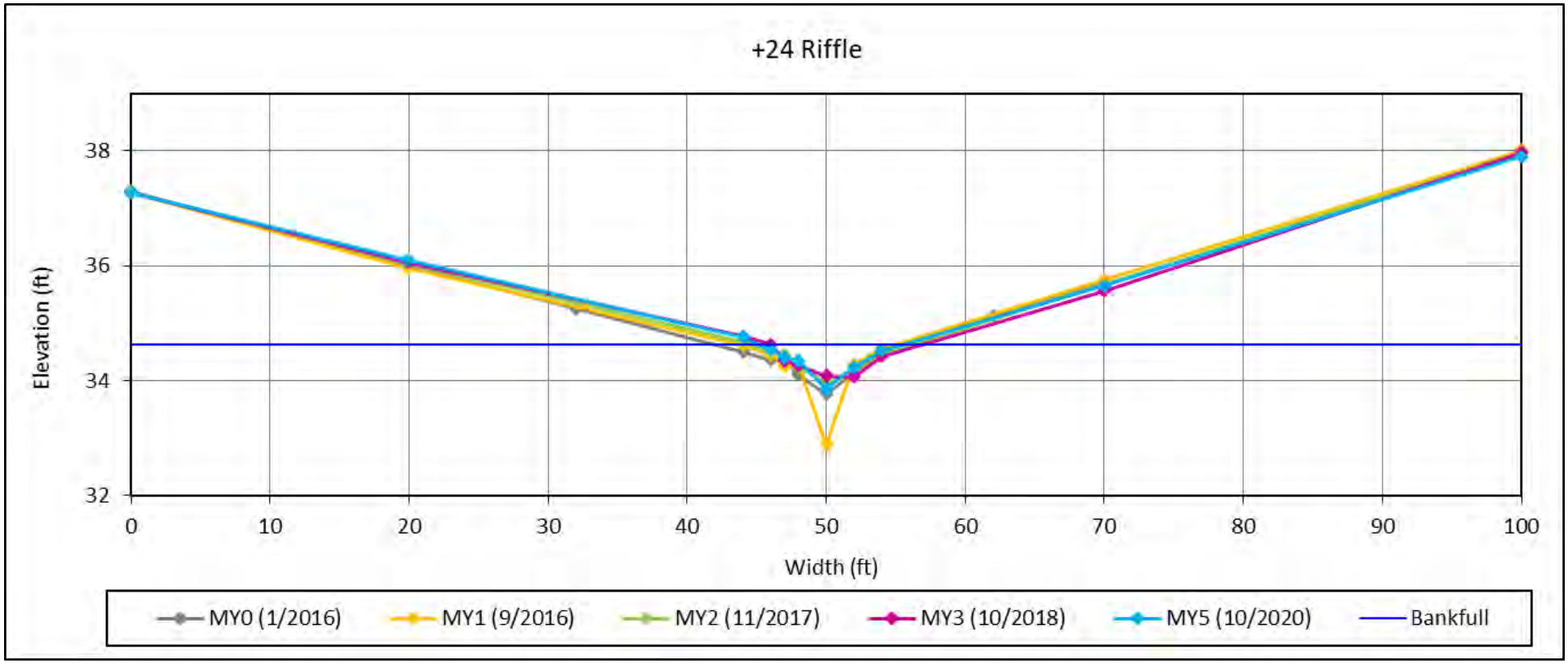
Table 11b. Monitoring Data – Stream Reach Data Summary (Reach 1-4)



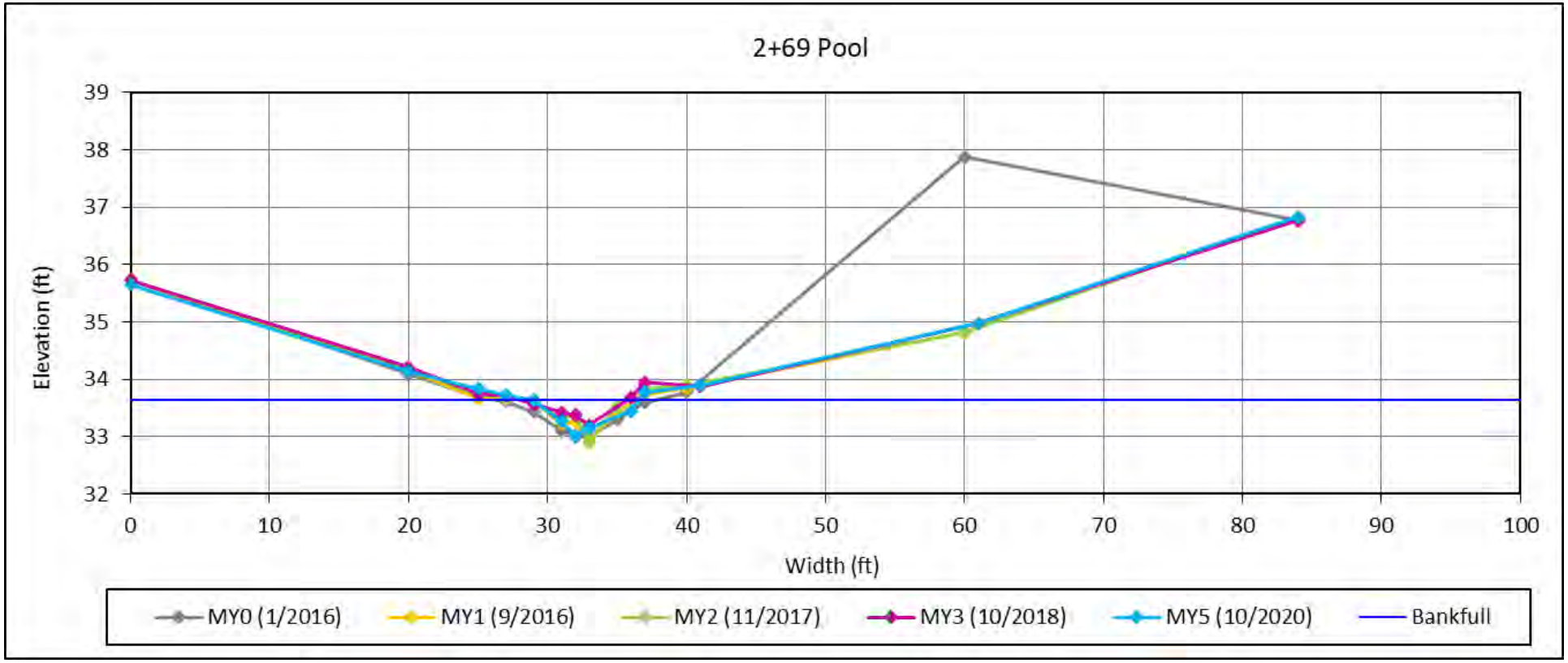
Cross Section 1 – Reach 3



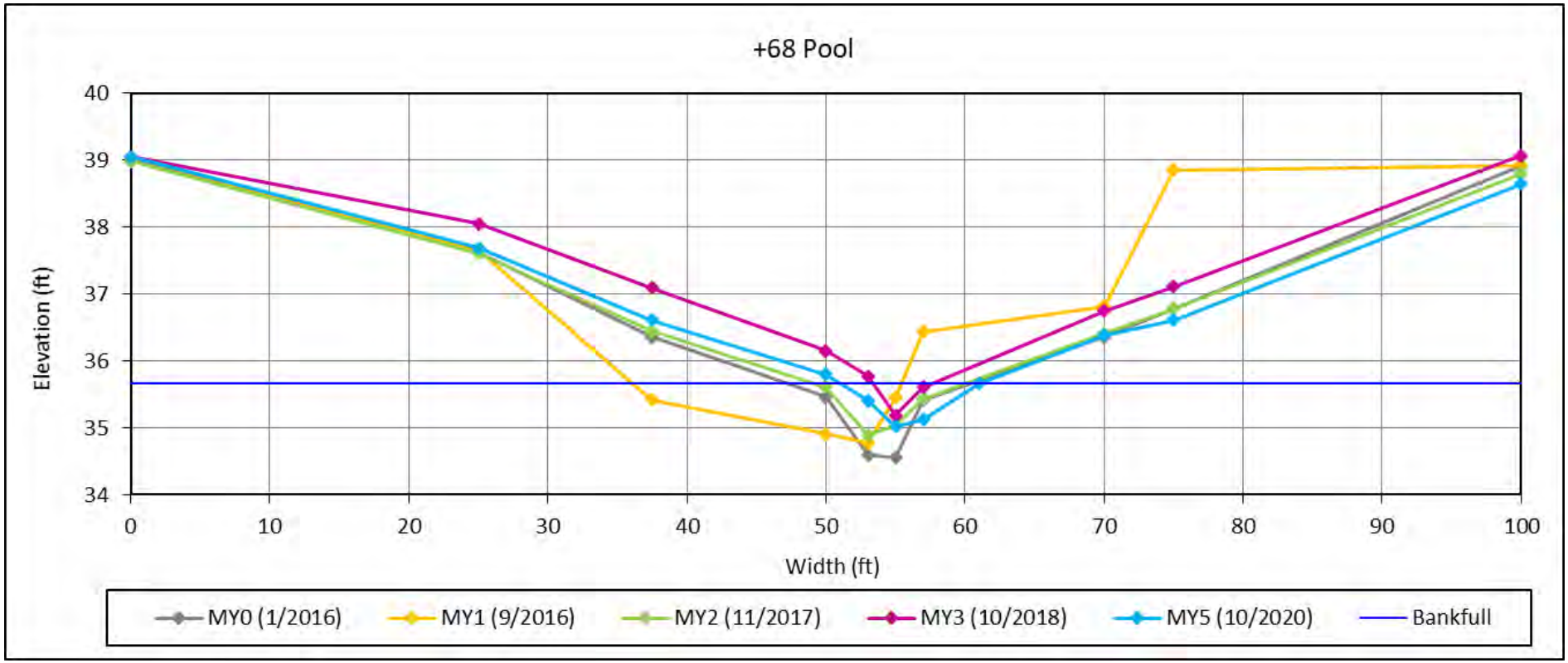
Cross Section 2 – Reach 3



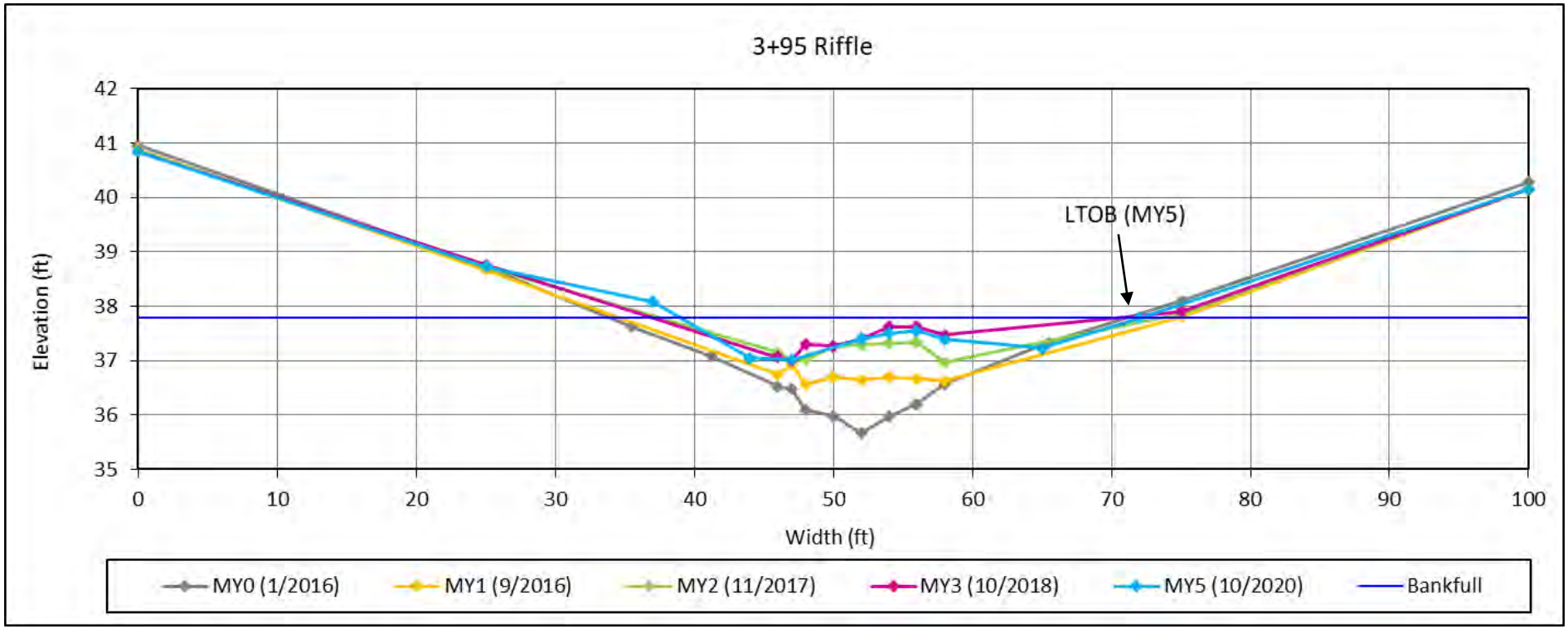
Cross Section 3 – Reach 4



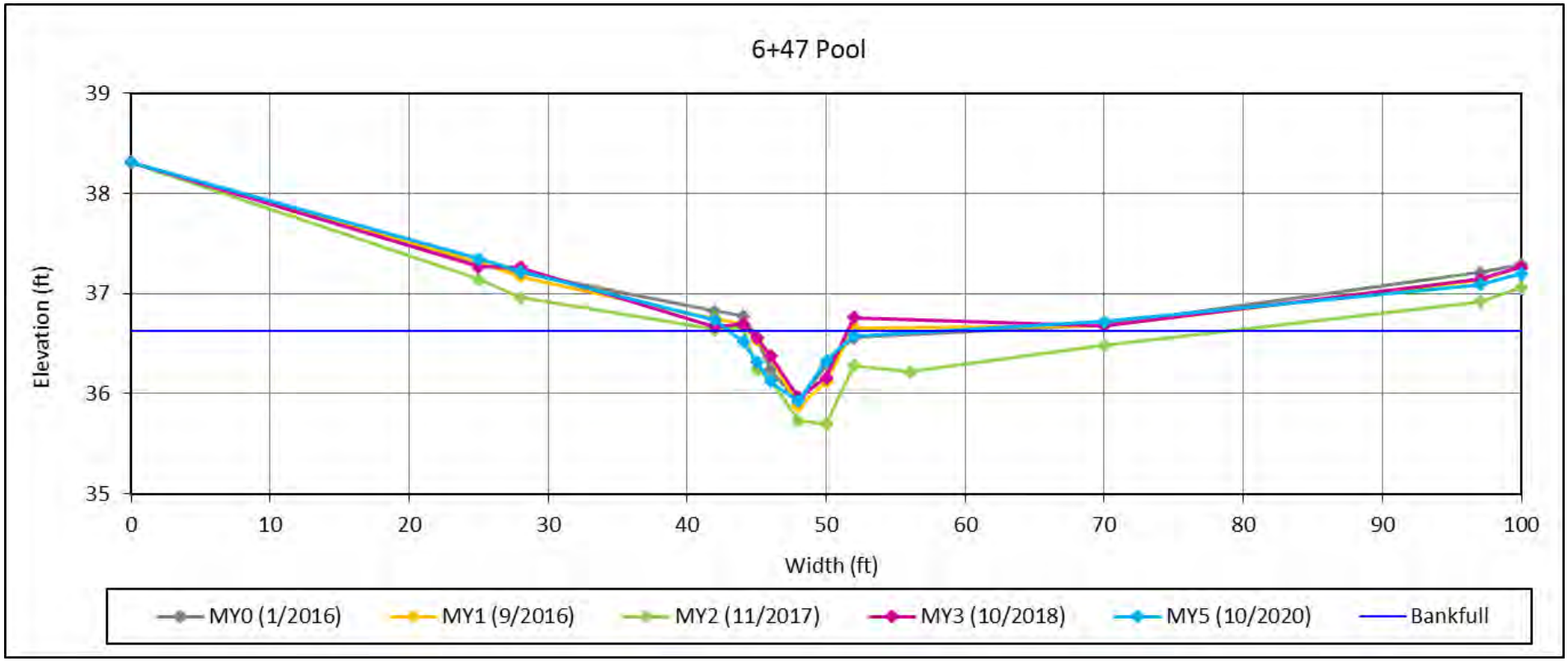
Cross Section 4 – Reach 4



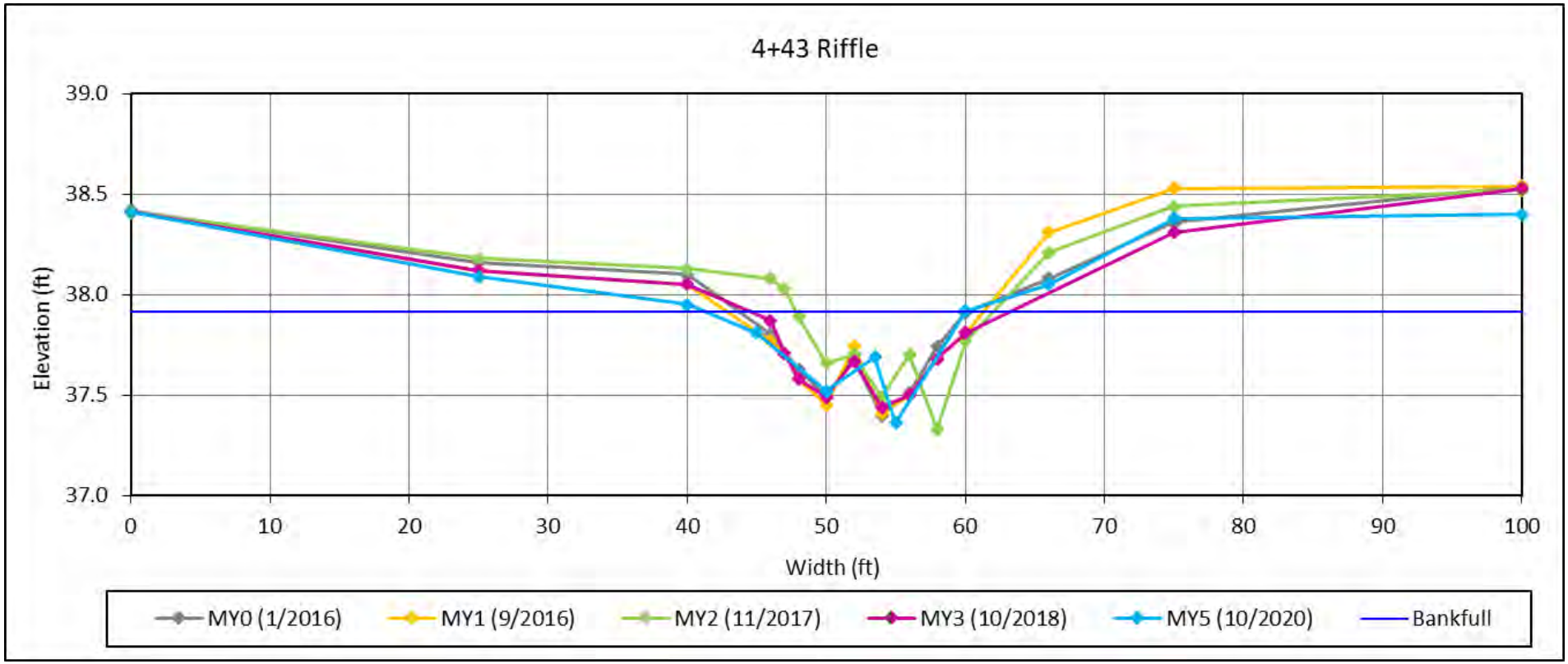
Cross Section 5 – Reach 2



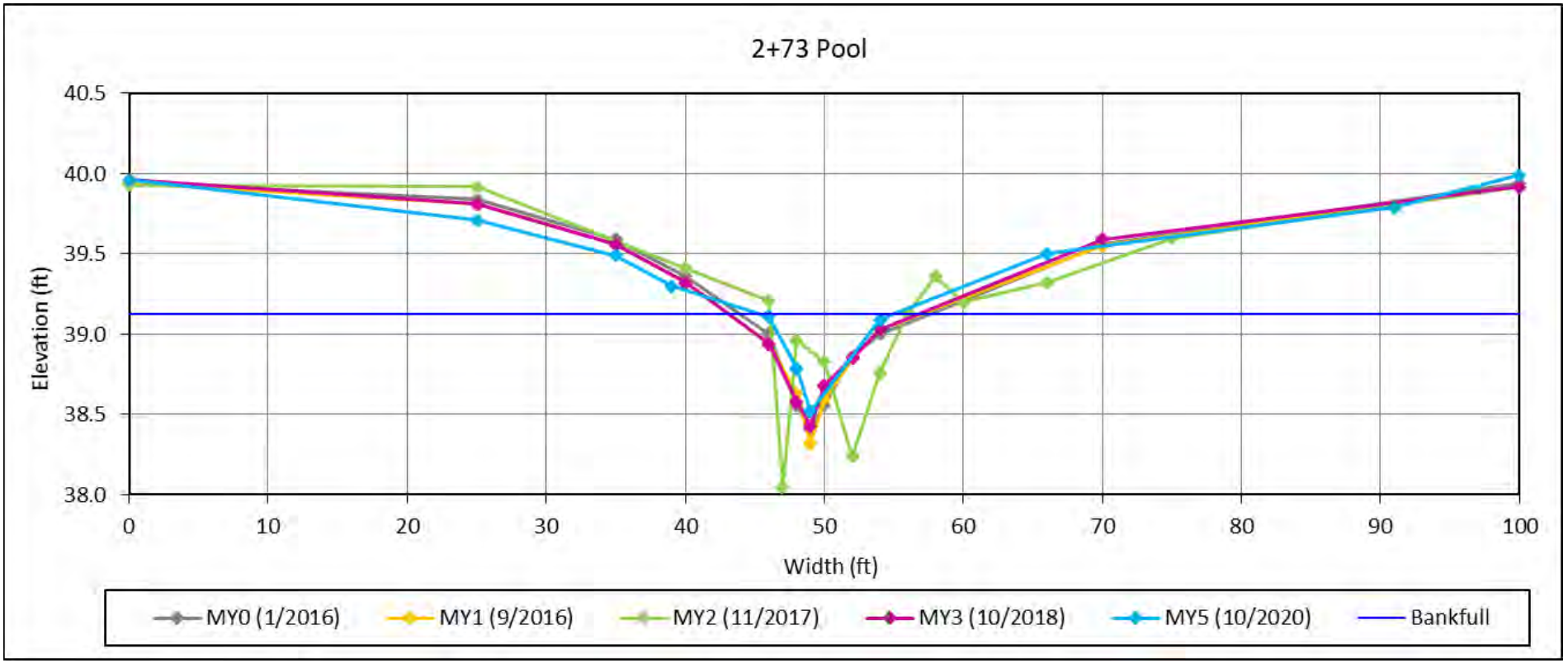
Cross Section 6 – Reach 2



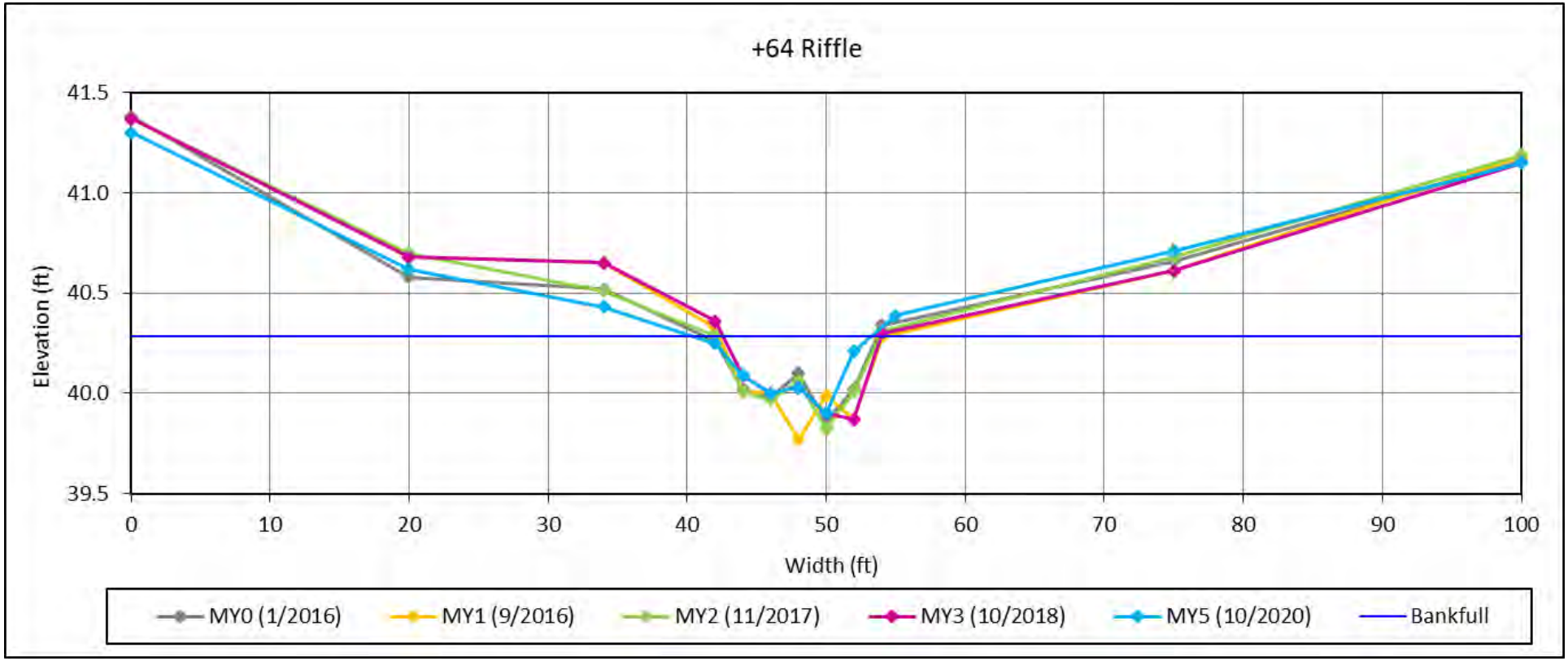
Cross Section 7 – Reach 1



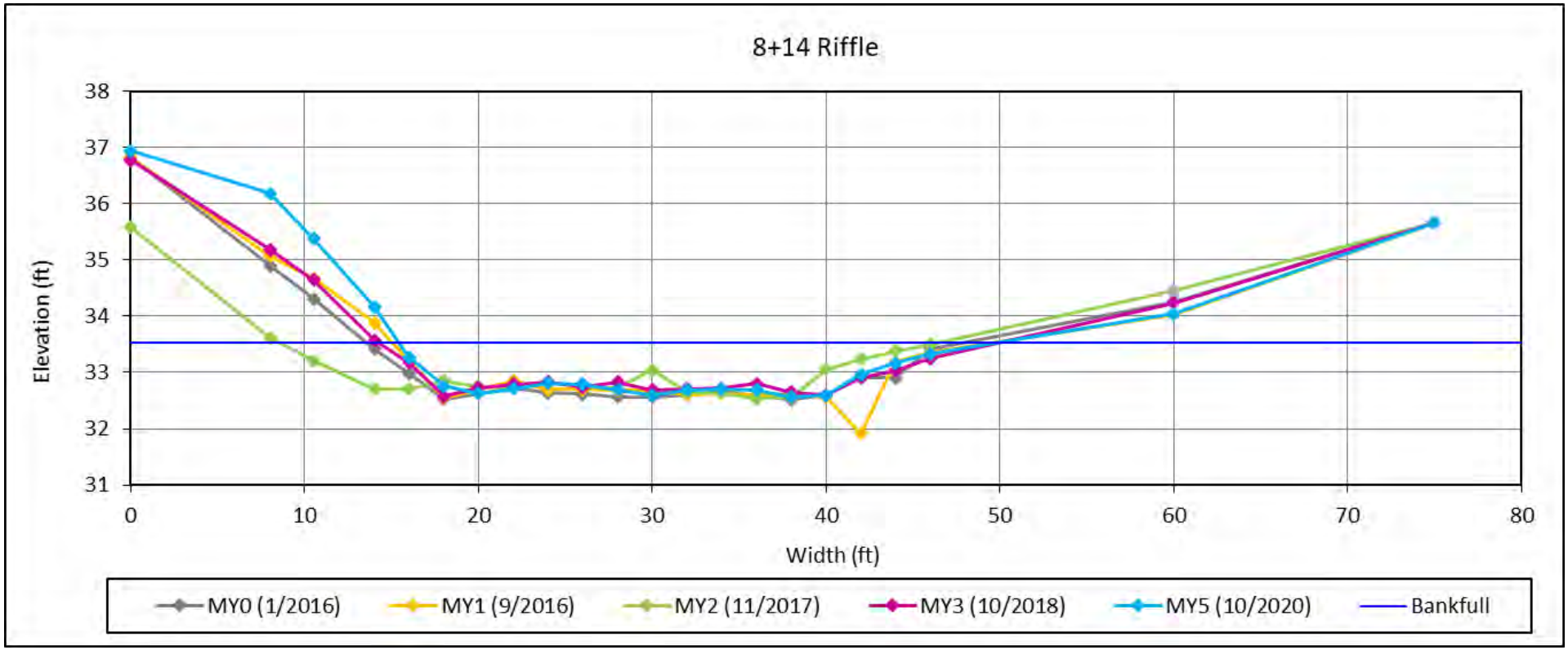
Cross Section 8 – Reach 1



Cross Section 9 – Reach 1



Cross Section 10 – Reach 1



Cross Section 11 – Reach 1 & 4 Confluence

Table 8: Monitoring Year 5 - Bank Pin Data

Pins arrays consist of three pins located in the middle of stream banks along meander bends

Bank Pin Array #1 @ XS 5 - Reach 2 – Station 2+69	
Pin	**Exposure**
Upstream Pin	Could not find- minor aggradation & dense vegetation
Middle Pin	Could not find- minor aggradation & dense vegetation
Downstream Pin	Could not find- minor aggradation & dense vegetation

Bank Pin Array #2 @ XS 4 - Reach 2 – Station 3+95	
Pin	**Exposure**
Upstream Pin	Could not find- minor aggradation & dense vegetation
Middle Pin	Could not find- minor aggradation & dense vegetation
Downstream Pin	Could not find- minor aggradation & dense vegetation

Bank Pin Array #1 @ XS 9 - Reach 1 – Station 2+73	
Pin	**Exposure**
Upstream Pin	Could not find- minor aggradation & dense vegetation
Middle Pin	Could not find- minor aggradation & dense vegetation
Downstream Pin	Could not find- minor aggradation & dense vegetation

Table 10a. Baseline Stream Data Summary																										
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 1																										
Parameter	**Gauge[2]**	**Regional Curve**			**Pre-Existing Condition**						**Reference Reach(es) Data**						**Design**			**Monitoring Baseline**					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					3.36		3.83	6.02			19.74		21.97	24.2				9.02		11.5			16.2		2
Floodprone Width (ft)					6.47		6.91	10.5			44		64.5	85			18.06	26.74	34.89	57			83.33		2
Bankfull Mean Depth (ft)					0.45		0.52	0.6			0.7		0.75	0.82				0.42		0.22			0.26		2
[1]Bankfull Max Depth (ft)					0.56		0.87	1.07			0.85		1.02	1.18			0.44	0.53	0.61	0.4			0.51		2
Bankfull Cross Sectional Area (ft^2)					1.99		2	2.68			16.09		16.49	16.89				3.8		2.58			4.26		2
Width/Depth Ratio					5.64		7.37	13.52			24.22		29.27	34.67				21.4		52.27			62.31		2
Entrenchment Ratio					1.74		1.8	1.93			2		2.94	3.87			2	2.94	3.87	4.96			5.14		2
[1]Bank Height Ratio																				1			1		2
Profile																									
Riffle Length (ft)						N/A*					12		46.5	81			4.93	19.09	33.25						
Riffle Slope (ft/ft)						N/A*					0.004		0.011	0.017			0.006	0.016	0.025						
Pool Length (ft)						N/A*					21		30.5	40			4.72	8.41	14.98						
Pool Max depth (ft)						N/A*					1.4		1.65	1.9			0.72	0.93	1.15						
Pool Spacing (ft)						N/A*					40		59	78			16.42	26.95	35.63						
Pattern																									
Channel Beltwidth (ft)						N/A*					27		49	76			11.08	20.11	31.19						
Radius of Curvature (ft)						N/A*					90		92	95			36.94	37.76	38.99						
Rc:Bankfull width (ft/ft)						N/A*											4.10	4.19	4.32						
Meander Wavelength (ft)						N/A*					12.43		15.07	18.25			112.1	135.9	164.6						
Meander Width Ratio						N/A*											1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2						0.26												0.18							
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2						0.56												0.14							
Additional Reach Parameters																									
Rosgen Classification						G5-G6						C5-C6						C5-C6			C5/6				
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)						5.6																			
Valley length (ft)						840						264									850				
Channel Thalweg length (ft)						846						264						833							
Sinuosity (ft)						1.01						1						1.04			1.04				
Water Surface Slope (Channel) (ft/ft)						0.007						0.004						0.007							
BF slope (ft/ft)																					0.006				
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10a. Baseline Stream Data Summary																									
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 2																									
Parameter	**Gauge[2]**	**Regional Curve**			**Pre-Existing Condition**						**Reference Reach(es) Data**						**Design**			**Monitoring Baseline**					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					5.97		6.87	7.2			19.74		21.97	24.2				14.83				11.78			1
Floodprone Width (ft)					10.03		12.03	13.47			44		64.5	85			29.71	43.55	57.39			28.2			1
Bankfull Mean Depth (ft)					0.91		0.92	0.94			0.7		0.75	0.82				0.67				0.45			1
[1]Bankfull Max Depth (ft)					1.38		1.42	1.54			0.85		1.02	1.18			0.7	0.84	0.98			0.86			1
Bankfull Cross Sectional Area (ft^2)					5.59		6.32	6.58			16.09		16.49	16.89				10				5.28			1
Width/Depth Ratio					6.38		7.47	7.88			24.22		29.27	34.67				22				26.18			1
Entrenchment Ratio					1.67		1.68	1.96			2		2.94	3.87				2.94				2.39			1
[1]Bank Height Ratio																						1			1
Profile																									
Riffle Length (ft)						N/A*					12		46.5	81			8.1	31.39	54.68						
Riffle Slope (ft/ft)						N/A*					0.004		0.011	0.017			0.003	0.008	0.012						
Pool Length (ft)						N/A*					21		30.5	40			14.18	20.59	27						
Pool Max depth (ft)						N/A*					1.4		1.65	1.9			1.16	1.48	1.84						
Pool Spacing (ft)						N/A*					40		59	78			27	44.33	58.61						
Pattern																									
Channel Beltwidth (ft)						N/A*					27		49	76			18.23	33.08	51.31						
Radius of Curvature (ft)						N/A*					90		92	95			60.76	62.11	64.14						
Rc:Bankfull width (ft/ft)						N/A*											4.10	4.19	4.32						
Meander Wavelength (ft)						N/A*					12.43		15.07	18.25			184.3	223.5	270.7						
Meander Width Ratio						N/A*											1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2						0.42												0.11							
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2						1.25												0.18							
Additional Reach Parameters																									
Rosgen Classification						G5-G6						C5-C6						C5-C6			C 5/6				
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)						17.2																			
Valley length (ft)						486						264													
Channel Thalweg length (ft)						516						264						532			541				
Sinuosity (ft)						1.06						1						1.05			1.05				
Water Surface Slope (Channel) (ft/ft)						0.003						0.004						0.003							
BF slope (ft/ft)																					0.0035				
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10a. Baseline Stream Data Summary																									
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 3																									
Parameter	**Gauge[2]**	**Regional Curve**			**Pre-Existing Condition**						**Reference Reach(es) Data**						**Design**			**Monitoring Baseline**					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					3.55		4.03	5.05			19.74		21.97	24.2				10				12.5			1
Floodprone Width (ft)					5.97		6.44	9.13			44		64.5	85			20.03	29.36	38.69			32.9			1
Bankfull Mean Depth (ft)					0.55		0.79	0.84			0.7		0.75	0.82				0.5				0.57			1
[1]Bankfull Max Depth (ft)					0.88		1.15	1.44			0.85		1.02	1.18			0.52	0.63	0.72			0.85			1
Bankfull Cross Sectional Area (ft^2)					1.94		3.17	4.26			16.09		16.49	16.89				5				7.07			1
Width/Depth Ratio					5.12		5.99	6.5			24.22		29.27	34.67				20				21.95			1
Entrenchment Ratio					1.6		1.68	1.8			2		2.94	3.87			2	2.94	3.87			2.63			1
[1]Bank Height Ratio																						1			1
Profile																									
Riffle Length (ft)						N/A*					12		46.5	81			5.46	21.17	36.87						
Riffle Slope (ft/ft)						N/A*					0.004		0.011	0.017			0.005	0.014	0.021						
Pool Length (ft)						N/A*					21		30.5	40			9.56	13.88	18.21						
Pool Max depth (ft)						N/A*					1.4		1.65	1.9			0.86	1.1	1.36						
Pool Spacing (ft)						N/A*					40		59	78			18.21	29.89	39.51						
Pattern																									
Channel Beltwidth (ft)						N/A*					27		49	76			12.29	22.3	24.59						
Radius of Curvature (ft)						N/A*					90		92	95			40.96	41.88	43.24						
Rc:Bankfull width (ft/ft)						N/A*											4.10	4.19	4.32						
Meander Wavelength (ft)						N/A*					12.43		15.07	18.25			124.3	150.7	182.5						
Meander Width Ratio						N/A*											1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					0.37												0.14								
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2					1.02												0.18								
Additional Reach Parameters																									
Rosgen Classification					G5-G6						C5-C6						C5-C6			C 5/6					
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)					8																				
Valley length (ft)					442						264														
Channel Thalweg length (ft)					460						264						445			446					
Sinuosity (ft)					1.04						1						1.01			1.08					
Water Surface Slope (Channel) (ft/ft)					0.007						0.004						0.007								
BF slope (ft/ft)																				0.005					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 10a. Baseline Stream Data Summary																									
Project Name/Number (Hudson/ DMS:95361) - Segment/Reach: Reach 4																									
Parameter	**Gauge[2]**	**Regional Curve**			**Pre-Existing Condition**						**Reference Reach(es) Data**						**Design**			**Monitoring Baseline**					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					7.34		7.48	8.84			19.74		21.97	24.2				21.82				9.9			1
Floodprone Width (ft)					12.21		13.83	16.28			44		64.5	85			43.69	64.05	84.41			31.36			1
Bankfull Mean Depth (ft)					0.97		1	1.05			0.7		0.75	0.82				0.78				0.32			1
[1]Bankfull Max Depth (ft)					1.47		1.51	1.82			0.85		1.02	1.18			0.81	0.98	1.13			0.74			1
Bankfull Cross Sectional Area (ft^2)					7.49		7.69	8.58			16.09		16.49	16.89				17				3.17			1
Width/Depth Ratio					7.01		7.47	9.11			24.22		29.27	34.67				28				30.9			1
Entrenchment Ratio					1.63		1.84	1.88			2		2.94	3.87			2	2.94	3.87			3.17			1
[1]Bank Height Ratio																						1			1
Profile																									
Riffle Length (ft)							N/A*				12		46.5	81			11.92	46.18	80.44						
Riffle Slope (ft/ft)							N/A*				0.004		0.011	0.017			0.006	0.016	0.025						
Pool Length (ft)							N/A*				21		30.5	40			20.85	30.29	39.72						
Pool Max depth (ft)							N/A*				1.4		1.65	1.9			1.34	1.71	2.12						
Pool Spacing (ft)							N/A*				40		59	78			39.72	65.21	86.21						
Pattern																									
Channel Beltwidth (ft)							N/A*				27		49	76			26.8	48.66	75.47						
Radius of Curvature (ft)							N/A*				90		92	95			89.37	91.36	94.34						
Rc:Bankfull width (ft/ft)							N/A*										4.096	4.188	4.324						
Meander Wavelength (ft)							N/A*				12.43		15.07	18.25			271.1	328.7	398.2						
Meander Width Ratio							N/A*										1.23	2.23	3.46						
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					0.48												0.16								
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2					1.01												0.22								
Additional Reach Parameters																									
Rosgen Classification					G5-G6						C5-C6						C5-C6			C 5/6					
Bankfull Velocity (fps)																									
Bankfull Discharge (cfs)					26.2																				
Valley length (ft)					434						264														
Channel Thalweg length (ft)					503						264						437			447					
Sinuosity (ft)					1.16						1						1.01			1.01					
Water Surface Slope (Channel) (ft/ft)					0.003						0.004						0.003								
BF slope (ft/ft)																				0.0035					
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks																									
Channel Stability or Habitat Metric																									
Biological or Other																									

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 1-4 (2200 feet)

	Cross Section 1 (Pool - Reach 3)							Cross Section 2 (Riffle - Reach 3)							Cross Section 3 (Riffle - Reach 4)							Cross Section 4 (Pool - Reach 4)							Cross Section 5 (Pool - Reach 2)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area								36.40	36.36	36.55	36.42	36.43			34.50	34.34	34.60	34.62	34.63																
Bank Height Ratio_Based on AB Bankfull[1] Area								1.00	1.00	0.77	0.88	0.79			1.00	1.14	0.77	0.65	0.90																
Thalweg Elevation	36.33	37.05	37.54	38.28	38.08			35.55	35.44	35.52	35.51	35.51			33.76	32.88	33.96	34.06	33.85			33.00	32.92	32.90	33.20	33.02			34.56	34.77	34.89	35.19	35.02		
LTOB[2] Elevation	37.57	37.53	38.05	38.65	38.49			36.40	36.36	36.31	36.31	36.24			34.50	34.55	34.45	34.42	34.52			33.60	33.64	33.60	33.75	33.73			35.46	35.42	35.44	36.15	35.41		
LTOB[2] Max Depth (ft)	1.24	0.48	0.51	0.37	0.50			0.85	0.92	0.79	0.80	0.70			0.74	1.67	0.49	0.36	0.70			0.60	0.72	0.70	0.55	0.60			0.90	0.65	0.55	0.96	0.60		
LTOB[2] Cross Sectional Area (ft^2)	3.90	1.50	1.40	1.80	1.80			7.07	7.07	2.90	5.60	4.60			3.17	4.40	2.00	1.70	2.30			3.19	2.30	1.80	2.50	2.50			3.70	4.90	2.00	3.40	3.40		

	Cross Section 6 (Riffle - Reach 2)							Cross Section 7 (Pool - Reach 1)							Cross Section 8 (Riffle - Reach 1)							Cross Section 9 (Pool - Reach 1)							Cross Section 10 (Riffle - Reach 1)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	36.53	37.13	37.75	37.84	37.52										37.91	37.90	37.97	37.93	37.91											40.26	40.22	40.27	40.28	40.29		
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.63	0.47	0.74	1.50										1.00	1.30	1.09	0.88	0.80											1.00	1.13	1.04	1.00	0.90		
Thalweg Elevation	35.67	36.57	36.97	37.01	37.02			35.91	35.87	35.70	35.96	35.93			37.40	37.41	37.33	37.44	37.36			38.41	38.32	38.05	38.43	38.52			39.86	39.77	39.82	39.87	39.90		
LTOB[2] Elevation	36.53	36.92	37.34	37.62	37.78			36.56	36.66	36.25	36.70	36.58			37.91	38.05	38.03	37.87	37.81			39.00	39.03	39.21	39.05	39.09			40.26	40.28	40.29	40.28	40.25		
LTOB[2] Max Depth (ft)	0.86	0.35	0.37	0.61	0.80			0.65	0.79	0.55	0.74	0.70			0.51	0.64	0.70	0.43	0.50			0.59	0.71	1.16	0.62	0.60			0.40	0.51	0.47	0.41	0.40		
LTOB[2] Cross Sectional Area (ft^2)	5.25	2.82	1.60	2.66	12.09			2.30	3.10	2.30	3.20	3.20			4.28	7.20	5.01	3.80	2.77			2.20	2.40	5.20	2.40	2.40			2.40	3.30	2.90	2.40	2.00		

	Cross Section 11 (Confluence - Reach 1)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-Bankfull[1] Area	33.42	33.44	33.49	33.52	33.53		
Bank Height Ratio_Based on AB Bankfull[1] Area	1.00	0.84	0.73	0.71	0.79		
Thalweg Elevation	32.51	31.91	32.56	32.58	32.60		
LTOB[2] Elevation	33.42	33.19	33.24	33.25	33.33		
LTOB[2] Max Depth (ft)	0.91	1.28	0.68	0.67	0.50		
LTOB[2] Cross Sectional Area (ft^2)	22.54	14.68	14.13	13.85	16.54		

The above morphology parameters reflect the 2018 guidance that arose from the mitigation technical workgroup consisting of DMS, the IRT and industry mitigation providers/practitioners. The outcome resulted in the focus on three primary morphological parameters of interest for the purposes of tracking channel change moving forward. They are the bank height ratio using a constant As-built bankfull area and the cross sectional area and max depth based on each years low top of bank. These are calculated as follows:

1 - **Bank Height Ratio (BHR)** takes the As-built bankful area as the basis for adjusting each subsequent years bankfull elevation. For example if the As-built bankfull area was 10 ft2, then the MY1 bankfull elevation would be adjusted until the calculated bankfull area within the MY1 cross section survey = 10 ft2. The BHR would then be calculated with the difference between the low top of bank (LTOB) elevation for MY1 and the thalweg elevation for MY1 in the numerator with the difference between the MY1 bankfull elevation and the MY1 thalweg elevation in the denominator. This same process is then carried out in each successive year.

2 - **LTOB Area and Max depth -** These are based on the LTOB elevation for each years survey (The same elevation used for the LTOB in the BHR calculation). Area below the LTOB elevation will be used and tracked for each year as above. The difference between the LTOB elevation and the thalweg elevation (same as in the BHR calculation) will be recroded and tracked above as LTOB

Note: The smaller the channel the closer the survey measurements are to their limit of reliable detection, therefore inter-annual variation in morphological measurement (as a percentage) is by default magnified as channel size decereases. Some of the variability above is the result of this factor and some is due to the large amount of depositional sediments observed.

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary																																			
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 1																																			
Parameter	**Baseline**						**MY-1**						**MY-2**						**MY- 3**						**MY- 5**						**MY- 7**					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	11.50			16.20		2	11.46			20.00		2	11.19			16.10		2	11.24			17.33		2	11.20			14.90		2						
Floodprone Width (ft)	57.00			83.30		2	58.28			86.26		2	53.80			97.70		2	57.38			74.01		2	54.00			>100		2						
Bankfull Mean Depth (ft)	0.22			0.26		2	0.24			0.28		2	0.23			0.26		2	0.25			0.26		2	0.20			0.60		2						
[1]Bankfull Max Depth (ft)	0.40			0.51		2	0.49			0.50		2	0.42			0.57		2	0.40			0.45		2	0.40			0.60		2						
Bankfull Cross Sectional Area (ft^2)	2.58			4.26		2	3.25			4.77		2	2.58			4.26		2	2.58			4.26		2	2.58			4.26		2						
Width/Depth Ratio	52.27			62.31		2	40.49			83.95		2	48.60			60.83		2	38.10			38.50		2	52.20			52.80		2						
Entrenchment Ratio	4.96			5.14		2	4.31			5.08		2	5.21			5.36		2	4.27			5.10		2	4.80			---		2						
[1]Bank Height Ratio	1.00			1.00		2	1.00			1.00		2	1.12			0.88		2	0.91			1.10		2	0.80			0.90		2						
Profile																																			
Riffle Length (ft)																																			
Riffle Slope (ft/ft)																																			
Pool Length (ft)																																			
Pool Max depth (ft)																																			
Pool Spacing (ft)																																			
Pattern																																			
Channel Beltwidth (ft)																																			
Radius of Curvature (ft)																																			
Rc:Bankfull width (ft/ft)																																			
Meander Wavelength (ft)																																			
Meander Width Ratio																																			
Additional Reach Parameters																																			
Rosgen Classification	C 5/6						C 5/6						C 5/6						C 5/6						C 5/7											
Channel Thalweg length (ft)	850						850						850						850						850											
Sinuosity (ft)	1.04						1.04						1.04						1.04						1.04											
Water Surface Slope (Channel) (ft/ft)																																			
BF slope (ft/ft)	0.006						0.006						0.006						0.006						0.006											
2 = Bankfull for XS 6 recalculated																																			
[3]Ri% / Ru% / P% / G% / S%																																			
[3]SC% / Sa% / G% / C% / B% / Be%																																			
[3]d16 / d35 / d50 / d84 / d95 /																																			
[2]% of Reach with Eroding Banks																																			
Channel Stability or Habitat Metric																																			
Biological or Other																																			

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 2

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 5						MY- 7					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)			11.78			1			12.51			1			12.51			1			26.22			1			24.4			1						
Floodprone Width (ft)			28.2			1			25			1			42.3			1			48.32			1			36.3			1						
Bankfull Mean Depth (ft)			0.45			1			0.11			1			0.42			1			0.22			1			0.2			1						
[1]Bankfull Max Depth (ft)			0.86			1			0.21			1			0.54			1			0.64			1			0.5			1						
Bankfull Cross Sectional Area (ft^2)			5.28			1			1.39			1			5.28			1			5.28			1			5.28			1						
Width/Depth Ratio			26.2			1			112.3			1			29.64			1			40.9			1			112.7			1						
Entrenchment Ratio			2.39			1			2			1			2			1			1.8			1			1.5			1						
[1]Bank Height Ratio			1			1			1			1			1			1			1			1			1			1						
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern									71																											
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C 5/5						C 5/5						C 5/5						C 5/5						C 5/6											
Channel Thalweg length (ft)	541						541						541						541						541											
Sinuosity (ft)	1.05						1.05						1.05						1.05						1.05											
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)	0.0035						0.0035						0.0035						0.0035						0.0035											
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

2 = Bankfull for XS 6 recalculated

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 3

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 5						MY- 7					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)			12.50			1			14.44			1			16.33			1			14.80			1			13.00			1						
Floodprone Width (ft)			32.90			1			36.68			1			42.80			1			36.01			1			38.20			1						
Bankfull Mean Depth (ft)			0.57			1			0.48			1			0.43			1			0.47			1			0.50			1						
[1]Bankfull Max Depth (ft)			0.85			1			0.96			1			1.04			1			0.88			1			0.90			1						
Bankfull Cross Sectional Area (ft^2)			7.07			1			16.24			1			7.07			1			7.07			1			7.05			1						
Width/Depth Ratio			21.95			1			69.34			1			37.73			1			16.80			1			24.00			1						
Entrenchment Ratio			2.63			1			2.53			1			2.25			1			2.42			1			2.90			1						
[1]Bank Height Ratio			1.00			1			1.00			1			1.00			1			0.45			1			1.00			1						
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C 5/6						C 5/6						C 5/6						C 5/6						C 5/7											
Channel Thalweg length (ft)	446						446						446						446						446											
Sinuosity (ft)	1.08						1.08						1.08						1.08						1.08											
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)	0.005						0.005						0.005						0.005						0.005											
2 = Bankfull for XS 6 recalculated																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 11b. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Hudson/ DMS:95361) Segment/Reach: Reach 4

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 5						MY- 7					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)			9.90			1			8.27			1			10.59			1			10.00			1			8.00			1						
Floodprone Width (ft)			31.36			1			57.96			1			29.01			1			25.46			1			34.20			1						
Bankfull Mean Depth (ft)			0.32			1			0.52			1			0.30			1			0.30			1			0.40			1						
[1]Bankfull Max Depth (ft)			0.74			1			1.62			1			0.62			1			0.52			1			0.80			1						
Bankfull Cross Sectional Area (ft^2)			3.17			1			4.31			1			3.17			1			3.17			1			3.17			1						
Width/Depth Ratio			30.90			1			15.86			1			35.39			1			19.23			1			20.20			1						
Entrenchment Ratio			3.17			1			7.01			1			5.47			1			2.55			1			4.30			1						
[1]Bank Height Ratio			1.00			1			1.00			1			1.00			1			0.70			1			1.00			1						
Profile																																				
Riffle Length (ft)																																				
Riffle Slope (ft/ft)																																				
Pool Length (ft)																																				
Pool Max depth (ft)																																				
Pool Spacing (ft)																																				
Pattern																																				
Channel Beltwidth (ft)																																				
Radius of Curvature (ft)																																				
Rc:Bankfull width (ft/ft)																																				
Meander Wavelength (ft)																																				
Meander Width Ratio																																				
Additional Reach Parameters																																				
Rosgen Classification	C 5/6						C 5/6						C 5/6																							
Channel Thalweg length (ft)	447						447						447																							
Sinuosity (ft)	1.01						1.01						1.01																							
Water Surface Slope (Channel) (ft/ft)																																				
BF slope (ft/ft)	0.0035						0.0035						0.0035																							
2 = Bankfull for XS 6 recalculated																																				
[3]Ri% / Ru% / P% / G% / S%																																				
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks																																				
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

APPENDIX E: HYDROLOGIC DATA

Table 9: Verification of Bankfull Events

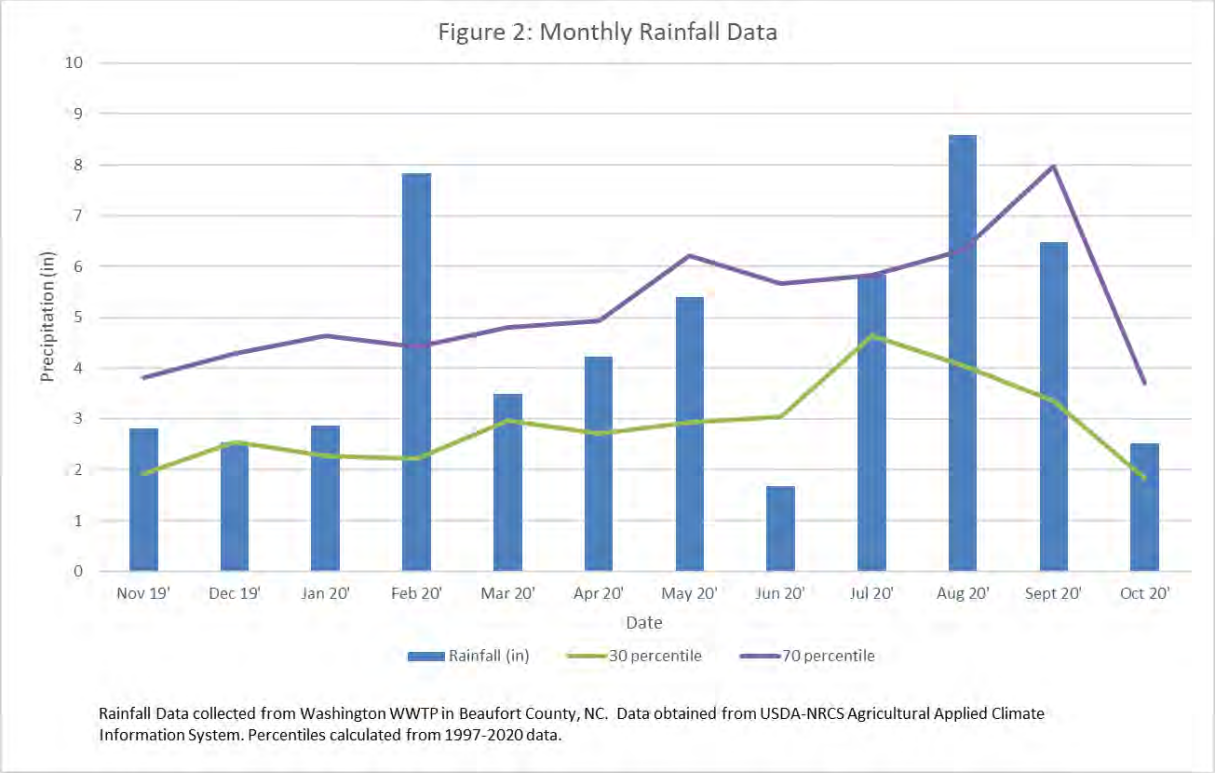
Table 12: Verification of Baseflow

Figure 2: Monthly Rainfall Data with Percentiles

Figures 3-12: Stream Surface Water Hydrology (Well 1-10)

Table 9: Verification of Bankfull Events				
Date of Observation	**Dates of Occurence**	**Method**	**Greater than Qbkf Stage?**	**Notes**
10/28/2020	Various, including: 11/11-12/22/19, 1/4-4/26/20 ,5/20-6/24, 9/15-9/21	Data logger	Y	Reach 1 (Well 6) *Well 5 malfunction
10/23/19	Various, including: 11/11/18-4/6/19, 6/7-6/15/19	Data logger	Y	Reach 1 (Well 5, 6)
10/5/18	12/8-4/6/18, 5/05-5/10, 5/30-6/6, 6/14, 7/24-8/8, 8/22-8/26, 9/13-9/20	Data logger	Y	Reach 1 (Well 5, 6)
11/17/17	9/29/2016-10/17/2016, 10/21-10/24, 7/16-7/17, 8/11, 8/13-8/14, 9/6- 9/8/2017	Data logger	Y	Reach 1 (Well 5, 6)
9/29/16	2/7-2/13/16, 3/7-3/9/16	Data logger	Y	Reach 1 (Well 5, 6)
10/28/20	Various, including: 11/24/19-6/23/20, 9/18-10/28	Data logger		Reach 2 (Well 7)
10/23/19	Various, including: 10/5/18-5/5/19, 6/7-7/2, 7/12-7/25, 8/16-8/24, 9/6-9/14, 10/22	Data logger	Y	Reach 2 (Well 7)
10/5/18	1/7-1/16/18, 1/25-2/23, 2/27, 3/24-3/27, 3/21, 4/9-4/15, 8/2-8/5, 9/13-9/20	Data logger	Y	Reach 2 (Well 7)
11/17/17	9/29/2016-10/16/2016, 10/25, 12/18-12/28, 12/30-1/3, 1/5-1/19, 1/30-1/31, 2/1-2/6, 2/20-2/21, 3/3-3/6, 3/19-3/27, 3/29-3/30, 4/1-4/3, 4/13, 4/18-4/20, 4/28-4/30, 5/30/2017	Data logger	Y	Reach 2 (Well 7)
9/29/16	1/29-2/1/16, 2/2-2/8/16	Data logger	Y	Reach 2 (Well 7)
10/28/20	Various, including between 12/14/19-3/10/20	Data logger	Y	Reach 3 (Well 1, 2)
10/23/19	Various, including: 11/4/18, 11/11-11/15, 12/24-12/28, 12/30-12/31, 1/7/19, 1/15-1/23, 1/31-2/02. 3/13, 3/19-21, 3/27-3/28	Data logger	Y	Reach 3 (Well 1, 2)
10/5/18	12/27/2017, 1/1/18, 1/6, 1/16, 1/25-2/5, 3/27, 9/13-9/18	Data logger	Y	Reach 3 (Well 1, 2)
11/17/17	9/29/2016-11/3/2017	Data logger	Y	Reach 3 (Well 1, 2)
9/29/16	2/5-6/16, 2/18/16, 5/29/16, 6/7/16	Data logger	Y	Reach 3 (Well 1, 2)
10/28/20	Various, including between 12/7-12/22/19, 1/8-1/22/20, 2/6-2/24	Data logger	Y	Reach 4 (Well 3)
10/23/19	Various, including: 10/17-10/26/18, 11/4, 11/9, 11/11-11/23, 12/5-12/16, 12/25-1/2/19, 1/21-2/4, 2/8-2/11, 2-16-3/14, 3-19-3/21, 3/25-3/31, 4/1-4/7 , 9/6/18	Data logger	Y	Reach 4 (Well 3)
10/5/18	11/9, 11/17-11/22/17, 3/24-4/24/18, 5/22-6/10, 9/11-9/19	Data logger	Y	Reach 4 (Well 3)
11/17/17	9/29/2016-10/2, 10/6-10/12, 10/14-10/16, 10/25-10/29, 11/1-11/2, 11/5-11/8, 11/12, 12/4-12/5, 12/9-12/28, 12/30-1/3, 1/6-1/17, 2/2-2/6, 2/10-2/11, 2/21, 3/2-3/31, 4/2-4/3, 4/9-4/20, 4/24-4/26, 4/29-4/30, 5/5, 5/25, 5/30, 6/21, 6/24-6/25, 7/5, 7/18, 8/13-8/14, 9/9-9/11/2017	Data logger	Y	Reach 4 (Well 3)
9/29/16	2/4/16, 2/18/16, 5/3/16, 6/7/16	Data logger	Y	Reach 4 (Well 3)
10/28/20	Various, including between 12/19-12/22/19, 1/8-1/23/20, 2/14-2/24, 3/7-3/23	Data logger		Reach 1& 4 Confluence (Well 4)
10/23/19	Various, including: 10/18/18, 11/3, 11/8, 11/11-11/18, 11/21-11/23, 12/5-12/15, 12/24-12/31, 1/31/19-2/2, 2/18-2/27, 3/6-3/14, 4/1-4/5, 6/10, 7/12, 9/5	Data logger	Y	Reach 1& 4 Confluence (Well 4)
10/5/18	11/13, 11/17, 12/12, 12/26, 12/31/17, 1/10/18, 2/13-2/15, 3/24-3/26, 4/22, 5/31, 6/1, 7/24, 7/29, 8/8, 9/12, 9/16	Data logger	Y	Reach 1& 4 Confluence (Well 4)
11/17/17	10/7-10/9, 12/19-12/20, 1/2, 1/7-1/10, 1/13-1/14, 3/5, 3/23-3/24, 4/24-4/25, 5/5, 5/23, 5/25, 6/24, 9/6/2017	Data logger	Y	Reach 1& 4 Confluence (Well 4)
9/29/16	2/4/16, 2/18/16, 5/3/16, 6/7/16	Data logger	Y	Reach 1& 4 Confluence (Well 4)

Table 12: Verification of Baseflow			
Well (Reach)	**Dates of Occurrence**	**30 Consecutive Days Minimum Flow Requirement Met?**	**Notes**
1 (Reach 3)	Various	Y	On-site data logger
2 (Reach 3)	Various	Y	On-site data logger
3 (Reach 4)	Various	Y	On-site data logger
4 (Confluence R1&4)	Various	Y	On-site data logger
5 (Reach 1)	Various	Y	On-site data logger
6 (Reach 1)	Various	Y	On-site data logger
7 (Reach 2)	Various	Y	On-site data logger
8 (Reach 5)	Various	Y	On-site data logger
9 (Reach 5)	Various	Y	On-site data logger
10 (Reach 5)	Various	Y	On-site data logger



Rainfall Data collected from Washington WWTP in Beaufort County, NC. Data obtained from USDA-NRCS Agricultural Applied Climate Information System. Percentiles calculated from 1997-2020 data.

Figure 3

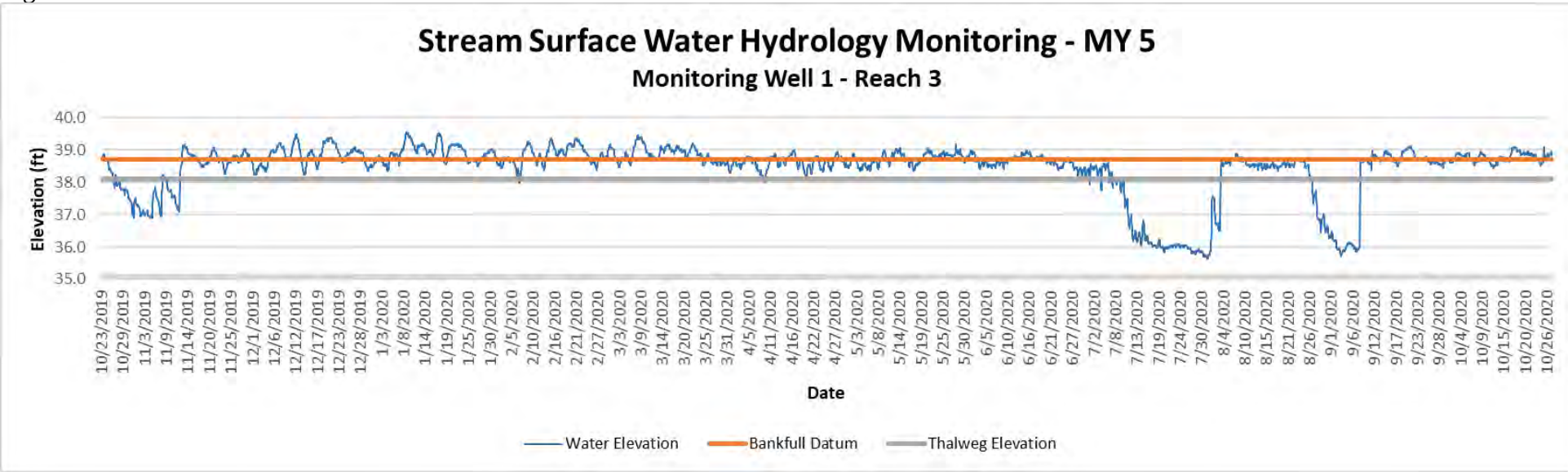


Figure 4

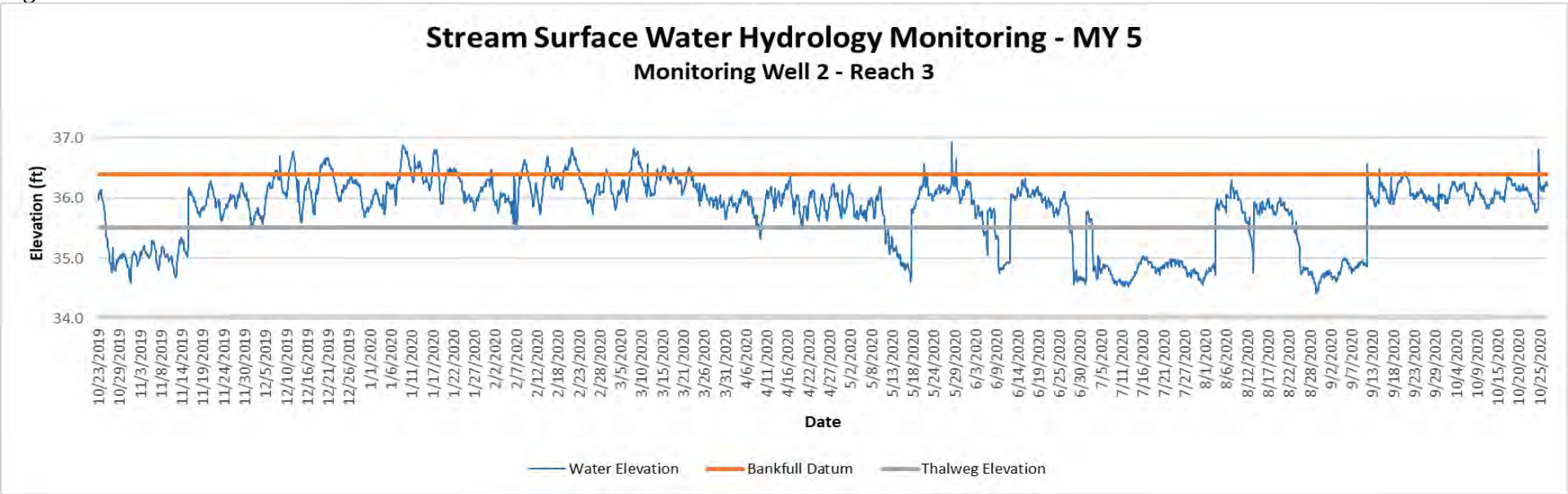


Figure 5

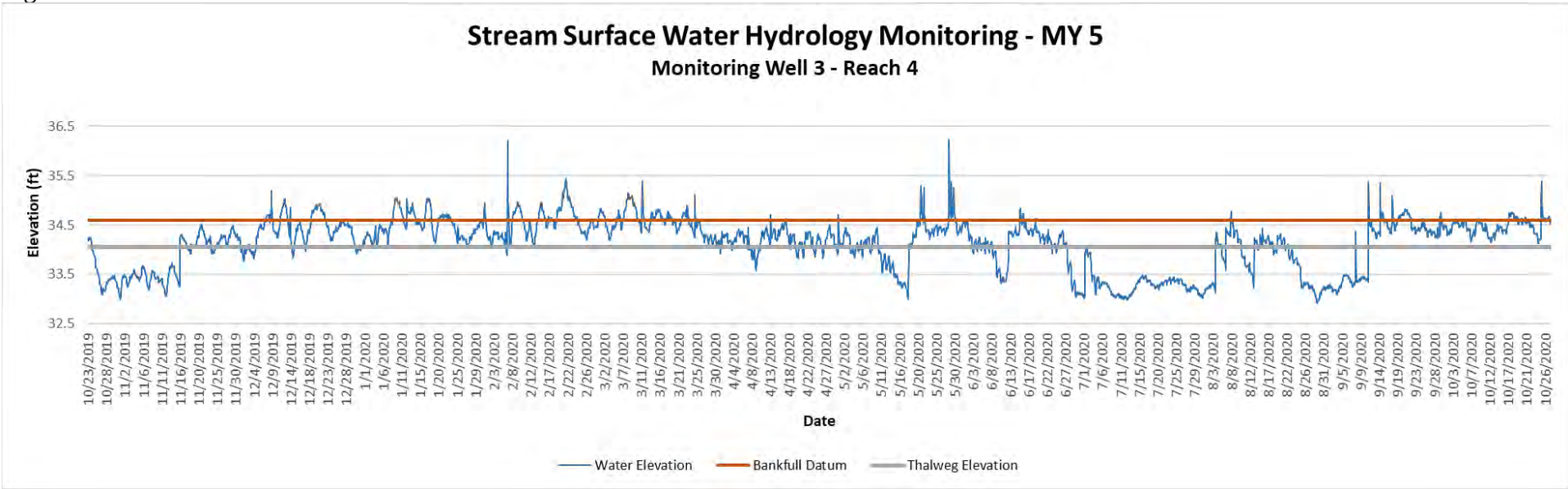


Figure 6

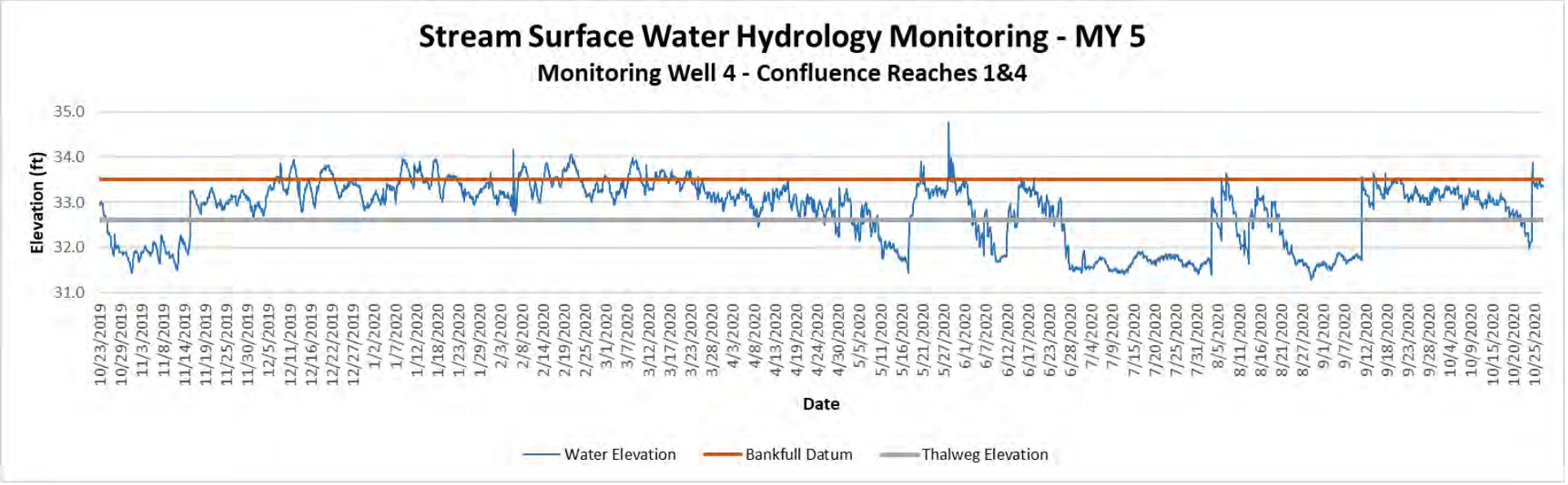


Figure 7

Monitoring Well 5 – Reach 1

Logger Malfunction; unable to download MY 5 data.

Figure 8

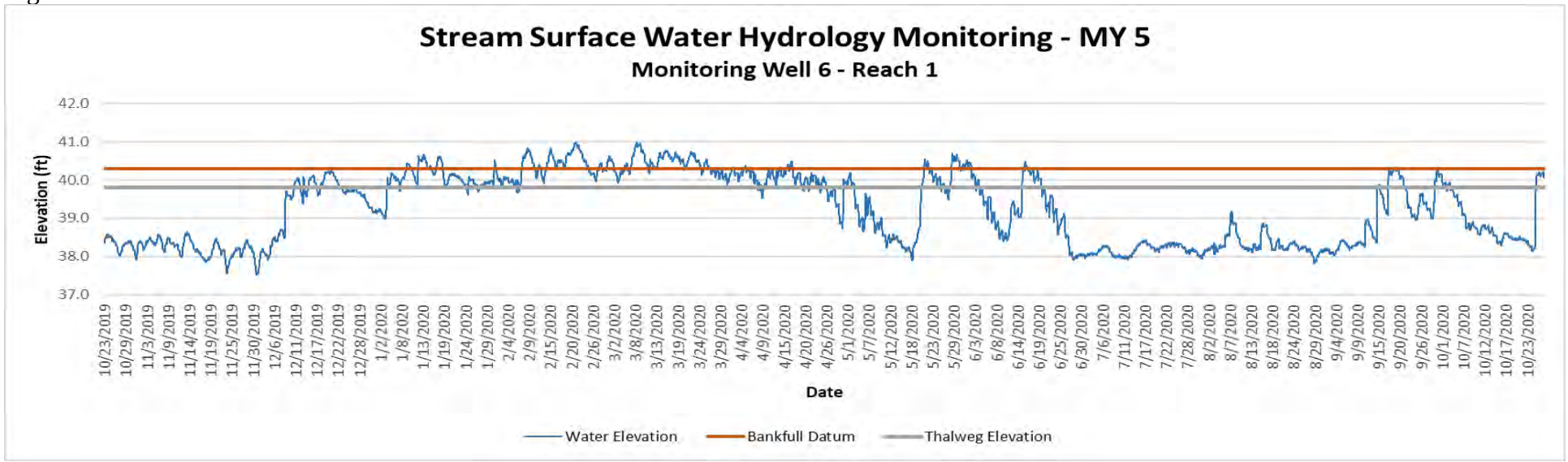


Figure 9

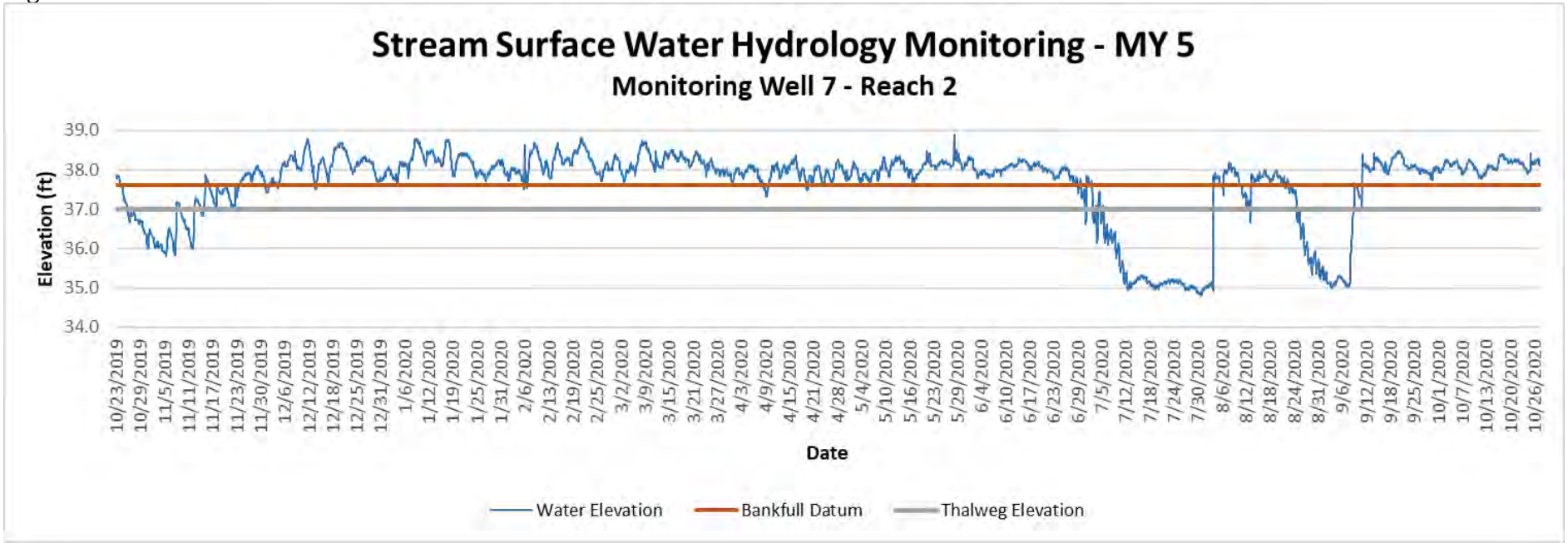


Figure 10

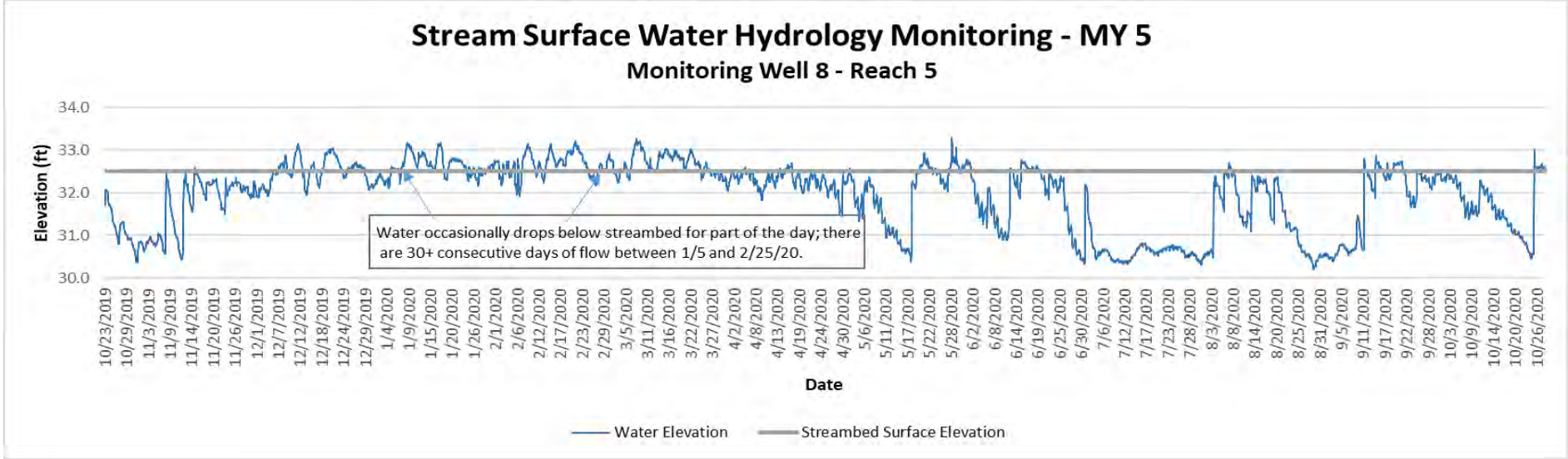


Figure 11

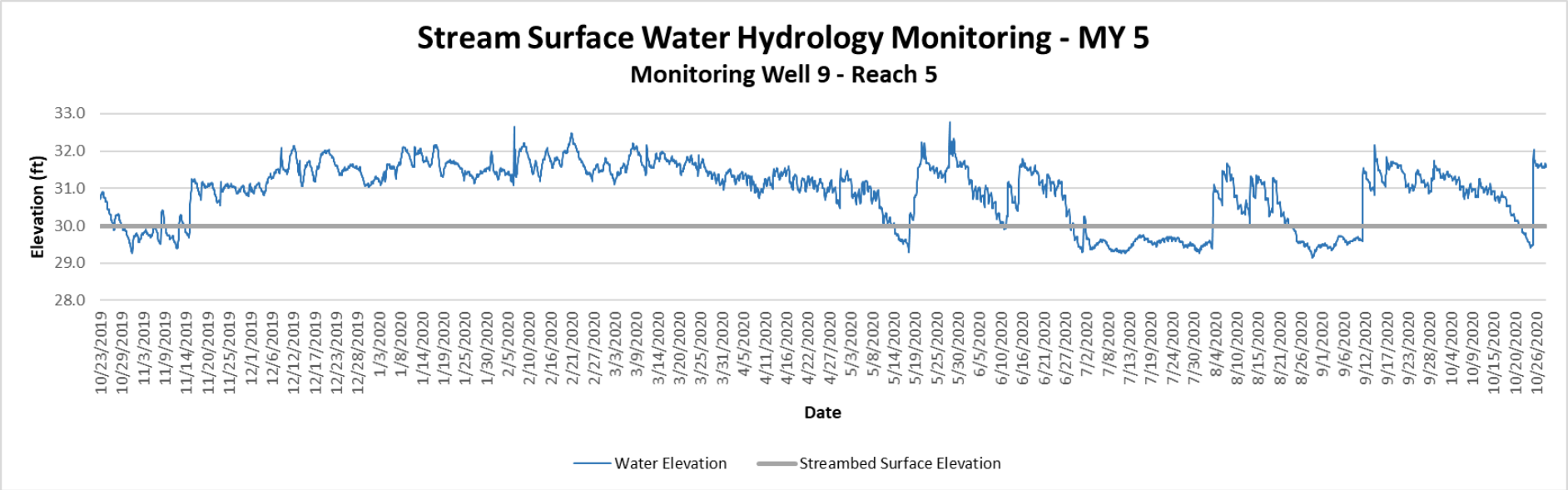


Figure 12