Year 1 Monitoring Report

FINAL

LITTLE SEBASTIAN SITE

NCDMS Project # 100027 (Contract # 7187) | RFP 16-006993 (Issued 9/16/2016)
USACE Action ID: SAW-2017-01507 | DWR Project # 2017-1041

Surry County, North Carolina
Yadkin River Basin
HUC 03040101

Provided by:

Resource Environmental Solutions, LLC
For Environmental Banc & Exchange, LLC

Provided for:
NC Department of Environmental Quality
Division of Mitigation Services

February 2022

3600 Glenwood Avenue, Suite 100
Raleigh, NC 27612

Corporate Headquarters
6575 W Loop S #300
Bellaire, TX 77401
Main: 713.520.5400

February 3, 2022

Paul Wiesner
NC DEQ Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: Little Sebastian Mitigation Site: Year 1 Monitoring Report (NCDMS Project ID #100027)

Listed below are comments provided by DMS on January 18, 2022 regarding the Little Sebastian Mitigation Site: Year 1 Monitoring Report Draft and RES' responses.

General: Please confirm that the two (2) areas of fencing identified within the conservation easement at MY0 (adjacent to MC1) have been relocated outside of the conservation easement or to the conservation easement line. Please point out these two relocated fence areas on the CCPV map sheets and briefly discuss in the report text.
These areas of fencing will be relocated in early 2022. Photo documentation and a call-out on the CCPV will be provided with the 2022 MY2 report. A note has been added to Section 1.7: Monitoring Performance in the MY1 report, regarding plans to remove the fencing from within the conservation easement.

General: As noted in the MY0 IRT responses, please be sure to provide photo documentation of overbank events on MC1-C in MY2 (2022) and future monitoring reports.
Photo documentation of evidence of overbank events on MC1-C will be included in future monitoring reports.

Section 1.6 Construction and As-Built Conditions: This section notes; "The record drawings are included in Appendix E." Please delete the sentence.
This sentence has been deleted.

Appendix E – Hydrology Data (MY1 Little Sebastian GW1): In the graph, please point out the 87 consecutive days reported in Table 14.
Maximum consecutive days have been added to both GW1 and GW2 graphs, found in **Appendix E**.

Digital Support Files: Please include figures displaying the data for overbank stage recorders JN3-B & BS1-E.
Figures was added to **Appendix E** displaying the overbank data for the stage recorders. Please note, the stage recorder on JN3-B is installed with the sensor approximately 0.9 feet below the top of bank. All readings when the water level is below that elevation are inaccurate.

Table of Contents

1.0 Project Summary

1.1 Project Location and Description

The Little Sebastian Mitigation Site ("the Project") is located in Surry County, approximately 10 miles north of Elkin. The Project presents 4,554.300 Cool Stream Mitigation Units (SMU) along Mill Creek and three unnamed tributaries.

The Project's total easement area is approximately 25.91 acres within the overall drainage area of 3,261 acres. The Project has two separate portions and in between those portions is the Gideon Mitigation Site. The Gideon Mitigation Site has a total easement area that is approximately 11.23 ac and presents 4,782 linear feet of stream restoration, enhancement, and preservation. Therefore, a total 37.14 ac and 12,887 LF of stream are protected in perpetuity. Grazing livestock historically had access to all stream reaches within the Project. The lack of riparian buffer vegetation, deep-rooted vegetation, and unstable channel characteristics contributed to the degradation of stream banks throughout the Project area.

The Project will be monitored on a regular basis throughout the seven-year post-construction monitoring period, or until performance standards are met. The Project will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld.

1.2 Project Goals and Objectives

Through the comprehensive analysis of the Project's maximum functional uplift using the Stream Functions Pyramid Framework, specific, attainable goals and objectives were realized by the Project. These goals clearly address the degraded water quality and nutrient input from farming that were identified as major watershed stressors in the 2009 Upper Yadkin Pee-Dee River RBRP. The Project will address outlined RBRP Goals 2, 4, and 6 (**Mitigation Plan**).

The Project goals are:

- Improve water transport from watershed to the channel in a non-erosive manner in a stable channel;
- Improve flood flow attenuation on site and downstream by allowing for overbanks flows and connection to the active floodplain;
- Improve instream habitat;
- Restore and enhance native floodplain vegetation; and
- Indirectly support the goals of the 2009 Upper Yadkin Pee-Dee RBRP to improve water quality and to reduce sediment and nutrient loads.

The Project objectives to address the goals are:

- Designed and reconstructed stream channels sized to convey bankfull flows that maintain a stable dimension, profile, and planform based on modeling, watershed conditions, and reference reach conditions;
- Permanently excluded livestock from stream channels and their associated buffers;
- Added in-stream structures and bank stabilization measures to protect restored and enhanced streams;
- Installed habitat features such as brush toes, constructed riffles, woody materials, and pools of varying depths to restored and enhanced streams;
- Reduced bank height ratios and increased entrenchment ratios to reference reach conditions;

- Increased forested riparian buffers to at least 30 feet on both sides of the channel along the Project reaches with a hardwood riparian plant community;
- Implemented one agricultural BMP in order to limit inputs of sediment, nutrients, and fecal coliform to streams from surrounding farming operations;
- Treated exotic invasive species; and
- Established a permanent conservation easement on the Project.

1.3 Project Success Criteria

The success criteria for the Project follows the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update, the Little Sebastian Final Mitigation Plan, and subsequent agency guidance. Cross section and vegetation plot monitoring takes place in Years 0, 1, 2, 3, 5, and 7. Stream hydrology, wetland hydrology, and visual monitoring takes place annually. Specific success criteria components are presented below.

Stream Restoration Success Criteria

Four bankfull flow events must be documented within the seven-year monitoring period. The bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until four bankfull events have been documented in separate years.

There should be little change in as-built cross sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion) or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross sections shall be classified using the Rosgen stream classification method, and all monitored cross sections should fall within the quantitative parameters defined for channels of the design stream type. Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be above 1.4 within restored riffle cross sections. Channel stability should be demonstrated through a minimum of four bankfull events documented in the seven-year monitoring period.

Digital images are used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal images should not indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral images should not indicate excessive erosion or continuing degradation of the banks over time. A series of images over time should indicate successional maturation of riparian vegetation.

Stream restoration reaches will be monitored to document intermittent or seasonal surface flow. This will be accomplished through direct observation and the use of hydraulic pressure transducers with data loggers. Reaches must demonstrate a minimum of 30 consecutive days of flow. Flow gauges will be installed on JN2-A and BS1-A. The flow gauge on BS1-A will also be capable of monitoring bankfull events.

Vegetation Success Criteria

Specific and measurable success criteria for plant density within the riparian buffers on the Project follow IRT Guidance. The interim measures of vegetative success for the Project is the survival of at least 320 planted three-year old trees per acre at the end of Year 3, 260 trees per acre with an average height of six feet at the end of Year 5, and the final vegetative success criteria is 210 trees per acre with an average height of eight feet at the end of Year 7. Volunteer trees are counted, identified to species, and included in the yearly monitoring reports, but are not counted towards the success criteria of total planted stems until they

are present in the plot for greater than two seasons. Moreover, any single species can only account for up to 50 percent of the required number of stems within any vegetation plot. Any stems in excess of 50 percent will be shown in the monitoring table but will not be used to demonstrate success.

1.4 Project Components

The project streams were significantly impacted by livestock production, agricultural practices, and a lack of riparian buffer. Improvements to the Project help meet the river basin needs expressed in the 2009 Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) as well as ecological improvements to riparian corridor within the easement.

Through stream restoration, enhancement, and preservation, the Project presents 4,554.300 Cool Stream Mitigation Units (SMU) (**Table 1**).

Mitigation Approach	Linear Feet	Ratio	Cool Base SMU
Restoration	2,758	1	2,721
Enhancement I	597	1.5	398
Enhancement II	1,898	2.5	759.2
Enhancement II	1,372	5	274.4
Enhancement II	819	7.5	109.2
Enhancement II	243	10	24.3
Preservation	418	10	41.8
Total	**8,068**		**4,327.9**
		Credit Loss in Required Buffer	**-278.7**
		Credit Gain for Additional Buffer	**505.1**
		Total Adjusted SMUs	**4,554.300**

1.5 Stream Mitigation Approach

The Project includes priority I stream restoration, enhancement I, enhancement II, and preservation. Priority I stream restoration incorporates the design of a single thread meandering channel, with parameters based on data taken from reference sites, published empirical relationships, regional curves developed from existing project streams, and NC Regional Curves. Analytical design techniques also were a crucial element of the project and were used to determine the design discharge and to verify the design as a whole.

Reach JN2-A - Preservation activities included improving the existing livestock exclusion fencing and buffers greater than 30 feet. The easement was extended to provide preservation beyond the origin point of the stream as per the PJD.

Reach JN2-B - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. Minimal bank grading and buffer re-establishment was done along the downstream end. In-stream structures such as log sills and one log cross vane were installed for stability and to improve habitat. The restoration of the riparian areas at the downstream end filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach JN2-C - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. Minimal bank grading and buffer re-establishment were done along the downstream end. The restoration of the riparian areas at the downstream end filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach JN2-D - Enhancement activities included some channel relocation, bed, and bank stabilization, removing an existing ford crossing and access road, improving habitat through supplemental buffer plantings, and livestock exclusion fencing. The restoration of the riparian areas at the downstream end filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach JN3-A –Enhancement II activities at a 7.5:1 ratio included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the right bank filters runoff from adjacent pasture and reduce sediment loads.

Reach JN3-B - Restoration activities included constructing a new channel within the natural valley to the north with appropriate dimensions and pattern and backfilling the abandoned channel. In-stream structures such as log sills, brush toes, and log vanes were installed for stability and to improve habitat. Habitat was further improved through buffer plantings and livestock exclusion. Buffer activities improved riparian areas that filter runoff from adjacent pastures, thereby reducing nutrient and sediment loads to the channel. Also, the reach was built through two small jurisdictional wetlands that are currently on the right bank floodplain and degraded from cattle access and pasture-use. While this project is not claiming any wetland credit, the raised channel bed enhances the wetlands' hydrology by reconnecting the floodplain wetlands to the stream. Two groundwater wells were installed on the right floodplain to monitor the wetland hydrology and will be reported in the yearly monitoring reports.

Reach MC1-A - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the right bank filters runoff from adjacent pasture and reduce sediment loads.

Reach MC1-B - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach MC1-C - Restoration activities included using log structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill was balanced in an effort to raise the channel bed to provide regular inundation of the adjacent floodplain. Habitat was improved through supplemental buffer plantings and livestock exclusion fencing. The Gideon Mitigation Bank was constructed with the Project.

Reach MC3-A - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the right bank filters runoff from adjacent pasture and reduce sediment loads.

Reach MC3-B - Enhancement activities included reshaping the left bank, install coir matting and livestakes, and improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area. A ford crossing was installed on this reach.

Reach MC3-C - Enhancement activities included reshaping the left bank, install coir matting and livestakes, and improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the project area.

Reach MC3-D - Enhancement activities includes improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach BS1-A - Restoration activities included using log and rock structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill were balanced in an effort to raise the channel bed to provide small floodplain benches where topography allows. Habitat was further improved through supplemental buffer plantings and livestock exclusion fencing. An engineered sediment pack was installed at the top of this reach.

Reach BS1-B - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the project area.

Reach BS1-C - Restoration activities included using log and rock structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill was balanced in an effort to raise the channel bed to provide small floodplain benches where topography allows. Habitat was further improved through supplemental buffer plantings and livestock exclusion fencing.

Reach BS1-D - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach BS1-E - Restoration activities included using log structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill were balanced in an effort to raise the channel bed to provide small floodplain benches where topography allows. Habitat was further improved through supplemental buffer plantings and livestock exclusion fencing.

1.6 Construction and As-Built Conditions

Stream construction was completed in February 2021 and planting was completed in March 2021. Additionally, five-strand high tensile electric fencing was installed for cattle exclusion. The Little Sebastian Site was built to design plans and guidelines. Two minor changes were made during construction: a log sill was added on JN2-B for extra grade control and log sills were removed from BS1 due to bedrock. Additionally, JN7 was added between Final Mitigation Plan approval and construction. This reach has a 30-acre drainage area and includes a pond located about 150 linear feet upstream of the easement area. Historically, this pond drained through a short ditch into JN3-B but due to the relocation of JN3-B, a channel was constructed in order to connect the pond back to JN3-B. The restored JN7 includes 37 linear feet within the easement. A photo of JN7 is in **Appendix B**. RES proposed the addition of JN7 for credit; however, this request was denied by IRT. RES will monitor the stability and hydrology of this reach and if back-up credits are needed at closeout there is the potential to use the 19.660 SMUs from JN7.

Planting plan changes included replacing blackgum (*Nyssa sylvatica*) and elderberry (*Sambucus canadensis*) with sugarberry (*Celtis laevigata*) and buttonbush (*Cephalanthus occidentalis*). These changes were based on bare root availability. A planted species summary is included in **Appendix C**. Minor monitoring device location changes were made during as-built installation due to site conditions. The only monitoring devices not installed were the stage recorders proposed for MC1-C and BS1-C due to the reach

being less than 1,000 linear feet and there being two stage recorders proposed for the same reach, respectively.

1.7 Monitoring Performance (MY1)

The Little Sebastian Year 1 monitoring activities were performed in November 2021. All Year 1 monitoring data is present below and in the appendices. The Project is on track to meeting vegetation and stream interim success criteria.

In August 2021, RES submitted an Adaptive Management Plan to include JN7 as a creditable project reach. This request was denied by the IRT. Correspondence is in **Appendix F**.

Two areas of pre-existing fencing, adjacent to reach MC1, will be removed from the conservation easement in early 2022. Approximate fence locations can be found in **Figure 2**, **Appendix B.**

Vegetation

Monitoring of six fixed vegetation plots and three random vegetation plots was completed on November 17, 2021. Vegetation data can be found in **Appendix C**, associated photos are in **Appendix B,** and plot locations are in **Appendix B**. MY1 monitoring data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 445 to 1,174 planted stems per acre with a mean of 836 planted stems per acre across all plots. A total of 10 species were documented within the plots. Volunteer species were not noted but are expected to establish in upcoming years. The average stem height in the plots was 2 feet.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. A few small, sparse areas of Chinese privet were observed during MY1 and were treated accordingly in December 2021.

Stream Geomorphology

Cross section and geomorphology data collection for MY1 was collected on November 17, 2021. Summary tables and cross section plots are in **Appendix D**. Overall the MY1 cross sections and profile relatively match the proposed design. The current conditions show that shear stress and velocities have been reduced for all restoration/enhancement reaches. The reaches were designed as gravel/cobble bed channels and remain classified as gravel/cobble bed channels post-construction.

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. The channel is transporting sediment as designed and will continue to be monitored for aggradation and degradation.

Stream Hydrology

Two stage recorders and two flow gauges were installed in March 2021 and document bankfull events and flow days, respectively. Neither stage recorder documented any bankfull events during MY0 and MY1; however, RES expects to see in increase in bankfull events in future monitoring years. Photo documentation of overbank events will be included in future monitoring reports. The flow gauges on JN2-B and BS1-A both recorded one flow event lasting 243 consecutive days. All recorded streams are on track to pass hydrology metrics. Stream hydrology data is included in **Appendix E**. Gauge locations can be found on **Figure 2** and photos are in **Appendix B**. RES plans to add a flow gauge on JN7 in winter 2022.

Wetland Hydrology

Two groundwater wells with automatic recording pressure transducers were installed in March 2021. The goal of the groundwater wells is to track the hydrology of the jurisdictional wetlands on site post-stream construction. There is no hydroperiod success criteria for these groundwater wells. In MY1, GW1 recorded a consecutive hydroperiod of 41 percent of the growing season and GW2 recorded a consecutive hydroperiod of 100 percent of the growing season. Wetland hydrology data is included in **Appendix E**. Groundwater well locations can be found on **Figure 2**.

2.0 Methods

Stream cross section monitoring was conducted using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section data were collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data were collected at 12 cross-sections. Survey data were imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. The stage recorders include an automatic pressure transducer placed in PVC casing in a pool. The elevation of the bed and top of bank at each stage recorder are used to detect bankfull events.

Vegetation success is being monitored at six fixed monitoring plots and three random monitoring plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are to be taken from the origin each monitoring year. The random plot is to be collected in locations where there are no permanent vegetation plots. Random plot will most likely be collected in the form of 100 square meter belt transects with variable dimensions. Tree species and height will be recorded for each planted stem and the transects will be mapped and new locations will be monitored in subsequent years.

Wetland hydrology is monitored to track the hydrology of the jurisdictional wetlands on site post-stream construction. This is accomplished with two automatic pressure transducer gauges (located in groundwater wells) that record daily groundwater levels. One automatic pressure transducer is installed above ground for use as a barometric reference. Gauges are downloaded quarterly and wetland hydroperiods are calculated during the growing season. Gauge installation followed current regulatory guidance. Visual observations of primary and secondary wetland hydrology indicators are also recorded during quarterly site visits.

Fixed digital image locations are established at each cross section, vegetation plot, stage recorder, flow gauge, and the upstream and downstream side of each crossing.

3.0 References

Griffith, G.E., J.M.Omernik, J.A. Comstock, M.P. Schafale, W.H.McNab, D.R.Lenat, T.F.MacPherson, J.B. Glover, and V.B. Shelburne. (2002). Ecoregions of North Carolina and South Carolina, (color Poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

Lee Michael T., Peet Robert K., Roberts Steven D., and Wentworth Thomas R., 2008. *CVS-EEP Protocol for Recording Vegetation Level*. Version 4.2

Peet, R.K., Wentworth, T.S., and White, P.S. (1998), *A flexible, multipurpose method for recording vegetation composition and structure*. Castanea 63:262-274

Resource Environmental Solutions (2018). Little Sebastian Final Mitigation Plan.

Schafale, M.P. 2012. Guide to the Natural Communities of North Carolina, Fourth Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDENR, Raleigh, NC.

USACE. (2016). Wilmington District Stream and Wetland Compensatory Mitigation Update. NC: Interagency Review Team (IRT).

Appendix A

Background Tables

Table 1. Little Sebastian (ID-100027) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Migitation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits		As-Built Footage or Acreage	Comments
JN2-A	418	418	Cool	P	NA	10.00000	41.800		418	Livestock exclusion
JN2-B	187	187	Cool	EI	NA	1.50000	124.667		187	Buffer planting and livestock exclusion
JN2-C	307	307	Cool	EII	NA	2.50000	122.800		307	Buffer planting and livestock exclusion; 31-foot crossing
JN2-C	837	837	Cool	EII	NA	2.50000	334.800		837	Buffer planting and livestock exclusion
JN2-D	39	43	Cool	EI	NA	1.50000	28.667		43	Channel relocation, bed and bank stabilization, crossing relocation, buffer plantings, and livestock exclusion; 62-foot crossing
JN2-D	150	153	Cool	EI	NA	1.50000	102.000		153	Channel relocation, bed and bank stabilization, crossing relocation, buffer plantings, and livestock exclusion
JN3-A	350	350	Cool	EII	NA	7.50000	46.667		350	Buffer planting and livestock exclusion
JN3-B	900	781	Cool	R	I	1.00000	781.000		781	Channel relocation in the natural valley, improved stream structures, buffer planting, and livestock exclusion; 43-foot crossing
JN3-B	224	262	Cool	R	I	1.00000	262.000		262	Channel relocation, bed and bank stabilization, crossing relocation, buffer plantings, and livestock exclusion
JN7*	0	0	Cool	R	I	1.00000	0.000		37	Channel construction, bed and bank stabilization, buffer plantings, and livestock exclusion; No Credit
MC1-A	469	469	Cool	EII	NA	7.50000	62.533		469	Buffer planting and livestock exclusion
MC1-B	717	717	Cool	EII	NA	5.00000	143.400		717	Buffer planting and livestock exclusion; 41-foot utility line crossing
MC1-B	260	260	Cool	EII	NA	5.00000	52.000		260	Buffer planting and livestock exclusion
MC1-C	545	555	Cool	R	I	1.00000	555.000		555	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion
MC3-A	243	243	Cool	EII	NA	10.00000	24.300		243	Buffer planting and livestock exclusion
MC3-B	402	402	Cool	EII	NA	2.50000	160.800		402	Buffer planting and livestock exclusion; 41-foot crossing
MC3-C	214	214	Cool	EI	NA	1.50000	142.667		214	Bank stabilization, improved stream structures, buffer planting, and livestock exclusion
MC3-D	395	395	Cool	EII	NA	5.00000	79.000		395	Buffer planting and livestock exclusion
BS1-A	205	214	Cool	R	I	1.00000	214.000		214	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion
BS1-B	190	175	Cool	EII	NA	2.50000	70.000		175	Buffer planting and livestock exclusion
BS1-C	580	541	Cool	R	I	1.00000	541.000		541	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion
BS1-D	185	177	Cool	EII	NA	2.50000	70.800		177	Buffer planting and livestock exclusion
BS1-E	278	274	Cool	R	I	1.00000	274.000		274	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion; 45-foot crossing
BS1-E	94	94	Cool	R	I	1.00000	94.000		94	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion

*Added between Final Mitigation Plan and Construction; no credit but potential to add credits if reach meets success criteria and back-up credits are needed

Note: all crossings and utility easements have been removed from credit calculations.

Project Credits

Restoration Level	Stream			Riparian Wetland	Non-rip Wetland	Coastal Marsh
	Warm	Cool	Cold			
Restoration		2721.000				
Re-establishment						
Rehabilitation						
Enhancement						
Enhancement I		398.000				
Enhancement II		1167.100				
Creation						
Preservation		41.800				
NSBW		226.400				
TOTALS		**4,554.300**				

Table 2. Project Activity and Reporting History
Little Sebastian

Elapsed Time Since grading complete: **11 months**
Elapsed Time Since planting complete: **10 months**
Number of reporting Years[1]: **1**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Mitigation Plan	NA	Nov-18
Final Design – Construction Plans	NA	Sep-20
Stream Construction	NA	Feb-21
Site Planting	NA	Mar-21
As-built (Year 0 Monitoring – VP, XS, Hydro, Visual)	Mar-21	Oct-21
Year 1 Monitoring	Stream: Nov-21 Vegetation: Nov-21	Dec-21
Invasive Treatment	NA	Dec-21
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

1 = The number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table Little Sebastian	
Designer Primary project design POC	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612 Frasier Mullen, PE
Construction Contractor Construction contractor POC	KBS Earthwork Inc. / 5616 Coble Church Rd., Julian, NC 27283 Kory Strader
Survey Contractor Survey contractor POC	Acension Land Surveying, PC / 116 Williams Road, Mocksville, NC 27028 Chris Cole, PLS
Planting Contractor Planting contractor POC	Shenandoah Habitats David Coleman
Monitoring Performers Monitoring POC	RES / 3600 Glenwood Ave, Suite 100, Raleigh, NC 27612 Emily Ulman (910) 274-8231

Table 4. Project Background Information					
Project Name		Little Sebastian			
County		Surry			
Project Area (acres)		25.91			
Project Coordinates (latitude and longitude)		36.40, -80.86			
Planted Acreage (Acres of Woody Stems Planted)		10.7			
Project Watershed Summary Information					
Physiographic Province		45e - Northern Inner Piedmont			
River Basin		Yadkin			
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	03040101080020		
DWR Sub-basin		03-04-01			
Project Drainage Area (Acres and Square Miles)		3,261 acres (5.1 sq mi)			
Project Drainage Area Percentage of Impervious Area		<1%			
Reach Summary Information					
Parameters	**JN2-A**	**JN2-B**	**JN2-C**	**JN2-D**	**JN3-A**
Length of reach (linear feet)	418	187	1114	189	350
Valley confinement (Confined, moderately confined, unconfined)	UC	MC	MC	MC	UC
Drainage area (Acres)	10	17	37	38	956
Perennial, Intermittent, Ephemeral	I	P	P	P	P
Parameters	**JN3-B**	**MC1-A**	**MC1-B**	**MC1-C**	**MC3-A/B/C**
Length of reach (linear feet)	1043	469	977	555	859
Valley confinement (Confined, moderately confined, unconfined)	C	UC	UC	UC	UC
Drainage area (Acres)	999	1862	1915	2921	3225
Perennial, Intermittent, Ephemeral	P	P	P	P	P
Parameters	**MC3-D**	**BS1-A/C/E**	**BS1-B/D**	**JN7**	
Length of reach (linear feet)	395	1029	352	37	
Valley confinement (Confined, moderately confined, unconfined)	UC	C	C	UC	
Drainage area (Acres)	3262	12-29	14-28	30	
Perennial, Intermittent, Ephemeral	P	I/P	P	I	

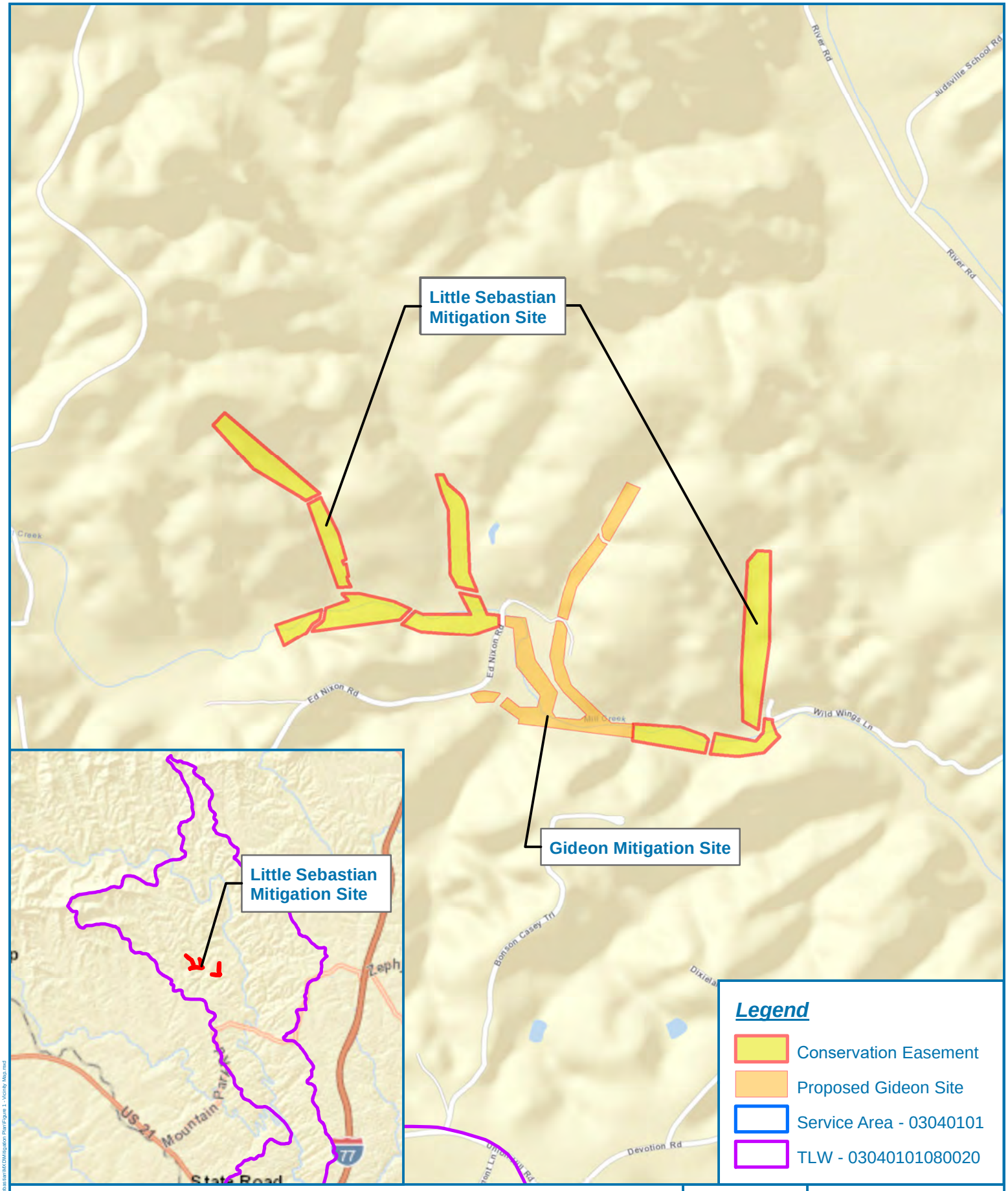


Figure 1 - Site Location Map

Little Sebastian Mitigation Site

Surry County, North Carolina

Date: 10/30/2018

Drawn by: MDE

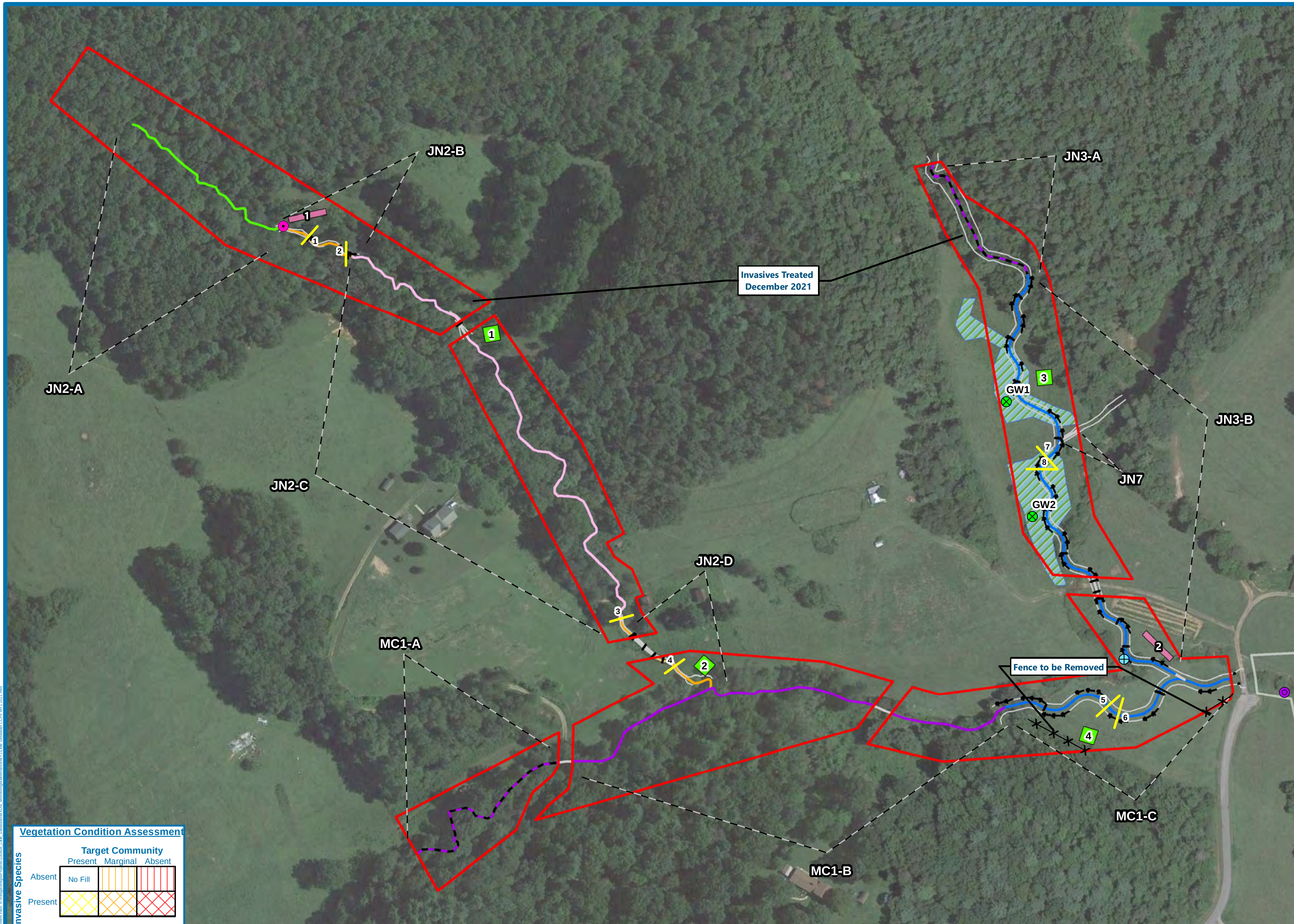
Checked by: ATP

res

Document Path: S:\IBRES GIS\Projects\NC\Little Sebastian\MXD\Mitigation Plan\Figure 1 - Vicinity Map.mxd

Appendix B

Visual Assessment Data



res

N
W
E
S
0 100 200
Feet

Figure 2

Current Conditions Plan View

MY1 2021

Little Sebastian Mitigation Site

Surry County, NC

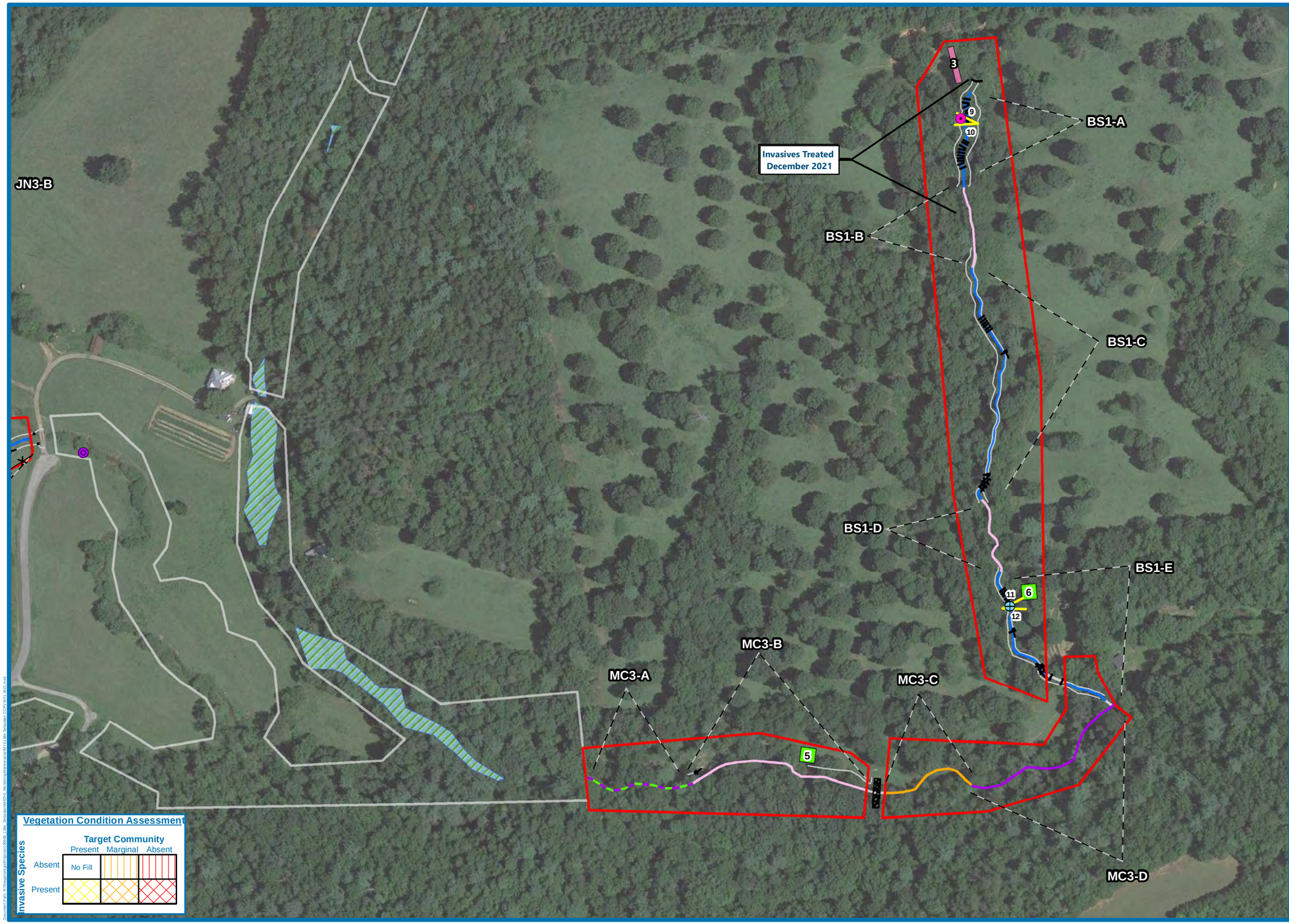
Date: 1/24/2022	Drawn by: EJU
Lat: 35.937509	Long: -81.234876

LEGEND

- Conservation Easement
- Gideon Bank Site
- Fixed Veg Plot
- Random Veg Plot
- Existing Wetland
- Structure
- Top of Bank
- Cross Section

Stream Mitigation

- Restoration
- Enhancement I
- Enhancement II
- Enhancement II (5:1)
- Enhancement II (7.5:1)
- Enhancement II (10:1)
- Preservation
- No Credit
- Approximate Fence Location
- Groundwater Well
- Stage Recorder
- Flow Gauge
- Ambient



res

N
W E
S

0 100 200
Feet

Figure 2

Current Conditions
Plan View

MY1 2021

Little Sebastian
Mitigation Site

Surry County, NC

Date: 1/24/2022	Drawn by: EJU
Lat: 35.937509	Long: -81.234876

LEGEND

- Conservation Easement
- Gideon Bank Site
- Fixed Veg Plot
- Random Veg Plot
- Existing Wetland
- Structure
- Top of Bank
- Cross Section

Stream Mitigation

- Restoration
- Enhancement I
- Enhancement II
- Enhancement II (5:1)
- Enhancement II (7.5:1)
- Enhancement II (10:1)
- Preservation
- No Credit
- Approximate Fence Location
- Groundwater Well
- Stage Recorder
- Flow Gauge
- Ambient

Visual Stream Stability Assessment

Assessment Date: 11/17/2021

Reach JN3

Assessed Stream Length 1043

Assessed Bank Length 2086

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	10	10		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	18	18		100%

Visual Stream Stability Assessment

Assessment Date: 11/17/2021

Reach MC1-C

Assessed Stream Length 555

Assessed Bank Length 1110

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	2	2		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	7	7		100%

Visual Stream Stability Assessment

Assessment Date: 11/17/2021

Reach BS1

Assessed Stream Length 1123

Assessed Bank Length 2246

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	8	8		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	3	3		100%

Table 6 Vegetation Condition Assessment

Assessment Date: 11/17/2021

Planted Acreage[1] **10.7**

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	Red Simple Hatch	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Orange Simple Hatch	0	0.00	0.0%
			Total			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	Orange Simple Hatch	0	0.00	0.0%
			Cumulative Total			0.0%

Easement Acreage[2] **25.91**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Yellow Crosshatch	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Red Simple Hatch	0	0.00	0.0%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Little Sebastian MY1 Vegetation Monitoring Plot Photos

Vegetation Plot 1 (11/17/2021)

Vegetation Plot 2 (11/17/2021)

Vegetation Plot 3 (11/17/2021)

Vegetation Plot 4 (11/17/2021)

Vegetation Plot 5 (11/17/2021)

Vegetation Plot 6 (11/17/2021)

Random Vegetation Plot 1 (11/17/2021)

Random Vegetation Plot 2 (11/17/2021)

Random Vegetation Plot 3 (11/17/2021)

Little Sebastian Monitoring Device Photos, November 17, 2021

Flow Gauge JN2-A

Stage Recorder JN3-B

Flow Gauge BS1-A

Stage Recorder BS1-E

Groundwater Well 1

Groundwater Well 2

Little Sebastian Crossing Photos, November 17, 2021

JN2-C (upstream)

JN2-C (downstream)

JN2-D (upstream)

JN2-D (downstream)

JN3-B (upstream)

JN3-B (downstream)

MC1-C (downstream)

MC3-B/D

BS1-E (upstream)

BS1-E (downstream)

Appendix C

Vegetation Plot Data

Table 7. Planted Species Summary

Common Name	Scientific Name	Mit Plan %	As-Built %	Total Stems Planted
Willow Oak	*Quercus phellos*	15	15	1,600
River Birch	*Betula nigra*	15	15	1,600
Sycamore	*Platanus occidentalis*	10	15	1,600
Water Oak	*Quercus nigra*	15	14	1,600
Northern Red Oak	*Quercus rubra*	10	11	1,200
Yellow Poplar	*Liriodendron tulipifera*	10	10	1,100
Green Ash	*Fraxinus pennsylvanica*	10	5	600
Persimmon	*Diospyros virginiana*	5	5	600
Buttonbush	*Cephalanthus occidentalis*	0	5	600
Sugarberry	*Celtis laevigata*	0	5	600
Elderberry	*Sambucus canadensis*	5	0	0
Nyssa sylvatica	*Blackgum*	5	0	0
			Total	11,100
			Planted Area	10.7
			As-built Planted Stems/Acre	1,037

Table 8. Vegetation Plot Mitigation Success Summary

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Averaged Planted Stem Height (ft)
1	890	0	890	Yes	1.9
2	1012	0	1012	Yes	1.5
3	1093	0	1093	Yes	2.3
4	1174	0	1174	Yes	1.9
5	607	0	607	Yes	1.8
6	1012	0	1012	Yes	2.1
R1	445	0	445	Yes	1.6
R2	526	0	526	Yes	2.2
R3	769	0	769	Yes	2.1
Project Avg	**836**	**0**	**836**	**Yes**	**2.0**

Table 9. Stem Count Total and Planted by Plot Species

Little Sebastian			Current Plot Data (MY1 2021)																	
			100027-01-0001			100027-01-0002			100027-01-0003			100027-01-0004			100027-01-0005			100027-01-0006		
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
Betula nigra	river birch	Tree	6	6	6				4	4	4							5	5	5
Celtis laevigata	sugarberry	Tree													2	2	2	1	1	1
Cephalanthus occidentalis	common buttonbush	Shrub	5	5	5	4	4	4				1	1	1	1	1	1			
Diospyros virginiana	common persimmon	Tree													3	3	3			
Fraxinus pennsylvanica	green ash	Tree				1	1	1							1	1	1	2	2	2
Liriodendron tulipifera	tuliptree	Tree	2	2	2				1	1	1	2	2	2				1	1	1
Platanus occidentalis	American sycamore	Tree	4	4	4	6	6	6	15	15	15	8	8	8	2	2	2	6	6	6
Quercus nigra	water oak	Tree				3	3	3	2	2	2	3	3	3	2	2	2	2	2	2
Quercus phellos	willow oak	Tree	1	1	1	7	7	7	4	4	4	14	14	14	3	3	3	2	2	2
Quercus rubra	northern red oak	Tree	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	6	6	6
		Stem count	22	22	22	25	25	25	27	27	27	29	29	29	15	15	15	25	25	25
		size (ares)	1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	6	6	6	6	6	6	6	6	6	6	8	8	8	8	8	8
		Stems per ACRE	890	890	890	1012	1012	1012	1093	1093	1093	1174	1174	1174	607	607	607	1012	1012	1012

Little Sebastian			Current Plot Data (MY1 2021)									Annual Means					
			100027-01-R1			100027-01-R2			100027-01-R3			MY1 (2021)			MY0 (2021)		
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
Betula nigra	river birch	Tree	5	5	5	2	2	2				22	22	22	15	15	15
Celtis laevigata	sugarberry	Tree										3	3	3	4	4	4
Cephalanthus occidentalis	common buttonbush	Shrub				1	1	1				12	12	12	13	13	13
Diospyros virginiana	common persimmon	Tree										3	3	3	5	5	5
Fraxinus pennsylvanica	green ash	Tree										4	4	4	4	4	4
Liriodendron tulipifera	tuliptree	Tree				1	1	1	1	1	1	8	8	8	7	7	7
Platanus occidentalis	American sycamore	Tree	1	1	1	5	5	5	6	6	6	53	53	53	41	41	41
Quercus nigra	water oak	Tree							1	1	1	13	13	13	13	13	13
Quercus phellos	willow oak	Tree	5	5	5	4	4	4	8	8	8	48	48	48	32	32	32
Quercus rubra	northern red oak	Tree							3	3	3	20	20	20	22	22	22
		Stem count	11	11	11	13	13	13	19	19	19	186	186	186	156	156	156
		size (ares)	1			1			1			9			6		
		size (ACRES)	0.02			0.02			0.02			0.22			0.15		
		Species count	3	3	3	5	5	5	5	5	5	10	10	10	10	10	10
		Stems per ACRE	445	445	445	526	526	526	769	769	769	836	836	836	1052	1052	1052

Appendix D

Stream Measurement and Geomorphology Data

Table 10. Baseline Stream Data Summary
Little Sebastian Mitigation Site - Reach BS-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)		---	---	---	---	---	3.2	---	---	1	7.1	12.3	--	17.5	---	2	---	4.5	---	5.7	6.0	---	6.3	---	2
Floodprone Width (ft)					---	---	60.0	---	---	1	>30	51.3	--	72.5	---	2	---	---	---	11.3	17.6	---	23.8	---	2
Bankfull Mean Depth (ft)		---	---	---	---	---	1.6	---	---	1	1.0	1.3	--	1.6	---	2	---	0.6	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	3.9	---	---	1	1.2	1.9	--	2.6	---	2	---	0.7	---	0.7	0.9	---	1.1	---	2
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	2.4	---	---	1	6.7	17.2	--	27.7	---	2	---	2.7	---	2.6	3.3	---	4.0	---	2
Width/Depth Ratio					---	---	4.2	---	---	1	7.4	9.3	--	11.1	---	2	---	7.4	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	3.4	---	---	1	>4	4.2	--	4.3	---	2	---	>1.4	---	2.0	2.9	---	3.8	---	2
[1]Bank Height Ratio					---	---	1.0	---	---	1	1.0	1.2	--	1.3	---	2	---	1.0	---	1.0	1.0	---	1.0	---	2
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	5.6	---	---	17	---	---	4.0	---	11	4	16	16	32	8	19
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.1	5.9	5.0	14.5	3.7	19
Pool Length (ft)					---	---	---	---	---	---	4	---	---	16	---	---	2.0	---	7	11	18	15	43	8	17
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	26	---	---	68	---	---	5.0	---	20	21	34	33	63	10	17
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	20	---	---	85	---	---	13.0	---	19.0	13.0	---	---	19.0	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	7	---	---	54	---	---	4.0	---	10.0	4.0	---	---	10.0	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	0.9	---	---	3.7	---	---	1.0	---	2.0	1.0	---	---	2.0	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	33	---	---	105	---	---	21.0	---	32.0	21.0	---	---	32.0	---	---
Meander Width Ratio					---	---	---	---	---	---	2.4	---	---	5.9	---	---	3.0	---	4.0	3.0	---	---	4.0	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					B4a						E3/E4b						B4/E4			B4/E4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					1508						160						1017			1017					
Channel Thalweg length (ft)					1703						189						1028			1028					
Sinuosity (ft)					1.13						1.195						1.01			1.01					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.049						1.85						0.025-0.035			0.025-0.035					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

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 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10. Baseline Stream Data Summary
Little Sebastian Mitigation Site - Reach JN-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)		---	---	---	14.9	16.4	--	17.9	---	2	7.1	12.3	--	17.5	---	2	---	16.0	---	---	---	15.0	---	---	1
Floodprone Width (ft)					37.0	48.5	--	60.0	---	2	>30	51.3	--	72.5	---	2	---	>50	---	---	---	>64.4	---	---	1
Bankfull Mean Depth (ft)		---	---	---	1.6	1.7	--	1.6	---	2	1.0	1.3	--	1.6	---	2	---	2.2	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					2.1	3.0	--	3.9	---	2	1.2	1.9	--	2.6	---	2	---	2.9	---	---	---	2.2	---	---	1
Bankfull Cross Sectional Area (ft^2)		---	---	---	26.1	27.3	--	28.5	---	2	6.7	17.2	--	27.7	---	2	---	26.9	---	---	---	22.8	---	---	1
Width/Depth Ratio					8.5	9.9	--	11.2	---	2	7.4	9.3	--	11.1	---	2	---	9.5	---	---	---	---	---	---	---
Entrenchment Ratio					2.5	3.0	--	3.4	---	2	>4	4.2	--	4.3	---	2	---	>2.2	---	---	---	>4.3	---	---	1
[1]Bank Height Ratio					1.0	1.2	--	1.3	---	2	1.0	1.2	--	1.3	---	2	---	1.0	---	---	---	1.0	---	---	1
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	5.6	---	---	17	---	---	7	---	29	14	25	22	48	10	18
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.43	2.605	2.735	5.1	1.23176	18
Pool Length (ft)					---	---	---	---	---	---	4	---	---	16	---	---	4	---	18	19	35	34	55	10	17
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	26	---	---	68	---	---	29	---	75	38	59	59	78	11	15
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	20	---	---	85	---	---	39	---	94	39	---	---	94	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	7	---	---	54	---	---	14	---	60	14	---	---	60	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	0.9	---	---	3.7	---	---	0.9	---	3.7	0.9	---	---	3.7	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	33	---	---	105	---	---	74	---	116	74	---	---	116	---	---
Meander Width Ratio					---	---	---	---	---	---	2.4	---	---	5.9	---	---	2.4	---	5.9	2.4	---	---	5.9	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					E3						E3/E4b						E3			E3					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					602						160						945			945					
Channel Thalweg length (ft)					772						189						1088			1088					
Sinuosity (ft)					1.225						1.195						1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.0125						1.85						0.0085			0.0085					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

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 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10. Baseline Stream Data Summary
Little Sebastian Mitigation Site - Reach MC1-C

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
		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
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)		---	---	---	---	---	17.4	---	---	1	7.1	12.3	--	17.5	---	2	---	23.0	---	---	---	21.3	---	---	1
Floodprone Width (ft)					---	---	50.0	---	---	1	>30	51.3	--	72.5	---	2	---	>50	---	---	---	>64.9	---	---	1
Bankfull Mean Depth (ft)		---	---	---	---	---	1.8	---	---	1	1.0	1.3	--	1.6	---	2	---	2.4	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	2.9	---	---	1	1.2	1.9	--	2.6	---	2	---	3.2	---	---	---	3.2	---	---	1
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	30.6	---	---	1	6.7	17.2	--	27.7	---	2	---	54.4	---	---	---	49.8	---	---	1
Width/Depth Ratio					---	---	10.0	---	---	1	7.4	9.3	--	11.1	---	2	---	9.7	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	2.9	---	---	1	>4	4.2	--	4.3	---	2	---	>2.2	---	---	---	>3	---	---	1
[1]Bank Height Ratio					---	---	1.0	---	---	1	1.0	1.2	--	1.3	---	2	---	1.0	---	---	---	1.0	---	---	1
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	5.6	---	---	17	---	---	10	---	41	14	25	18	61	17	7
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.19	2.32	1.35	4.8	1.89753	7
Pool Length (ft)					---	---	---	---	---	---	4	---	---	16	---	---	6	---	25	36	51	48	73	12	6
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	26	---	---	68	---	---	41	---	108	65	81	73	109	19	5
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	20	---	---	85	---	---	56	---	135	56	---	---	135	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	7	---	---	54	---	---	21	---	86	21	---	---	86	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	0.9	---	---	3.7	---	---	1	---	4	1	---	---	4	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	33	---	---	105	---	---	106	---	167	106	---	---	167	---	---
Meander Width Ratio					---	---	---	---	---	---	2.4	---	---	5.9	---	---	2	---	6	2	---	---	6	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					E3						E3/E4b						E3			E3					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					1109						160						478			478					
Channel Thalweg length (ft)					1288						189						542			542					
Sinuosity (ft)					1.16						1.195						1.13			1.13					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.008						1.85						0.0085			0.0085					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

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 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

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

Project Name/Number: Little Sebastian #100027

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Riffle)							Cross Section 5 (Riffle)						
	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-XSA[1]	1214.7	1214.8						1211.2	1211.3						1170.7	1170.7						1165.0	1164.9						1150.6	1150.7					
Bankfull Width (ft)[1]	5.4	5.1						5.4	5.6						5.3	5.8						9.0	8.8						21.3	21.0					
Floodprone Width (ft)[1]	13.1	11.2						8.7	8.8						>34.8	>34.1						>43.9	>43.2						>64.9	>65.1					
Bankfull Max Depth (ft)[2]	0.7	1.0						0.5	0.8						1.0	1.1						0.9	0.8						3.2	3.1					
Low Bank Elevation (ft)	1214.74	1215.0						1211.2	1211.6						1170.7	1170.8						1165.0	1164.8						1150.6	1150.6					
Bankfull Cross Sectional Area (ft^2)[2]	2.4	4.1						2.3	4.1						3.5	4.3						3.5	2.6						49.8	48.2					
Bankfull Entrenchment Ratio[1]	2.4	2.2						1.6	1.6						>6.6	>5.9						>4.9	>4.9						>3.0	>3.1					
Bankfull Bank Height Ratio[1]	1.0	1.4						1.0	1.5						1.0	1.1						1.0	0.9						1.0	1.0					

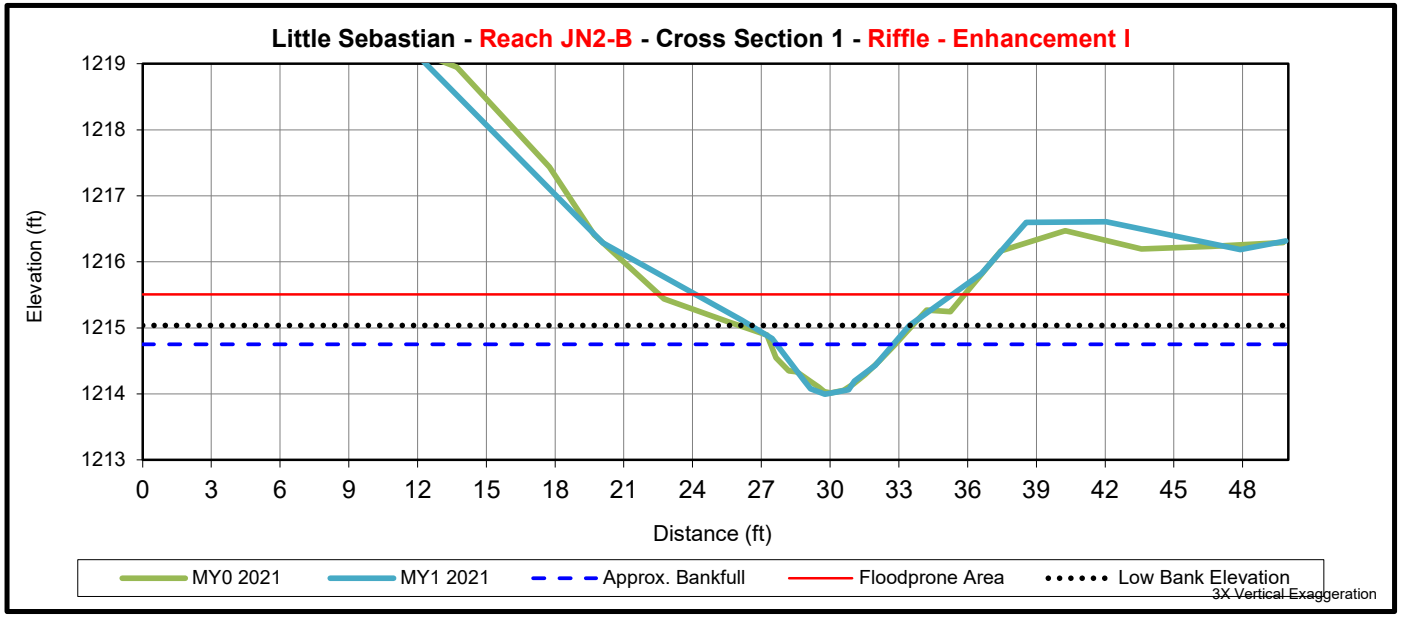
	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1150.5	1150.6						1157.4	1157.3						1157.2	1157.2						1188.3	1188.4						1187.6	1187.6					
Bankfull Width (ft)[1]	-	-						15.0	15.0						-	-						-	-						6.3	7.1					
Floodprone Width (ft)[1]	-	-						>64.4	>64.7						-	-						-	-						23.8	23.5					
Bankfull Max Depth (ft)[2]	4.1	4.1						2.2	2.4						3.6	4.2						1.0	0.9						1.1	1.0					
Low Bank Elevation (ft)	-	-						1157.4	1157.4						-	-						-	-						1187.6	1187.5					
Bankfull Cross Sectional Area (ft^2)[2]	56.7	56.4						22.8	24.4						34.8	34.0						3.6	3.0						4.0	3.4					
Bankfull Entrenchment Ratio[1]	-	-						>4.3	>4.3						-	-						-	-						3.8	3.3					
Bankfull Bank Height Ratio[1]	-	-						1.0	1.0						-	-						-	-						1.0	0.9					

	Cross Section 11 (Riffle)							Cross Section 12 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1136.4	1136.4						1136.1	1136.2					
Bankfull Width (ft)[1]	5.7	6.5						-	-					
Floodprone Width (ft)[1]	11.3	11.3						-	-					
Bankfull Max Depth (ft)[2]	0.7	0.7						1.2	0.9					
Low Bank Elevation (ft)	1136.4	1136.5						-	-					
Bankfull Cross Sectional Area (ft^2)[2]	2.6	3.0						4.6	4.1					
Bankfull Entrenchment Ratio[1]	2.0	1.7						-	-					
Bankfull Bank Height Ratio[1]	1.0	1.1						-	-					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

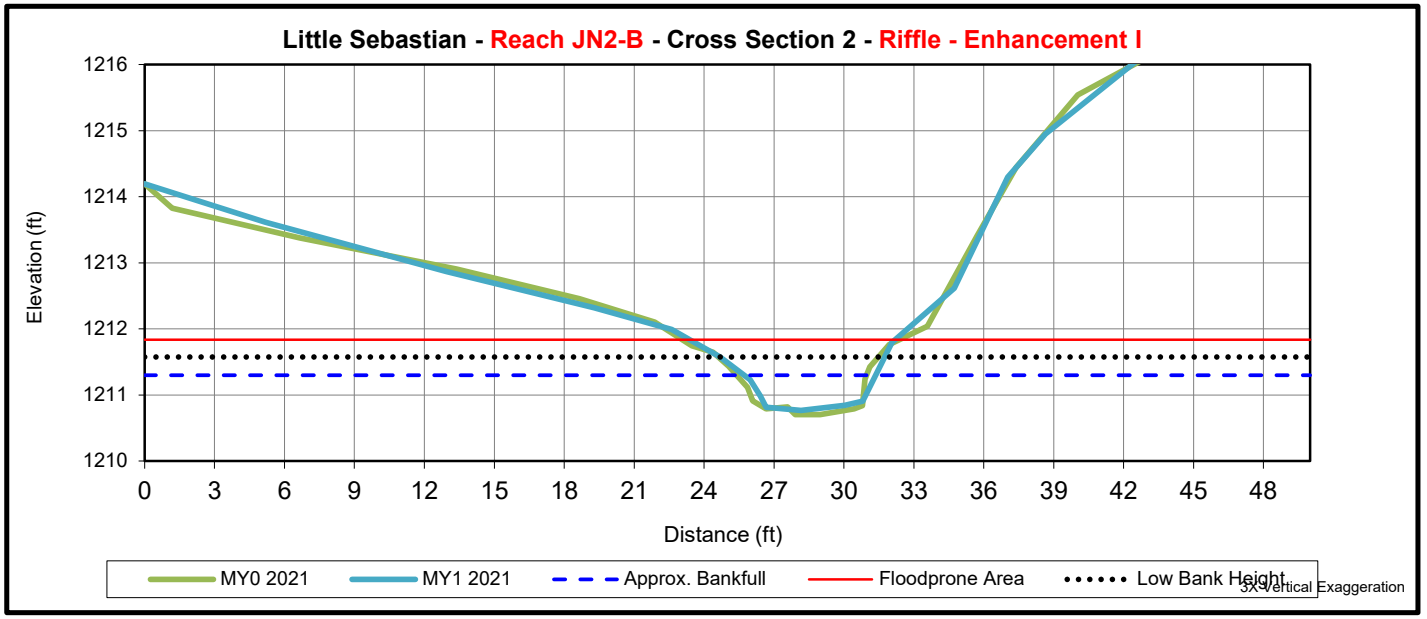


	Cross Section 1 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1214.7	1214.8					
Bankfull Width (ft)[1]	5.4	5.1					
Floodprone Width (ft)[1]	13.1	11.2					
Bankfull Max Depth (ft)[2]	0.7	1.0					
Low Bank Elevation (ft)	1214.74	1215.0					
Bankfull Cross Sectional Area (ft^2)[2]	2.4	4.1					
Bankfull Entrenchment Ratio[1]	2.4	2.2					
Bankfull Bank Height Ratio[1]	1.0	1.4					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

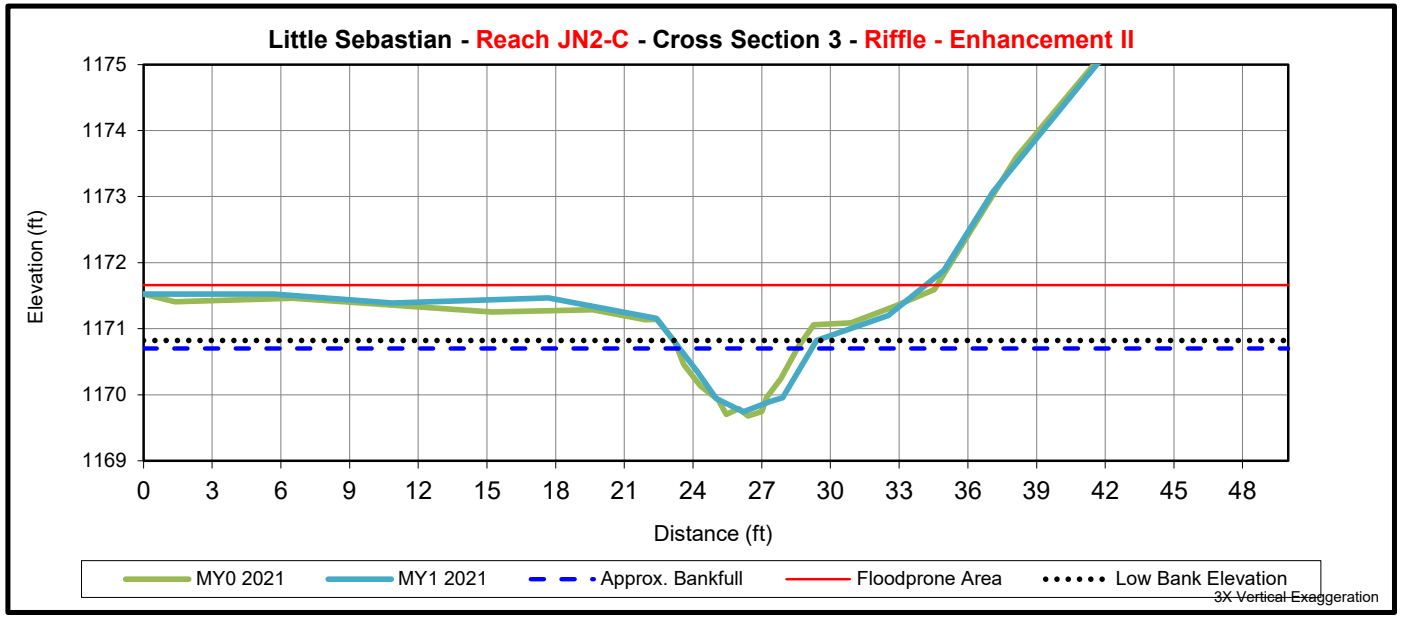


	Cross Section 2 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1211.2	1211.3					
Bankfull Width (ft)[1]	5.4	5.6					
Floodprone Width (ft)[1]	8.7	8.8					
Bankfull Max Depth (ft)[2]	0.5	0.8					
Low Bank Elevation (ft)	1211.2	1211.6					
Bankfull Cross Sectional Area (ft^2)[2]	2.3	4.1					
Bankfull Entrenchment Ratio[1]	1.6	1.6					
Bankfull Bank Height Ratio[1]	1.0	1.5					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

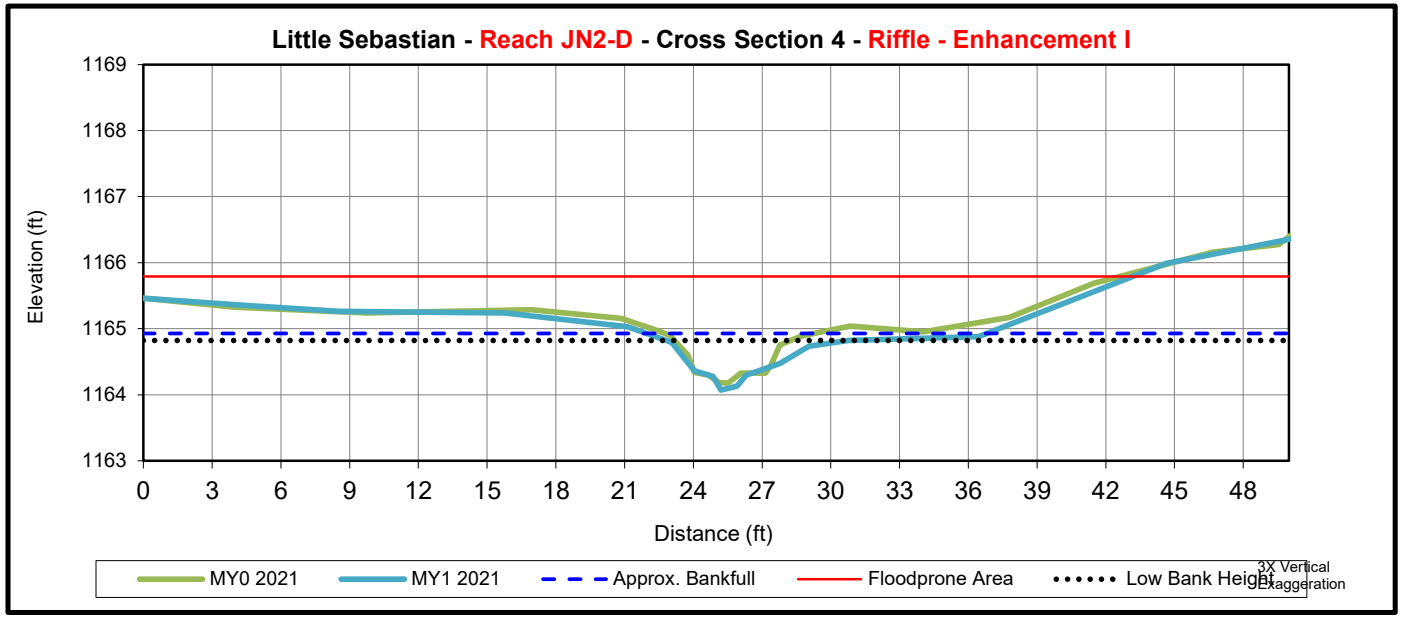


	Cross Section 3 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1170.7	1170.7					
Bankfull Width (ft)[1]	5.3	5.8					
Floodprone Width (ft)[1]	>34.8	>34.1					
Bankfull Max Depth (ft)[2]	1.0	1.1					
Low Bank Elevation (ft)	1170.7	1170.8					
Bankfull Cross Sectional Area (ft^2)[2]	3.5	4.3					
Bankfull Entrenchment Ratio[1]	>6.6	>5.9					
Bankfull Bank Height Ratio[1]	1.0	1.1					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

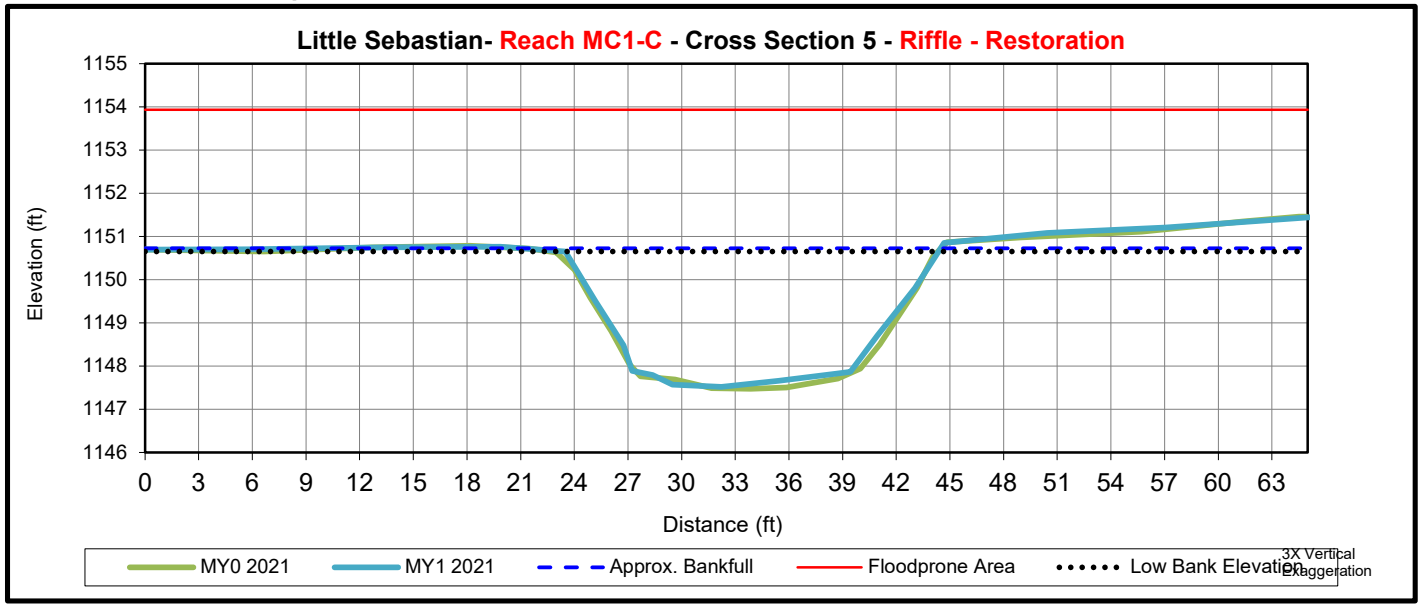


	Cross Section 4 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1165.0	1164.9					
Bankfull Width (ft)[1]	9.0	8.8					
Floodprone Width (ft)[1]	>43.9	>43.2					
Bankfull Max Depth (ft)[2]	0.9	0.8					
Low Bank Elevation (ft)	1165.0	1164.8					
Bankfull Cross Sectional Area (ft^2)[2]	3.5	2.6					
Bankfull Entrenchment Ratio[1]	>4.9	>4.9					
Bankfull Bank Height Ratio[1]	1.0	0.9					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

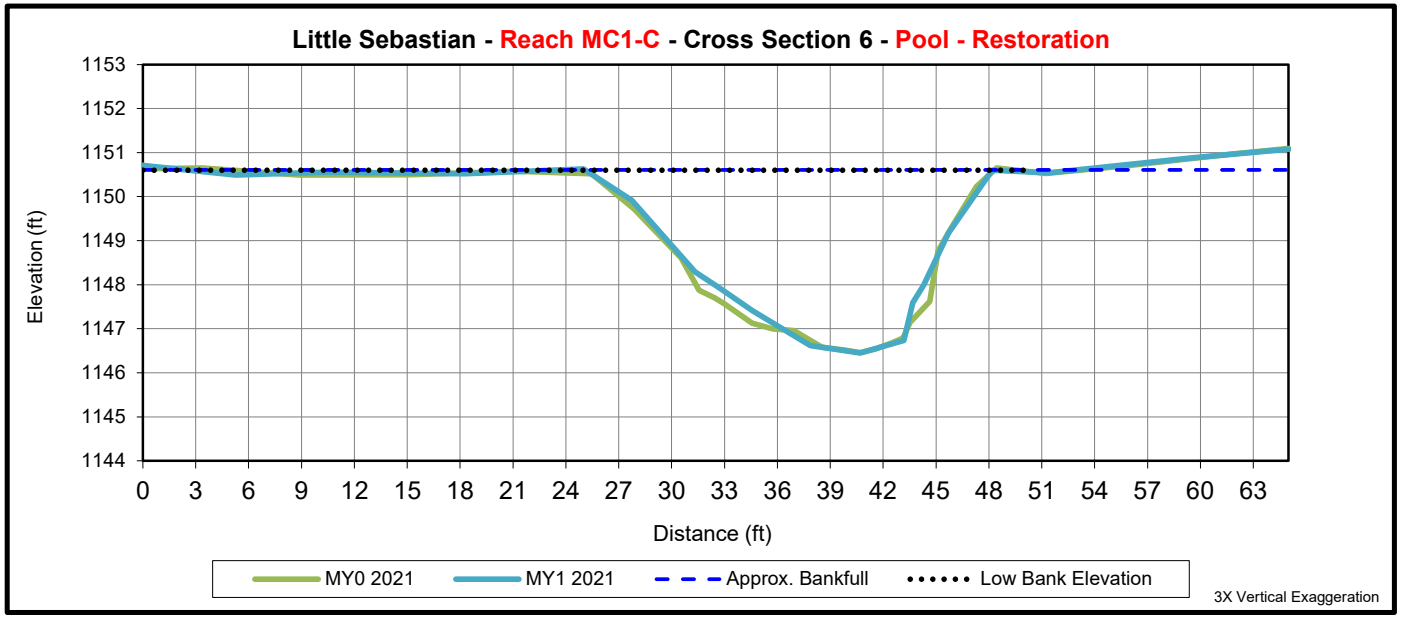


	Cross Section 5 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1150.6	1150.7					
Bankfull Width (ft)[1]	21.3	21.0					
Floodprone Width (ft)[1]	>64.9	>65.1					
Bankfull Max Depth (ft)[2]	3.2	3.1					
Low Bank Elevation (ft)	1150.6	1150.6					
Bankfull Cross Sectional Area (ft^2)[2]	49.8	48.2					
Bankfull Entrenchment Ratio[1]	>3.0	>3.1					
Bankfull Bank Height Ratio[1]	1.0	1.0					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

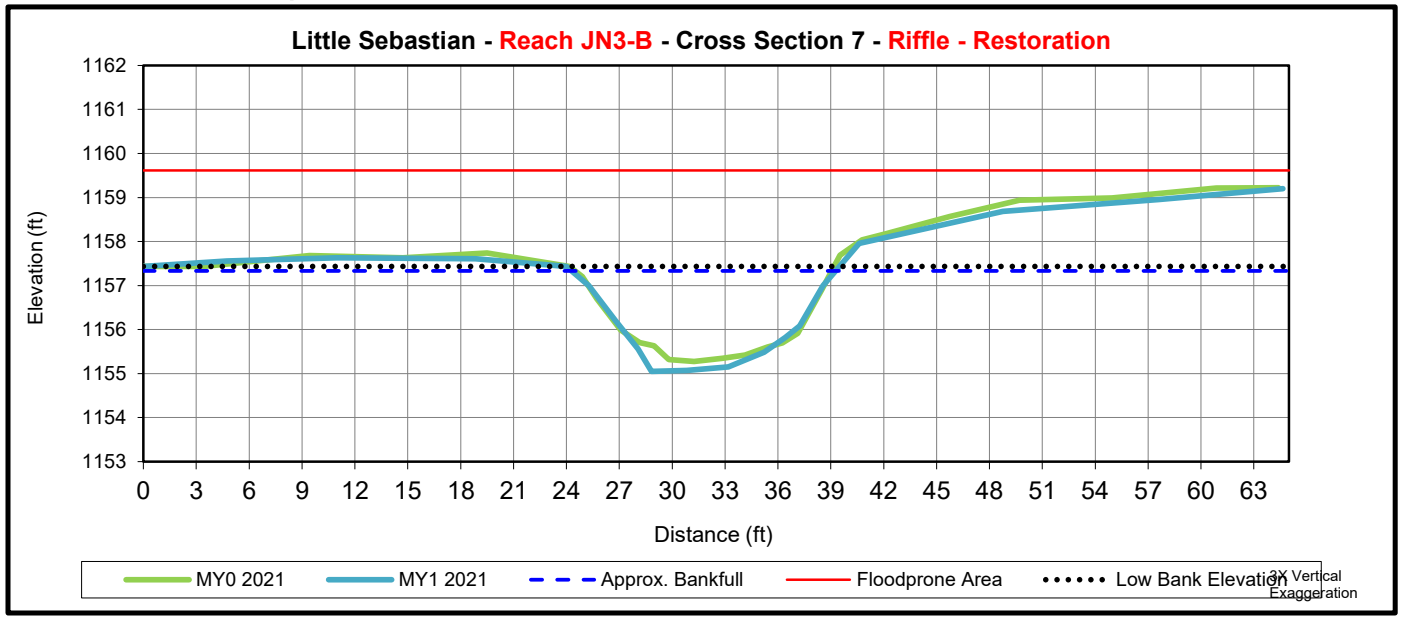


	Cross Section 6 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1150.5	1150.6					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	4.1	4.1					
Low Bank Elevation (ft)	-	-					
Bankfull Cross Sectional Area (ft^2)[2]	56.7	56.4					
Bankfull Entrenchment Ratio[1]	-	-					
Bankfull Bank Height Ratio[1]	-	-					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

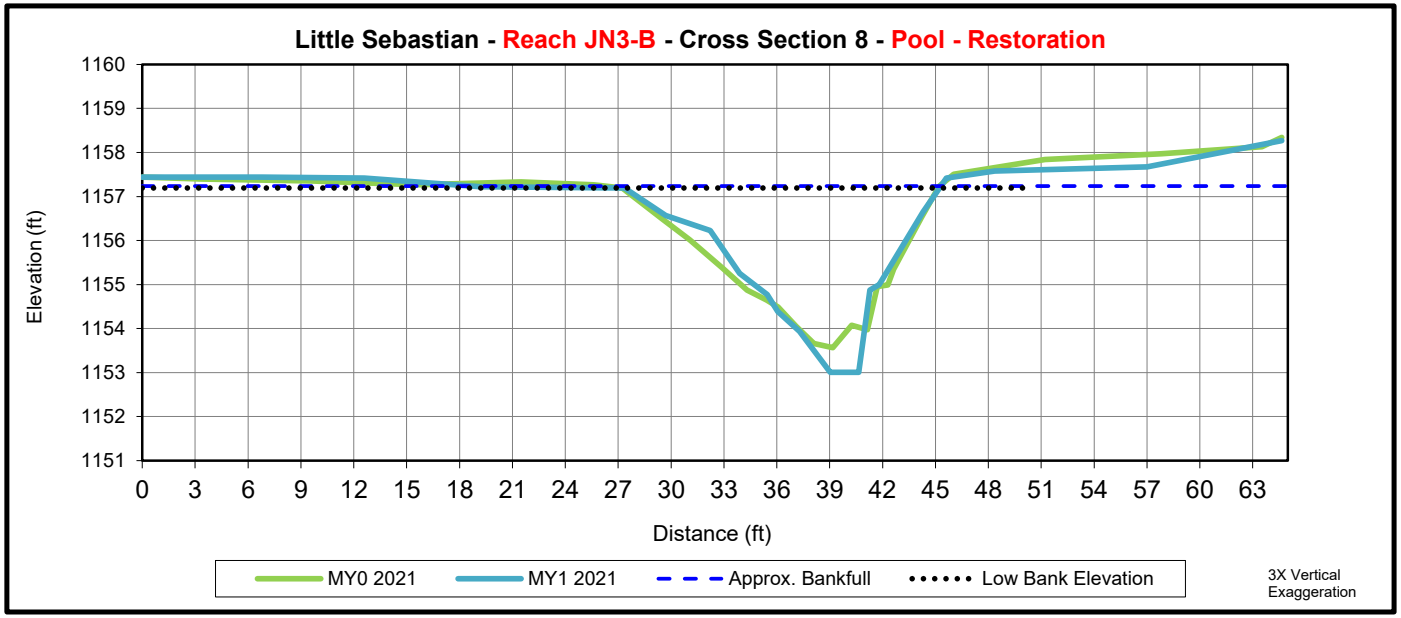


	Cross Section 7 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1157.4	1157.3					
Bankfull Width (ft)[1]	15.0	15.0					
Floodprone Width (ft)[1]	>64.4	>64.7					
Bankfull Max Depth (ft)[2]	2.2	2.4					
Low Bank Elevation (ft)	1157.4	1157.4					
Bankfull Cross Sectional Area (ft^2)[2]	22.8	24.4					
Bankfull Entrenchment Ratio[1]	>4.3	>4.3					
Bankfull Bank Height Ratio[1]	1.0	1.0					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

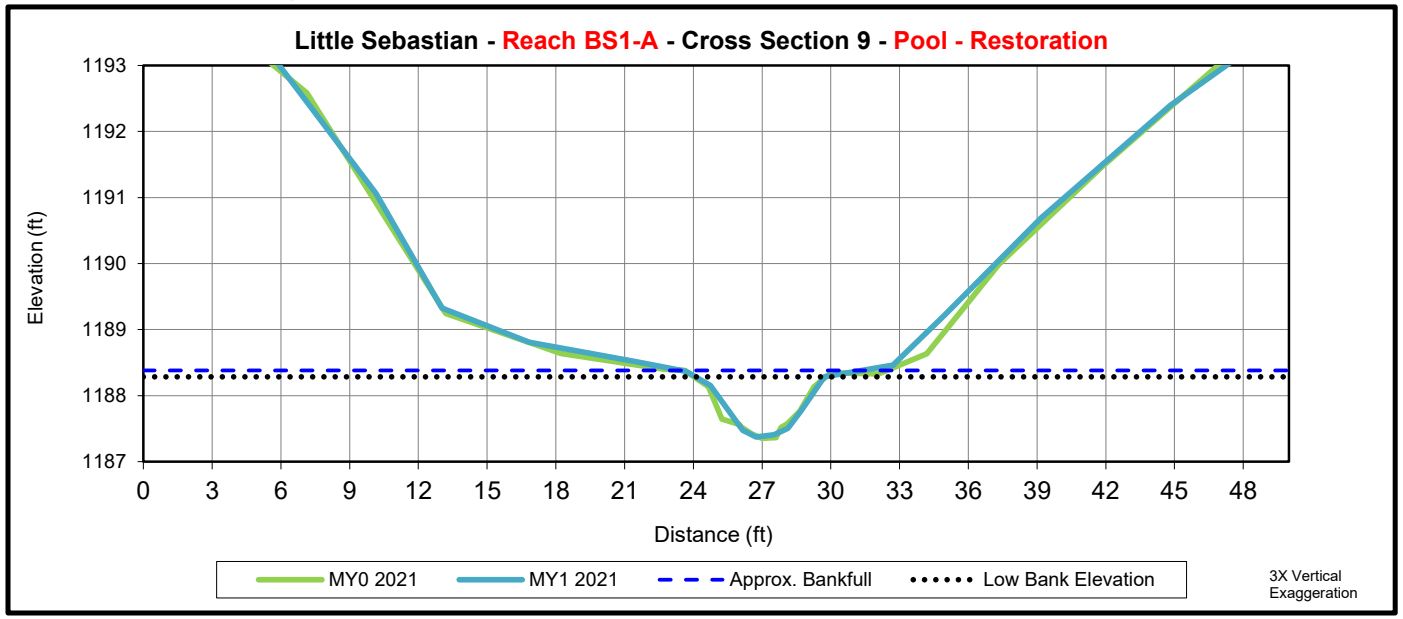


	Cross Section 8 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1157.2	1157.2					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	3.6	4.2					
Low Bank Elevation (ft)	-	-					
Bankfull Cross Sectional Area (ft^2)[2]	34.8	34.0					
Bankfull Entrenchment Ratio[1]	-	-					
Bankfull Bank Height Ratio[1]	-	-					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

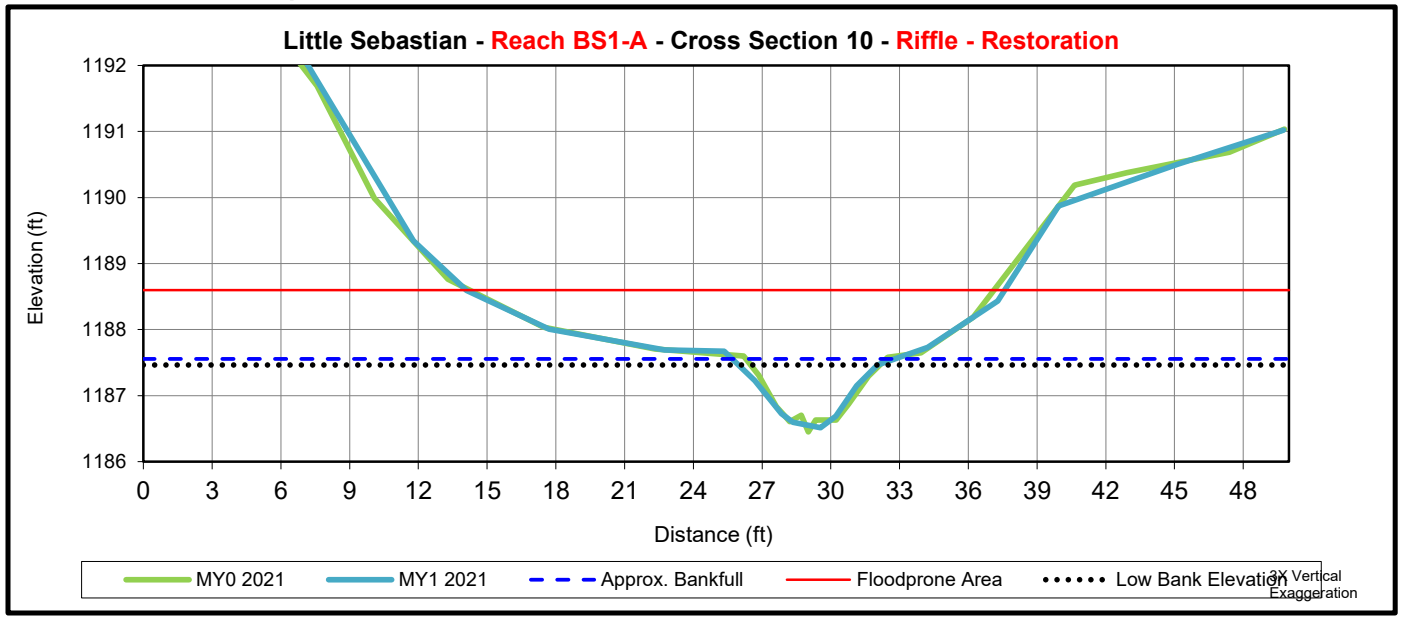


	Cross Section 9 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1188.3	1188.4					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	1.0	0.9					
Low Bank Elevation (ft)	-	-					
Bankfull Cross Sectional Area (ft^2)[2]	3.6	3.0					
Bankfull Entrenchment Ratio[1]	-	-					
Bankfull Bank Height Ratio[1]	-	-					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

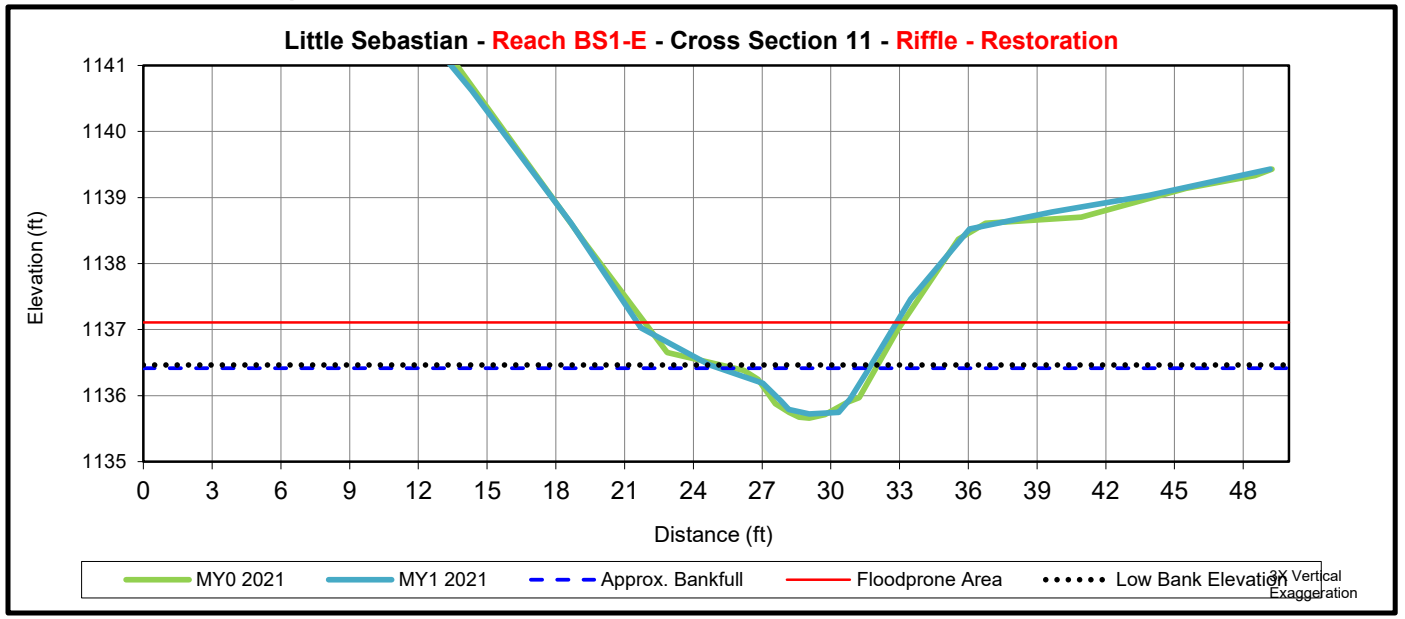


	Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1187.6	1187.6					
Bankfull Width (ft)[1]	6.3	7.1					
Floodprone Width (ft)[1]	23.8	23.5					
Bankfull Max Depth (ft)[2]	1.1	1.0					
Low Bank Elevation (ft)	1187.6	1187.5					
Bankfull Cross Sectional Area (ft^2)[2]	4.0	3.4					
Bankfull Entrenchment Ratio[1]	3.8	3.3					
Bankfull Bank Height Ratio[1]	1.0	0.9					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

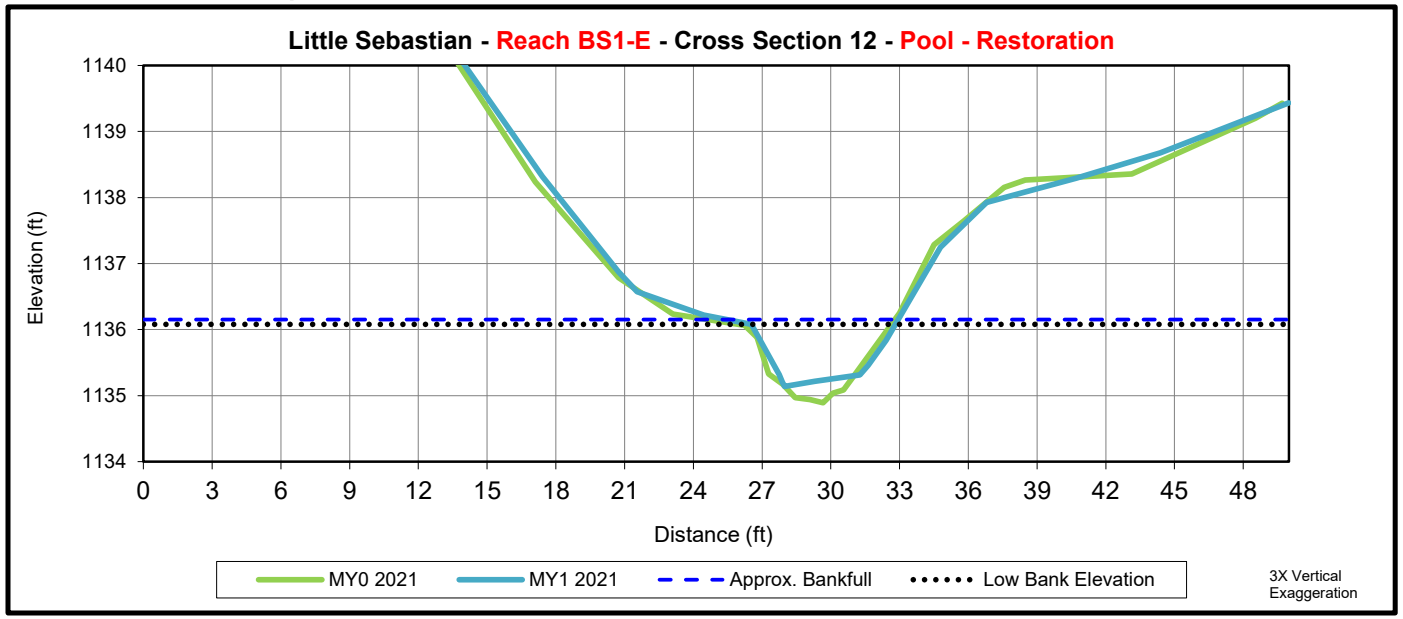


	Cross Section 11 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1136.4	1136.4					
Bankfull Width (ft)[1]	5.7	6.5					
Floodprone Width (ft)[1]	11.3	11.3					
Bankfull Max Depth (ft)[2]	0.7	0.7					
Low Bank Elevation (ft)	1136.4	1136.5					
Bankfull Cross Sectional Area (ft^2)[2]	2.6	3.0					
Bankfull Entrenchment Ratio[1]	2.0	1.7					
Bankfull Bank Height Ratio[1]	1.0	1.1					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



	Cross Section 12 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1136.1	1136.2					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	1.2	0.9					
Low Bank Elevation (ft)	-	-					
Bankfull Cross Sectional Area (ft^2)[2]	4.6	4.1					
Bankfull Entrenchment Ratio[1]	-	-					
Bankfull Bank Height Ratio[1]	-	-					

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Appendix E

Hydrology Data

Table 12. Rainfall Summary MY1 2021

Month	Average	Normal Limits		Raven Knob Station Precipitation
		30 Percent	70 Percent	
January	3.99	2.78	4.80	2.58
February	3.14	2.12	3.76	3.88
March	4.19	2.95	4.97	5.07
April	4.29	2.88	5.13	1.95
May	4.53	3.09	5.53	2.46
June	4.95	3.39	5.90	5.98
July	5.24	3.71	6.20	6.61
August	4.69	3.46	5.85	8.82
September	4.26	3.06	5.05	2.39
October	3.54	2.19	4.26	3.24
November	3.44	2.17	4.15	0.48
December	4.20	3.03	4.91	---
Total	50.46	34.83	60.51	43.46

Above Normal Limits	Below Normal Limits

Note: Raven Knob CRONOS Station is approximately 6 miles north of the site

Table 13. Documentation of Geomorphically Significant Flow Events

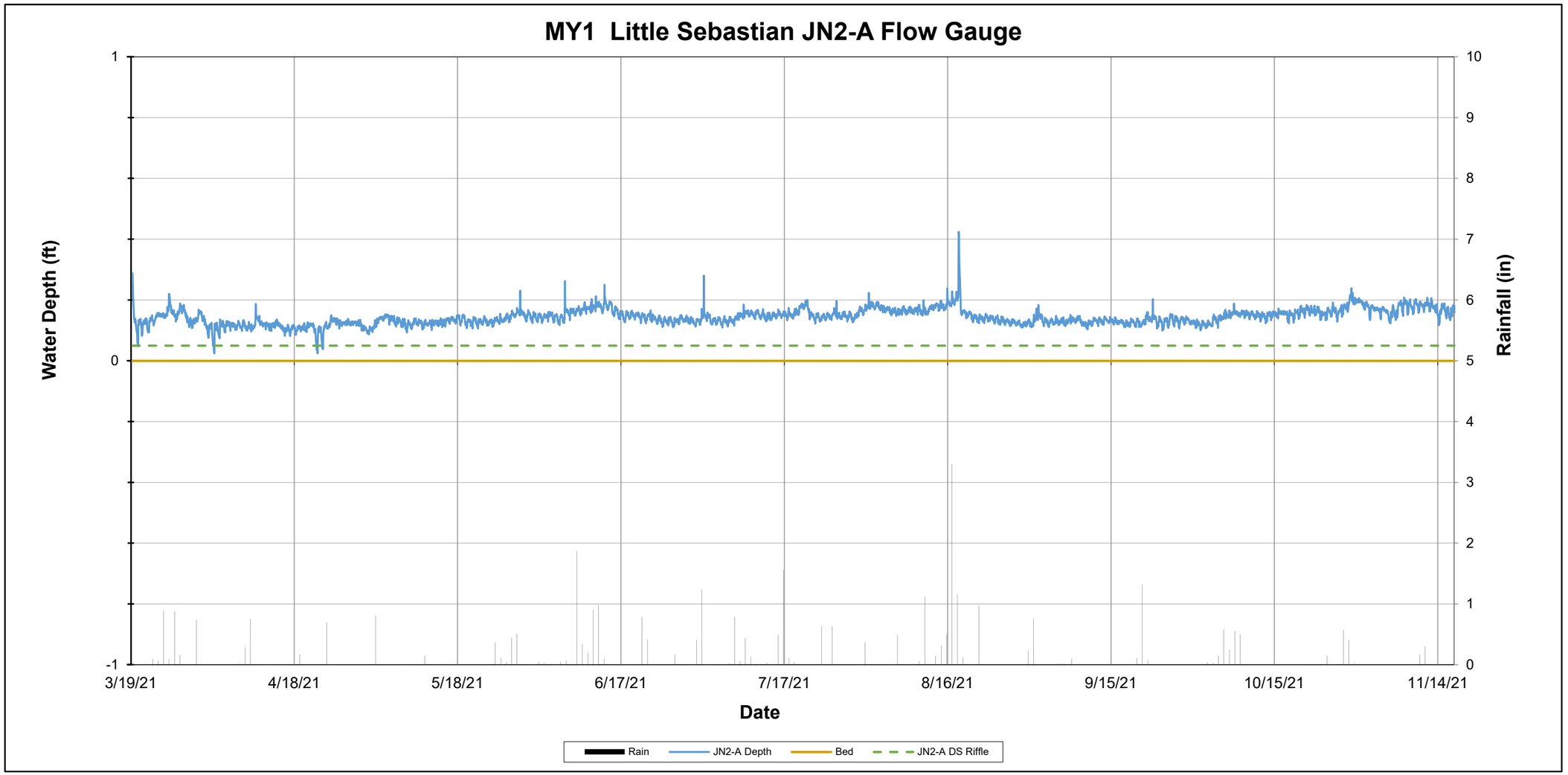
Year	Number of Bankfull Events	Maximum Bankfull Height (ft)	Date of Maximum Bankfull Event	
Stage Recorder JN3-B				
MY1 2021	0	N/A	N/A	
Stage Recorder BS1-E				
MY1 2021	0	N/A	N/A	
Year	**Number of Flow Events**	**Maximum Consecutive Flow Days**	**Maximum Cummlative Flow Days**	**Maximum Consecutive Flow Date Range**
Flow Gauge JN2-A				
MY1 2021	1	243	243	3/19/2021 - 11/17/2021
Flow Gauge BS1-A				
MY1 2021	1	243	243	3/19/2021 - 11/17/2021

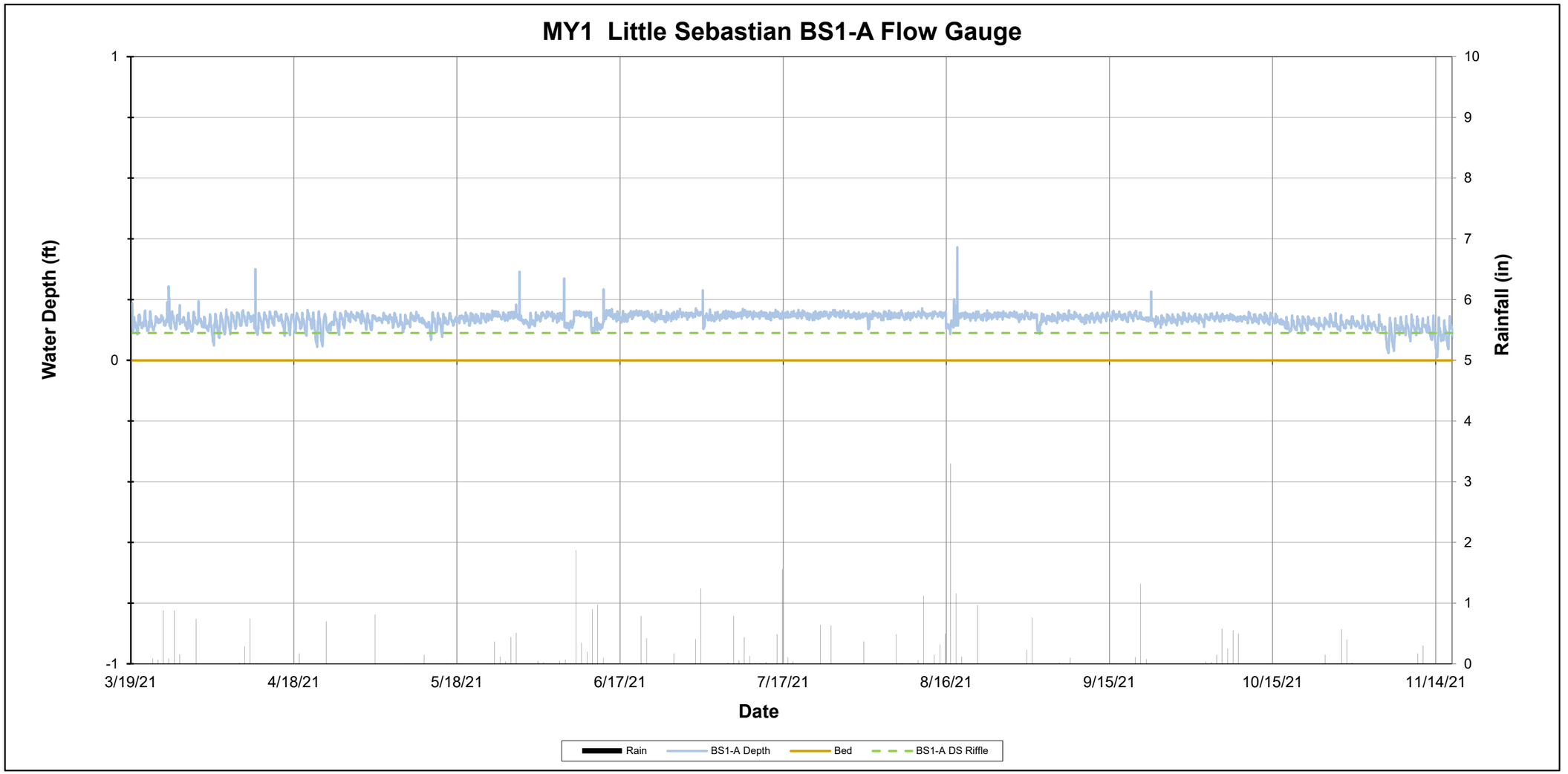
Table 14. 2021 Max Hydroperiod

2021 Max Hydroperiod (Growing Season 3-Apr through 30-Oct, 210 days)					
Well ID	**Consecutive**		**Cumulative**		**Occurrences**
	Days	**Hydroperiod (%)**	**Days**	**Hydroperiod (%)**	
GW1	87	41	137	65	14
GW2	210	100	210	100	1

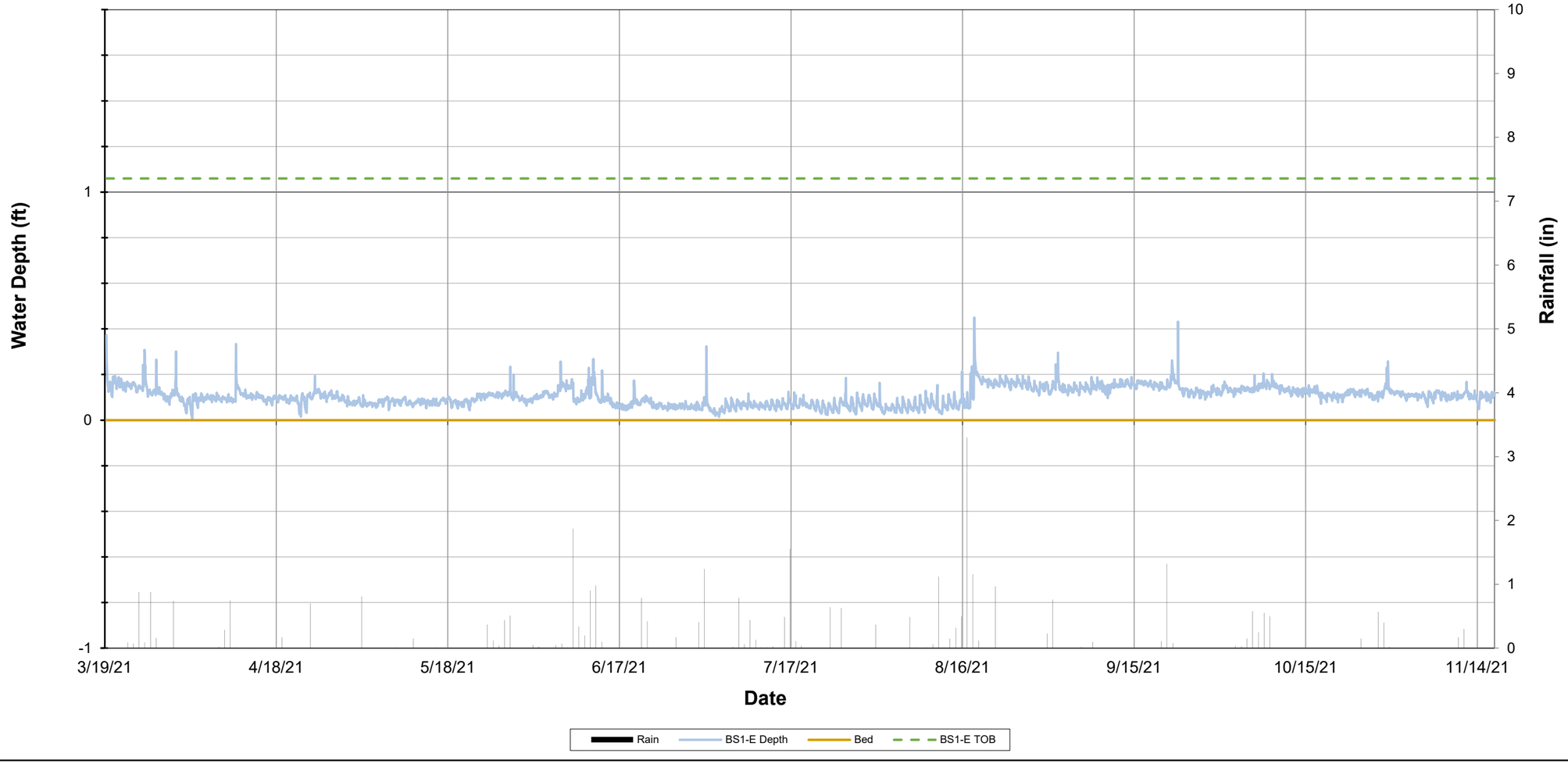
Table 15. Summary of Groundwater Monitoring Results

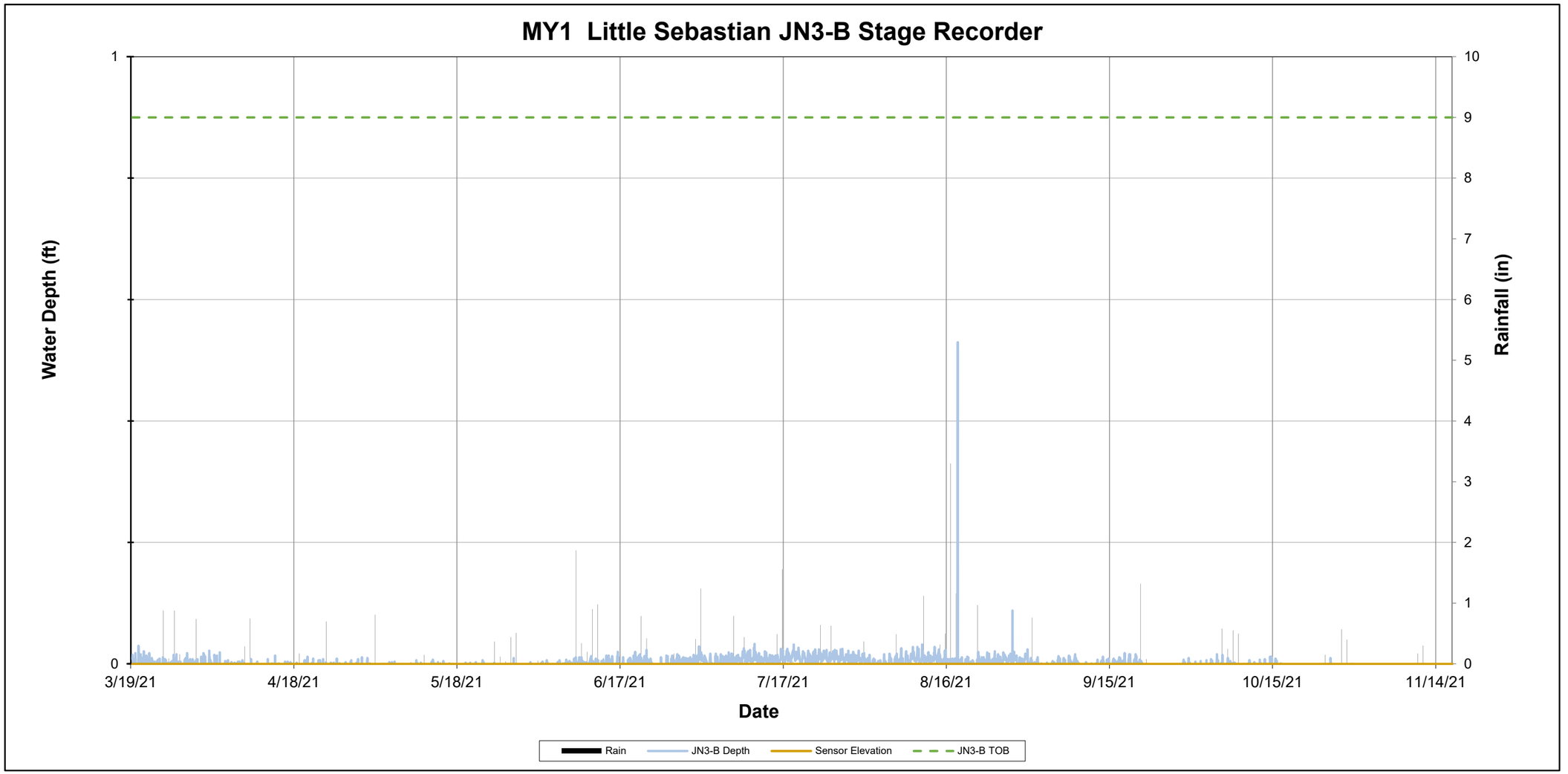
Summary of Groundwater Monitoring Results Little Sebastian							
Well ID	**Hydroperiod (%)**						
	Year 1 (2021)	**Year 2 (2022)**	**Year 3 (2023)**	**Year 4 (2024)**	**Year 5 (2025)**	**Year 6 (2026)**	**Year 7 (2027)**
GW1	41						
GW2	100						

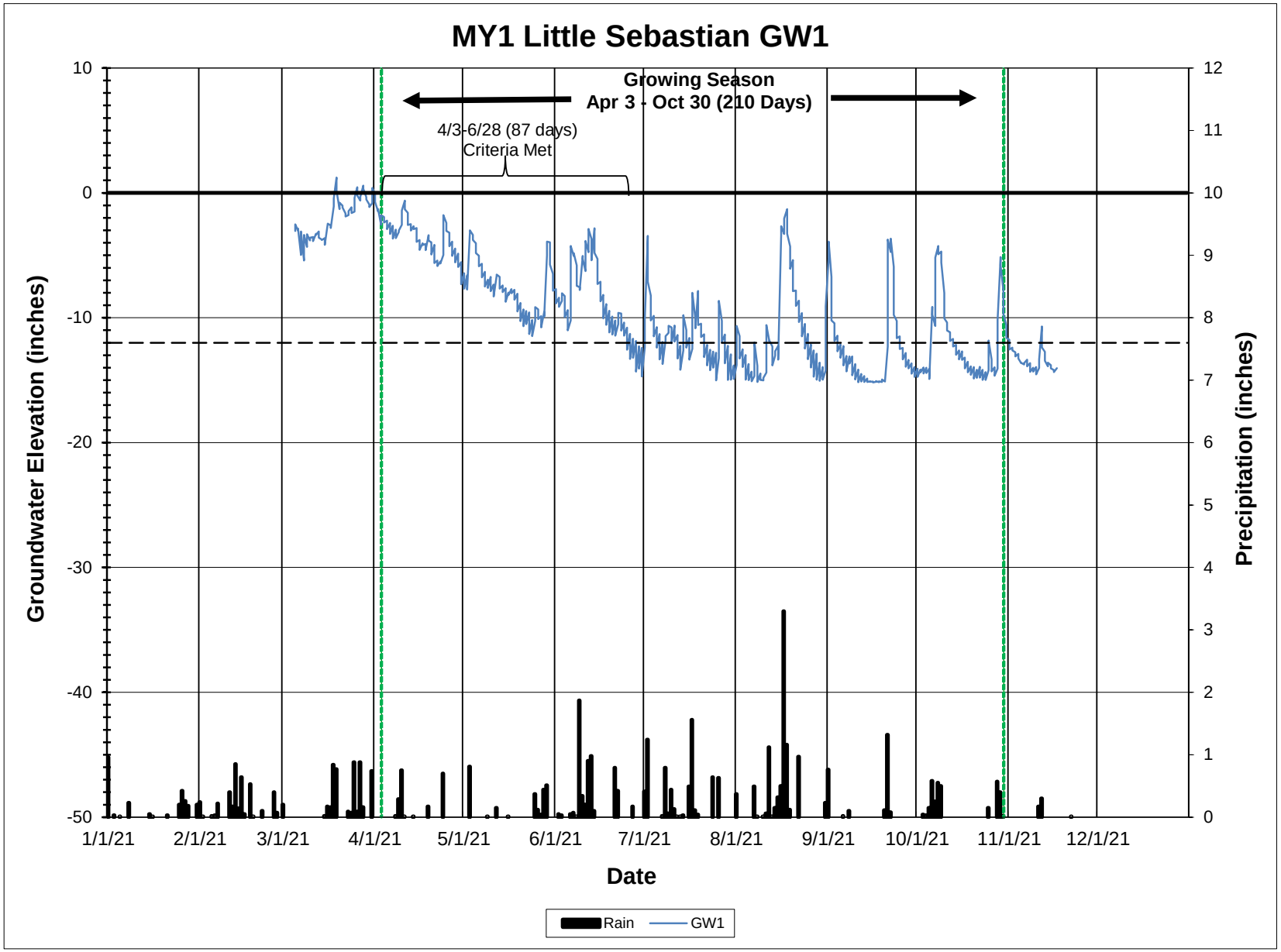

MY1 Little Sebastian JN2-A Flow Gauge
Water Depth (ft)
Rainfall (in)
1
0
-1
10
9
8
7
6
5
4
3
2
1
0
3/19/21
4/18/21
5/18/21
6/17/21
7/17/21
8/16/21
9/15/21
10/15/21
11/14/21
Date
Rain
JN2-A Depth
Bed
JN2-A DS Riffle

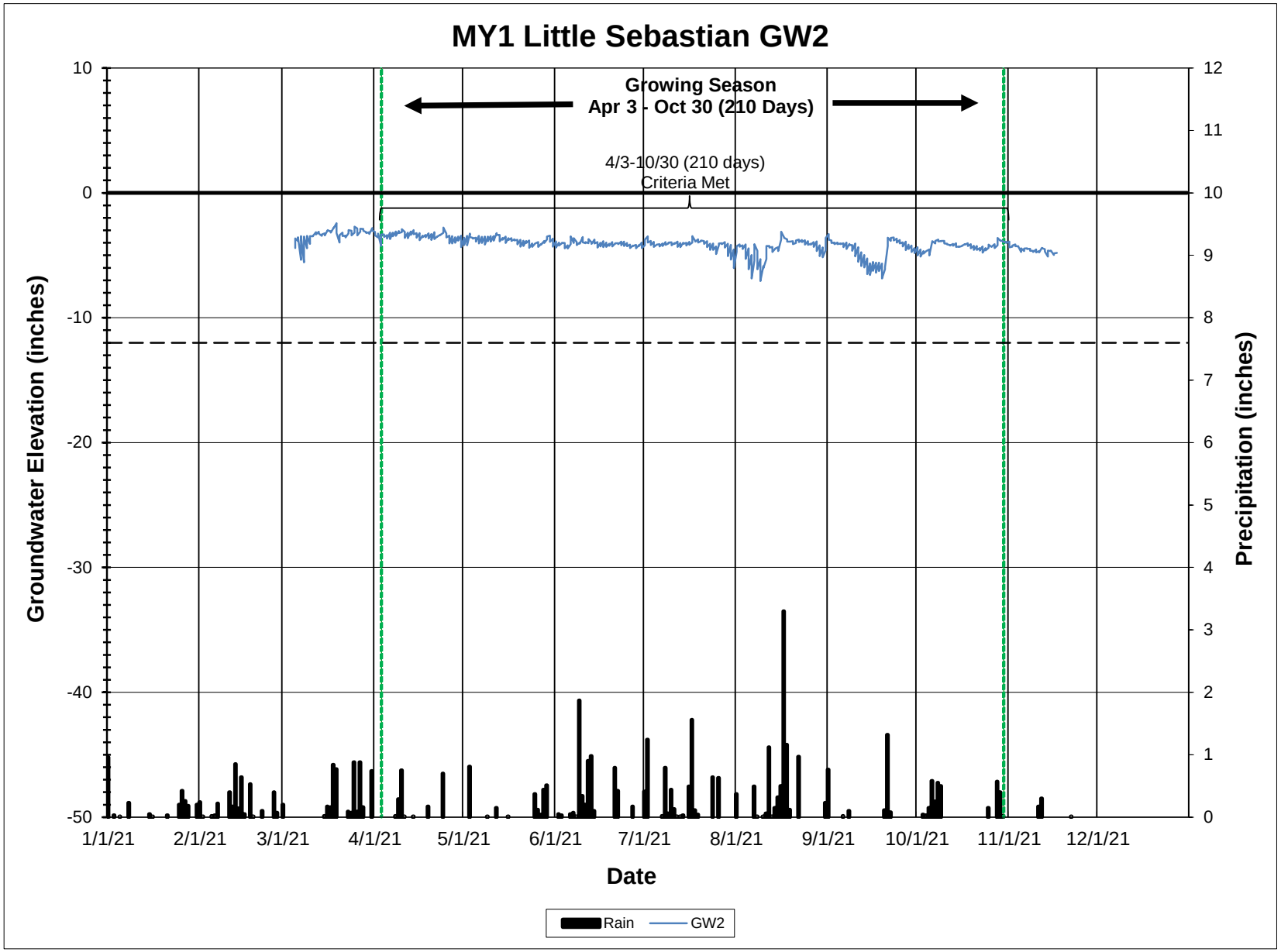

MY1 Little Sebastian BS1-A Flow Gauge
Water Depth (ft)
Rainfall (in)
1
0
-1
10
9
8
7
6
5
4
3
2
1
0
3/19/21
4/18/21
5/18/21
6/17/21
7/17/21
8/16/21
9/15/21
10/15/21
11/14/21
Date
Rain
BS1-A Depth
Bed
BS1-A DS Riffle

MY1 Little Sebastian BS1-E Stage Recorder




MY1 Little Sebastian JN3-B Stage Recorder
Water Depth (ft)
Rainfall (in)
1
0
10
9
8
7
6
5
4
3
2
1
0
3/19/21
4/18/21
5/18/21
6/17/21
7/17/21
8/16/21
9/15/21
10/15/21
11/14/21
Date
Rain
JN3-B Depth
Sensor Elevation
JN3-B TOB


MY1 Little Sebastian GW1
Growing Season
Apr 3 - Oct 30 (210 Days)
4/3-6/28 (87 days)
Criteria Met
Groundwater Elevation (inches)
Precipitation (inches)
Date
10
0
-10
-20
-30
-40
-50
12
11
10
9
8
7
6
5
4
3
2
1
0
1/1/21
2/1/21
3/1/21
4/1/21
5/1/21
6/1/21
7/1/21
8/1/21
9/1/21
10/1/21
11/1/21
12/1/21
Rain
GW1


MY1 Little Sebastian GW2
Growing Season
Apr 3 - Oct 30 (210 Days)
4/3-10/30 (210 days)
Criteria Met
Groundwater Elevation (inches)
Precipitation (inches)
Date
10
0
-10
-20
-30
-40
-50
12
11
10
9
8
7
6
5
4
3
2
1
0
1/1/21
2/1/21
3/1/21
4/1/21
5/1/21
6/1/21
7/1/21
8/1/21
9/1/21
10/1/21
11/1/21
12/1/21
Rain
GW2

Appendix F

IRT Correspondence

3600 Glenwood Avenue, Suite 100
Raleigh, NC 27612

Corporate Headquarters
6575 W Loop S #300
Bellaire, TX 77401
Main: 713.520.5400

October 5, 2021

Paul Wiesner
NC DEQ Division of Mitigation Services
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

RE: Little Sebastian Mitigation Site: Mitigation Plan Addendum and Baseline Report and As-Built Drawings (NCDMS Project ID #100027)

Listed below are comments provided by IRT on October 4, 2021 regarding the Little Sebastian Mitigation Site: Mitigation Plan Addendum and Baseline Report and As-Built Drawings and RES' responses.

USACE Addendum Comments, Kim Browning:

1. Were stream and wetland impacts evaluated with the addition of reach JN-7, and were they accounted for in the 404/401 permit?
   This reach was not included in the PCN or 404/401 permit.
2. Is JN-7 perennial or intermittent? If flow is a concern, the IRT may request a flow gauge be installed.
   Based on drainage area (30 acres), RES believes this reach is intermittent. However, it was not included in the JD. RES will install a flow gauge on it.
3. What was the condition of JN-7 prior to construction, and was the design incorporated into the final design? Were there stability issues with the channel?
   The condition of JN-7 prior to construction was a ditch-like channel connecting the pond outlet to JN-3. This channel was about 75-feet long, incised, and a straight line from the pond outlet to JN-3. A design was incorporated into the final design, after Final Mitigation Plan submittal, to create a 150-foot stable channel from the pond outlet to the newly constructed JN3-A.
4. If JN-7 serves as an outlet for the adjacent pond, are there any concerns with stability or sediment loads if the spillway fails or the dam breaches?
   RES does not anticipate a dam failure considering the small drainage acre of the pond. However, if it were to fail, there would likely be minor impacts, but the system should be able to handle the relatively minor influx of sediment.

DWR MY-0 Comments, Erin Davis:

1. DWR appreciate DMS' request for crossing photos in future reports. Those photos would've been helpful for this review.
   Crossing photos will be included in future reports.
2. DWR is ok with the plant species substitutes. We were glad to see the reduction in percent green ash planted.
3. Please confirm that all areas were planted, including any supplemental/understory planting, as proposed in the approved mitigation plan.
   Confirmed.
4. DWR is ok with the extra stage recorder not being installed on BS1-C. However, when we recently visited the downstream Gideon Site we observed the presence of drift lines mid-slope up the bank but not on the floodplain. Therefore, in lieu of the stage recorder being installed along MC1-C as specified in the approved mitigation plan, DWR requests photo documentation of evidence of overbank events be provided for this reach.
   RES will provide photo documentation of overbank events on MC1-C.

USACE MY-0 Comments, Casey Haywood:

1. Concur with DWR's comments.
2. It was noted that two veg plots were moved (both on JN2); however, a random plot was also added.

Ryan Medric

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Wednesday, October 6, 2021 3:23 PM
To: Wiesner, Paul
Cc: Tugwell, Todd J CIV USARMY CESAW (USA); Haywood, Casey M CIV (USA); Davis, Erin B; Wilson, Travis W.; Leslie, Andrea J; Bowers, Todd; Ryan Medric; Bradley Breslow; Daniel Ramsay
Subject: [EXTERNAL] As-Built & Mitigation Plan Addendum Review/ NCDMS Little Sebastian Mitigation Site/ SAW-2017-01507/ Surry County
Attachments: Little Sebastian_100027_Response To IRT Comments_10-5-2021.pdf; NWP27_Little Sebastian_SAW-2017-01507_Surry Co.pdf; JN-7.JPG

Good afternoon Paul,

Thank you for sending the response to IRT comments for the proposed NCDMS Little Sebastian Addendum on October 5, 2021 (attached). Per Section 332.8(o)(9) of the 2008 Mitigation Rule, this review followed the streamlined review process. The IRT raised several concerns during this review; outlined below. Based on these concerns, the Corps' decision is to disapprove this addendum for the addition of reach JN-7 which proposed an upward adjustment of the project's stream assets (+19.660 Cool SMUs) for 37 linear feet of restoration. The Corps approves the initial 30% credit release of the approved mitigation plan project credits (4,554.300 cool SMUs), which totals 1,366.290 SMUs. Please send me the credit ledger that reflects this amount. Additionally, please address the IRT concerns below.

1. Reach JN-7 was included on the PJD completed by William Elliott on May 22, 2018, as "JN-7, -80.855351 36.394343, 55 LF." It appears that the JN-7 that was included on the PJD was on the Gideon Mitigation Bank easement, which caused confusion with two reaches having the same name. It appears that the restored reach JN-7 that exits the pond and ties in with JN-3B on the Little Sebastian easement was not evaluated during the JD visit, nor was it evaluated during the IRT site visit. For future jurisdictional determination submittals, please keep each project separate and use a consistent naming convention for each reach/wetland.

2. Design plans submitted with the PCN as well as all special, general and regional conditions must be strictly adhered to in order for the attached NWP-27 verification letter/authorization to remain valid. Table 1 of the NWP-27 lists all authorized discharge of fill material into waters of the U.S., and the impacts associated with the restoration of reach JN-7 were not accounted for with this authorization. Since RES states that this reach is intermittent, impacts to this reach will need to be accounted for. Please re-submit the 404 permit application to include any stream and wetland impacts that were associated with the restoration of JN-7 so the Corps can re-authorize the NWP-27 and verify these additional impacts under an After-The-Fact permit verification. (Reach photo attached.) If RES feels that JN-7 was not jurisdictional, there will still be impacts to account for with the tie-in with JN-3B. . The IRT would not support issuing stream credit on a non-jurisdictional reach.

3. Large-scale deviations, including adding a restoration reach, from the approved final mitigation plan and design should be proposed to the IRT PRIOR to conducting the work. The IRT did not have the opportunity to evaluate this reach to determine the appropriate mitigation approach or potential functional uplift, and therefore do not think it is appropriate to allow stream credit; however, we would like you to monitor flow and stability of the reach during monitoring since work was completed on it, and if other reaches on the approved project are not meeting success standards towards the end of monitoring, the IRT may consider allowing these credits to be potential back-up credits (assuming reach JN-7 is successfully meeting performance standards).

4. DWR may require additional 401 permits for any additional impacts. Please contact Erin Davis to confirm.

Moving forward, please contact the IRT prior to completing any major deviations from the approved mitigation plan or design. Feel free to reach out with any questions.