FINAL

Baseline Monitoring Document and As-Built Baseline Report

Town Creek Restoration Project – Option B

Stanly County, North Carolina

DMS Project ID No. 95026; NCDEQ Contract No. 003990

SAW-2014-00016; DWR#14-1259 V2

Yadkin Pee-Dee River Basin: 03040105060040

Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Data Collection Period – February – June 2016

Submission Date – November 2016

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1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc., (Baker) restored 2,785 linear feet (LF) and enhanced approximately 943 LF of jurisdictional stream along an unnamed tributary (UT) that flows into Town Creek. Baker also planted native riparian species within the 11.97 acre (AC) recorded conservation easement along the restored and enhanced reaches (Reaches 1 – 5). The Town Creek Restoration Project – Option B (Site) is located in Stanly County, approximately 1.5 miles west of the Town of New London, within cataloging unit 03040105 of the Yadkin Pee-Dee River Basin. The Project is located in a North Carolina Division of Mitigation Services (NCDMS) - Targeted Local Watershed (HUC 03040105060-040), and involved stream restoration and enhancement along a UT to Town Creek, which had been impaired due to historical pasture conversion and active cattle grazing. See Figure 1.

Based on both the River Basin Restoration Priorities (RBRP) document for the Lower Yadkin – Pee Dee River Basin (NCEEP, 2009) and the Yadkin-Pee Dee River Basinwide Water Quality Plan (NCDENR, 2008), many streams in the Rocky River Watershed (03040105) are documented as impaired or impacted due to habitat degradation. Stressors identified in the plan include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. As stated in the Yadkin-Pee Dee River Basinwide Water Quality Plan, the project watershed naturally consists of erodible soils; therefore, increasing the system's vulnerability to the aforementioned stressors.

The primary goals of the project are as follows:

- Improve aquatic and terrestrial habitat through the increase of dissolved oxygen concentrations, reduction of nutrient and sediment loads, improvement of substrate and in-stream cover, reduction of stream bank erosion, and reduction of in-stream water temperature,
- Create geomorphically stable conditions along the channels,
- Enhance hydrologic connections between streams and the degraded riparian buffer and overall ecosystem functionality;
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.
- Improve terrestrial habitat and reduce sediment and nutrient loading to the project reaches and the Little Long Creek Watershed.

To accomplish these goals, the project pursued the following objectives:

- Restore existing incised, eroding, and channelized streams by creating a stable stream channel with access to its floodplain,
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and areas of water re-aeration, and reducing bank erosion,
- Prevent cattle from accessing the project boundary by installing permanent fencing and thus reduce excessive bank erosion and undesired nutrient inputs,
- Plant native species riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, and shade the stream to decrease water temperature,
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period.

This report documents the completion of the restoration construction activities and presents as-built monitoring data for the post-construction monitoring period. Table 1 summarizes the project components and mitigation credit assets and is located in Appendix A.

2.0 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

2.1 Project Location and Description

The Site is located in Stanly County, NC, approximately 1.5 miles west of the Town of New London, as shown on the Vicinity Map (Figure 1). The project is located within the Yadkin-Pee Dee River Basin and the NCDMS - Targeted Local Watershed (HUC 03040105060-040). The project is located in the Piedmont physiographic region within the Carolina Slate Belt and includes an Unnamed Tributary (UT) that flows directly into Town Creek just downstream of the project's extent. The project channel was divided into five reaches (Reach 1, Reach 2, Reach 3, Reach 4, and Reach 5) as shown in Figure 2.

The United States Geologic Survey (USGS) topographic quadrangle maps (Richfield and New London) depict the stream channel (Reach 1 – Reach 5) as a dashed blue-line stream, along its entire length within the project limits. Preliminary on-site field investigations determined that 654 LF of the project channel (which included all of R1 and 291 LF of R2) was classified as an intermittent, while the remaining 3,444 LF of the channel (428 LF of R2 through R5) was classified as perennial. On-site field investigations were confirmed during an on-site jurisdictional determination field review with the United States Army Corps of Engineers (USACE). The jurisdictional determination was approved on January 2, 2014.

2.2 Site Directions

To access the Site from Raleigh, take I-40 West toward Sanford/Wake Forest. Take Exit 293 (I-440/US-64 W/US-1) toward Sanford/Wake Forest. Keep left at the fork toward US-1 S/US-64 W. Take Exit 293A for US-1 S/US-64 W toward Sanford/Asheboro. Keep left at the fork toward US-1 S/US-64 W. Continue on US-1 S/US-64 W towards Apex/Sanford/Asheboro. Take exit 98B to merge onto US-64 W towards Pittsboro/Asheboro. After 62 miles, turn left onto Connector Rd. Turn right onto NC 49 S. After 28.4 miles, take a slight left onto N Main St. After 1.1 miles, turn left onto Old Salisbury Rd. Follow Old Salisbury Rd. for approximately 2.0 miles to its intersection with Misenheimer Rd. / Steakhouse Rd. Go through the intersection and continue on Old Salisbury Rd. for approximately 0.4 miles and the Project site is on the left accessed via a paved driveway.

2.3 Project Goals and Objectives

The primary goals of the project are to improve aquatic habitat degradation by improving ecologic functions and reducing non-points source loads from agricultural run-off to the impaired areas as described in the Lower Yadkin – Pee Dee RBRP and as identified below:

- Improve aquatic and terrestrial habitat through the increase of dissolved oxygen concentrations, reduction of nutrient and sediment loads, improvement of substrate and in-stream cover, reduction of stream bank erosion, and reduction of in-stream water temperature,
- Create geomorphically stable conditions along the channels,
- Enhance hydrologic connections between streams and the degraded riparian buffer and overall ecosystem functionality;
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.
- Improve terrestrial habitat and reduce sediment and nutrient loading to the project reaches and the Little Long Creek Watershed.

To accomplish these goals, the project incorporated the following objectives:

- Restore existing incised, eroding, and channelized streams by creating a stable stream channel with access to its floodplain.
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and areas of water re-aeration, and reducing bank erosion.
- Prevent cattle from accessing the project boundary by installing permanent fencing and thus reduce excessive bank erosion and undesired nutrient inputs.
- Plant native species riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, and shade the stream to decrease water temperature.
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period.

3.0 PROJECT STRUCTURE, RESTORATION TYPE AND APPROACH

3.1 Project Components

The project area consists of the restoration and enhancement of a UT to Town Creek. The project is located in the Carolina Slate Belt Level IV Ecoregion of the Piedmont physiographic region. For assessment and design purposes, the project channel was divided into five individual reaches (Reach 1, Reach 2, Reach 3, Reach 4, and Reach 5). A riparian buffer of native species vegetation was established and/or protected at least 50 feet from the top of both bank along all entire project length. Lastly, cattle were excluded along all project reaches and existing riparian wetlands located within the conservation easement with the installation of permanent fencing. The reach designations have remained in the same order to be consistent throughout the document. No wetland credit is being sought for inclusion of the riparian wetlands within the conservation easement boundary.

3.2 Restoration Approach

Based on the post-construction as-built survey, the project consisted of 317 LF of Restoration on Reach 1, 711 LF of Enhancement I on Reach 2, 1,621 LF of Restoration on Reach 3, 232 LF of Enhancement I on Reach 4, and 822 LF of Restoration on Reach 5. A recorded conservation easement consisting of 11.97 acres protects and preserves all stream reaches, existing wetland areas, and riparian buffers in perpetuity.

The vegetative components of this project include stream bank, floodplain, and transitional upland planting and is described as the riparian buffer zone. The Site was planted with native riparian buffer species as shown in Table 7 and Table 8 (Appendix C) and is protected within the permanent conservation easement. Table 1 and Figure 2 (Appendix A) provide a summary of the project components.

3.2.1 Reach 1 Restoration

A restoration approach began on Reach 1 at the property boundary. A series of boulder steps were implemented to stabilize a head cut at the property boundary and allow for a stable transition into the restored channel. The upstream 105 LF of Reach 1 was realigned to fall along the center of the valley and bankfull benches were excavated to provide floodplain connections and to restore stream functions. The newly formed channel reconnects with the existing channel alignment at Station 11+38.

The remainder of the reach was constructed mostly on-line along the existing valley bottom as a Rosgen B stream type. In-stream structures included constructed riffles for grade control and aquatic habitat improvement, grade control j-hook vanes, rock step structures for stream bed/bank stability, and habitat diversity.

The existing, abandoned channel was filled along its length using material excavated during construction for the restored channel. A second modification to the existing channel alignment was made near the end of R1 where a large bedrock outcrop was promoting lateral instability by diverting flows around the feature. Therefore, the channel was moved off-line to allow for the bedrock outcrop to function as bank stability and a habitat feature.

Riparian buffers in excess of 50 feet were restored along all of Reach 1 and permanent fencing was installed to exclude livestock from entering the restored stream or buffer area. The buffer was planted with a diverse mix of woody and herbaceous vegetation to reestablish a native plant community.

3.2.2 Reach 2 Enhancement Level I

Work on Reach 2 involved a Level I Enhancement approach for the entire reach and included the implementation of streambank stabilization measures and in-stream structures to enhance bedform morphology, provide improved connection to the floodplain, and stabilize the reach profile. In-stream

structures included the use of constructed riffles for grade control and aquatic habitat improvement, grade control j-hook vanes, rock step structures for stream bed/bank stability, and habitat diversity.

Riparian buffers in excess of 50 feet were restored along all of Reach 2 and permanent fencing was installed to exclude livestock from entering the restored stream or buffer area. This buffer was planted with a diverse mix of woody and herbaceous vegetation to reestablish a native plant community. Along this reach, a jurisdictional wetland area that may have historically been used as a livestock-watering pond has been preserved within the buffer. To enhance the hydrology of this wetland, the existing berm between the wetland and the channel was lowered to improve hydrologic connectivity between the channel and the riparian wetland.

This reach terminates as Station 20+61 where a 48-inch culverted stream crossing was installed to allow for livestock and farm equipment to cross the channel. Originally, the project was designed to exclude the entire crossing area from the easement; however, after initial installation of the crossing it was determined that the upstream face of the crossing embankment was too steep. Therefore, an additional eight feet was added to the upstream face of the culverted crossing, which extended the crossing into the easement by 6 feet.

3.2.3 Reach 3 Restoration

Reach 3 begins immediately downstream of the easement crossing. Due to varying existing bank height ratios (BHR) that ranged from 1.0 to greater than 2.0 throughout this reach, a restoration approach was implemented in order to fully restore stream functions and floodplain connectivity.

Channel banks were graded to stabilize slopes, appropriate bankfull geometry was established throughout the reach. Bankfull benches were incorporated as needed to further promote stability and re-establish floodplain connection. The channel pattern throughout this reach meanders throughout the floodplain within the valley walls and incorporates a variety of bank stabilization measures and high quality habitat features such as vegetated geolifts, toewood, and rootwads. In-stream structures such as rock and log step pools, vanes, and constructed riffle structures were installed to control grade and dissipate flow energies.

The restored channel was constructed as a Rosgen "C" stream type. The existing, unstable channel was filled along its length using material excavated for construction of the restored channel. An existing stream crossing within this reach was removed. Riparian buffers in excess of 50 feet were restored along all of Reach 3 and permanent fencing was installed to exclude livestock from entering the restored stream or buffer area. The existing vegetation within the riparian corridor of this reach was preserved where feasible. The remainder of the buffer was planted with a diverse mix of woody and herbaceous vegetation to supplement the existing vegetation and establish a native plant community. In addition to these plantings, existing non-native, invasive vegetation was treated with herbicides or physically removed to control them inside the easement.

3.2.4 Reach 4 Enhancement Level I

The presence of bedrock and mature trees along this reach has helped minimize vertical incision; however, previous livestock access has affected bank stability and bedform morphology. Therefore, Enhancement Level I was implemented to stabilize stream banks and to enhance bedform diversity with the installation of in-stream structures such as constructed riffles. Riparian buffers in excess of 50 feet were restored and/or preserved throughout the reach and permanent fencing was installed to exclude livestock from entering the easement. Mature woody vegetation within the riparian corridor along this reach was also preserved where feasible. The remainder of the buffer was planted with a diverse mix of woody and herbaceous vegetation to supplement the existing vegetation to establish a native plant community. In addition to these plantings, existing exotic invasive species vegetation were treated to control them within the easement.

3.2.5 Reach 5 Restoration

Work along Reach 5 involved the implementation of a restoration approach to restore stream functions and floodplain connection. Stream banks were graded and planted to promote bank stability and re-establish riparian vegetation. In-stream structures such as log vanes, rock vanes, and constructed riffles were implemented to control grade, dissipate energies, and eliminate the potential for upstream channel incision, while geo-lifts and toe wood were implemented to enhance the variability of aquatic habitat. A series of rock cross vanes were implemented in the downstream extent of the reach in order to step the channel down to meet the confluence elevation of Town Creek.

The restored channel was designed and constructed as a Rosgen "C" stream type. The existing, unstable channel was filled along its length using material excavated for construction of the restored channel. An existing farm crossing previously located at the upper extent of this reach was relocated downstream within the alignment of an overhead power line in order to minimize easement breaks. Along this reach, just downstream of the relocated farm road crossing, a jurisdictional wetland feature has been preserved within the right floodplain of the conservation easement. As in Reach 2, this wetland may have historically been a livestock watering pond. In order to improve the wetland's hydrologic connectivity to the channel and stabilize an existing breach in the wetland berm, the elevation of the berm was lowered and a rock-lined swale was constructed from the wetland spillway to the main channel.

Riparian buffers in excess of 50 feet were restored along all of Reach 5 and permanent fencing was installed to exclude livestock from entering the restored stream or buffer area. The existing vegetation through this reach was preserved to the greatest extent possible. The buffer was planted with a diverse mix of woody and herbaceous vegetation to supplement the existing vegetation and to establish a native plant community. In addition to these plantings, existing non-native, invasive vegetation were removed and/or treated to control them within the easement.

3.3 Project History, Contacts, and Attribute Data

Baker implemented the project under a full delivery contract with NCDMS to provide stream mitigation credits in the Yadkin – Pee Dee River Basin. The chronology of the project is presented in Table 2. The contact information for all designers, contractors, and relevant suppliers is presented in Table 3. Relevant project background information is presented in Table 4. Tables 2, 3, and 4 are located in Appendix A of this report. As-built stationing is outlined in the Construction Summary, below, and in Table 1 in Appendix A.

3.3.1 Construction Summary

In accordance with the approved Mitigation Plan and regulatory permits (i.e., 401/404, S&EC), construction activities began in late October 2015 with site preparation, installation of sedimentation and erosion control measures, and the establishment of staging areas, haul roads, and stockpile areas. The construction contractor was Wright Contracting, LLC. (Wright). Materials were stockpiled as needed for the initial stages of construction. Suitable channel fill material and alluvium were harvested on-site from existing spoil piles and within the existing streambed. Rock material was also harvested on-site from rocky outcrops where feasible; however, some of the larger boulders came from a local quarry and brought into the project site for use.

Construction equipment was equipped with Topcon GPS units to allow for the quick layout of the design plan for channel work and floodplain grading; however, survey grade stakes were also set along the extents of the floodplain and limits of disturbance to aid the grading activities. Since construction activities began during the growing season of the NC Piedmont, vegetation installation of vegetated

geo-lifts, live stakes, and bare root areas were delayed until after the onset of the dormant season (November 15).

Actual in-stream structure location, placement, and type varied slightly from the design plans in various sections due to exposed bedrock, as well as to promote bedform diversity, increase vertical stability, and maintain structure integrity. Additional rock lined channels and matted grass swales, not shown on the Mitigation Plan, were incorporated within the floodplain of Reach 2 and Reach 3. Originally, it wasn't anticipated that discharges from natural and stormwater drainages into the project floodplain would lead to stream bank instability; however, after multiple large rain events, it was determined that these measures were necessary to maintain the restored channel's integrity.

Construction began on the upstream portion of Reach 1 at Station 10+33 where an additional boulder step was installed to stabilize an existing headcut at the property line. During the construction of Reach 1, a rock line channel was also incorporated to discharge surface flow into the reach at Station 10+80 from a hillside seep located in the left floodplain across the upstream property boundary. Work proceeded downstream.

The work involved the construction of a defined single thread channel that was built mostly on-line using a pump around operation. The existing degraded channel was filled in and graded back to match the surrounding natural topographic contours. The entire length of Reach 1 was designed as a combination step-pool system.

Upon completion of new channel segments and in-stream structures, coir fiber matting and permanent seeding, were installed before moving to the next section. Invasive removal was minimal throughout the buffer area along Reach 1 due to lack of vegetation along the stream bank and within the floodplain. Live stake plantings along the channel were halted at the time of initial construction until after the end of the growing season (Nov. 15th). All disturbed areas were seeded with temporary and permanent seed and mulched with straw before mobilizing downstream to Reach 2. The as-built length of Reach 1 after construction is 317 LF.

Work on Reach 2 began at Station 13+50 and progressed downstream to its terminus at a newly installed culverted stream crossing at Station 20+61. Enhancement activities were implemented along Reach 2 to restore the channel to the appropriate dimension and profile of a 'C4' type stream. Work was conducted on-line using a pump around operation. Structure type and placement followed the design plans; however, constructed riffles were added in multiple areas along the upstream portion of the reach to aid in grade control and improve bedform diversity.

Upon completion of new channel segment and in-stream structures, coir fiber matting and permanent seeding, were installed before moving to the next section. As in Reach 1, invasive species removal was minimal throughout the buffer due to lack of vegetation along the stream bank and within the floodplain. Live plant material installation for bio-engineered structures was halted at the time of initial construction until after the end of the growing season (Nov. 15th). All disturbed areas were temporarily and permanently seeded and mulched with straw before work began on the farm road crossing. The as-built length of Reach 2 after construction is 711 LF.

A culverted crossing (48-inch reinforced concrete pipe (RCP)) was installed from the end of Reach 2 (Station 20+61) to the head of Reach 3 (Station 20+87). The majority of the crossing lies outside of the conservation easement. However, due to crossing stability issues, the culvert extends upstream approximately six feet into the conservation easement. This minor easement encroachment has been removed from the as-built restoration length on Reach 2 and the associated SMUs have been adjusted accordingly. The installation of the crossing in conjunction with easement fencing along Reach 2 and Reach 3 restricts cattle access to the restored stream, while still allowing for pasture rotation and farm equipment passage. Upon completion of the crossing, side slopes were stabilized and work progressed downstream.

Construction on Reach 3 began by installing a boulder step just downstream of the newly installed culverted crossing to tie in the channel grade and aid in dissipating energy from flow from the pipe. Work continued downstream and involved the construction of a defined single thread channel. Due to valley constraints and exposed bedrock, the channel remains on-line for first 450 LF of Reach 3. The implementation of grade control and habitat structures were also limited to areas along this section of the Reach where bedrock was not present.

Around Station 25+50, the valley begins to open up and the floodplain widens allowing for the channel to move off-line and for the more natural meandering pattern of a "C" type stream. The channel pattern throughout the remainder of Reach 3 meanders throughout the floodplain within the valley walls. A variety of bank stabilization measures and high quality habitat features were incorporated throughout the remainder of the reach to accommodate for existing constraints along the stream bed and within the floodplain such as: Adjacent wetlands, mature hardwood trees, and existing bedrock outcrops. The existing degraded channel was filled and graded to match the design topography and to promote hydrologic connectivity to the floodplain and existing riparian wetlands, while minimizing the disturbance of the wetland areas and mature hardwoods. Upon completion of the new channel, coir fiber matting and permanent seeding were installed before moving to the next section.

Vegetation planting of bioengineered structures were delayed along the upstream portion of Reach 3; however, the construction of the downstream section coincided with onset of the dormant season, and were planted at the time of construction. Invasive species were removed and/or treated throughout the easement area. The as-built length of Reach 3 is 1,621.

Construction enhancement activities continued downstream along Reach 4 to its terminus at Station 39+40. Work along Reach 4 was kept on-line and consisted of Enhancement Level I activities to restore the channel's dimension and profile. Construction work along Reach 4 followed the design plans; however, a long constructed riffle at the end of Reach 3 that continues into Reach 4 was extended for approximately 50 LF to help control grade within the area. The contractor did not disturb vegetation within the Enhancement area, unless it was necessary to remove existing invasive species vegetation or trees that were damaged due to bank work. Upon completion of Reach 4, coir fiber matting and permanent seeding were installed before moving to Reach 5. The as-built length of Reach 4 is 232 LF.

Work along Reach 5 began at Station 39+40 and consisted of restoration activities along the Reach to Station 45+60. Within this section of the Reach, the channel was constructed a "C" type stream, mostly off-line, but intercepted the existing channel in areas within the floodplain. A pump around operation was used in the areas where the new channel intercepted the existing channel and the remainder of the existing degraded channel was filled.

An existing and undersized culverted farm road crossing was relocated downstream from Station 42+00 to Station 45+61 in order to align it with an existing overhead power line and to minimize easement breaks. The culvert was replaced with a 48-in RCP and the relocated crossing is located outside the conservation easement. Restoration continued on the downstream side of the farm road crossing.

At Station 47+00, the new meandering channel converges with the existing channel and continues on-line to its confluence with the main stem of Town Creek. A series of rock cross vanes and constructed riffles are implemented throughout this section of the reach to step the channel down to the elevation of Town Creek.

A pump around operation was used in the areas where the new channel intercepted the existing channel and the remainder of the existing degraded channel was filled. The floodplain was graded to match the design topography and promote the re-establishment of hydrologic connectivity to the floodplain and riparian wetlands, while minimizing the disturbance of the wetland areas and mature hardwoods. Upon completion of the new channel segment, coir fiber matting and permanent seeding were installed

throughout the Reach. Invasive species were either treated or removed throughout the easement. The as-built length of Reach 5 after construction is 822 LF, which excludes the length of the RCP.

All excess fill material generated during construction of all reaches was wasted and stabilized on-site in the locations and as noted in the Erosion and Sediment Control plans. All riparian buffer areas within the project boundaries are a minimum of 50 feet along both stream banks and are protected in perpetuity by a recorded conservation easement that totals 11.97 acres. Permanent cattle exclusion fencing (woven wire) was installed outside the conservation easement boundary along all reaches with access gates near each stream crossing as shown on the As-built/Record Drawing in Appendix D. In addition, Baker has installed permanent watering systems for the cattle outside of the project boundary.

Minimal Site modifications involved the location and selection of some in-stream structures and bank stabilization practices. Substitutions and/or relocations were made based on existing field conditions and best professional judgment. As-built/Record Drawings depict actual surveyed areas within the project area and depict any changes from the final design plans to what was implemented on-site during construction. The As-built/Record Drawings are located in Appendix D. The as-built results for the project totaled 3,703 LF of stream and are outlined in Table 1, which excludes both stream crossings.

After construction was complete, multiple large rain events in November and December 2015 exposed multiple unstable floodplain drainage features along Reach 1, Reach 2, Reach 3, and Reach 5. Therefore, prior to the removal of sediment and control measures and permanent demobilization and the onset of easement planting, Baker and Wright met on-site on January 5, 2016 to generate a punch-list of final items for completion and to discuss a strategy to best address the areas of instability while limiting re-disturbance.

Work to repair areas of instability and to address outstanding punch list items began on January 11, 2016. Work began by installing two additional constructed riffles at Station at 13+70 and 14+05 to aid in grade control. Next work moved to the left floodplain of Reach 2, where a matted drainage swale was incorporated from a floodplain seep to outfall onto a constructed riffle at Station 14+60. A small rock lined trapezoidal spillway (approximately 1 – 2 feet wide) was incorporated into the design of the floodplain wetland's berm on Reach 2 to maintain channel stability as well as the floodplain wetland's integrity. The addition of this feature was strategically placed at the downstream end of the wetland berm where it would outfall into the channel across the arm of a log vane and into the downstream plunge pool.

Construction work then progressed downstream on Reach 2 to stabilize the farm road crossing by extending the culvert pipe 8 LF upstream and re-grading the crossing side slopes to a flatter angle of repose and adding additional stone to the slope faces for erosion protection. Next, a trapezoidal rock-lined channel was constructed down the hillslope in the right floodplain of Reach 3. The channel was integrated into the project in order to intercept stormflows from outside the easement area and convey them onto a constructed riffle at Station 28+30. Lastly, a small rock lined trapezoidal swale (approximately 2 – 3 feet wide) was incorporated into the design of the floodplain wetland's berm along Reach 5. The feature was incorporated into the project's design to intercept drainage from an existing breach in the wetland's berm and directed to outfall into the channel at Station 47+10 across the arm of a rock cross vane and into the downstream plunge pool.

Repair work and punch list items were complete on January 14, 2016. Upon final approval from Baker, sedimentation and erosion control measures such as temporary construction entrances, rock check dams, and silt fence were removed, and all disturbed areas were stabilized with temporary and permanent seed and mulch before de-mobilizing from the Site. Baker met with NCDMS on-site on February 2, 2016 for the final construction Site walk. NCDMS approved the construction work during the visit. The planting of bare-root trees and shrubs, live stakes, vegetated geo-lifts were completed and approved on March 11, 2016. NCDMS approved the Site plantings and monitoring device installations on June 20, 2016.

4.0 PERFORMANCE STANDARDS

Baker has obtained regulatory approval for numerous stream mitigation plans involving NCDMS full-delivery projects. The success criteria for the project site will follow the mitigation plan developed for this project, as well as the 2003 *Stream Mitigation Guidelines* (SMG). As outlined in the RFP #16-003579, all monitoring activities will follow the NCDMS Monitoring Report Template, Version 1.3 – 1/15/10, will be conducted for a period of 5 years, and will evaluate the effectiveness of the restoration and enhancement practices based on the performance success criteria outlined in the approved mitigation plan and the 2003 SMG. If Year 5 does not meet performance success criteria, NCDMS may require additional monitoring until the site does meet all performance success criteria.

Based on the design approaches and overall project goals, different monitoring methods are proposed for the project reaches. For reaches that involve Restoration and Enhancement Level I (stream bed/bank stabilization) approaches, geomorphic monitoring methods will follow those recommended by the 2003 SMG. For reaches involving Enhancement Level II approaches, monitoring efforts will focus primarily on visual inspections, photo documentation, and vegetation assessments. The monitoring parameters shall be consistent with the requirements described in the Federal Rule for compensatory mitigation sites in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.5 paragraphs (a) and (b). Specific success criteria components and evaluation methods are described below and report documentation will follow the NCDMS Baseline Monitoring Document template and guidance (v 2.0, dated 10/14/10).

5.0 MONITORING PLAN AND SUCCESS CRITERIA

5.1 Stream Monitoring

Geomorphic monitoring of the proposed restoration reaches will be conducted once a year for a minimum of five years following the completion of construction. These activities will evaluate the success criteria associated with a geomorphically stable channel, hydrologic connectivity, and aquatic habitat diversity. The stream parameters to be monitored include stream dimension (cross-sections), pattern (planimetric survey), profile (longitudinal profile survey), visual observation with photographic documentation, and documentation of bank full events. The success criteria for the proposed Enhancement Level II reaches/sections will follow the methods described in sections 5.1.7 and 5.2. The methods used and related success criteria are described below for each parameter.

5.1.1 Bankfull Events and Flooding Functions

The occurrence of bankfull events within the monitoring period will be documented by the use of a crest gauge and photographs. The crest gauge will be installed on the floodplain within ten feet (horizontal) of the restored channel. The crest gauge will record the highest watermark between site visits, and the gauge will be checked at each site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented within a five-year monitoring period. The two bankfull events must occur in separate years; otherwise, the monitoring will continue until two bankfull events have been documented in separate years to demonstrate a floodplain connection has been restored.

5.1.2 Flow Documentation

Monitoring of flow will be conducted to demonstrate that the restored stream systems classified as intermittent exhibit base flow for some portion of the year during a year with normal rainfall conditions. In order to determine if rainfall amounts are normal for the given year, rainfall gauge data will be obtained from the nearest Stanly County weather station (CRONOS Database, NEWL – North Stanly Middle School, if available) and compared to the average monthly rainfall amounts from the Stanly Count WETS Table (NRCS, 2002). If a normal year of precipitation does not occur during the first five years of monitoring, flow conditions will continue to be monitored on the site until it documents that the intermittent streams have been flowing during the appropriate times of the year.

The proposed monitoring of the restored intermittent reaches will include a combination of photographic documentation and the installation of two in-stream pressure transducers within the thalweg (bottom) of the channel, one in the upstream portion of the reach and one in the downstream portion of the reach. A regular series of remote photos over time will be used to subjectively evaluate channel flow conditions throughout the year. More specifically, the longitudinal photos should indicate the presence of flow within the channel in order to discern water levels within the pools and riffles. The photographs will be taken from a height of approximately five to six feet to ensure that the same locations (and view directions) at the site are documented in each monitoring period and will be shown on a plan view map. The visual monitoring effort, including the photo locations with descriptions, will be included with NCDMS's annual monitoring reports. The devices will be inspected on a quarterly/semi-annual basis to document surface hydrology and provide a basis for evaluating general flow response to rainfall events and surface runoff during various water tables levels throughout the monitoring period.

5.1.3 Cross-sections

Permanent cross-sections were installed at an approximate rate of one cross-section per 500 LF of restored stream, or nine (9) cross-sections located at riffles, and four (4) located at pools. Each cross-section was marked on both stream banks with permanent monuments using rebar in place to establish the exact transect used. A common benchmark was used for cross-sections and will be consistently used to facilitate easy comparison of year-to-year data. The cross-section surveys will occur annually and must include measurements of Bank Height Ratio (BHR) and Entrenchment Ratio (ER). The monitoring survey includes points measured at all breaks in slope, including top of stream banks, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections will be classified using the Rosgen Stream Classification System.

There should be little change in as-built cross-sections. If changes do take place, they will be documented in the survey data and evaluated to determine if they represent a movement toward a more unstable condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the stream banks, or decrease in width/depth ratio). Using the Rosgen Stream Classification System, and all monitored cross-sections should fall within the quantitative parameters (i.e. BHR no more than 1.2 and ER no less than 2.2 for 'C' stream types) defined for channels of the design stream type. Given the smaller channel sizes and meander geometry of the proposed steams, bank pins will not be installed unless monitoring results indicate active lateral erosion.

Reference photo transects will be taken at each permanent cross-section. Lateral photos should not indicate excessive erosion or continuing degradation of the stream banks. Photographs will be taken of both stream banks at each cross-section. The survey tape will be centered in the photographs of the stream banks. The water line will be located in the lower edge of the frame, and as much of the stream bank as possible will be included in each photo. Photographers should make a consistent effort to maintain the same area in each photo over time.

5.1.4 Pattern

The plan view measurements such as sinuosity, radius of curvature, meander width ratio will be taken on newly constructed meanders during baseline (Year 0) only. Subsequent visual monitoring will be conducted twice a year, at least five months apart, to document any changes or excessive lateral movement in the plan view of the restored channel.

5.1.5 Longitudinal Profile

A longitudinal profile will be surveyed for the entire length of restored channel immediately after construction to document as-built baseline conditions for the first year of monitoring only. The survey will be tied to a permanent benchmark and measurements will include thalweg, water surface, bankfull, and top of low bank. Each of these measurements will be taken at the head of each feature (e.g., riffle, pool) and at the maximum pool depth. The longitudinal profile should show that the bedform features installed are consistent with intended design stream type. The longitudinal profiles will not be taken during subsequent monitoring years unless vertical channel instability has been documented or remedial actions/repairs are deemed necessary.

5.1.6 Bed Material Analysis

After construction, there should be minimal change in the pebble count data over time given the current watershed conditions and sediment supply regime. Significant changes in particle sizes or size distribution in otherwise stable riffles and pools could warrant additional sediment transport analyses and calculations. A substrate sample will be collected annually at cross-sections where constructed riffles were installed as part of the project. One constructed riffle substrate sample will be compared to existing riffle substrate data collected during the design phase and any significant changes (i.e.;

aggradation, degradation) will be noted after stream bank vegetation becomes established and a minimum of two bankfull flows or greater have been documented.

5.1.7 Visual Assessment

Visual monitoring assessments of all stream sections will be conducted by qualified personnel twice per monitoring year with at least five months in between each site visit. Photographs will be used to document system performance and any areas of concern related to stream bank stability, condition of in-stream structures, channel migration, headcuts, live stake mortality, impacts from invasive plant species or animal species, and condition of pools and riffles. The photo locations and descriptions will be shown on a plan view map.

The Photographs will be taken from a height of approximately five to six feet to ensure that the same locations (and view directions) at the site are documented in each monitoring period. A series of photos over time will be also be used to subjectively evaluate channel aggradation (bar formations) or degradation, stream bank erosion, successful maturation of riparian vegetation, and effectiveness of sedimentation and erosion control measures.

5.2 Vegetation Monitoring

Successful restoration of the vegetation on a site is dependent upon hydrologic restoration, planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the planting success criteria are achieved and riparian buffer establishment goals are met, vegetation monitoring will be conducted once a year for a minimum of five years following the completion of construction and one full growing season. These activities will evaluate the success criteria associated with the restoration and protection of the riparian buffer functions and corridor habitat, and reduction of sediment loading from floodplain erosion and nutrient loading through the uptake of riparian vegetation.

In order to assess the success criteria of the riparian buffer effectively, vegetation-monitoring quadrants were installed and will be monitored across the restoration site in accordance with the CVS-NCDMS Protocol for Recording Vegetation, Version 4.0 (2006). The vegetation monitoring plots shall be a minimum of 2% of the planted portion of the site with a minimum of eight (8) plots established randomly within the planted riparian buffer areas per Monitoring Levels 1 and 2. No monitoring quadrants were established within areas where there are significant stands of undisturbed trees. The size of individual quadrants will be 100 square meters for woody tree species.

Vegetation monitoring will occur in the fall, prior to the loss of leaves. Individual quadrant data will be provided and will include species diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first full growing season (from baseline/year 0) or after 180 days between March 1st and November 30th, species composition, stem density, and survival will be evaluated. For each subsequent year, until the final success criteria are achieved, the restored site will be evaluated March and November. The interim measure of vegetative success for the site will require the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. The final vegetative success criteria will be measured at year five and must consist of a density of no less than 260, 5-year old, planted trees per acre.

While measuring species density and height is the current accepted methodology for evaluating vegetation success on mitigation projects, species density and height alone may be inadequate for assessing plant community health. For this reason, the vegetation monitoring plan will incorporate the evaluation of additional plant community indices, native volunteer species, and the presence of invasive species vegetation to assess overall vegetative success.

Baker will provide required remedial action on a case-by-case basis, such as: replanting more wet/drought tolerant species vegetation, conducting beaver management/dam removal, and removing undesirable/invasive species vegetation, and will continue to monitor vegetation performance until the corrective actions demonstrate that the site is trending towards or meeting the standard requirement. Existing mature woody vegetation will be visually monitored during annual site visits to document any mortality, due to construction activities or changes to the water table, that negatively impact existing forest cover or favorable buffer vegetation.

5.3 Wetland Monitoring

Wetland mitigation has not been proposed for the site; therefore, no monitoring is included.

5.4 Stormwater Management Monitoring

No stormwater BMPs are proposed for the site; therefore, no monitoring is included.

6.0 AS-BUILT DATA DOCUMENTATION

Stream and vegetation components will be monitored for five years post-construction to evaluate project success. The specific locations of vegetation plots, flow/crest gauges, and cross-sections are shown on the as-built plan sheets.

6.1 Stream Data

For monitoring stream success criteria, thirteen permanent cross-sections were installed along restored and enhanced reaches on the site of greater than 500 LF (Reach 2 – 3 and Reach 5). The permanent cross-sections will be used to monitor channel dimension and bank stability over time. One crest gauge was installed along the restored channels on Reach 5. The crest gauge will be used to document the occurrence of bankfull events. A longitudinal survey was completed for all restored and enhanced reaches to provide a baseline for evaluating changes in bed conditions over time. Pebble count data was collected for riffle cross-sections where constructed riffles were installed (X1, X4, X5, X7, X9, X10, and X12). The as-built permanent cross-sections (with photos), longitudinal data, and pebble count data, as well as the quantitative pre-construction, reference reach, and design data used to determine restoration approach are provided in Appendix B. As-built data will be used for comparison to post-construction monitoring data. The locations of the permanent cross-sections and the crest gauge are shown on the as-built plan sheets in Appendix D. Photographs of the selected portions of the restored reaches are provided in Appendix E.

6.2 Vegetation Data

Bare-root trees and shrubs were planted within restoration and enhancement areas of the conservation easement. A minimum 50-foot buffer was established and/or protected along both banks of all stream reaches. Planting of bare-root trees, shrubs and live stakes began in March 2016 and was completed on March 11, 2016.

The Mitigation Plan for the Site specifies that the number of quadrants required shall be based on the CVS-NCDMS Protocol for Recording Vegetation, Version 4.0 (2006). The total number of quadrants was calculated using the CVS-NCDMS Entry Tool Database version 2.3.1. The sizes of individual quadrants are 100 square meters. A total of eight (8) vegetation plots were installed throughout the project Site. The initial planted density within each of the vegetation monitoring plots is provided in Table 8. The average density of planted bare root stems, based on the data from the eight vegetation monitoring plots, is 804 stems per acre. The location of each vegetation plot is shown on the as-built plan sheets in Appendix D.

6.3 Areas of Concern

Per observations made during the NCDMS Site visit on February 2, 2016, invasive species such as parrotfeather (*Myiophyllum aquaticum*) and Chinese privet (*Ligustrum sinese*), which are prevalent in areas outside of the conservation easement, may try to reestablish within the easement if not properly maintained. No other areas of concern were noted for the time of this report.

Section 7.3 describes a specific corrective action plan that will be implemented for areas of concern.

7.0 MAINTENANCE AND CONTINGENCY PLANS

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Projects with sandy, non-cohesive soils are more prone to bank erosion than cohesive soils or soils with high gravel and cobble content.
- Alluvial valley channels with access to their floodplain are less vulnerable to erosion than channels that have been disconnected from their floodplain.
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive vegetation species can affect the extent to which a native species vegetation buffer can be established.
- The presence of beaver can affect vegetation survivability and stream function.

The Site will be monitored on a regular basis and as well as a physical inspection of the Site at least once a year throughout the post-construction monitoring period. These site inspections may identify site components and features that require routine maintenance. Maintenance issues and recommended remediation measures will be detailed and documented in the post-construction monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed. Routine maintenance will be most likely in the first two years following site construction and may include the following components as described below.

7.1 Streams

Routine channel maintenance and repair activities may include modifying in-stream structures to prevent piping, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the project reaches. Areas of concentrated stormwater and floodplain flows that intercept the channel may also require maintenance to prevent bank failures and head-cutting until vegetation becomes established.

7.2 Wetland

No wetland mitigation was proposed for the Site; therefore, no such maintenance is required.

7.3 Vegetation

Vegetation will be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, and fertilizing. Exotic invasive plant species will controlled by mechanical and/or chemical methods. Any invasive plant species control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.

The vegetation plantings will be documented in the Year 1 Monitoring Report and areas of concern will be observed closely during subsequent monitoring periods to determine if further corrective action is required to meet the interim vegetative success criteria of 260 stems per acre at the end of five years.

7.4 Site Boundary

Site boundaries have been demarcated in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries are identified by fence, marker, bollard, post, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

7.5 Farm Road Crossing

The farm road crossings within the Site may be maintained only as allowed by the recorded Conservation Easement, deed restrictions, rights of way, or corridor agreements.

7.6 Beaver Management

Routine maintenance and repair activities caused by beaver activity may include supplemental planting, pruning, and dam breeching/dewatering and/or removal. Beaver management will be performed in accordance with US Department of Agriculture (USDA) rules and regulations using accepted trapping and removal techniques only within the project boundary.

8.0 REFERENCES

Carolina Vegetation Survey (CVS) and NC Division of Mitigation Services (formerly NC Ecosystem Enhancement Program). 2012. CVS-NCEEP Data Entry Tool v. 2.3.1. University of North Carolina, Raleigh, NC.

Lee, M., Peet R., Roberts, S., Wentworth, T. CVS-NCEEP Protocol for Recording Vegetation, Version 4.0, 2006.

North Carolina Division of Mitigation Services (formerly NC Ecosystem Enhancement Program). 2010. Baseline Monitoring Document Format, Data Requirements, and Content Guidance, v. 2.0, dated 10/14/10. Raleigh, NC.

Rosgen, D. L. 1994. A classification of natural rivers. Catena 22:169-199.

_____. 1996. Applied River Morphology. Wildland Hydrology Books, Pagosa Springs, Colo.

Schafale, M.P. 2012. *Guide to the Natural Communities of North Carolina*, Fourth Approximation. North Carolina Natural Heritage Program (NHP), NCDEQ (formerly DENR), Raleigh, North Carolina.

United States Army Corps of Engineers. 2010. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region. *ERDC/EL TR-10-9*, Vicksburg, MS. http://www.saw.usace.army.mil/Wetlands/JDs/EMP_Piedmont.pdf

_____. 2003. Stream Mitigation Guidelines. Prepared with cooperation from US Environmental Protection Agency, NC Wildlife Resources Commission, and the NC Division of Water Quality. www.saw.usace.army.mil/wetlands/Mitigation/stream_mitigation.html

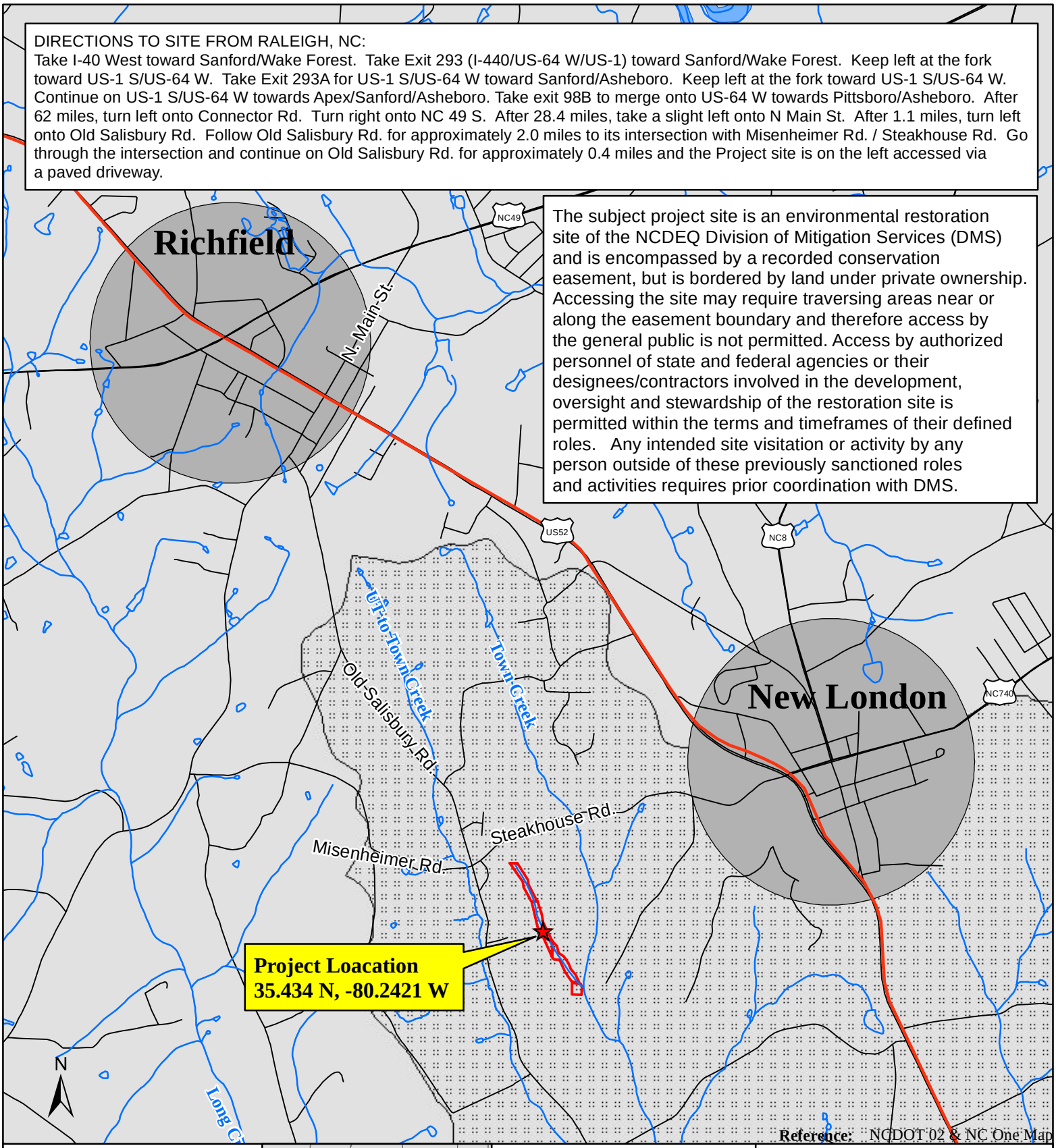
_____. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. Environmental Laboratory. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

APPENDIX A

Figures 1 – 4b
Tables 1 – 4

DIRECTIONS TO SITE FROM RALEIGH, NC:
Take I-40 West toward Sanford/Wake Forest. Take Exit 293 (I-440/US-64 W/US-1) toward Sanford/Wake Forest. Keep left at the fork toward US-1 S/US-64 W. Take Exit 293A for US-1 S/US-64 W toward Sanford/Asheboro. Keep left at the fork toward US-1 S/US-64 W. Continue on US-1 S/US-64 W towards Apex/Sanford/Asheboro. Take exit 98B to merge onto US-64 W towards Pittsboro/Asheboro. After 62 miles, turn left onto Connector Rd. Turn right onto NC 49 S. After 28.4 miles, take a slight left onto N Main St. After 1.1 miles, turn left onto Old Salisbury Rd. Follow Old Salisbury Rd. for approximately 2.0 miles to its intersection with Misenheimer Rd. / Steakhouse Rd. Go through the intersection and continue on Old Salisbury Rd. for approximately 0.4 miles and the Project site is on the left accessed via a paved driveway.

The subject project site is an environmental restoration site of the NCDEQ Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with DMS.



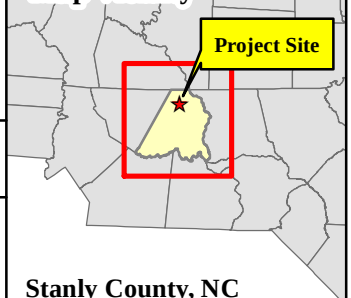
Michael Baker INTERNATIONAL

November 2016

0 1,500 3,000 Feet

1" = 3000'

Map Vicinity



Stanly County, NC

LEGEND

- Streams
- Project Boundary
- US Highways
- Roads
- Major Waterways
- Municipalities
- Yadkin (03040105060-040)

Figure 1. Vicinity Map

Town Creek Restoration Site - Option B

Stanly County, NC

NC DMS Project No. 95026
NC DEQ Contract No. 003990

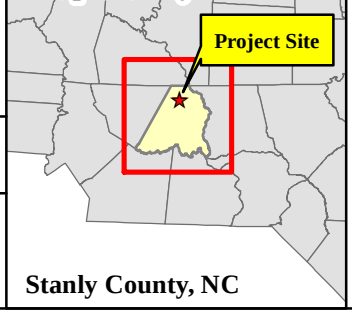
Michael Baker INTERNATIONAL

November 2016

0 200 400 Feet

1" = 400'

Map Vicinity



LEGEND

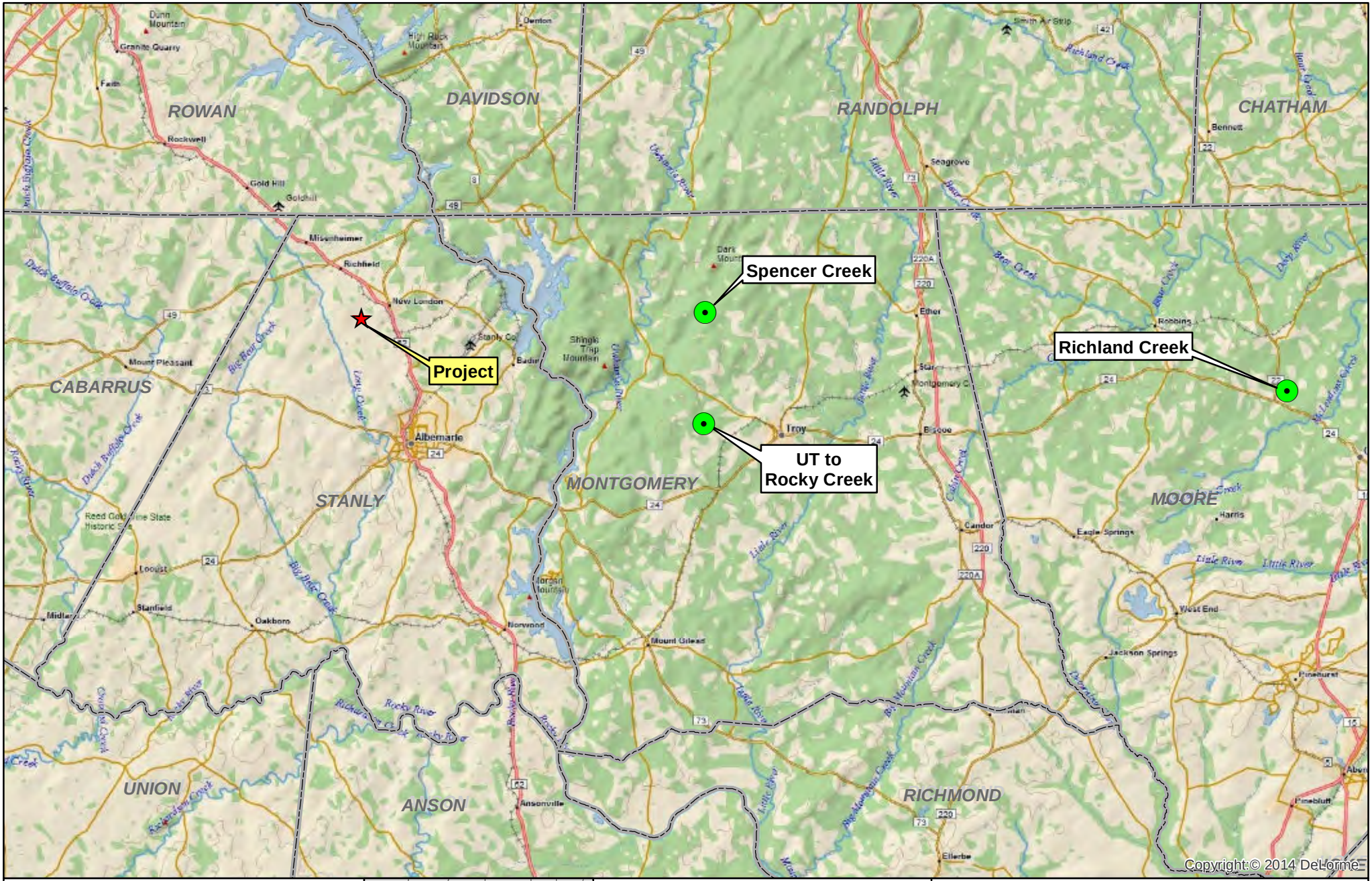
- Enhancement I
- Restoration
- Manholes
- Conservation Easement
- Wetland Areas
- Streams
- Roads

Figure 2. Mitigation Summary Map

Town Creek Restoration Site - Option B

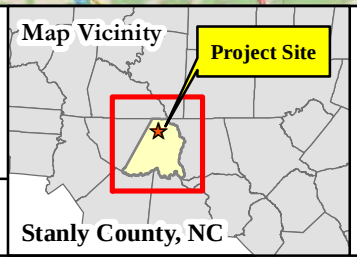
Stanly County, NC

NC DMS Project No. 95026
NC DEQ Contract No. 003990



Michael Baker
INTERNATIONAL

November 2016



LEGEND

- Reference Reach Locations
- Town Creek Site

N

0 3 6 Miles

1" = 6 Miles

Figure 3. Reference Site Locations Map

Town Creek Restoration Site - Option B

Stanly County, NC

DMS Project No. 95026
NCDEQ Contract No. 003990

Reach 1
Station 10+33 - 13+50

Reach 2
Station 13+50 - 20+61

Figure 4a

Figure 4b

Reach 3
Station 20+87 - 37+08

Reach 4
Station 37+08 - 39+40

Reach 5
Station 39+40 - 47+87

Legend

- Photo Identification Points
- Flow Transducer
- Crest Gauge
- Vegetation Plots
- Cross Section - Pool
- Cross Section - Riffle

Michael Baker INTERNATIONAL

0 100 200 Feet

1" = 200'

November 2016

NC DMS Project No. 95026
NC DEQ Contract No. 003990

Figure 4. Current Condition Plan View - Overview Map

Town Creek Restoration Project - Option B
Stanly County, NC

Michael Baker INTERNATIONAL

0 50 100 Feet

1" = 100'

November 2016

NC DMS Project No. 95026
NC DEQ Contract No. 003990

Figure 4a. Current Condition Plan View

Town Creek Restoration Project - Option B
Stanly County, NC

Michael Baker INTERNATIONAL

0 50 100 Feet

1" = 100'

November 2016

NC DMS Project No. 95026
NC DEQ Contract No. 003990

Figure 4b. Current Condition Plan View

Town Creek Restoration Project - Option B

Stanly County, NC

Table 1. Project Mitigation Components
Town Creek Restoration Project - Option B: DMS Project No ID. 95026

Project Component (reach ID, etc.)	Wetland Position and Hydro Type	Existing Footage or Acreage	Stationing	Restored Footage, Acreage, or SF	Creditable Footage, Acreage, or SF	Restoration Level	Approach		Mitigation Credits	Notes/Comments
							Priority Level	Mitigation Ratio (X:1)		
Reach 1		363	10+33 - 13+50	317	317	R	PI	1	317	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Reach 2		737	13+50 - 20+61	711	711	EI	PIII	1.5	474	Dimension and Profile modified in keeping with reference, Planted Buffer, Livestock Exclusion, Permanent Conservation Easement. A 26-ft culverted farm road crossing was implemented between Reach 2 and Reach 3 from Station 20+61 - 20+87.
Reach 3		1,849	20+87 - 37+08	1621	1,621	R	PI	1	1,621	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, and Permanent Conservation Easement.
Reach 4		234	37+08 - 39+40	232	232	EI	PIII	1.5	155	Dimension and Profile modified in keeping with reference, Planted Buffer, Livestock Exclusion, Permanent Conservation Easement.
Reach 5		849	39+40 - 47+87	847	822	R	PI	1	822	Full Channel Restoration, Planted Buffer, Exclusion of Livestock, Permanent Conservation Easement and a 27-ft culverted farm road crossing.
Wetland Group 1 (WG1)										
Wetland Group 2 (WG2)										
Buffer Group 1 (BG1)										
Buffer Group 2 (BG2)										
Buffer Group 3 (BG3)										

Length and Area Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)
		Riverine	Non-Riverine		
Restoration	2,760				
Enhancement					
Enhancement I	943				
Enhancement II					
Creation					
Preservation					
High Quality Pres					

Overall Assets Summary

Asset Category	Overall Credits
Stream	**3,389**

General Note - The above component table is intended to be a close complement to the asset map. Each entry in the above table should have clear distinction and appropriate symbology in the asset map.

1 - **Wetland Groups** represent pooled wetland polygons in the map with the same wetland type and restoration level. If some of the wetland polygons within a group are in meaningfully different landscape positions, soil types or have different community targets (as examples), then further segmentation in the table may be warranted. **Buffer groups** represent pooled buffer polygons with common restoration levels.

2 - **Wetland Position and Hydro Type** - Indicates Riparian Riverine, (RR) , riparinan non-riverine (RNR) or Non-Riverine (NR)

3- **Restored** Footage, Acreage or Square Feet (SF)

4 - **Creditible Footage**, Acreage or Square feet - creditible anounts after exclusion and reductions are accounted for, such as utility impacts, crossings, single

* Stream assests are based on the stream length from the As-Built survey. Since the As-Built survey stream lengths exceeded the anticipated design lengths, the stream assets exceeded that of the proposed assests listed in the Mitigation Plan.

Table 2. Project Activity and Reporting History			
Town Creek Restoration Project - Option B: DMS Project No ID. 95026			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan Prepared	N/A	N/A	Aug-14
Mitigation Plan Amended	N/A	N/A	Oct-14
Mitigation Plan Approved	N/A	N/A	Feb-15
Final Design – (at least 90% complete)	N/A	N/A	Feb-15
Construction Begins	N/A	N/A	Oct-15
Temporary S&E mix applied to entire project area	N/A	N/A	Jan-16
Permanent seed mix applied to entire project area	Feb-16	N/A	Jan-16
Planting of live stakes	Feb-16	N/A	Mar-16
Planting of bare root trees	Feb-16	N/A	Mar-16
End of Construction	Feb-16	N/A	Jan-16
Survey of As-built conditions (Year 0 Monitoring-baseline)	Apr-16	May-16	Jun-16
Baseline Monitoring Report	May-16	Jun-16	Nov-16
Year 1 Monitoring	Dec-16	N/A	N/A
Year 2 Monitoring	Dec-17	N/A	N/A
Year 3 Monitoring	Dec-18	N/A	N/A
Year 4 Monitoring	Dec-19	N/A	N/A
Year 5 Monitoring	Dec-20	N/A	N/A

Table 3. Project Contacts	
Town Creek Restoration Project - Option B: DMS Project ID No. 95026	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Road, Suite 201 Asheville, NC 28806 Contact: Jake Byers, PE, Tel. 828-412-6101
Construction Contractor	
Wright Contracting, LLC.	160 Walker Road Lawndale, NC 28090 Contact: Joe Wright, Tel. 919-663-0810
Planting Contractor	
H.J. Forest Service	P.O. Box 458 Holly Ridge, NC 28445 Contact: Matt Hitch, Tel. 910-512-1743
Seeding Contractor	
Wright Contracting, LLC.	160 Walker Road Lawndale, NC 28090 Contact: Joe Wright, Tel. 919-663-0810
Seed Mix Sources	Green Resources, Tel. 336-855-6363 Mellow Marsh Farm, Tel. 919-742-1200
Nursery Stock Suppliers	Mellow Marsh Farm, Tel. 919-742-1200 Foggy Mountain Nursery, Tel. 336-384-5323 ArborGen, Tel. 843-528-3203
Monitoring Performers	
Michael Baker Engineering, Inc.	5550 Seventy-Seven Center Drive, Suite 320 Charlotte, NC 28217 Contact:
Stream Monitoring Point of Contact	Kristi Suggs, Tel. 704-665-2206
Vegetation Monitoring Point of Contact	Kristi Suggs, Tel. 704-665-2206

Table 4. Project Attributes					
Town Creek Restoration Project - Option B: DMS Project ID No. 95026					
Project Information					
Project Name	Town Creek Restoration Project - Option B				
Project County	Stanly				
Project Area (Acres)	11.97				
Project Coordinates	35.434 N, -80.2421 W				
Project Watershed Summary Information					
Physiographic Region	Piedmont				
Ecoregion	Carolina Slate Belt				
Project River Basin	Yadkin - Pee Dee				
USGS Hydrologic Unit Code 8- and 14-digit	03040105 / 03040105060-040				
NCDWR Sub-basin for Project	03-07-13				
Project Drainage Area (Acres)	134.8				
Project Drainage Area Percent Impervious	<5%				
CGIA Land Use Classification	2.01, 412 / Forest (40%) Agriculture (25%) Impervious Cover (7%)				
Within Extent of DMS Watershed Plan	Lower Yadkin RBRP, 2009				
WRC Class (Warm Cool Cold)	Warm				
% Project Easement Fenced/Demarcated	100%				
Beaver activity observed during design phase	No activity observed				
Reach Summary Information					
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**
Restored Length of Reach (LF)	317	711	1,621	232	822
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	59.8	77.8	115.6	119.4	134.8
NCDWR Stream Identification Score	27.25	27.25 - 32.0	32	32	32
NCDWR Water Quality Classification	C, Index #: 13-17-31-1-1				
Existing Morphological Description (Rosgen stream type)	E4b: Incised, unstable & straight	E4 : Incised, unstable & straight	C4: variable; unstable	E4: Incised & unstable	C4 and E4: Incised & straight
Evolutionary Trend	Eb→G→B	E→G→F→Bc	C→G→F→C	E→Gc→F→C	C→Gc→F→C
As-built Morphological Description (Rosgen stream type)	C4	C4	C4	C4	C4
Underlying Mapped Soils	BaD	BaD, BaF	BaF	BaF	OaA
Drainage Class	Well drained	Well drained	Well drained	Well drained	Moderately well drained
Soil Hydric Status	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric	Hydric
Average Channel Slope (ft/ft)	0.0181	0.0180	0.0122	0.0120	0.0128
FEMA Classification	N/A	N/A	N/A	N/A	N/A
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	0%	0%	0%	0%	0%
Regulatory Considerations					
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**		
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion		
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion		
Endangered Species Act	Yes	Yes	Categorical Exclusion		
Historic Preservation Act	Yes	Yes	Categorical Exclusion		
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion		
FEMA Floodplain Compliance	No	N/A	Categorical Exclusion		
Essential Fisheries Habitat	No	N/A	Categorical Exclusion		

APPENDIX B

Morphological Summary Data
Tables 5 and 6
Cross-section Data and Photos
Longitudinal Profile
Pebble Count Data

Table 5. Baseline Stream Summary

Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 1 (317 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	4.2	5.5	-----	-----	7.2	-----	2	-----	9.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	72.1	-----	-----	76.6	-----	2	20	-----	-----	50	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.7	0.8	-----	-----	1.1	-----	2	-----	0.68	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	1.8	-----	-----	2.3	-----	2	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	4.2	5.4	-----	-----	5.9	-----	2	-----	6.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	5.22	-----	-----	9.43	-----	2	-----	13.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	10.1	-----	-----	13.8	-----	2	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	1.3	-----	-----	1.5	-----	2	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	6.9	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	0.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.022	-----	-----	-----	-----	-----	0.012	-----	-----	-----	8
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14.0	-----	-----	45.0	-----	-----	12.0	-----	-----	42.0	-----	11
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.4	-----	-----	0.2	-----	-----	0.8	-----	11
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----			0.2 / 4.3 / 6.9 / 30.8 / 54.5				-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.09	-----	-----	-----	0.09	-----	-----	-----	-----	-----	0.09	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----			-----	E4b (incised)	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----		-----	-----	2.76	-----	-----	-----	2.72	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	15.6	-----	-----	-----	16.3	-----	-----	-----	16.3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	301.9	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	363	-----	-----	-----	316	-----	-----	-----	-----	-----	317.0	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.17	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.1	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0212	-----	-----	-----	0.0217	-----	-----	-----	-----	-----	0.0181	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

[1] Reach 1 data based on two riffle cross-sections and one pool cross-section.

Table 5. Baseline Stream Summary (continued)

Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 2 (711 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	4.8	6.6	-----	-----	8.8	-----	2	-----	9.0	-----	-----	-----	-----	8.8	-----	-----	12.0	-----	3
Floodprone Width (ft)	-----	-----	-----	-----	25.5	-----	-----	42.7	-----	2	20	-----	-----	50.0	-----	-----	27.1	-----	-----	42.6	-----	3
BF Mean Depth (ft)	-----	2.3	5.8	0.8	1.1	-----	-----	1.6	-----	2	-----	0.7	-----	-----	-----	-----	0.7	-----	-----	1.0	-----	3
BF Max Depth (ft)	-----	-----	-----	-----	1.9	-----	-----	2.4	-----	2	-----	1.0	-----	-----	-----	-----	1.1	-----	-----	2.3	-----	3
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	5.1	6.9	-----	-----	14.0	-----	2	-----	6.1	-----	-----	-----	-----	5.8	-----	-----	12.0	-----	3
Width/Depth Ratio	-----	-----	-----	-----	5.6	-----	-----	6.2	-----	2	-----	13.3	-----	-----	-----	-----	10.2	-----	-----	13.2	-----	3
Entrenchment Ratio	-----	-----	-----	-----	3.9	-----	-----	4.8	-----	2	-----	-----	-----	>2.2	-----	-----	3.1	-----	-----	3.7	-----	3
Bank Height Ratio	-----	-----	-----	-----	1.5	-----	-----	1.6	-----	2	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	-----	-----	-----	-----	16.7	-----	-----	-----	1	-----	-----	-----	-----	-----	-----	17.1	-----	-----	23.3	-----	2
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.0175	-----	-----	-----	-----	-----	0.010	-----	-----	-----	9
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	14	-----	-----	45	-----	-----	19.0	-----	-----	63.0	-----	19
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.4	-----	-----	0.200	-----	-----	3.4	-----	20
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	<0.063 / 7.2 / 16.7 / 54.5 / 85.7						-----	-----	-----	-----	-----	-----	<0.063 - 4.4 / 8.7 - 12.1 / 17.1 - 23.3 / 55.3 - 77.1 / 75.6 - 117.2					
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	0.79	-----	-----	-----	-----	-----	0.65	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	34.9	-----	-----	-----	-----	-----	32.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.1	-----	-----	-----	0.12	-----	-----	-----	-----	-----	0.12	-----	-----	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	E4 (incised)	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4 / E4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	1.49	-----	-----	-----	3.48	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	19.3	-----	-----	-----	20.9	-----	-----	-----	20.9	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	695	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	737	-----	-----	-----	708	-----	-----	-----	-----	-----	711	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.06	-----	-----	-----	1.02	-----	-----	-----	-----	-----	1.02	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0159	-----	-----	-----	0.0177	-----	-----	-----	-----	-----	0.0180	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 5. Baseline Stream Summary (continued)

Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 3 (1,621 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition[1]						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	5.5	6.0	-----	-----	16.1	-----	4	-----	10.0	-----	-----	-----	-----	9.8	-----	-----	10.7	-----	3
Floodprone Width (ft)	-----	-----	-----	-----	32.0	-----	-----	>89	-----	4	2	-----	-----	80.0	-----	-----	37.8	-----	-----	48.1	-----	3
BF Mean Depth (ft)	-----	2.3	5.8	0.9	0.5	-----	-----	1.3	-----	4	-----	0.7	-----	-----	-----	-----	0.6	-----	-----	0.8	-----	3
BF Max Depth (ft)	-----	-----	-----	-----	1.3	-----	-----	1.9	-----	4	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.4	-----	3
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	6.4	5.7	-----	-----	13.6	-----	4	-----	7.0	-----	-----	-----	-----	6.5	-----	-----	8.7	-----	3
Width/Depth Ratio	-----	-----	-----	-----	4.6	-----	-----	35.6	-----	4	-----	14.3	-----	-----	-----	-----	13.1	-----	-----	16.9	-----	3
Entrenchment Ratio	-----	-----	-----	-----	5.0	-----	-----	8.2	-----	4	-----	-----	-----	>.2.2	-----	-----	3.5	-----	-----	4.5	-----	3
Bank Height Ratio	-----	-----	-----	-----	1.1	-----	-----	1.9	-----	4	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	-----	-----	-----	6.5	-----	-----	7.3	-----	2	-----	-----	-----	-----	-----	-----	18.6	-----	-----	28.9	-----	3
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	35.0	-----	-----	80.0	-----	-----	22.0	-----	-----	52.1	-----	12
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	20.0	-----	-----	30.0	-----	-----	28.7	-----	-----	43.6	-----	15
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	3.0	-----	-----	3.0	-----	-----	3.8	-----	3
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	70.0	-----	-----	120.0	-----	-----	90.2	-----	-----	130.9	-----	15.0
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8.0	-----	-----	3.0	-----	-----	4.9	-----	3
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.016	-----	-----	-----	-----	-----	0.011	-----	-----	-----	23
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	36	-----	-----	63	-----	-----	11	-----	-----	80	-----	35
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.4	-----	-----	2.4	-----	-----	0.2	-----	-----	1.3	-----	34
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	<0.063 / 3.9 - 4.6 / 6.5 - 7.3 / 19.3 - 20.4 / 30.8 - 32.0						-----	-----	-----	-----	-----	-----	.063 - 5.6 / 9.9 - 16.3 / 18.6 - 28.9 / 85.1 - 99.5 / 154.8 - >2048 / 180 - >20					
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	0.3	-----	-----	-----	-----	-----	0.47	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	15.7	-----	-----	-----	-----	-----	25.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	C4 / E4 (incised)	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	3.6	-----	-----	3.6	-----	2	-----	3.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	24.8	26.4	-----	-----	28.0	-----	2	-----	26.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1377	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	1,849	-----	-----	-----	1,630	-----	-----	-----	-----	-----	1621	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.31	-----	-----	-----	1.17	-----	-----	-----	-----	-----	1.18	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0111	-----	-----	-----	0.0122	-----	-----	-----	-----	-----	0.0122	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

[1] Reach 3 data based on two riffle cross-sections and two pool cross-section.

Table 5. Baseline Stream Summary (continued)

Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 4 (232 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	5.7	-----	-----	-----	-----	-----	-----	-----	10.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Floodprone Width (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25	-----	-----	110.0	-----	-----	-----	-----	-----	-----	-----	-----
BF Mean Depth (ft)	-----	2.3	5.8	0.9	-----	-----	-----	-----	-----	-----	-----	0.8	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	6.7	-----	-----	-----	-----	-----	-----	-----	8.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Width/Depth Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	12.5	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Entrenchment Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	>2.2	-----	-----	-----	-----	-----	-----	-----	-----
Bank Height Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d50 (mm)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----						-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----				-----			-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----
Reach Shear Stress (competency) lb/f^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.22	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	25.8	-----	-----	-----	28	-----	-----	-----	28	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	202	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	234	-----	-----	-----	232	-----	-----	-----	-----	-----	232	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.21	-----	-----	-----	1.20	-----	-----	-----	-----	-----	1.15	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0094	-----	-----	-----	0.0113	-----	-----	-----	-----	-----	0.012	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 5. Baseline Stream Summary (continued)

Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Reach 5 (822 LF)

Parameter	USGS Gauge	Regional Curve Interval (Harman et al, 1999)*			Pre-Existing Condition						Design						As-built					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																						
BF Width (ft)	-----	23.0	80.0	6.1	5.2	-----	-----	17.0	-----	3	-----	10.5	-----	-----	-----	-----	10.2	-----	-----	11.1	-----	3
Floodprone Width (ft)	-----	-----	-----	-----	51.0	-----	-----	84.0	-----	3	25	-----	-----	110.0	-----	-----	43.8	-----	-----	59.4	-----	3
BF Mean Depth (ft)	-----	2.3	5.8	0.9	0.7	-----	-----	1.5	-----	3	-----	0.8	-----	-----	-----	-----	0.5	-----	-----	0.8	-----	3
BF Max Depth (ft)	-----	-----	-----	-----	1.6	-----	-----	2.1	-----	3	-----	1.2	-----	-----	-----	-----	0.9	-----	-----	1.2	-----	3
BF Cross-sectional Area (ft^2)	-----	80.0	300.0	7.4	8.0	-----	-----	12.3	-----	3	-----	8.7	-----	-----	-----	-----	5.7	-----	-----	8.0	-----	3
Width/Depth Ratio	-----	-----	-----	-----	3.5	-----	-----	23.5	-----	3	-----	12.5	-----	-----	-----	-----	13.4	-----	-----	21.5	-----	3
Entrenchment Ratio	-----	-----	-----	-----	3.0	-----	-----	13.2	-----	3	-----	-----	-----	>2.2	-----	-----	4.0	-----	-----	5.7	-----	3
Bank Height Ratio	-----	-----	-----	-----	1.3	-----	-----	1.3	-----	3	-----	1.0	-----	-----	-----	-----	1.0	-----	-----	1.0	-----	3
d50 (mm)	-----	-----	-----	-----	5.6	-----	-----	8.6	-----	2	-----	-----	-----	-----	-----	-----	27.5	-----	-----	41.8	-----	2
Pattern																						
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	37.0	-----	-----	84.0	-----	-----	23.8	-----	-----	44.2	-----	10
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	21.0	-----	-----	31.5	-----	-----	24.5	-----	-----	40.9	-----	9
Rc:Bankfull width (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2.0	-----	-----	3.0	-----	-----	2.8	-----	-----	3.5	-----	3
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	73.5	-----	-----	126.0	-----	-----	95.2	-----	-----	139.9	-----	9
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3.5	-----	-----	8.0	-----	-----	2.9	-----	-----	3.9	-----	3
Profile																						
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.02	-----	-----	-----	-----	-----	0.018	-----	-----	-----	11
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	42.0	-----	-----	74.0	-----	-----	25.0	-----	-----	96.0	-----	14
Pool Max Depth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1.7	-----	-----	2.9	-----	-----	0.4	-----	-----	1.1	-----	15
Pool Volume (ft^3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Substrate and Transport Parameters																						
Ri% / Ru% / P% / G% / S%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SC% / Sa% / G% / B% / Be%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	<0.063 / 2 - 4.8 / 5.6 - 8.6 / 20.4 - 28.7 / 77 - 87.7						-----	-----	-----	-----	-----	-----	3.2 - 13.6 / 20.4 - 27.8 / 27.5 - 41.8 / 65.1 - 84.1 / 114.6 - 122.5 / 128 - 25					
Reach Shear Stress (competency) lb/ft^2	-----	-----	-----	-----	-----	0.55	-----	-----	-----	-----	-----	0.47	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Max part size (mm) mobilized at bankfull (Rosgen Curve)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m^2	-----	-----	-----	-----	-----	19.4	-----	-----	-----	-----	-----	23.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																						
Drainage Area (SM)	-----	-----	-----	-----	-----	-----	-----	0.210	-----	-----	-----	-----	-----	0.2	-----	-----	-----	-----	-----	0.2	-----	-----
Impervious cover estimate (%)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Rosgen Classification	-----	-----	-----	-----	-----	-----	-----	C4 / E4	-----	-----	-----	C4	-----	-----	-----	-----	-----	C4	-----	-----	-----	-----
BF Velocity (fps)	-----	-----	-----	-----	2.41	-----	-----	3.15	-----	-----	-----	3.4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BF Discharge (cfs)	-----	290.0	2000.0	28.8	-----	-----	-----	29.6	-----	-----	-----	29.6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Valley Length	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	742	-----	-----	-----	-----
Channel length $(ft)^2$	-----	-----	-----	-----	-----	-----	-----	849	-----	-----	-----	809	-----	-----	-----	-----	-----	822	-----	-----	-----	-----
Sinuosity	-----	-----	-----	-----	-----	-----	-----	1.17	-----	-----	-----	1.17	-----	-----	-----	-----	-----	1.11	-----	-----	-----	-----
Water Surface Slope (Channel) (ft/ft)	-----	-----	-----	-----	-----	-----	-----	0.0133	-----	-----	-----	0.0106	-----	-----	-----	-----	-----	0.0128	-----	-----	-----	-----
BF slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Bankfull Floodplain Area (acres)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
BEHI VL% / L% / M% / H% / VH% / E%	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Channel Stability or Habitat Metric	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Biological or Other	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

* Harman, W.A., G.D. Jennings, J.M. Patterson, D.R. Clinton, L.O. Slate, A.G. Jessup, J.R. Everhart, and R.E. Smith. 1999. Bankfull hydraulic geometry relationships for North Carolina streams. Wildland Hydrology. AWRA Symposium Proceedings. D.S. Olsen and J.P. Potyondy, eds. American Water Resources Association. June 30-July 2, 1999. Bozeman, MT.

Table 6. Morphology and Hydraulic Monitoring Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026
Reach 2 (711 LF)

	Cross-section X-1 (Riffle)							Cross-section X-2 (Riffle)							Cross-section X-3 (Pool)							Cross-section X-4 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	8.75	-	-	-	-	-	-	9.17	-	-	-	-	-	-	11.96	-	-	-	-	-	-	10.00	-	-	-	-	-	-
BF Mean Depth (ft)	0.66	-	-	-	-	-	-	0.90	-	-	-	-	-	-	1.00	-	-	-	-	-	-	0.84	-	-	-	-	-	-
Width/Depth Ratio	13.23	-	-	-	-	-	-	10.17	-	-	-	-	-	-	11.92	-	-	-	-	-	-	11.92	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	5.79	-	-	-	-	-	-	8.28	-	-	-	-	-	-	12.01	-	-	-	-	-	-	8.38	-	-	-	-	-	-
BF Max Depth (ft)	1.09	-	-	-	-	-	-	1.37	-	-	-	-	-	-	2.25	-	-	-	-	-	-	1.45	-	-	-	-	-	-
Width of Floodprone Area (ft)	27.05	-	-	-	-	-	-	33.92	-	-	-	-	-	-	42.56	-	-	-	-	-	-	41.34	-	-	-	-	-	-
Entrenchment Ratio	3.09	-	-	-	-	-	-	3.70	-	-	-	-	-	-	3.56	-	-	-	-	-	-	4.13	-	-	-	-	-	-
Bank Height Ratio	1.01	-	-	-	-	-	-	1.01	-	-	-	-	-	-	1.00	-	-	-	-	-	-	1.00	-	-	-	-	-	-
Wetted Perimeter (ft)	10.07	-	-	-	-	-	-	10.97	-	-	-	-	-	-	13.96	-	-	-	-	-	-	11.68	-	-	-	-	-	-
Hydraulic Radius (ft)	0.57	-	-	-	-	-	-	0.75	-	-	-	-	-	-	0.86	-	-	-	-	-	-	0.72	-	-	-	-	-	-
Based on current/developing bankfull feature																												
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft^2)	-							-							-							-						
d50 (mm)	23.33							-							-							17.14						

Table 6. Morphology and Hydraulic Monitoring Summary
Town Creek Restoration Project - Option B: DMS Project ID No. 95026
Reach 3 (1,621 LF)

	Cross-section X-5 (Riffle)							Cross-section X-6 (Pool)							Cross-section X-7 (Riffle)							Cross-section X-8 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	10.65	-	-	-	-	-	-	13.63	-	-	-	-	-	-	9.84	-	-	-	-	-	-	11.92	-	-	-	-	-	-
BF Mean Depth (ft)	0.82	-	-	-	-	-	-	1.07	-	-	-	-	-	-	0.66	-	-	-	-	-	-	1.21	-	-	-	-	-	-
Width/Depth Ratio	13.05	-	-	-	-	-	-	12.77	-	-	-	-	-	-	14.87	-	-	-	-	-	-	9.85	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	8.68	-	-	-	-	-	-	14.54	-	-	-	-	-	-	6.51	-	-	-	-	-	-	14.42	-	-	-	-	-	-
BF Max Depth (ft)	1.44	-	-	-	-	-	-	2.09	-	-	-	-	-	-	1.03	-	-	-	-	-	-	2.24	-	-	-	-	-	-
Width of Floodprone Area (ft)	48.09	-	-	-	-	-	-	50.26	-	-	-	-	-	-	38.30	-	-	-	-	-	-	50.45	-	-	-	-	-	-
Entrenchment Ratio	4.52	-	-	-	-	-	-	3.69	-	-	-	-	-	-	3.89	-	-	-	-	-	-	4.23	-	-	-	-	-	-
Bank Height Ratio	1.00	-	-	-	-	-	-	1.00	-	-	-	-	-	-	1.00	-	-	-	-	-	-	1.00	-	-	-	-	-	-
Wetted Perimeter (ft)	12.29	-	-	-	-	-	-	15.77	-	-	-	-	-	-	11.16	-	-	-	-	-	-	14.34	-	-	-	-	-	-
Hydraulic Radius (ft)	0.71	-	-	-	-	-	-	0.92	-	-	-	-	-	-	0.58	-	-	-	-	-	-	1.01	-	-	-	-	-	-
Based on current/developing bankfull feature																												
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-							
d50 (mm)	18.55	-	-	-	-	-	-	-	-	-	-	-	-	-	28.91	-	-	-	-	-	-							

	Cross-section X-9 (Riffle)																											
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																												
BF Width (ft)	10.71	-	-	-	-	-	-																					
BF Mean Depth (ft)	0.63	-	-	-	-	-	-																					
Width/Depth Ratio	16.87	-	-	-	-	-	-																					
BF Cross-sectional Area (ft²)	6.79	-	-	-	-	-	-																					
BF Max Depth (ft)	1.06	-	-	-	-	-	-																					
Width of Floodprone Area (ft)	37.79	-	-	-	-	-	-																					
Entrenchment Ratio	3.53	-	-	-	-	-	-																					
Bank Height Ratio	1.00	-	-	-	-	-	-																					
Wetted Perimeter (ft)	11.97	-	-	-	-	-	-																					
Hydraulic Radius (ft)	0.57	-	-	-	-	-	-																					
Based on current/developing bankfull feature																												
BF Width (ft)	-	-	-	-	-	-	-																					
BF Mean Depth (ft)	-	-	-	-	-	-	-																					
Width/Depth Ratio	-	-	-	-	-	-	-																					
BF Cross-sectional Area (ft²)	-	-	-	-	-	-	-																					
BF Max Depth (ft)	-	-	-	-	-	-	-																					
Width of Floodprone Area (ft)	-	-	-	-	-	-	-																					
Entrenchment Ratio	-	-	-	-	-	-	-																					
Bank Height Ratio	-	-	-	-	-	-	-																					
Wetted Perimeter (ft)	-	-	-	-	-	-	-																					
Hydraulic Radius (ft)	-	-	-	-	-	-	-																					
Cross Sectional Area between end pins (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d50 (mm)	25.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 6. Morphology and Hydraulic Monitoring Summary																											
Town Creek Restoration Project - Option B: DMS Project ID No. 95026																											
Reach 5 (822 LF)																											
	Cross-section X-10 (Riffle)							Cross-section X-11 (Pool)							Cross-section X-12 (Riffle)							Cross-section X-13 (Riffle)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																											
BF Width (ft)	10.36	-	-	-	-	-	-	16.70	-	-	-	-	-	-	11.06	-	-	-	-	-	-	10.19	-	-	-	-	-	-
BF Mean Depth (ft)	0.77	-	-	-	-	-	-	1.09	-	-	-	-	-	-	0.52	-	-	-	-	-	-	0.59	-	-	-	-	-	-
Width/Depth Ratio	13.43	-	-	-	-	-	-	15.34	-	-	-	-	-	-	21.45	-	-	-	-	-	-	17.40	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	8.00	-	-	-	-	-	-	18.19	-	-	-	-	-	-	5.71	-	-	-	-	-	-	5.97	-	-	-	-	-	-
BF Max Depth (ft)	1.18	-	-	-	-	-	-	2.20	-	-	-	-	-	-	1.07	-	-	-	-	-	-	0.91	-	-	-	-	-	-
Width of Floodprone Area (ft)	59.38	-	-	-	-	-	-	63.54	-	-	-	-	-	-	43.79	-	-	-	-	-	-	56.59	-	-	-	-	-	-
Entrenchment Ratio	5.70	-	-	-	-	-	-	3.81	-	-	-	-	-	-	3.96	-	-	-	-	-	-	5.55	-	-	-	-	-	-
Bank Height Ratio	1.01	-	-	-	-	-	-	1.00	-	-	-	-	-	-	1.01	-	-	-	-	-	-	1.00	-	-	-	-	-	-
Wetted Perimeter (ft)	11.90	-	-	-	-	-	-	18.88	-	-	-	-	-	-	12.10	-	-	-	-	-	-	11.37	-	-	-	-	-	-
Hydraulic Radius (ft)	0.67	-	-	-	-	-	-	0.96	-	-	-	-	-	-	0.47	-	-	-	-	-	-	0.53	-	-	-	-	-	-
Based on current/developing bankfull feature																											
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross-sectional Area (ft²)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width of Floodprone Area (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cross Sectional Area between end pins (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d50 (mm)	41.83	-	-	-	-	-	-	-	-	-	-	-	-	-	27.48	-	-	-	-	-	-	-	-	-	-	-	-	-

Permanent Cross-section

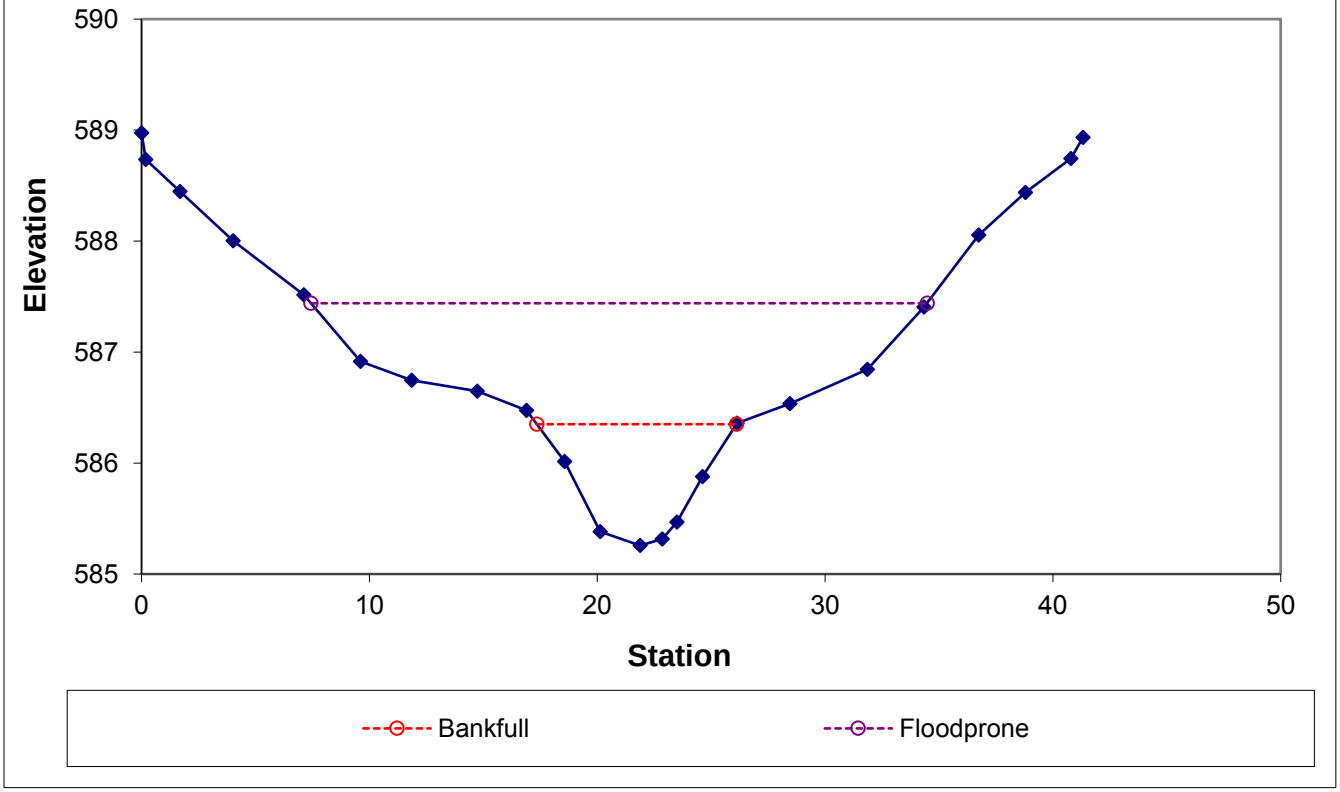
X1 - Reach 2

(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	5.79	8.75	0.66	1.09	13.23	1.01	3.09	586.35	586.36	27.05

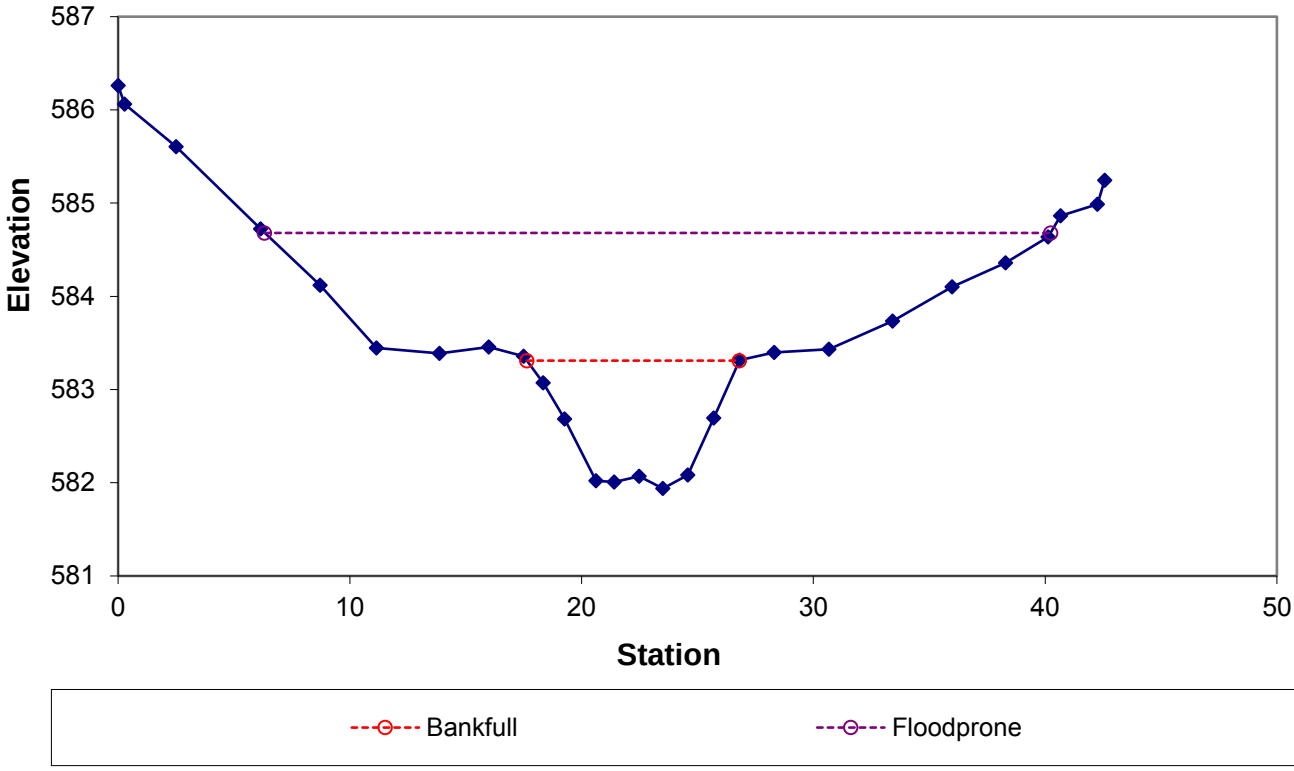


Permanent Cross-section
X2 - Reach 2
(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	E	8.28	9.17	0.90	1.37	10.17	1.01	3.70	583.31	583.32	33.92



Permanent Cross-section

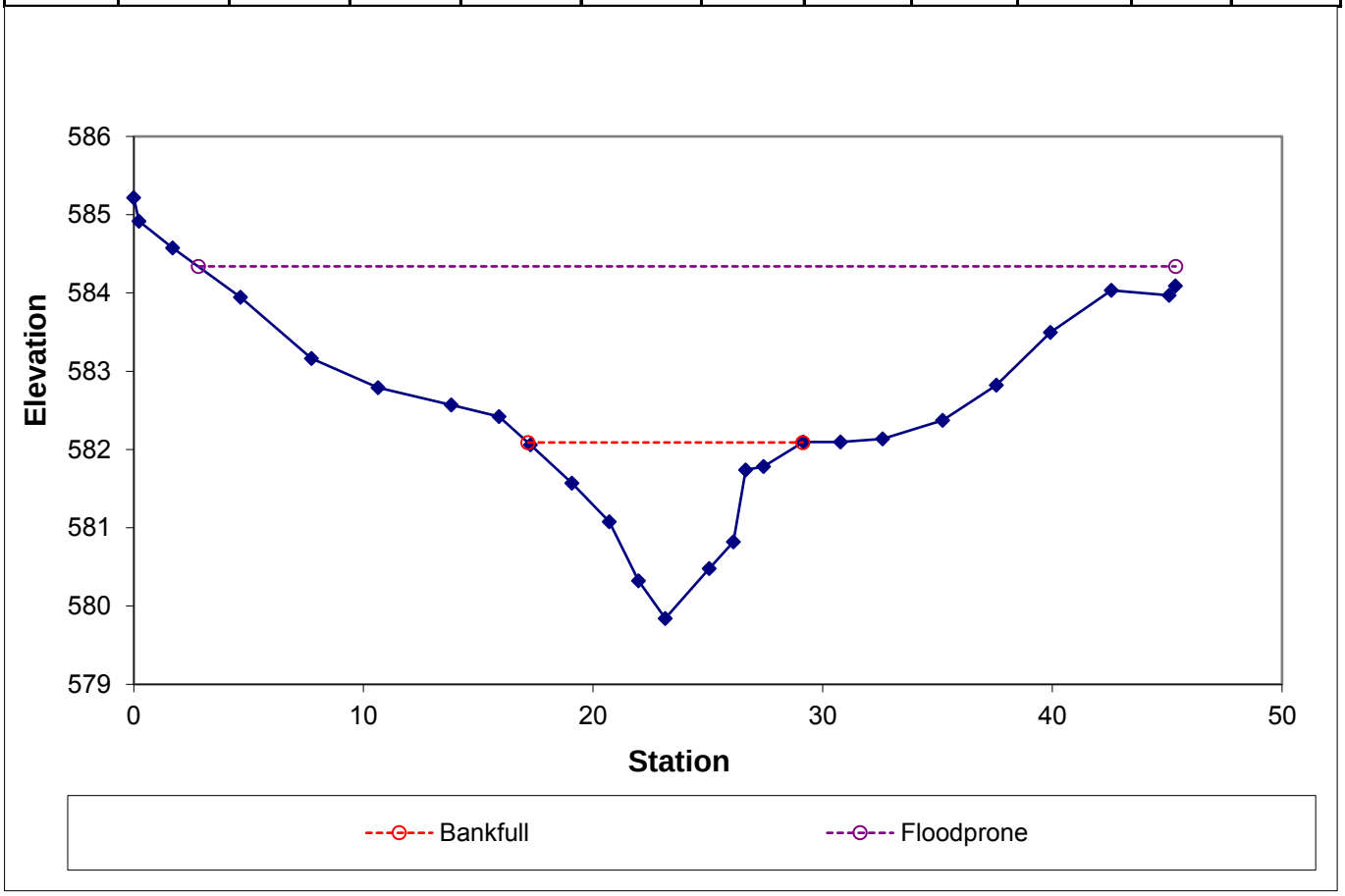
X3 - Reach 2

(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		12.01	11.96	1.00	2.25	11.92	1.00	3.56	582.09	582.10	42.56



Permanent Cross-section

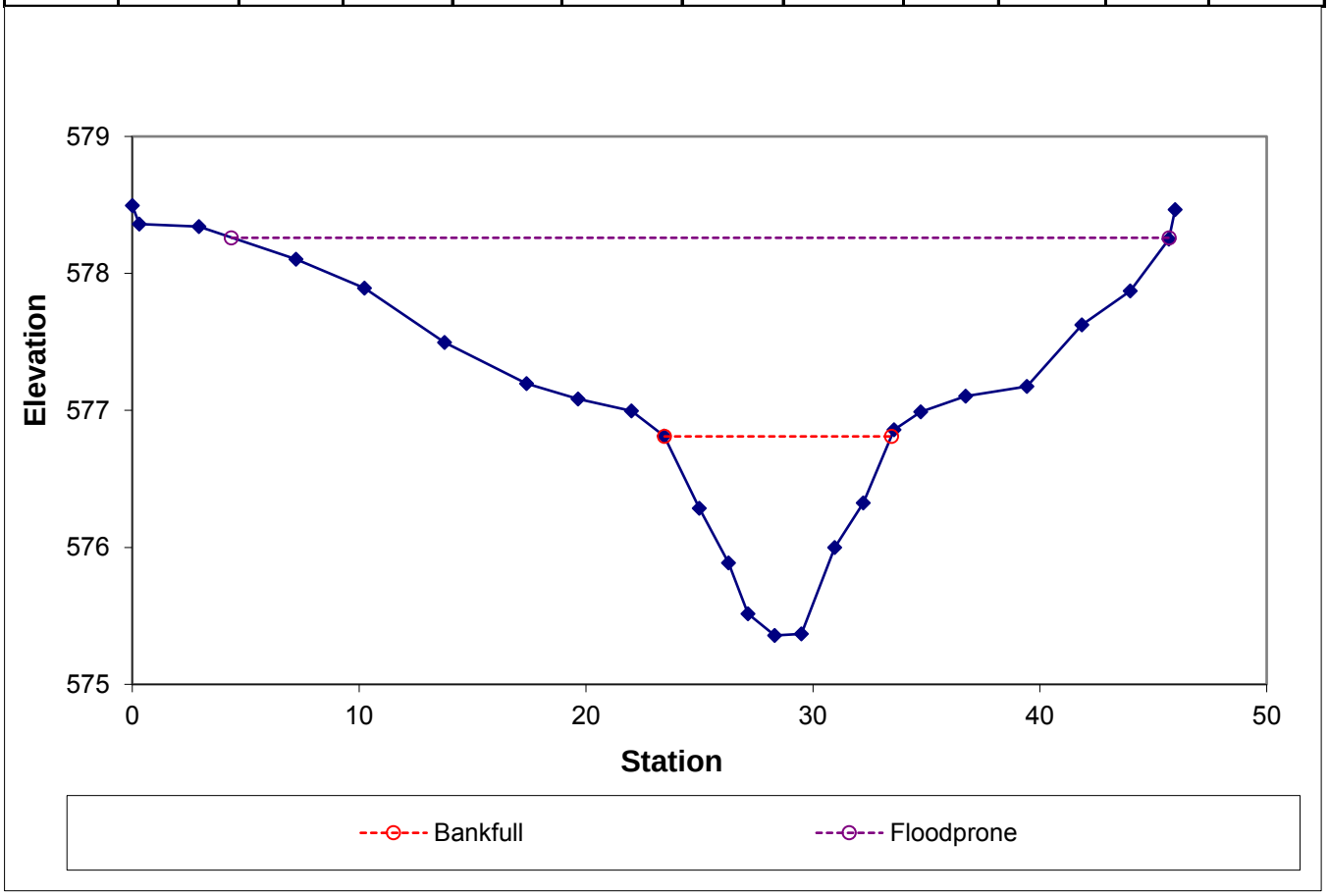
X4 - Reach 2

(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	8.38	10.00	0.84	1.45	11.92	1.00	4.13	576.81	576.81	41.34



Permanent Cross-section

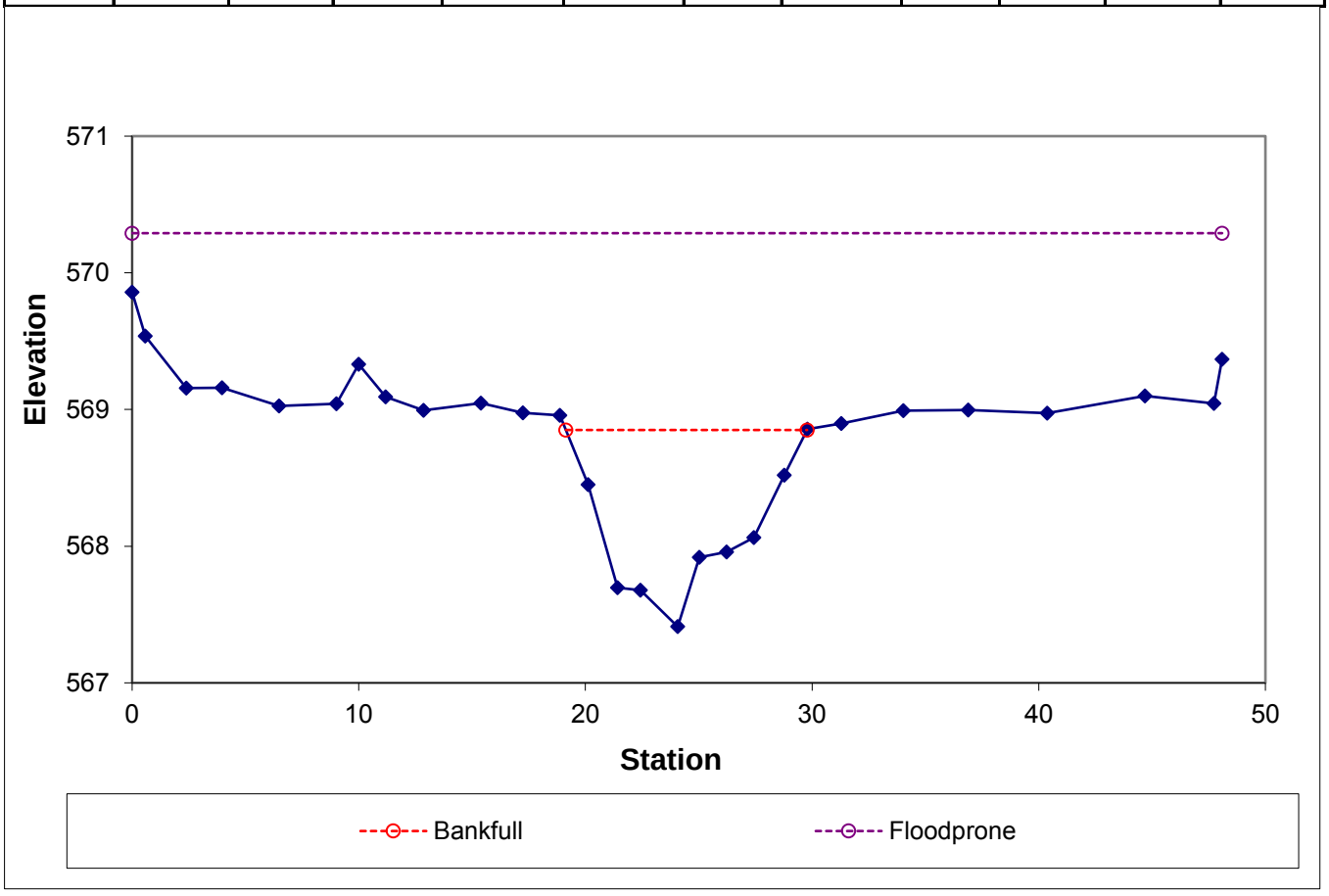
X5 - Reach 3

(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	8.68	10.65	0.82	1.44	13.05	1.00	4.52	568.85	568.86	48.09

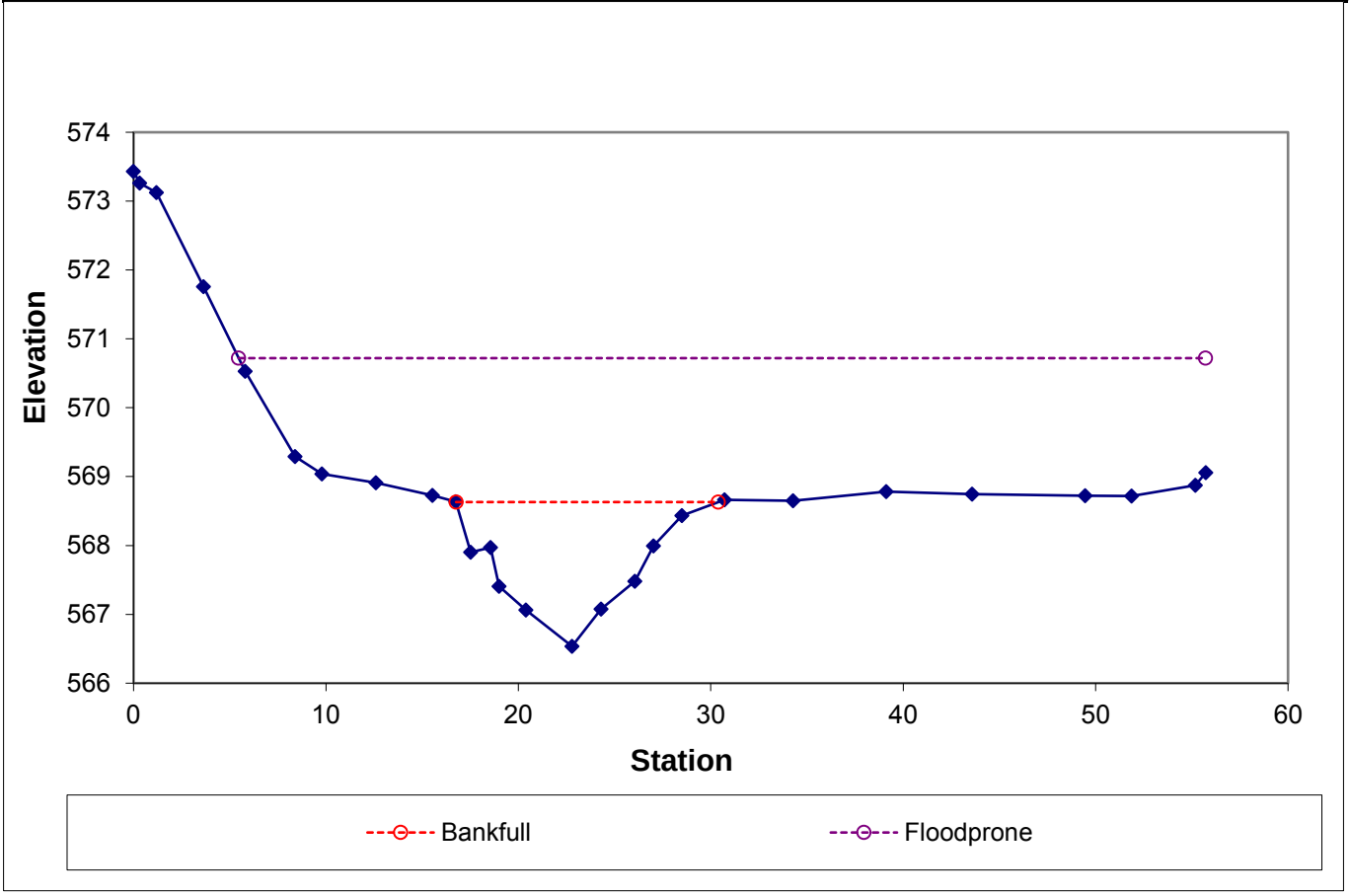


Permanent Cross-section
X6 - Reach 3
(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		14.54	13.63	1.07	2.09	12.77	1.00	3.69	568.63	568.63	50.26



Permanent Cross-section

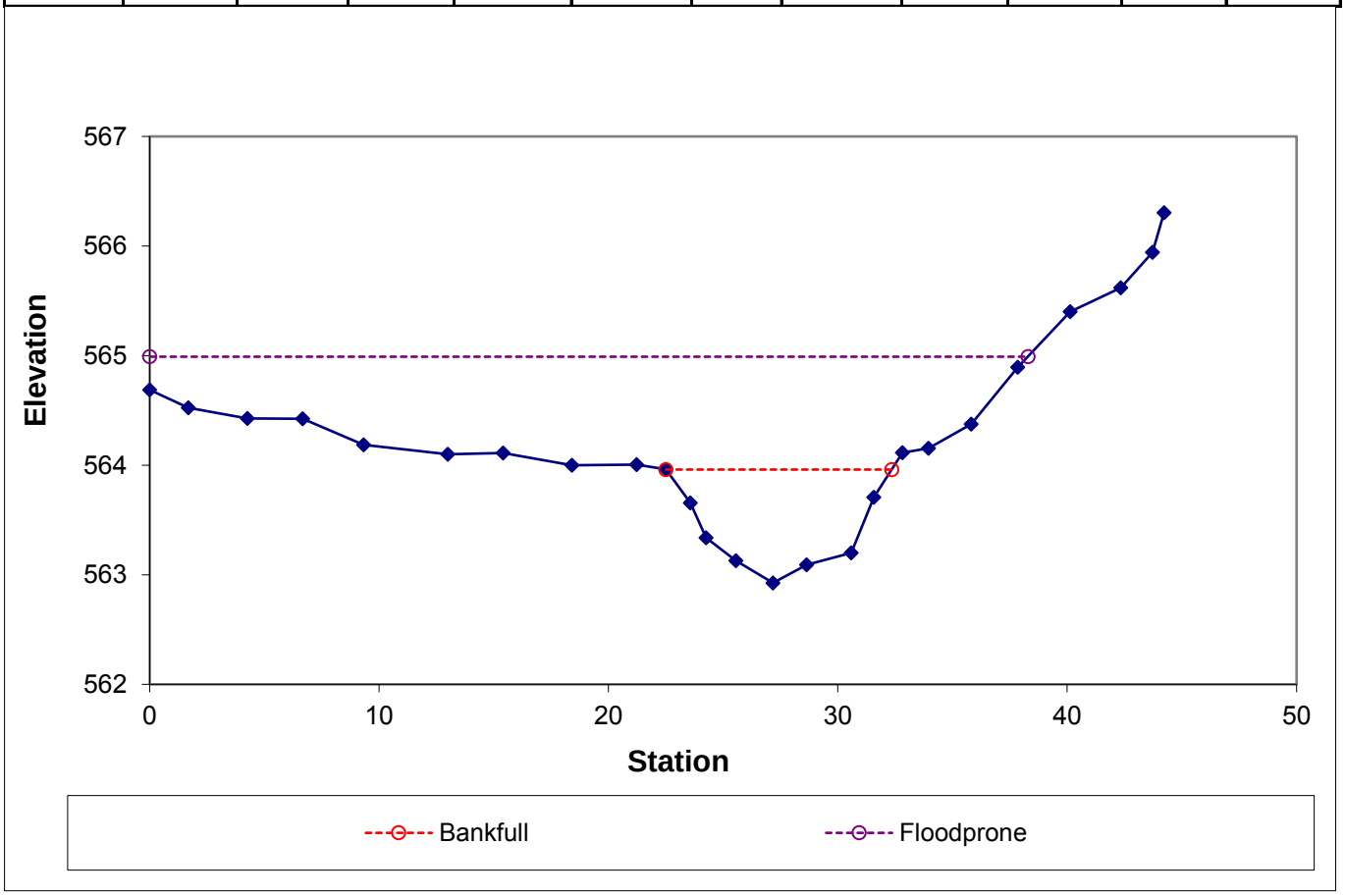
X7 - Reach 3

(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	6.51	9.84	0.66	1.03	14.87	1.00	3.89	563.96	563.96	38.30



Permanent Cross-section

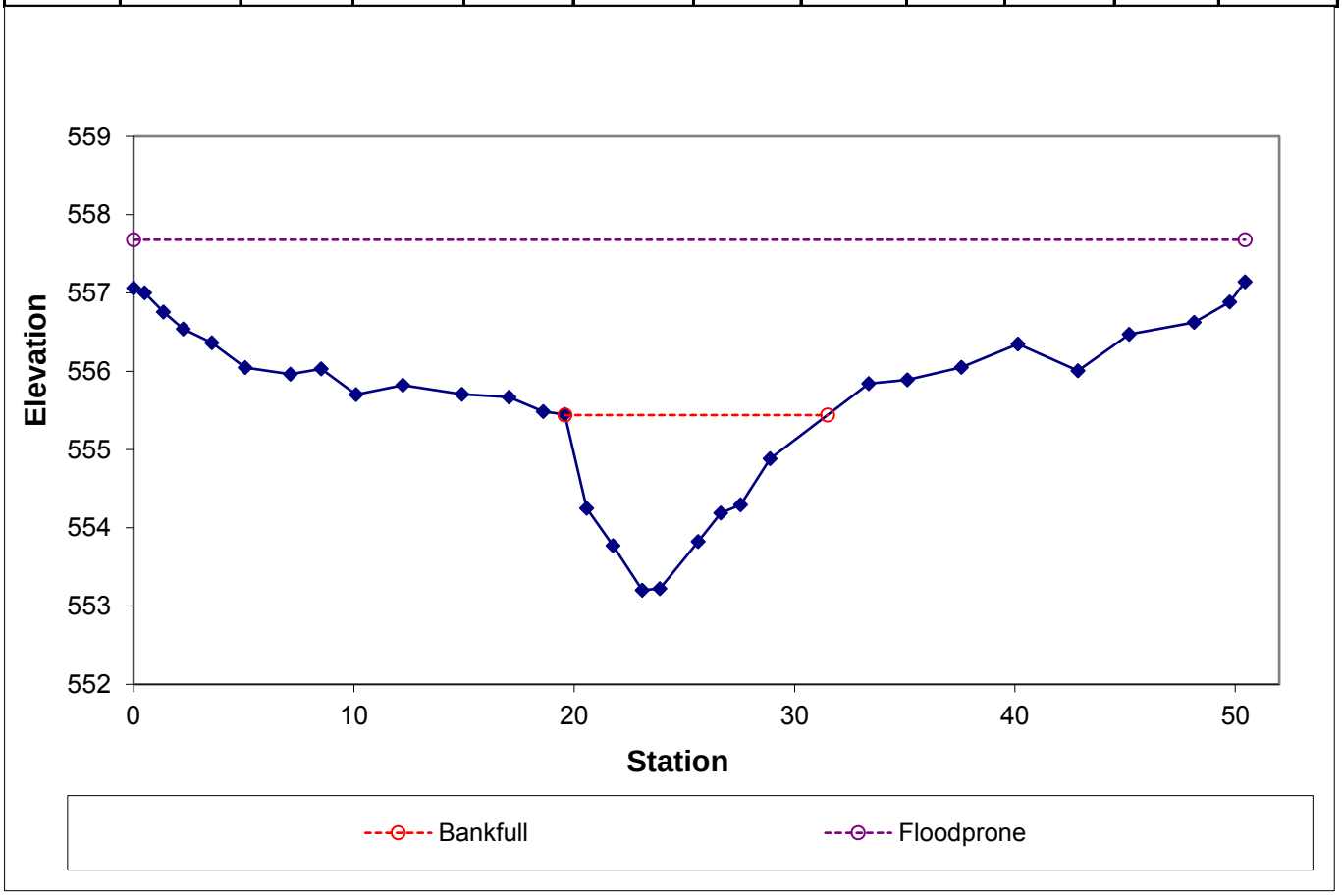
X8 - Reach 3

(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		14.42	11.92	1.21	2.24	9.85	1.00	4.23	555.44	555.45	50.45

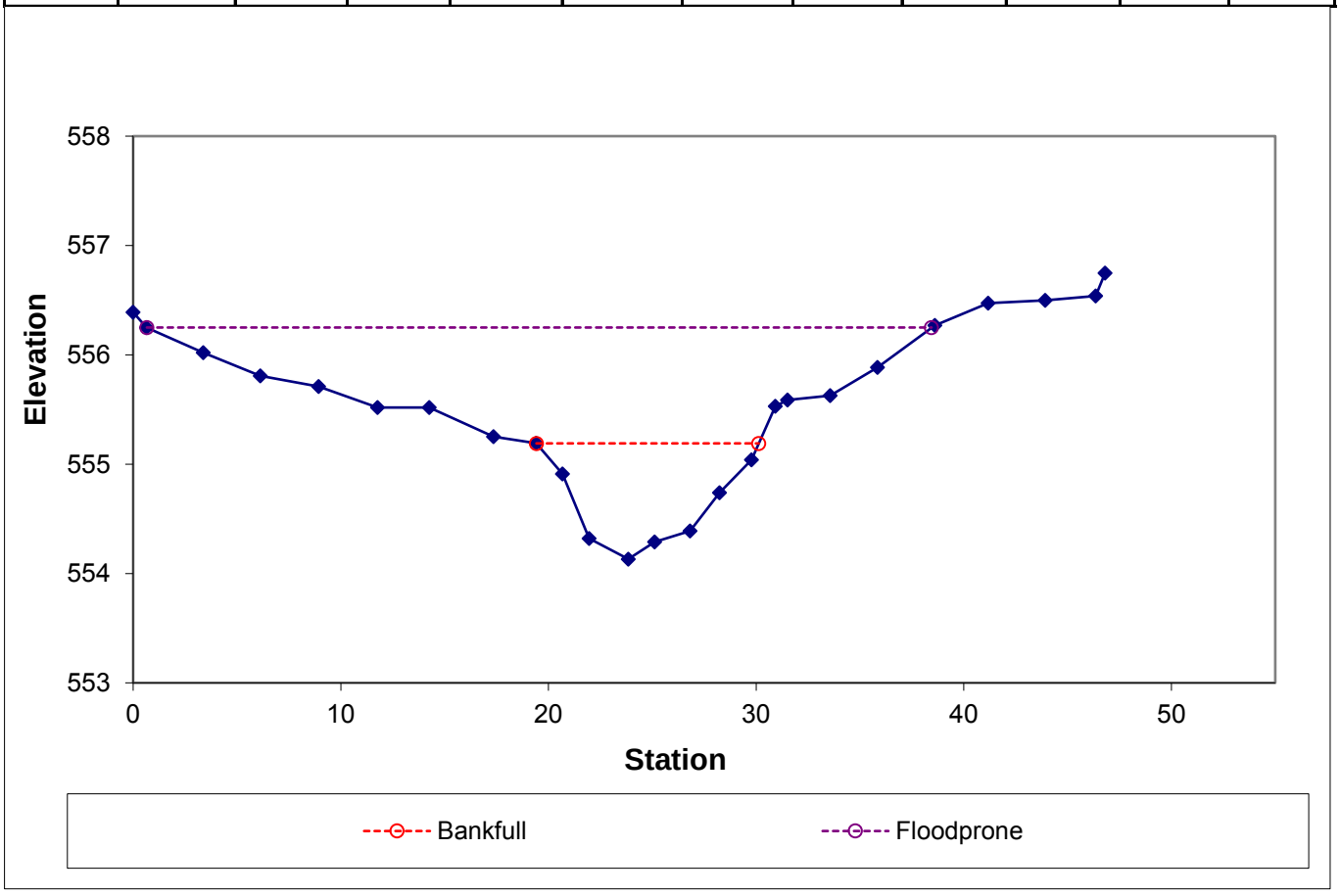


Permanent Cross-section
X9 - Reach 3
(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	6.79	10.71	0.63	1.06	16.87	1.00	3.53	555.19	555.19	37.79



Permanent Cross-section

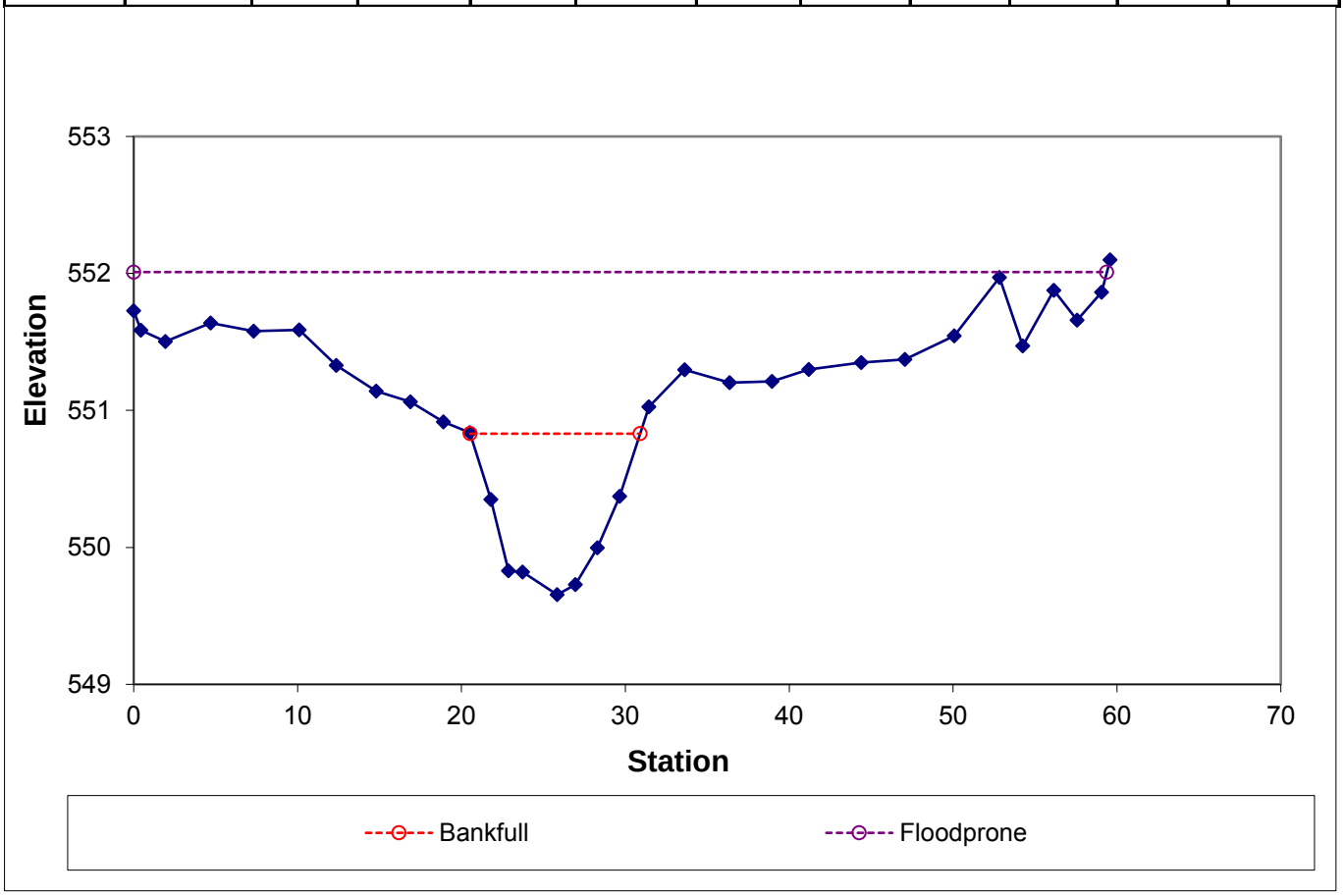
X10 - Reach 5

(As-built Data - Collected April 2016)

LEFT BANK

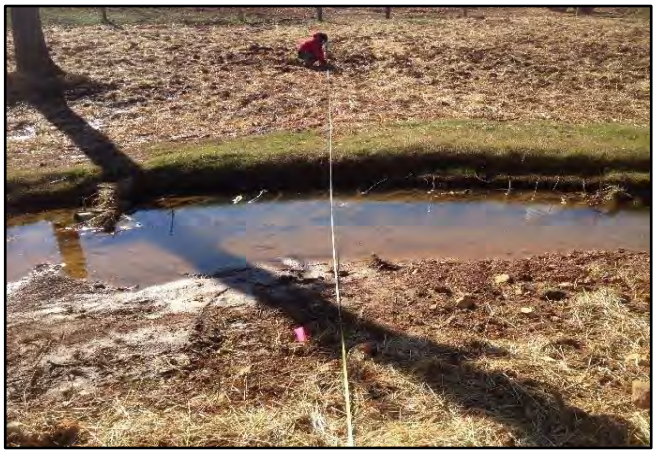
RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	8.00	10.36	0.77	1.18	13.43	1.01	5.70	550.83	550.84	59.38



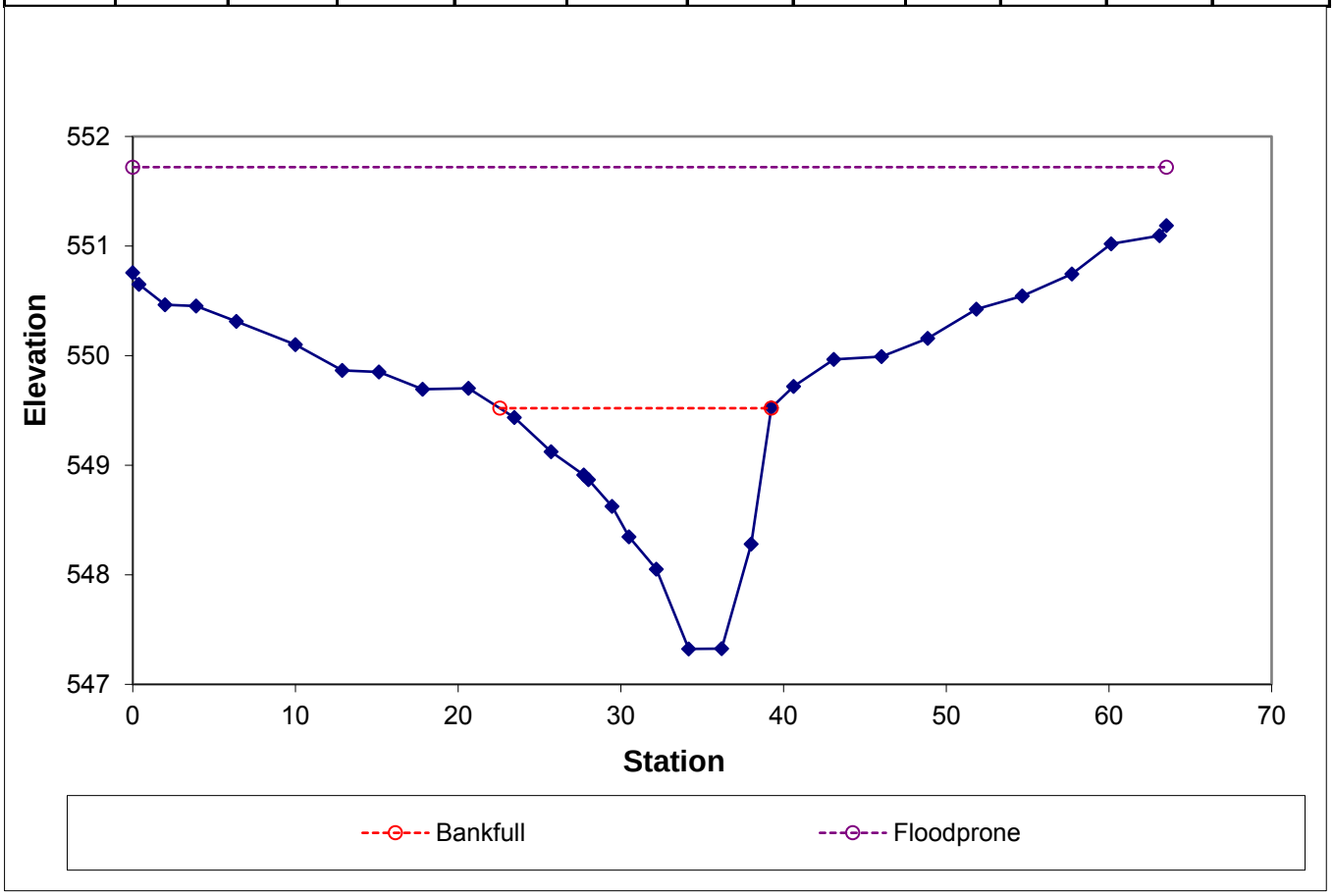
Permanent Cross-section
X11 - Reach 5
(As-built Data - Collected April 2016)

LEFT BANK



RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Pool		18.19	16.70	1.09	2.20	15.34	1.00	3.81	549.52	549.52	63.54

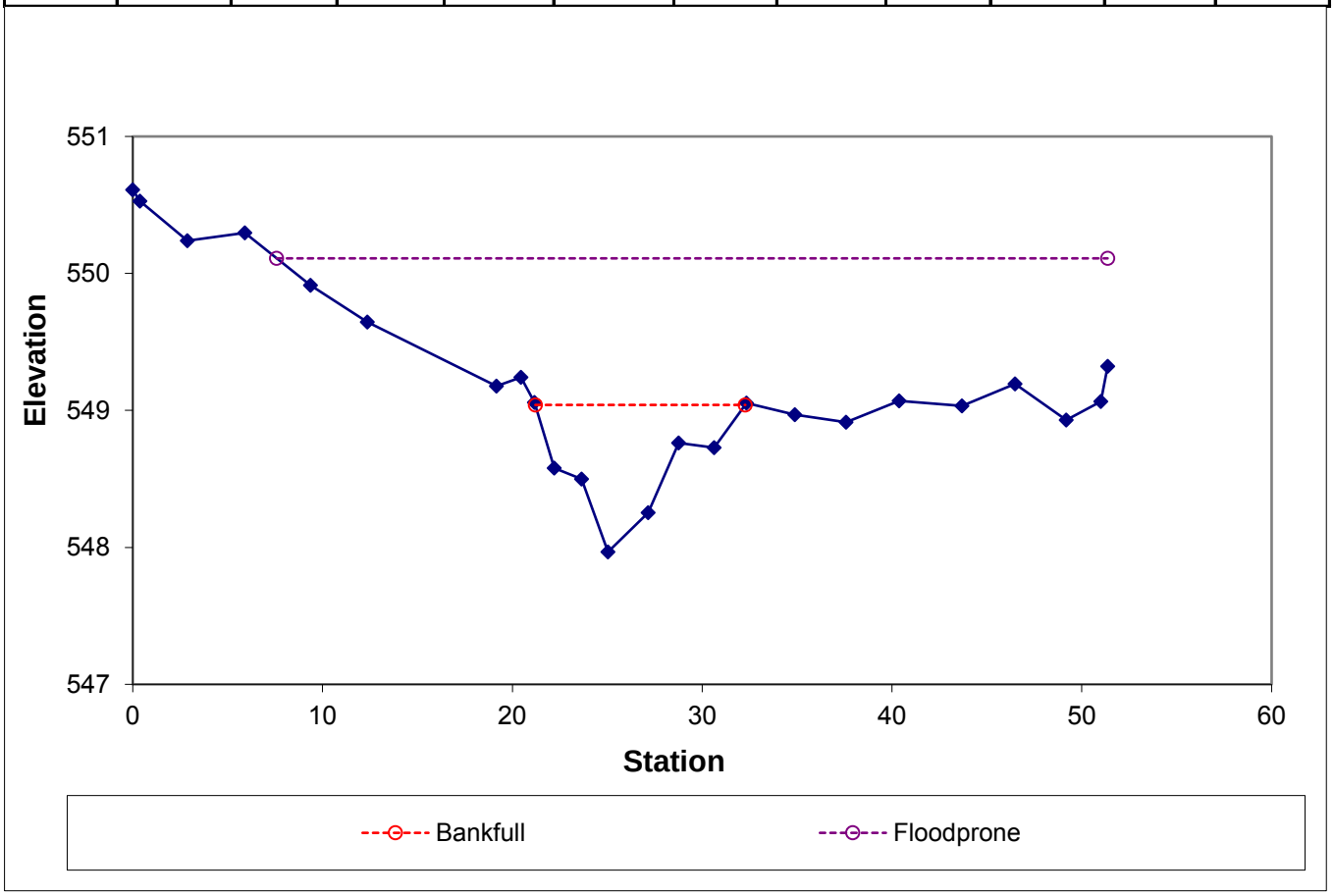


Permanent Cross-section
X12 - Reach 5
(As-built Data - Collected April 2016)

LEFT BANK

RIGHT BANK

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	5.71	11.06	0.52	1.07	21.45	1.01	3.96	549.04	549.054	43.79

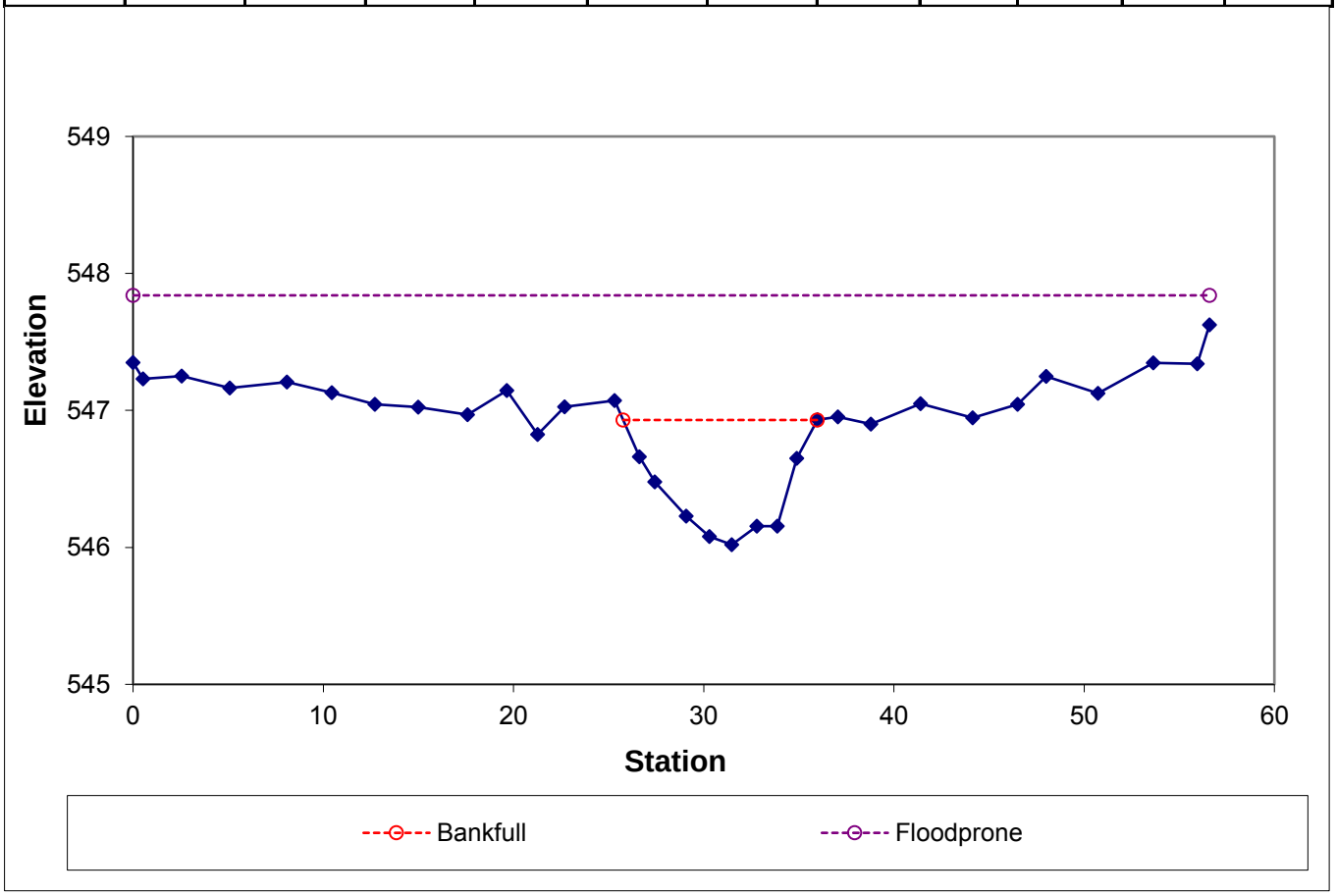


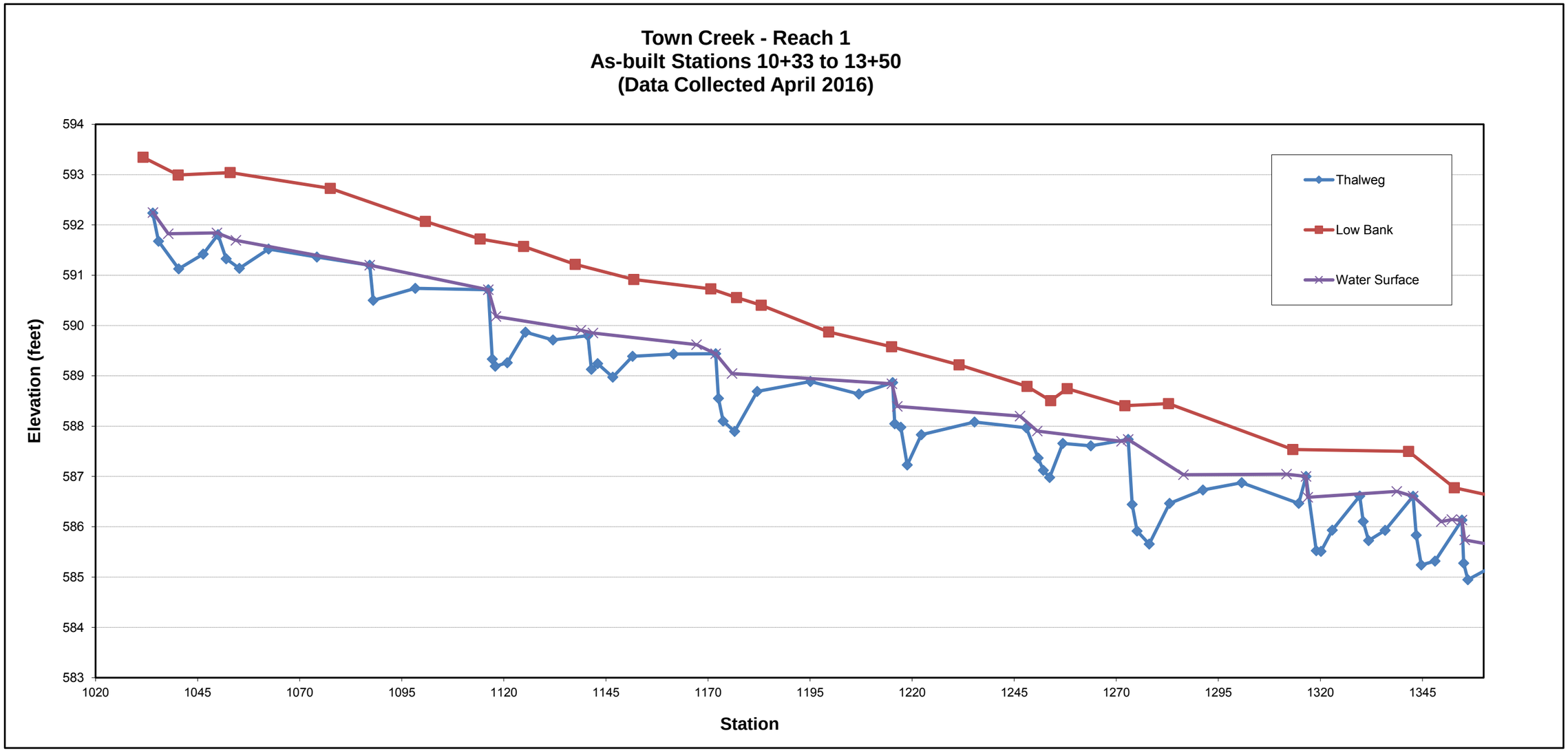
Permanent Cross-section
X13 - Reach 5
(As-built Data - Collected April 2016)

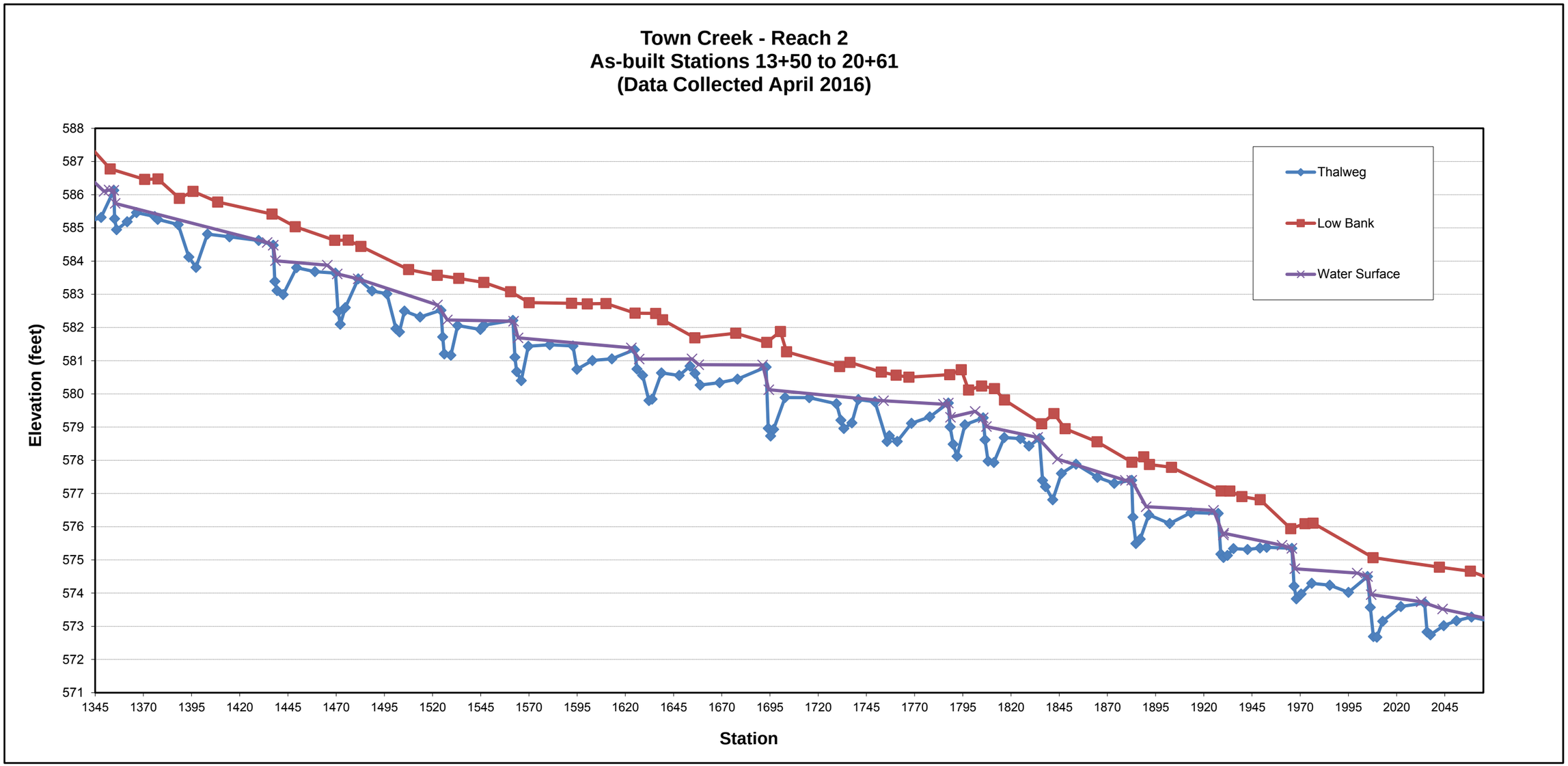
LEFT BANK

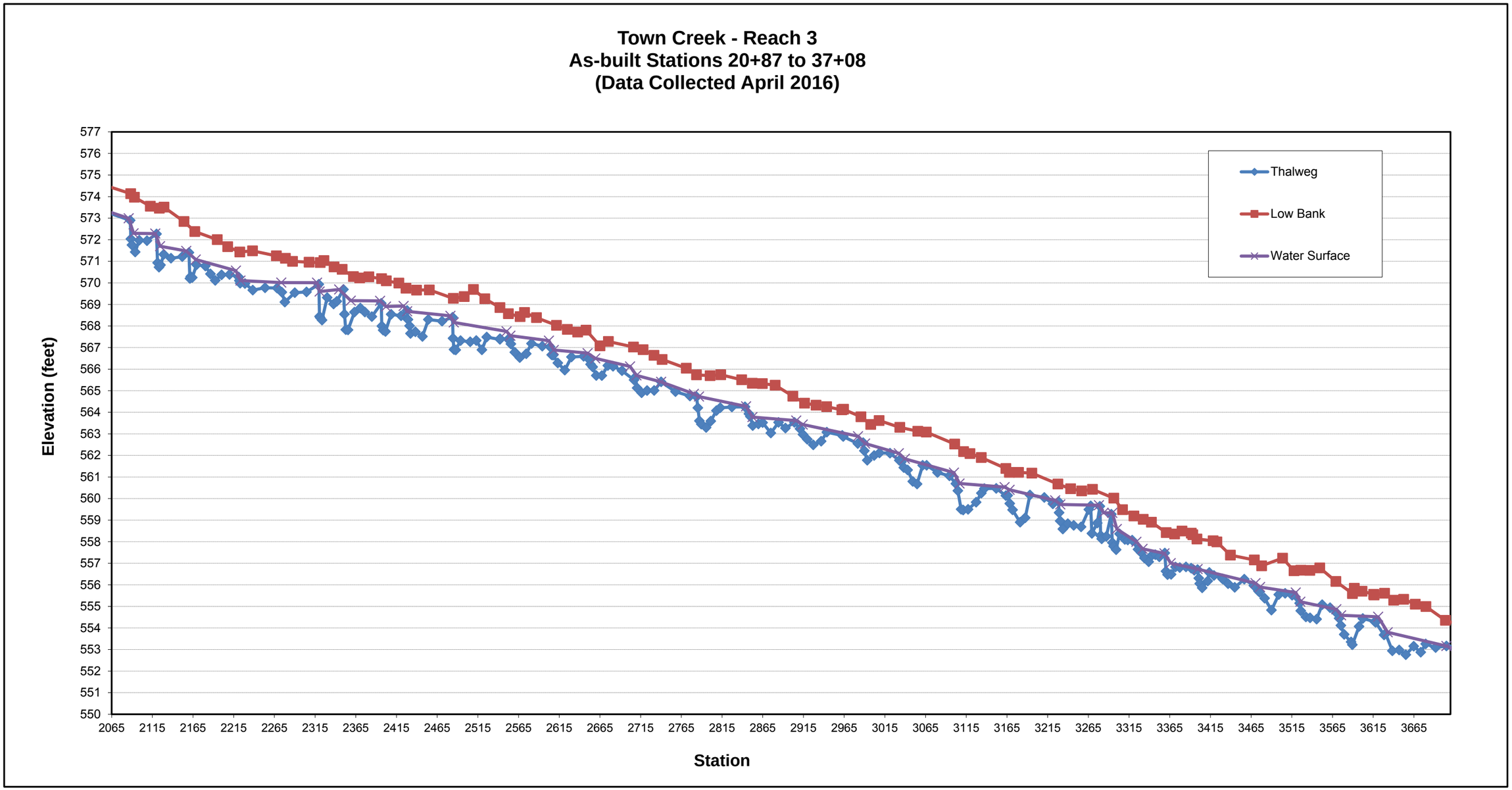
RIGHT BANK

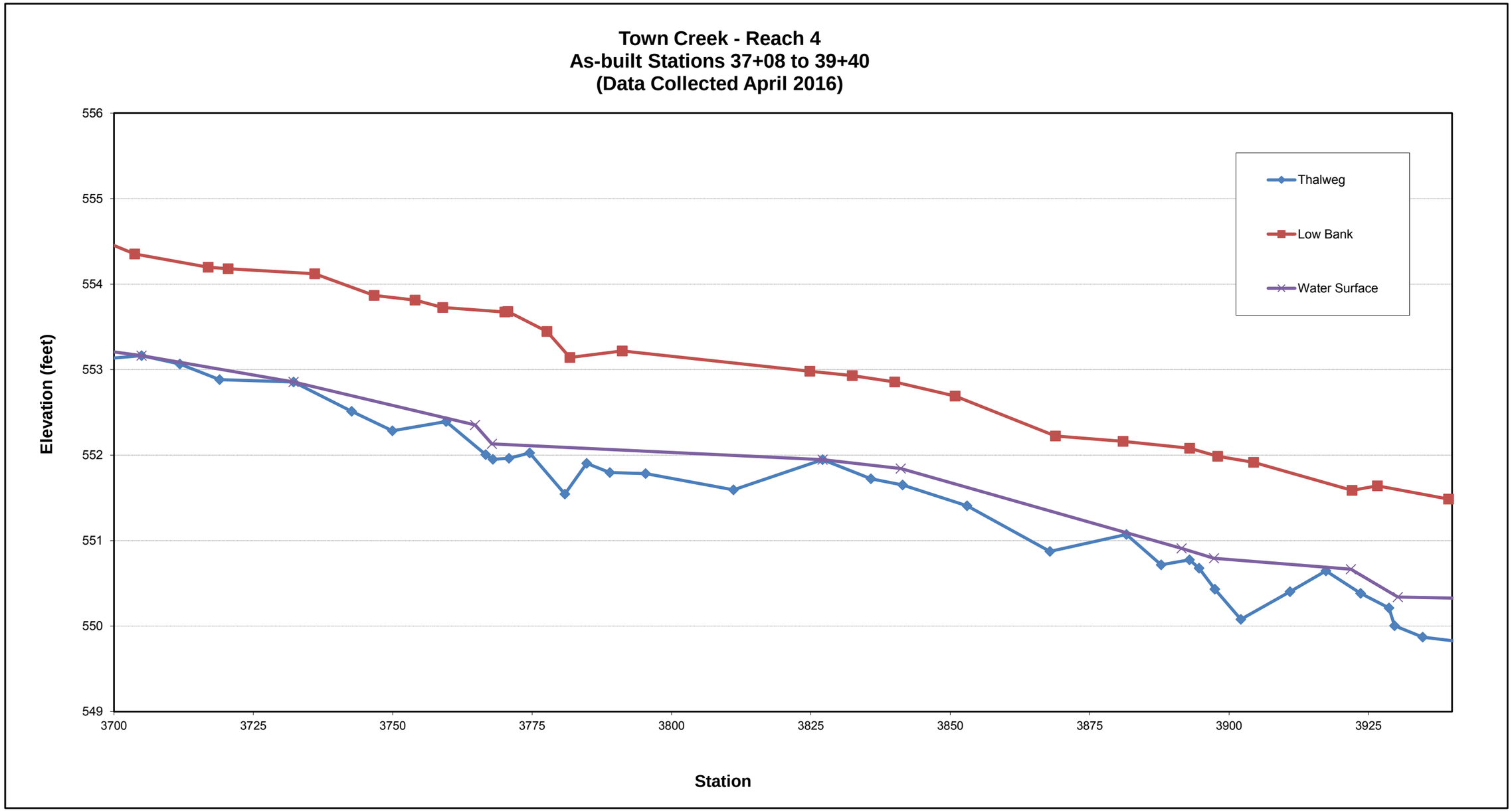
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev	WFPA
Riffle	C	5.97	10.19	0.59	0.91	17.40	1.00	5.55	546.93	546.93	56.59

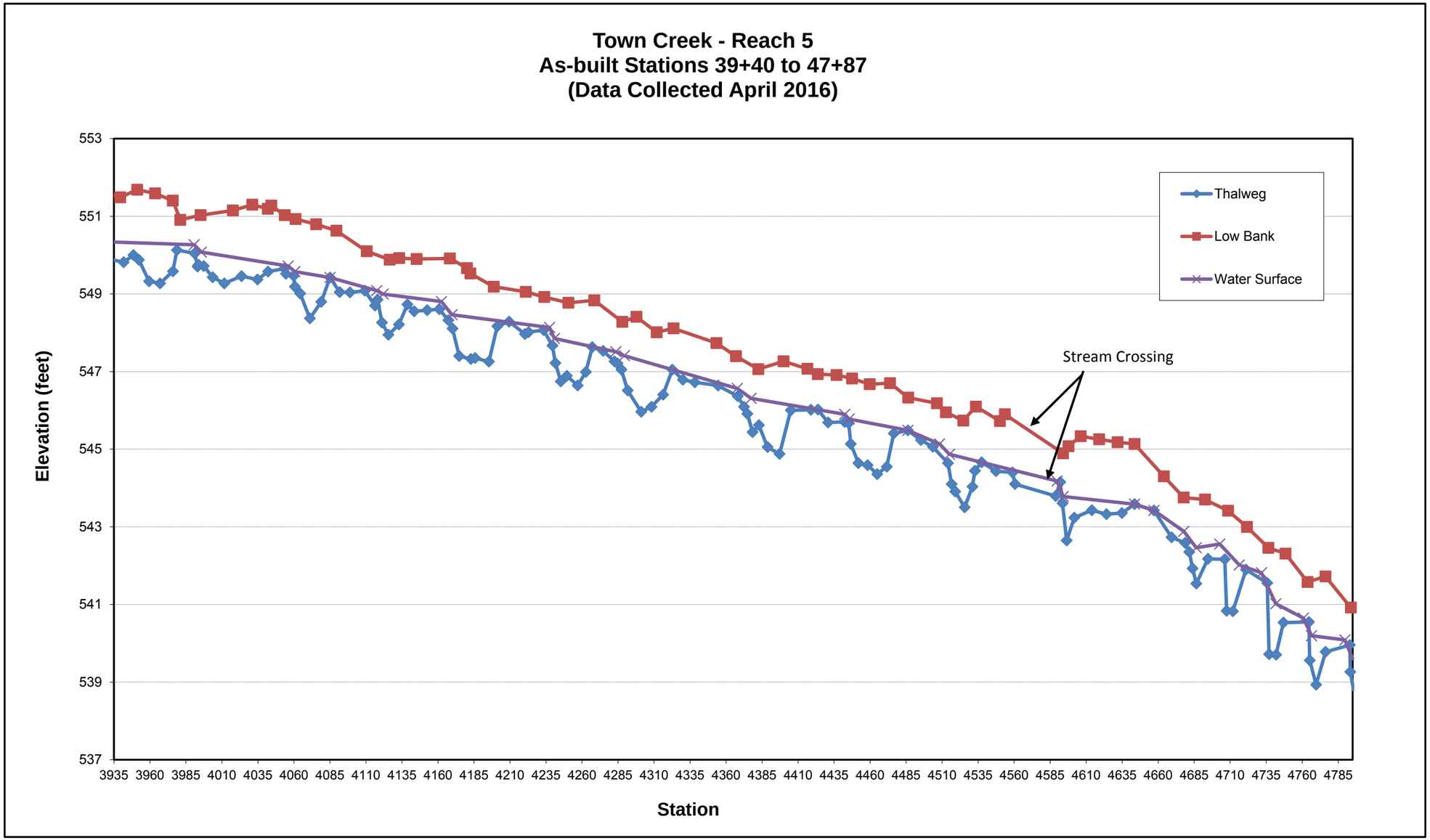



Town Creek - Reach 1
As-built Stations 10+33 to 13+50
(Data Collected April 2016)
Elevation (feet)
594
593
592
591
590
589
588
587
586
585
584
583
1020
1045
1070
1095
1120
1145
1170
1195
1220
1245
1270
1295
1320
1345
Station
Thalweg
Low Bank
Water Surface


Town Creek - Reach 2
As-built Stations 13+50 to 20+61
(Data Collected April 2016)
Elevation (feet)
588
587
586
585
584
583
582
581
580
579
578
577
576
575
574
573
572
571
1345
1370
1395
1420
1445
1470
1495
1520
1545
1570
1595
1620
1645
1670
1695
1720
1745
1770
1795
1820
1845
1870
1895
1920
1945
1970
1995
2020
2045
Station
Thalweg
Low Bank
Water Surface


Town Creek - Reach 3
As-built Stations 20+87 to 37+08
(Data Collected April 2016)
Elevation (feet)
577
576
575
574
573
572
571
570
569
568
567
566
565
564
563
562
561
560
559
558
557
556
555
554
553
552
551
550
2065
2115
2165
2215
2265
2315
2365
2415
2465
2515
2565
2615
2665
2715
2765
2815
2865
2915
2965
3015
3065
3115
3165
3215
3265
3315
3365
3415
3465
3515
3565
3615
3665
Station
Thalweg
Low Bank
Water Surface


Town Creek - Reach 4
As-built Stations 37+08 to 39+40
(Data Collected April 2016)
Elevation (feet)
556
555
554
553
552
551
550
549
3700
3725
3750
3775
3800
3825
3850
3875
3900
3925
Station
Thalweg
Low Bank
Water Surface


Town Creek - Reach 5
As-built Stations 39+40 to 47+87
(Data Collected April 2016)
Elevation (feet)
553
551
549
547
545
543
541
539
537
3935 3960 3985 4010 4035 4060 4085 4110 4135 4160 4185 4210 4235 4260 4285 4310 4335 4360 4385 4410 4435 4460 4485 4510 4535 4560 4585 4610 4635 4660 4685 4710 4735 4760 4785
Station
Thalweg
Low Bank
Water Surface
Stream Crossing

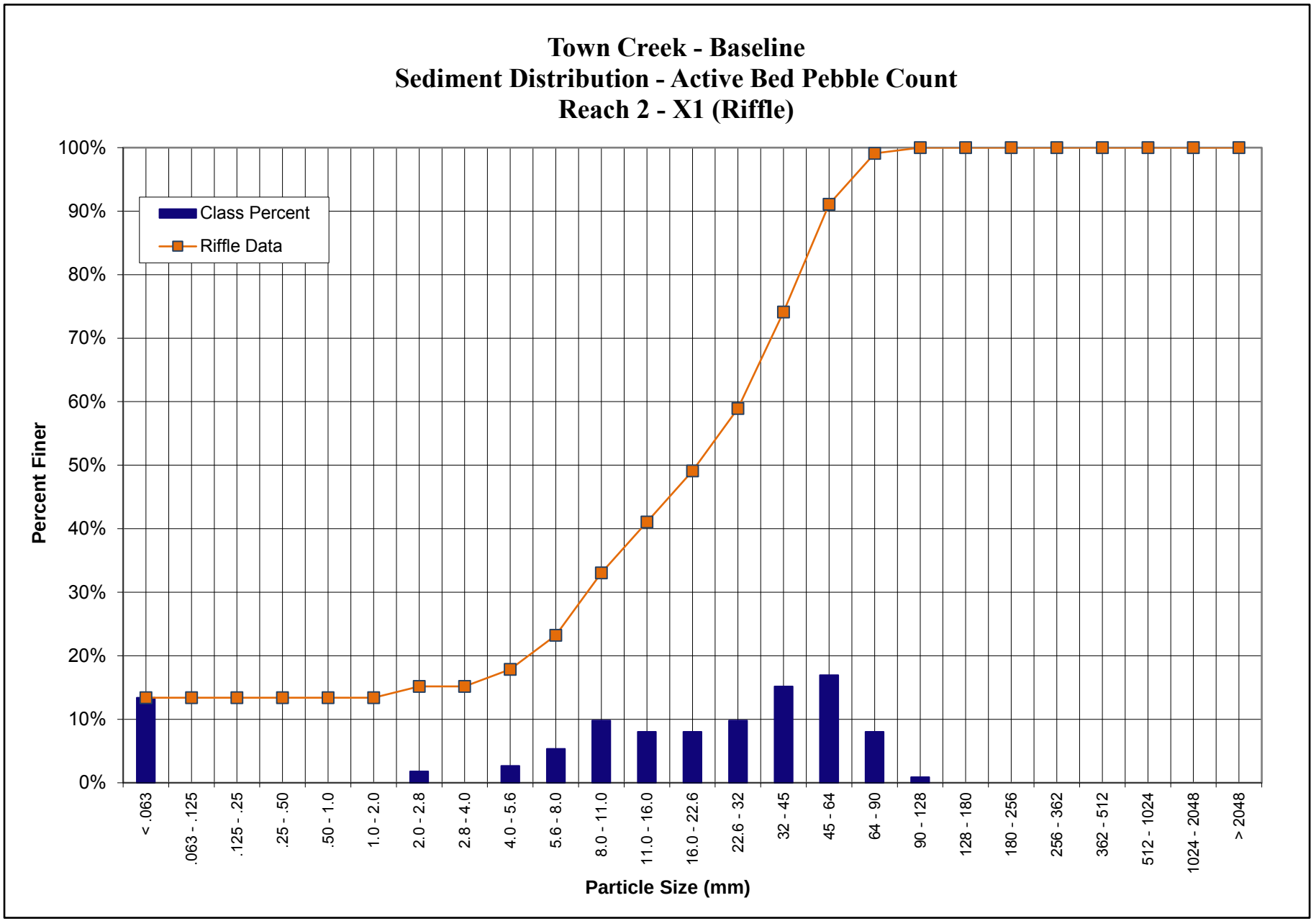
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 2 - X1
DATE COLLECTED:	6/14/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
	Silt / Clay	< .063	15	13%	13%
SAND	Very Fine	.063 - .125			13%
	Fine	.125 - .25			13%
	Medium	.25 - .50			13%
	Coarse	.50 - 1.0			13%
	Very Coarse	1.0 - 2.0			13%
GRAVEL	Very Fine	2.0 - 2.8	2	2%	15%
	Very Fine	2.8 - 4.0			15%
	Fine	4.0 - 5.6	3	3%	18%
	Fine	5.6 - 8.0	6	5%	23%
	Medium	8.0 - 11.0	11	10%	33%
	Medium	11.0 - 16.0	9	8%	41%
	Coarse	16.0 - 22.6	9	8%	49%
	Coarse	22.6 - 32	11	10%	59%
	Very Coarse	32 - 45	17	15%	74%
	Very Coarse	45 - 64	19	17%	91%
COBBLE	Small	64 - 90	9	8%	99%
	Small	90 - 128	1	1%	100%
	Large	128 - 180			100%
	Large	180 - 256			100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	**112**	**100%**	

Largest particles: 100 **(riffle)**

Riffle Channel materials	
D16 =	4.43
D35 =	12.06
D50 =	23.33
D84 =	55.26
D95 =	75.61
D100 =	90 - 128


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 2 - X1 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

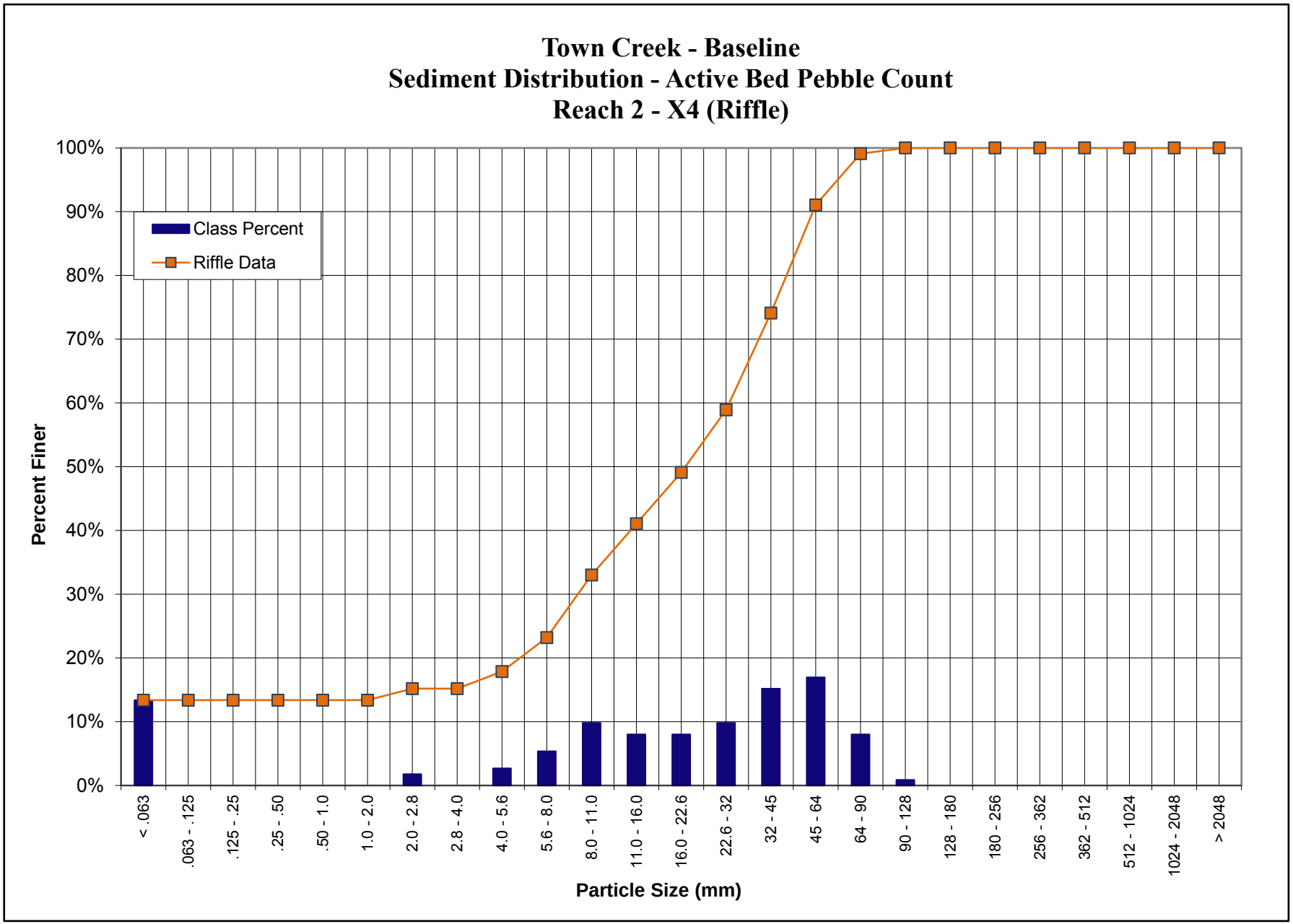
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 2 - X4
DATE COLLECTED:	6/16/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Riffle	Summary Class %	Summary % Cum
	Silt / Clay	< .063	19	19%	19%
SAND	Very Fine	.063 - .125			19%
	Fine	.125 - .25			19%
	Medium	.25 - .50			19%
	Coarse	.50 - 1.0	1	1%	20%
	Very Coarse	1.0 - 2.0			20%
GRAVEL	Very Fine	2.0 - 2.8	4	4%	24%
	Very Fine	2.8 - 4.0	1	1%	25%
	Fine	4.0 - 5.6	4	4%	29%
	Fine	5.6 - 8.0	4	4%	33%
	Medium	8.0 - 11.0	8	8%	41%
	Medium	11.0 - 16.0	8	8%	49%
	Coarse	16.0 - 22.6	5	5%	54%
	Coarse	22.6 - 32	9	9%	63%
	Very Coarse	32 - 45	7	7%	70%
	Very Coarse	45 - 64	8	8%	78%
COBBLE	Small	64 - 90	11	11%	89%
	Small	90 - 128	8	8%	97%
	Large	128 - 180	1	1%	98%
	Large	180 - 256	2	2%	100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	**100**	**100%**	

Largest particles: 210 **(riffle)**

Riffle Channel materials	
D16 =	<0.063
D35 =	8.66
D50 =	17.14
D84 =	77.08
D95 =	117.21
D100 =	180 - 256


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 2 - X4 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

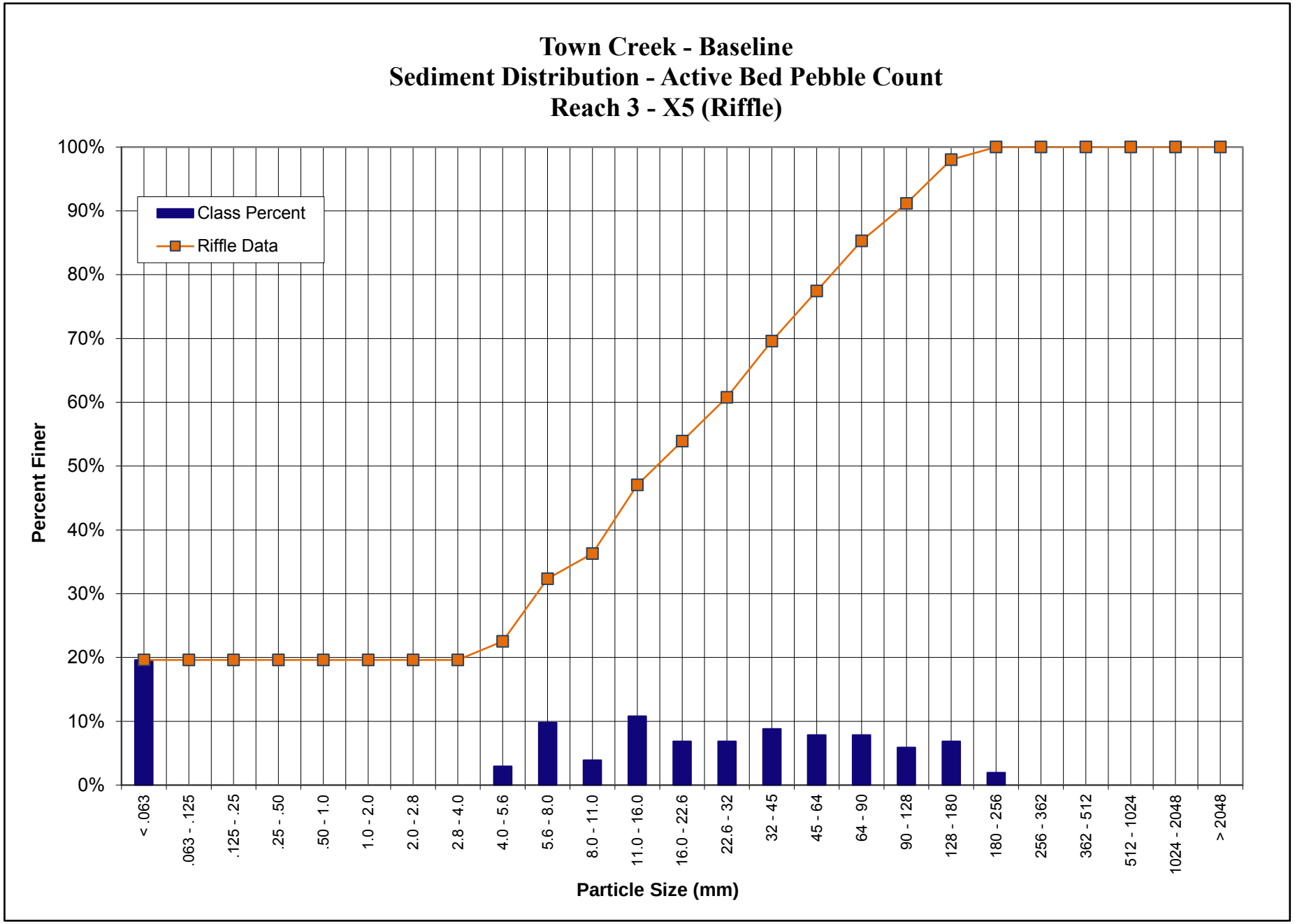
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 3 - X5
DATE COLLECTED:	6/16/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
	Silt / Clay	< .063	20	20%	20%
SAND	Very Fine	.063 - .125			20%
	Fine	.125 - .25			20%
	Medium	.25 - .50			20%
	Coarse	.50 - 1.0			20%
	Very Coarse	1.0 - 2.0			20%
GRAVEL	Very Fine	2.0 - 2.8			20%
	Very Fine	2.8 - 4.0			20%
	Fine	4.0 - 5.6	3	3%	23%
	Fine	5.6 - 8.0	10	10%	32%
	Medium	8.0 - 11.0	4	4%	36%
	Medium	11.0 - 16.0	11	11%	47%
	Coarse	16.0 - 22.6	7	7%	54%
	Coarse	22.6 - 32	7	7%	61%
	Very Coarse	32 - 45	9	9%	70%
	Very Coarse	45 - 64	8	8%	77%
COBBLE	Small	64 - 90	8	8%	85%
	Small	90 - 128	6	6%	91%
	Large	128 - 180	7	7%	98%
	Large	180 - 256	2	2%	100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	102	100%	

Largest particles: 190 **(riffle)**

Riffle Channel materials	
D16 =	<0.063
D35 =	9.92
D50 =	18.55
D84 =	85.08
D95 =	154.78
D100 =	180 - 256


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 3 - X5 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

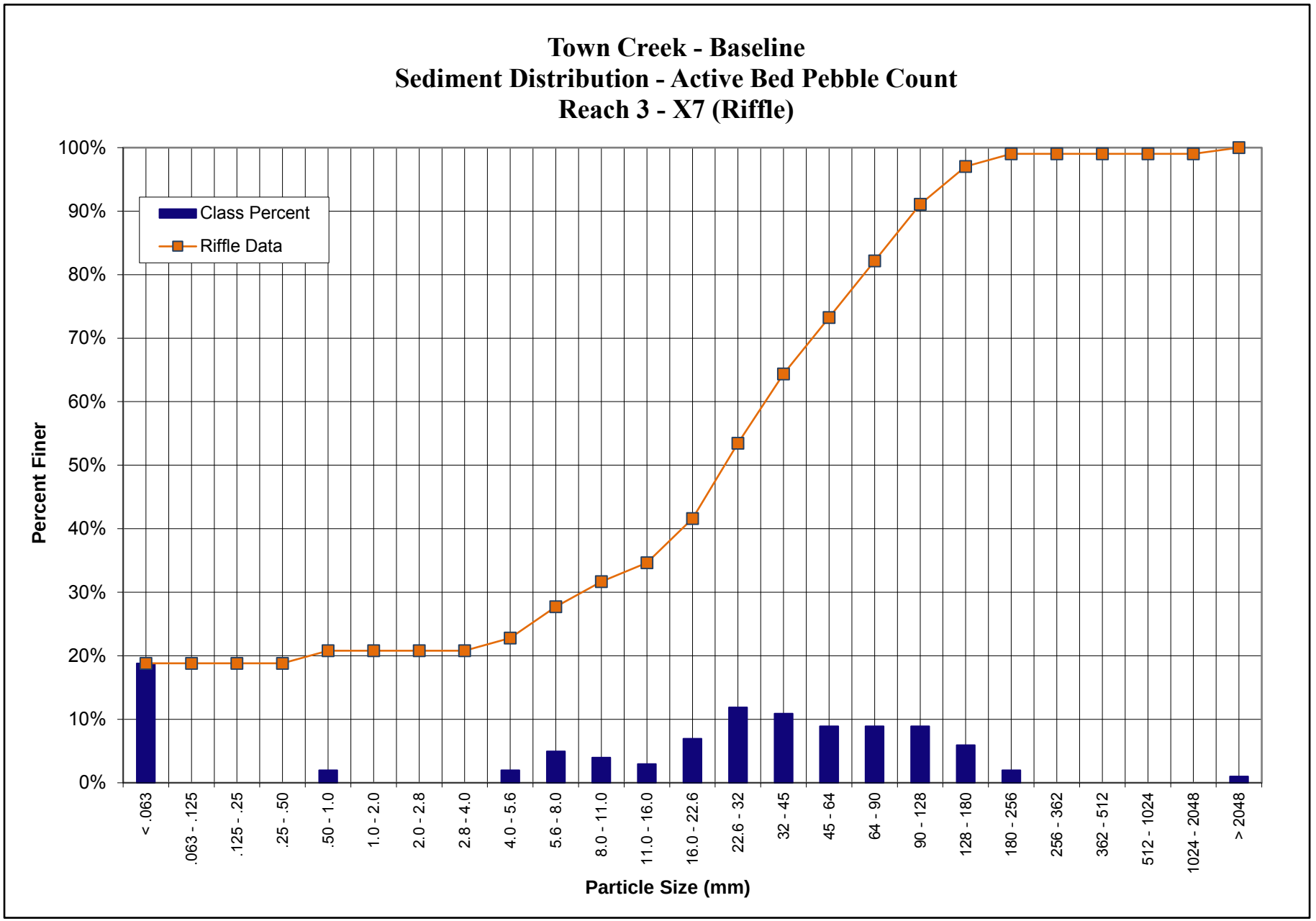
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 3 - X7
DATE COLLECTED:	6/16/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
	Silt / Clay	< .063	19	19%	19%
SAND	Very Fine	.063 - .125			19%
	Fine	.125 - .25			19%
	Medium	.25 - .50			19%
	Coarse	.50 - 1.0	2	2%	21%
	Very Coarse	1.0 - 2.0			21%
GRAVEL	Very Fine	2.0 - 2.8			21%
	Very Fine	2.8 - 4.0			21%
	Fine	4.0 - 5.6	2	2%	23%
	Fine	5.6 - 8.0	5	5%	28%
	Medium	8.0 - 11.0	4	4%	32%
	Medium	11.0 - 16.0	3	3%	35%
	Coarse	16.0 - 22.6	7	7%	42%
	Coarse	22.6 - 32	12	12%	53%
	Very Coarse	32 - 45	11	11%	64%
	Very Coarse	45 - 64	9	9%	73%
COBBLE	Small	64 - 90	9	9%	82%
	Small	90 - 128	9	9%	91%
	Large	128 - 180	6	6%	97%
	Large	180 - 256	2	2%	99%
BOULDER	Small	256 - 362			99%
	Small	362 - 512			99%
	Medium	512 - 1024			99%
	Large-Very Large	1024 - 2048			99%
BEDROCK	Bedrock	> 2048	1	1%	100%
		Total	101	100%	

Largest particles: Bedrock **(riffle)**

Riffle	
Channel materials	
D16 =	<0.063
D35 =	16.28
D50 =	28.91
D84 =	96.72
D95 =	160.21
D100 =	> 2048


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 3 - X7 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

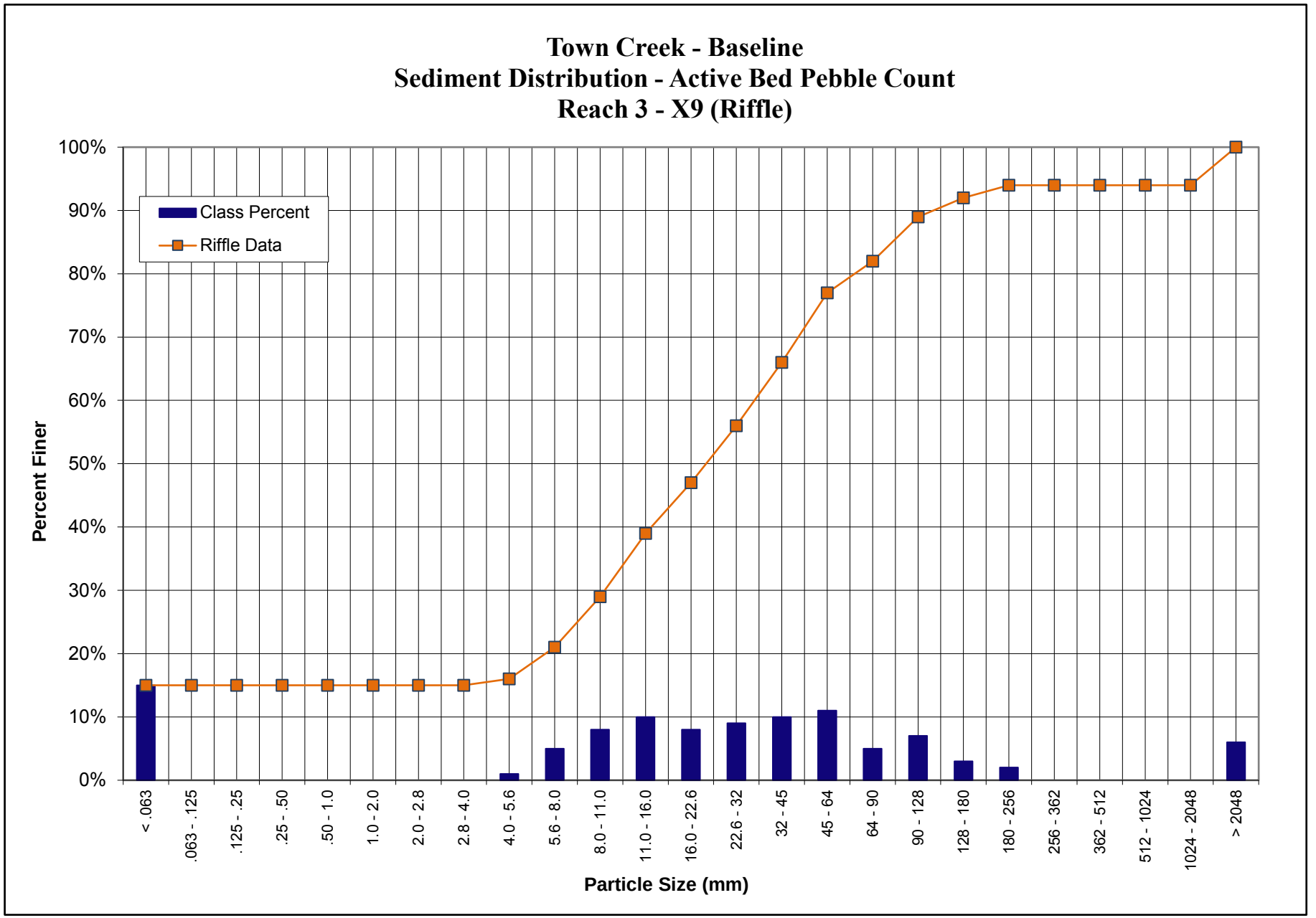
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 3 - X9
DATE COLLECTED:	6/14/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
	Silt / Clay	< .063	15	15%	15%
SAND	Very Fine	.063 - .125			15%
	Fine	.125 - .25			15%
	Medium	.25 - .50			15%
	Coarse	.50 - 1.0			15%
	Very Coarse	1.0 - 2.0			15%
GRAVEL	Very Fine	2.0 - 2.8			15%
	Very Fine	2.8 - 4.0			15%
	Fine	4.0 - 5.6	1	1%	16%
	Fine	5.6 - 8.0	5	5%	21%
	Medium	8.0 - 11.0	8	8%	29%
	Medium	11.0 - 16.0	10	10%	39%
	Coarse	16.0 - 22.6	8	8%	47%
	Coarse	22.6 - 32	9	9%	56%
	Very Coarse	32 - 45	10	10%	66%
	Very Coarse	45 - 64	11	11%	77%
COBBLE	Small	64 - 90	5	5%	82%
	Small	90 - 128	7	7%	89%
	Large	128 - 180	3	3%	92%
	Large	180 - 256	2	2%	94%
BOULDER	Small	256 - 362			94%
	Small	362 - 512			94%
	Medium	512 - 1024			94%
	Large-Very Large	1024 - 2048			94%
BEDROCK	Bedrock	> 2048	6	6%	100%
		Total	**100**	**100%**	

Largest particles: Bedrock **(riffle)**

Riffle	
Channel materials	
D16 =	5.60
D35 =	13.77
D50 =	25.38
D84 =	99.53
D95 =	>2048
D100 =	> 2048


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 3 - X9 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

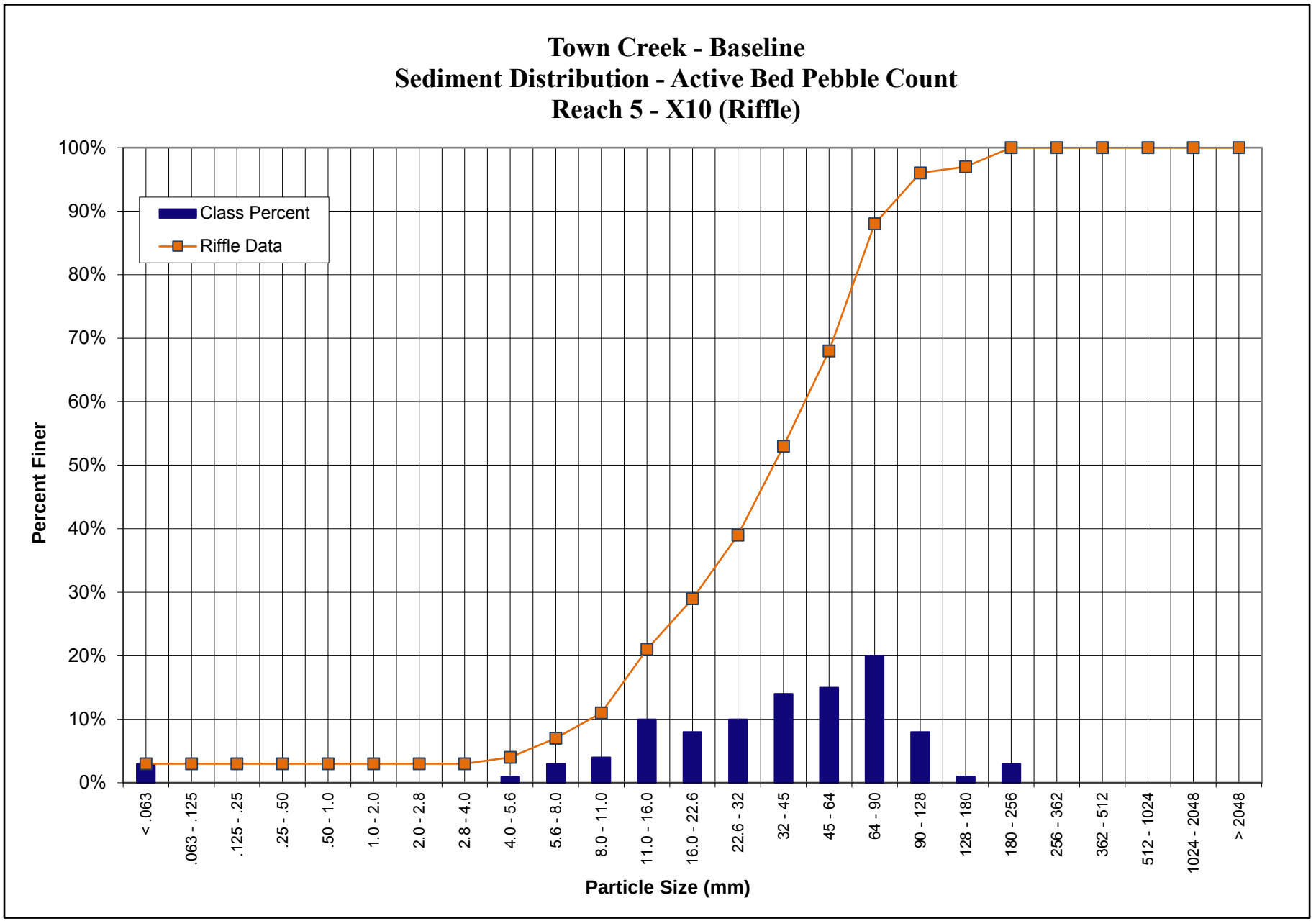
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 5 - X10
DATE COLLECTED:	6/15/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
	Silt / Clay	< .063	3	3%	3%
SAND	Very Fine	.063 - .125			3%
	Fine	.125 - .25			3%
	Medium	.25 - .50			3%
	Coarse	.50 - 1.0			3%
	Very Coarse	1.0 - 2.0			3%
GRAVEL	Very Fine	2.0 - 2.8			3%
	Very Fine	2.8 - 4.0			3%
	Fine	4.0 - 5.6	1	1%	4%
	Fine	5.6 - 8.0	3	3%	7%
	Medium	8.0 - 11.0	4	4%	11%
	Medium	11.0 - 16.0	10	10%	21%
	Coarse	16.0 - 22.6	8	8%	29%
	Coarse	22.6 - 32	10	10%	39%
	Very Coarse	32 - 45	14	14%	53%
	Very Coarse	45 - 64	15	15%	68%
COBBLE	Small	64 - 90	20	20%	88%
	Small	90 - 128	8	8%	96%
	Large	128 - 180	1	1%	97%
	Large	180 - 256	3	3%	100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	**100**	**100%**	

Largest particles: 200 **(riffle)**

Riffle Channel materials	
D16 =	13.27
D35 =	27.84
D50 =	41.83
D84 =	84.07
D95 =	122.49
D100 =	180 - 256


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 5 - X10 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

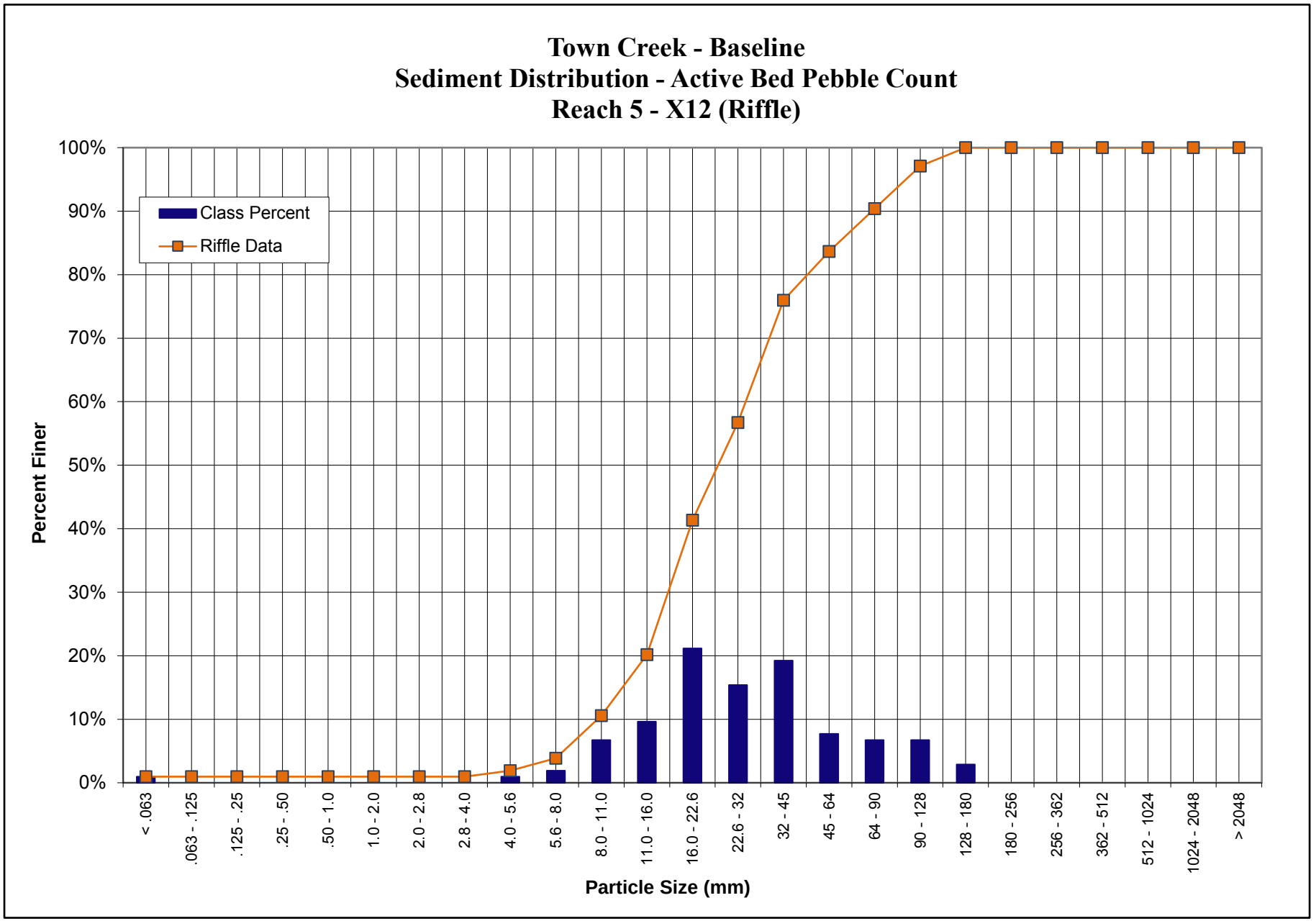
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

BAKER PROJECT NO.	124526
SITE OR PROJECT:	Town Creek - Baseline
REACH/LOCATION:	Reach 5 - X12
DATE COLLECTED:	6/15/2016
FIELD COLLECTION BY:	KS & DH
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary	
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum
	Silt / Clay	< .063	1	1%	1%
SAND	Very Fine	.063 - .125			1%
	Fine	.125 - .25			1%
	Medium	.25 - .50			1%
	Coarse	.50 - 1.0			1%
	Very Coarse	1.0 - 2.0			1%
GRAVEL	Very Fine	2.0 - 2.8			1%
	Very Fine	2.8 - 4.0			1%
	Fine	4.0 - 5.6	1	1%	2%
	Fine	5.6 - 8.0	2	2%	4%
	Medium	8.0 - 11.0	7	7%	11%
	Medium	11.0 - 16.0	10	10%	20%
	Coarse	16.0 - 22.6	22	21%	41%
	Coarse	22.6 - 32	16	15%	57%
	Very Coarse	32 - 45	20	19%	76%
	Very Coarse	45 - 64	8	8%	84%
COBBLE	Small	64 - 90	7	7%	90%
	Small	90 - 128	7	7%	97%
	Large	128 - 180	3	3%	100%
	Large	180 - 256			100%
BOULDER	Small	256 - 362			100%
	Small	362 - 512			100%
	Medium	512 - 1024			100%
	Large-Very Large	1024 - 2048			100%
BEDROCK	Bedrock	> 2048			100%
		Total	**104**	**100%**	

Largest particles: 178 **(riffle)**

Riffle Channel materials	
D16 =	13.59
D35 =	20.38
D50 =	27.48
D84 =	65.13
D95 =	114.59
D100 =	128 - 180


Town Creek - Baseline
Sediment Distribution - Active Bed Pebble Count
Reach 5 - X12 (Riffle)
Class Percent
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
< .063
.063 - .125
.125 - .25
.25 - .50
.50 - 1.0
1.0 - 2.0
2.0 - 2.8
2.8 - 4.0
4.0 - 5.6
5.6 - 8.0
8.0 - 11.0
11.0 - 16.0
16.0 - 22.6
22.6 - 32
32 - 45
45 - 64
64 - 90
90 - 128
128 - 180
180 - 256
256 - 362
362 - 512
512 - 1024
1024 - 2048
> 2048
Particle Size (mm)

APPENDIX C

Vegetation Summary Data
Tables 7 and 8
CVS Tables

Table 7. Vegetation Species Planted Across the Restoration Site Town Creek Restoration Project - Option B: DMS Project ID No. 95026				
Botanical Name	**Common Name**	**% Planted by Species**	**Wetland Tolerance**	**Number of Stems**
Bare-Root Overstory Species				
Betula nigra	river birch	8%	FACW	612
Carpinus caroliniana	ironwood	2%	FAC	125
Fraxinus pennsylvanica	green ash	8%	FACW	589
Liriodendron tulipfera	tulip poplar	6%	FACU	448
Platanus occidentalis	sycamore	7%	FACW	542
Quercus michauxii	swamp chestnut oak	7%	FACW	500
Quercus falcata	Southern red oak	6%	FACU	440
Quercus alba	white oak	3%	FACU	200
Quercus phellos	willow oak	10%	FAC	730
Quercus pagoda	cherry bark oak	6%	FACW	400
Bare-Root Understory Species				
Cercis canadensis	redbud	4%	FACU	300
Callicarpa americana	beautyberry	3%	FACU	250
Sambucus nigra	elderberry	1%	FAC	100
Asimina triloba	paw paw	8%	FAC	588
Cornus amomum	silky dogwood	10%	FACW	742
Diospyros virginiana	persimmon	11%	FAC	770
Total Species Planted		**100%**		**7,336**
Total Acreage Planted		**10.73**	**# Stems / Acre**	**684**
Riparian Live Stake Plantings				
Cornus amomum	silky dogwood	10%	FAC	
Salix nigra	black willow	10%	OBL	
Salix sericea	silky willow	40%	OBL	
Sambucus nigra	elderberry	40%	FAC	

Table 8. Planted and Total Stem Counts (Species by Plot with Annual Means)
Town Creek Restoration Project - Option B: DMS Project ID No. 95026

Tree Species	Common Name	Type	Current Data (AB 2016)																							Annual Means			
			Plot 1			Plot 2			Plot 3			Plot 4			Plot 5			Plot 6			Plot 7			Plot 8			Current Mean		AB (2016)	
			PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	PnoL	P-all	T	P	T	P	T
Asimina triloba	paw paw	Tree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1
Betula nigra	river birch	Tree	3	3	3	0	0	0	2	2	2	1	1	1	0	0	0	2	2	2	0	0	0	4	4	4	11	11	11	11
Callicarpa americana	American beautyberry	Shrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	4	4	4	0	0	0	7	7	7	7
Carpinus caroliniana	ironwood	Tree	1	1	1	2	2	2	1	1	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	4
Cercis canadensis	redbud	Tree	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	1	1	1	0	0	0	7	7	7	7
Cornus amomum	silky dogwood	Shrub	0	0	0	0	0	0	0	0	0	5	5	5	0	0	0	0	0	0	5	5	5	0	0	0	5	5	5	5
Diospyros virginiana	common persimmon	Tree	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	3	3	3	3
Fraxinus pennsylvanica	green ash	Tree	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lirodendron tulipifera	tulip poplar	Tree	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Platanus occidentalis	sycamore	Tree	2	2	2	2	2	2	4	4	4	2	2	2	3	3	3	4	4	4	0	0	0	13	13	13	28	28	28	28
Quercus alba	white oak	Tree	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	0	0	0	8	8	8	8
Quercus falcata	southern red oak	Tree	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3
Quercus michuaxii	swamp chestnut oak	Tree	6	6	6	4	4	4	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	15	15	15	15
Quercus pagoda	cherrybark oak	Tree	0	0	0	5	5	5	5	5	5	0	0	0	5	5	5	3	3	3	0	0	0	2	2	2	20	20	20	20
Quercus phellos	willow oak	Tree	0	0	0	5	5	5	5	5	5	0	0	0	5	5	5	3	3	3	0	0	0	2	2	2	20	20	20	20
Sambucus nigra	elderberry	Shrub	0	0	0	2	2	2	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	1	1	1	3	3	3	3
	Stems Per Plot		18	18	18	21	21	21	20	20	20	15	15	15	16	16	16	21	21	21	14	14	14	25	25	25	135	135	135	135
	Plot area (ares)		1			1			1			1			1			1			1			1			8	8	8	8
	Plot area (acres)		0.025			0.025			0.025			0.025			0.025			0.025			0.025			0.025			0.20	0.20	0.20	0.20
	Species Count		7	7	7	7	7	7	7	7	7	6	6	6	4	4	4	7	7	7	4	4	4	6	6	6	14	14	14	14
	Stems Per Acre		720	720	720	840	840	840	800	800	800	600	600	600	640	640	640	840	840	840	560	560	560	1000	1000	1000	675	675	675	675

Notes: CVS Level 1 Survey performed.

PnoL = Planted No Live Stakes
P-all = Planted Including Live Stakes
Total = Total number of Plants

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%

CVS Table: Metadata	
Report Prepared By	Kristi Suggs
Date Prepared	11/15/2016 12:05
database name	124526_TownCreek_cvs-eep-entrytool-v2.3.1.mdb
database location	C:\My Documents\Baker\CVS\124526_TownCreek
computer name	CHABLKSUGGS
file size	58146816
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	95026
project Name	Town Creek Restoration Project - Option B
Description	
River Basin	Yadkin-Pee Dee
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	8

CVS Table: Planted Stems			
Living planted stems, excluding live stakes, per acre: Negative (red) numbers indicate the project failed to reach requirements in a particular year.			
Project Code	**Project Name**	**River Basin**	**Year 0 (baseline)**
95026	Town Creek Restoration Project - Option B	Yadkin-Pee Dee	804.3127155

CVS Table: Total Stems			
Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems:			
Project Code	**Project Name**	**River Basin**	**Year 0 (baseline)**
95026	Town Creek Restoration Project - Option B	Yadkin-Pee Dee	804.3127155

CVS Table: Vigor		
vigor	**Count**	**Percent**
4	159	100

CVS Table: Damage		
Damage	**Count**	**Percent Of Stems**
(no damage)	159	100

CVS Table: Project Plots																			
plot	Plot Level	Year	Latitude/ Northing	Longitude/ Easting	Zone	Datum	Date Sampled	Planted Living Stems	Planted Living Stems EXCLUDING Live Stakes	Dead/Missing Stems	Natural (Volunteer) Stems	Total Living Stems	Total Living Stems EXCLUDING Live Stakes	Planted Living Stems per ACRE	Planted Living Stems EXCLUDING Live Stakes PER ACRE	Natural (Volunteer) Stems PER ACRE	Total Living Stems PER ACRE	Total Living Stems EXCLUDING Live Stakes PER ACRE	# species
95026-01-VP1	1	0					6/14/2016	22	22	0	0	22	22	890.3084146	890.3084146	0	890.3084146	890.3084146	8
95026-01-VP2	1	0					6/14/2016	21	21	0	0	21	21	849.8398503	849.8398503	0	849.8398503	849.8398503	8
95026-01-VP3	1	0					6/14/2016	19	19	0	0	19	19	768.9027217	768.9027217	0	768.9027217	768.9027217	8
95026-01-VP4	1	0					6/14/2016	21	21	0	0	21	21	849.8398503	849.8398503	0	849.8398503	849.8398503	7
95026-01-VP5	1	0					6/15/2016	23	23	0	0	23	23	930.7769789	930.7769789	0	930.7769789	930.7769789	5
95026-01-VP6	1	0					6/15/2016	18	18	0	0	18	18	728.4341574	728.4341574	0	728.4341574	728.4341574	6
95026-01-VP7	1	0					6/15/2016	18	18	0	0	18	18	728.4341574	728.4341574	0	728.4341574	728.4341574	6
95026-01-VP8	1	0					6/15/2016	17	17	0	0	17	17	687.9655931	687.9655931	0	687.9655931	687.9655931	4

CVS Table: Vigor by Species									
	Species	**CommonName**	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Asimina triloba	pawpaw	1						
	Betula nigra	river birch	12						
	Callicarpa americana	American beautyberry	1						
	Cornus amomum	silky dogwood	14						
	Diospyros virginiana	common persimmon	4						
	Fraxinus pennsylvanica	green ash	2						
	Quercus alba	white oak	3						
	Quercus falcata	southern red oak	5						
	Quercus michauxii	swamp chestnut oak	9						
	Quercus pagoda	cherrybark oak	6						
	Quercus phellos	willow oak	47						
	Sambucus nigra	European black elderberry	2						
	Carpinus caroliniana	American hornbeam	1						
	Cercis canadensis	eastern redbud	11						
	Liriodendron tulipifera	tuliptree	27						
	Platanus occidentalis	American sycamore	14						
TOT:	**16**	**16**	**159**						

CVS Table: Damage by Species

	Species	CommonName	Count of Damage Categories	(no damage)	
	Asimina triloba	pawpaw	0	1	
	Betula nigra	river birch	0	12	
	Callicarpa americana	American beautyberry	0	1	
	Carpinus caroliniana	American hornbeam	0	1	
	Cercis canadensis	eastern redbud	0	11	
	Cornus amomum	silky dogwood	0	14	
	Diospyros virginiana	common persimmon	0	4	
	Fraxinus pennsylvanica	green ash	0	2	
	Liriodendron tulipifera	tuliptree	0	27	
	Platanus occidentalis	American sycamore	0	14	
	Quercus alba	white oak	0	3	
	Quercus falcata	southern red oak	0	5	
	Quercus michauxii	swamp chestnut oak	0	9	
	Quercus pagoda	cherrybark oak	0	6	
	Quercus phellos	willow oak	0	47	
	Sambucus nigra	European black elderberry	0	2	
TOT:	**16**	**16**	**0**	**159**	

CVS Table: Damage by Plot

	plot	Count of Damage Categories	(no damage)	
	95026-01-VP1	0	22	
	95026-01-VP2	0	21	
	95026-01-VP3	0	19	
	95026-01-VP4	0	21	
	95026-01-VP5	0	23	
	95026-01-VP6	0	18	
	95026-01-VP7	0	18	
	95026-01-VP8	0	17	
TOT:	**8**	**0**	**159**	

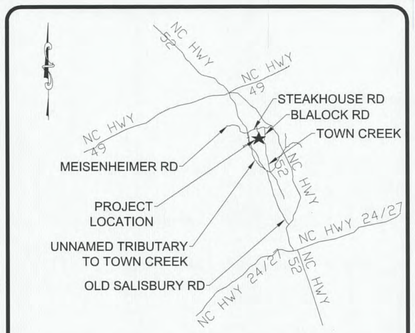
CVS Table: Planted Stems by Plot and Species

	Comment	Species	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot 95026-01-VP1	plot 95026-01-VP2	plot 95026-01-VP3	plot 95026-01-VP4	plot 95026-01-VP5	plot 95026-01-VP6	plot 95026-01-VP7	plot 95026-01-VP8
		Asimina triloba	Shrub Tree	pawpaw	1	1	1					1			
		Betula nigra	Tree	river birch	12	5	2.4	3		2	1		2		4
		Callicarpa americana	Shrub	American beautyberry	1	1	1		1						
		Carpinus caroliniana	Shrub Tree	American hornbeam	1	1	1				1				
		Cercis canadensis	Shrub Tree	eastern redbud	11	2	5.5					7	4		
		Cornus amomum	Shrub	silky dogwood	14	5	2.8		4	4	1	4		1	
		Diospyros virginiana	Tree	common persimmon	4	1	4			4					
		Fraxinus pennsylvanica	Tree	green ash	2	2	1	1						1	
		Liriodendron tulipifera	Tree	tuliptree	27	7	3.86	3	3	3		5	1	6	6
		Platanus occidentalis	Tree	American sycamore	14	4	3.5	2		1				5	6
		Quercus alba	Tree	white oak	3	3	1	1			1	1			
		Quercus falcata	Tree	southern red oak	5	3	1.67	3	1	1					
		Quercus michauxii	Tree	swamp chestnut oak	9	3	3		3		2		4		
		Quercus pagoda	Tree	cherrybark oak	6	4	1.5		1	1	3			1	
		Quercus phellos	Tree	willow oak	47	8	5.88	8	7	3	12	6	6	4	1
		Sambucus nigra	Shrub Tree	European black elderberry	2	2	1	1	1						
TOT:	**0**	**16**	**16**	**16**	**159**	**16**		**22**	**21**	**19**	**21**	**23**	**18**	**18**	**17**

APPENDIX D

As-Built / Record Drawings

PROJECT: 124526 TOWN CREEK RESTORATION PROJECT-OPTION B



VICINITY MAP
NOT TO SCALE

NC DIVISION OF MITIGATION SERVICES

STANLY COUNTY

LOCATION:
APPROXIMATELY 1.5 MILES WEST OF THE TOWN OF NEW LONDON, NC NEAR THE INTERSECTION OF STEAKHOUSE ROAD AND OLD SALISBURY ROAD

TYPE OF WORK: AS-BUILT SURVEY / RECORD DRAWING

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	124526	1	24

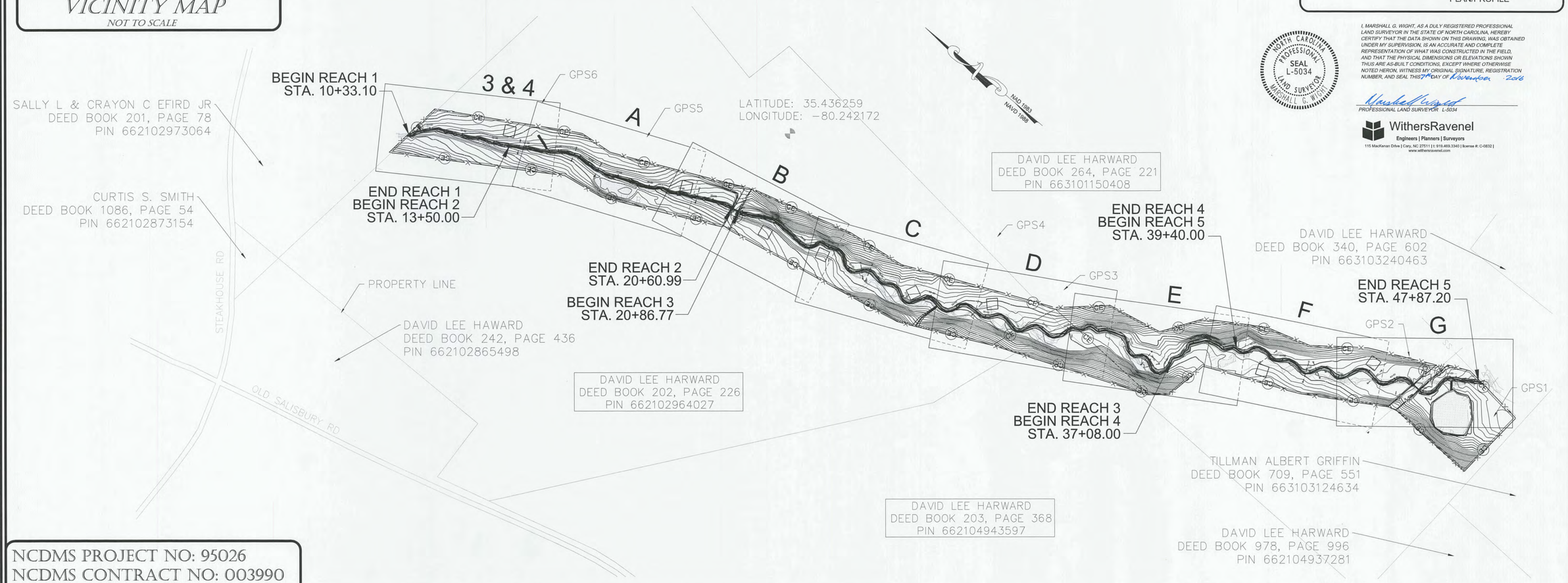
SHEET INDEX

NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

I, MARSHALL G. WIGHT, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THUS ARE AS-BUILT CONDITIONS, EXCEPT WHERE OTHERWISE NOTED HERON, WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 7TH DAY OF November, 2016

PROFESSIONAL LAND SURVEYOR L-5034

WithersRavenel
Engineers | Planners | Surveyors
115 MacKenan Drive | Cary, NC 27511 | t: 919.469.3340 | license #: C-0832 |
www.withersravenel.com



NCDMS PROJECT NO: 95026
NCDMS CONTRACT NO: 003990

GRAPHIC SCALES

20 0 20 40
PLANS
20 0 20 40
PROFILE (HORIZONTAL)
4 0 4 8
PROFILE (VERTICAL)

CONTROL POINTS

POINT	NORTHING	EASTING	ELEVATION
GPS1	613754.25	1630860.98	541.40
GPS2	614063.02	1630823.49	553.43
GPS3	614976.29	1630276.26	573.19
GPS4	615228.37	1630262.04	585.99
GPS5	616217.36	1629783.66	600.72
GPS6	616519.86	1629648.52	601.23

AS-BUILT SUMMARY

REACH NAME	METHOD	AS-BUILT LENGTH (FT)
1	RESTORATION	317
2	ENHANCEMENT I	711
3	RESTORATION	1621
4	ENHANCEMENT I	232
5	RESTORATION	822

PREPARED FOR THE OFFICE OF:

NCDEQ
DIVISION OF MITIGATION SERVICES
5 RAVENCROFT DR., #102
ASHEVILLE, NC 28801

NCDMS CONTACT: HARRY TSOMIDES
PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
9716-B Rea Road #56
Charlotte, NORTH CAROLINA 28277
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

JACOB M. BYERS, PE
PROJECT ENGINEER
KRISTI SUGGS
PROJECT MANAGER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

SIGNATURE 11/8/16 P.E.

CONVENTIONAL SYMBOLS - PLAN VIEW

EXISTING MAJOR CONTOUR

EXISTING MINOR CONTOUR

EXISTING STREAM ALIGNMENT

SS — EXISTING SANITARY SEWER

OE — EXISTING OVERHEAD ELECTRIC

EXISTING FENCE

10+00 — DESIGN STREAM ALIGNMENT

FLOW — FLOW DIRECTION

DESIGN TOP OF BANK

LOD — LOD — LIMITS OF DISTURBANCE

DESIGN FENCE

DESIGN GATE

CE — CONSERVATION EASEMENT

EXISTING TREE

EXISTING WETLAND

ROCK CROSS VANE

LOG J-HOOK

BOULDER STEP

BOULDER TOE

CONSTRUCTED RIFFLE

LOG VANE

ROOT WADS

ANGLED LOG STEP

VEGETATED GEOLIFT

TOE WOOD

TRANSPLANT

VEG PLOT

CREST GUAGE

FLOW GUAGE

PHOTO POINT

AS-BUILT
SURVEYED CROSS SECTION

1200 — AS-BUILT MAJOR CONTOUR

AS-BUILT MINOR CONTOUR

AS-BUILT THALWEG

AS-BUILT TOP OF BANK

CONVENTIONAL SYMBOLS - PROFILE VIEW

AS-BUILT THALWEG

AS-BUILT LOW BANK

PROPOSED THALWEG

PROPOSED LOW BANK

EXISTING GROUND

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	1-A

NCDMS PROJECT NO. 95026

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/9/16
DATE:

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Michael Baker Engineering Inc.
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Charlotte, NORTH CAROLINA 28277
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

AS BUILT /RECORD DRAWING

TOWN CREEK RESTORATION PROJECT-OPTION B

CONVENTIONAL SYMBOLS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	1-B
NCDMS PROJECT NO. 95026	

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

APPROVED BY:

11/8/16
DATE:

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Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

AS BUILT /RECORD DRAWING

GENERAL NOTES
1. CONSTRUCTION BEGAN IN OCTOBER 2015 AND WAS COMPLETED IN JANUARY 2016
2. RIPARIAN VEGETATION PLANTING BEGAN IN MARCH 2016 AND WAS COMPLETED IN MARCH 2016

STANDARD SPECIFICATIONS
NORTH CAROLINA
6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
6.24 RIPARIAN AREA SEEDING
6.62 TEMPORARY SILT FENCE
6.63 TEMPORARY ROCK DAM
6.70 TEMPORARY STREAM CROSSING

The folloing table lists the bare root vegetation selection for the project site. The planting area is approximately 11 acres.

Riparian Buffer - Overstory Trees (8' x 8' spacing - 680 stems / acre)

Scientific Name	Common Name	% Planted by Species	Wetland Tolerance	Approx. Number of Stems
Betula nigra	river birch	8%	FACW	612
Carpinus caroliniana	ironwood	2%	FAC	125
Fraxinus pennsylvanica	green ash	8%	FACW	589
Liriodendron tulipfera	tulip poplar	6%	FACU	448
Platanus occidentalis	sycamore	7%	FACW	542
Quercus michauxii	swamp chestnut oak	7%	FACW	500
Quercus falcata	Southern red oak	6%	FACU	440
Quercus alba	white oak	3%	FACU	200
Quercus phellos	willow oak	10%	FAC	730
Quercus pagoda	cherry bark oak	6%	FACW	400

Riparian Buffer - Understory (8' x 8' spacing - 680 stems / acre)

Scientific Name	Common Name	% Planted by Species	Wetland Tolerance	Approx. Number of Stems
Cercis canadensis	redbud	4%	FACU	300
Callicarpa americana	beautyberry	3%	FACU	250
Sambucus nigra	elderberry	1%	FAC	100
Asimina triloba	paw paw	8%	FAC	588
Cornus amomum	silky dogwood	10%	FACW	742
Diospyros virginiana	persimmon	11%	FAC	770
Total Species Planted		**100%**		**7,336**
Total Acreage Planted		**10.73**	**# Stems / Acre**	**684**

Live staking was applied to all restored streambanks following the details in this plan set and according to the construction specifications.

Scientific Name	Common Name	% Planted by Species	Wetland Tolerance
Cornus amomum	silky dogwood	10%	FAC
Salix nigra	black willow	10%	OBL
Salix sericea	silky willow	40%	OBL
Sambucus nigra	elderberry	40%	FAC

Permanent herbaceous seed mixtures for the project site were planted throughout thte floodplain and riparian buffer areas. Permanent seed mixtures were applied with temporary seed, as defined in the construction specifications

Scientific Name	Common Name	% Planted by Species	Lbs. / Acre	Wetland Tolerance
Andropogon gerardii	Big blue stem	10%	1.5	FAC
Dichanthelium clandestinum	Deer Tongue	15%	2.25	FAC
Carex crinita	Fringed sedge	10%	1.5	OBL
Chasmanthium latifolium	River oats	5%	0.75	FACU
Elymus virginicus	Virginia wild rye	15%	2.25	FACW
Juncus effusus	Soft rush	5%	0.75	FACW
Panicum virgatum	Switchgrass	10%	1.5	FAC
Polygonum pensylvanicum	Pennsylvania Smartweed	5%	0.75	FACW
Schizachyrium scoparium	Little blue stem	10%	1.5	FACU
Tripsacum dactyloides	Eastern gamagrass	5%	0.75	FACW
Sorghastrum nutans	Indiangrass	10%	1.5	FACU

TOWN CREEK RESTORATION PROJECT-OPTION B

GENERAL NOTES & VEGETATION SELECTION

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	2

NCEEP PROJECT NO. 95026

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/8/16
DATE:

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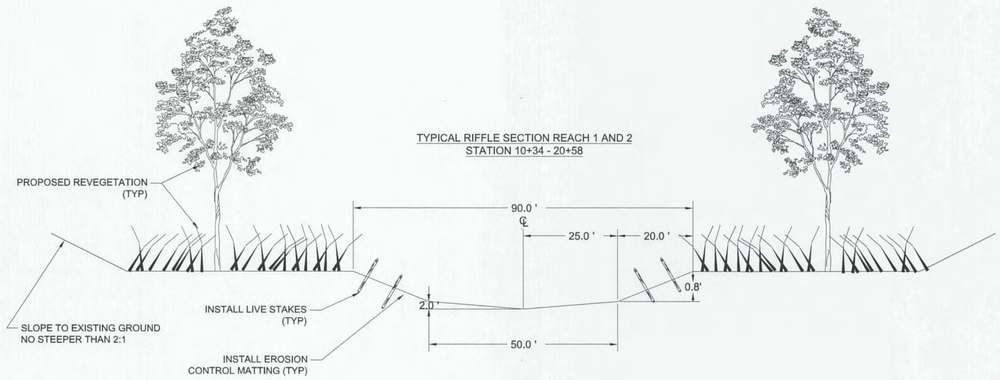
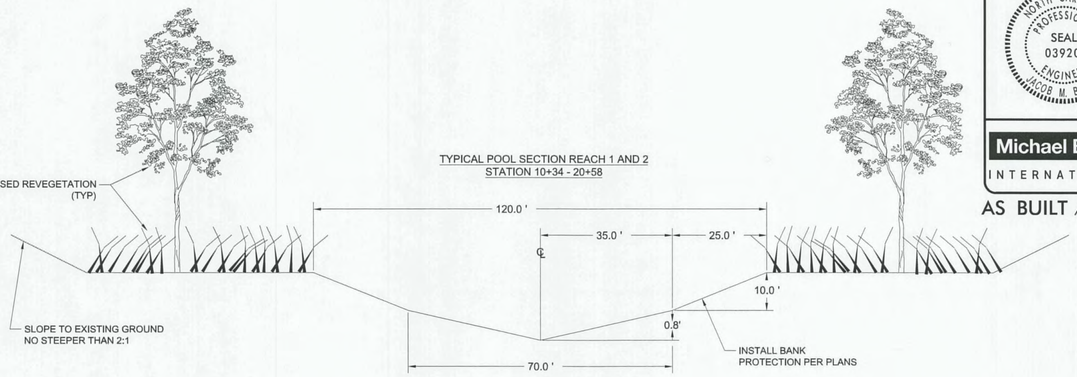
Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

AS BUILT /RECORD DRAWING

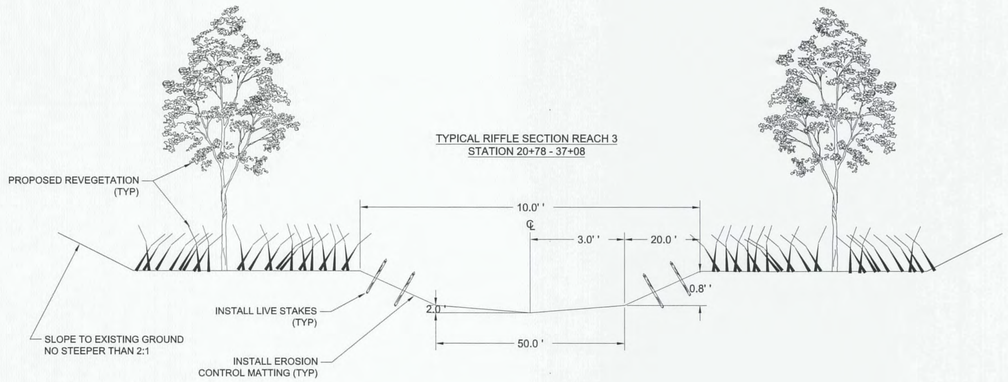
TYPICAL RIFFLE SECTION REACH 1 AND 2
STATION 10+34 - 20+58



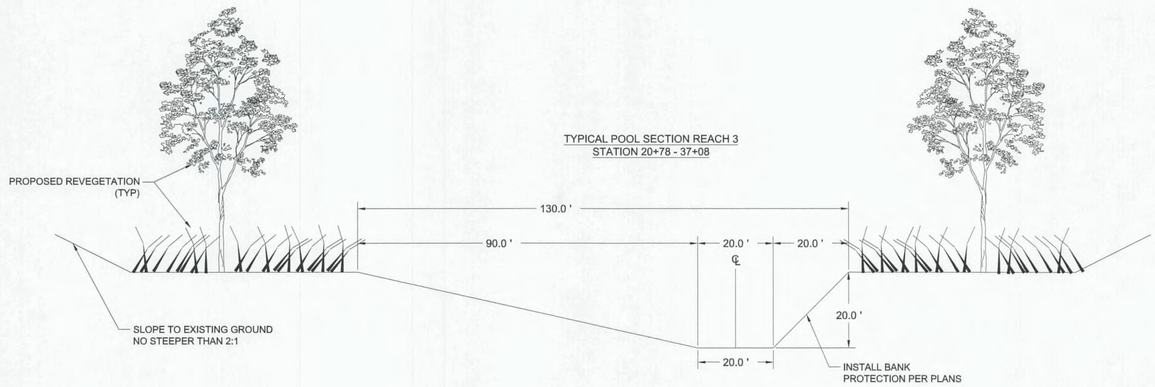
TYPICAL POOL SECTION REACH 1 AND 2
STATION 10+34 - 20+58



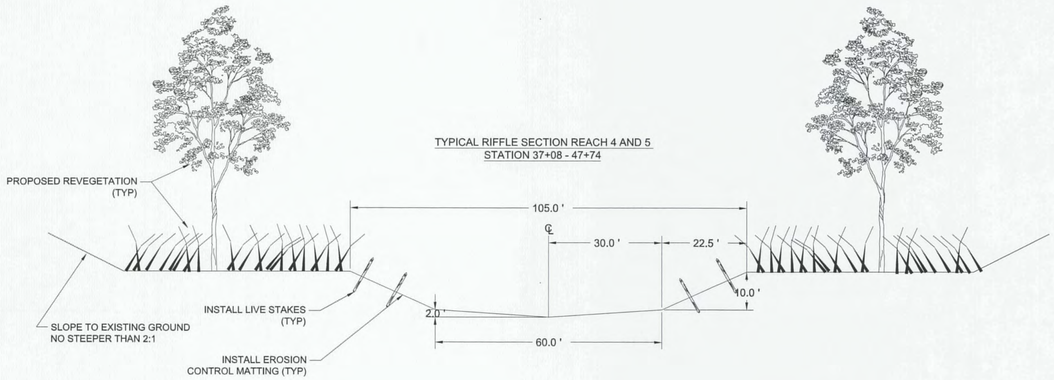
TYPICAL RIFFLE SECTION REACH 3
STATION 20+78 - 37+08



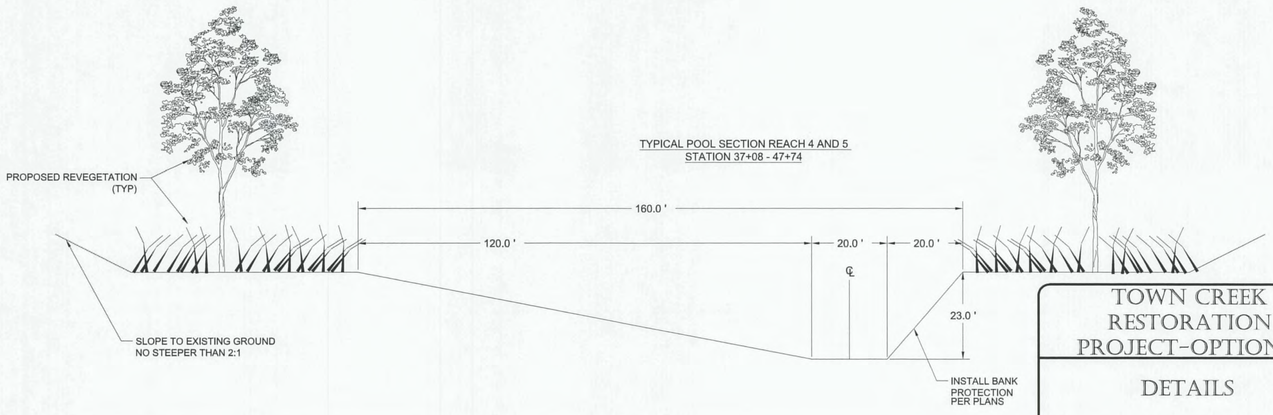
TYPICAL POOL SECTION REACH 3
STATION 20+78 - 37+08



TYPICAL RIFFLE SECTION REACH 4 AND 5
STATION 37+08 - 47+74



TYPICAL POOL SECTION REACH 4 AND 5
STATION 37+08 - 47+74



TOWN CREEK RESTORATION PROJECT-OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	2-A
NCEEP PROJECT NO. 95026	

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

APPROVED BY:

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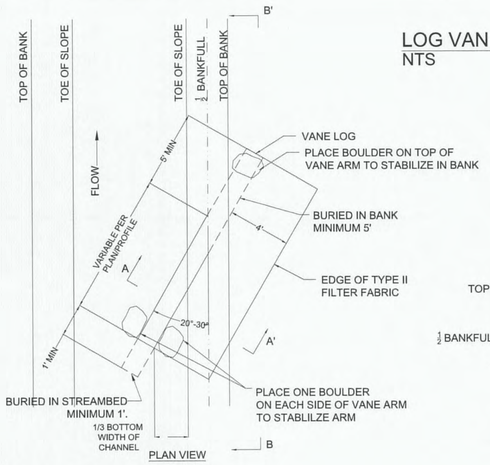
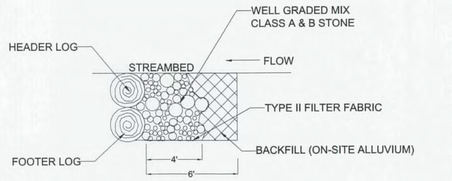
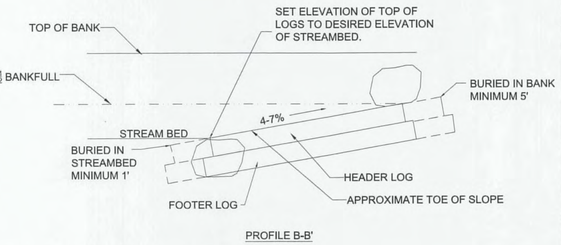
AS BUILT /RECORD DRAWING

LOG VANE
NTS





SECTION A-A'

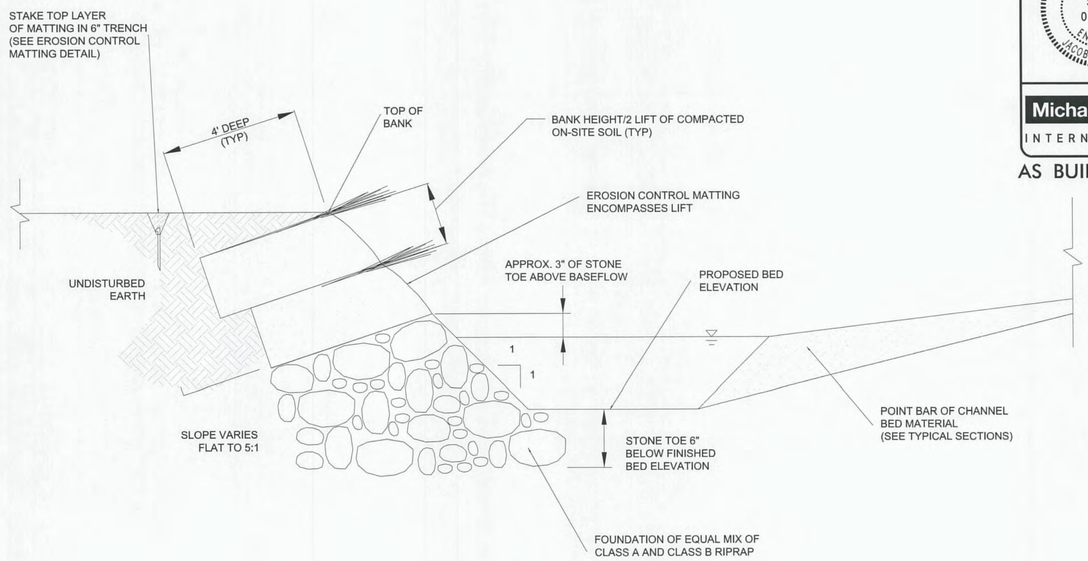


PROFILE B-B'

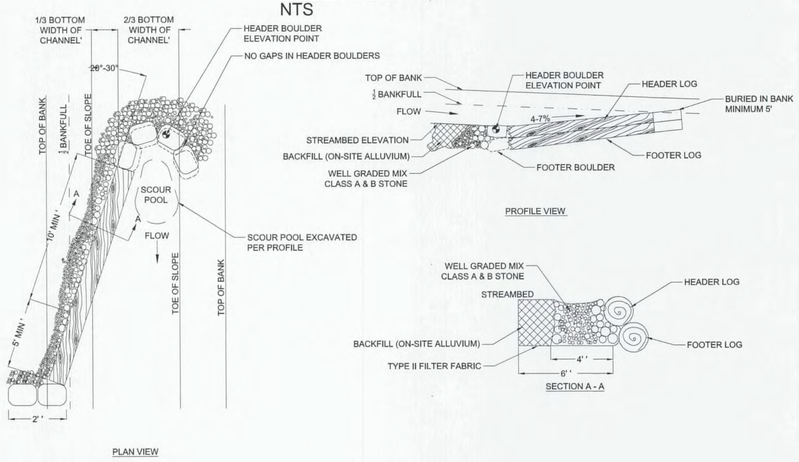
LOG VANE STRUCTURE NOTES

1. BOULDERS SHALL BE AT LEAST 3'X2'X1'.
2. LOGS SHALL BE AT LEAST 12" IN DIAMETER WITH A MAXIMUM DIAMETER OF 24", RELATIVELY STRAIGHT, AND HARDWOOD.
3. A SINGLE LOG WITH A MINIMUM DIAMETER OF 36 INCHES MAY BE USED IN PLACE OF TWO LOGS (A HEADER AND FOOTER) PER ON-SITE ENGINEER APPROVAL.
4. LOGS FOR LOG VANES SHALL BE A MININUM OF 30' IN LENGTH.
5. VANE ARM LOG SHALL BE BURIED INTO THE BANK A MINIMUM OF 5'.
6. DIG A TRENCH BELOW THE BED FOR FOOTER LOG. START AT BANK AND PLACE FOOTER LOG FIRST AND THE HEADER LOGS. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
7. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS.
8. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER LOG AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER LOG, AND THEN UPSTREAM FOR A MINIMUM OF SIX FEET.
9. NAIL FILTER FABRIC TO TOP OF HEADER LOG USING 3" 10d GALVANIZED COMMON NAIL ON 1' SPACING ALONG LOG.
10. USE WELL GRADED MIX OF CLASS A AND B STONE ON UPSTREAM SIDE OF STRUCTURE
11. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER LOG.
12. FILTER FABRIC SHALL BE TRIMMED ALONG THE TRANSITION BETWEEN THE STONE BACKFILL AND THE HEADER LOG SO THAT THE FILTER FABRIC DOES NOT OVERLAP THE HEADER LOG.

VEGETATED GEOLIFT
NTS



J-HOOK LOG VANE
NTS



PLAN VIEW

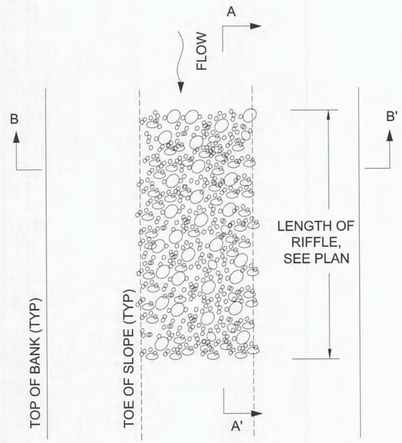
PROFILE VIEW

SECTION A - A

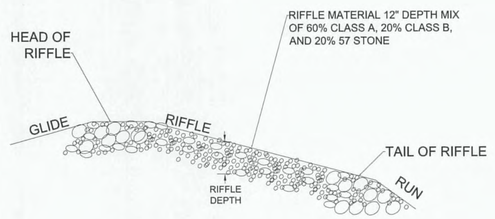
J-HOOK LOG VANE STRUCTURE NOTES:

1. BOULDERS MUST BE AT LEAST 2'x2'x2'.
2. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER WITH A MAXIMUM DIAMETER OF 24 INCHES, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
3. A SINGLE LOG WITH A MINIMUM DIAMETER OF 36 INCHES MAY BE USED IN PLACE OF TWO LOGS (A HEADER AND FOOTER) PER ON-SITE ENGINEER APPROVAL.
4. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS/BOULDERS.
5. DIG A TRENCH BELOW THE BED FOR FOOTER LOGS/BOULDERS. START AT BANK AND PLACE FOOTER LOG/BOULDERS FIRST AND THE HEADER LOG/BOULDERS. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER LOG/BOULDERS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER LOG/BOULDERS, AND THEN UPSTREAM FOR A MINIMUM OF SIX FEET.
7. NAIL FILTER FABRIC TO TOP OF HEADER LOG USING 3" 10d GALVANIZED COMMON NAIL ON 1' SPACING ALONG LOG.
8. USE WELL GRADED MIX OF CLASS A AND B STONE ON UPSTREAM SIDE OF STRUCTURE.
9. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER LOG/ROCK.
10. FILTER FABRIC SHALL BE TRIMMED ALONG THE TRANSITION BETWEEN THE STONE BACKFILL AND THE HEADER LOG/BOULDERS SO THAT THE FILTER FABRIC DOES NOT OVERLAP THE HEADER LOG/BOULDERS.

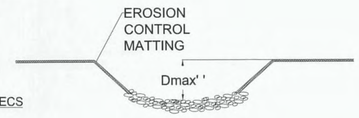
CONSTRUCTED RIFFLE
NTS



PLAN VIEW



PROFILE A-A'



SECTION B-B'

TOWN CREEK PROJECT SPECIFIC SPECS

ALL REACHES

RIFFLE DEPTH	12	IN
RIFFLE COMPOSTION	0-10	% ONSITE COARSE ALLUVIUM
	60	% CLASS A
	20	% CLASS B
	20	% 57 STONE
	0	OTHER

TOWN CREEK RESTORATION PROJECT-OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	2-B

NCEEP PROJECT NO. 95026

PROJECT ENGINEER

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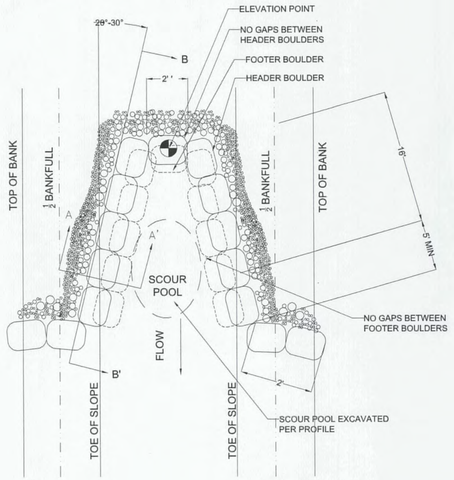
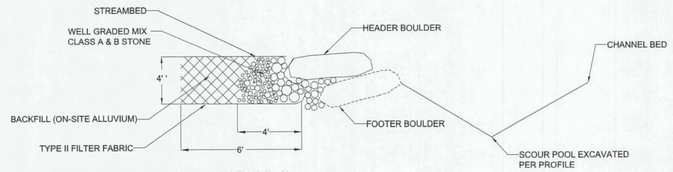
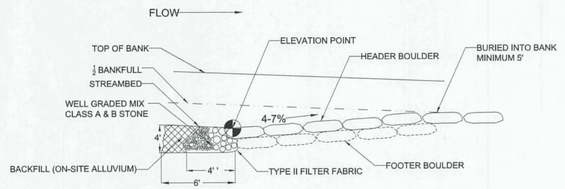
AS BUILT /RECORD DRAWING

ROCK CROSS VANE
NTS





SECTION A - A'

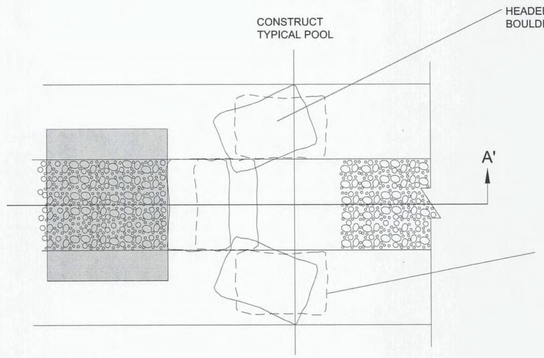


PROFILE VIEW B-B'

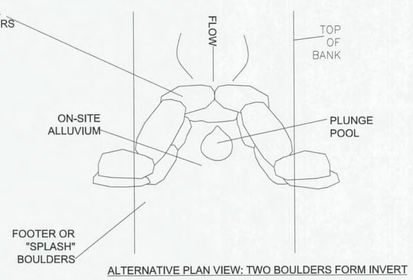
ROCK CROSS VANE STRUCTURE NOTES:

1. BOULDERS MUST BE AT LEAST 3'x2'x1'.
2. USE FILTER FABRIC TO SEAL GAPS BETWEEN BOULDERS.
3. DIG A TRENCH BELOW THE BED FOR FOOTER BOULDERS. START AT BANK AND PLACE FOOTER BOULDERS FIRST AND THE HEADER BOULDERS. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER BOULDERS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER BOULDERS, AND THEN UPSTREAM FOR A MINIMUM OF SIX FEET.
5. USE WELL GRADED MIX OF CLASS A AND B STONE ON UPSTREAM SIDE OF STRUCTURE.
6. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER BOULDER.
7. FILTER FABRIC SHALL BE TRIMMED ALONG THE TRANSITION BETWEEN THE STONE BACKFILL AND THE HEADER BOULDERS SO THAT THE FILTER FABRIC DOES NOT OVERLAP THE HEADER BOULDERS.

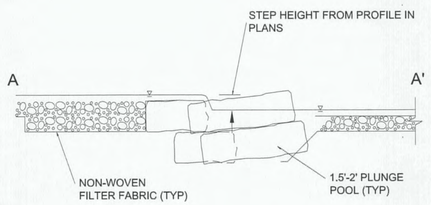
BOULDER STEP
NTS



PLAN VIEW



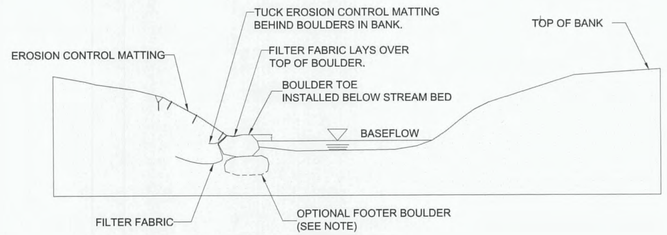
ALTERNATIVE PLAN VIEW: TWO BOULDERS FORM INVERT



LEGEND:

- APPROXIMATE LEVEL OF BASEFLOW WATER SURFACE
- CHANNEL THALWEG / CONTROL LINE
- CHANNEL BED MATERIAL
- CHANNEL SEDIMENT
- UNDISTURBED IN-SITU SOIL
- NON-WOVEN FILTER FABRIC
- BOULDER: 2'x1.5'x1' to 3'x3'x2

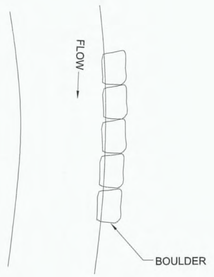
BOULDER TOE
NTS



CROSS SECTION VIEW

NOTE:

1. BOULDERS SHOULD EXTEND BELOW SCOUR DEPTH AND ABOVE BASE FLOW WATER LEVELS. FOOTER BOULDERS MAY BE REQUIRED, DEPENDING ON EXISTING BED MATERIAL.
2. TOE BOULDERS SHALL BE TOUCHING SO THAT VOID SPACE IS MINIMIZED.
3. THE MAJORITY OF THE BOULDER SHOULD BE BURIED IN THE STREAM BANK, LEAVING FACE OF BOULDER EXPOSED TO FLOW.
4. FILTER FABRIC SHOULD BE PLACED BEHIND BOULDER TOE, BURIED BELOW BOULDER DEPTH, AND EXTEND INTO THE BANK.
5. EROSION CONTROL MATTING SHOULD BE PLACED AGAINST BOULDER BEFORE BACKFILL, THEN FOLDED BACK OVER SEEDED BANK SLOPE.
6. BOULDER TOE SHOULD BE BACKFILLED AND COMPACTED, VOID SPACE BETWEEN FABRIC AND BOULDER TOE SHOULD BE MINIMIZED.
7. BOULDER TOE SHOULD NOT EXCEED MAXIMUM BANKFULL ELEVATION.



PLAN VIEW

TOWN CREEK RESTORATION PROJECT-OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	2-C

NCEP PROJECT NO. 95026

PROJECT ENGINEER

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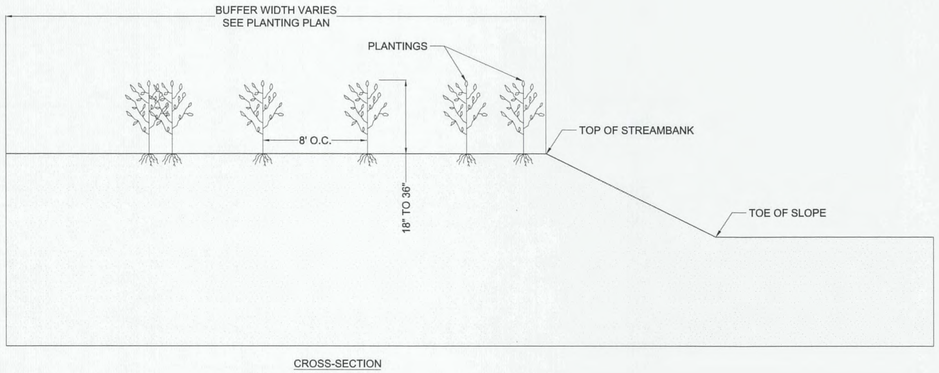
AS BUILT /RECORD DRAWING

BARE ROOT PLANTING
NTS

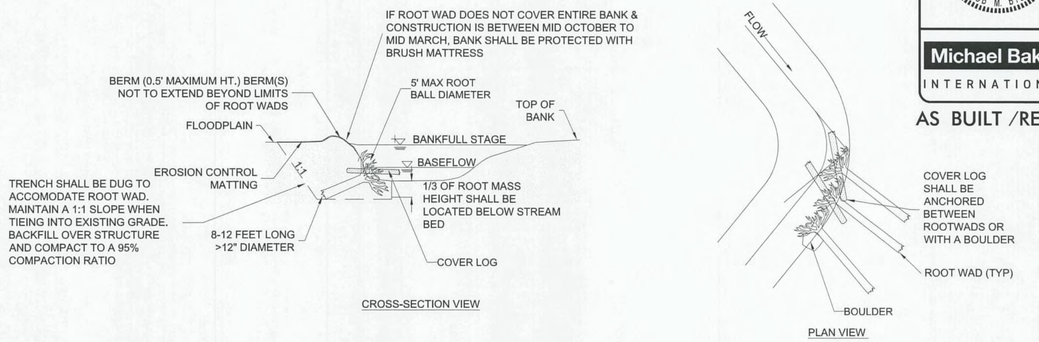


CROSS-SECTION

BARE ROOT PLATING NOTES:

1. BARE ROOT SHRUBS AND TREES SHALL BE PLANTED AS SHOWN ON THE PLANS.
2. COMPACTED SOIL SHALL BE LOOSENED PRIOR TO PLANTING.
3. PLANTS SHALL BE PLACED IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
4. ROOTS SHALL BE KEPT MOIST BY MEANS OF WET CANVAS, BURLAP, OR STRAW WHILE DISTRIBUTING OR WAITING TO PLANT.
5. PLANTS SHALL BE HEELED-IN TO MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL AT PROJECT SITE.
6. SEE PLANTING PLAN FOR PLANT SPACING.
7. SEE SPECIAL PROVISION, SEE DETAIL 6/26, AND PLANTING PLAN FOR PLANTING DETAILS.

ROOT WAD
NTS



CROSS-SECTION VIEW

PLAN VIEW

NOTE
1. ROOTWADS SHALL BE A HARDWOOD SPECIES WITH A 12" MINIMUM DIAMETER
2. THE CHANNEL BASEFLOW ELEVATION WILL VARY SEASONALLY AND MAY BE VERY LOW DURING TIMES OF DROUGHT. FOR CONSTRUCTION PURPOSES, THE BASEFLOW ELEVATION WILL BE CONSIDERED TO BE EQUAL TO THE DOWNSTREAM RIFFLE ELEVATION.
3. ELEVATION OF THE ROOTWADS WILL BE BASED ON THE DOWNSTREAM RIFFLE ELEVATION. ROOTWADS SHOULD BE CONSTRUCTED SUCH THAT HALF OF THE ROOTWAD MASS IS BELOW THE BASEFLOW WATER SURFACE
4. THE CONTRACTOR WILL BE RESPONSIBLE FOR CHANGES TO THE ROOTWADS ELEVATION AND PLACEMENT IF IT IS DETERMINED BY THE ENGINEER THAT THE ROOTWADS WERE NOT INSTALLED PROPERLY ACCORDING TO THIS DETAIL.

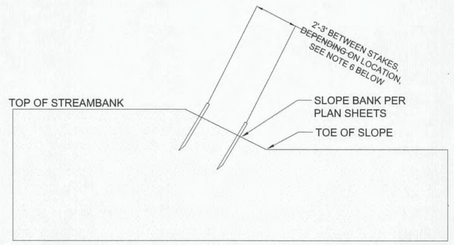
NOTE

TRENCHING METHOD:
IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK REQUIRES RECONSTRUCTION, THE TRENCHING METHOD SHALL BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. ONE-THIRD OF THE ROOT WAD SHALL REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

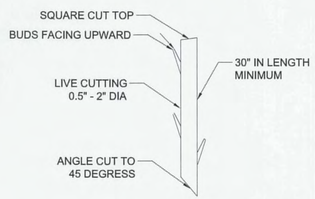
NOTE

DRIVE POINT METHOD:
THE TRUNK END OF THE LOG SHALL BE SHARPENED WITH A CHAINSAW BEFORE "DRIVING" IT INTO THE BANK. ROOT WADS SHALL BE ORIENTED UPSTREAM SO THAT THE STREAM FLOW MEETS THE ROOT WAD AT A 90-DEGREE ANGLE, DEFLECTING THE WATER AWAY FROM THE BANK. A TRANSPLANT OR BOULDER SHALL BE PLACED ON THE DOWNSTREAM SIDE OF THE ROOT WAD IF A BACK EDDY IS FORMED BY THE ROOT WAD. THE BOULDER SHALL BE APPROXIMATELY 4' X 3' X 2'.

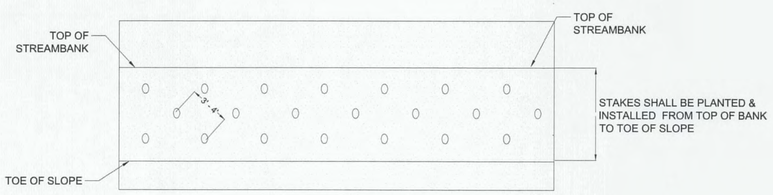
LIVE STAKE
NTS



CROSS-SECTION



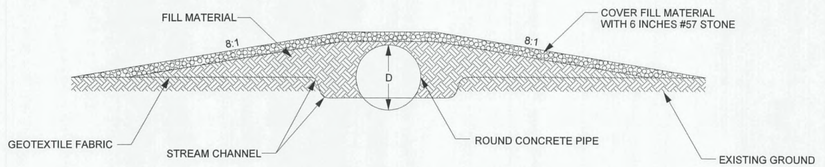
LIVE STAKE DETAIL



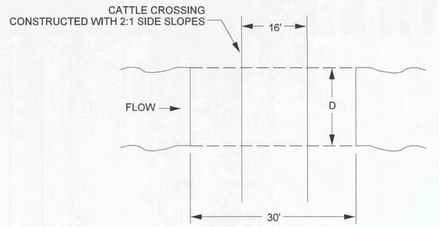
PLAN VIEW

NOTES
1. STAKES THAT HAVE BEEN SPLIT SHALL BE REJECTED AND NOT USED FOR CONSTRUCTION.
2. STAKES SHALL BE INSTALLED WITH BUDS POINTING UPWARD.
3. STAKES SHALL BE INSTALLED PERPENDICULAR TO BANK.
4. STAKES SHALL BE 0.5" - 2" INCHES IN DIAMETER AND 15" IN LENGTH MINIMUM.
5. STAKES SHALL BE INSTALLED WITH APPROXIMATELY 3" OF STAKE REMAINING ABOVE GROUND.
6. STAKE SPACING SHALL BE 4' ON CENTER ON RIFFLE BANKS AND 3' ON CENTER ON OUTSIDE BANK BENDS.

PERMANENT STREAM CROSSING
NTS



CROSS SECTION VIEW



PLAN VIEW

TOWN CREEK RESTORATION PROJECT-OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	2-D
NCEEP PROJECT NO. 95026	

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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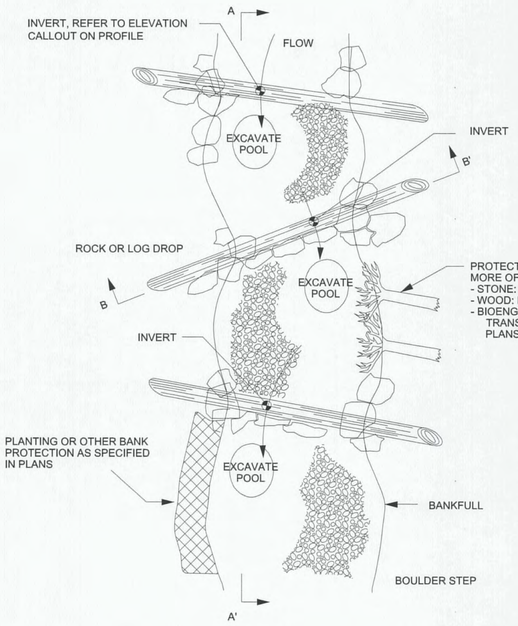
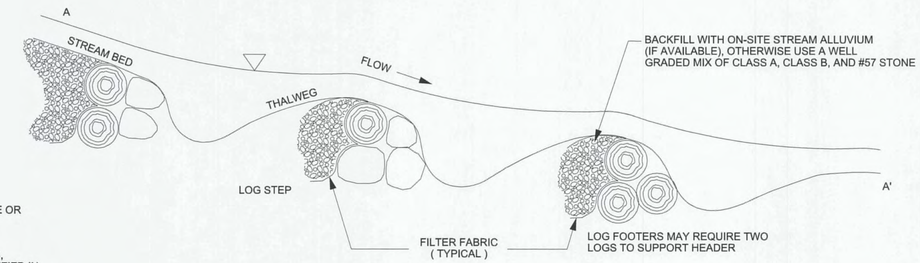
AS BUILT /RECORD DRAWING

ANGLED LOG STEP
NTS



PLAN VIEW

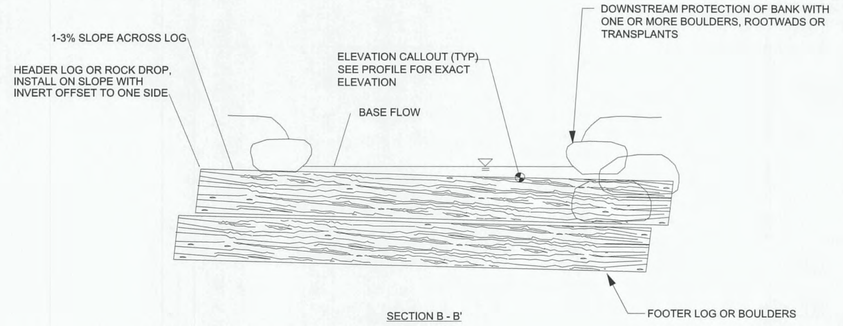


SECTION A - A'

NOTES:
1. LOGS SHOULD BE HARDWOOD, RECENTLY HARVESTED AND EXTENDING INTO THE BANK ON EACH SIDE AT MINIMUM DISTANCE SPECIFIED BELOW.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG
3. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL
4. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING AND INCORPORATED INTO BANK
5. TRANSPLANTS CAN BE USED INSTEAD OF BOULDERS WITH ENGINEER'S APPROVAL

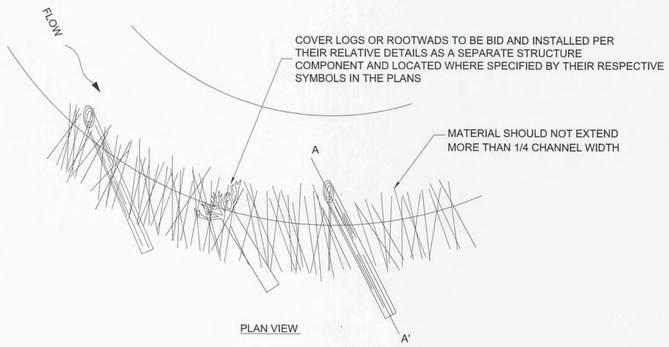
PROJECT SPECIFIC SPECS

MINIMUM BOULDER SIZE	2.5x1.5x1	FT
MINIMUM LOG DIAMETER	10	IN
MINIMUM LOG EXTEND INTO BANKS	3	FT
AVERAGE CHANNEL BOTTOM WIDTH	5	FT
APPROXIMATE LOG LENGTHS	11+	FT

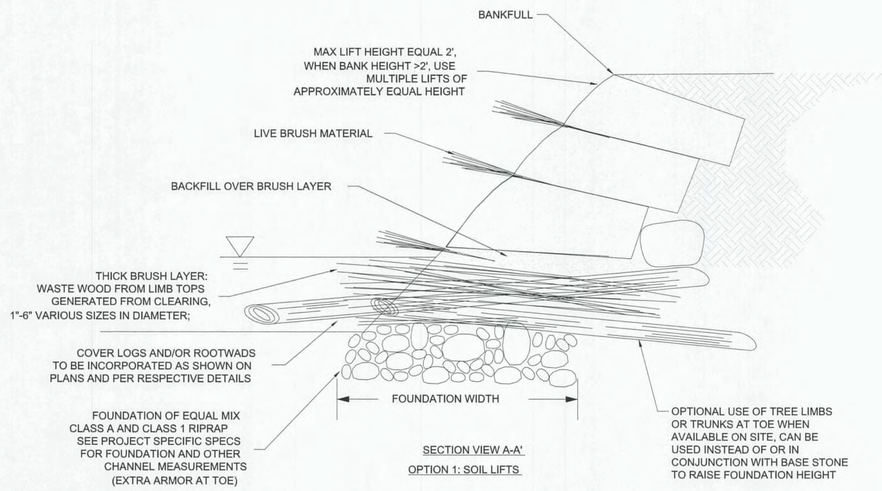


SECTION B - B'

TOE WOOD
NTS



PLAN VIEW



SECTION VIEW A-A'

OPTION 1: SOIL LIFTS

PROJECT SPECIFIC SPECS

POOL WATER DEPTH	2.0	FT
FOUNDATION HEIGHT	12	IN
FOUNDATION WIDTH	2	FT
BRUSH THICKNESS	~8	IN

TOWN CREEK RESTORATION PROJECT-OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3

NCDMS PROJECT NO. 95026

I, MARSHALL G. WIGHT, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THUS ARE AS-BUILT CONDITIONS, EXCEPT WHERE OTHERWISE NOTED HEREON, WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 7th DAY OF November 2016

Marshall G. Wight
PROFESSIONAL LAND SURVEYOR L-5034

NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

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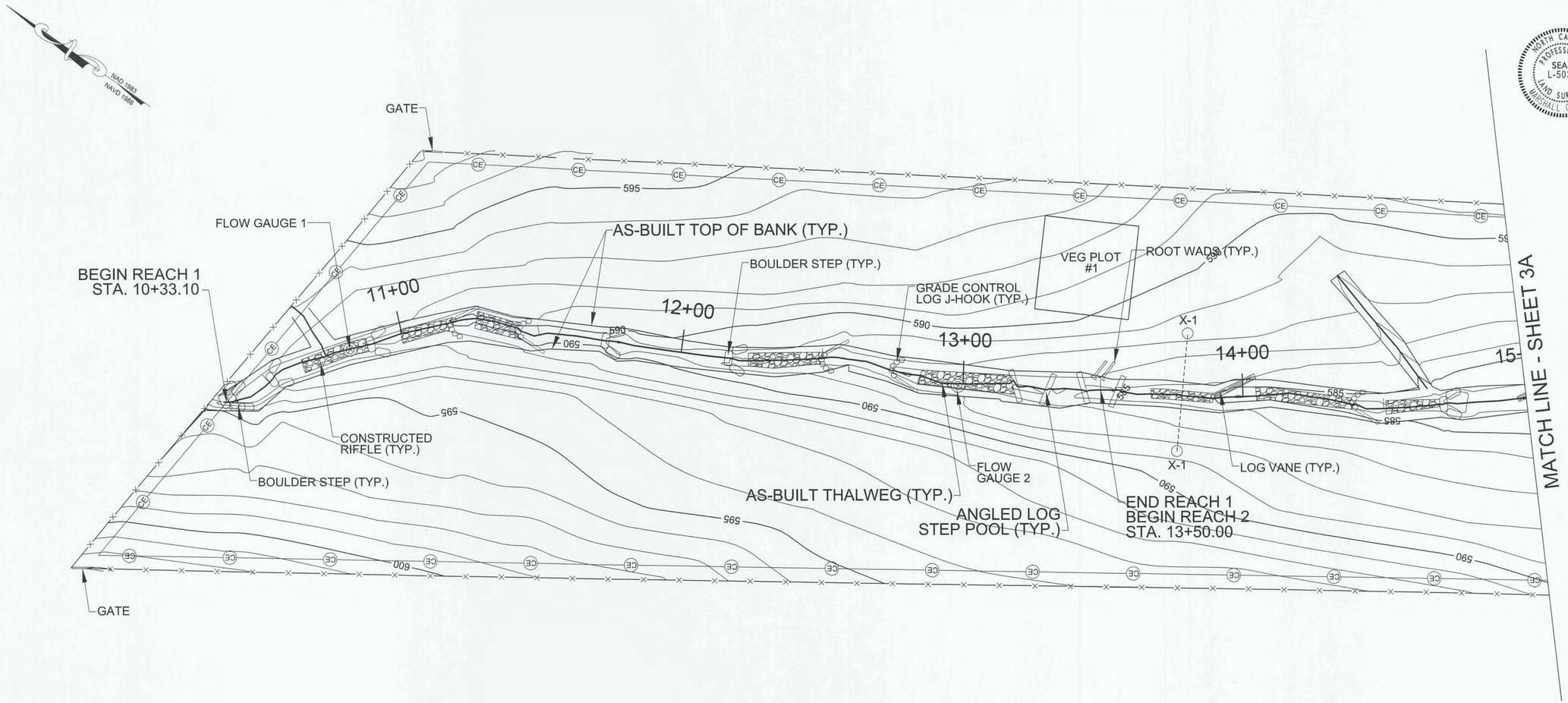

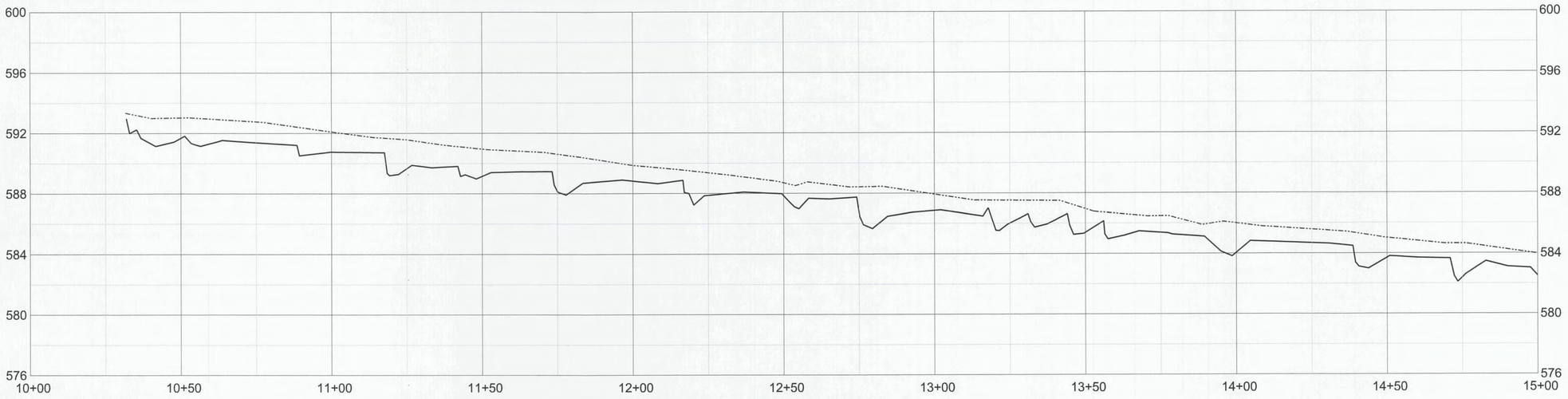

LEGEND OF PROFILES
- AS-BUILT THALWEG
- AS-BUILT LOW BANK

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3A
NCDMS PROJECT NO. 95026	

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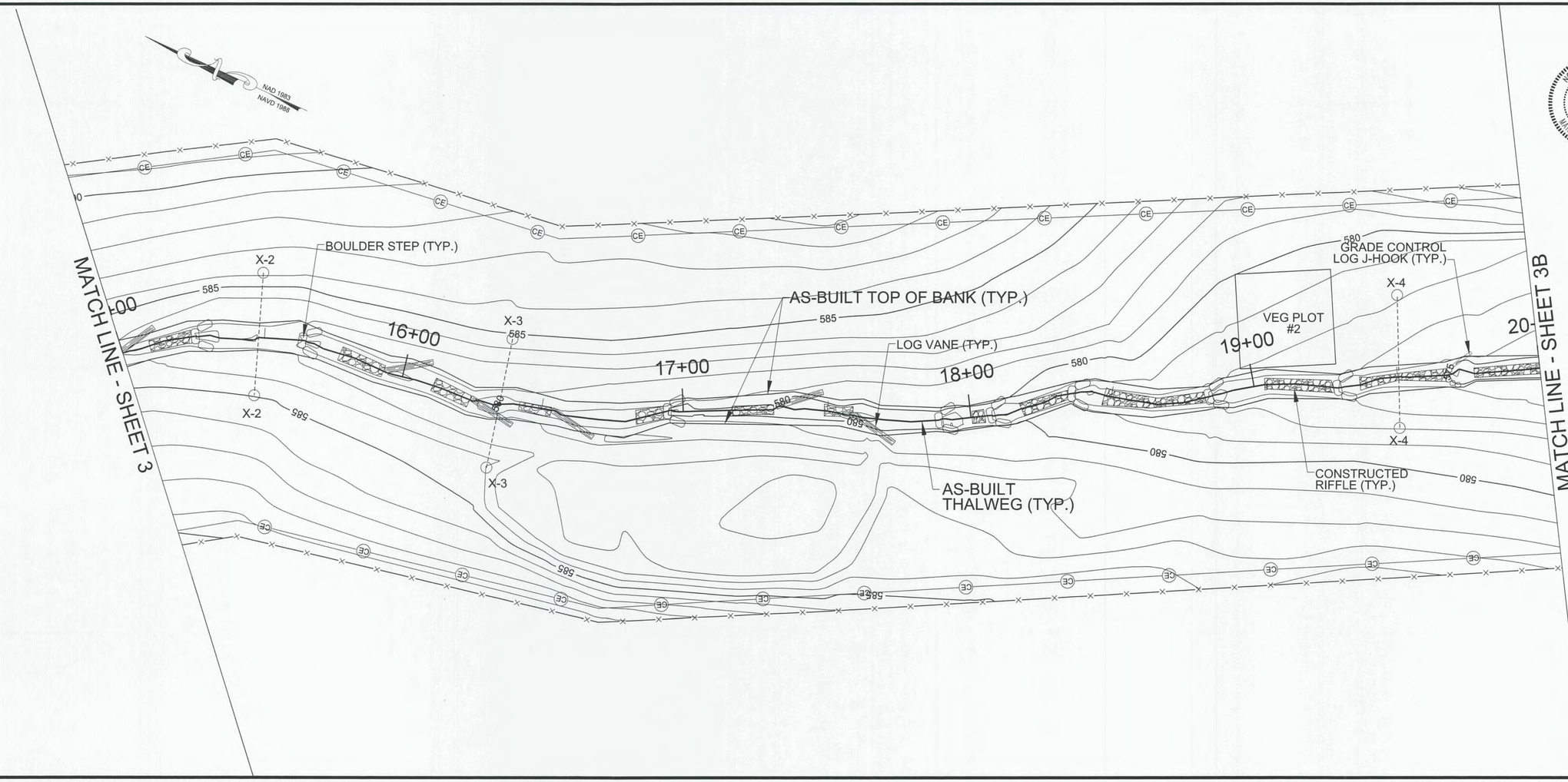
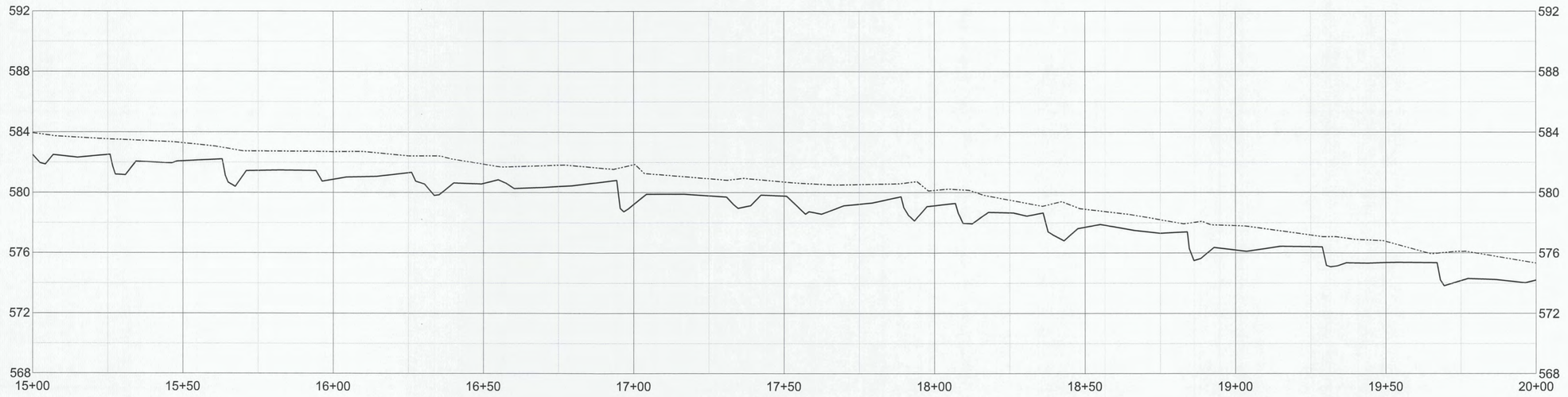




LEGEND OF PROFILES

AS-BUILT THALWEG

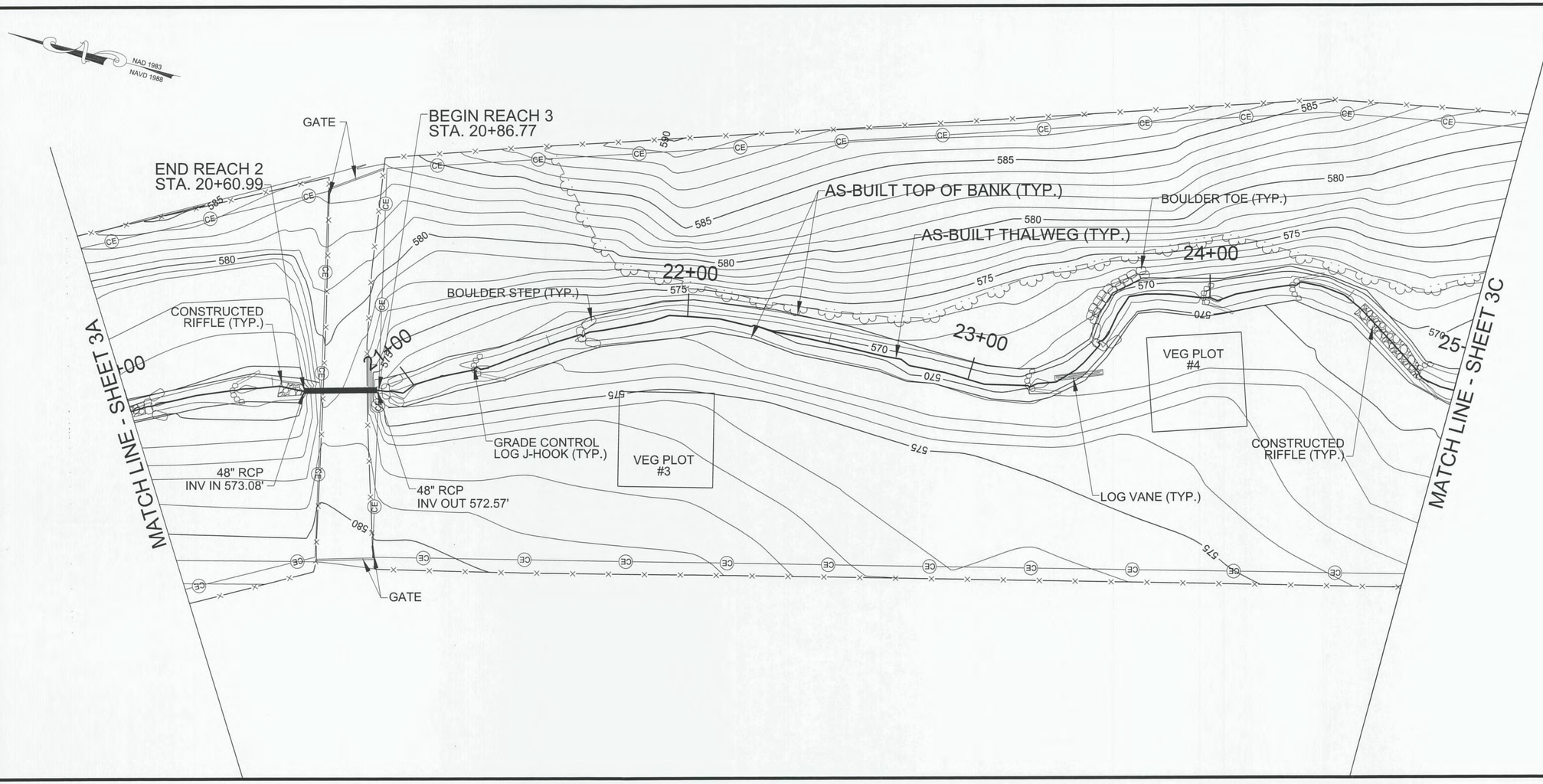
AS-BUILT LOW BANK

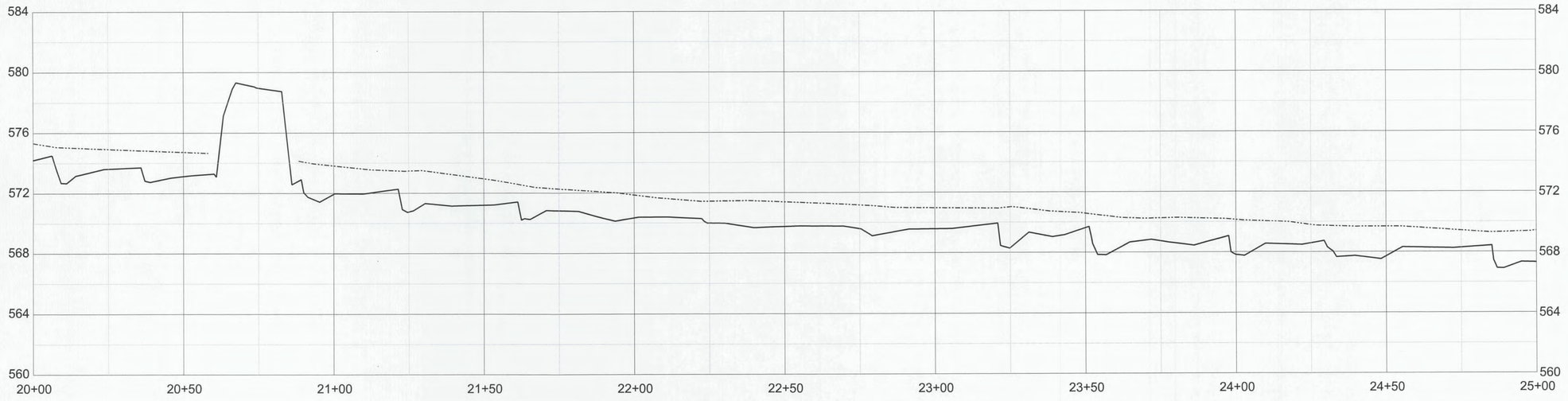
4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE





LEGEND OF PROFILES

AS-BUILT THALWEG

AS-BUILT LOW BANK

4 0 4 8

VERTICAL SCALE (FT)

20 0 20 40

HORIZONTAL SCALE (FT)

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3B
NCDMS PROJECT NO. 95026	

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NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

Marshall Wight

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TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE

NAD 1983
NAVD 1988

MATCH LINE - SHEET 3B

MATCH LINE - SHEET 3D

AS-BUILT TOP OF BANK (TYP.)

GRADE CONTROL
LOG J-HOOK (TYP.)

CONSTRUCTED RIFFLE (TYP.)

VEG PLOT
#5

VEGETATED
GEOLIFT (TYP.)

LOG VANE (TYP.)

ROOT WADS (TYP.)

TOE WOOD (TYP.)

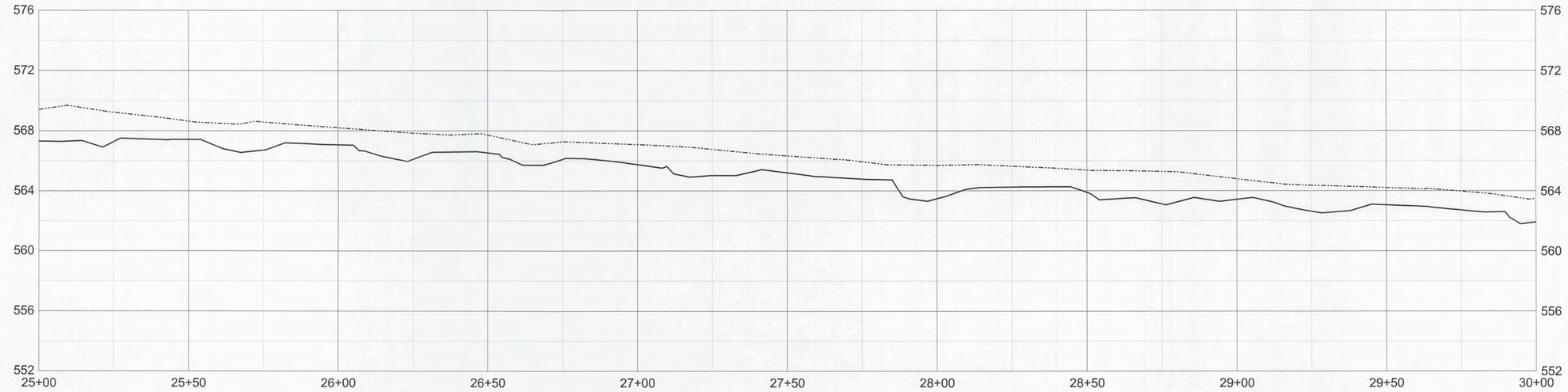
AS-BUILT THALWEG (TYP.)

ROOT WADS
(TYP.)

X-5
X-6
X-7

25+00
26+00
27+00
28+00
29+00
30+00

575
570
565
580



LEGEND OF PROFILES

AS-BUILT THALWEG

AS-BUILT LOW BANK

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK
RESTORATION
PROJECT-OPTION B

AS-BUILT SURVEY
PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3C

NCDMS PROJECT NO. 95026

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BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3D

NCDMS PROJECT NO. 95026

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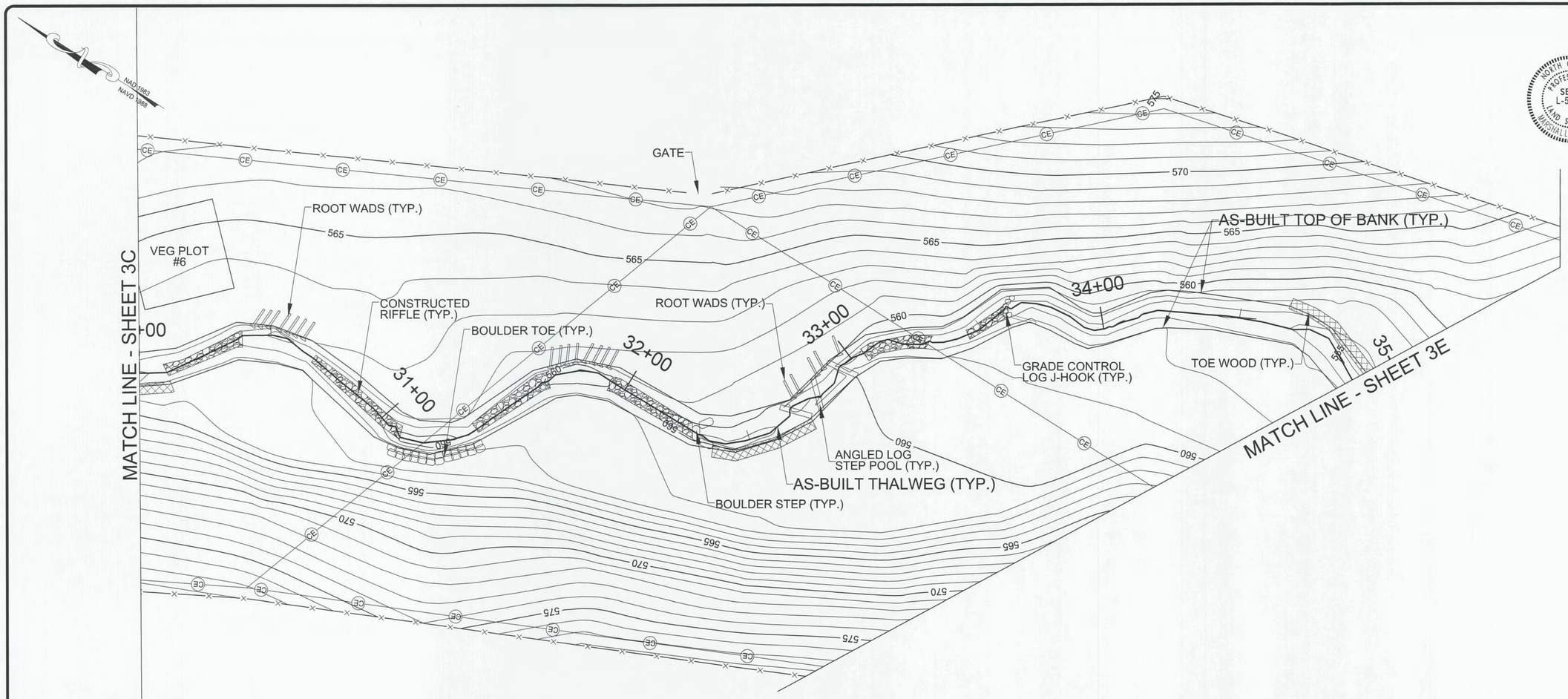

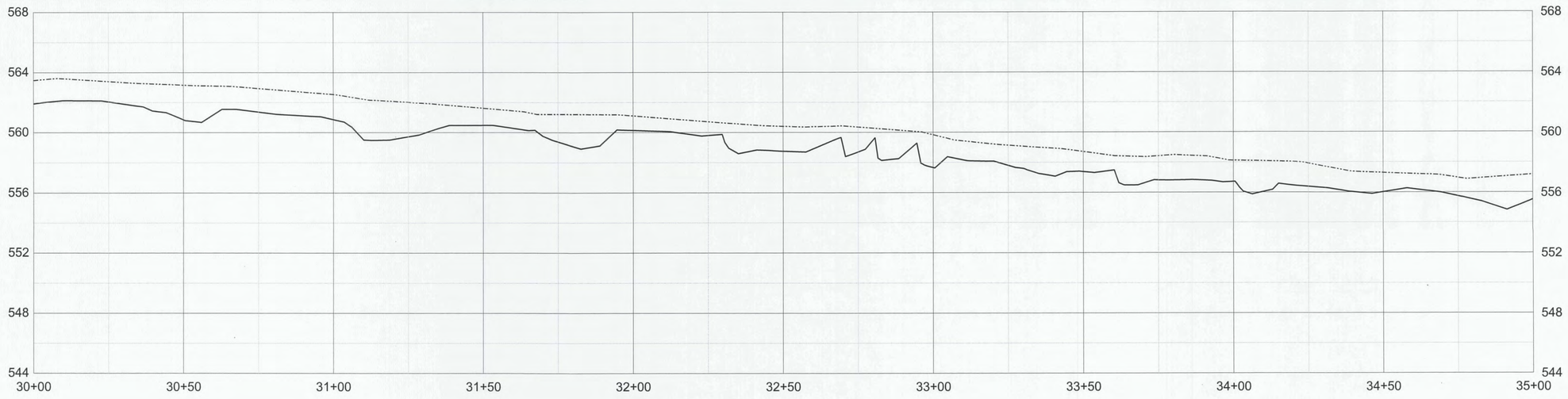

LEGEND OF PROFILES
- AS-BUILT THALWEG
- AS-BUILT LOW BANK

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3E
NCDMS PROJECT NO. 95026	

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NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

Marshall Wight
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License #: F-1084

NAD 1983
NAVD 1988

MATCH LINE - SHEET 3D

MATCH LINE - SHEET 3F

END REACH 3
BEGIN REACH 4
STA. 37+08.00

END REACH 4
BEGIN REACH 5
STA. 39+40.00

AS-BUILT
THALWEG (TYP.)

CONSTRUCTED RIFFLE (TYP.)

AS-BUILT TOP
OF BANK (TYP.)

TOE WOOD (TYP.)

LOG VANE (TYP.)

VEGETATED GEOLIFT
WITH ROOT WADS (TYP.)

VEG
PLOT
#7

X-8

X-9

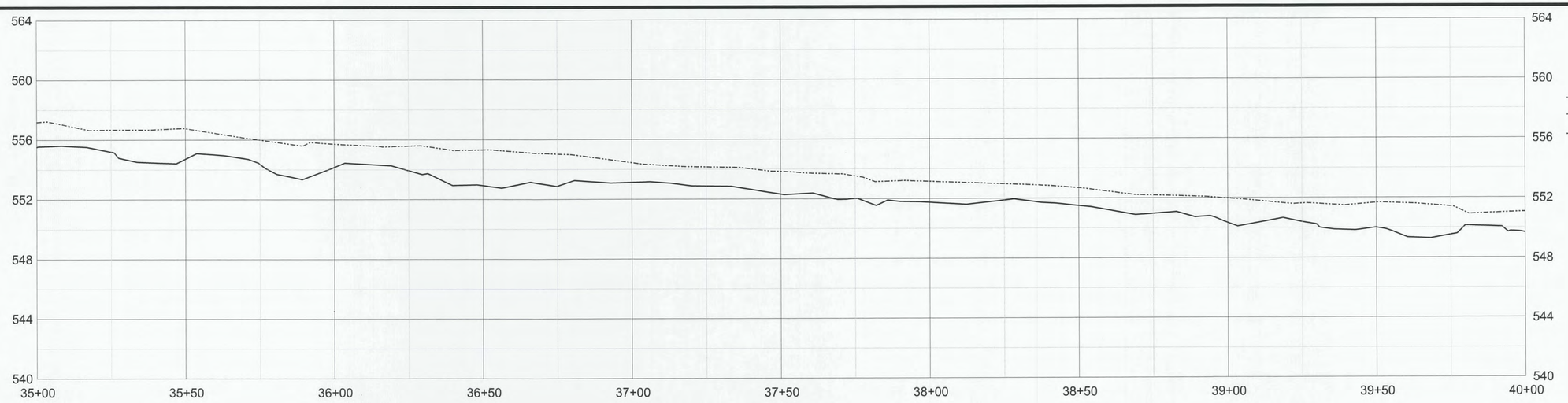
36+00

37+00

38+00

39+00

40+00



LEGEND OF PROFILES
AS-BUILT THALWEG
AS-BUILT LOW BANK

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3F

NCDMS PROJECT NO. 95026

I, MARSHALL G. WIGHT, AS A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF NORTH CAROLINA, HEREBY CERTIFY THAT THE DATA SHOWN ON THIS DRAWING, WAS OBTAINED UNDER MY SUPERVISION, IS AN ACCURATE AND COMPLETE REPRESENTATION OF WHAT WAS CONSTRUCTED IN THE FIELD, AND THAT THE PHYSICAL DIMENSIONS OR ELEVATIONS SHOWN THUS ARE AS-BUILT CONDITIONS, EXCEPT WHERE OTHERWISE NOTED HERON, WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 2nd DAY OF November, 2016

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NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

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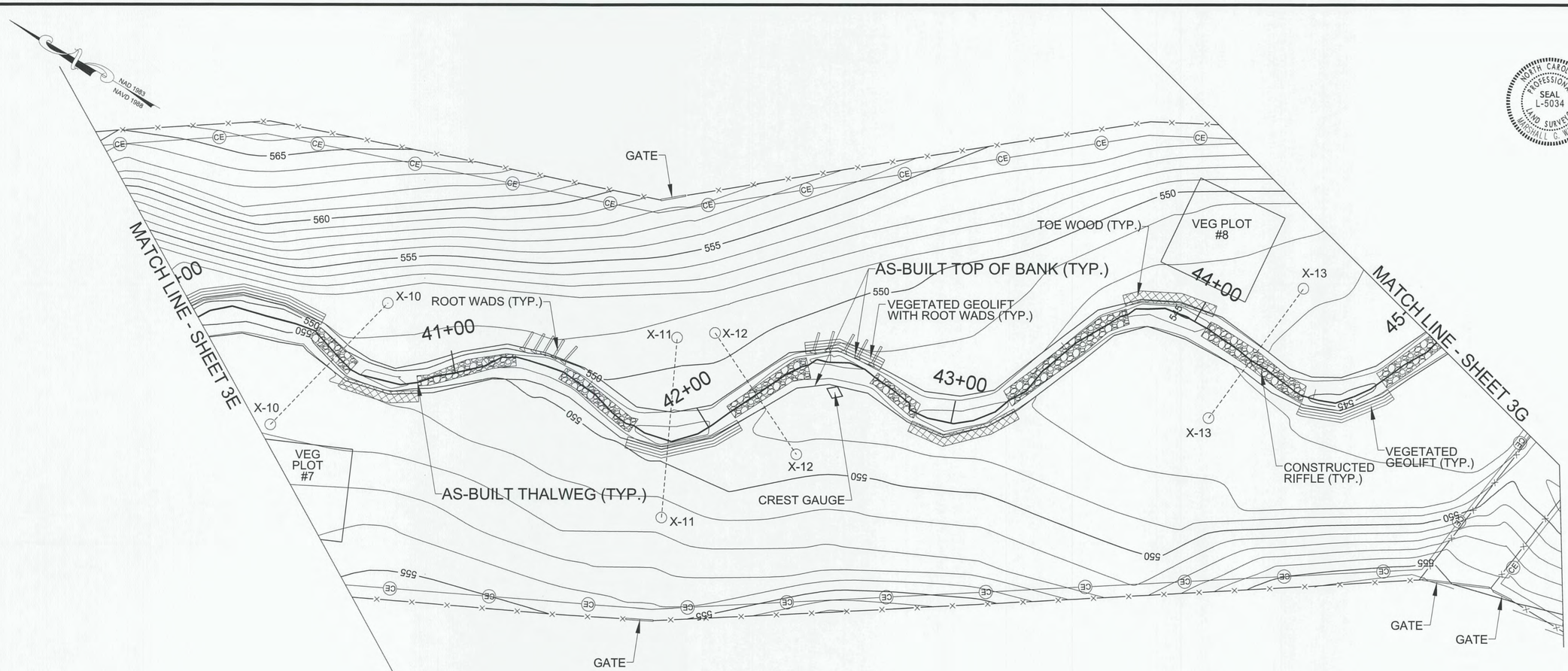

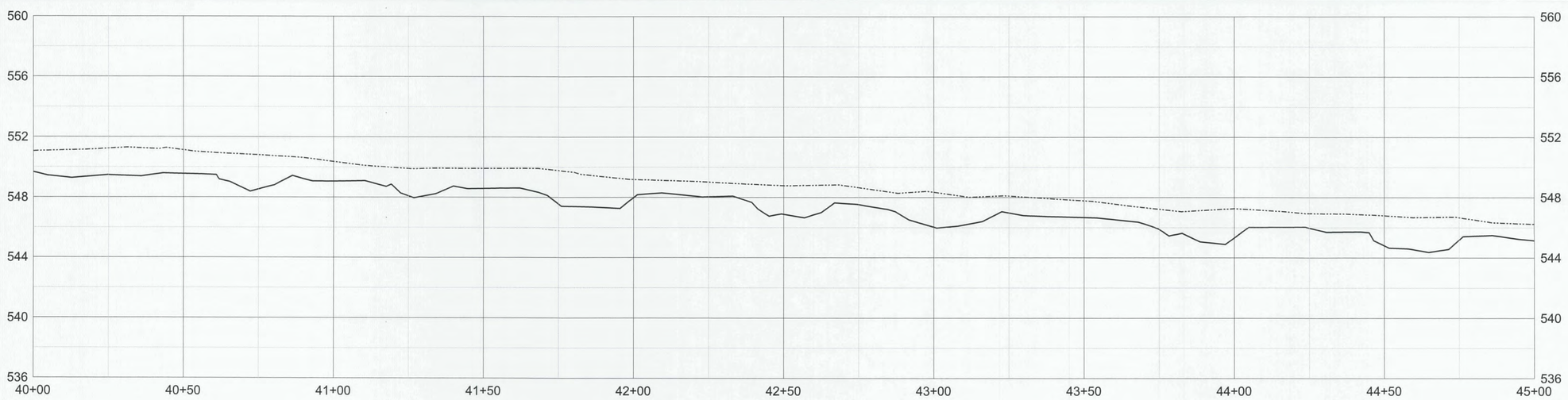

LEGEND OF PROFILES
- AS-BUILT THALWEG
- AS-BUILT LOW BANK

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3G
NCDMS PROJECT NO. 95026	

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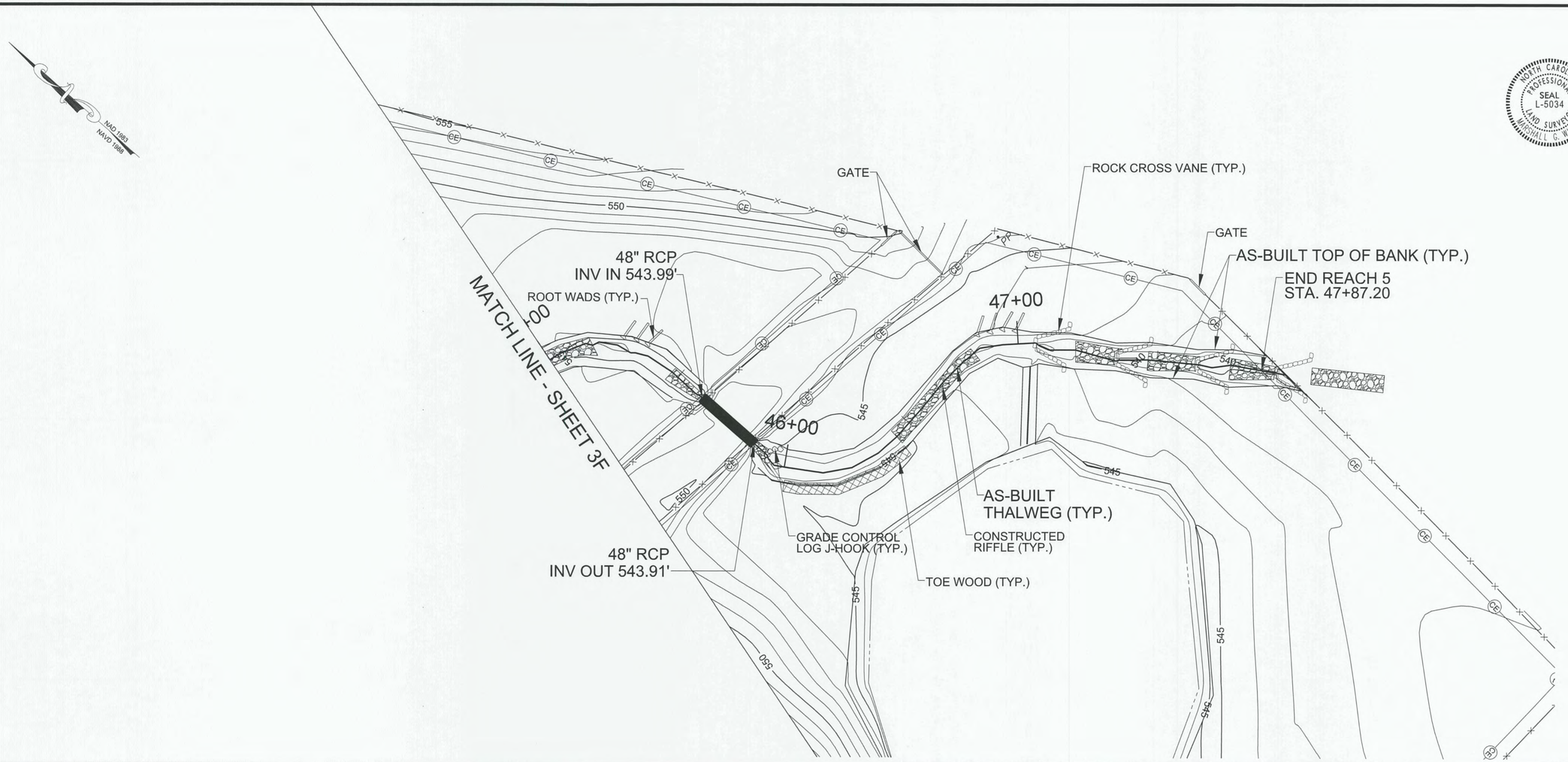
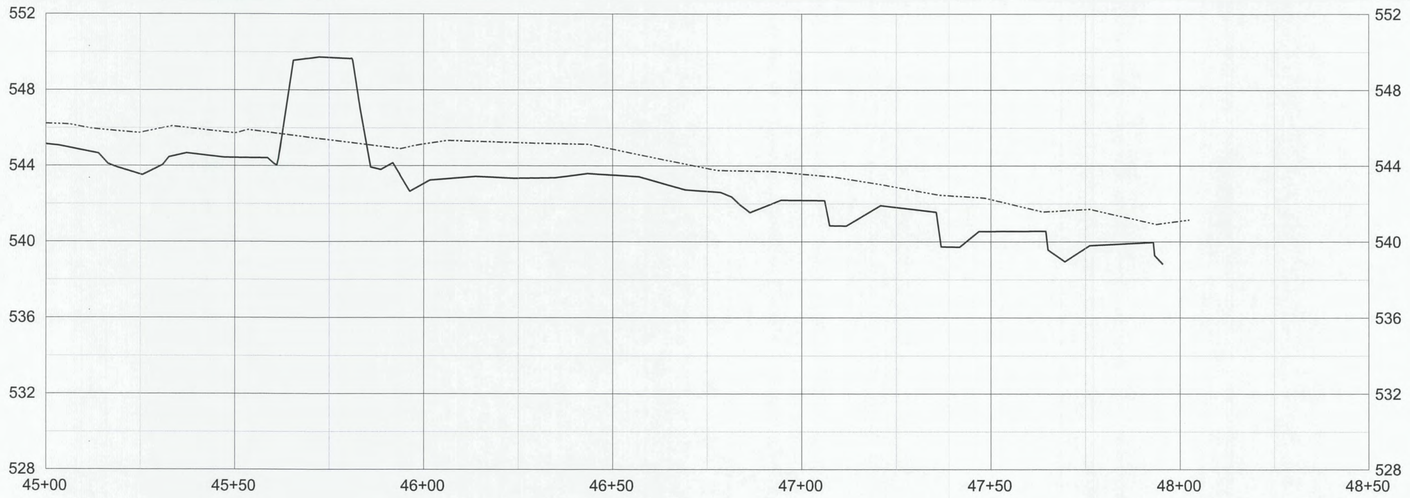
NAD 1983
NAVD 1988





LEGEND OF PROFILES
- AS-BUILT THALWEG
- AS-BUILT LOW BANK

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

AS-BUILT SURVEY PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4
NCDMS PROJECT NO. 95026	

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/8/16
DATE:

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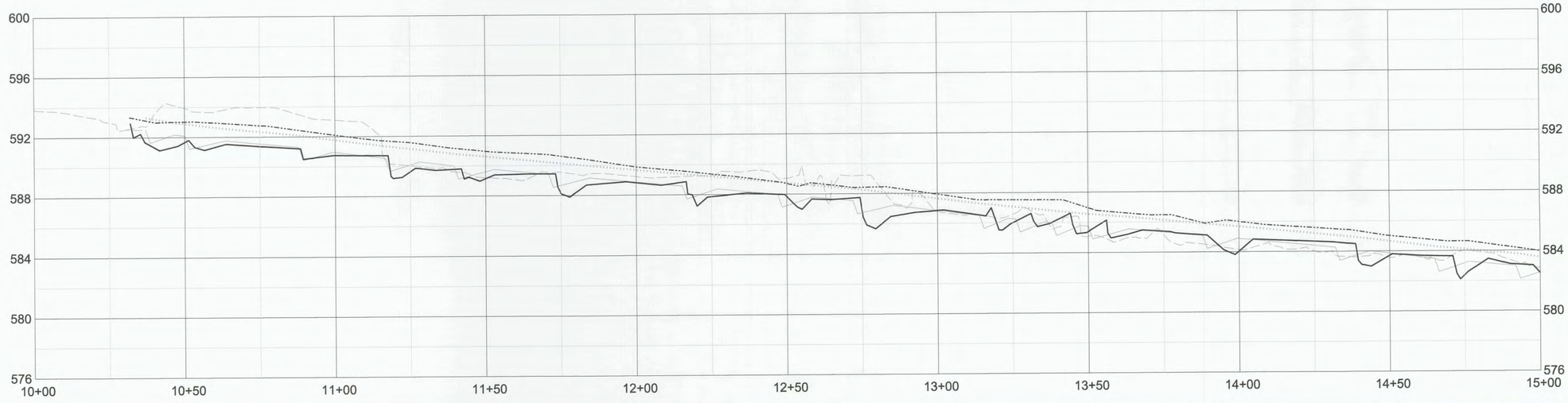
Fax: 704.665.2201
License #: F-1084

NAD 1983
NAVD 1988

GPS6
N: 616519.86
E: 1629648.52
ELEV: 601.23'

GATE
FLOW GAUGE 1
ADDED ROCK LINED DRAINAGE SWALE FROM OFF-SITE SPRING
BEGIN REACH 1
STA. 10+33.10
ADDED BOULDER STEP
AS-BUILT TOP OF BANK (TYP.)
BOULDER STEP (TYP.)
GRADE CONTROL LOG J-HOOK (TYP.)
VEG PLOT #1
ROOT WADS (TYP.)
ADDED MATTED DRAINAGE SWALE
ADDED CONSTRUCTED RIFFLE
X-1
CONSTRUCTED RIFFLE (TYP.)
DESIGN CHANNEL ALIGNMENT
BOULDER STEP (TYP.)
AS-BUILT THALWEG (TYP.)
FLOW GAUGE 2
ANGLED LOG STEP POOL (TYP.)
END REACH 1
BEGIN REACH 2
STA. 13+50.00
LOG VANE (TYP.)
ADDED CONSTRUCTED RIFFLE
MATCH LINE - SHEET 4A
GATE



LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4A
NCDMS PROJECT NO. 95026	

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/8/16
DATE:

Michael Baker INTERNATIONAL

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Phone: 704.665.2200
Fax: 704.665.2201
License #: F-1084

GPS5
N: 616217.36
E: 1629783.66
ELEV: 600.72'

NAD 1983
NAVD 1988

MATCH LINE - SHEET 4

MATCH LINE - SHEET 4B

BOULDER STEP (TYP.)

AS-BUILT TOP OF BANK (TYP.)

LOG VANE (TYP.)

GRADE CONTROL LOG J-HOOK (TYP.)

VEG PLOT #2

X-2

X-3

X-4

ADDED CONSTRUCTED RIFFLE

ADDED CONSTRUCTED RIFFLE

AS-BUILT THALWEG (TYP.)

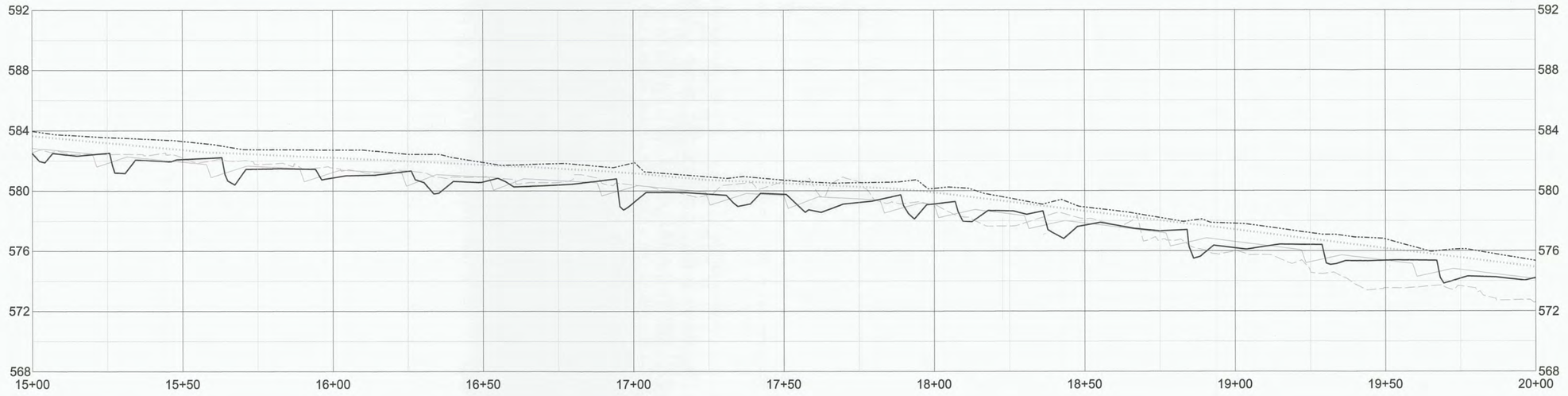
DESIGN CHANNEL ALIGNMENT

CONSTRUCTED RIFFLE (TYP.)

15+00 15+50 16+00 16+50 17+00 17+50 18+00 18+50 19+00 19+50 20

585 580

10 11 12 13 14



LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4B
NCDMS PROJECT NO. 95026	

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/8/16
DATE:

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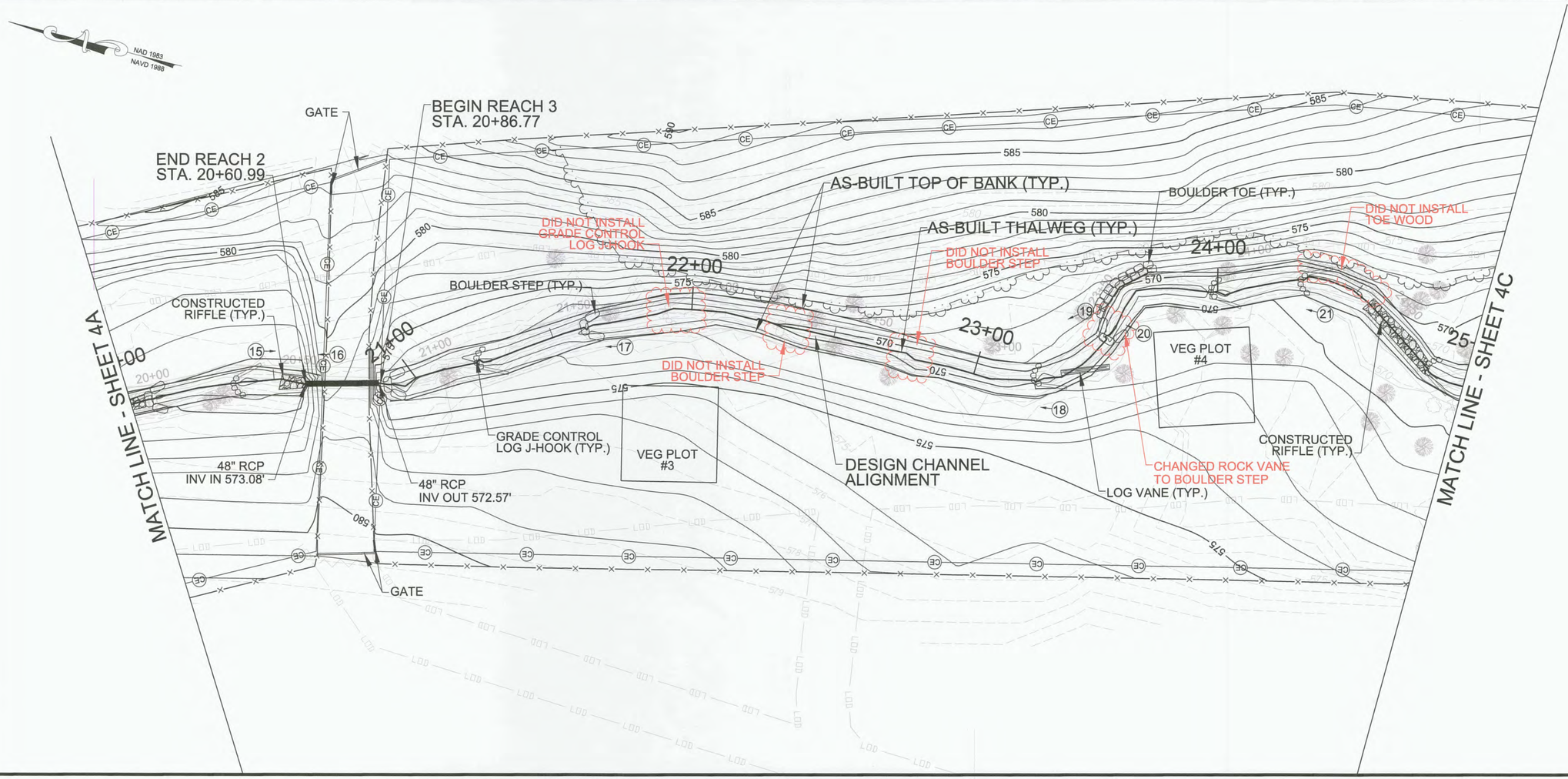
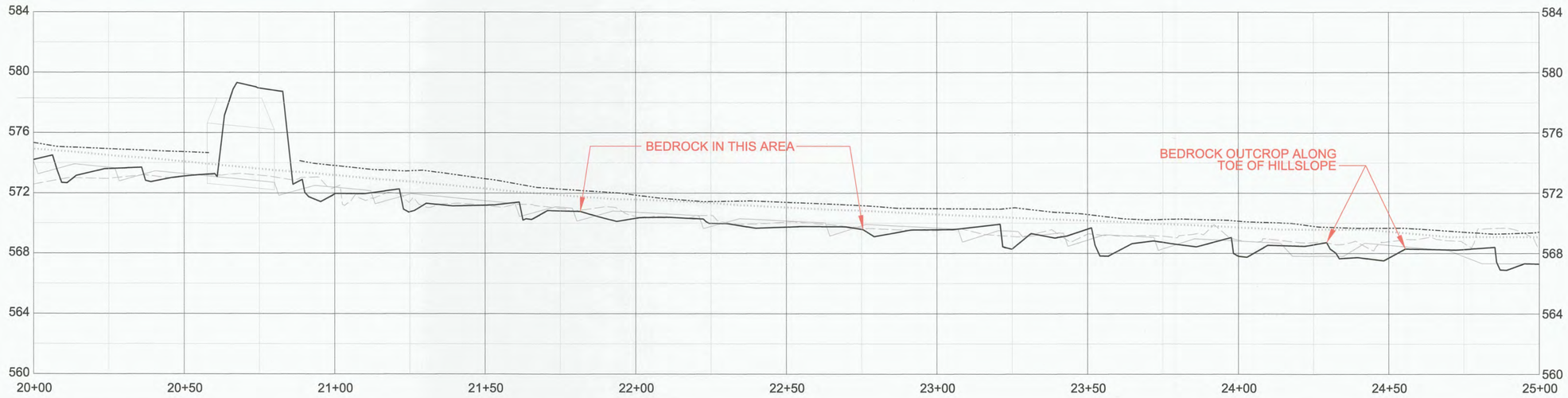
NAVD 1988





LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4C

NCDMS PROJECT NO. 95026

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/3/16
DATE:

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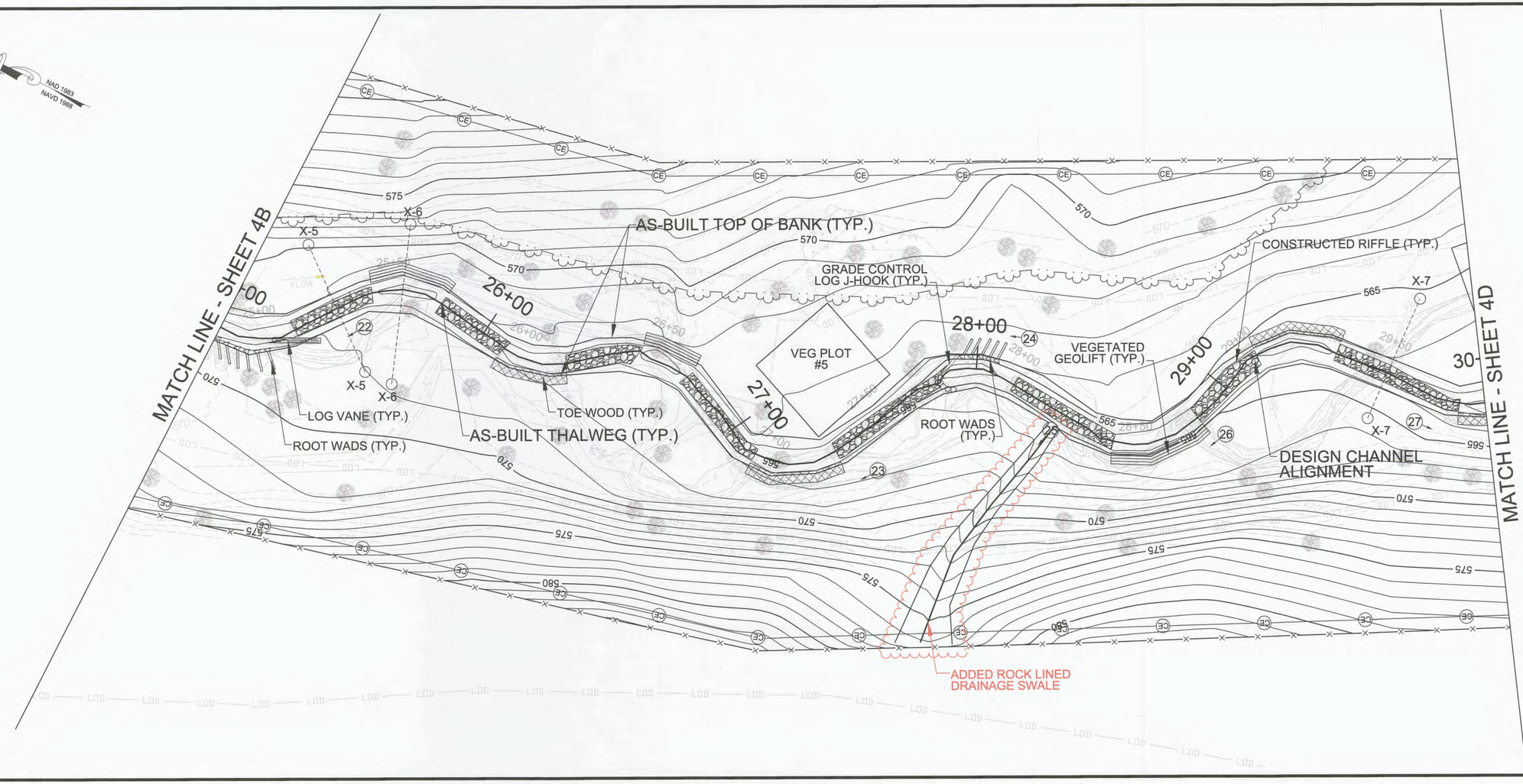
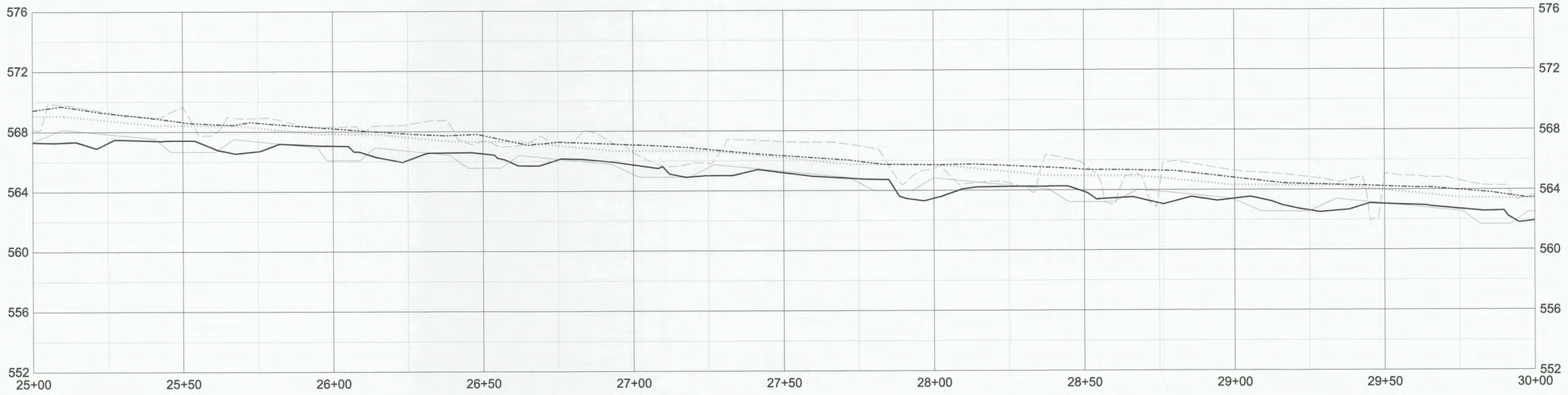
Fax: 704.665.2201
License #: F-1084

NAD 1983
NAVD 1988





LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4D
NCDMS PROJECT NO. 95026	

PROJECT ENGINEER

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License #: F-1084

NAD 1983
NAVD 1988

GPS3
N: 614976.29
E: 1630276.26
ELEV: 573.19'

MATCH LINE - SHEET 4C

MATCH LINE - SHEET 4E

VEG PLOT #6

GATE

ROOT WADS (TYP.)

DESIGN CHANNEL ALIGNMENT

CONSTRUCTED RIFFLE (TYP.)

BOULDER TOE (TYP.)

ROOT WADS (TYP.)

AS-BUILT TOP OF BANK (TYP.)

GRADE CONTROL LOG J-HOOK (TYP.)

TOE WOOD (TYP.)

ANGLED LOG STEP POOL (TYP.)

AS-BUILT THALWEG (TYP.)

BOULDER STEP (TYP.)

30+00 30+50 31+00 31+50 32+00 32+50 33+00 33+50 34+00 34+50 35+00

28 29 30 31 32

565 570 575 560 555

568 564 560 556 552 548 544

LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

NAD 1983
NAVD 1988

MATCH LINE - SHEET 4D

MATCH LINE - SHEET 4F

END REACH 3
BEGIN REACH 4
STA. 37+08.00

CHANGED VEGETATED GEOLIFT
WITH ROOT WADS TO TOE WOOD

EXTENDED
CONTRUCTED RIFFLE

DESIGN CHANNEL
ALIGNMENT

AS-BUILT
THALWEG (TYP.)

CONSTRUCTED RIFFLE (TYP.)

LOG VANE (TYP.)

VEGETATED GEOLIFT
WITH ROOT WADS (TYP.)

AS-BUILT TOP
OF BANK (TYP.)

TOE WOOD (TYP.)

END REACH 4
BEGIN REACH 5
STA. 39+40.00

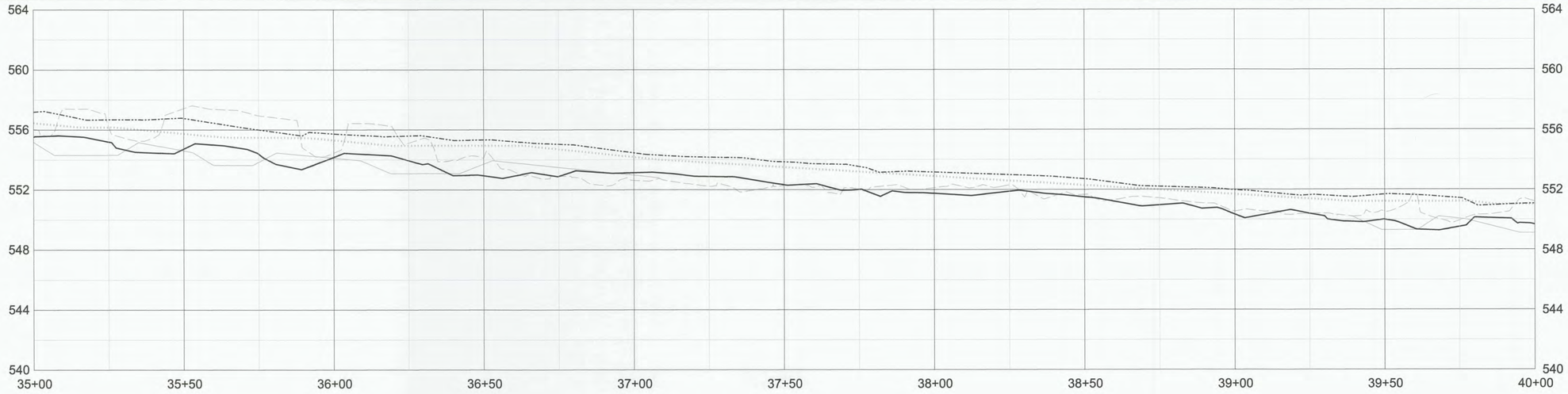
VEG
PLOT
#7

X-8

X-9

35+00
35+50
36+00
36+50
37+00
37+50
38+00
38+50
39+00
39+50
40

31
32
33
34



LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4E

NCDMS PROJECT NO. 95026

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

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TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4F
NCDMS PROJECT NO. 95026	

PROJECT ENGINEER

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NAD 1983
NAVD 1988

MATCH LINE - SHEET 4E

MATCH LINE - SHEET 4G

GATE

AS-BUILT TOP OF BANK (TYP.)

VEGETATED GEOLIFT WITH ROOT WADS (TYP.)

ROOT WADS (TYP.)

TOE WOOD (TYP.)

VEG PLOT #8

VEG PLOT #7

AS-BUILT THALWEG (TYP.)

CREST GAUGE

DESIGN CHANNEL ALIGNMENT

CONSTRUCTED RIFFLE (TYP.)

VEGETATED GEOLIFT (TYP.)

X-10

X-11

X-12

X-13

40+00

41+00

42+00

43+00

44+00

45+00

35

36

37

565

560

555

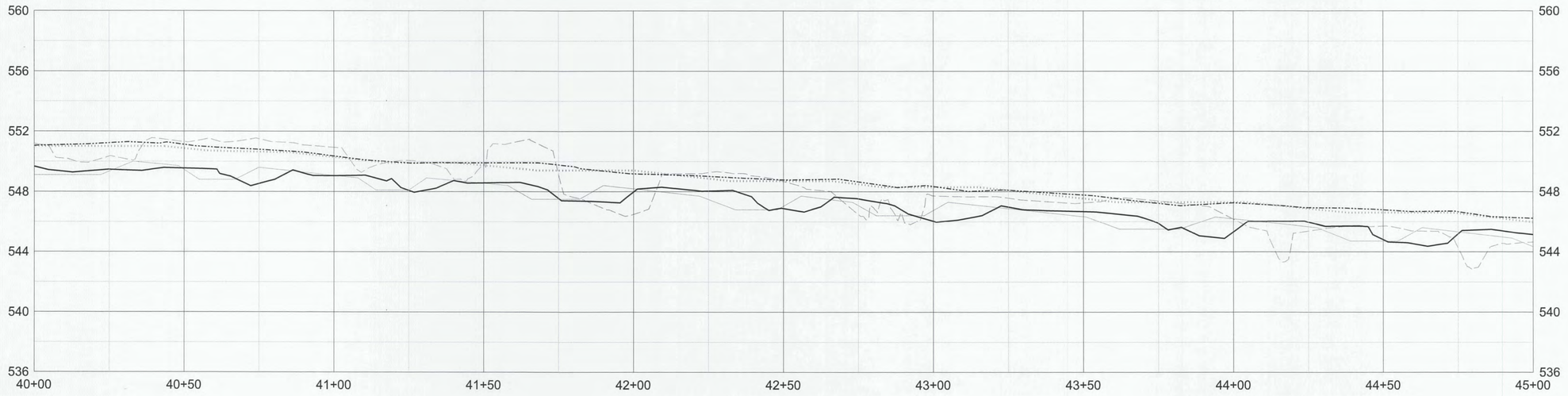
550

545

LOD

CE

FLOW



LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4G

NCDMS PROJECT NO. 95026

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

11/15/16

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Fax: 704.665.2201
License #: F-1084

NAD 1983
NAVD 1988

GPS2
N: 614063.02
E: 1630823.49
ELEV: 553.43'

MATCH LINE - SHEET 4F

GATE

ROCK CROSS VANE (TYP.)

DESIGN CHANNEL ALIGNMENT

GATE

AS-BUILT TOP OF BANK (TYP.)

END REACH 5
STA. 47+87.20

48" RCP
INV IN 543.99'

ROOT WADS (TYP.)

48" RCP
INV OUT 543.91'

ADDED ROCK LINED CHANNEL FROM FLOODPLAIN WETLAND

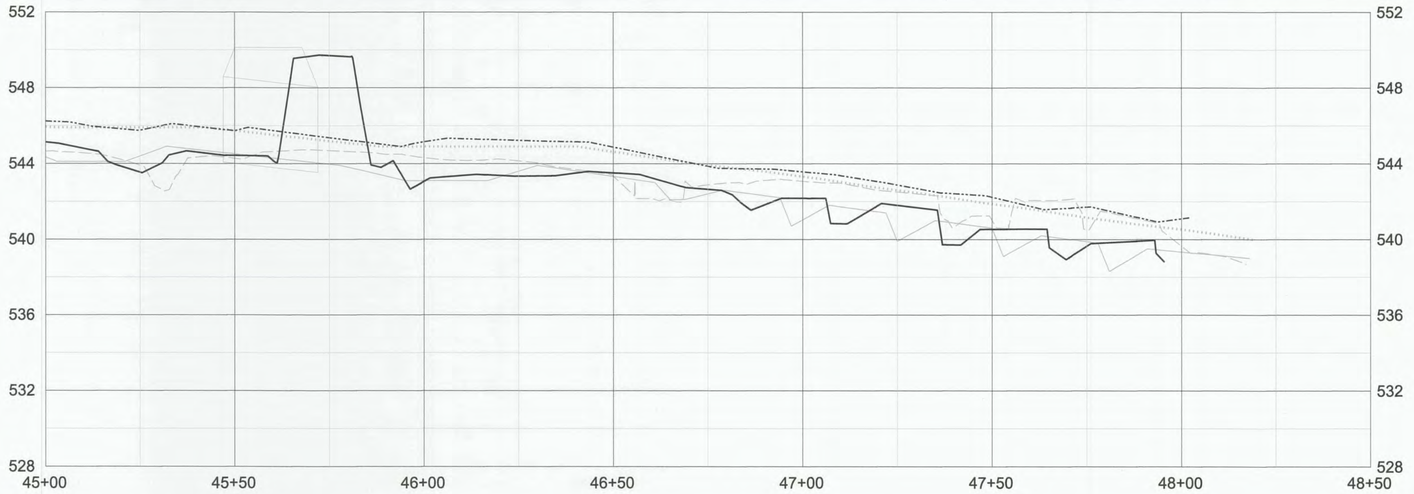
AS-BUILT THALWEG (TYP.)

GRADE CONTROL LOG J-HOOK (TYP.)

CONSTRUCTED RIFFLE (TYP.)

TOE WOOD (TYP.)

GPS1
N: 613754.25
E: 1630860.98
ELEV: 541.40'



LEGEND OF PROFILES

- AS-BUILT THALWEG
- AS-BUILT LOW BANK
- PROPOSED THALWEG
- PROPOSED LOW BANK
- EXISTING GROUND

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT-OPTION B

RECORD DRAWING PLAN & PROFILE

APPENDIX E

Photo Log

Town Creek – Reach 1

PID 1: Station 10+40 – Upstream (12/31/15)

PID 3: Station10+70 – Left Floodplain Rock Lined Channel (12/31/15)

PID 2: Station 10+60 – Downstream (12/31/15)

PID 4: Station 11+25 – Downstream (12/31/15)

PID 5: Station 12+20 – Downstream (1/13/16)

PID 6: Station 13+60 – Upstream (12/11/15)

UT to Town Creek – Reach 2

PID 7: Station 13+75 – Downstream (12/11/15)

PID 8: Station 14+65 – Left Floodplain Matted Drainage Swale (1/14/16)

PID 9: Station 14+65 – Downstream (12/11/15)

PID 10: Station 16+15 – Upstream (3/11/16)

PID 12: Station 17+75 – Upstream (2/4/16)

PID 13: Station 18+75 – Upstream (12/11/15)

PID 11: Station 16+90 – Upstream (12/11/15)

PID 14: Station 19+25 – Upstream (12/11/15)

PID 15: Station 20+50 – Downstream (2/4/16)

PID 16: Station 20+70 – Upstream (2/4/16)

PID 17: Station 21+75 – Upstream (12/15/15)

PID 18: Station 23+30 – Upstream (12/15/16)

PID 19: Station 23+60 – Upstream (1/13/16)

PID 20: Station 23+60 – Left Bank (12/15/15)

PID 21: Station 24+50 – Upstream (12-15-15)

PID 22: Station 25+50 – Upstream (12/15/15)

PID 23: Station 27+50 – Upstream (12/15/15)

PID 24: Station 28+10 – Upstream (12/15/15)

PID 25: Station 28+35 – Right Floodplain Rock Lined Channel (1/13/16)

PID 26: Station 28+90 – Upstream (12/15/15)

PID 27: Station 29+80 – Downstream (12/15/15)

PID 28: Station 31+40 – Upstream (12/15/15)

PID 29: Station 33+10 – Upstream (1/13/16)

PID 30: Station 33+45 – Downstream (12/15/15)

PID 31: Station 35+50 – Upstream (12/15/15)

PID 32: Station 36+90 – Upstream (12/15/15)

UT to Town Creek – Reach 4

PID 33: Station 37+15 – Downstream (1/13/16)

PID 34: Station 39+05 – Upstream (2/4/16)

PID 35: Station 42+00 – Downstream (2/4/16)

PID 36: Station 43+25 – Downstream (1/13/16)

PID 37: Station 44+25 – Downstream (1/13/16)

PID 38: Station 45+30 Downstream (1/13/16)

PID 39: Station 45+50 – Upstream (2/4/16)

PID 40: Station 46+90 – Upstream (1/13/16)

PID 41: Station 47+00 – Right Floodplain Rock Lined Channel from Wetland (1/13/16)

PID 42: Station 47+75 – Upstream (1/13/16)

PID 43: Station 48+05 – Downstream (1/13/16)