BEST STREAM AND WETLAND RESTORATION PROJECT
BASELINE MONITORING DOCUMENT

DUPLIN COUNTY, NORTH CAROLINA, PROJECT # 95353

Prepared for:

Division of Mitigation Services

North Carolina Department of Environment and Natural Resources
1652 Mail Service Center
Raleigh, NC 27699-1652

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Best
Duplin County, North Carolina
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Cape Fear River Basin
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Prepared by:

Resource Environmental Solutions, LLC
302 Jefferson Street, Suite 110
Raleigh, NC 27605
919-209-1061

EXECUTIVE SUMMARY

The Best Site Stream & Wetland Mitigation Project is located within an agricultural watershed in Duplin County, North Carolina, approximately two miles east of Beulaville. The project streams were significantly impacted by channelization and agricultural practices. The project involved the restoration and protection of streams and wetlands in the Muddy Creek watershed. The purpose of this restoration project is to restore and enhance a stream/wetland complex located within the Cape Fear River Basin.

The project lies within USGS Hydrologic Unit Code 03030007060010 (USGS, 1998) and within the North Carolina Division of Water Quality (NCDWQ) Cape Fear River Sub-basin 03-06-22 (NCDENR, 2005). The 2009 Cape Fear River Basin Plan identified HUC 03030007060010 as a Targeted Local Watershed. The watershed is characterized by 52 percent agricultural land use area with Muddy Creek identified as Impaired for aquatic life because of a Fair benthic community rating. The plan listed water quality and animal operations as major stressors within this TLW, and the planning goals include identifying restoration and stormwater BMP needs.

The Best stream and wetland mitigation project is located within the northern (upstream) portion of the TLW and includes sections of Muddy Creek (303d listed) and headwater streams that discharge into Muddy Creek. The stream and wetland restoration and enhancement activities on this project will provide numerous ecological and water quality benefits within the Cape Fear River Basin. These benefits will address the degraded water quality and nutrient inputs from agriculture that were identified as major watershed stressors in the 2009 Cape Fear River Basin Plan.

The Best Site consists of stream and wetland restoration on tributaries that located directly adjacent to Muddy Creek and includes 19,807 linear feet of Stream Preservation and Buffer Enhancement along Muddy Creek and its tributaries. Stream restoration has been completed for two tributaries, headwater valley restoration along a portion of one tributary, stream enhancement along three tributaries, and stream preservation and buffer enhancement for the remaining streams.

The eastern portion of the project originates approximately 0.3 miles west of Edwards Road and includes the upstream portion of Muddy Creek and tributaries UT1 and UT2 flowing from the north and UT3 and UT4 flowing from the south. The western portion of the project is located southeast of the intersection of NC HWY 24 and Lyman Road and terminates approximately 0.4 miles south of Lyman Road. This area includes the lower section of Muddy Creek and its tributaries; UT5, UT6, UT7, UT8, UT9, and UT10.

The site consists of farmland, concentrated animal feeding operations (CAFO), and wooded areas. The total easement area is 142.7 acres, 116.4 acres of which are wooded. The remaining area is agricultural. The wooded areas along the corridor were classified as disturbed deciduous forest, and invasive species were prevalent throughout. Several ditches exist throughout the project and flow into the main channel. Each ditch contributes to the overall design discharge of the channel. Channels that were restored or enhanced were degraded to a point where they no longer accessed their floodplain, lacked riparian buffers, allowed livestock access, and aquatic life was not supported. Little aquatic habitat was available to support aquatic life, and the riparian buffers were not maximizing their potential to filter nutrients.

The objective for this restoration project was to restore wetland areas and design natural waterways through stream/wetland complexes with appropriate cross-sectional dimension and slope that will provide function and meet the appropriate success criteria for the existing streams. Accomplishing this objective entailed the restoration of natural stream characteristics, such as stable cross sections, planform, and in-stream habitat. The floodplain areas were hydrologically reconnected to the channel to provide natural exchange and storage during flooding events. The design was based on reference conditions, USACE guidance (USACE, 2005), and criteria that was developed during this project to achieve success.

Additional project objectives were: restoring the riparian buffer with native vegetation, ensuring hydraulic stability, and eradicating invasive species.

The design approach for the Best Site was to combine the analog method of natural channel design with analytical methods to evaluate stream flows and hydraulic performance of the channel and floodplain. The analog method involves the use of a "template" stream adjacent to, nearby, or previously in the same location as the design reach. The template parameters of the analog reach are replicated to create the features of the design reach. The analog approach is useful when watershed and boundary conditions are similar between the design and analog reaches (Skidmore, et al., 2001). Hydraulic geometry was developed using analytical methods in an effort to identify the design discharge.

The headwater valley restoration approach was carried out along the upper section of UT4. The existing ditches/channels were backfilled such that cut and fill was balanced along the reach. Priority Level I restoration was constructed on UT1 and UT2. For the majority of the restoration reaches, the channel was rerouted form its current location to adjacent natural valley features. Enhancement Level I was completed for UT6 and UT8, and Level II was completed for UT3.

The restoration approach on UT1 and UT2 included relocating the channel to either side of its current location within the natural valley. The existing channels were plugged and filled to prevent continued flow within the ditches. By rerouting and raising the channel, the design allows the channel frequent access to its floodplain and the opportunity to create small depressional areas within the buffer to enhance habitat for wildlife and aquatic organisms. Relocating these channels did not impact any forested areas because the buffer along the restoration reaches was cultivated crop land or active pasture.

Enhancement Level I on UT6 and UT8 included grading a floodplain bench, bank stabilization treatment, and habitat improvements. Enhancement Level II was constructed for reach UT3, where habitat and buffer improvements were implemented.

Wetlands are present adjacent to streams UT3, UT4, UT5, UT6, UT10, and Muddy Creek. The three wetland restoration areas are located at the headwaters of UT1, on the floodplain adjacent to the UT2 stream restoration, and on the floodplain of Muddy Creek. Wetland restoration activities included plugging existing ditches, raising the elevation of the local groundwater, restoring natural drainage patterns both above and below the ground surface, roughing of the soil surface, planting wetland species, and permanent exclusion of livestock.

Now that all construction and planting activities are completed, the site will be monitored on a regular basis and a physical inspection of the site will be conducted at a minimum of twice per year throughout the seven-year post-construction monitoring period, or until performance standards are met. These site inspections will identify site components and features that require routine maintenance. Success criteria on the headwater valley reaches will include documented surface flow and vegetative success. The measure of stream restoration success will be documented bankfull flows and no change in stream channel classification. Sand bed channels are dynamic and minor adjustments to dimension and profile are expected. The measure of vegetative success for the site will be the survival of at least 210 seven-year old planted trees per acre. Successful establishment of wetland hydrology will be demonstrated by a wetland hydroperiod of seven percent (17 days) or greater of one growing season at each groundwater gauge location. Annual monitoring data will be reported using the DMS monitoring template.

Upon approval for closeout by the Interagency Review Team (IRT), the site will be transferred to the State of North Carolina (State). The State shall be responsible for periodic inspection of the site to ensure that restrictions required in the conservation easement or the deed restriction document(s) are upheld.

The original DMS (NCEEP) full delivery contract was for 10,133 stream mitigation units (SMUs) and 4.40 wetland mitigation units (WMUs). Following construction completion, the as-built survey indicated 26,945 linear feet of stream channel and 5.25 acres of riparian wetlands are within the conservation easement generating 10,180 SMUs and 5.25 WMUs.

Best Site Project Components – Stream Mitigation

Reach	Mitigation Type*	As-Built Stationing (Existing)			Existing Length (LF)	As-Built Length (LF)	Mitigation Ratio	SMUs
UT1	P1 Restoration	0+46	to	18+63	1,551	1,757	1 : 1.0	1,757
UT1	SP & BE	18+63	to	21+42	303	279	1 : 5.0	56
UT2	P1 Restoration	2+30	to	30+64	2,552	2,772	1 : 1.0	2,772
UT2	SP & BE	30+64	to	33+95	331	331	1 : 5.0	66
UT3	Enhancement II	0+00	to	8+42	1,458	812	1 : 2.5	325
UT3	SP & BE	14+58	to	15+22	64	64	1 : 5.0	13
UT4	HV Restoration	5+63	to	11+19	534	494	1 : 1.0	494
UT4	SP & BE	11+19	to	17+65	655	646	1 : 5.0	129
UT5	SP & BE	0+00	to	40+86	4,086	4,043	1 : 5.0	809
UT6	Enhancement I	0+62	to	6+00	538	538	1 : 1.5	359
UT7	SP & BE	0+44	to	32+27	3,183	3,183	1 : 5.0	637
UT8	Enhancement I	0+75	to	9+00	825	765	1 : 1.5	510
UT8	SP & BE	9+00	to	12+13	313	313	1 : 5.0	63
UT9	SP & BE	0+64	to	11+71	1,107	1,107	1 : 5.0	221
UT10	SP & BE	3+37	to	11+05	768	768	1 : 5.0	154
Muddy Creek	SP & BE	0+35	to	92+49	9,214	9,073	1 : 5.0	1,815
		Total			**27,482**	**26,945**		**10,180**

*P1 = Priority 1, SP & BE= Stream Preservation and Buffer Enhancement, HV = Headwater Valley

Best Site Project Components – Wetland Mitigation

Wetland	Mitigation Type	Mitigation Area (ac)	Mitigation Ratio	WMUs
W1	Restoration	3.77	1:1	3.77
W2	Restoration	0.31	1:1	0.31
W3A	Restoration	0.58	1:1	0.58
W3B	Restoration	0.59	1:1	0.59
	Total	**5.25**		**5.25**

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1 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

1.1 Location and Setting

The Best Stream and Wetland Site is located in Duplin County approximately two miles east of Beulaville, NC (**Figure 1**). To access the downstream end of the Site from the town of Beulaville, travel 0.6 miles east on NC HWY 24, take a right onto Lyman Road (SR 1801), and continue 1.6 miles southeast to the crossing with Muddy Creek. Reaches UT7, UT8, UT9, UT10 and the lower end of Muddy Creek may all be accessed from Lyman Road. Reaches UT5 and UT6 are located just south of NC HWY 24, approximately 1.9 miles east of Beulaville. The upstream portion of the site may be accessed from two locations. Reaches UT1, UT2 and Muddy Creek are located to the south of NC HWY 24, opposite of the intersection of NC HWY 24 and Penny Road (SR 1720), approximately 2.8 miles east of Beulaville. To access reaches UT3, UT4 and Muddy Creek, travel 3.2 miles east on NC HWY 24 from Beulaville to Edwards Road (SR 1835), continue south for approximately 1.0 mile, turn right onto Put Lane, and follow the road down to Reaches UT3 and UT4.

1.2 Project Goals and Objectives

The Best stream and wetland mitigation project will provide numerous ecological and water quality benefits within the Cape Fear River Basin. While many of these benefits are limited to the project area, others, such as pollutant removal and improved aquatic and terrestrial habitat, have more far-reaching effects. Expected improvements to water quality, hydrology, and habitat are outlined below.

Design Goals and Objectives

Benefits Related to Water Quality	
Nutrient removal	Benefit will be achieved through filtering of runoff from adjacent CAFOs through buffer areas, the conversion of active farm fields to forested buffers, improved denitrification and nutrient uptake through buffer zones, and installation of BMPs at the headwaters of selected reaches and ditch outlets.
Sediment removal	Benefit will be achieved through the stabilization of eroding stream banks and reduction of sediment loss from field areas due to lack of vegetative cover. Channel velocities will also be decreased through a reduction in slope, therefore decreasing erosive forces.
Increase dissolved oxygen concentration	Benefit will be achieved through the construction of instream structures to increase turbulence and dissolved oxygen concentrations and lower water temperature to increase dissolved oxygen capacity.
Runoff filtration	Benefit will be achieved through the restoration of buffer areas that will receive and filter runoff, thereby reducing nutrients and sediment concentrations reaching water bodies downstream.
Benefits to Flood Attenuation	
Water storage	Benefit will be achieved through the restoration of buffer areas which will infiltrate more water during precipitation events than under current site conditions.
Improved groundwater recharge	Benefit will be achieved through the increased storage of precipitation in buffer areas, ephemeral depressions, and reconnection of existing floodplain. Greater storage of water will lead to improved infiltration and groundwater recharge.
Improved/restored hydrologic connections	Benefit will be achieved by restoring the stream to a natural meandering pattern with an appropriately sized channel, such that the channel's floodplain will be flooded more frequently at flows greater than the bankfull stage.
Benefits Related to Ecological Processes	
Restoration of habitats	Benefit will be achieved by restoring riparian buffer habitat to appropriate bottomland hardwood ecosystem.

Improved substrate and instream cover	Benefit will be achieved through the construction of instream structures designed to improve bedform diversity and to trap detritus. Substrate will become coarser as a result of the stabilization of stream banks and an overall decrease in the amount of fine materials deposited in the stream.
Addition of large woody debris	Benefit will be achieved through the addition of wood structures as part of the restoration design. Such structures may include log vanes, root wads, and log weirs.
Reduced temperature of water due to shading	Benefit will be achieved through the restoration of canopy tree species to the stream buffer areas.
Restoration of terrestrial habitat	Benefit will be achieved through the restoration of riparian buffer bottomland hardwood habitats.

1.3 Project Structure

Table 1a. Best Site Project Components – Stream Mitigation

Reach	Mitigation Type*	As-Built Stationing (Existing)			Existing Length (LF)	As-Built Length (LF)	Mitigation Ratio	SMUs
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		Total			**27,482**	**26,945**		**10,180**

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Table 1b. Best Site Project Components – Wetland Mitigation

Wetland	Mitigation Type	Mitigation Area (ac)	Mitigation Ratio	WMUs
W1	Restoration	3.77	1:1	3.77
W2	Restoration	0.31	1:1	0.31
W3A	Restoration	0.58	1:1	0.58
W3B	Restoration	0.59	1:1	0.59
	Total	**5.25**		**5.25**

1.3.1 Restoration Type and Approach

UT1

Priority Level 1 restoration was completed for UT1 to address all existing impairments, particularly the greatly oversized channel and lack of bedform diversity. The design approach included meandering the channel within the natural valley and backfilling the existing stream. A minimum 50 foot buffer was established and planted with native riparian vegetation. Because the pre-existing buffer was devoid of significant woody vegetation, woody debris was installed along the bed to improve in-stream habitat. Livestock was excluded with fencing installed along the easement boundary. An existing CMP culvert located along the middle of the reach was removed and replaced downstream at station 13+75 to allow the landowner access to both sides of the property. Stream Preservation and Buffer Enhancement was completed for the downstream section of the channel where it flows through a forested buffer down to the confluence with Muddy Creek. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT2

Similar to UT1, Priority 1 restoration was completed for UT2 to address historic straightening and channel enlargement. The existing channel was backfilled, and the restored channel was relocated such that it meanders within the existing valley. A diffuse flow structure was installed at the ditch adjacent to the proposed crossing. The structure was placed such that flows from the existing ditch will be attenuated to establish sheet flow as the water enters the restored channel. All areas within the minimum 50 foot buffer were planted with native riparian vegetation. An existing 60” CMP culvert located at station 20+25 of the reach was removed and replaced with a 48” HDPE culvert to allow the landowner access to the entire property. Additionally, the existing culvert at the upstream end of UT2 was upgraded to a 48” HDPE culvert and reset to more effectively transition the existing channel upstream into the project stream. Priority Level I restoration was appropriate for this channel because it was the only mitigation approach that would address bed and bank instability, establish a forested riparian buffer, and significantly enhance aquatic habitat. Stream Preservation and Buffer Enhancement was completed for the most downstream section, where the channel enters the existing forested buffer, down to its confluence with Muddy Creek. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT3

Enhancement Level II was completed on Reach UT3 due to the channel's stability and appropriate size. The design approach on this reach focused on improving the riparian buffer. The existing hog lagoon located within buffer on the west side of the reach has remained in place, preventing the generation of stream credits for approximately 600 linear feet. Through this section, the left buffer was extended out to a minimum of 75 feet along the left bank, and the right buffer was extended just past top of bank. The existing crossing located at station 8+50 was replaced and upgraded with a 30" HDPE pipe, allowing the landowner continued access across his property. Additional bank grading and stabilization was included in the culvert replacement. The grading of pools and the installation of woody debris structures was performed along the reach to improve aquatic habitat. Upstream of the crossing, a 75-foot buffer was restored along the east bank where the channel currently flowed through an active pasture. A 100-foot buffer was implemented for the headwater origin point to further protect water quality from cattle access. Cattle have been excluded with fencing. All areas within the buffer were planted with native riparian vegetation. Stream Preservation and Buffer Enhancement was implemented along the downstream end where the channel enters the Muddy Creek floodplain. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT4

Headwater valley restoration was completed for the upper section of UT4. The existing channel was backfilled, and flow was directed from its current position east back to the historic valley location. A minor amount of earthwork was completed in the headwater valley restoration apart from ditch plugging to tie the existing ditch back to the natural valley. Areas within the 100 foot buffer that were disturbed or lacked riparian vegetation were planted. Cattle were excluded from the buffer through the installation of fencing. An existing 15" CPP culvert crossing located at station 8+50 of the reach was removed and replaced with triple 18" HDPE culverts. This crossing was relocated to the low spot in the valley to allow the landowner continued access to an agricultural field west of the channel. Downstream of the crossing, a smaller low flow channel was constructed within the natural valley. This segment now connects the upstream headwater valley section to the existing channel approximately 230 feet below the crossing. Due to the stable nature of the buffer along the downstream reach of UT4, Stream Preservation and Buffer Enhancement was implemented from just downstream of the crossing to the confluence with Muddy Creek. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT5
Stream Preservation and Buffer Enhancement was completed on UT5. The channel is stable throughout the easement and provides a variety of aquatic habitats. The easement boundary extends a minimum of 50 feet outward from the stream channel, or the limit of adjacent riparian wetlands, whichever is wider. The riparian buffer is an intact hardwood forest with localized areas of privet. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT6
Enhancement Level I was completed on UT6. The mitigation approach on this reach focused on bank stabilization, bedform diversity, and improving the riparian buffer. The existing channel was impaired by channelization, vertical un-vegetated banks, and a dense privet understory within the buffer. The grading of pools, grade control structures, and the installation of woody debris structures were implemented along the reach to improve aquatic habitat. All disturbed areas within the riparian buffer were planted with native riparian vegetation.

UT7
Stream Preservation and Buffer Enhancement was completed on UT7. The channel is stable throughout the easement and provides a variety of aquatic habitats. The easement boundary extends a minimum of 50 feet outward from the stream channel, or the limit of adjacent riparian wetlands, whichever is wider. The riparian buffer is an intact hardwood forest with localized areas of privet. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT8
Enhancement Level I was completed on UT8. The mitigation approach on this reach focused on bank stabilization, bedform diversity, and riparian buffer restoration. The existing channel was impaired by channelization, localized bank instability, and cleared agricultural land in the buffer. Stabilization activities included grading a floodplain bench, installing grade control structures, and installing woody debris structures to improve hydraulic efficiency and aquatic habitat. All disturbed areas within the riparian buffer were planted with native riparian vegetation. Stream Preservation and Buffer Enhancement was completed on 313 linear feet where the channel enters the existing forested buffer, down to its confluence with Muddy Creek. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as

planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT9
Stream Preservation and Buffer Enhancement was completed on UT9. The stream is channelized, but stable throughout the easement. The active channel is meandering within the larger excavated channel bottom. The riparian buffer is intact hardwood forest with localized areas of privet. The easement boundary extends a minimum of 50 feet outward from the stream channel, or to the limit of adjacent riparian wetlands, whichever is wider. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

UT10
Stream Preservation and Buffer Enhancement was completed on UT10. The channel is stable throughout the easement and provides a variety of aquatic habitats. The easement boundary extends a minimum of 50 feet outward from the stream channel, or the limit of adjacent riparian wetlands, whichever is wider. The riparian buffer is an intact hardwood forest with localized areas of privet. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

Muddy Creek
Stream Preservation and Buffer Enhancement was completed for the majority of Muddy Creek. The buffer was restored and increased to a width of 75 feet along the south side. Buffer enhancement activities included the treatment of invasive exotic species by herbicide applications and/or mechanical control as well as planting bare root seedlings in sparsely vegetated areas. RES will continue to conduct invasive species treatments on an as needed basis. Additional treatments will be dependent on monitoring results and regulatory agency guidance. These treatments will be timed in accordance with specific invasive exotic plant phenology for the most effective control. Considering

such factors as the influence of established invasive exotics on adjacent land, it is not feasible to expect complete eradication of the targeted invasive species. However, RES does expect to achieve significant reduction of targeted invasive exotic species through this control plan. The goal of the treatment program is control of invasive exotic species such that the target natural communities are present and on a positive trajectory at project closeout.

Wetland W1
Wetland W1 is located at the headwater of UT1 and has a natural constriction at the outlet. The soil is a sandy loam/loamy sandy underlain by clayey textured subsoil that forms an effective restrictive layer to groundwater loss. This area receives runoff from NC HWY 24. Based upon soil and landscape position, it is likely this area has a seasonal seepage along the upper boundary.

Site modifications included removal of dredged and excavated materials, plugging the ditch, and raising the streambed elevation to bring the water table closer to the ground surface. Additional temporal habitat was constructed to eliminate surface leveling and smoothing for agricultural use. The temporal habitat is variable to mimic sloughs, oxbows, root-tips and other shallow natural features. During monitoring, beaver activity will be controlled to allow the site to stabilize and vegetative community to establish. After the monitoring period, the site is designed to promote and tolerate beaver activity. No hydrologic trespass is anticipated due to beaver activity in this wetland. These modifications will increase storage and eliminate the rapid loss of surface water. This area may receive limited overbank flows due to location in the headwater of UT1. Subsoil ripping and roughing of the soil surface were performed to ameliorate soil compaction and create an uneven surface more conducive for surface water retention, infiltration, and increase storage that would be present in natural wetland systems.

Wetland W2
Wetland W2 is located at the toe slope along Muddy Creek and UT2. The soil is a sandy loam/loamy sandy underlain by sandy clay loam and sandy clay. This site is at a low elevation and is influenced by the water table on the floodplain of Muddy Creek. It is unlikely that groundwater loss is significant during most of the year. This area has a small watershed, but flooding from UT2 and Muddy Creek will increase hydrologic storage.

Hydrology was restored by removing dredge material along the channel and raising the streambed elevation, bringing the water table closer to the ground surface. Site modifications included subsoil ripping, crown removal, and surface roughing of the area. Additional temporal habitat was constructed to eliminate the surface leveling and smoothing for agricultural use. The temporal habitat is variable to mimic sloughs, root-tips and other shallow natural features. This ameliorates past soil leveling and compaction and creates an uneven surface more conducive of infiltration and storage that would be present in natural wetland systems.

Wetland W3
Wetland W3 is composed of two similar area (W3a and W3b) located at the toe slope along Muddy Creek. A low finger of soil separates them. The soil in these areas is a loamy sand/sandy loam. The surrounding upland is underlain by clayey subsoil that forms an effective restrictive layer that lateral flow rides provide additional hydrological input. A ditch is located upslope of these areas and alongside W3a that drains to Muddy Creek.

The soil is a sandy loam/loamy sand. The surrounding upland has a sandy clay loam and sandy clay that form an effective restrictive layer that lateral flow rides provide additional hydrological input. Both areas have small watersheds, but W3b receives groundwater seepage along the toe of slope diverted by the upslope ditch.

Hydrology was restored by filling ditches and enhancing the concave topography by removing soil material where cultivation had filled low features and leveled the surface to facilitate cultivation. Additional groundwater seepage diverted by the ditch was restored to these wetlands. Temporal habitat was constructed to eliminate the surface leveling and smoothing for agricultural use. Subsoil ripping and surface roughing of the area was performed to ameliorate soil compaction and create an uneven surface more conducive of infiltration and storage that would be present in natural wetland systems.

1.4 Project History, Contacts and Attribute Data

1.4.1 Project History

The Best Restoration Site was restored by Resource Environmental Solutions, LLC (RES) through a full-delivery contract awarded by NCDMS in 2012. Tables 2, 3, and 4 provide a time sequence and information pertaining to the project activities, history, contacts, and baseline information.

1.4.2 Project Watersheds

The easement totals 142.7 acres and the project streams include ten unnamed tributaries to Muddy Creek and a portion of Muddy Creek extending from approximately 0.3 miles west of Edwards Road to 0.4 miles past Lyman Road. The total drainage area at the downstream limits of the project is 2,928 acres (4.58 mi^2). The land use in the project watershed is approximately 47 percent cultivated cropland, 21 percent evergreen and deciduous forest, 13 percent shrub/scrub, ten percent bottomland forest/hardwood swamp, three percent developed, and six percent managed herbaceous cover and pasture.

UT1 has a drainage area of 0.06 square miles (41 acres), and flows in a southerly direction to the confluence with Muddy Creek. UT2 flows south to its confluence with Muddy Creek and has a drainage area of 0.23 square miles (146 acres). UT3 is located to the south of Muddy Creek, opposite of UT2, and flows to the north and into Muddy Creek. This reach has a drainage area of 0.09 square miles (56 acres). UT4 is located to the west of UT3 and discharges to Muddy Creek. This reach has a drainage area of 0.13 square miles (82 acres). UT5 flows in a southerly direction from NC HWY 24 to Muddy Creek and has a drainage area of 0.59 square miles (380 acres). UT6 flows southeast to its confluence with UT5 and has a drainage area of 0.12 square miles (79 acres). UT7 flows in a southerly direction east of Lyman Road down to its confluence with UT5 before discharging to Muddy Creek. UT7 has a drainage area of 0.60 square miles (387 acres). UT8 has a drainage area of 0.09 square miles (56 acres), and flows in an easterly direction through a cultivated field east of Lyman Road down to the confluence with UT7. UT9 flows southeast to its confluence with Muddy Creek and has a drainage area of 0.06 square miles (36 acres). UT10 is the downstream-most tributary within the Best Site and flows in a westerly direction from a farm crossing west of Lyman Road down to Muddy Creek. UT10 has a drainage area of 0.48 square miles (306 acres). Muddy Creek is a stable swamp stream system with intact hardwood forest floodplain, extending from approximately 0.3 miles west of Edwards Road to 0.5 miles south of Lyman Road. Muddy Creek has a drainage area of 4.6 square miles (2,930 acres) at the downstream limits and has an existing length of 9,214 linear feet.

2 Success Criteria

The success criteria for the Best Site stream restoration will follow accepted and approved success criteria presented in the USACE Stream Mitigation Guidelines and subsequent NCEEP and agency guidance. Specific success criteria components are presented below.

2.1 Stream Restoration

2.1.1 Bankfull Events

Two bankfull flow events must be documented within the seven-year monitoring period. The two bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until two bankfull events have been documented in separate years. Bankfull events will be documented using crest gauges, auto-logging crest gauges, photographs, and visual assessments for evidence of debris rack lines.

2.1.2 Cross Sections

There should be little change in as-built cross-sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion), or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen stream classification method, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

2.1.3 Bank Pin Arrays

Bank pin arrays will be used as a supplemental method to monitor erosion on selected meander bends where there is not a cross section. Bank pin arrays will be installed along the outer bend of the meander. Bank pins will be installed just above the water surface and every two feet above the lowest pin. Bank pin exposure will be recorded at each monitoring event, and the exposed pin will be driven flush with the bank.here should be little change in as-built cross-sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion), or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross-sections shall be classified using the Rosgen stream classification method, and all monitored cross-sections should fall within the quantitative parameters defined for channels of the design stream type.

2.1.4 Digital Image Stations

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

2.2 Wetland Success Criteria

The NRCS does not have a current WETs table for Duplin County upon which to base a normal rainfall amount and average growing season. The closest comparable data was determined to be from Sampson County. The growing season is from March 17 to November 14. Based on a daily minimum temperature greater than 28 degrees Fahrenheit occurring in five of ten years, the growing season for Sampson County is 242 days long. Successful establishment of wetland hydrology will be demonstrated by a wetland hydroperiod of nine percent or greater of one growing season (22 days) at each groundwater gauge location. In growing seasons with less than normal rainfall, no hydrology data will be used.

If a gauge location fails to meet these success criteria in the seven year monitoring period then monitoring may be extended, remedial actions may be undertaken, or groundwater modeling may be used to demonstrate the limits of wetland restoration.

2.3 Vegetation Success Criteria

Vegetative monitoring success criteria for plant density within the riparian buffers on the site will follow NCDMS Guidance dated 7 November 2011. Vegetation monitoring plots will be a minimum of 0.02 acres in size, and cover a minimum of two percent of the planted area. The following data will be recorded for all trees in the plots: species, height, planting date (or volunteer), and grid location. Monitoring will occur each year during the monitoring period. The interim measures of vegetative success for the site will be the survival of at least 320 three-year old trees per acre at the end of Year 3 and 260 five-year old trees per acre at the end of Year 5. The final vegetative success criteria will be the survival of 210 trees per acre at the end of Year 7 of the monitoring period.

Invasive and noxious species will be monitored and controlled so that none become dominant or alter the desired community structure of the site. If necessary, RES will develop a species-specific control plan.

2.4 Scheduling/Reporting

The monitoring program will be implemented to document system development and progress toward achieving the success criteria. The restored stream morphology will be assessed to determine the success of the mitigation. The monitoring program will be undertaken for five years or until the final success criteria are achieved, whichever is longer.

Monitoring reports will be prepared in the fall of each year of monitoring and submitted to NCDMS. The monitoring reports will include all information, and be in the format required by NCDMS in Version 2.0 of the NCDMS Monitoring Report Template.

3 MONITORING PLAN

Annual monitoring data will be reported using the DMS monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, population of DMS databases for analysis, research purposes, and assist in decision making regarding project close-out. The success criteria for the Best Site stream and wetland mitigation will follow current accepted and approved success criteria presented in the USACE Stream Mitigation Guidelines, NCDMS requirements, and subsequent agency guidance. Specific success criteria components are presented in **Table 2**. Monitoring reports will be prepared annually and submitted to NCDMS.

Table 2. Monitoring Requirements

Parameter	Quantity	Frequency	Notes
Pattern	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline	Additional surveys will be performed if monitoring indicates instability or significant channel migration
Dimension	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline, Years 1,2,3,5, and 7	Surveyed cross sections and bank pins
Profile	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Baseline	Additional surveys will be performed if monitoring indicates instability
Surface Water Hydrology	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Annual	Crest Gauges and/or Pressure Transducers will be installed on site; the devices will be inspected on a quarterly/semi-annual basis to document the occurrence of bankfull events on the project
Groundwater Hydrology		Annual	Groundwater monitoring gauges with data recording devices will be installed on site; the data will be downloaded on a quarterly basis during the growing season
Vegetation		Annual	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols
Exotic and Nuisance Vegetation		Annual	Locations of exotic and nuisance vegetation will be mapped
Project Boundary		Semi-annual	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be mapped
Stream Visual		Annual	Semi-annual visual assessments
Wetland Visual		Annual	Semi-annual visual assessments

3.1 Stream Restoration

3.1.1 As-Built Survey

An as-built survey was conducted following construction to document channel size, condition, and location. The survey includes a complete profile of thalweg, top of bank, and in stream channel structures to compare with future geomorphic data. Longitudinal profiles will not be required in annual monitoring reports unless requested by NCDMS or USACE.

3.1.2 Bankfull Events

Six sets of manual and auto-logging crest gauges were installed on the site, one along UT1, UT2, UT3, UT4, UT6, and one along UT8. The auto logging crest gauges were installed within the channel and will continuously record flow conditions at an hourly interval. Manual crest gauges were installed on the bank at bankfull elevation. Crest gauges will be checked during each site visit to determine if a bankfull event has occurred since the last site visit. Crest gauge readings and debris rack lines will be photographed to document evidence of bankfull events.

3.1.3 Cross Sections

A total of 31 permanent cross sections were installed to monitor channel dimensions and stability. Twelve cross sections were installed along UT1 where Priority 1 restoration was performed. Twelve cross sections (six pools and six shallows) were installed along UT2 also. UT4 has a total of 2 cross sections installed throughout its length. Stream segment UT6 has two cross sections installed along its length where enhancement activities was performed. On the UT8 side of the project, a total of three cross sections were installed. Cross sections were typically located at representative riffle and pool sections along each stream reach. Each cross section was permanently marked with 3/8 rebar pin to establish a monument location at each end. A marker pole was also installed at both ends of each cross section to allow ease locating during monitoring activities. Cross section surveys will be performed once a year during annual monitoring years 1, 2, 3, 5, and 7 and will include all breaks in slope including top of bank, bottom of bank, streambed, edge of water, and thalweg. Permanent cross-sections were installed at a minimum of one per 20 bankfull widths with half in pools and half in shallows. All cross-section measurements will include bank height ratio and entrenchment ratio. There should be little change in as-built cross-sections. If changes do take place, they should be evaluated to determine if they represent movement toward a less stable condition (for example down-cutting or erosion), or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be no less than 2.2 within restored reaches. Channel stability should be demonstrated through a minimum of two bankfull events documented in the seven-year monitoring period.

3.1.4 Digital Image Stations

Digital photographs will be taken at least once a year to visually document stream and vegetation conditions. This monitoring practice will continue for seven years following construction and planting. Permanent photo point locations at cross sections and vegetation plots have been established so that the same directional view and location may be repeated each monitoring year. Monitoring photographs will also be used to document any stream and vegetation problematic areas such as erosion, stream and bank instability, easement encroachment and vegetation damage.

3.1.5 Bank Pin Arrays

Eight bank pin array sets have been installed at pool cross sections located along UT1 and UT2. These bank pin arrays were installed along the upstream and downstream third of the meander. Bank pins are a minimum of three feet long, and have been installed just above the water surface and every two feet above the lowest pin. Bank pin exposure will be recorded at each monitoring event, and the exposed pin will be driven flush with the bank.

3.1.6 Surface Flow

The headwater valley restoration area on UT4 will be monitored to document intermittent or seasonal surface flow. This will be accomplished through direct observation, photo documentation of dye tests, and continuous flow monitoring devices (pressure transducers). An auto logging crest gauges has been installed within the headwater valley channel and will continuously record flow conditions at an hourly interval. This gauge will be downloaded during each site visit to determine if intermittent or seasonal flows conditions are present.

3.1.7 Visual Assessment Monitoring

Visual monitoring of all mitigation areas will be conducted a minimum of twice per monitoring year by qualified individuals. The visual assessments will include vegetation density, vigor, invasive species, and easement encroachments. Visual assessments of stream stability will include a complete streamwalk and structure inspection. Digital images will be taken at fixed representative locations to record each monitoring event, as well as any noted problem areas or areas of concern. Results of visual monitoring will be presented in a plan view exhibit with a brief description of problem areas and digital images. Photographs will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal photos should indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral photos should not indicate excessive erosion or continuing degradation of the banks over time. A series of photos over time should indicate successional maturation of riparian vegetation.

3.2 Wetland Hydrology

Wetland hydrology will be monitored to document hydric conditions in the wetland restoration areas. This will be accomplished with automatic recording pressure transducer gauges installed in representative locations across the restoration areas and reference wetland areas. The gauges will be downloaded quarterly and wetland hydroperiods will be calculated during the growing season. Gauge installation will follow current regulatory and DMS guidance. Visual observations of primary and secondary wetland hydrology indicators will also be recorded during quarterly site visits.

3.3 Vegetation

A total of 23 vegetation plots were randomly established within the planted stream riparian buffer easement. Vegetation plots measure 10 meters by 10 meters or 5 meters by 20 meters (0.02 acres) and has all four corners marked with metal posts. Planted woody vegetation was assessed within each plot to establish a baseline dataset. Within each vegetation plot, each planted stem was identified for species, “X” and “Y” origin located, and measured for height. Reference digital photographs were also captured to document baseline conditions. Species composition, density, growth patterns, damaged stems, and survival ratios will be measured and reported on an annual basis. Vegetation plot data will be reported for each plot as well as an overall site average.

4 MAINTENANCE AND CONTINGENCY PLAN

All identified problematic areas or areas of concern such as stream bank erosion/instability, aggradation/degradation, lack of targeted vegetation, and invasive/exotic species which prevent the site from meeting performance success criteria will be evaluated on a case by case basis. These areas will be documented and remedial actions will be discussed amongst NCDMS staff to determine a plan of action. If it is determined remedial action is required, a plan will be provided.

4.1 Stream

Any stream problem areas which are identified during post construction monitoring activities will be documented and mapped on the Current Conditions Plan View (CCPV) as part of the annual monitoring report. Stream problem areas or areas of concern may include bank erosion, aggradation/degradation, structure failure or not performing as designed, beaver dams, cattle

encroachment due to fence damage, etc. If it is determined through NCDMS correspondence that remedial action is required to repair an area, a proposed work plan will be submitted for remediation.

4.2 Vegetation

Any vegetation problem areas which are identified during post construction monitoring activities will be documented and mapped on the Current Conditions Plan View (CCPV) as part of the annual monitoring report. Vegetation problem areas or areas of concern may include vegetation plot not meeting success criteria, invasive species abundance, sparse vegetation areas, etc. If it is determined through NCDMS correspondence that remedial action is required to repair an area, a proposed work plan will submitted for remediation.

4.3 Wetlands

Any wetland problem areas which are identified during post construction monitoring activities will be documented and mapped on the Current Conditions Plan View (CCPV) as part of the annual monitoring report. Wetland problem areas may include planted vegetation or wetland hydrology not meeting success criteria. If it is determined through NCDMS correspondence that remedial action is required to repair an area, a proposed work plan will be submitted for remediation.

5 AS-BUILT CONDITIONS (BASELINE)

The Best Stream and Wetland Restoration as-built survey was completed in July 2015. A topographic survey on the constructed stream channel and adjacent floodplain areas was performed to document post construction conditions. The survey involved locating the stream channel thalweg, top of bank, stream structures, culvert crossings, woody debris, monitoring cross sections, vegetation plots, crest gauges, and a rain gauge.

The as-built survey drawings indicate that the Best Stream and Wetland Restoration site was constructed to the mitigation plan design. Profile and dimension parameters are within the tolerances for stream mitigation construction. The Best Site was constructed to design plan specifications with minimal modifications. Construction modifications performed along UT1 included substituting twin 24” HDPE with a 36” HDPE pipe at the crossing (Sta. 13+75). Also along UT1, rock was placed in some of the riffle beds to prevent degradation and scour. Over time it is anticipated that the rock placed within the channel bed will be covered with sediment and perform as a grade control. UT2 was constructed to design plans with very minimal modifications. The proposed 42” HDPE culvert at station 2+00 was substituted with a 48” HDPE culvert. All changes were approved by the design engineer and are documented on the as-built drawings.

5.1 As-Built Drawings

The Best Stream and Wetland Restoration As-Built Drawing is located in Appendix 4 which documents post construction conditions for the project.

5.2 Baseline Data Collection

5.2.1 Morphological State of the Channel

All morphological stream data for the as-built profile and dimensions were collected during the as-built survey performed during July 2015. Appendix B includes summary data tables, morphological parameters, and stream photographs.

Profile
The baseline (MY-0) profiles closely matches the proposed design profiles. The plotted longitudinal profiles can be found on the As-Built Drawings in Appendix 4 and morphological summary data tables can be found in Appendix B.

Dimension
The baseline (MY-0) cross sectional dimensions closely matches the proposed design cross section parameters. All cross section plots and data tables can be found in Appendix B.

Sediment Transport
The as-built conditions show that shear stress and velocities have been reduced for all restoration reaches. Pre-construction conditions documented both UT1 and UT2 stream reaches as sand bed channels and remain classified as sand bed channels post-construction. Visual assessment shows the channel is transporting sediment as designed and will continue to be monitored for aggradation and degradation. During restoration activities, class A stone was placed along several riffle locations in UT1 and UT2. This was done as a preventative action and to perform as grade controls. It is anticipated that over time, sediment transporting down the stream will cover the stone and make them less visible.

5.2.2 Vegetation

The baseline monitoring (MY-0) vegetation survey was completed in June 2015. The baseline vegetation monitoring on the Best Stream and Wetland Restoration Site resulted in an average of 1,108 planted stems per acre, which is greater than the required 680 stems per acre density. The average stems per vegetation plot was 27 planted stems. The minimum planted stems per plots was 15 stems and the maximum was 42 stems per plot. A total of 20,200 bare root stems were planted across the Best Stream and Wetland Restoration Site. A total of 3,000 live stakes were also planted along the stream banks for bank stabilization. Vegetation summary data tables and vegetation plot photos can be found in Appendix C. Invasive species control and privet treatment will be continued throughout the project as needed.

5.2.3 Photo Documentation

Permanent photo point locations have been established at cross sections, vegetation plots, stream crossings, and stream structures by RES staff. Any additional problem areas or areas of concern will also be documented with a digital photograph during monitoring activities. Stream digital photographs can be found in Appendix B and Appendix C for vegetation photos.

5.2.4 Hydrology

Six sets of manual and auto-logging crest gauges were installed on the site, one along UT1, UT2, UT3, UT4, UT6, and one along UT8. The auto logging crest gauges were installed within the channel and will continuously record flow conditions at an hourly interval. Manual crest gauges were installed on the bank at bankfull elevation. Crest gauges will be checked during each site visit to determine if a

bankfull event has occurred since the last site visit. Crest gauge readings and debris rack lines will be photographed to document evidence of bankfull events. Crest gauge data will be reported in each annual monitoring report. Wetland hydrology will be monitored with nine automatic recording pressure transducer gauges that have been installed in representative locations across the restoration areas. An additional three gauges were installed in reference wetlands.

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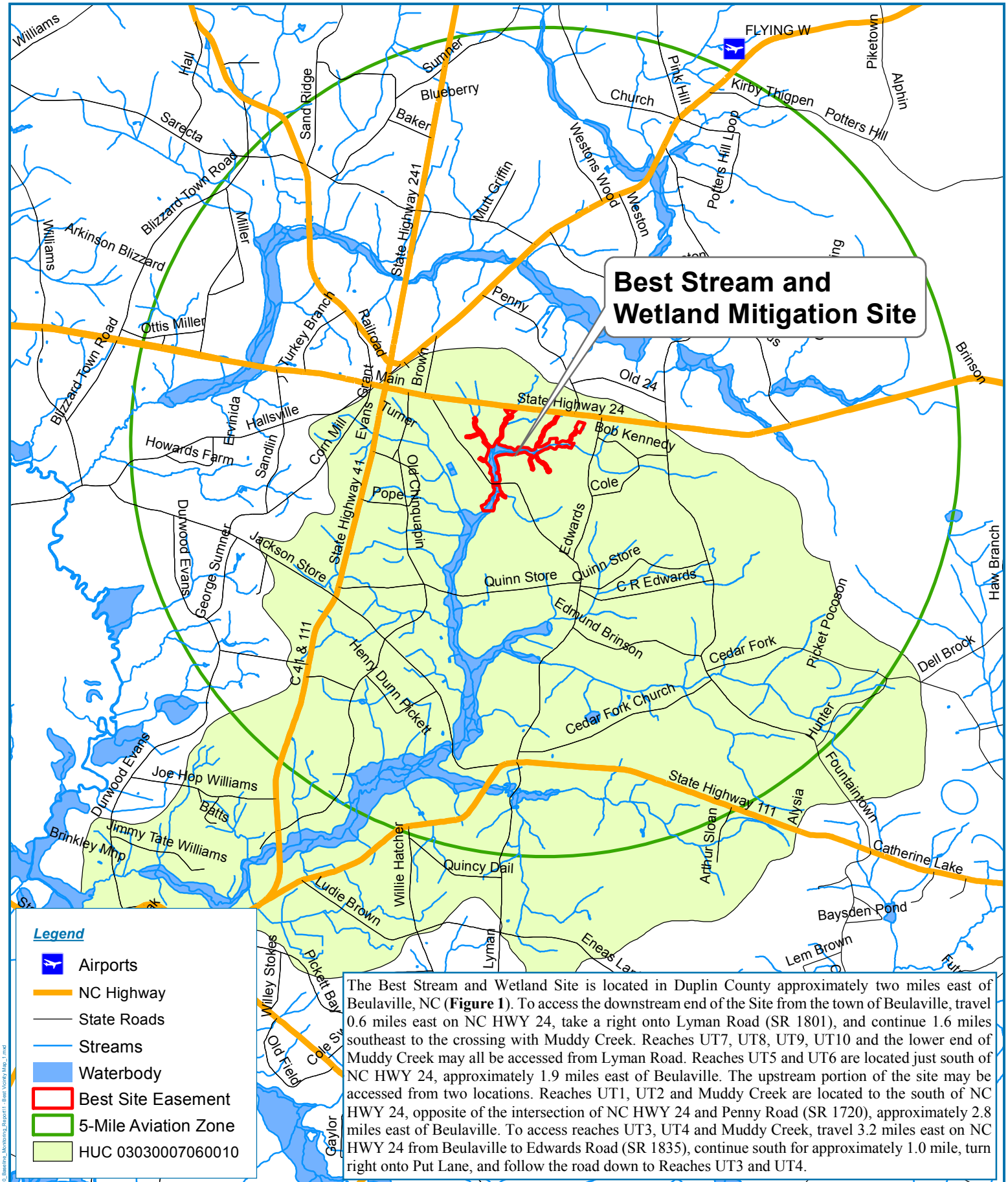
APPENDIX A

General Tables and Figures



The Best Stream and Wetland Site is located in Duplin County approximately two miles east of Beulaville, NC (**Figure 1**). To access the downstream end of the Site from the town of Beulaville, travel 0.6 miles east on NC HWY 24, take a right onto Lyman Road (SR 1801), and continue 1.6 miles southeast to the crossing with Muddy Creek. Reaches UT7, UT8, UT9, UT10 and the lower end of Muddy Creek may all be accessed from Lyman Road. Reaches UT5 and UT6 are located just south of NC HWY 24, approximately 1.9 miles east of Beulaville. The upstream portion of the site may be accessed from two locations. Reaches UT1, UT2 and Muddy Creek are located to the south of NC HWY 24, opposite of the intersection of NC HWY 24 and Penny Road (SR 1720), approximately 2.8 miles east of Beulaville. To access reaches UT3, UT4 and Muddy Creek, travel 3.2 miles east on NC HWY 24 from Beulaville to Edwards Road (SR 1835), continue south for approximately 1.0 mile, turn right onto Put Lane, and follow the road down to Reaches UT3 and UT4.

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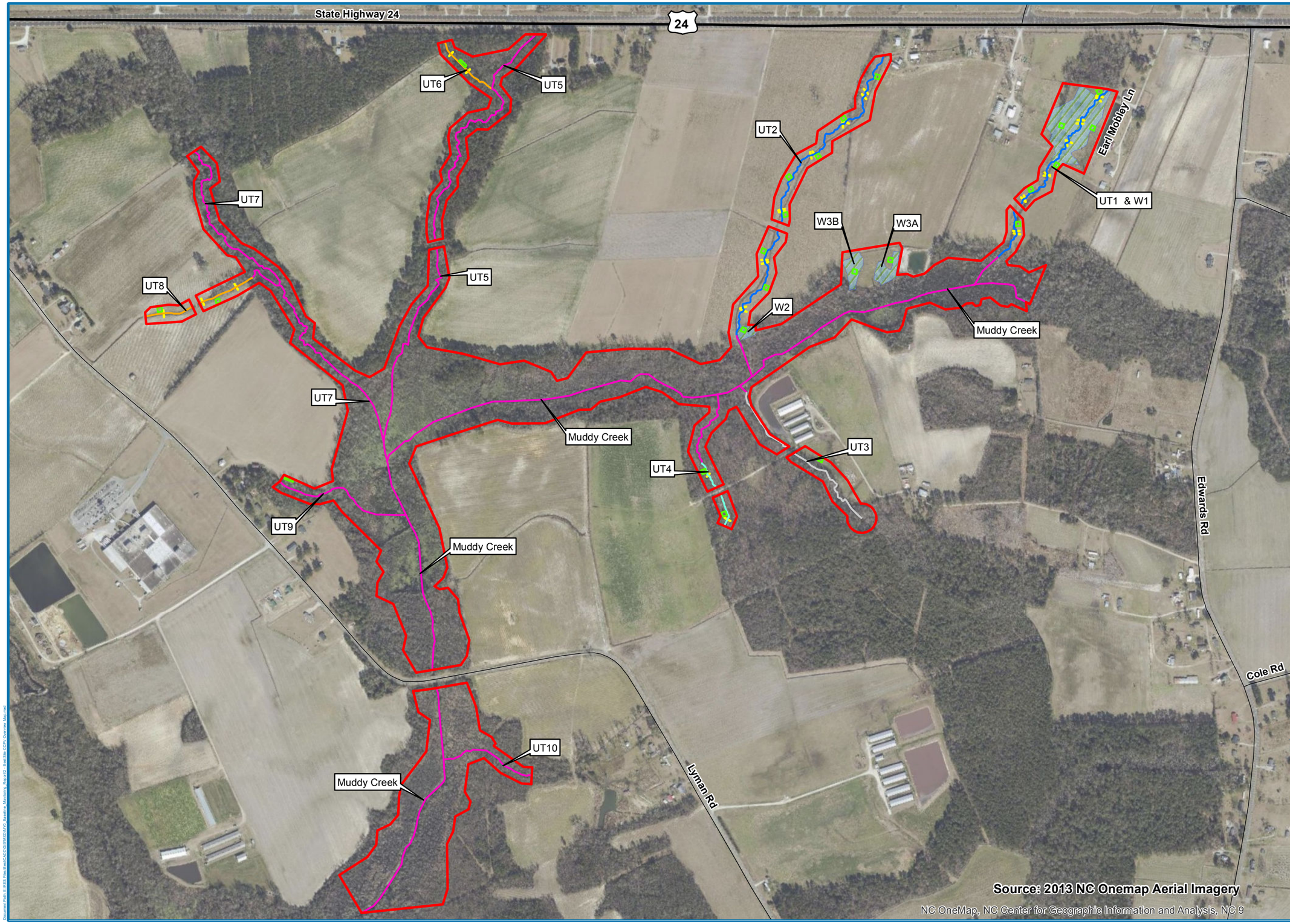
Miles

Figure1
Project Vicinity Map
Best Stream and Wetland Restoration Site
Duplin County, North Carolina

Date: 9/15/2015
Drawn by: BSH

res



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0 350 700
Feet

1 inch = 700 feet

Figure 2.

Best Stream and Wetland Restoration Project

Current Conditions Overview Map

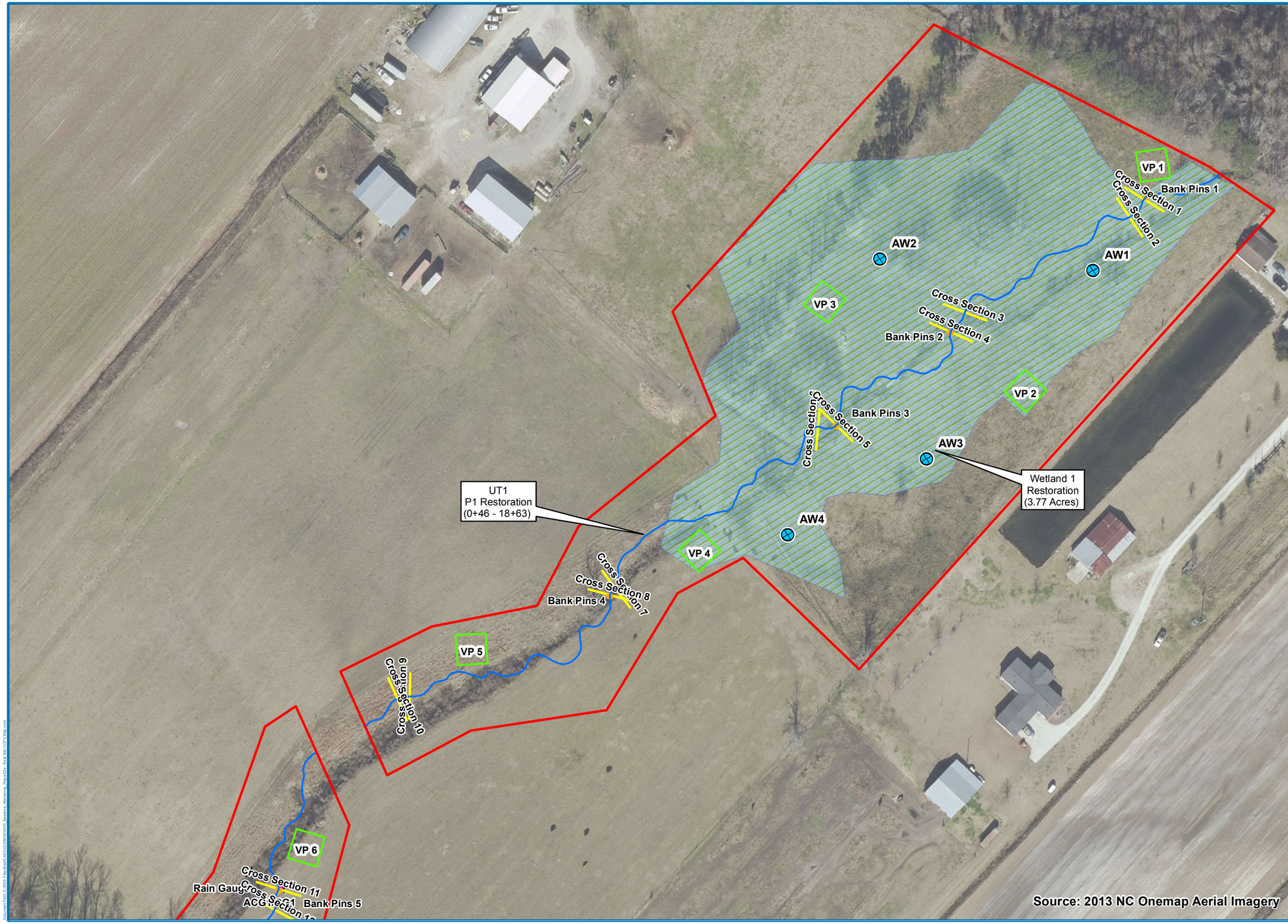
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- NC Highway
- State Roads
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Cross Sections
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species \ Target Community	Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



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Feet

1 inch = 100 feet

Figure 2a.

Best Stream and Wetland Restoration Project

UT1 & W1
Current Conditions
Plan View Map

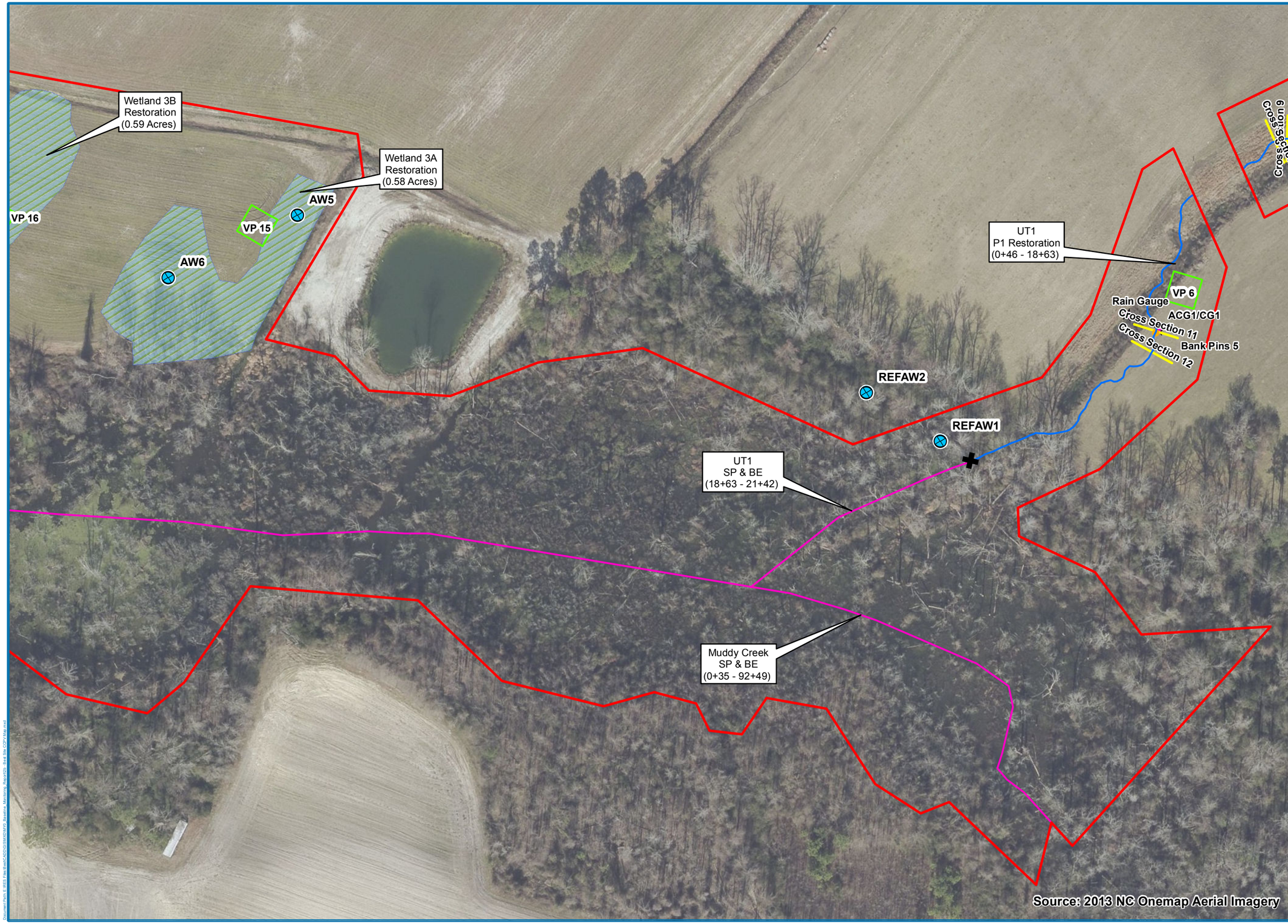
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Hydrology Gauges
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species	Target Community: Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



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Feet

1 inch = 100 feet

Figure 2b.

Best Stream and Wetland Restoration Project

UT1 & Muddy Creek Current Conditions Plan View Map

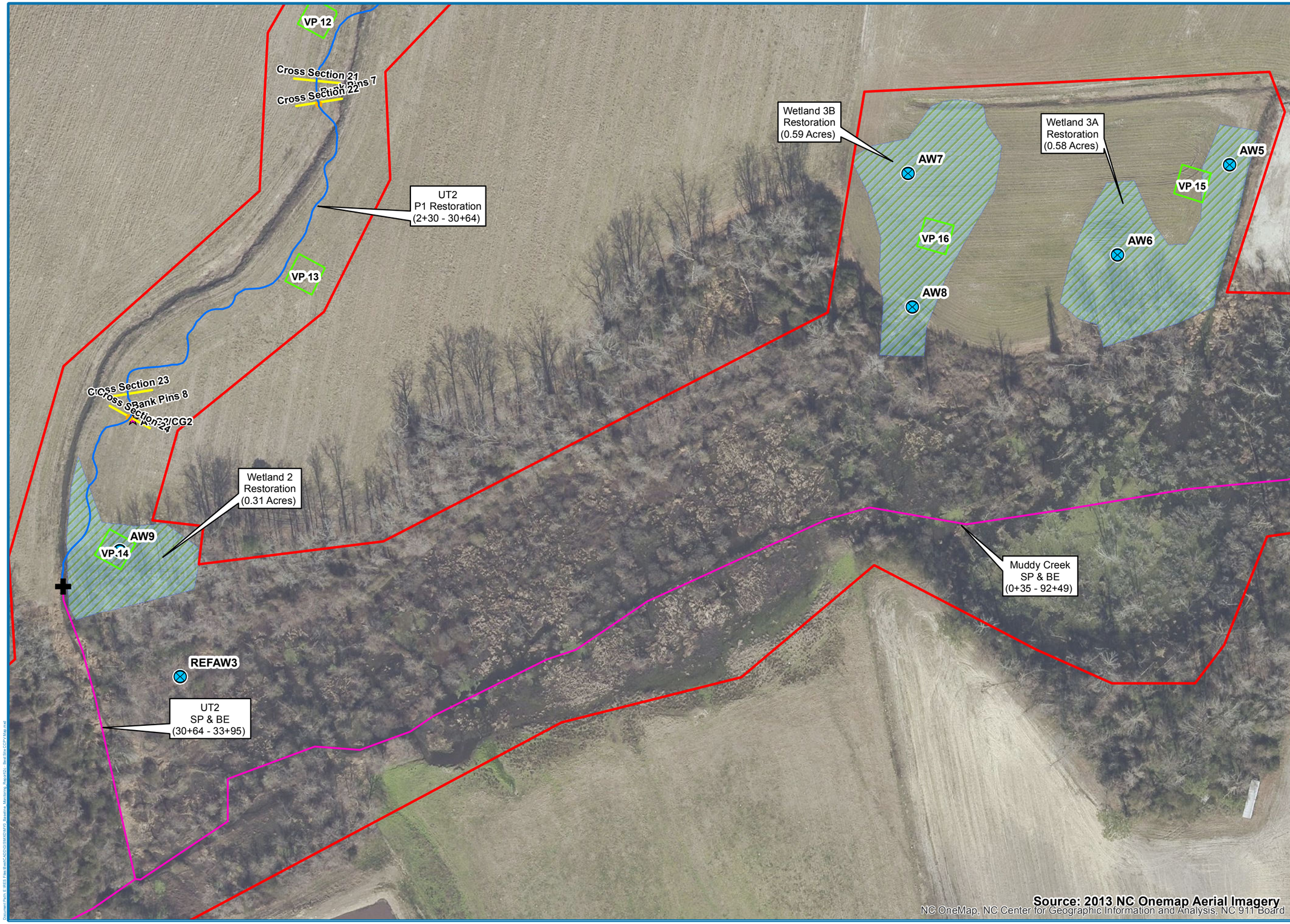
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Hydrology Gauges
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species	Target Community: Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



res

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Feet

1 inch = 100 feet

Figure 2c.

Best Stream and Wetland Restoration Project

UT2 & Muddy Creek Current Conditions Plan View Map

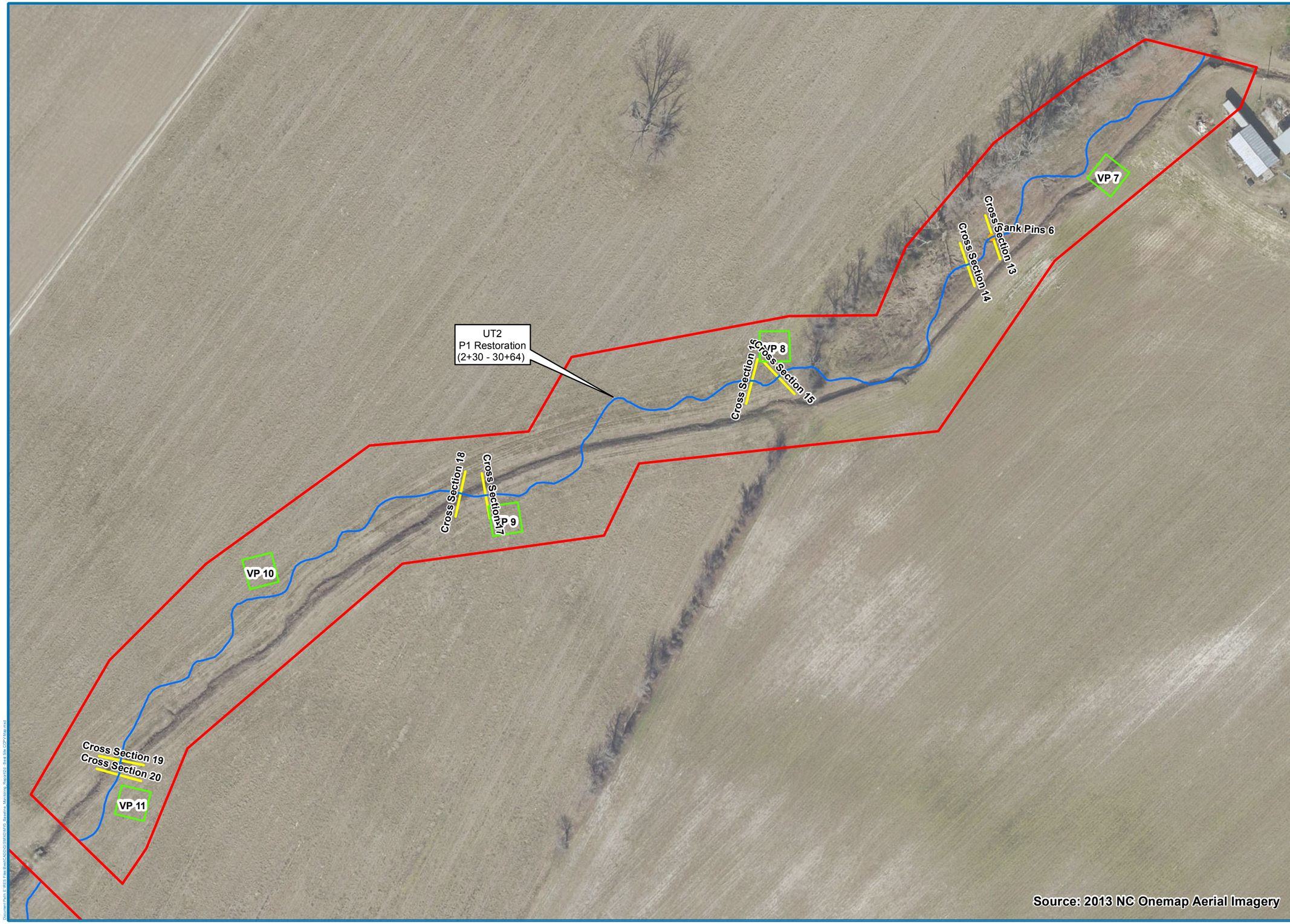
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Hydrology Gauges
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species	Target Community: Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



res

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Feet

1 inch = 100 feet

Figure 2d.

Best Stream and Wetland Restoration Project

UT2
Current Conditions Plan View Map

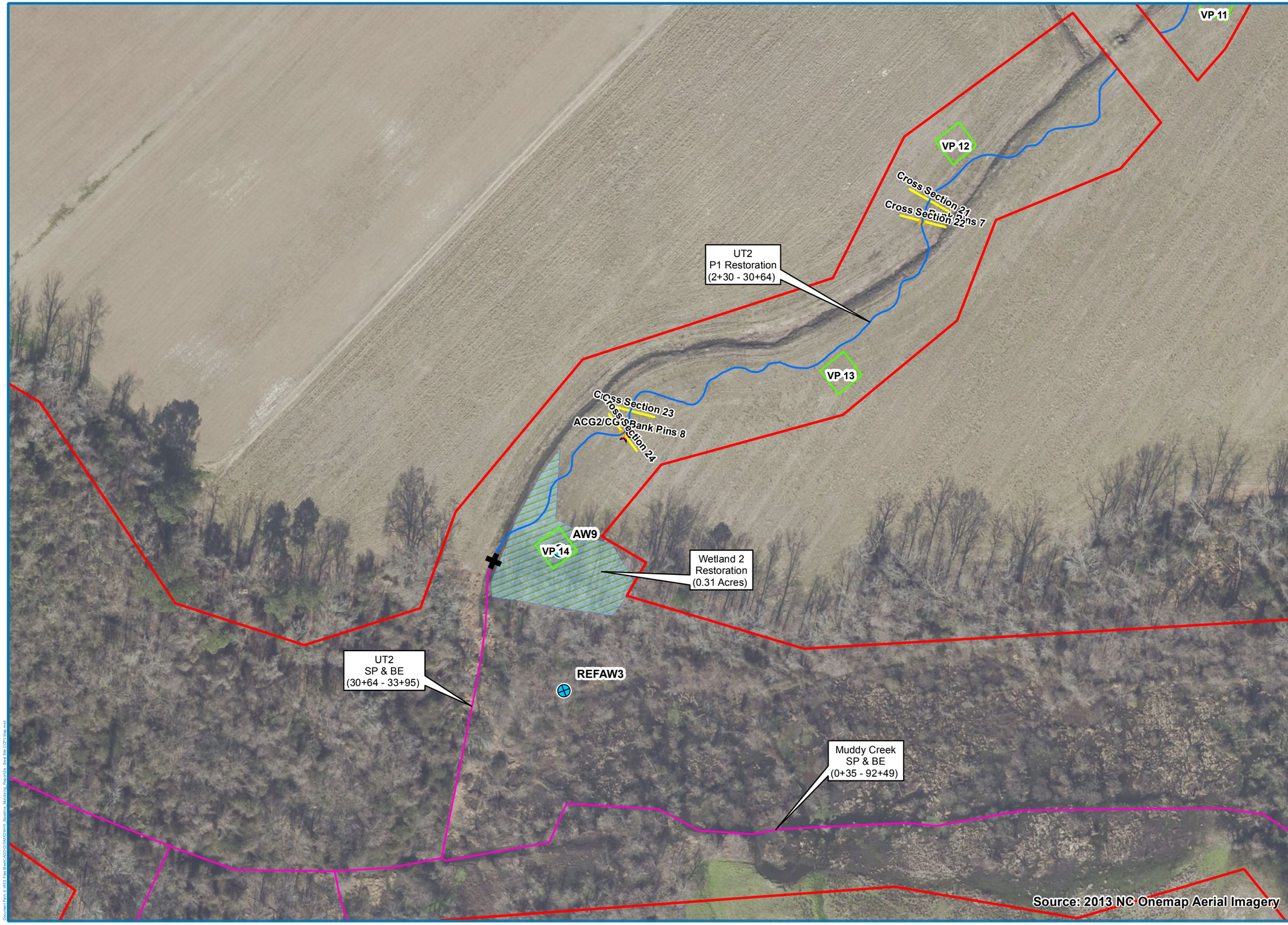
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species	Target Community: Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



res

N
W
E
S

0 50 100
Feet

1 inch = 100 feet

Figure 2e.

Best Stream and Wetland Restoration Project

UT2 & Muddy Creek Current Conditions Plan View Map

Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Hydrology Gauges
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species	Target Community: Present	Marginal	Absent
Absent	No Fill		
Present			
Common			

res

N
E
W
S

0 50 100
Feet

1 inch = 100 feet

Figure 2f.

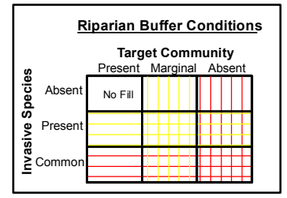
Best Stream and Wetland Restoration Project

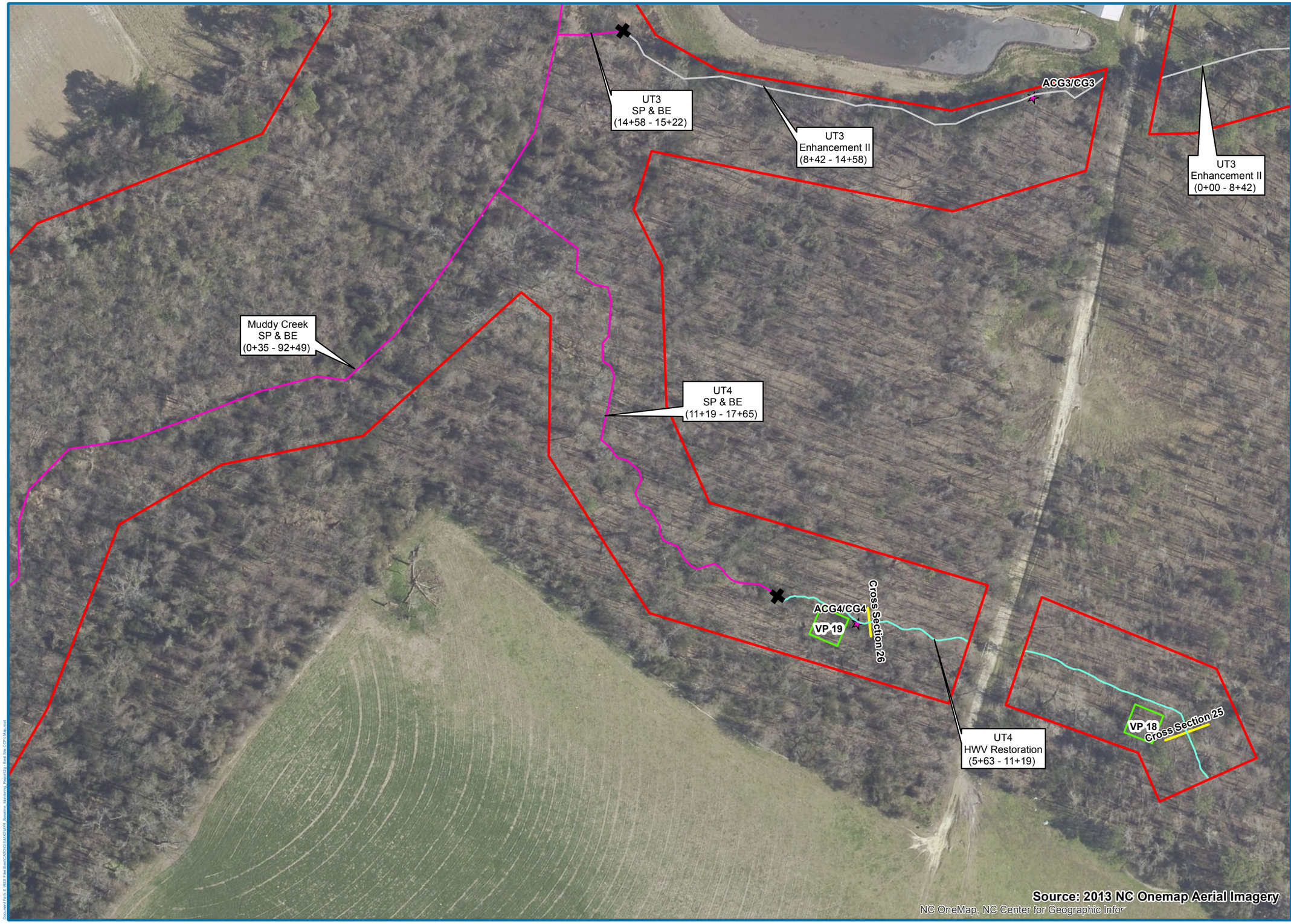
UT3
Current Conditions
Plan View Map

Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Restoration Areas





res

0 50 100
Feet

1 inch = 100 feet

Figure 2g.

Best Stream and Wetland Restoration Project

UT4 & Muddy Creek Current Conditions Plan View Map

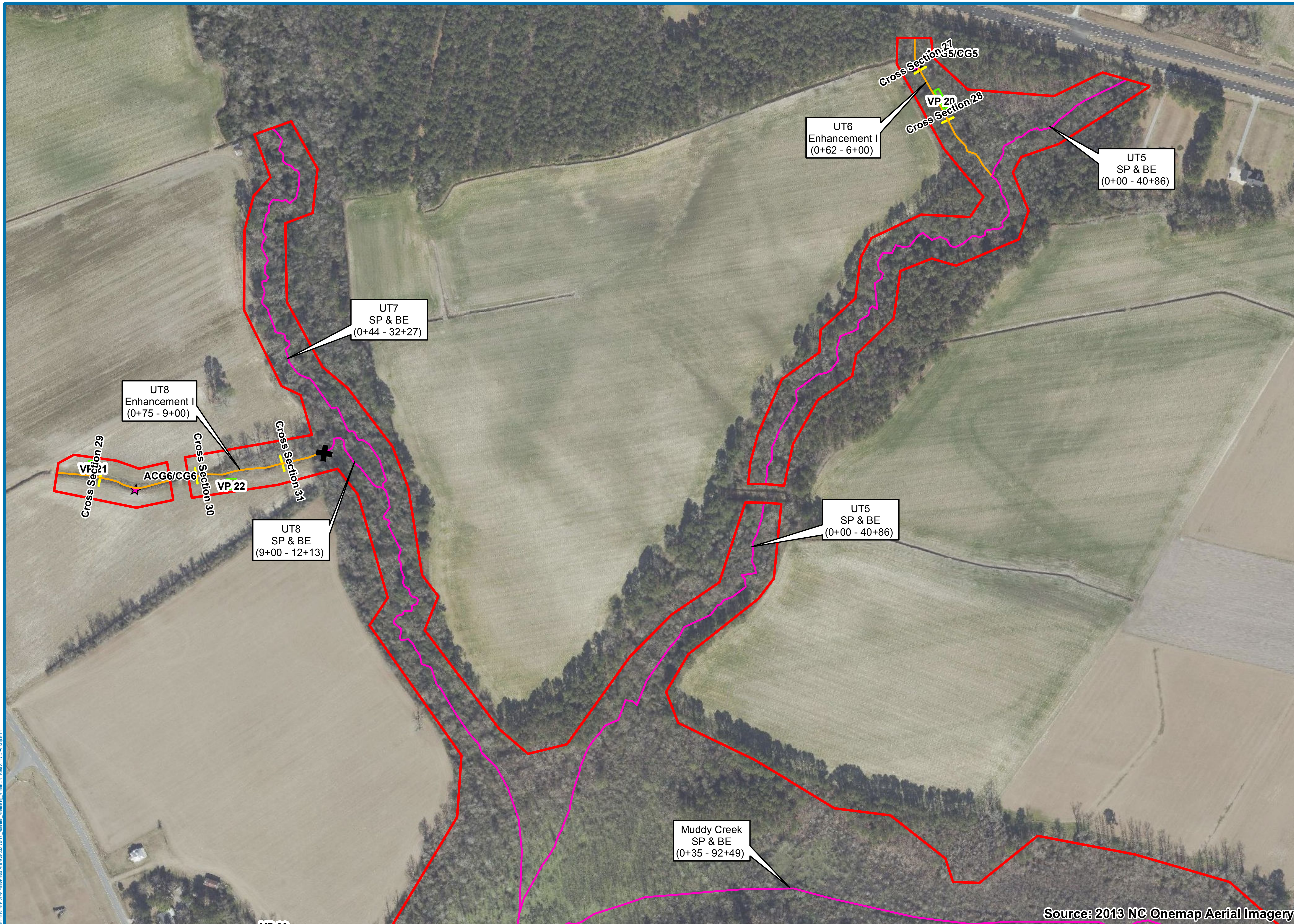
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species	Target Community: Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



res

0 150 300
Feet
1 inch = 300 feet

Figure 2h.

Best Stream and Wetland Restoration Project

UT5, UT6, UT7, & UT8 Current Conditions Plan View Map

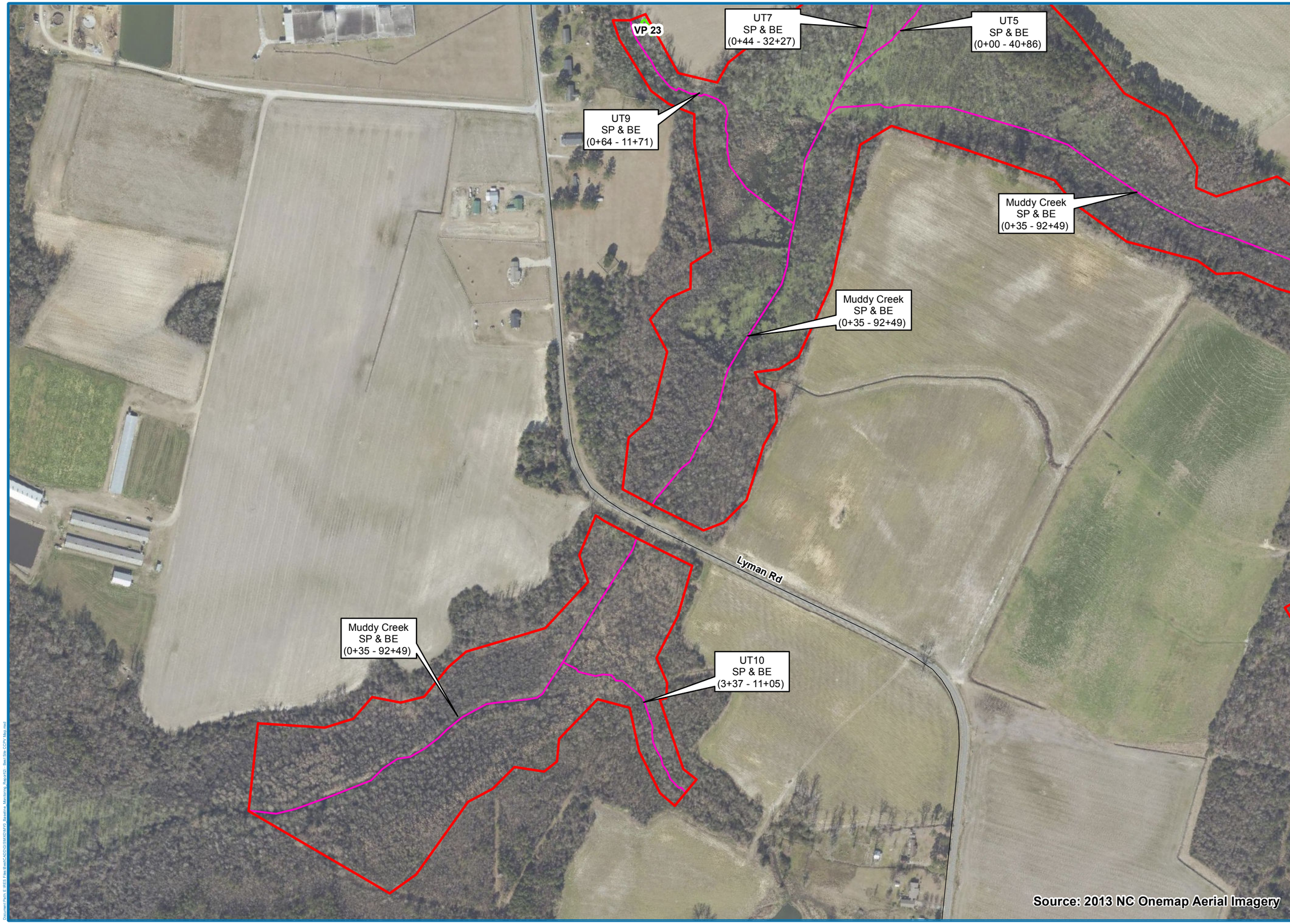
Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species \ Target Community	Present	Marginal	Absent
Absent	No Fill		
Present			
Common			



res

0 150 300
Feet

1 inch = 350 feet

Figure 2i.

Best Stream and Wetland Restoration Project

UT9, UT10 & Muddy Creek Current Conditions Plan View Map

Date: 11/17/2015	Drawn by: BSH

LEGEND

- Conservation Easement
- Vegetation Plots
- Reach Breaks
- BE & Preservation
- Enhancement I
- Enhancement II
- Headwater Valley Rest.
- P1 Restoration
- Stream Structures
- Bankpin Locations
- Cross Sections
- Crest Gauge/RG Locations
- Wetland Restoration Areas

Riparian Buffer Conditions

Invasive Species \ Target Community	Present	Marginal	Absent
Absent	No Fill		
Present			
Common			

Appendix A. General Tables and Figures
Table 1 Project Components and Mitigation Credits
Baseline Monitoring Report Year 0

Table 1. Project Components and Mitigation Credits
Best Stream and Wetland Restoration Project/DMS Project # 95353

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,023	5,157	5.25	N/A	N/A	N/A	N/A	N/A	N/A

Project Components

Project Component -or-Reach ID	As-Built Stationing/Location (LF)	Existing Footage/Acreage	Approach (PI, PII etc.)	Restoration -or-Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	SMUs/ WMUs
UT1	0+46 to 18+63	1,551	PI	R	1,757	1 : 1.0	1,757
UT1	18+63 to 21+42	303	Preservation & BE	RE	279	1 : 5.0	56
UT2	2+30 to 30+64	2,552	PI	R	2,772	1 : 1.0	2,772
UT2	30+64 to 33+95	309	Preservation & BE	RE	331	1 : 5.0	66
UT3	0+00 to 8+42	1,458	EII	RE	812	1 : 2.5	325
UT3	14+58 to 15+22	64	Preservation & BE	RE	64	1 : 5.0	13
UT4	5+63 to 11+19	534	HV Restoration	R	494	1 : 1.0	494
UT4	11+19 to 17+65	655	Preservation & BE	RE	646	1 : 5.0	129
UT5	0+00 to 40+86	4,086	Preservation & BE	RE	4,043	1 : 5.0	809
UT6	0+62 to 6+00	538	EI	RE	538	1 : 1.5	359
UT7	0+44 to 32+27	3,183	Preservation & BE	RE	3,183	1 : 5.0	637
UT8	0+75 to 9+00	825	EI	RE	765	1 : 1.5	510
UT8	9+00 to 12+13	313	Preservation & BE	RE	313	1 : 5.0	63
UT9	0+64 to 11+71	1,171	Preservation & BE	RE	1,107	1 : 5.0	221
UT10	3+37 to 11+05	768	Preservation & BE	RE	768	1 : 5.0	154
Muddy Creek	0+35 to 92+49	9,214	Preservation & BE	RE	9,073	1 : 5.0	1,815
Wetland 1	---	3.66	Restoration	RE	3.77	1 : 1.0	3.77
Wetland 2	---	0.29	Restoration	RE	0.31	1 : 1.0	0.31
Wetland 3A	---	0.58	Restoration	RE	0.58	1 : 1.0	0.58
Wetland 3B	---	0.59	Restoration	RE	0.59	1 : 1.0	0.59

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	4,529	5.25				
Headwater Valley	494					
Enhancement I	1,303					
Enhancement II	812					
Creation						
Preservation	19,807					
High Quality Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes
---	---	---	---
---	---	---	---
---	---	---	---

BMP Elements

BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer

Table 2. Project Activity and Reporting History

Project Activity and Reporting History Best Stream and Wetland Restoration Project / DMS Project #95353		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Mitigation Plan	NA	October 2013
Final Design – Construction Plans	NA	November 2014
Construction Completed	April 2015	May 2015
Site Planting Completed	May 2015	May 2015
Baseline Monitoring Document (Year 0 Monitoring – baseline)	July 2015	October 2015
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

Table 3. Project Contacts

Project Contacts Table Best Stream and Wetland Restoration Project /DMS Project # 95353	
Designer	WK Dickson and Co., Inc. 720 Corporate Center Drive Raleigh, NC 27607 (919) 782-0495 Frasier Mullen, PE
Construction Contractor	Wright Contracting PO Box 545 Siler City, NC 27344 (919) 663-0810 Joseph Wright
Planting Contractor	Resource Environmental Solutions, LLC 302 Jefferson Street, Suite 110 Raleigh, NC 27605 (919) 209-1061 David Godley
Seeding Contractor	Wright Contracting PO Box 545 Siler City, NC 27344 (919) 663-0810 Joseph Wright
Seed Mix Sources	Green Resource
Nursery Stock Suppliers	Arbogen, NC Forestry Services Nursery
Full Delivery Provider Project Manager:	Resource Environmental Solutions, LLC 302 Jefferson Street, Suite 110 Raleigh, NC 27605 (919) 209-1061 Daniel Ingram
Monitoring Performers Project Manager:	Resource Environmental Solutions, LLC 302 Jefferson Street, Suite 110 Raleigh, NC 27605 (919) 209-1061 Brian Hockett, PLS

Table 4. Project Information

Project Information

Project Name	Best Stream and Wetland Restoration Project
County	Duplin
Project Area (acres)	142.7
Project Coordinates (latitude and longitude)	34° 54' 44.011" N 77° 44' 57.344" W

Project Watershed Summary Information

Physiographic Province	Outer Coastal Plain
River Basin	Cape Fear
USGS Hydrologic Unit 8-digit	03030007
USGS Hydrologic Unit 14-digit	03030007060010
DWQ Sub-basin	03-06-22
Project Drainage Area (acres)	2,928 acres
Project Drainage Area Percentage of Impervious Area	6%
CGIA Land Use Classification	Woody wetlands, emergent herbaceous wetlands, cultivated crops, evergreen forest

Reach Summary Information (As-Built Conditions)

Parameters	UT1	UT2	UT3	UT4	UT5	UT6
Length of reach (linear feet)	2,036	3,103	876	1,140	4,043	538
Valley Classification	X	X	X	X	X	X
Drainage area (acres)	41	146	56	82	380	79
NCDWQ stream identification score	32.50	31.50	33.00	33.75	36.75	30.50
NCDWQ Water Quality Classification	N/A	C Sw	N/A	N/A	C Sw	N/A
Morphological Description (stream type)	G5c	G5c	E5	G5c/E5	C5	E5
Evolutionary trend	Stage II	Stage II	Stage VI	Stage II/VI	Stage I	Stage II
Underlying mapped soils	GoA MkA NbB RaA	AuB McC MkA NbA NbB	McC MkA NbB	McC MkA NbB	MkA NbB	NbA NbB
Drainage class	well; mod. well; poorly	well; poorly	well; poorly	well; poorly	well; poorly	well
Soil Hydric status	Hydric	Hydric	Hydric	Hydric	Hydric	Not hydric
Slope	0.66%	0.44%	0.93%	0.42%	0.40%	0.12%
FEMA classification	N/A	N/A	N/A	N/A	AE (high risk)	N/A
Native vegetation community	pasture, cultivated	cultivated	pasture	mixed hardwood forest	mixed hardwood forest	mixed hardwood forest
Percent composition of exotic invasive vegetation	0	0	5	5	<40	<25

Reach Summary Information (continued)

Parameters	UT7	UT8	UT9	UT10	Muddy Creek
Length of reach (linear feet)	3,183	1,078	1,107	768	9,214
Valley Classification	X	X	X	X	X
Drainage area (acres)	387	56	36	306	2930
NCDWQ stream identification score	38.50	30.50	32.00	34.00	43.25
NCDWQ Water Quality Classification	C Sw	N/A	N/A	C Sw	C Sw
Morphological Description (stream type)	C5	F5	E5	C5	E5
Evolutionary trend	Stage I	Stage II	Stage VI	Stage VI	Stage VI
Underlying mapped soils	McC MkA NbB	McC NbA NbB	McC MkA	McC MkA	McC MkA
Drainage class	well; poorly	well	well; poorly	well; poorly	well; poorly
Soil Hydric status	Hydric	Hydric	Hydric	Hydric	Hydric
Slope	0.40%	0.29%	0.80%	0.40%	0.11%
FEMA classification	AE (high risk)	N/A	AE (high risk)	AE (high risk)	AE (high risk)
Native vegetation community	mixed hardwood forest	cultivated	mixed hardwood forest	mixed hardwood forest	mixed hardwood forest
Percent composition of exotic invasive vegetation	<40	<5	<15	<20	<45

Wetland Summary Information

Parameters	Wetland 1	Wetland 2	Wetland 3A	Wetland 3B
Size of Wetland (acres)	3.77	0.31	0.58	0.59
Wetland Type (non-riparian, riparian	Riparian	Riparian	Riparian	Riparian
Mapped Soil Series	Rains, Goldston	Noboco, Autyville, Marvyn, Gritney	Marvyn, Gritney, Muckalee loam	Marvyn, Gritney, Muckalee loam
Drainage class	Poorly	Mod. Well, Poorly	Poorly, Well	Poorly, Well
Soil Hydric Status	Yes	Hydric with Hydric Inclusions	Hydric with Hydric Inclusions	Hydric with Hydric Inclusions
Source of Hydrology	Runoff/Groundwater Discharge	Runoff/Groundwater Discharge	Runoff, Flooding, Groundwater Discharge	Runoff, Flooding, Groundwater Discharge
Hydrologic Impairment	Grazing Cattle and Incised Channel	Incised Channel	Ditched	Ditched
Native vegetation community	Forested	Cultivated	Cultivated	Cultivated
Percent composition of exotic invasive	0	0	0	0

Regulatory Considerations

Regulation	Applicable	Resolved	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	SAW-2012-01384
Waters of the United States - Section 401	Yes	Yes	DWR # 13-0865
Endangered Species Act	Yes	Yes	USFWS (Corr. Letter)
Historic Preservation Act	Yes	Yes	SHPO (Corr. Letter)
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	NA	N/A
FEMA Floodplain Compliance	Yes	Yes	EEP Floodplain Requirements Checklist
Essential Fisheries Habitat	No	NA	N/A

APPENDIX B

Morphological Summary Data and Plots

Table 5. Morphological Parameters Summary Data
Table 6. Dimensional Morphology Summary – Cross Sections Data
Cross Section Plots
Stream Photos

Table 5.
Best Morphological Parameters

	Reference Reach			Existing[1]												Design				As-Built/Baseline			
				UT1	UT2	UT3	UT4 (US)	UT4 (DS)	UT5	UT6	UT7	UT8	UT9	UT10	Muddy Creek	UT1		UT2		UT1		UT2	
Feature	Pool	Run	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Shallow	Pool	Shallow	Pool	Shallow	Pool	Shallow	Pool
Drainage Area (ac)	286			41	146	59	82	82	380	79	387	56	36	306	2930	41		146		41		146	
Drainage Area (mi^2)	0.45			0.06	0.23	0.09	0.13	0.13	0.59	0.12	0.60	0.09	0.06	0.48	4.58	0.06		0		0.06		0	
NC Regional Curve Discharge (cfs)[2]	---	---	9.3	2.3	5.7	3.0	3.8	3.8	11.4	3.7	11.5	2.9	2.1	9.7	49.5	2.3		6		2.3		6	
NC Regional Curve Discharge (cfs)[3]	---	---	4.8	1.1	2.9	1.4	1.8	1.8	5.9	1.8	6.0	1.4	1.0	5.0	27.9	1.1		3		1.1		3	
Design/Calculated Discharge (cfs)	---	---	13	---	---	---	---	---	---	---	---	---	---	---	---	---		---		---		---	
Dimension																							
BF Width (ft)	10.9	8.9	7.0	5.1	4.8	9.8	6.4	7.5	11.0	5.1	10.1	9.5	6.5	13.7	15.7	6.2	7.1	9.4	10.8	6.6	7.8	10.0	11.9
Floodprone Width (ft)	100	100	100	9	9	22	10	>50	>100	>50	>50	12	>50	84	>50	>50	>50	>50	>50	>50	>50	>50	>50
BF Cross Sectional Area (ft^2)	11.4	8.4	5.0	3.2	4.6	8.1	6.4	6.2	6.0	4.3	6.1	4.9	3.6	7.8	21.2	3.9	6.1	8.9	14.2	3.0	5.1	10.2	15.0
BF Mean Depth (ft)	1.0	0.9	0.8	0.6	1.0	0.8	0.9	0.8	0.5	0.8	0.6	0.5	0.6	0.6	1.4	0.6	0.9	1.0	1.3	0.5	0.7	1.0	1.3
BF Max Depth (ft)	2.1	1.7	1.3	1.1	1.3	1.2	1.1	1.2	1.0	1.2	1.1	0.7	1.1	0.9	2.3	1.0	1.4	1.5	2.2	0.8	1.3	1.8	2.3
Width/Depth Ratio	10.4	9.5	8.8	8.1	5.0	11.8	8.4	9.1	20.2	6.2	16.7	18.2	11.8	24.0	11.6	9.9	8.3	9.9	8.2	14.8	12.3	9.9	9.5
Entrenchment Ratio	9.2	11.2	15.1	1.8	1.9	2.2	1.4	>2.2	>2.2	>2.2	>2.2	1.3	>2.2	6.1	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2	>2.2
Wetted Perimeter (ft)	12.8	9.7	7.4	5.8	6.3	10.8	8.1	8.3	11.3	6.0	10.5	9.8	7.2	13.9	17.0	6.6	7.7	10.0	11.8	6.8	8.3	10.8	13.0
Hydraulic Radius (ft)	0.9	0.9	0.7	0.6	0.7	0.8	0.8	0.8	0.5	0.7	0.6	0.5	0.5	0.6	1.2	0.6	0.8	0.9	1.2	0.4	0.6	0.9	1.2
Substrate																							
	Fine Sand			Fine Sand												Fine Sand		Fine Sand		Fine Sand		Fine Sand	
Pattern																							
	Min	**Max**	**Med**	---	---	---	---	---	---	---	---	---	---	---	---	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Channel Beltwidth (ft)	13.6	31.8	23.1	---	---	---	---	---	---	---	---	---	---	---	---	11	28	20	41	13	33	21	48
Radius of Curvature (ft)	11.0	27.6	17.6	---	---	---	---	---	---	---	---	---	---	---	---	9	27	17	37	9	34	14	44
Radius of Curvature Ratio	1.5	3.7	2.3	---	---	---	---	---	---	---	---	---	---	---		1.5	4.4	1.8	3.9	1.4	5.1	1.4	4.4
Meander Wavelength (ft)	34.9	68.3	54.5	---	---	---	---	---	---	---	---	---	---	---	---	32	71	44	106	31	67	35	108
Meander Width Ratio	1.8	4.2	3.1	---	---	---	---	---	---	---	---	---	---	---	---	1.8	4.5	2.1	4.4	1.9	5.0	2.1	4.8
Profile																							
Shallow Length (ft)	3.1	30.7	12.6	---	---	---	---	---	---	---	---	---	---	---	---	4	23	6	41	5	26	8	45
Run Length (ft)	2.2	33.2	11.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Length (ft)	4.2	9.5	5.8	---	---	---	---	---	---	---	---	---	---	---	---	3	10	7	12	5	14	8	15
Pool -to-Pool Spacing (ft)	17.5	59.8	36.3	---	---	---	---	---	---	---	---	---	---	---	---	16	49	25	68	18	55	30	74
Additional Reach Parameters																							
Valley Length (ft)	274			1826	2818	1417	253	686	2843	567	2192	942	725	1042	9021	1510		2529		1510		2529	
Channel Length (ft)	309			1905	2865	1522	255	772	3228	597	2629	994	769	1104	9808	1723		2770		1756		2771	
Sinuosity	1.13			1.04	1.02	1.07	1.01	1.13	1.14	1.05	1.20	1.06	1.06	1.06	1.09	1.14		1.10		1.16		1.10	
Water Surface Slope (ft/ft)	0.004			---	---	---	---	---	---	---	---	---	---	---	---	---		---		---		---	
Channel Slope (ft/ft)	0.003			0.0066	0.0044	0.0093	0.0042	0.0042	0.004	0.0012	0.004	0.0029	0.008	0.004	0.0011	0.0056		0.0027		0.0063		0.0045	
Rosgen Classification	E5			G5c	G5c	E5	G5c	E5	C5	E5	C5	F5	E5	C5	E5	E5		E5		E5		E5	

[1] Bankfull stage was estimated using NC Regional Curve equations and existing conditions data

[2] NC Regional Curve equations source: Doll et al. (2003)

[3] NC Regional Curve equations source: Sweet and Geratz (2003)

Appendix B. Table 6a. - Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number: Best Site/ NCDMS Project # 95353

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	74.7							74.8							73.1							72.8							71.9						
Bankfull Width (ft)	8.0							8.2							5.2							6.1							6.8						
Floodprone Width (ft)	50.0							50.0							50.0							50.0							50.0						
Bankfull Mean Depth (ft)	0.8							0.5							0.3							0.4							0.6						
Bankfull Max Depth (ft)	1.4							1.0							0.6							0.8							1.4						
Bankfull Cross Sectional Area (ft^2)	6.0							4.2							1.8							2.6							4.1						
Bankfull Width/Depth Ratio	10.5							15.9							15.1							14.5							11.4						
Bankfull Entrenchment Ratio	>2.2							>2.2							>2.2							>2.2							>2.2						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						

	Cross Section 6 (Riffle)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	72.1							70.7							70.7							66.0							68.8						
Bankfull Width (ft)	7.1							6.4							7.7							7.7							6.1						
Floodprone Width (ft)	50.0							50.0							50.0							50.0							50.0						
Bankfull Mean Depth (ft)	0.4							0.5							0.7							0.8							0.6						
Bankfull Max Depth (ft)	0.7							0.8							1.2							1.4							0.9						
Bankfull Cross Sectional Area (ft^2)	2.8							3.0							5.2							6.1							3.5						
Bankfull Width/Depth Ratio	18.0							14.0							11.3							9.9							10.4						
Bankfull Entrenchment Ratio	>2.2							>2.2							>2.2							>2.2							>2.2						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Run/Riffle)							Cross Section 15 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	66.5							66.6							71.0							70.7							69.9						
Bankfull Width (ft)	10.4							6.5							13.7							10.0							9.0						
Floodprone Width (ft)	50.0							37.0							50.0							50.0							50.0						
Bankfull Mean Depth (ft)	0.6							0.4							1.4							1.1							0.9						
Bankfull Max Depth (ft)	1.3							0.9							2.6							1.7							1.5						
Bankfull Cross Sectional Area (ft^2)	6.7							2.8							18.6							10.7							7.8						
Bankfull Width/Depth Ratio	16.0							15.1							10.1							9.3							10.3						
Bankfull Entrenchment Ratio	>2.2							>2.2							>2.2							>2.2							>2.2						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						

	Cross Section 16 (Pool)							Cross Section 17 (Riffle)							Cross Section 18 (Pool)							Cross Section 19 (Pool)							Cross Section 20 (Run/Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	69.4							68.7							68.1							66.7							67.1						
Bankfull Width (ft)	12.4							9.8							10.4							10.8							11.4						
Floodprone Width (ft)	50.0							50.0							50.0							50.0							50.0						
Bankfull Mean Depth (ft)	1.2							0.9							1.1							1.2							1.2						
Bankfull Max Depth (ft)	2.3							1.6							1.9							2.1							2.3						
Bankfull Cross Sectional Area (ft^2)	15.1							9.3							11.2							12.5							13.8						
Bankfull Width/Depth Ratio	10.2							10.3							9.7							9.4							9.4						
Bankfull Entrenchment Ratio	>2.2							>2.2							>2.2							>2.2							>2.2						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Appendix B. Table 6b. - Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

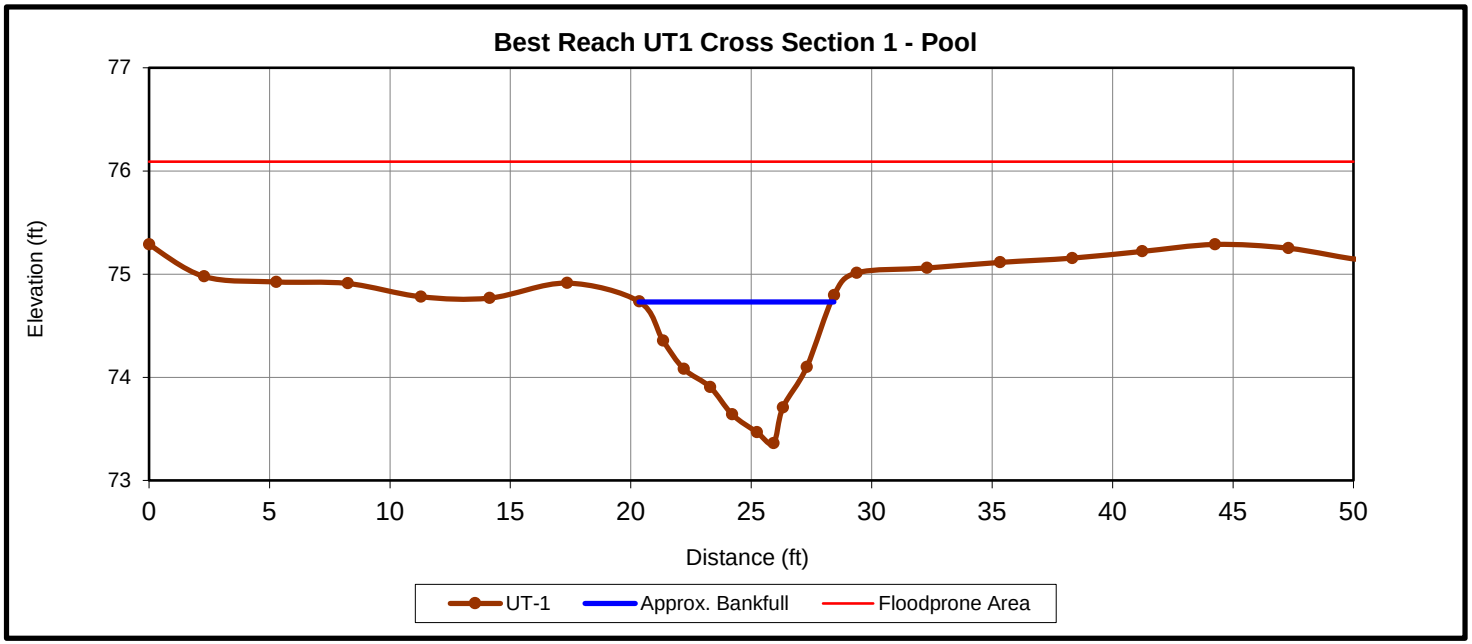
Project Name/Number: Best Site/ NCDMS Project # 95353

	Cross Section 21 (Run)							Cross Section 22 (Pool)							Cross Section 23 (Run)							Cross Section 24 (Pool)							Cross Section 25 (Run)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	65.1							65.0							62.8							62.5							71.5						
Bankfull Width (ft)	10.9							10.7							9.1							13.2							12.2						
Floodprone Width (ft)	50.0							50.0							50.0							50.0							50.0						
Bankfull Mean Depth (ft)	1.0							1.3							1.0							1.4							0.3						
Bankfull Max Depth (ft)	1.9							2.4							1.8							2.6							0.8						
Bankfull Cross Sectional Area (ft^2)	11.1							14.2							8.7							18.3							4.2						
Bankfull Width/Depth Ratio	10.7							8.1							9.4							9.5							35.5						
Bankfull Entrenchment Ratio	>2.2							>2.2							>2.2							>2.2							>2.2						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						
	Cross Section 26 (Run)							**Cross Section 27 (Riffle)**							**Cross Section 28 (Run)**							**Cross Section 29 (Pool)**							**Cross Section 30 (Run)**						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	67.9							69.9							69.2							65.3							63.7						
Bankfull Width (ft)	5.6							7.2							5.7							8.7							6.4						
Floodprone Width (ft)	50.0							50.0							50.0							50.0							50.0						
Bankfull Mean Depth (ft)	0.6							0.7							0.5							0.4							0.9						
Bankfull Max Depth (ft)	1.0							1.1							0.9							0.9							1.3						
Bankfull Cross Sectional Area (ft^2)	3.1							4.7							3.1							3.8							5.7						
Bankfull Width/Depth Ratio	10.2							10.8							10.4							19.9							7.1						
Bankfull Entrenchment Ratio	>2.2							>2.2							>2.2							>2.2							>2.2						
Bankfull Bank Height Ratio	1.0							1.0							1.0							1.0							1.0						
	Cross Section 31 (Riffle)																																		
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used	63.0																																		
Bankfull Width (ft)	7.7																																		
Floodprone Width (ft)	50.0																																		
Bankfull Mean Depth (ft)	0.4																																		
Bankfull Max Depth (ft)	0.7																																		
Bankfull Cross Sectional Area (ft^2)	3.0																																		
Bankfull Width/Depth Ratio	19.5																																		
Bankfull Entrenchment Ratio	>2.2																																		
Bankfull Bank Height Ratio	1.0																																		
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Record elevation (datum) used																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

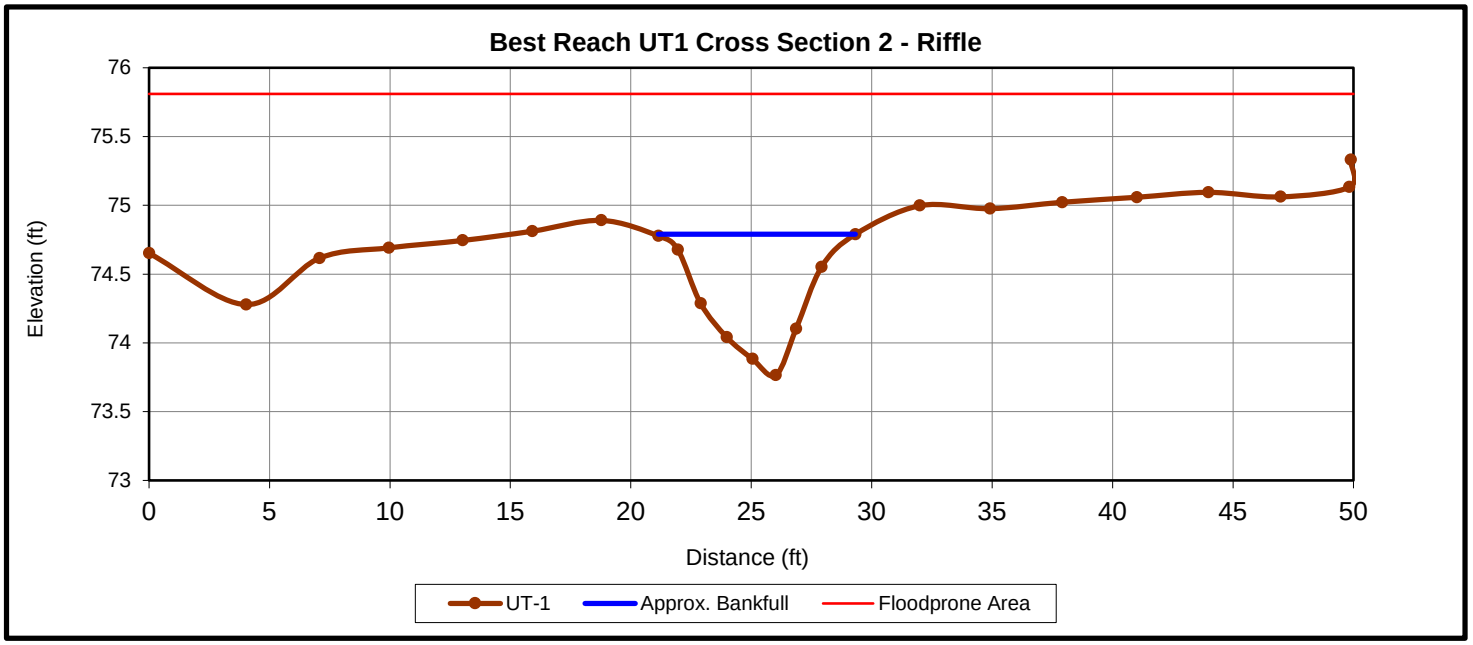
Upstream

Downstream



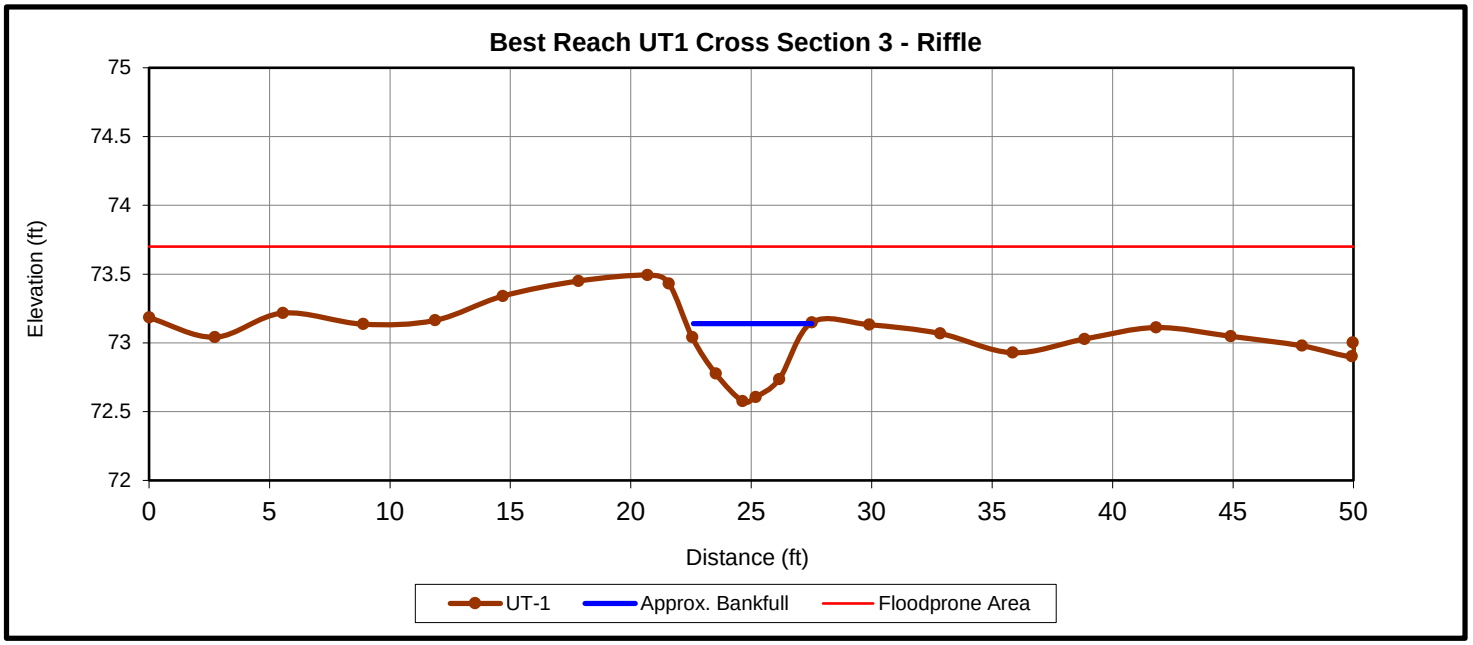
Upstream

Downstream



Upstream

Downstream



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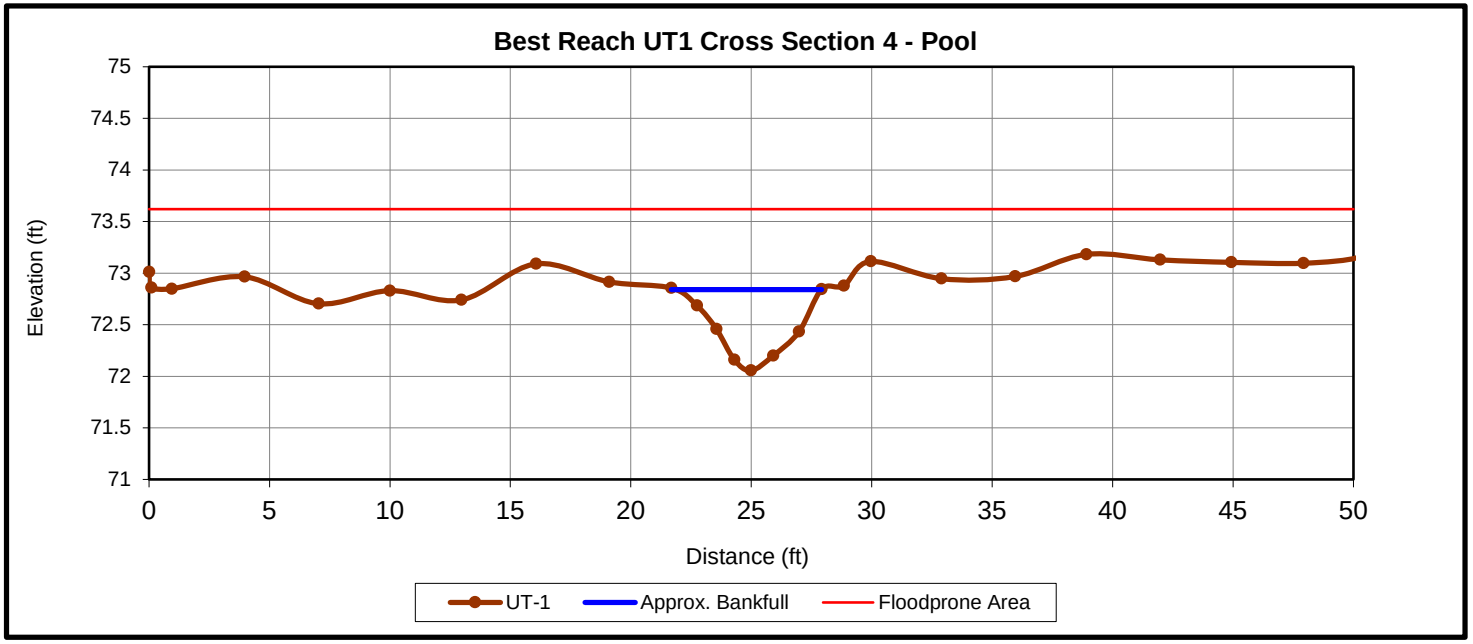
Downstream



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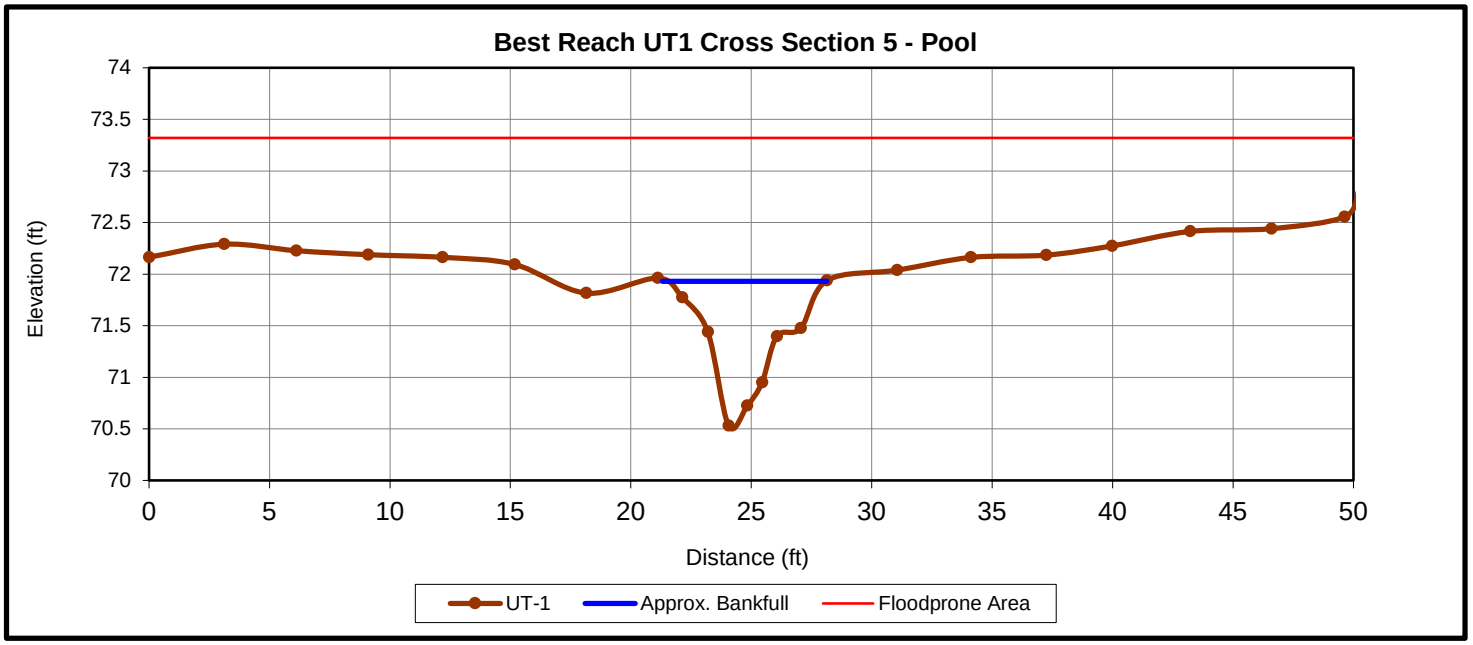
Downstream



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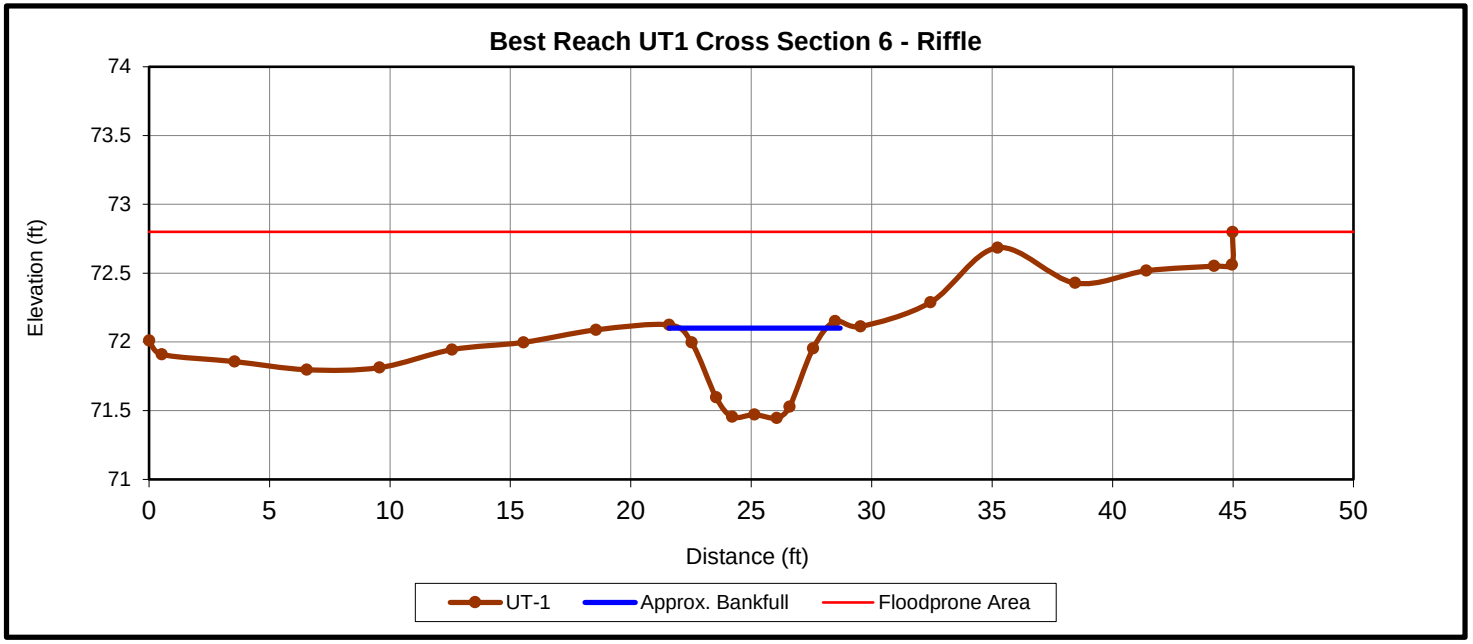
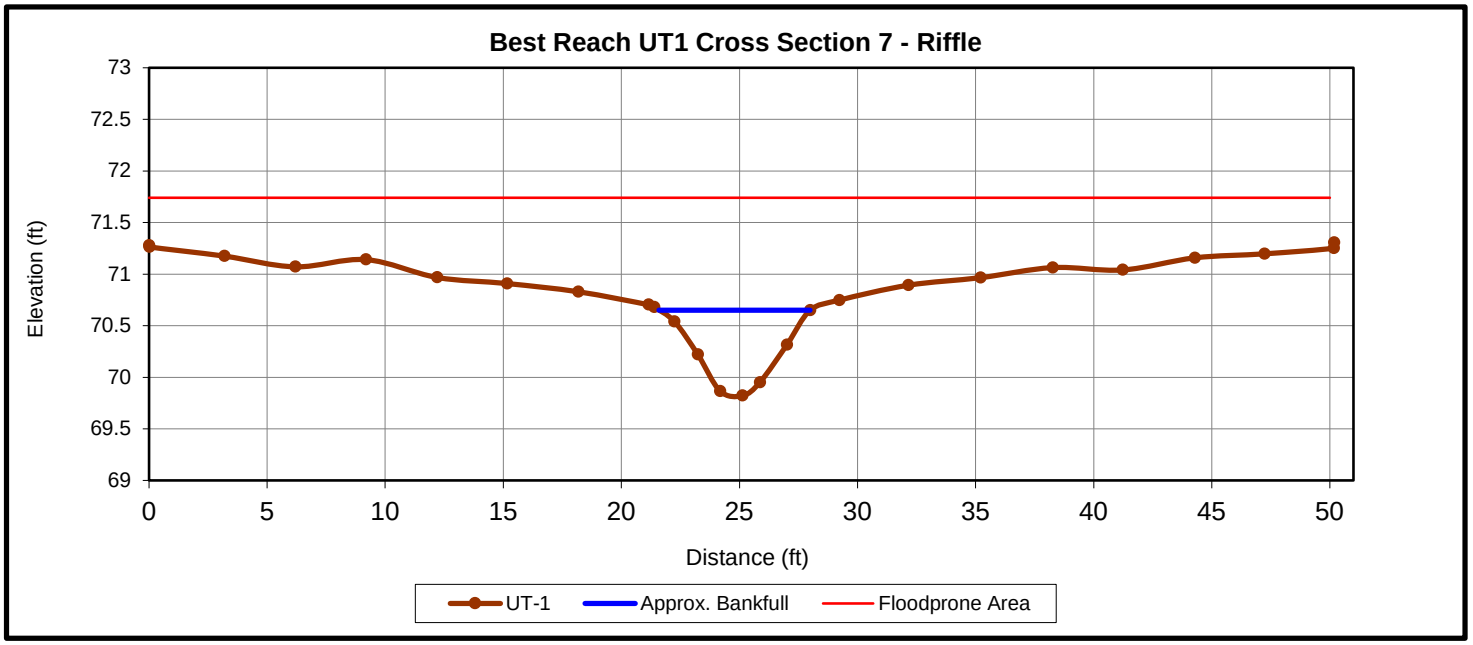
Downstream



Upstream

Downstream



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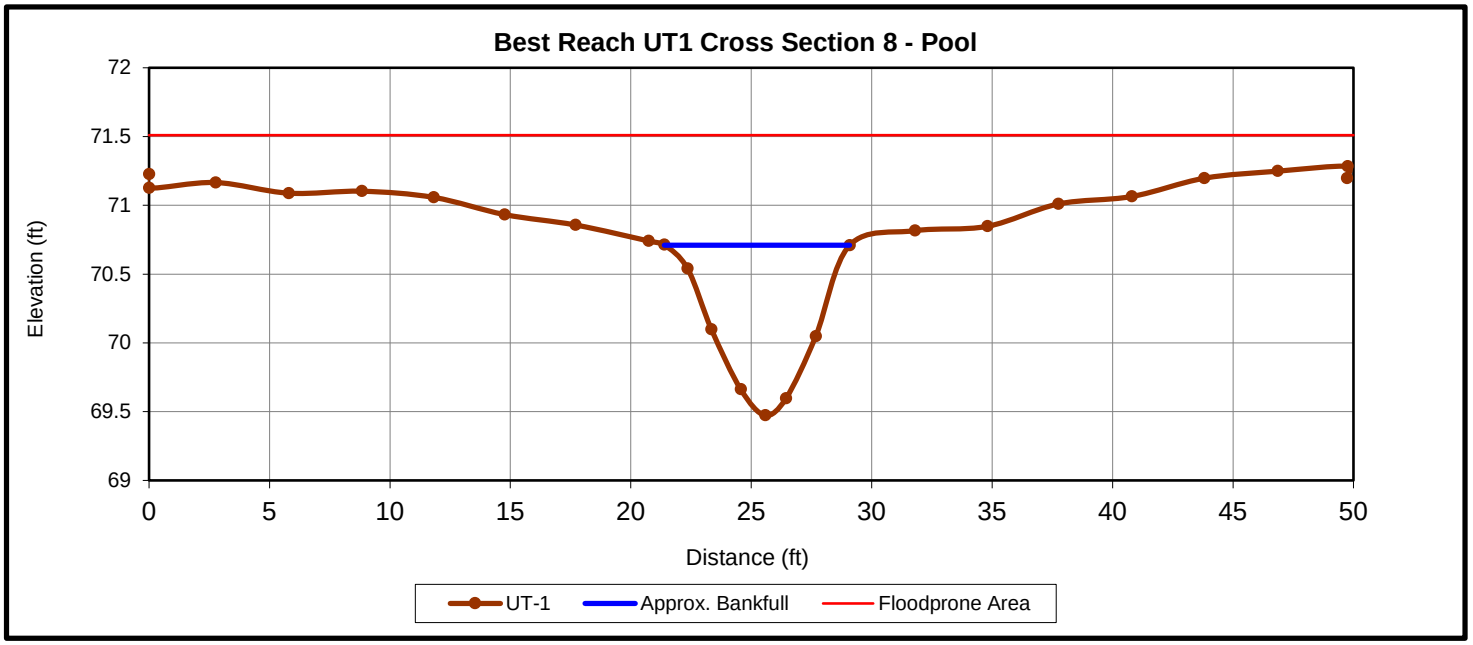
Downstream



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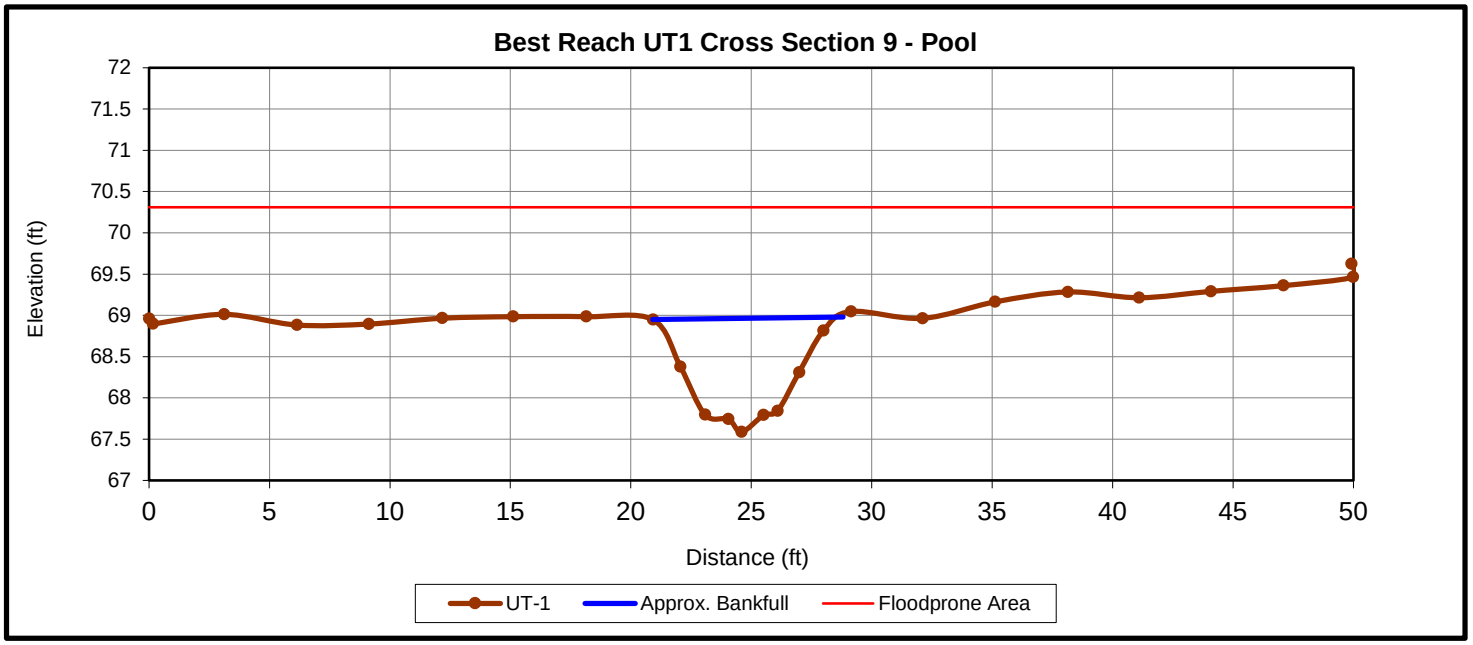
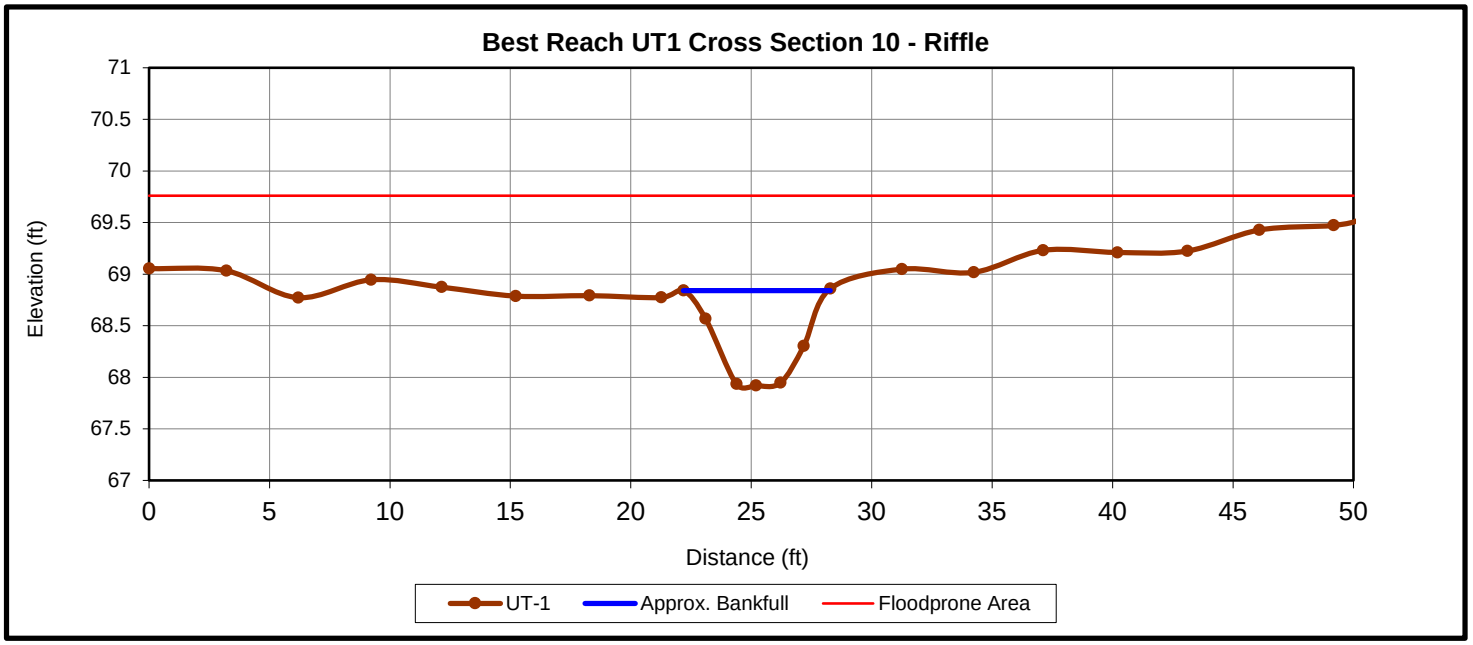
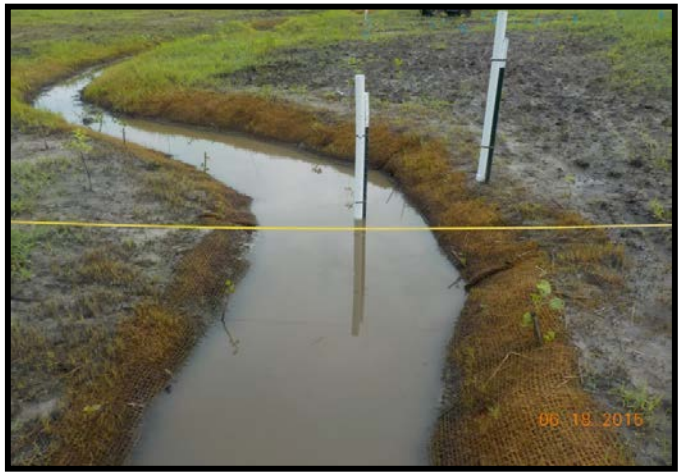
Downstream



Upstream

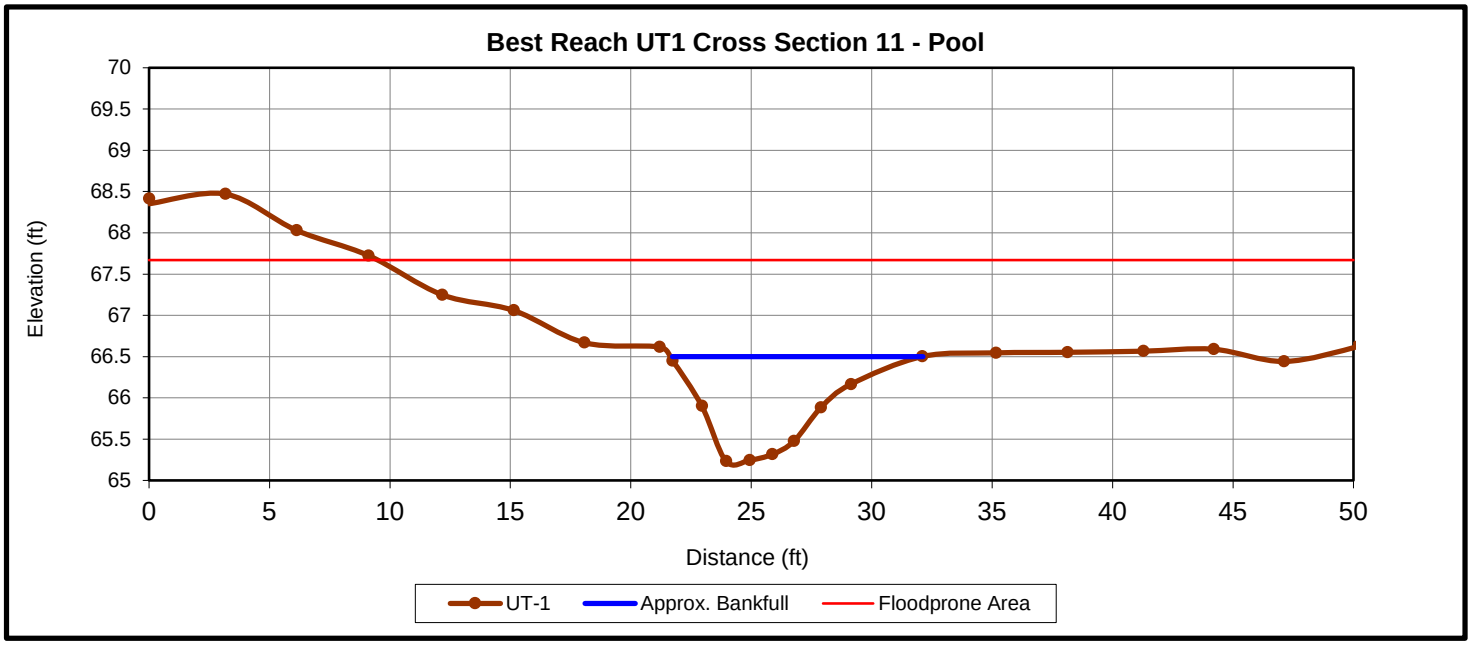
Downstream

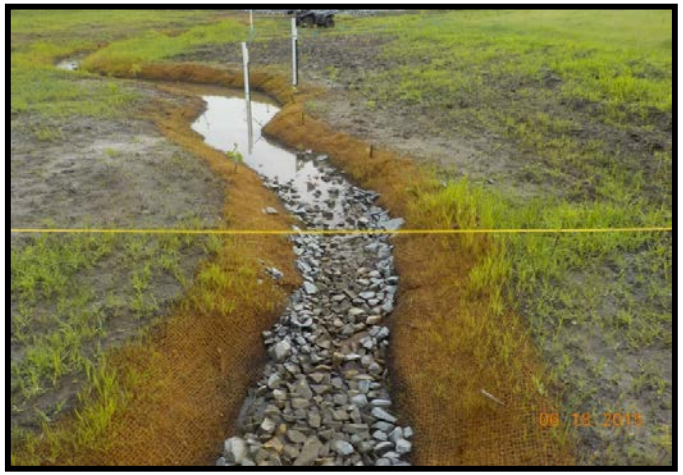




Upstream

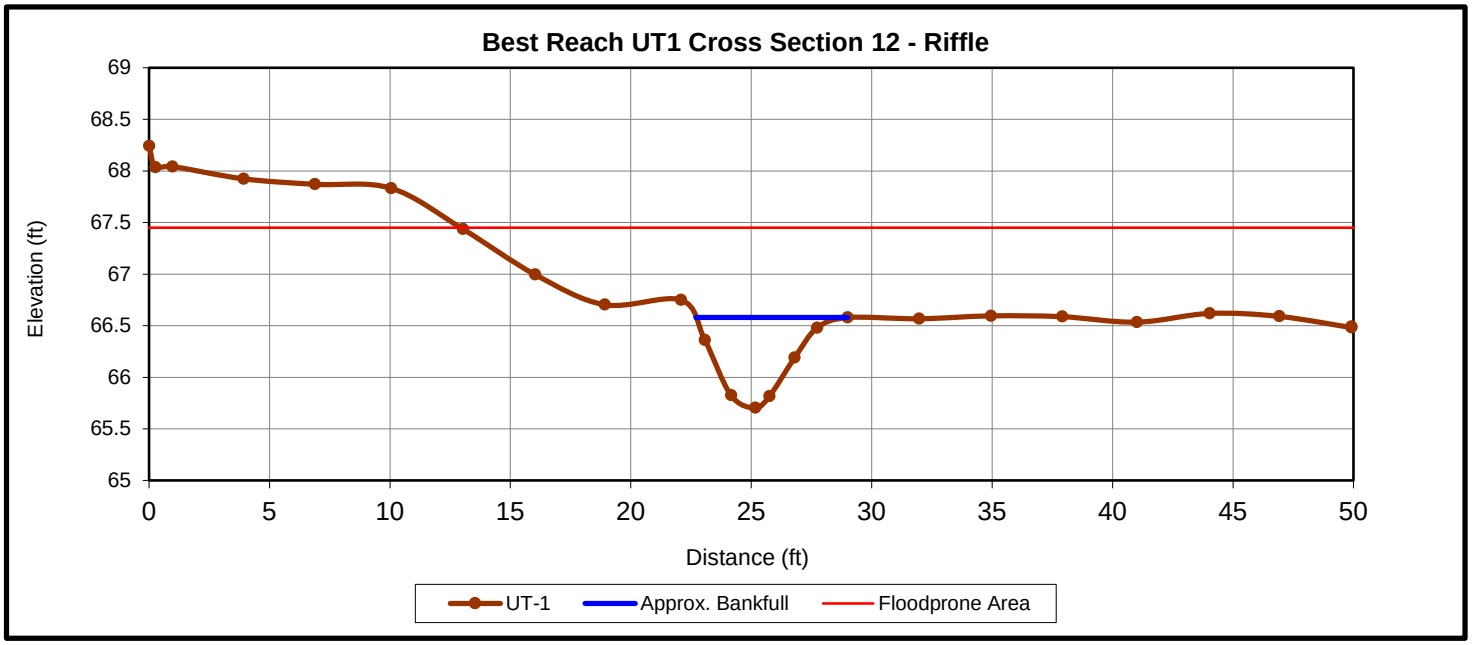
Downstream





Upstream

Downstream



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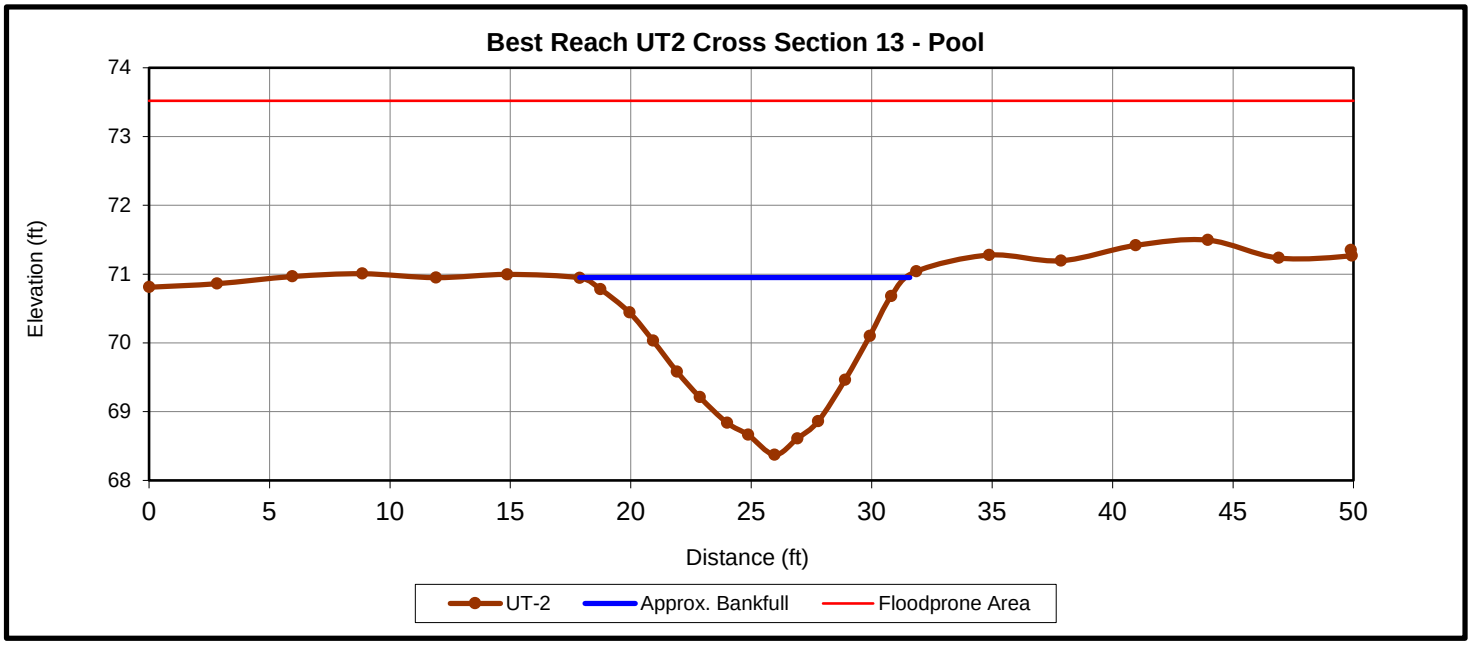
Downstream



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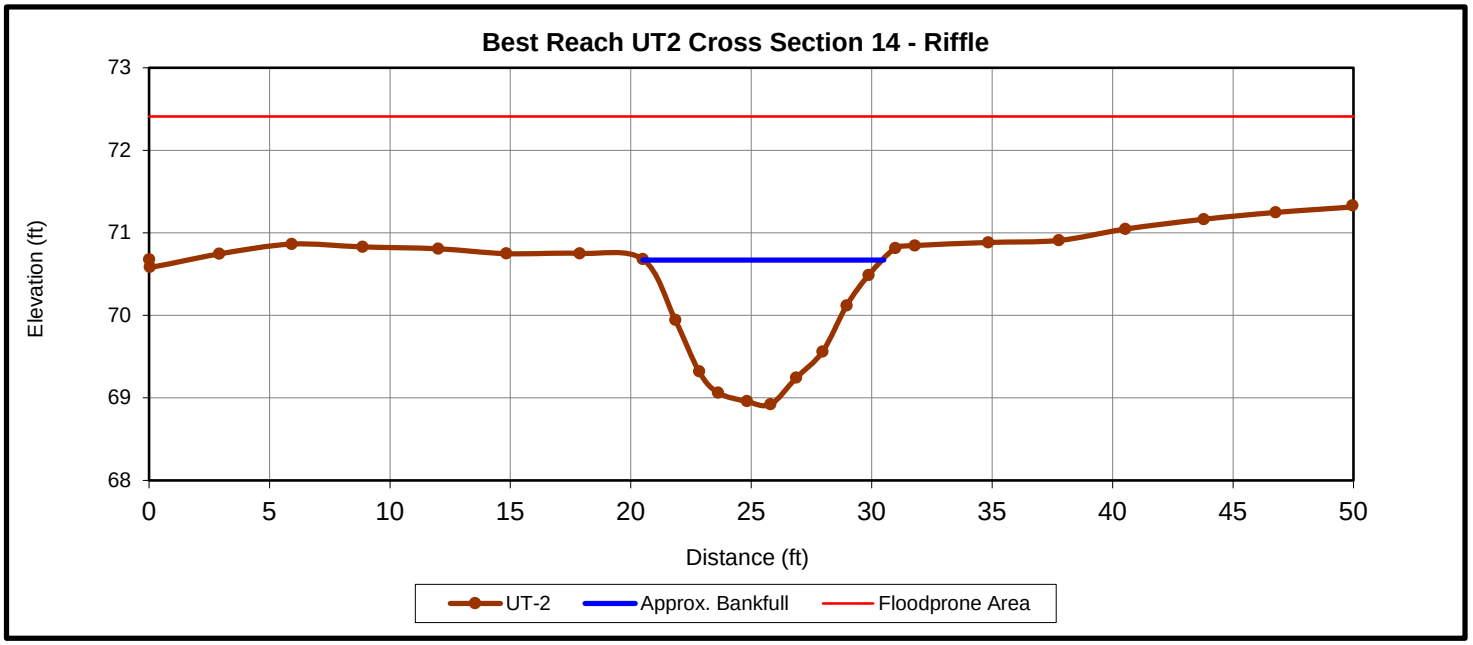
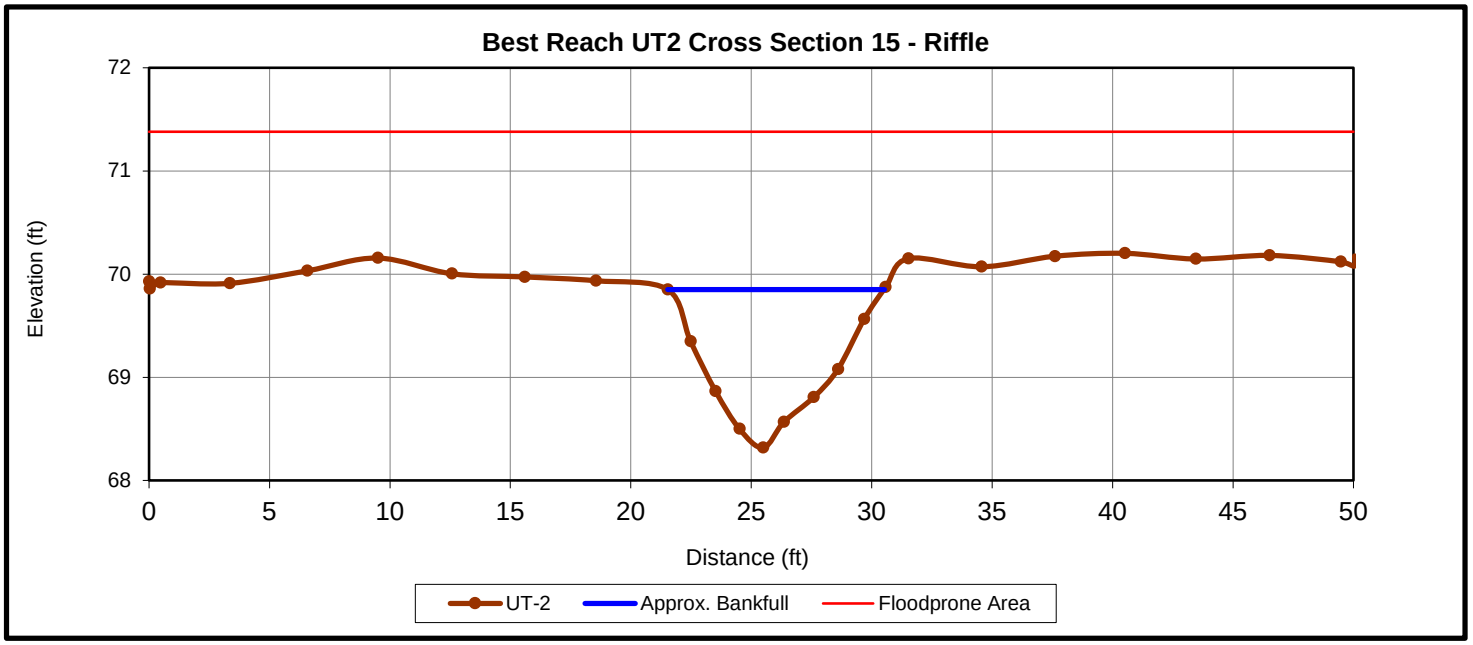
Downstream



Upstream

Downstream



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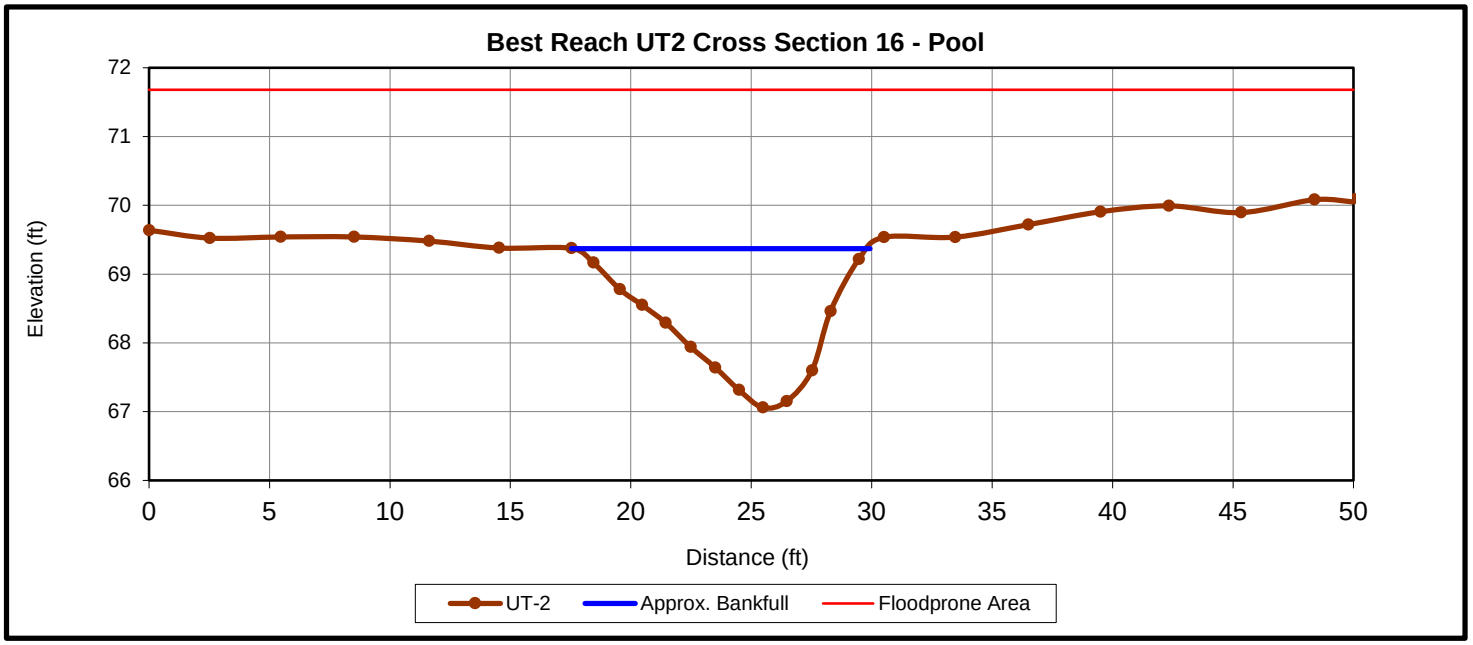
Downstream



Upstream

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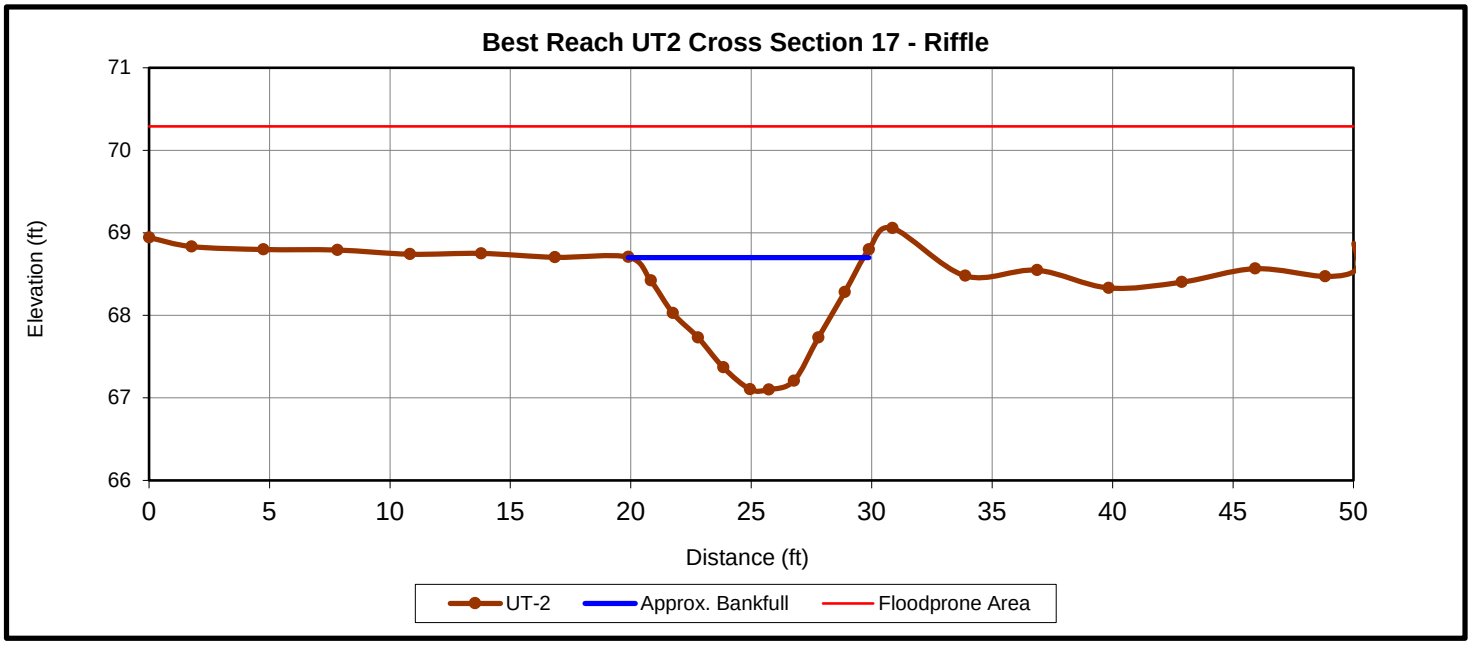
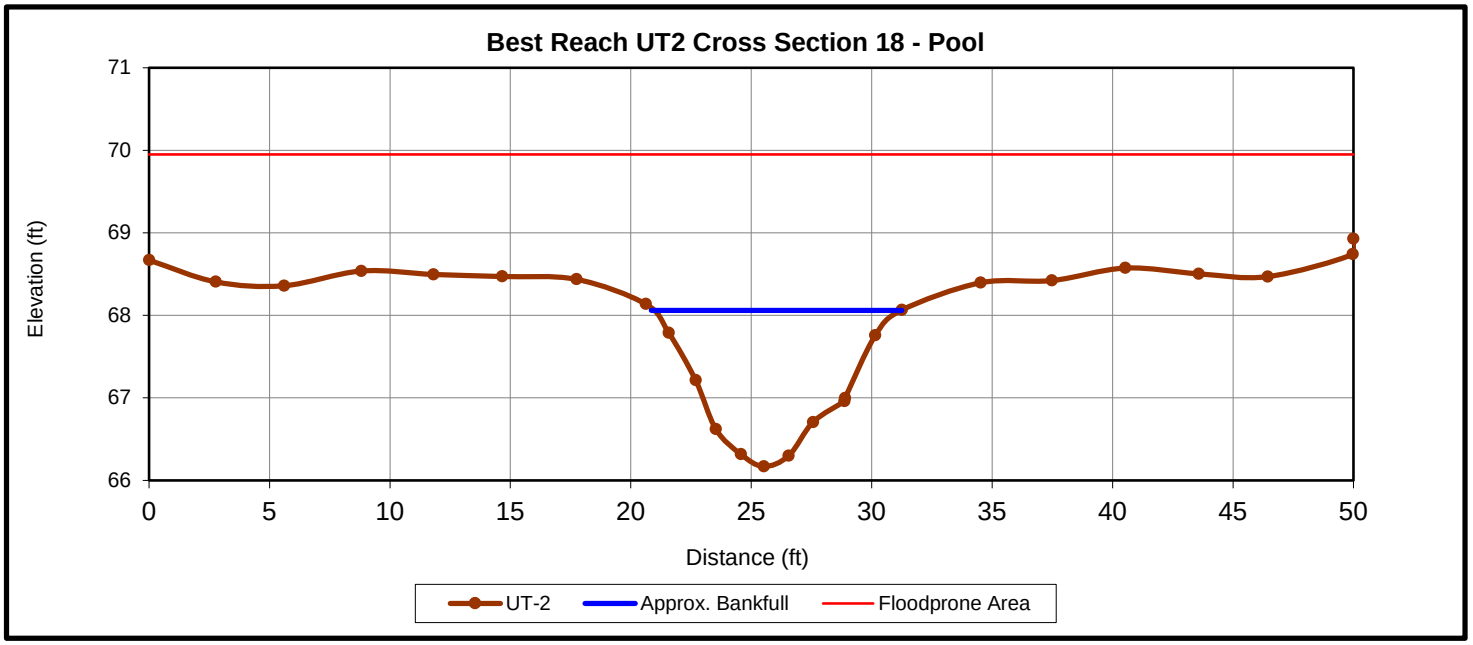


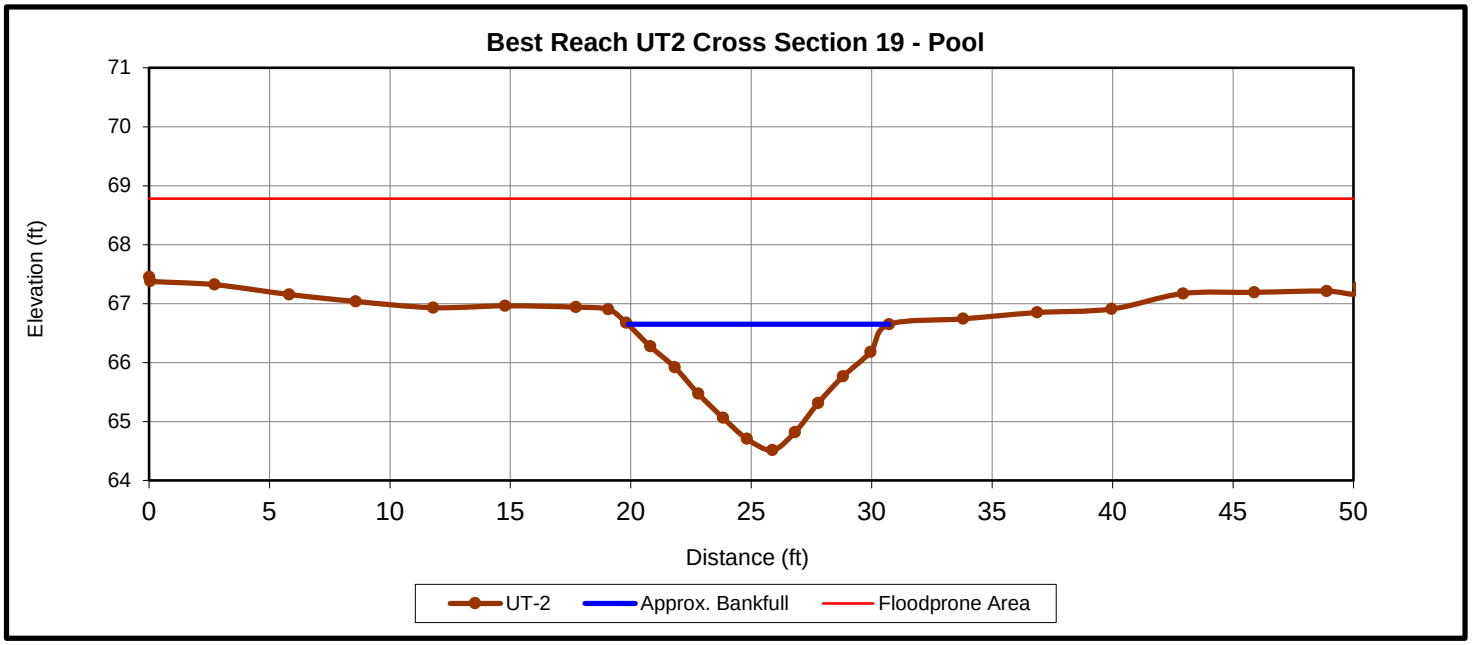
Upstream

Downstream



Upstream

Downstream



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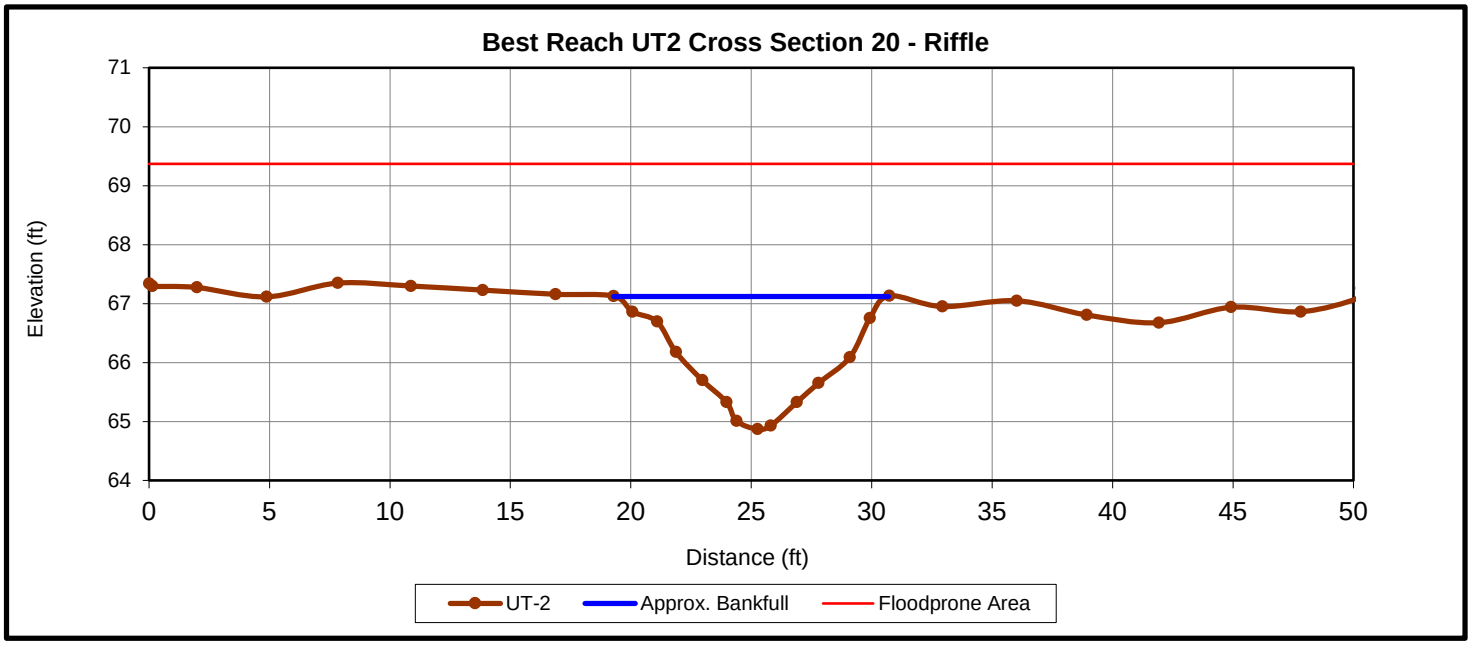
Downstream



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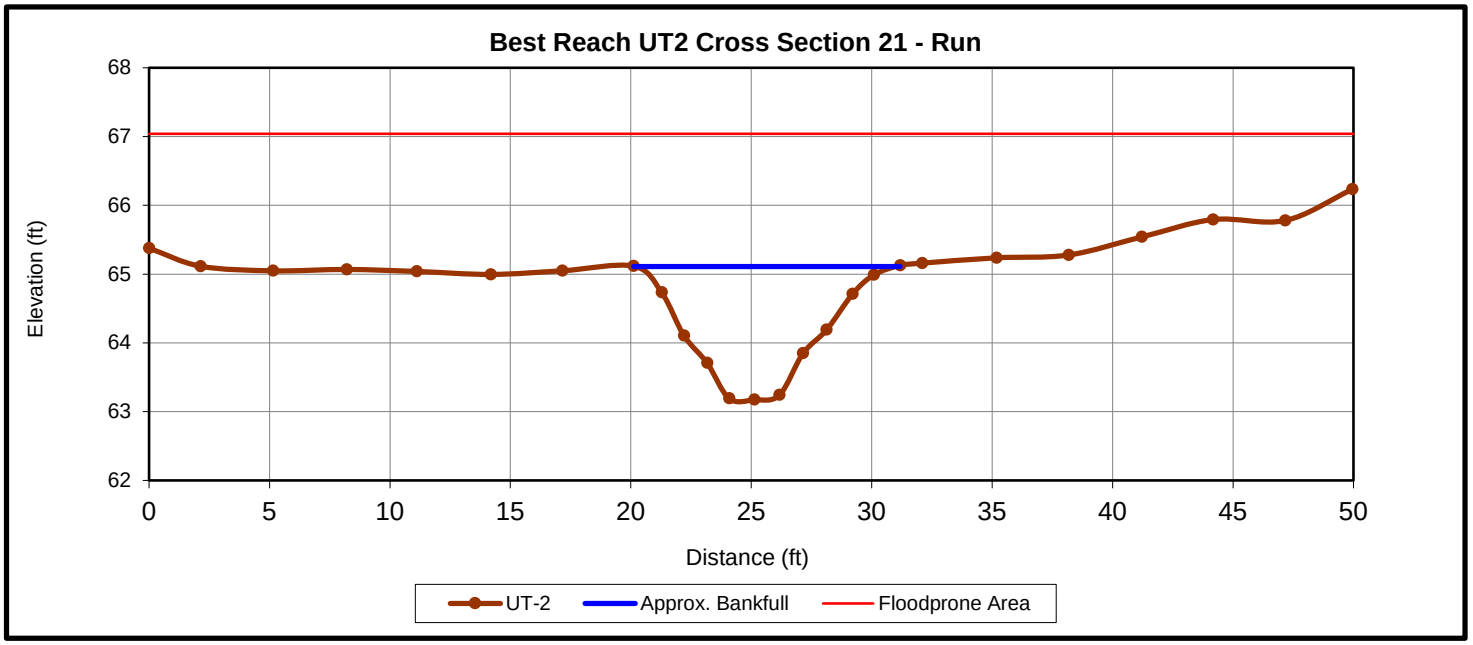
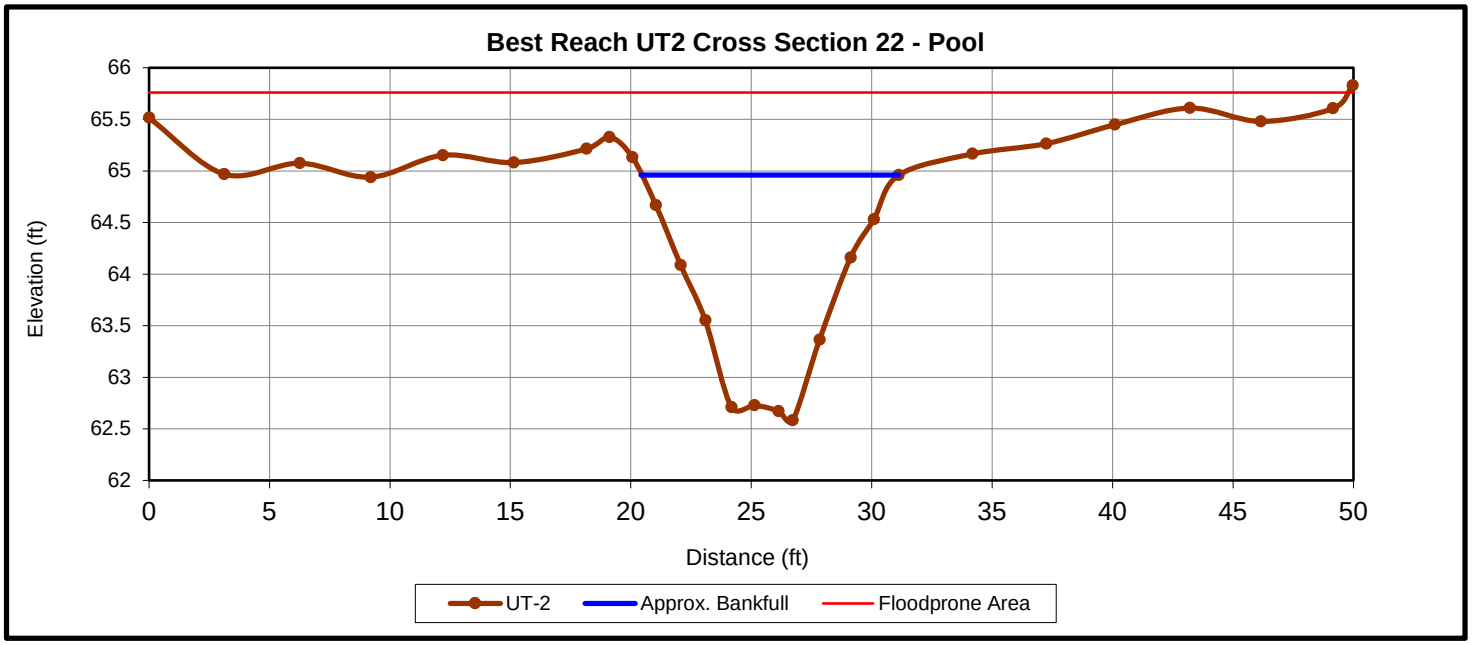
Downstream



Upstream

Downstream



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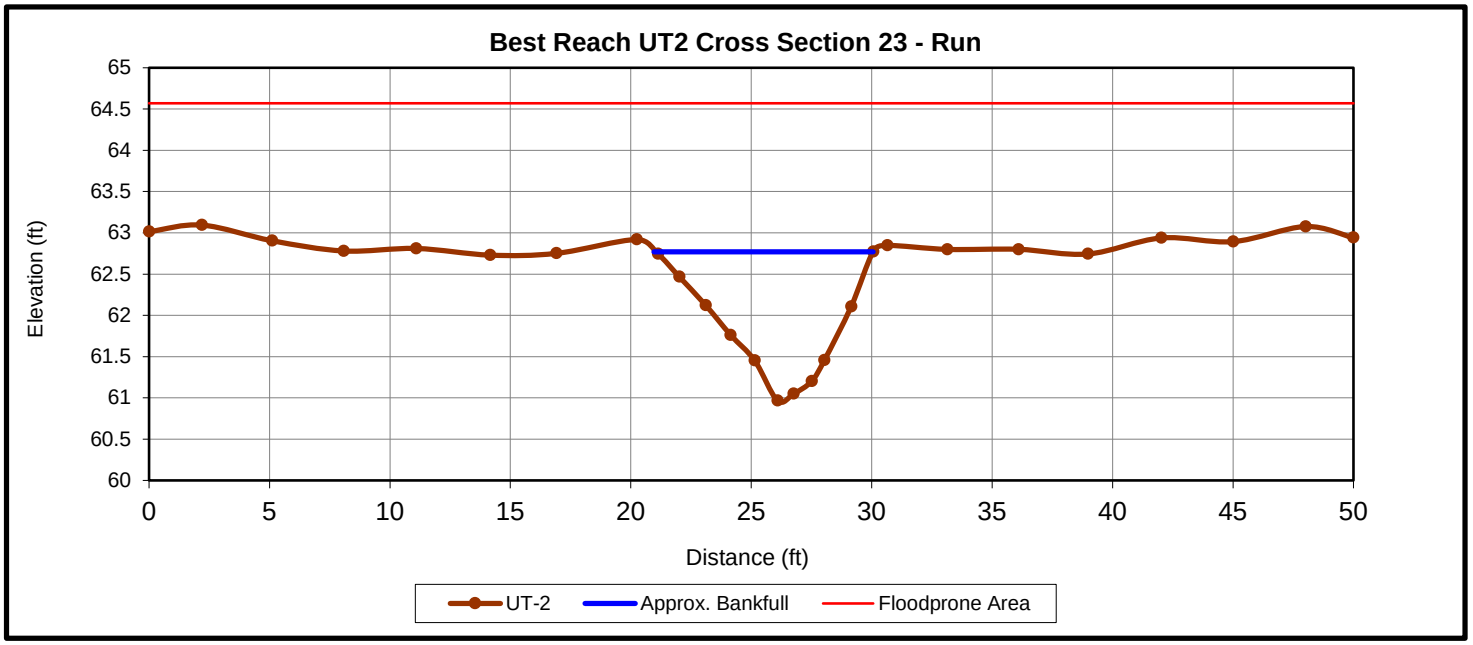
Downstream



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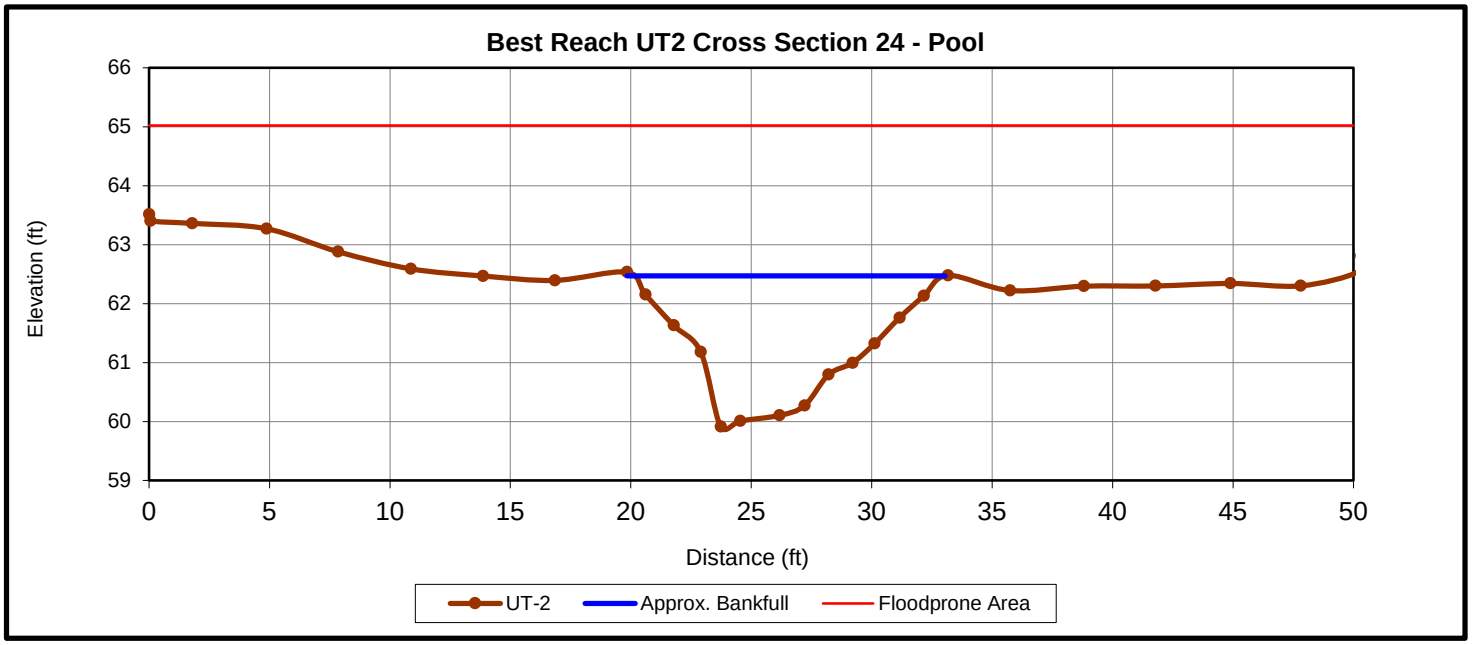
Downstream



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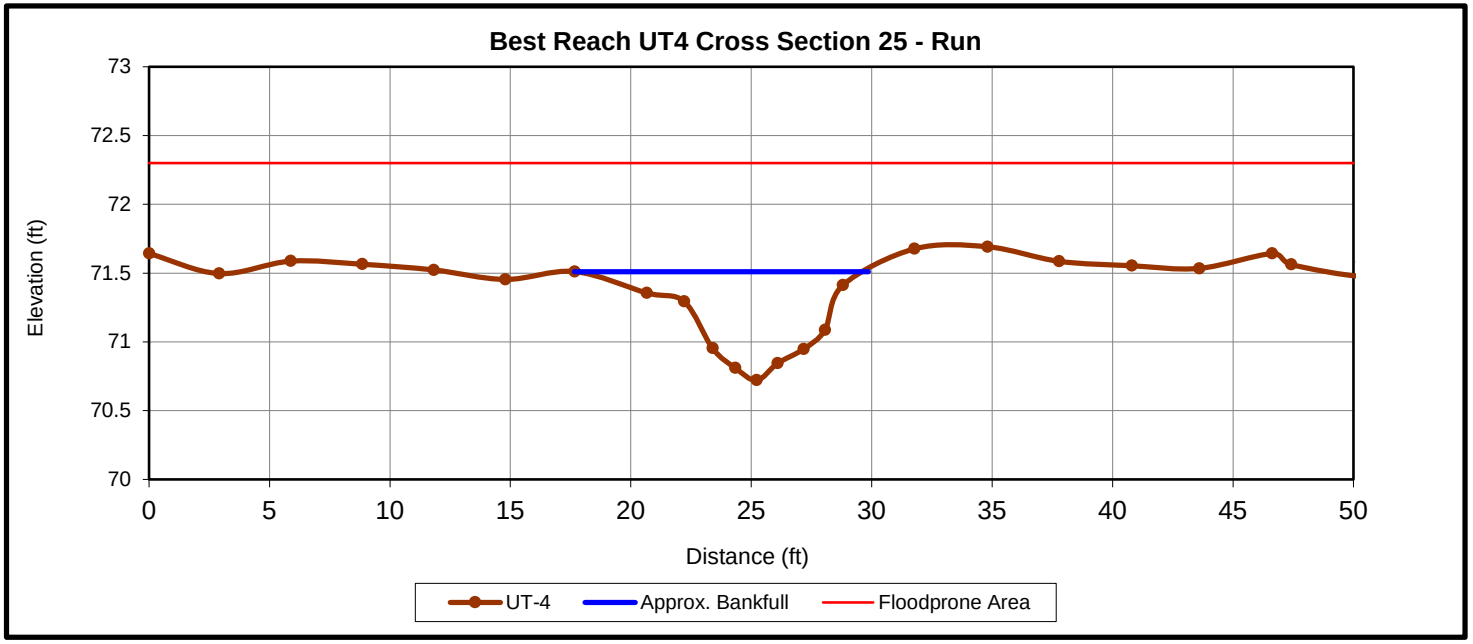
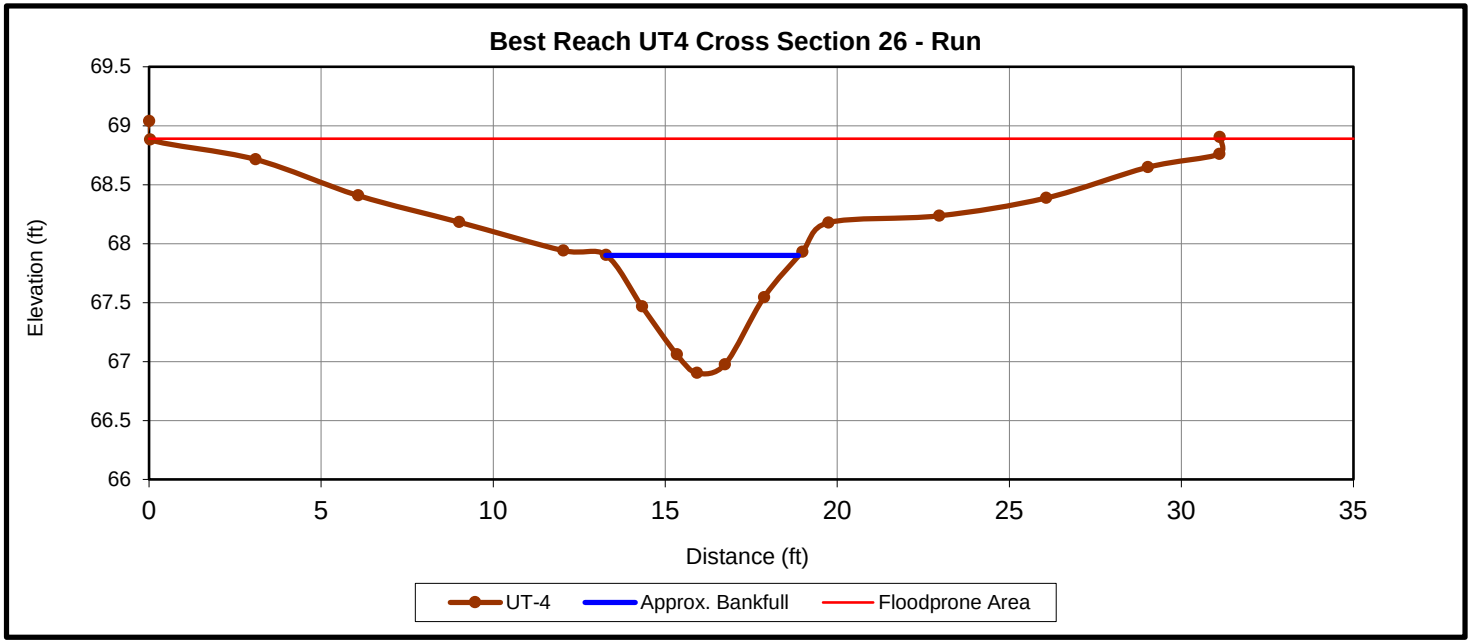
Downstream



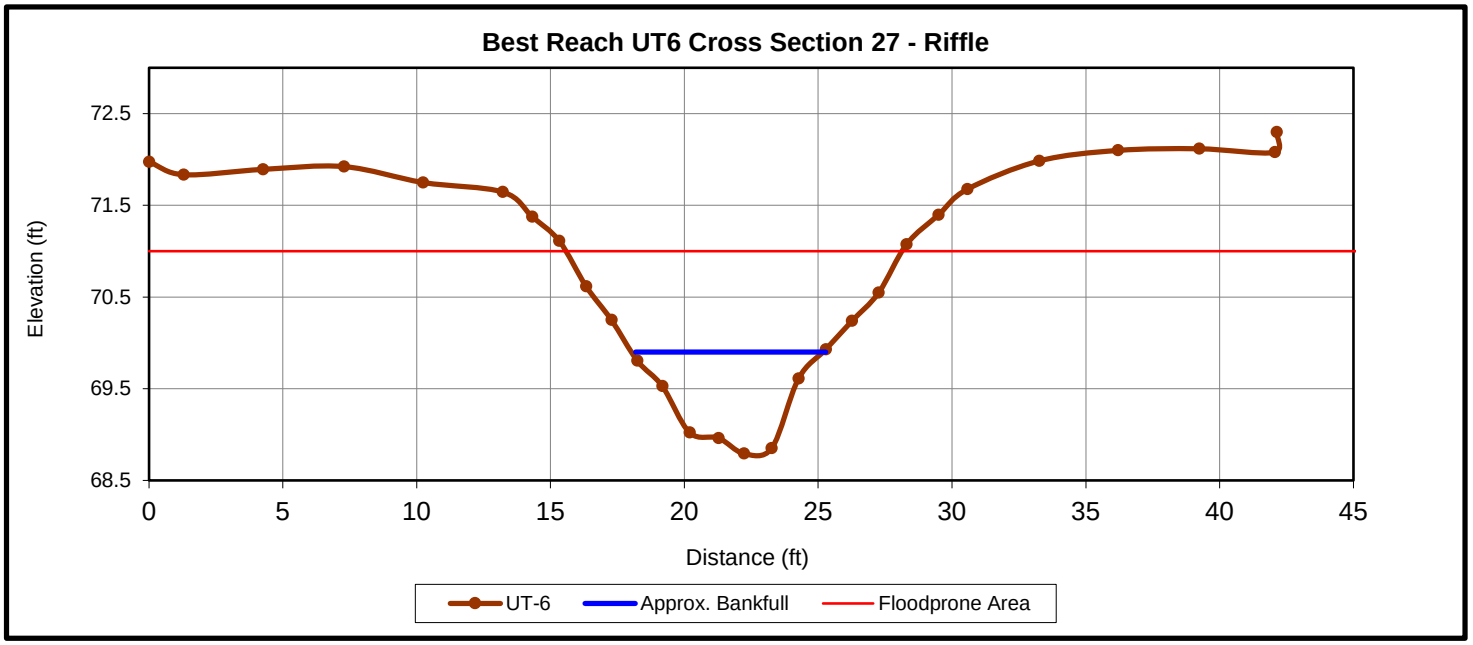
Upstream

Downstream



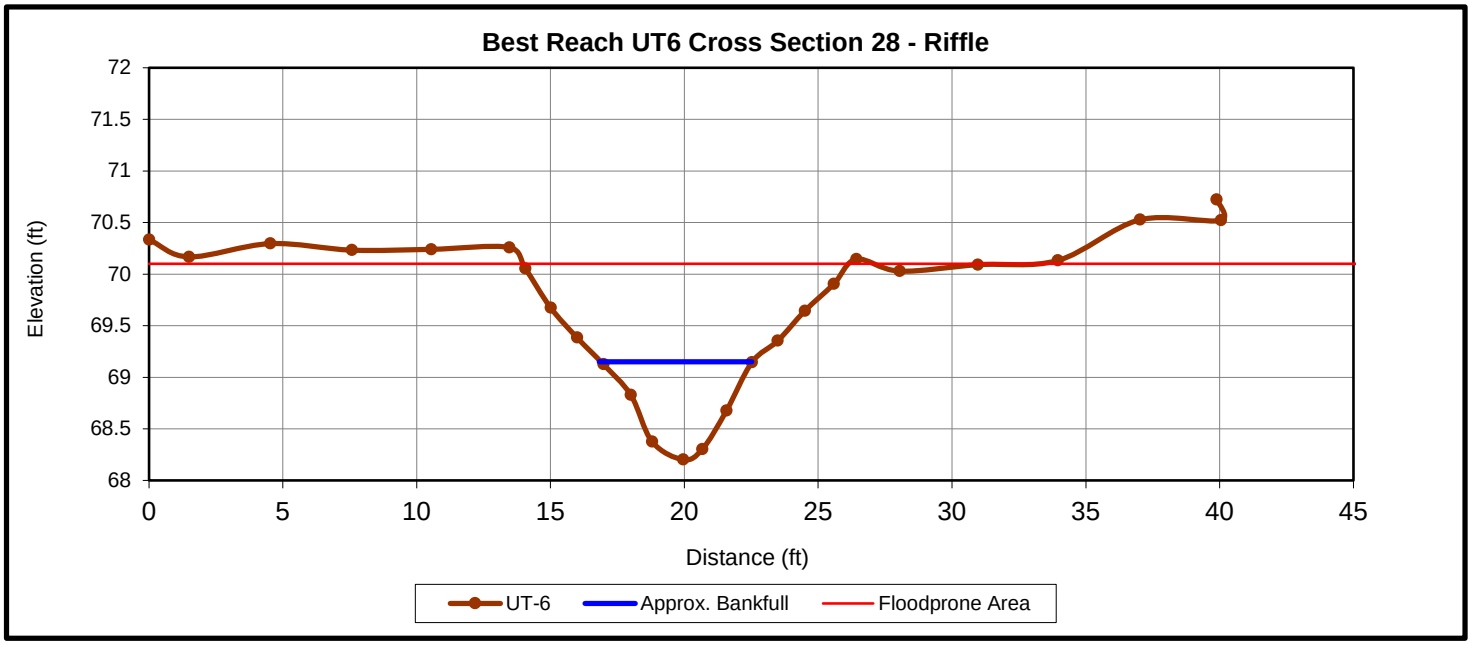
Upstream

Downstream



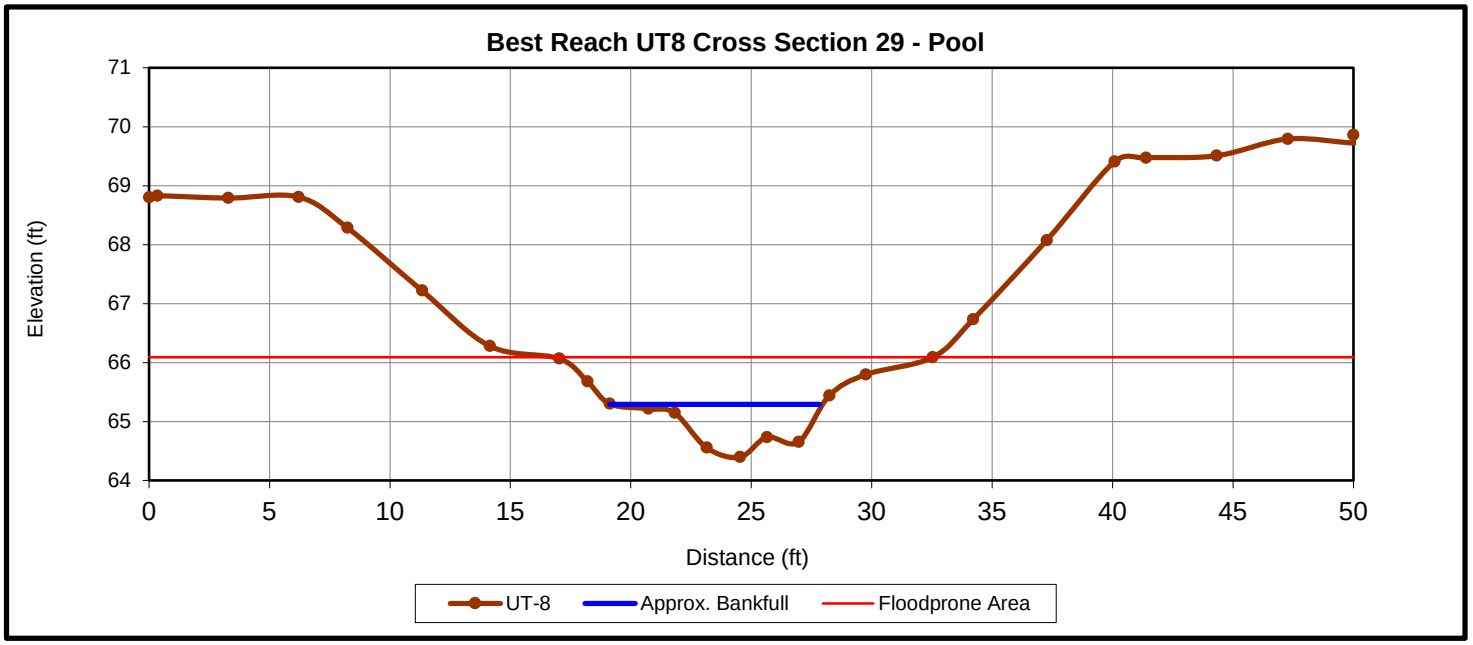
Upstream

Downstream



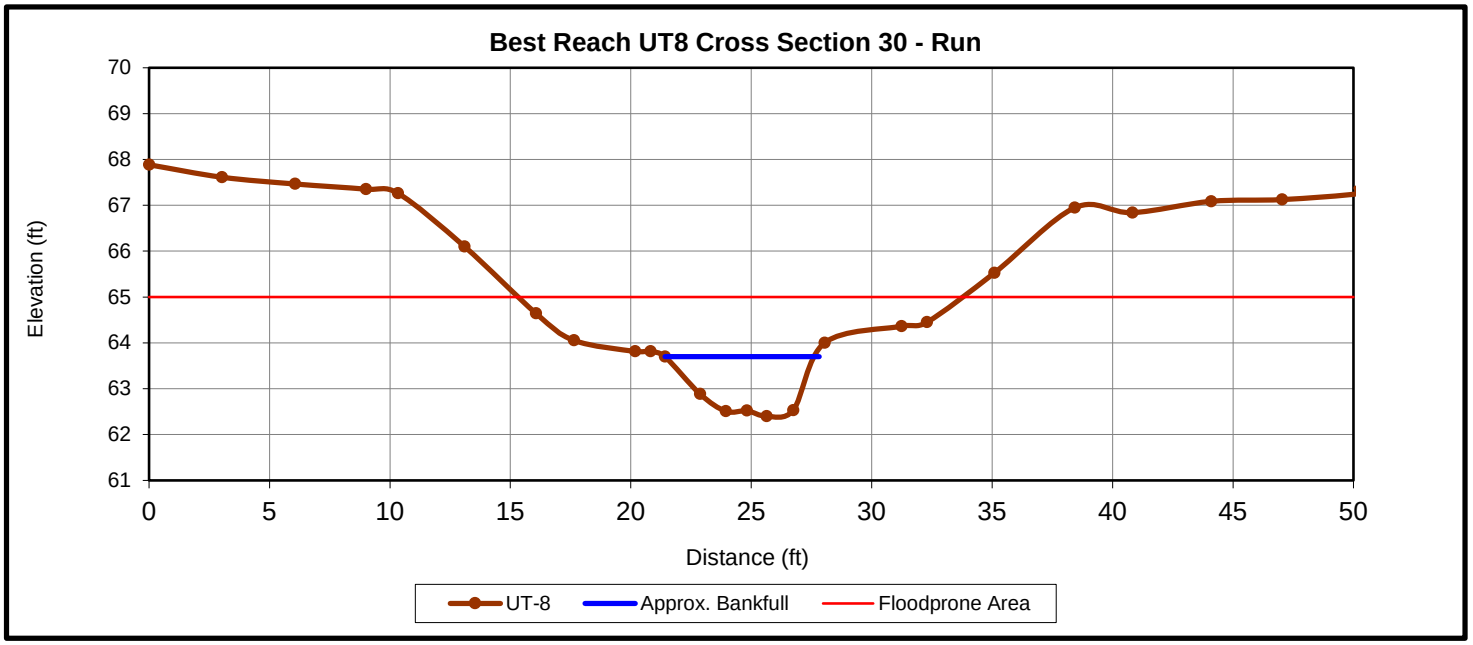
Upstream

Downstream



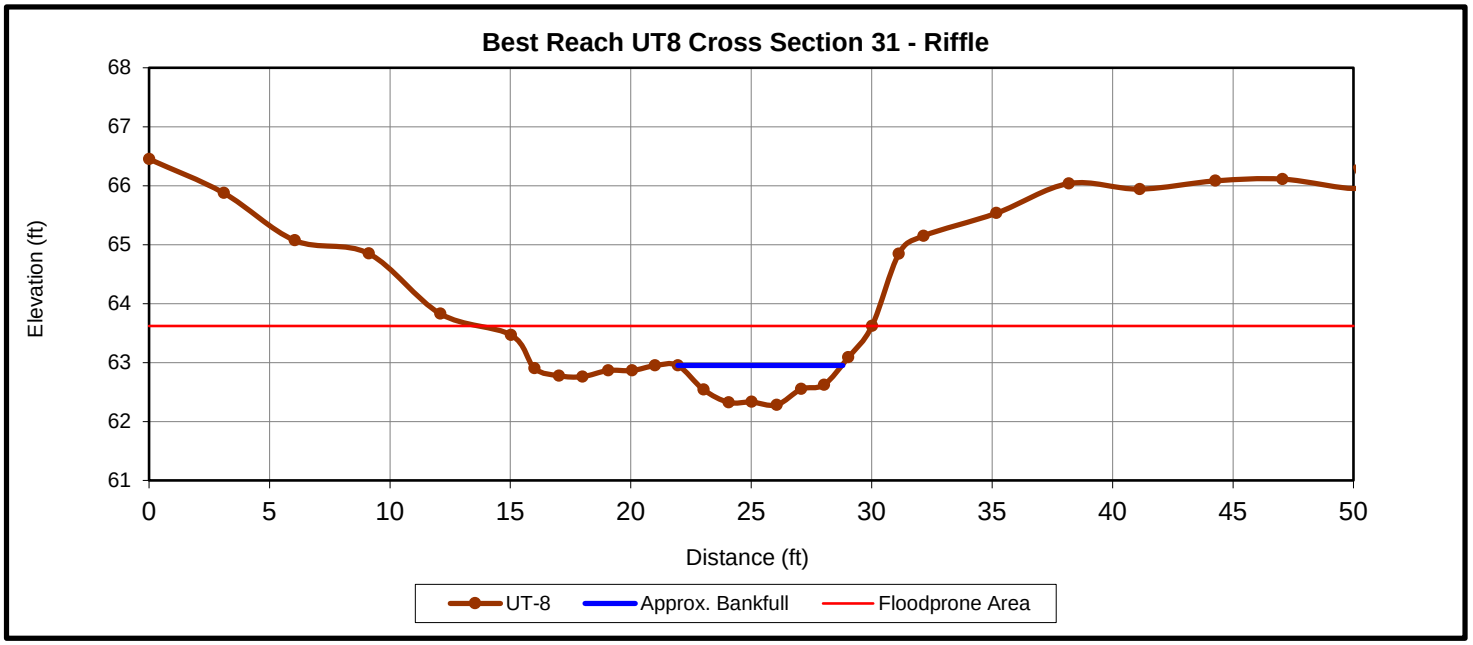
Upstream

Downstream



Upstream

Downstream



Appendix B.
Best Stream Photos


UT1/Wetland Area 1 Looking Upstream (6/25/2015)


UT1 STA 9+00 Looking Downstream (6/25/2015)


UT2 STA 20+00 Looking Downstream (6/25/2015)


UT2 STA 20+00 Looking Upstream (6/25/2015)

UT3 STA 8+50 at Crossing (6/25/2015)

UT4 STA 6+75 Looking Downstream (6/25/2015)

Appendix B.
Best Stream Photos

UT6 STA 2+00 Looking Downstream (6/24/2015)

UT8 STA 3+25 Looking Downstream (6/24/2015)

UT8 STA 3+25 Looking Upstream (6/24/2015)


UT9 STA 3+50 Buffer Enhancement Area (6/24/2015)


Muddy Creek Wetland Area (6/25/2015)


Muddy Creek Wetland Area (6/18/2015)

Appendix B.
Best Stream and Wetland Photos

Wetland Restoration Area 2 (6/18/2015)


AW-9 at Wetland Restoration Area 2 (6/18/2015)

Crest Gauge 1 – UT1 (6/17/2015)

Crest Gauge 2 – UT2 (6/18/2015)

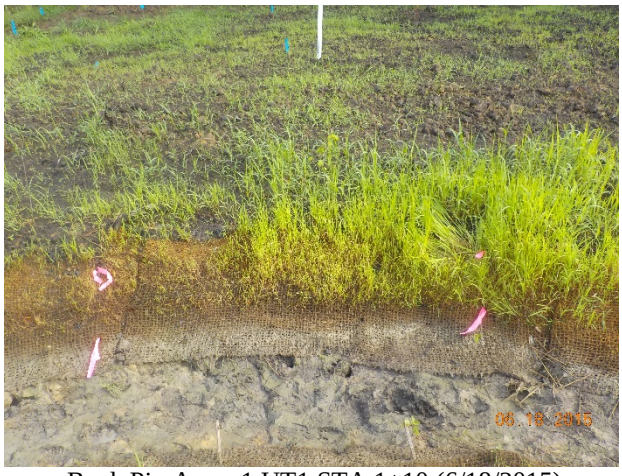

Crest Gauge 3 – UT3 (6/24/2015)

Crest Gauge 4 – UT4 (6/25/2015)

Appendix B.
Crest Gauges and Bank Pins

Crest Gauge 5 – UT6 (6/24/2015)

Crest Gauge 6 – UT8 (6/24/2015)



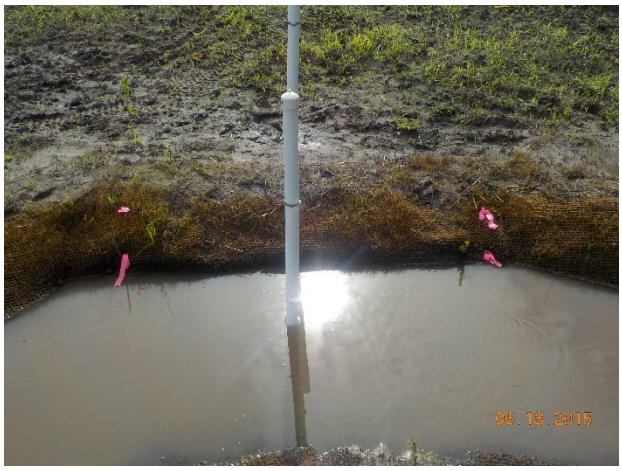
Bank Pin Array 1 UT1 STA 1+10 (6/18/2015)

Bank Pin Array 2 UT1 STA 4+25 (6/18/2015)

Bank Pin Array 3 UT1 STA 6+25 (6/18/2015)

Bank Pin Array 4 UT1 STA 9+90 (6/18/2015)

Best Site Bank Pin Array Photos



Bank Pin Array 5 UT1 STA 15+90 (6/18/2015)

Bank Pin Array 6 UT2 STA 5+75 (6/18/2015)

Bank Pin Array 8 UT2 STA 23+55 (6/18/2015)

Bank Pin Array 8 UT2 STA 28+45 (6/18/2015)

APPENDIX C

Vegetation Data and Tables

Table 7a. Baseline Planted Species Summary
Table 7b. Vegetation Plot Mitigation Success Criteria Summary
Table 7c. Vegetation Plot Data Summary (Species by Plot)
Vegetation Plot Photos

Table 7a. Baseline Planted Species Summary

Planted Date: May 27, 2015

Scientific Name	Common Name	Species Type	Total Stems Planted
Betula nigra	River Birch	Bare Root	2,500
Nyssa sylvatica	Blackgum	Bare Root	1,450
Platanus occidentalis	American sycamore	Bare Root	4,650
Quercus bicolor	Swamp White Oak	Bare Root	2,000
Quercus lyrata	Overcup Oak	Bare Root	2,300
Quercus michauxii	Swamp Chestnut Oak	Bare Root	2,500
Quercus nigra	Water Oak	Bare Root	2,400
Taxodium distichum	Bald Cypress	Bare Root	2,400
		Total	**20,200**
Salix nigra	Black Willow	Live Stake	1,500
Populus deltoides	Cottonwood	Live Stake	1,000
Cornus amomum	Silky Dogwood	Live Stake	500
		Total	**3,000**

Table 7b. Vegetation Plot Mitigation Success Criteria Summary

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	931	0	931	Yes
2	607	0	607	Yes
3	769	0	769	Yes
4	1335	0	1335	Yes
5	1133	0	1133	Yes
6	1093	0	1093	Yes
7	1012	0	1052	Yes
8	1012	0	1012	Yes
9	1052	0	1052	Yes
10	1052	0	1052	Yes
11	1416	0	1416	Yes
12	1376	0	1376	Yes
13	1214	0	1214	Yes
14	1093	0	1093	Yes
15	1214	0	1214	Yes
16	1052	0	1052	Yes
17	809	0	809	Yes
18	1133	0	1133	Yes
19	688	0	688	Yes
20	1457	0	1497	Yes
21	1214	0	1255	Yes
22	971	0	1012	Yes
23	1700	0	1700	Yes
Project Avg	**1101**	**0**	**1108**	**Yes**

Table 7c. Vegetation Plot Data Summary (Species by Plot)

			Current Plot Data (MY0 2015)																								Annual Means		
			95353-01-0001			95353-01-0002			95353-01-0003			95353-01-0004			95353-01-0005			95353-01-0006			95353-01-0007			95353-01-0008			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree	1	1	1							3	3	3	1	1	1										26	26	26
Liriodendron tulipifera	Tuliptree	Tree	4	4	4				2	2	2	1	1	1	5	5	5										25	25	25
Nyssa sylvatica	Blackgum	Tree																									6	6	6
Platanus occidentalis	American Sycamore	Tree	3	3	3	1	1	1	1	1	1	14	14	14				8	8	8	9	9	9	6	6	6	113	113	113
Quercus	Oak	Tree	8	8	8				1	1	1										6	6	6	2	2	2	48	48	48
Quercus lyrata	Overcup Oak	Tree	3	3	3	8	8	8	2	2	2	5	5	5	6	6	6	10	10	10	2	2	2	1	1	1	119	119	119
Quercus michauxii	Swamp Chestnut Oak	Tree	2	2	2	5	5	5	9	9	9	1	1	1	10	10	10				6	6	6	9	9	9	86	86	86
Quercus nigra	Water Oak	Tree	1	1	1	1	1	1				2	2	2													15	15	15
Quercus phellos	Willow Oak	Tree										7	7	7	6	6	6	9	9	9	2	2	2	6	6	6	90	90	90
Taxodium distichum	Bald Cypress	Tree	1	1	1				4	4	4													1	1	1	98	98	98
Unknown		Shrub or Tree																			1	1	1				4	4	4
Stem count			23	23	23	15	15	15	19	19	19	33	33	33	28	28	28	27	27	27	26	26	26	25	25	25	630	630	630
size (ares)			1			1			1			1			1			1			1			1			23		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.57		
Species count			8	8	8	4	4	4	6	6	6	7	7	7	5	5	5	3	3	3	6	6	6	6	6	6	11	11	11
Stems per ACRE			930.78	930.78	930.78	607.03	607.03	607.03	768.9	768.9	768.9	1335.5	1335.5	1335.5	1133.1	1133.1	1133.1	1092.7	1092.7	1092.7	1052.2	1052.2	1052.2	1011.7	1011.7	1011.7	1108.5	1108.5	1108.5

			Current Plot Data (MY0 2015) (Continued)																								Annual Means		
			95353-01-0009			95353-01-0010			95353-01-0011			95353-01-0012			95353-01-0013			95353-01-0014			95353-01-0015			95353-01-0016			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree				1	1	1	1	1	1	4	4	4	2	2	2	1	1	1							26	26	26
Liriodendron tulipifera	Tuliptree	Tree				1	1	1				3	3	3													25	25	25
Nyssa sylvatica	Blackgum	Tree	1	1	1																5	5	5				6	6	6
Platanus occidentalis	American Sycamore	Tree	13	13	13	5	5	5	1	1	1	7	7	7	13	13	13	7	7	7	1	1	1	1	1	1	113	113	113
Quercus	Oak	Tree				1	1	1	1	1	1	2	2	2	2	2	2	1	1	1							48	48	48
Quercus lyrata	Overcup Oak	Tree	4	4	4	8	8	8	1	1	1	10	10	10	6	6	6	6	6	6				9	9	9	119	119	119
Quercus michauxii	Swamp Chestnut Oak	Tree	2	2	2	1	1	1	2	2	2	4	4	4	3	3	3	2	2	2	1	1	1	12	12	12	86	86	86
Quercus nigra	Water Oak	Tree																									15	15	15
Quercus phellos	Willow Oak	Tree	2	2	2	2	2	2				1	1	1	1	1	1	1	1	1				3	3	3	90	90	90
Taxodium distichum	Bald Cypress	Tree	4	4	4	7	7	7	29	29	29	3	3	3	3	3	3	9	9	9	23	23	23	1	1	1	98	98	98
Unknown		Shrub or Tree																									4	4	4
Stem count			26	26	26	26	26	26	35	35	35	34	34	34	30	30	30	27	27	27	30	30	30	26	26	26	630	630	630
size (ares)			1			1			1			1			1			1			1			1			23		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.57		
Species count			6	6	6	8	8	8	6	6	6	8	8	8	7	7	7	7	7	7	4	4	4	5	5	5	11	11	11
Stems per ACRE			1052.2	1052.2	1052.2	1052.2	1052.2	1052.2	1416.4	1416.4	1416.4	1375.9	1375.9	1375.9	1214.1	1214.1	1214.1	1092.7	1092.7	1092.7	1214.1	1214.1	1214.1	1052.2	1052.2	1052.2	1108.5	1108.5	1108.5

			Current Plot Data (MY0 2015) (Continued)																					Annual Means		
			95353-01-0017			95353-01-0018			95353-01-0019			95353-01-0020			95353-01-0021			95353-01-0022			95353-01-0023			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	River Birch	Tree										6	6	6	6	6	6							26	26	26
Liriodendron tulipifera	Tuliptree	Tree				8	8	8	1	1	1													25	25	25
Nyssa sylvatica	Blackgum	Tree																						6	6	6
Platanus occidentalis	American Sycamore	Tree										12	12	12	3	3	3	8	8	8				113	113	113
Quercus	Oak	Tree	17	17	17	3	3	3				2	2	2	1	1	1				1	1	1	48	48	48
Quercus lyrata	Overcup Oak	Tree				10	10	10	7	7	7				5	5	5	9	9	9	7	7	7	119	119	119
Quercus michauxii	Swamp Chestnut Oak	Tree										16	16	16	1	1	1							86	86	86
Quercus nigra	Water Oak	Tree																3	3	3	8	8	8	15	15	15
Quercus phellos	Willow Oak	Tree				7	7	7	9	9	9				5	5	5	3	3	3	26	26	26	90	90	90
Taxodium distichum	Bald Cypress	Tree	3	3	3										9	9	9	1	1	1				98	98	98
Unknown		Shrub or Tree										1	1	1	1	1	1	1	1	1				4	4	4
		Stem count	20	20	20	28	28	28	17	17	17	37	37	37	31	31	31	25	25	25	42	42	42	630	630	630
		size (ares)	1			1			1			1			1			1			1			23		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.57		
		Species count	2	2	2	4	4	4	3	3	3	5	5	5	8	8	8	6	6	6	4	4	4	11	11	11
		Stems per ACRE	809.37	809.37	809.37	1133.1	1133.1	1133.1	687.97	687.97	687.97	1497.3	1497.3	1497.3	1254.5	1254.5	1254.5	1011.7	1011.7	1011.7	1699.7	1699.7	1699.7	1108.5	1108.5	1108.5

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

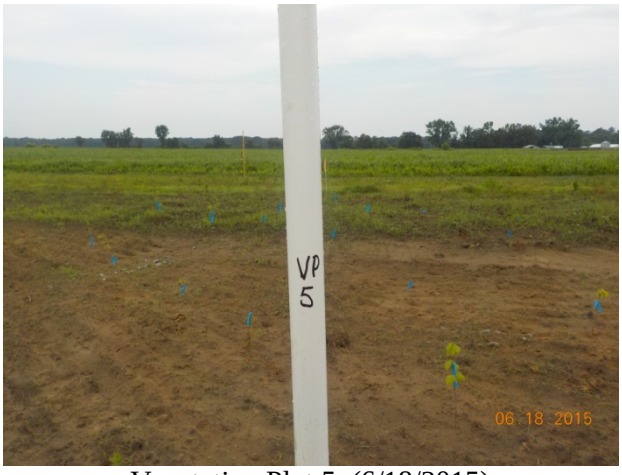
Appendix C.
Best Site Vegetation Plot Photos

Vegetation Plot 1 (6/17/2015)

Vegetation Plot 2 (6/17/2015)

Vegetation Plot 3 (6/17/2015)

Vegetation Plot 4 (6/18/2015)



Vegetation Plot 5 (6/18/2015)

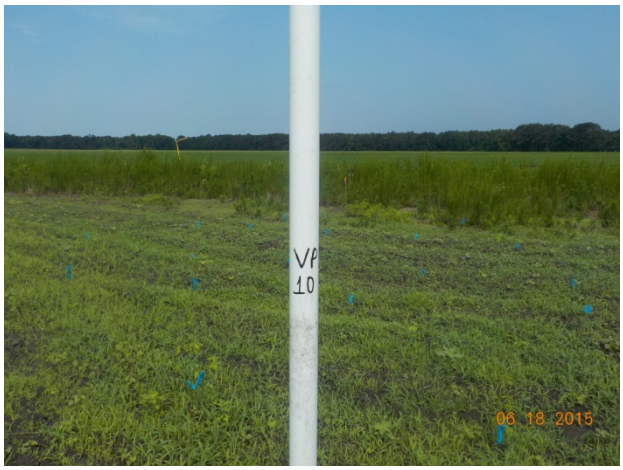
Vegetation Plot 6 (6/18/2015)

Best Site Vegetation Plot Photos

Vegetation Plot 7 (6/18/2015)

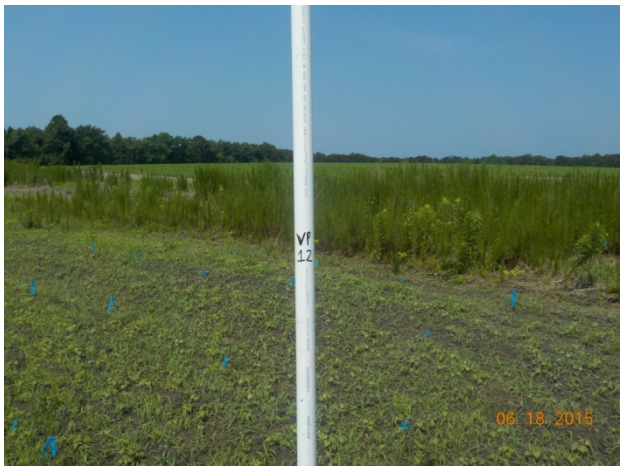
Vegetation Plot 8 (6/18/2015)

Vegetation Plot 9 (6/18/2015)



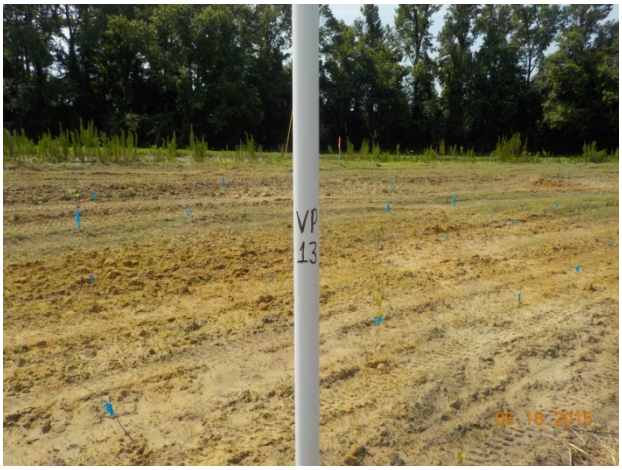
Vegetation Plot 10 (6/18/2015)

Vegetation Plot 11 (6/18/2015)



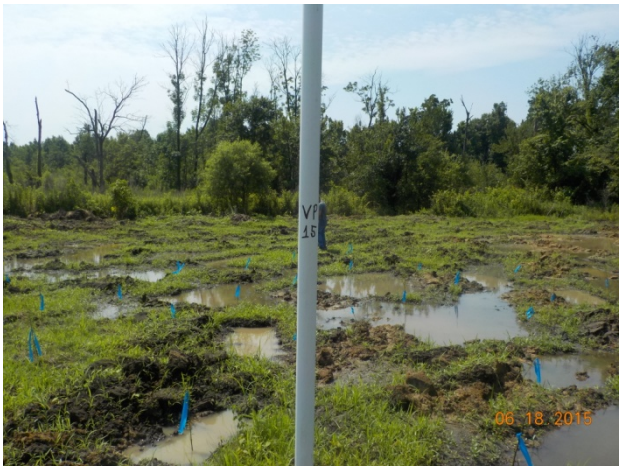
Vegetation Plot 12 (6/18/2015)

Best Site Vegetation Plot Photos

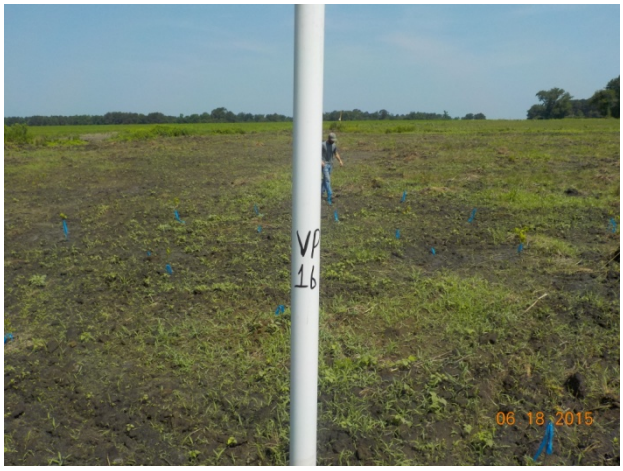


Vegetation Plot 13 (6/18/2015)

Vegetation Plot 14 (6/18/2015)



Vegetation Plot 15 (6/18/2015)



Vegetation Plot 16 (6/18/2015)

Vegetation Plot 17 (6/25/2015)

Vegetation Plot 18 (6/25/2015)

Best Site Vegetation Plot Photos

Vegetation Plot 19 (6/25/2015)

Vegetation Plot 20 (6/24/2015)

Vegetation Plot 21 (6/24/2015)

Vegetation Plot 22 (6/24/2015)

Vegetation Plot 23 (6/24/2015)

APPENDIX D

Best Stream and Wetland Restoration Project
As-Built Survey

As-Built Survey Plan Sheets
Design Red Line Plans

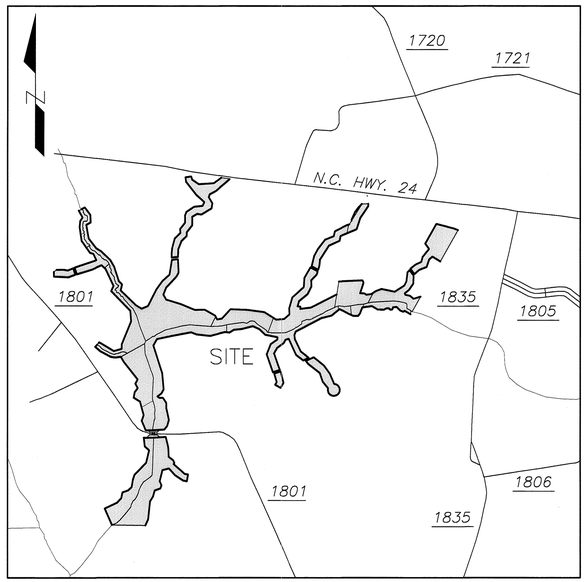
BEST STREAM AND WETLAND RESTORATION PROJECT

DUPLIN COUNTY, NORTH CAROLINA

CAPE FEAR RIVER BASIN
HUC: 03030007060010

NORTH CAROLINA DIVISION OF MITIGATION SERVICES:
PROJECT # 95353
CONTRACT # 004631

AS-BUILT SURVEY



VICINITY MAP
NOT TO SCALE

PROJECT COORDINATES:
LATITUDE: 34°54'44.011" N
LONGITUDE: 77°44'57.344" W

PROJECT DIRECTORY

DESIGNER:
W. K. DICKSON
720 CORPORATE CENTER DR.
RALEIGH, NC 27607
(919) 782-0495

CONSTRUCTION CONTRACTOR:
WRIGHT CONTRACTING
PO BOX 545
SILER CITY, NC 27344
(919) 663-0810

FULL DELIVERY PROVIDER:
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, NC 27605
(919) 209-1061

MONITORING PERFORMERS:
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, NC 27605
(919)209-1061

SURVEYING:
MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
(252)522-2500

SHEET INDEX

SEAL

SEAL
11/16/15
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR
SEAL L-4712
JAMES R. WATSON
James R. Watson

COVER SHEET

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, NC

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE		DEPARTMENT
DRAWN BY: JRW	DATE STARTED: 8-17-15	SHEET No.: 1 OF 20
APPROVED: JRW		DRAWING NO.: **S-1**
DRAWING NAME: BEST ASB		
PROJECT NO.: 20120072		

Best Baseline Monitoring Cross Section Control

Description	Northing	Easting	Elevation		Description	Northing	Easting	Elevation
XS1-LEFT PIN	427105.73	2380206.27	75.29		XS17-LEFT PIN	426905.96	2377975.96	68.94
XS1-RIGHT PIN	427121.93	2380158.71	75.25		XS17-RIGHT PIN	426950.79	2377953.78	68.87
XS2-LEFT PIN	427074.12	2380189.68	74.65		XS18-LEFT PIN	426897.43	2377939.99	68.67
XS2-RIGHT PIN	427108.27	2380153.30	75.33		XS18-RIGHT PIN	426947.25	2377935.94	68.93
XS3-LEFT PIN	426946.09	2380044.42	73.18		XS19-LEFT PIN	426538.65	2377693.00	67.45
XS3-RIGHT PIN	426952.76	2379994.90	73.00		XS19-RIGHT PIN	426534.09	2377643.13	67.33
XS4-LEFT PIN	426920.49	2380034.30	73.01		XS20-LEFT PIN	426521.31	2377695.08	67.34
XS4-RIGHT PIN	426929.67	2379984.94	73.29		XS20-RIGHT PIN	426520.01	2377644.90	67.27
XS5-LEFT PIN	426784.80	2379931.49	72.16		XS21-LEFT PIN	426168.00	2377518.13	65.38
XS5-6-RIGHT PIN	426811.03	2379888.69	72.80		XS21-RIGHT PIN	426172.85	2377468.41	66.23
XS6-LEFT PIN	426766.48	2379894.81	72.01		XS22-LEFT PIN	426150.75	2377520.33	65.51
XS5-6-RIGHT PIN	426811.03	2379888.69	72.80		XS22-RIGHT PIN	426142.99	2377470.96	65.83
XS7-LEFT PIN	426552.95	2379735.86	71.28		XS23-LEFT PIN	425832.83	2377313.32	63.02
XS7-RIGHT PIN	426584.97	2379697.22	71.31		XS23-RIGHT PIN	425824.60	2377263.94	62.98
XS8-LEFT PIN	426560.43	2379737.19	71.23		XS24-LEFT PIN	425791.28	2377311.01	63.51
XS8-RIGHT PIN	426561.92	2379687.48	71.20		XS24-RIGHT PIN	425815.66	2377267.16	62.83
XS9-LEFT PIN	426379.87	2379528.20	68.96		XS25-RIGHT PIN	424219.98	2377003.22	71.64
XS9-RIGHT PIN	426428.83	2379518.46	69.62		XS25-LEFT PIN	424247.91	2376961.51	71.58
XS10-LEFT PIN	426378.05	2379526.30	69.05		XS26-RIGHT PIN	424595.82	2376887.27	69.04
XS10-RIGHT PIN	426418.13	2379495.90	69.66		XS26-LEFT PIN	424575.04	2376864.11	68.90
XS11-LEFT PIN	426165.02	2379456.35	68.41		XS27-LEFT PIN	428024.64	2375313.12	71.97
XS11-RIGHT PIN	426168.87	2379406.41	66.66		XS27-RIGHT PIN	427998.21	2375280.31	72.30
XS12-LEFT PIN	426137.26	2379456.30	68.24		XS28-LEFT PIN	427877.44	2375426.06	70.33
XS12-RIGHT PIN	426150.72	2379408.24	66.49		XS28-RIGHT PIN	427854.65	2375393.33	70.72
XS13-LEFT PIN	427338.18	2378427.74	70.81		XS29-LEFT PIN	426320.84	2372886.62	68.80
XS13-RIGHT PIN	427378.82	2378398.80	71.35		XS29-RIGHT PIN	426270.87	2372885.19	69.86
XS14-LEFT PIN	427301.88	2378409.39	70.68		XS30-LEFT PIN	426375.57	2373183.06	67.88
XS14-RIGHT PIN	427342.63	2378380.48	71.33		XS30-RIGHT PIN	426328.00	2373198.78	67.38
XS15-LEFT PIN	427132.27	2378255.21	69.93		XS31-LEFT PIN	426457.62	2373448.79	66.45
XS15-RIGHT PIN	427157.03	2378211.70	70.18		XS31-RIGHT PIN	426412.07	2373469.63	66.32
XS16-LEFT PIN	427107.29	2378208.09	69.64					
XS16-RIGHT PIN	427157.26	2378205.60	70.14					

LEGEND

- C/L =CENTERLINE
- R/W =RIGHT OF WAY
- N/F =NOW OR FORMERLY
- HDPE =HIGH DENSITY POLYETHYLENE PIPE
- XS =CROSS SECTION
- VP =VEGETATION PLOT
- V =BANKPIN ARRAY
- BPA =BANKPIN ARRAY
- ◎ =CREST GAUGE
- CG =CREST GAUGE
- ● =AUTO-CREST GAUGE
- ACG =AUTO-CREST GAUGE
- ⊗ =WOODY DEBRIS BUNDLE
- =LOG STRUCTURE
- =ROCK STRUCTURE
- =ROCK AREA
- LCE =CONSERVATION EASEMENT LINE
- =BOUNDARY LINE
- =WETLAND BOUNDARY LINE
- =WOODLINE

NOTES:
1. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES UNLESS OTHERWISE NOTED.
2. THE HORIZONTAL DATUM IS NAD 83(2011) AND THE VERTICAL DATUM IS NAVD 88.
3. THIS MAP IS NOT FOR RECORDATION, SALES, OR CONVEYANCES.
4. THE PURPOSE OF THIS MAP IS TO SHOW POST CONSTRUCTION AS-BUILT CONDITIONS OF THE STREAM RESTORATION AND MAY NOT SHOW ALL UTILITIES, STRUCTURES, AND BOUNDARIES.
5. NO PROPERTY LINES WERE SURVEYED DURING THIS SURVEY. ALL CONSERVATION EASEMENTS, PROPERTY LINES, AND ADJOINING PROPERTY OWNERS ARE SHOWN BY PREVIOUS SURVEYS BY MATRIX EAST, PLLC AS RECORDED IN THE DUPLIN COUNTY REGISTER OF DEEDS OFFICE.

SEAL

SEAL 11/6/15
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4712 JAMES R. WATSON
James R. Watson

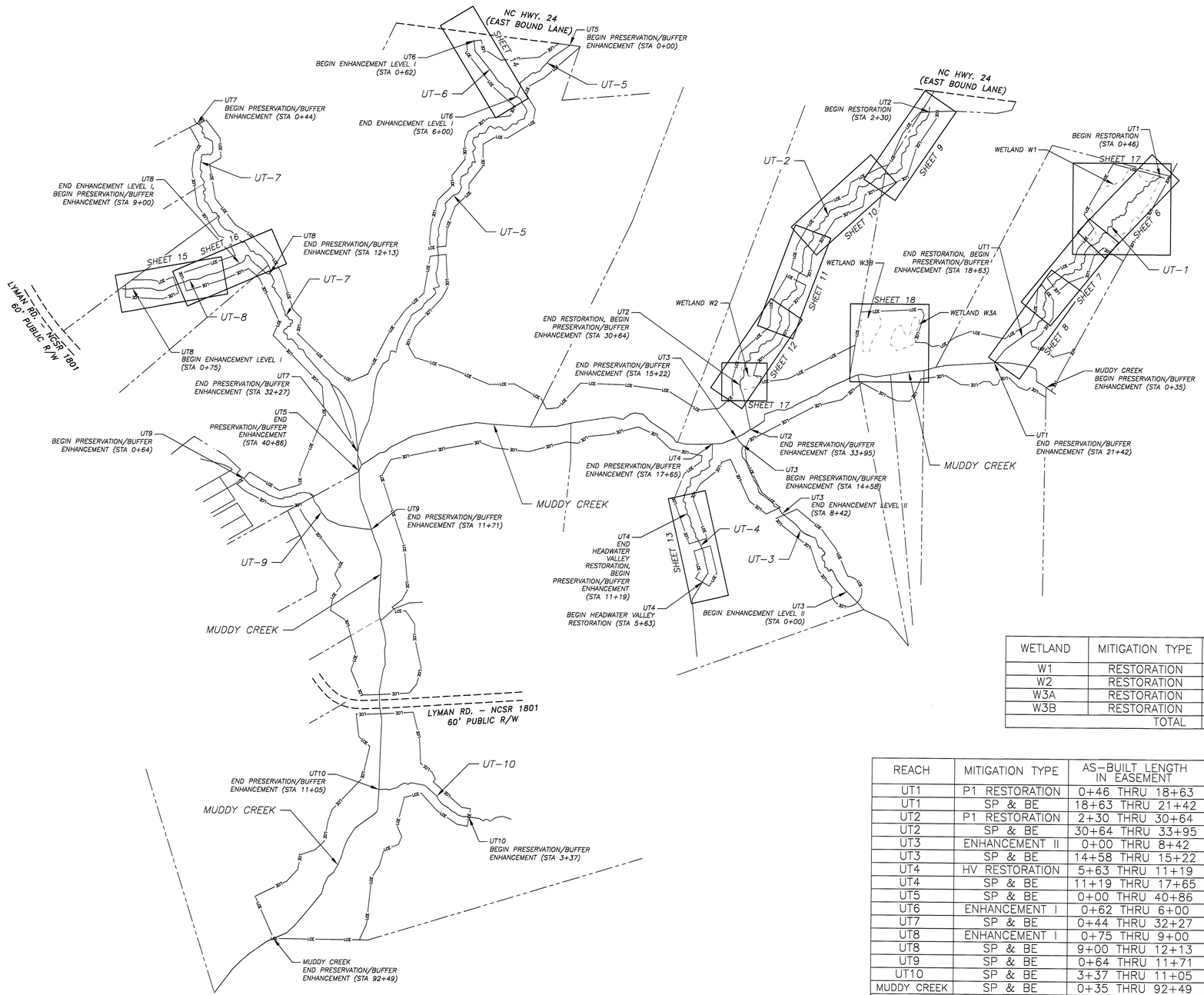
LEGEND, NOTES, & CROSS SECTION CONTROL

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, NC

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE		DEPARTMENT
DRAWN BY: JRW	DATE STARTED: 8-17-15	SHEET No.: 2 OF 20
APPROVED: JRW		DRAWING NO.: S-2
DRAWING NAME: BEST ASB		
PROJECT NO.: 20120072		



WETLAND	MITIGATION TYPE	MITIGATION AREA	WMUs
W1	RESTORATION	3.77 AC.±	3.77
W2	RESTORATION	0.31 AC.±	0.31
W3A	RESTORATION	0.58 AC.±	0.58
W3B	RESTORATION	0.59 AC.±	0.59
	TOTAL	5.25 AC.±	5.25

REACH	MITIGATION TYPE	AS-BUILT LENGTH IN EASEMENT	AS-BUILT LENGTH IN EASEMENT	SMUs
UT1	P1 RESTORATION	0+46 THRU 18+63	1,757'	1757
UT1	SP & BE	18+63 THRU 21+42	279'	56
UT2	P1 RESTORATION	2+30 THRU 30+64	2,772'	2772
UT2	SP & BE	30+64 THRU 33+95	331'	66
UT3	ENHANCEMENT II	0+00 THRU 8+42	812'	325
UT3	SP & BE	14+58 THRU 15+22	64'	13
UT4	HV RESTORATION	5+63 THRU 11+19	494'	494
UT4	SP & BE	11+19 THRU 17+65	646'	129
UT5	SP & BE	0+00 THRU 40+86	4,043'	809
UT6	ENHANCEMENT I	0+62 THRU 6+00	538'	359
UT7	SP & BE	0+44 THRU 32+27	3,183'	637
UT8	ENHANCEMENT I	0+75 THRU 9+00	765'	510
UT8	SP & BE	9+00 THRU 12+13	313'	63
UT9	SP & BE	0+64 THRU 11+71	1,107'	221
UT10	SP & BE	3+37 THRU 11+05	768'	154
MUDDY CREEK	SP & BE	0+35 THRU 92+49	9,073'	1815
		TOTAL	26,945'	10,180

0 400' 800'
HORIZONTAL SCALE

SEAL

SEAL
11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON
James R. Watson

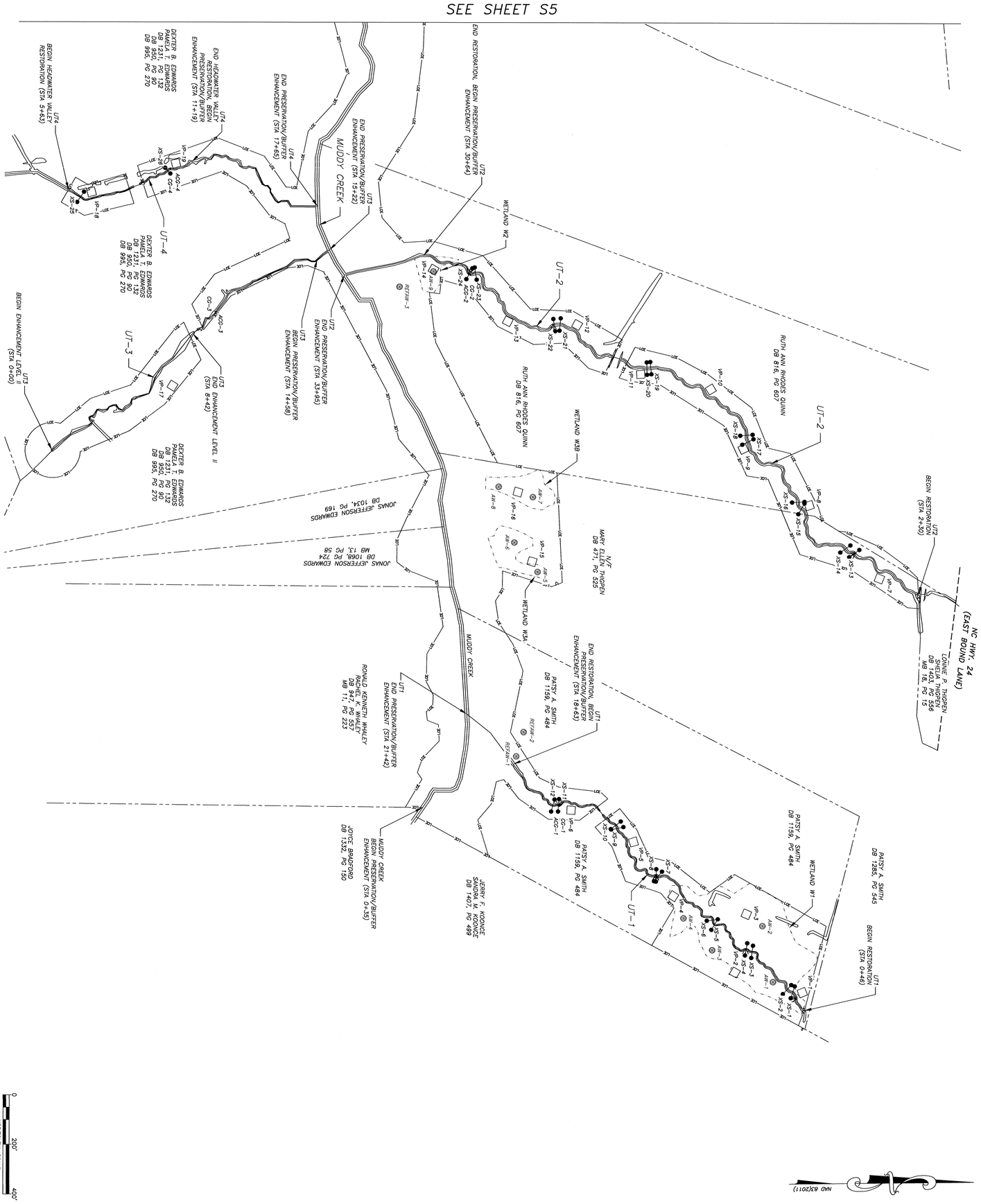
STREAM BASELINE OVERVIEW

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 400'	DEPARTMENT
DRAWN BY JRW / DATE STARTED 8-17-15	SHEET No. 3 OF 20
APPROVED JRW	DRAWING NO. S3
DRAWING NAME BEST ASB	
PROJECT NO. 20120072	



RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE: 1" = 200'
DRAWN BY: JRW
DATE STARTED: 8-17-15
APPROVED: JRW
SHEET No.: 4 OF 20
DRAWING NO.: S4
DRAWING NAME: BEST ASB
PROJECT NO.: 20120072
DEPARTMENT:

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
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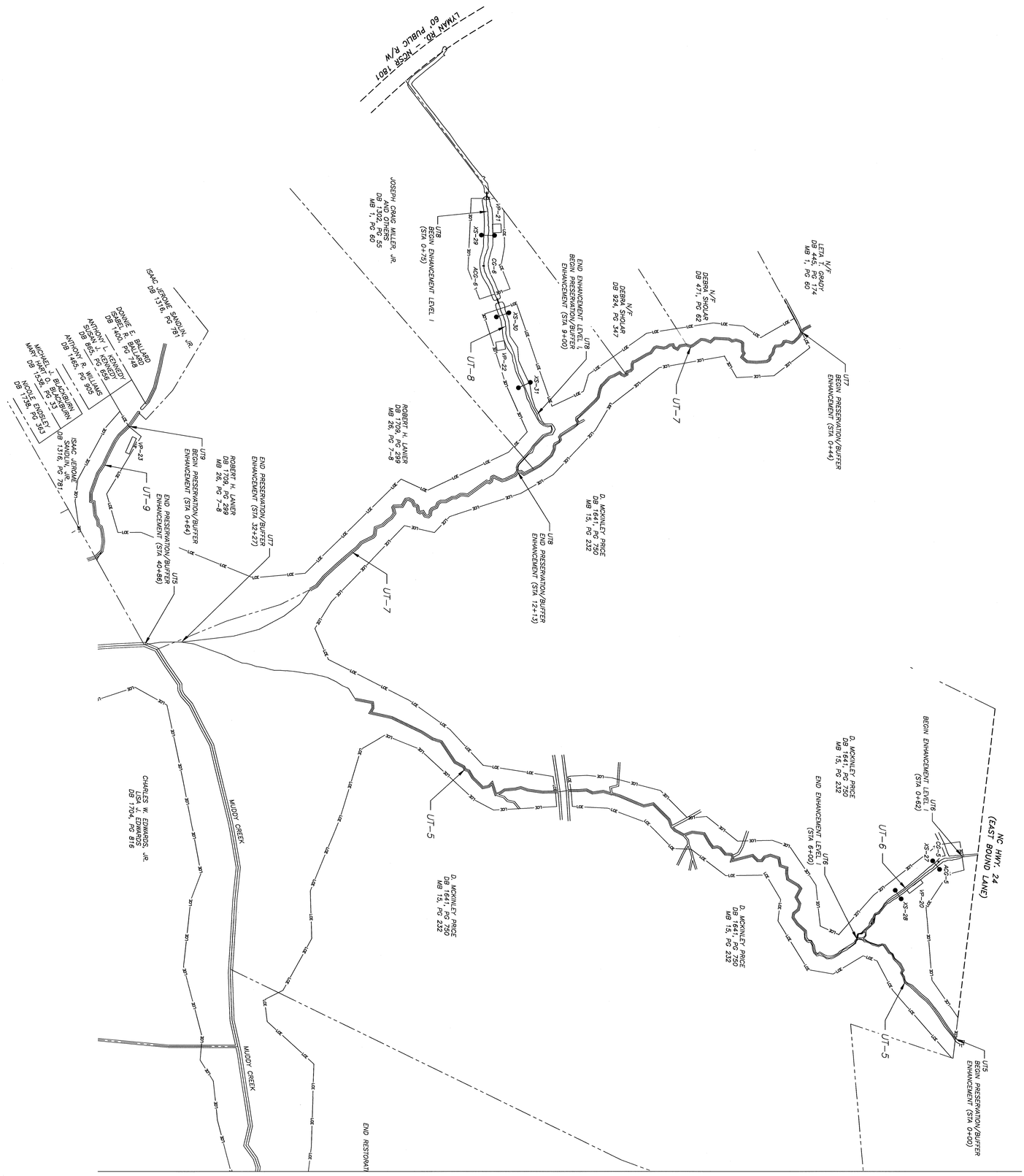
STREAM MONITORING OVERVIEW SHEET 1

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

SEAL
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR L-4712 JAMES R. WARD



RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE: 1" = 200'
DRAWN BY: JRW
APPROVED: JRW
DATE STARTED: 8-17-15
SHEET No. 5 OF 20
DRAWING NO. S5
DRAWING NAME: BEST ASB
PROJECT NO. 20120072
DEPARTMENT

MATRIX EAST, PLLC

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KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
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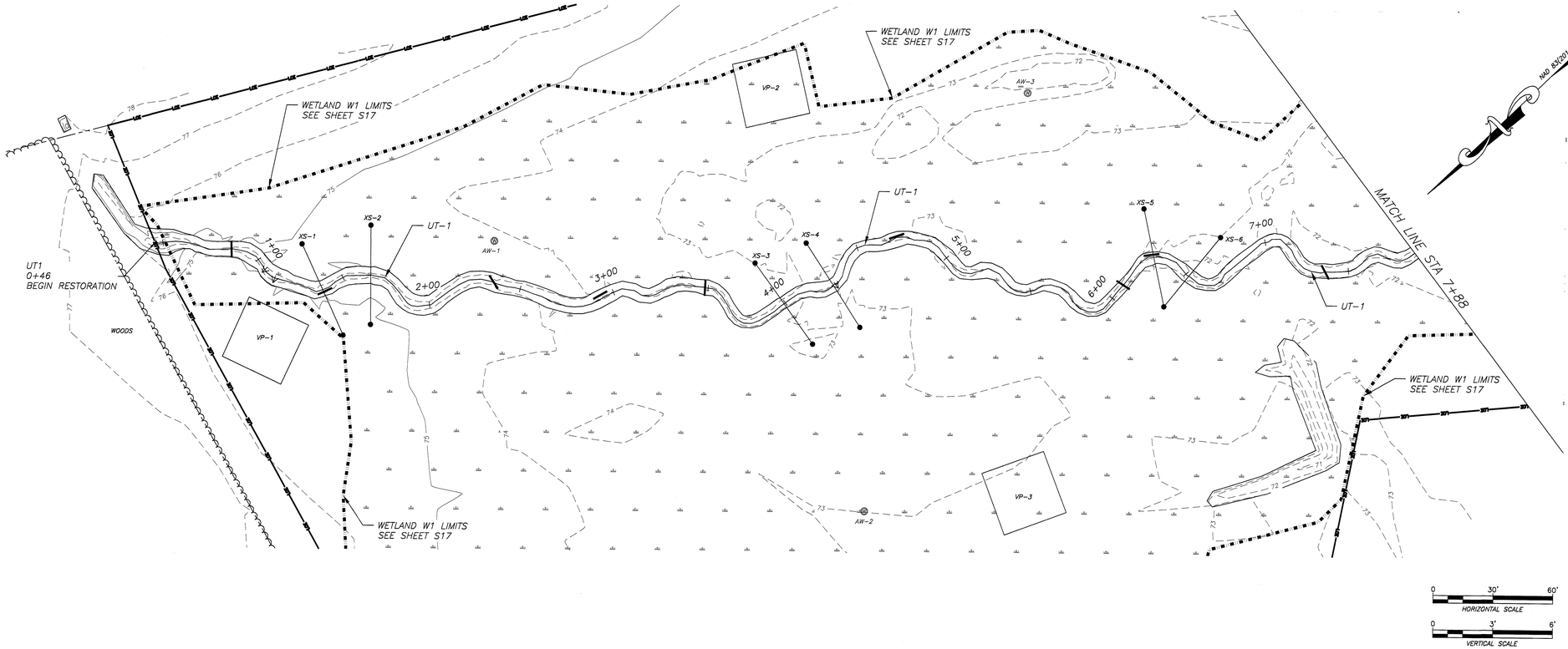
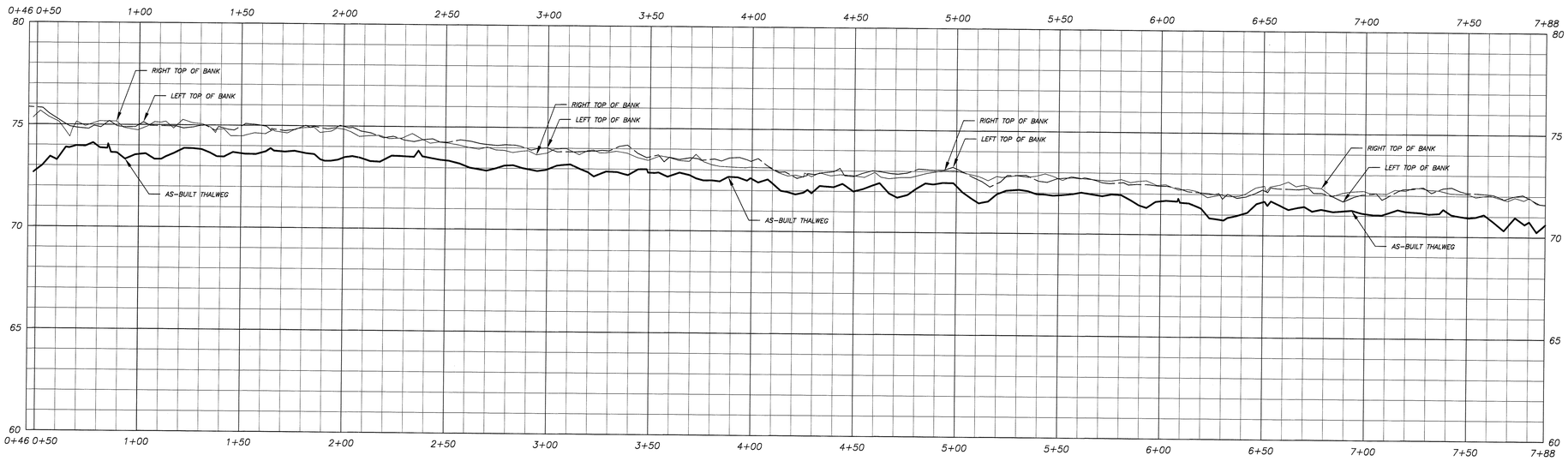
STREAM MONITORING OVERVIEW SHEET 2

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

SEAL
11/9/15
NORTH CAROLINA PROFESSIONAL SURVEYOR L-4712 SEAL





SEAL

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11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON
James R. Watson

STREAM BASELINE AS-BUILT
UT-1 PLAN & PROFILE (0+46 - 7+88)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

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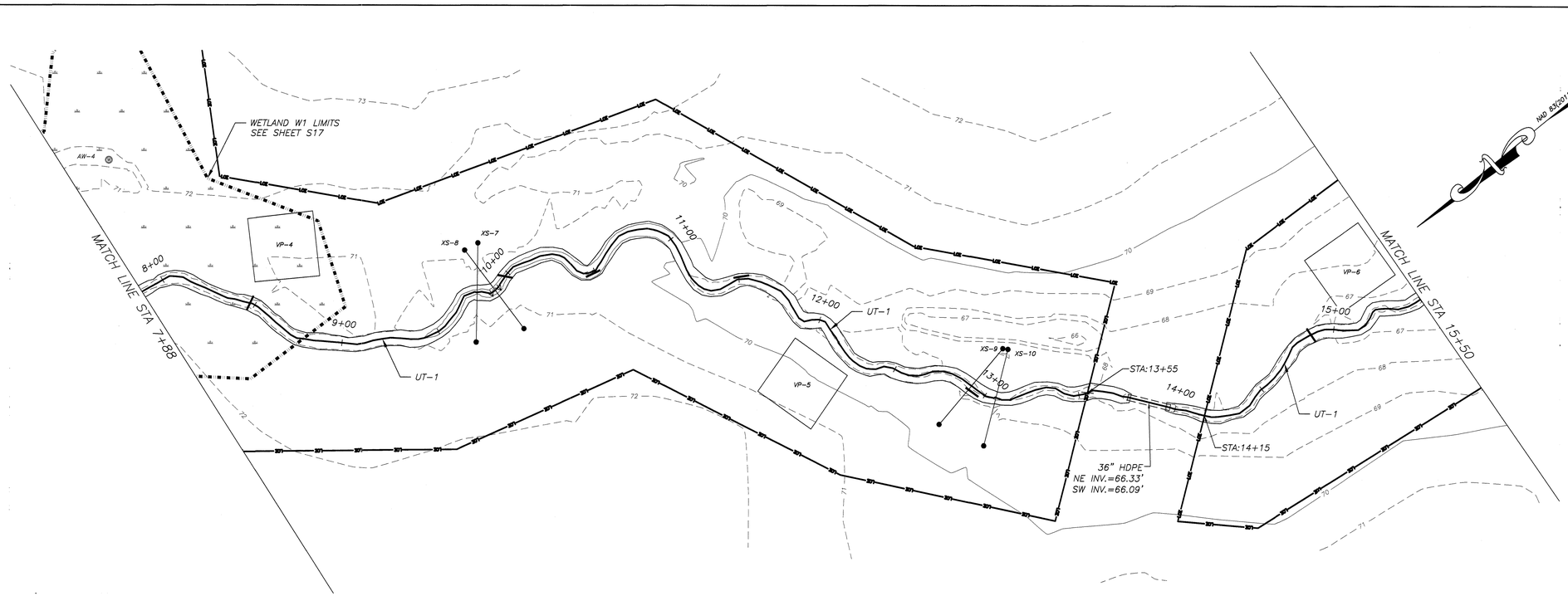
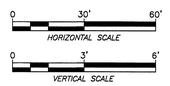
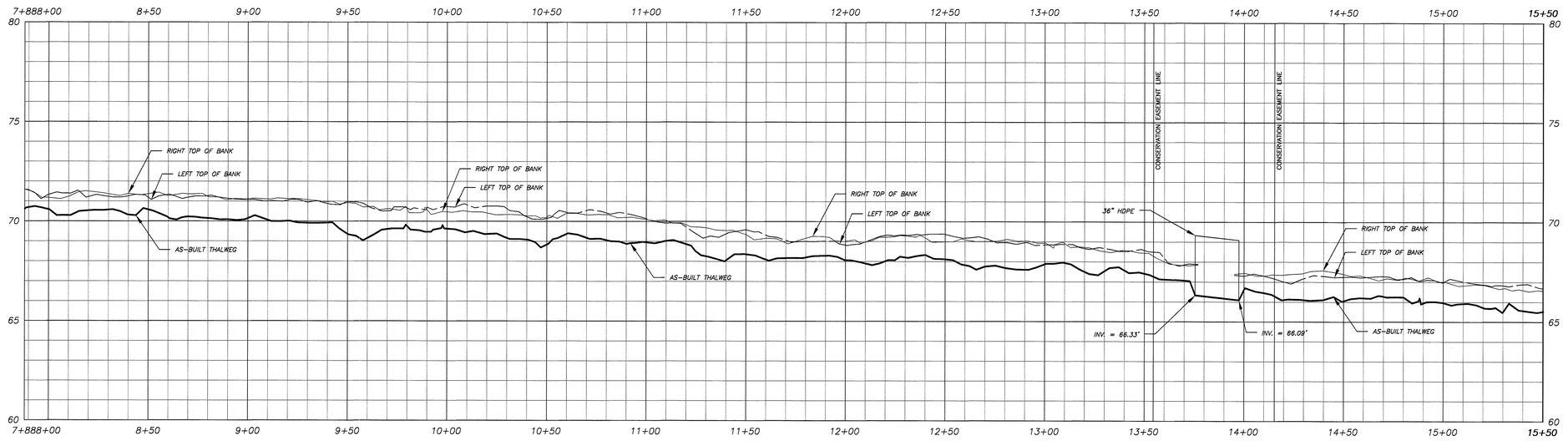
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'		DEPARTMENT	
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 6 OF 20	
APPROVED JRW		DRAWING NO. **S6**	
DRAWING NAME BEST ASB			
PROJECT NO. 20120072			







SEAL

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11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON
James R. Watson

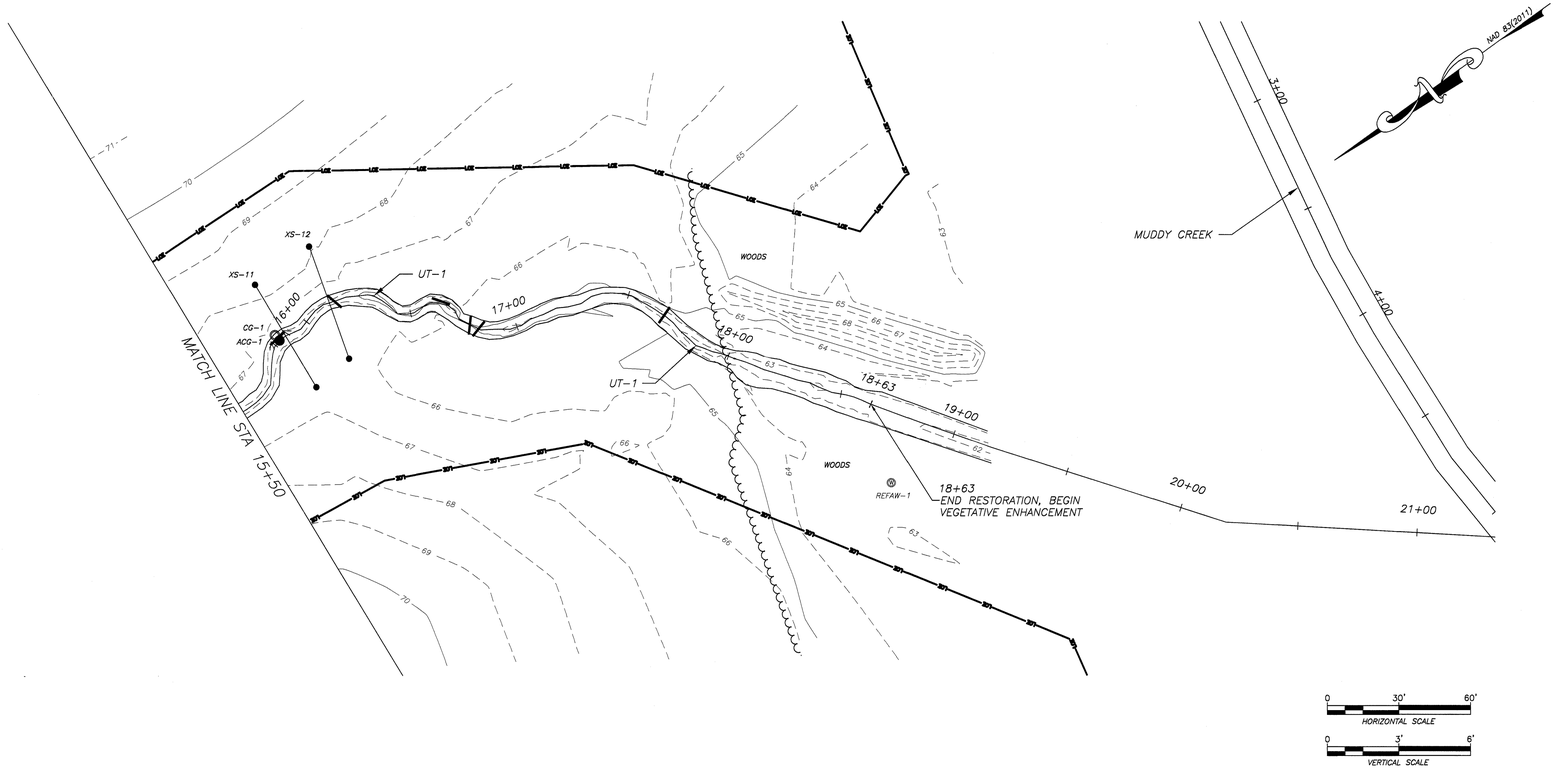
STREAM BASELINE AS-BUILT
UT-1 PLAN & PROFILE (7+88 - 15+50)

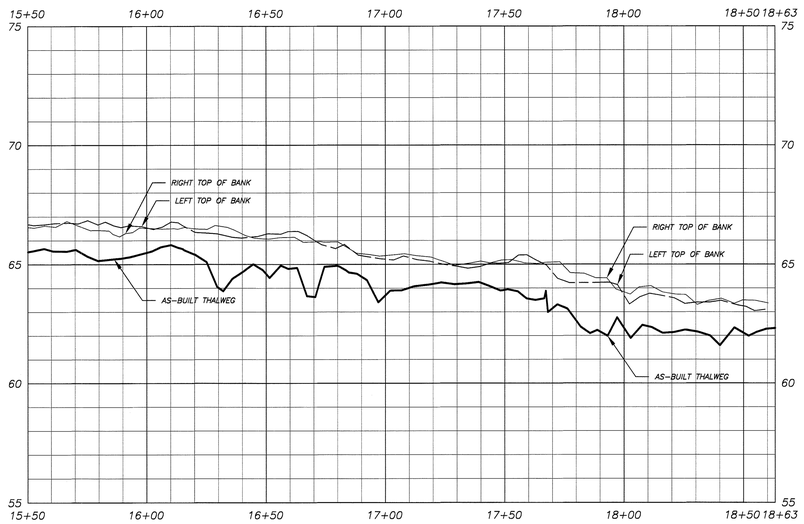
BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'		DEPARTMENT	
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 7 OF 20	
APPROVED JRW		DRAWING NO. **S7**	
DRAWING NAME BEST ASB			
PROJECT NO. 20120072			





SEAL

SEAL

11/16/15
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR
SEAL L-4712
JAMES R. WATSON

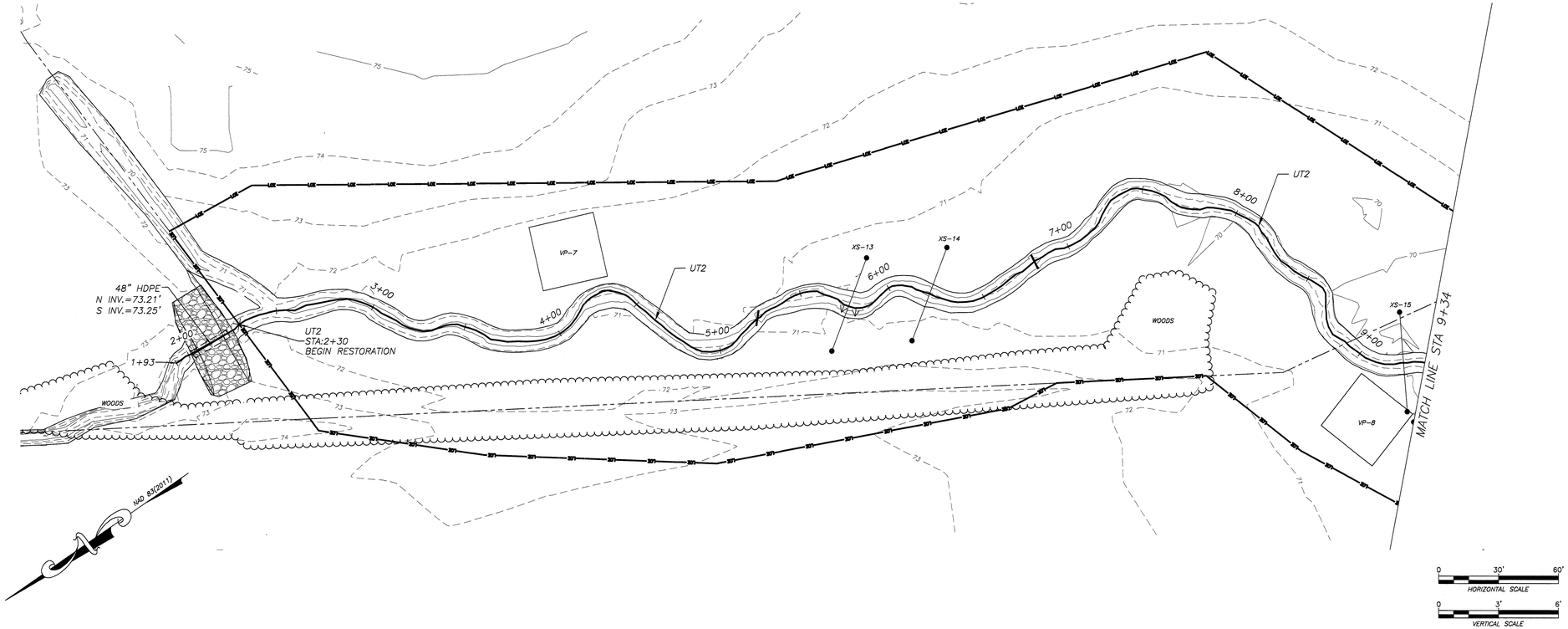
BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

STREAM BASELINE AS-BUILT
UT-1 PLAN & PROFILE (15+50 - 18+63)

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

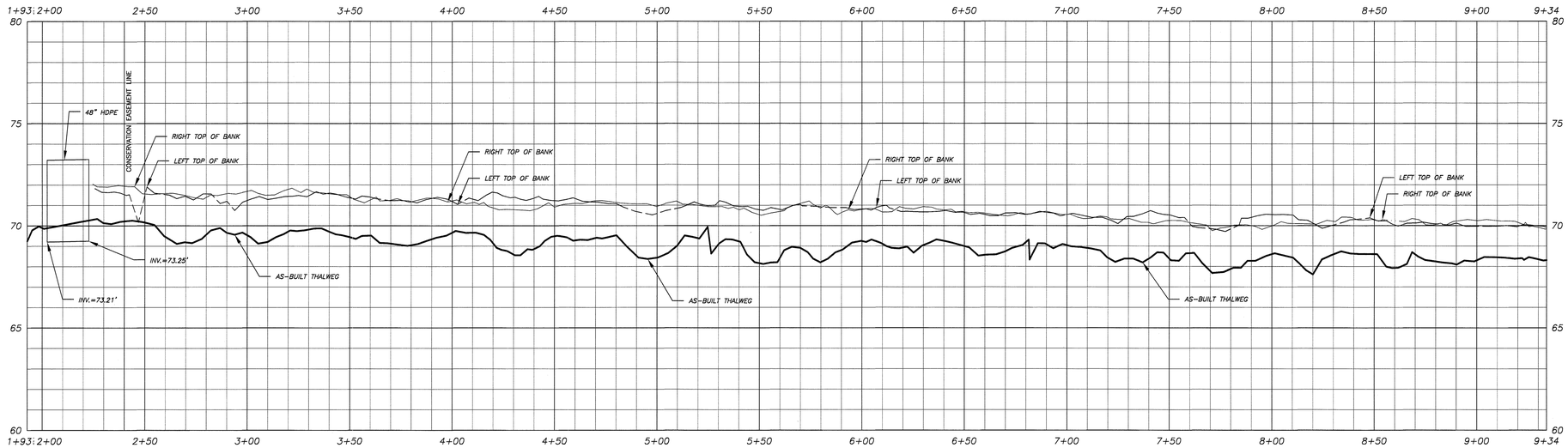
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'	DEPARTMENT
DRAWN BY JRW / DATE STARTED 8-17-15	SHEET No. 8 OF 20
APPROVED JRW	DRAWING NO. **S8**
DRAWING NAME BEST ASB	
PROJECT NO. 20120072	



0 30' 60'
HORIZONTAL SCALE

0 3' 6'
VERTICAL SCALE



SEAL

SEAL
11/16/15
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4712 JAMES R. WATSON
James R. Watson

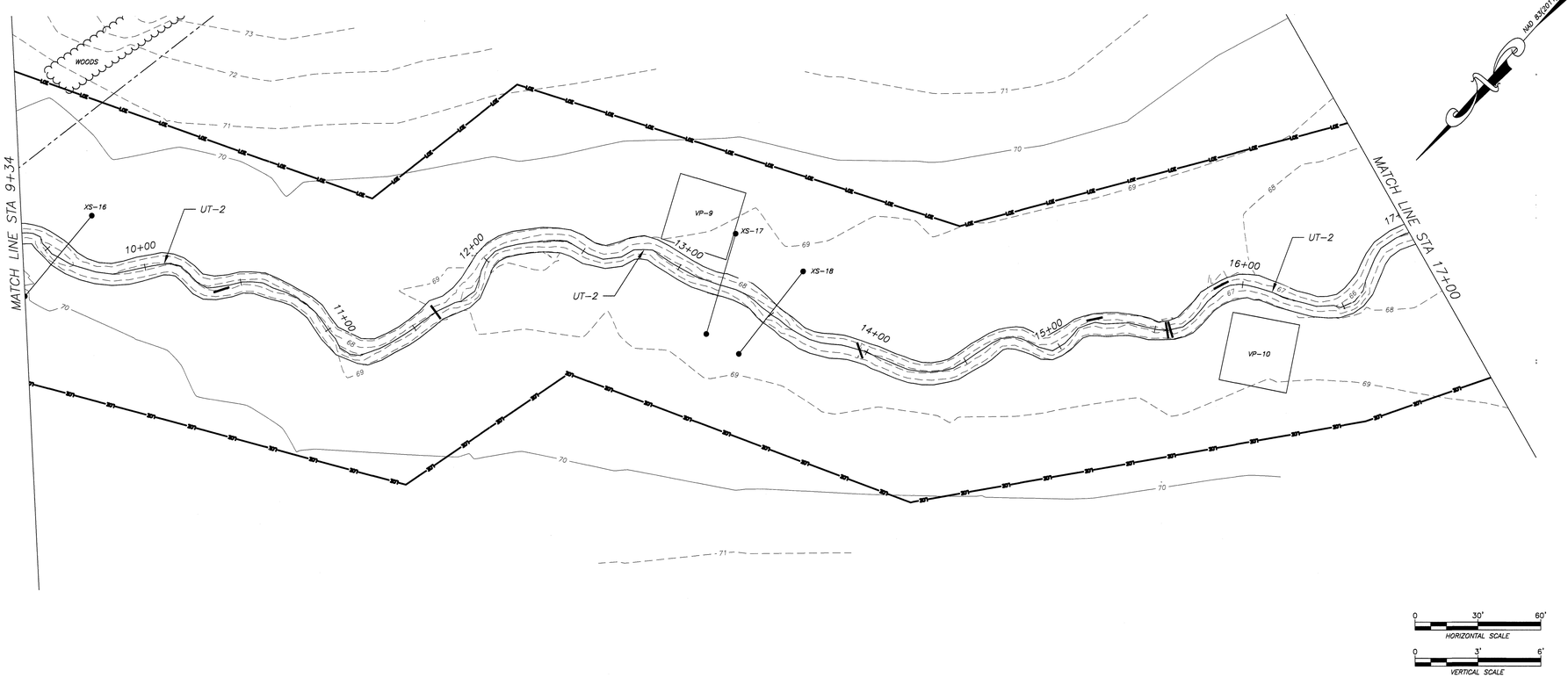
STREAM BASELINE AS-BUILT
UT-2 PLAN & PROFILE (1+93 - 9+34)

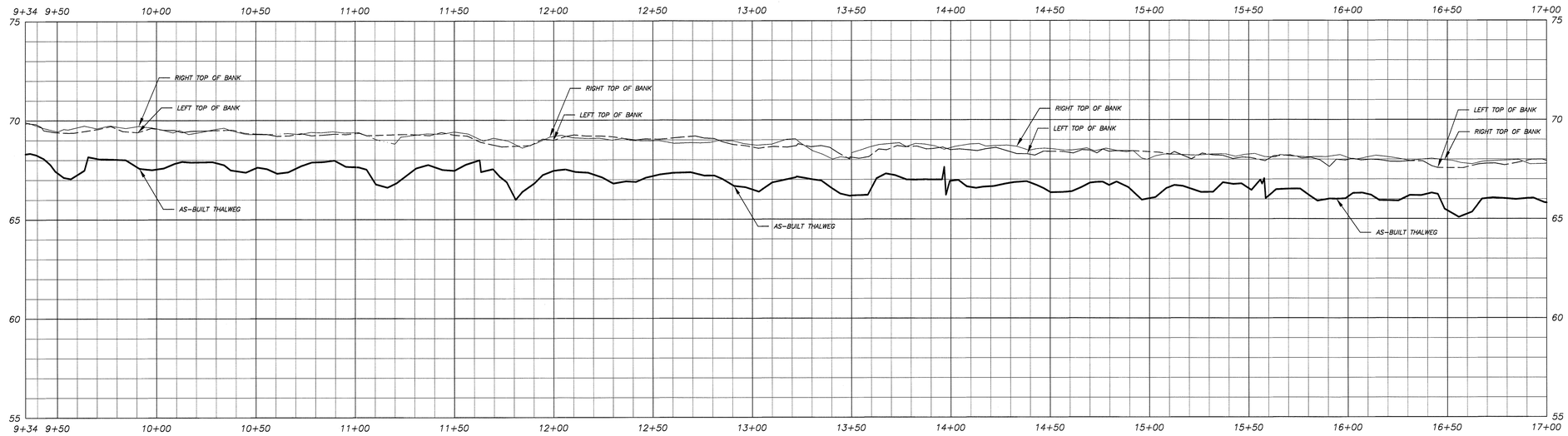
BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE: 1" = 30'		DEPARTMENT
DRAWN BY: JRW	DATE STARTED: 8-17-15	SHEET No.: 9 OF 20
APPROVED: JRW		DRAWING NO.: S9
DRAWING NAME: BEST ASB		
PROJECT NO.: 20120072		





SEAL

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11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON
James R. Watson

STREAM BASELINE AS-BUILT
UT-2 PLAN & PROFILE (9+34 - 17+00)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
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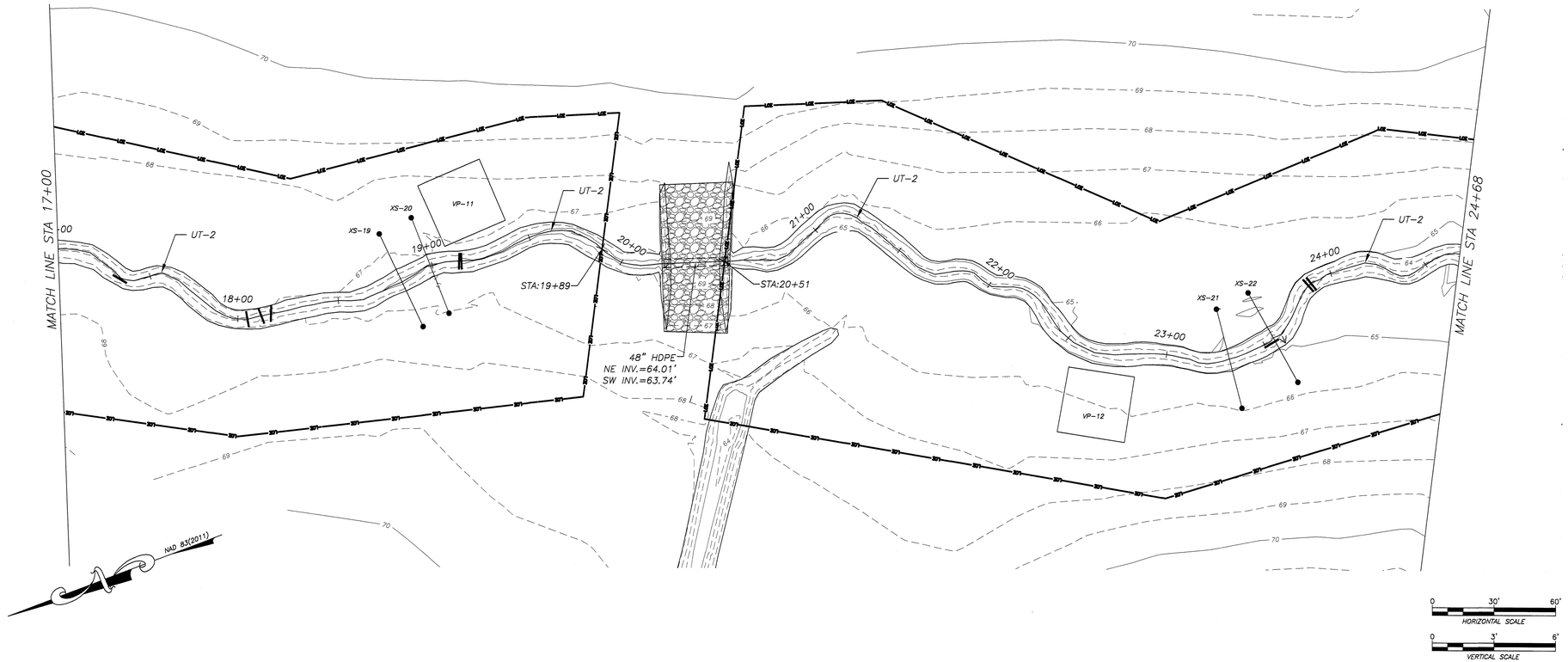
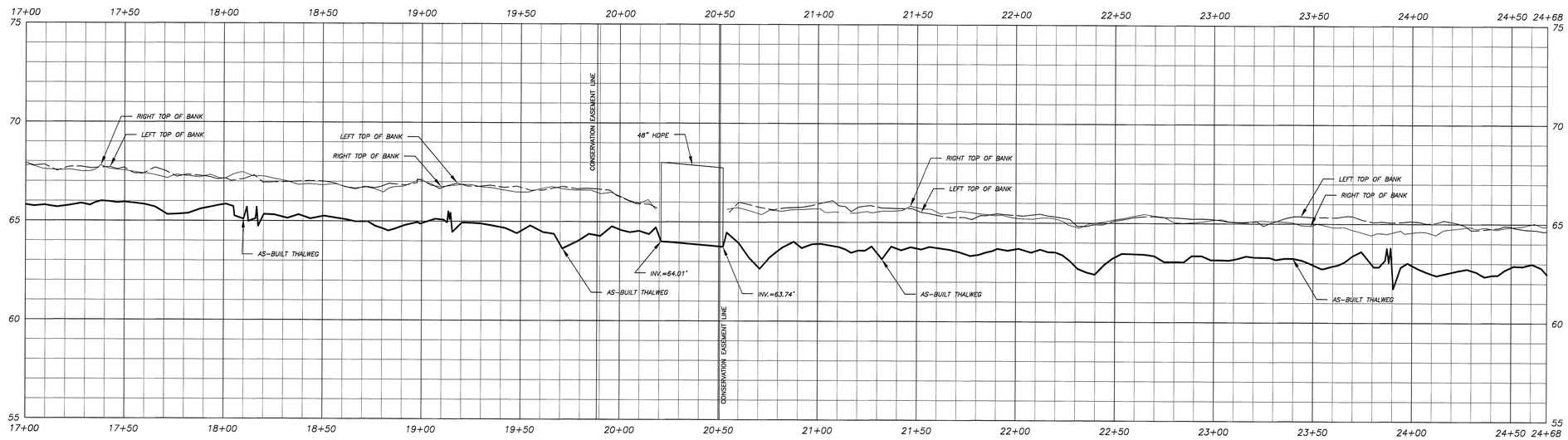
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE: 1" = 30'	DEPARTMENT:
DRAWN BY: JRW	DATE STARTED: 8-17-15
SHEET No.: 10 OF 20	
APPROVED: JRW	DRAWING NO.: **S10**
DRAWING NAME: BEST ASB	
PROJECT NO.: 20120072	





SEAL

SEAL
11/10/15
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4712 JAMES R. WATSON
James R. Watson

STREAM BASELINE AS-BUILT
UT-2 PLAN & PROFILE (17+00 - 24+68)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
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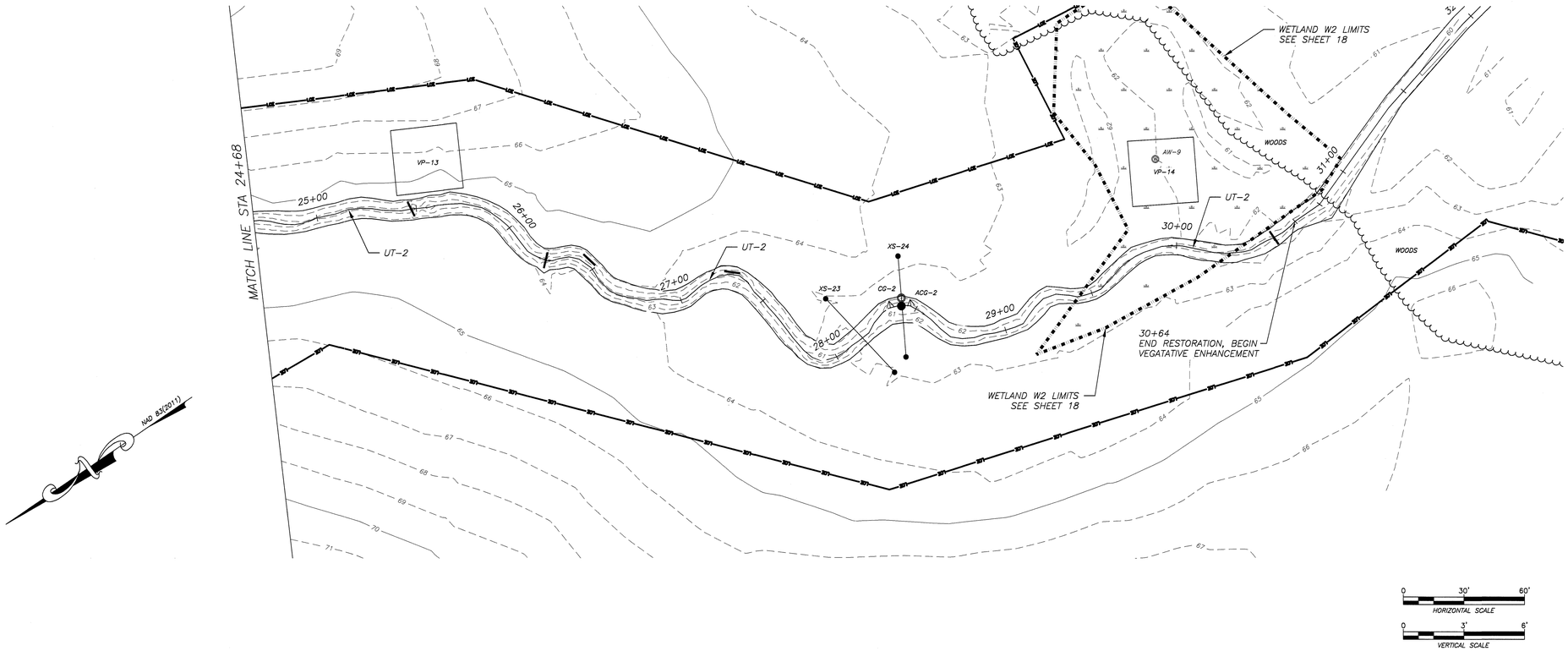
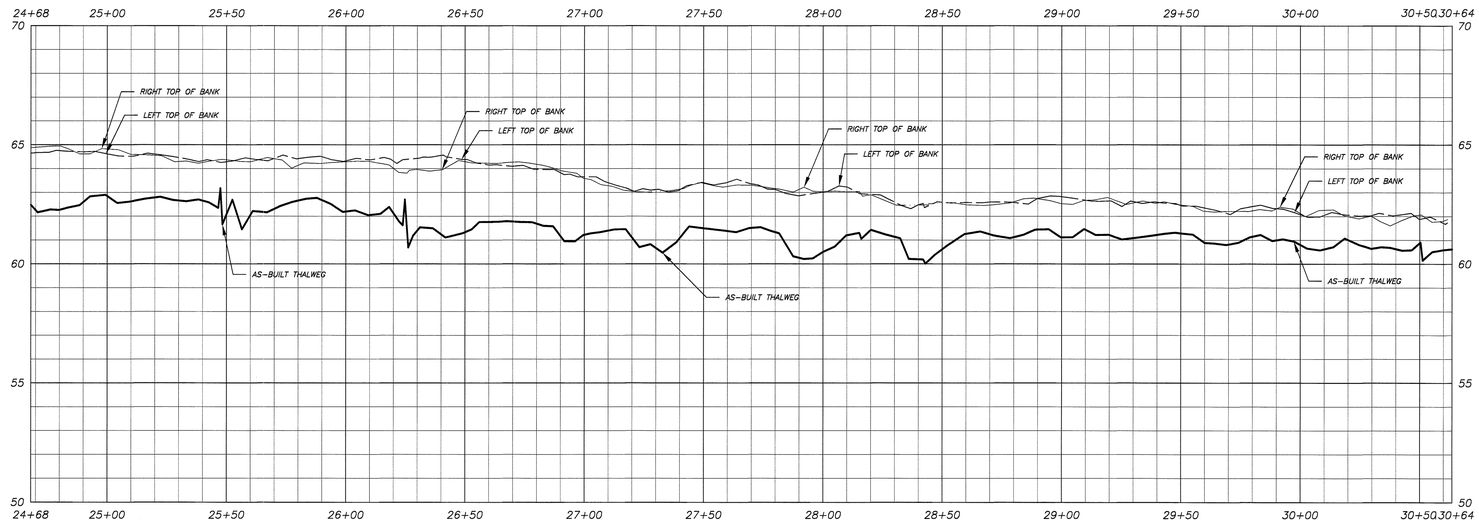
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'		DEPARTMENT
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 11 OF 20
APPROVED JRW		DRAWING NO. **S11**
DRAWING NAME BEST ASB		
PROJECT NO. 20120072		





SEAL

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11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

STREAM BASELINE AS-BUILT
UT-2 PLAN & PROFILE (24+68 - 30+64)

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
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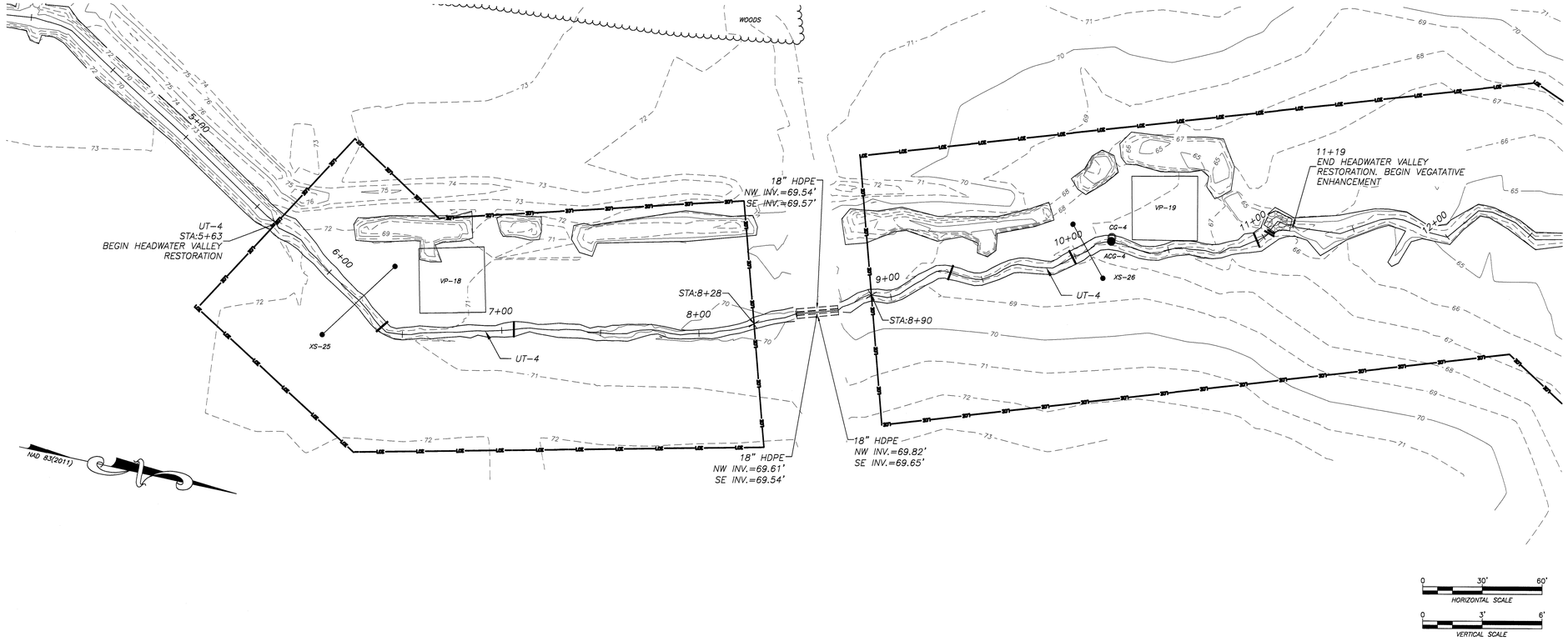
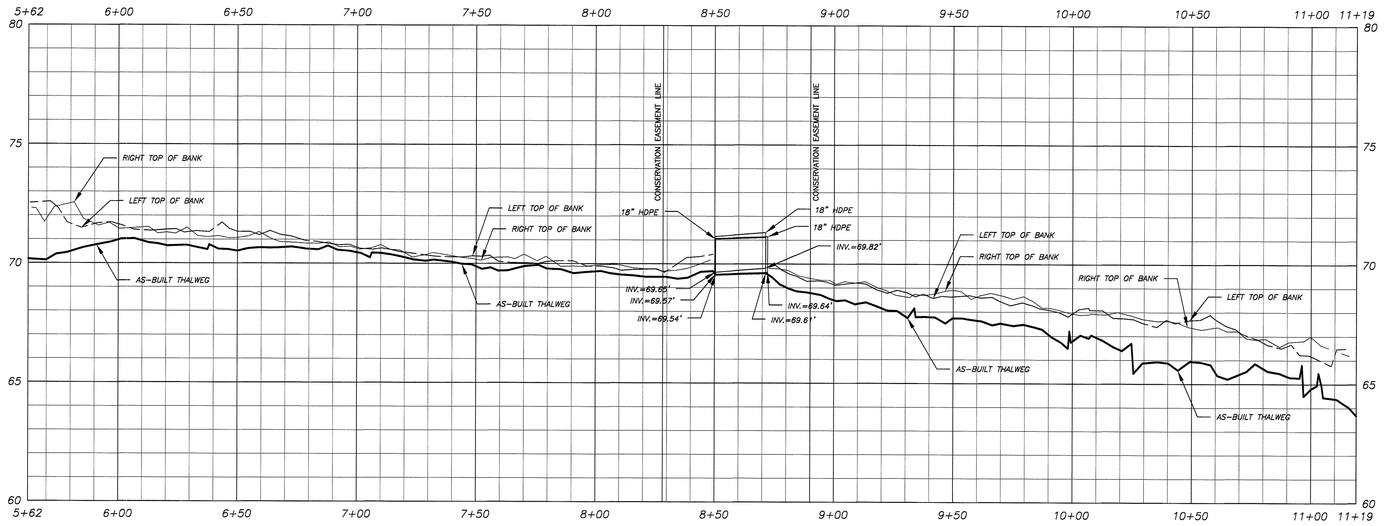
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'		DEPARTMENT	
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 12 OF 20	
APPROVED JRW		DRAWING NO. **S12**	
DRAWING NAME BEST ASB			
PROJECT NO. 20120072			





SEAL

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11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

STREAM BASELINE AS-BUILT
UT-4 PLAN & PROFILE (5+63 - 11+19)

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
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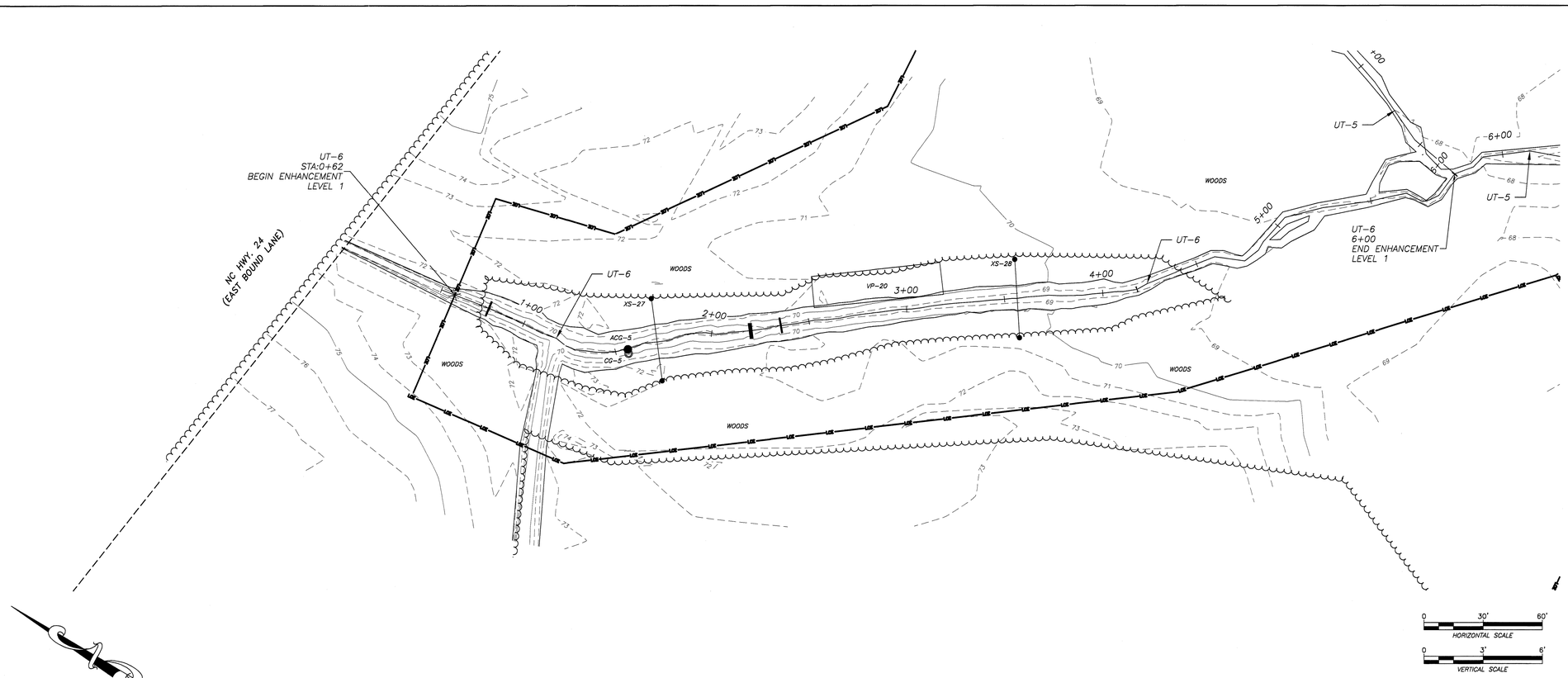
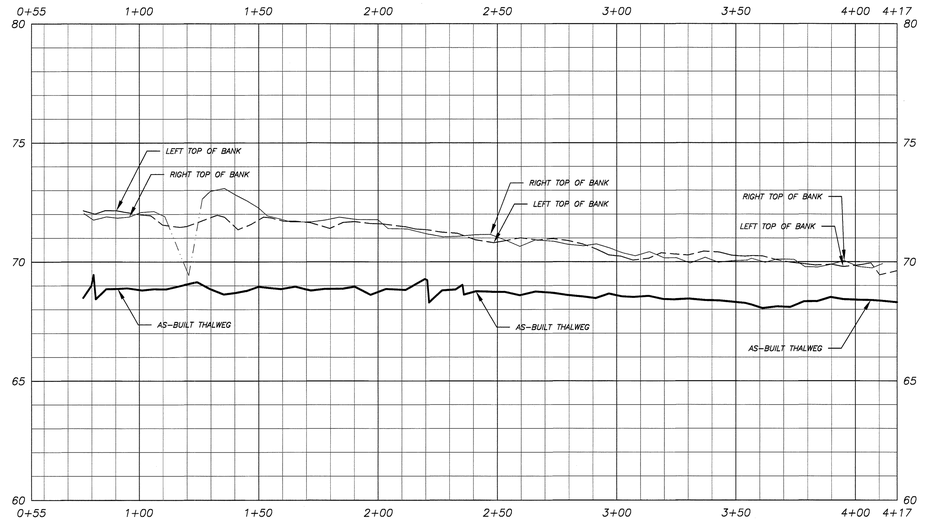
FIRM LIC. # P–0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE: 1" = 30'	DEPARTMENT:
DRAWN BY: JRW	DATE STARTED: 8–17–15
APPROVED: JRW	SHEET No.: 13 OF 20
DRAWING NAME: BEST ASB	DRAWING NO.: **S13**
PROJECT NO.: 20120072	





SEAL

SEAL
4/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON

STREAM BASELINE AS-BUILT
UT-6 PLAN & PROFILE (0+55 - 4+17)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

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906 N. QUEEN ST., SUITE A
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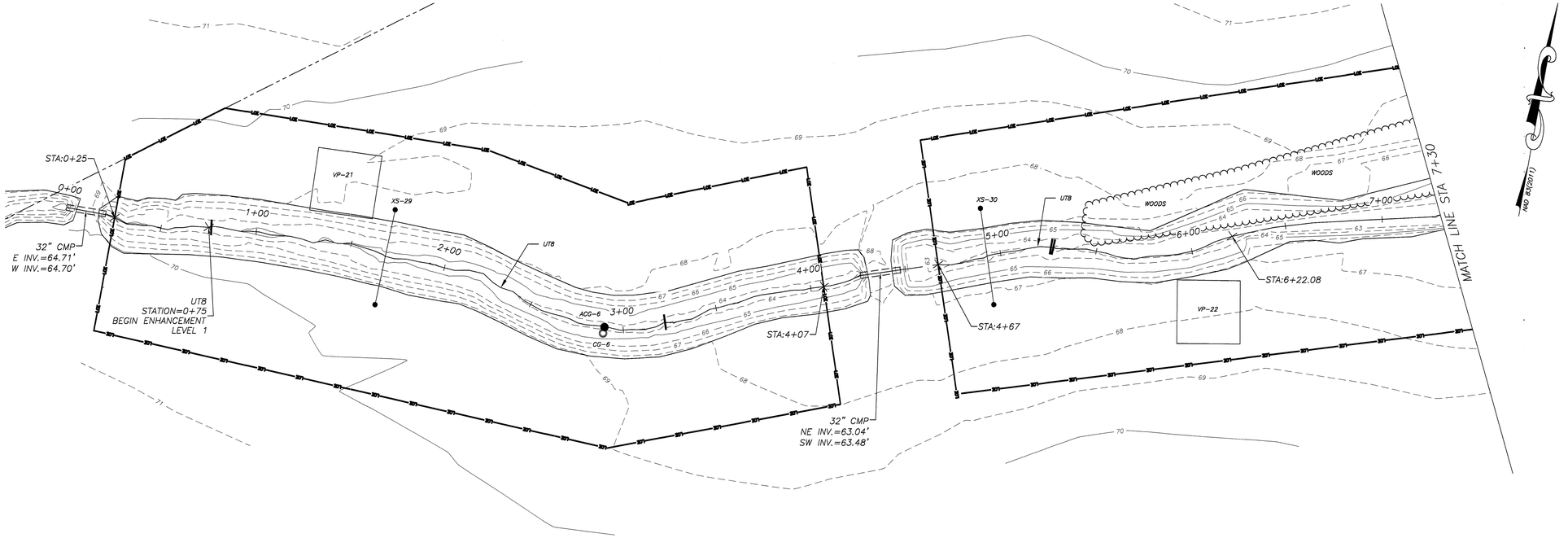
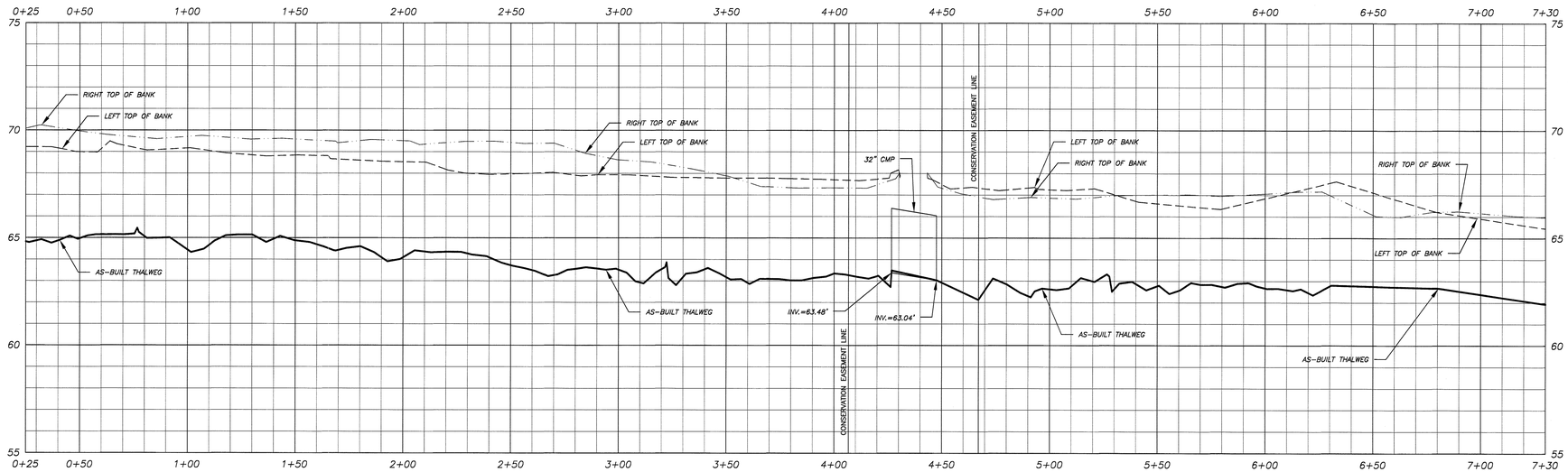
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'	DEPARTMENT
DRAWN BY JRW	DATE STARTED 8-17-15
	SHEET No. 14 OF 20
APPROVED JRW	DRAWING NO. S14
DRAWING NAME BEST ASB	
PROJECT NO. 20120072	



0 30' 60'
HORIZONTAL SCALE

0 3' 6'
VERTICAL SCALE



SEAL

SEAL
11/16/15
NORTH CAROLINA
PROFESSIONAL
SEAL
L-4712
LAND SURVEYOR
JAMES R. WATSON
James R. Watson

STREAM BASELINE AS-BUILT
UT-8 PLAN & PROFILE (0+25 - 7+30)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

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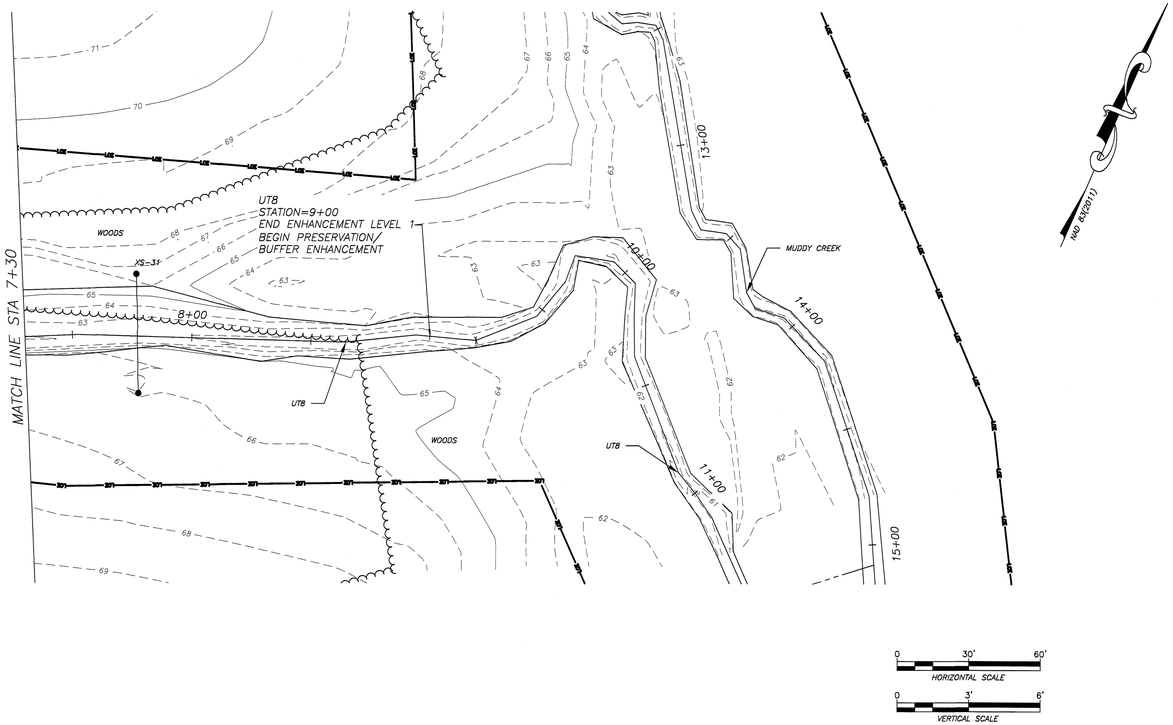
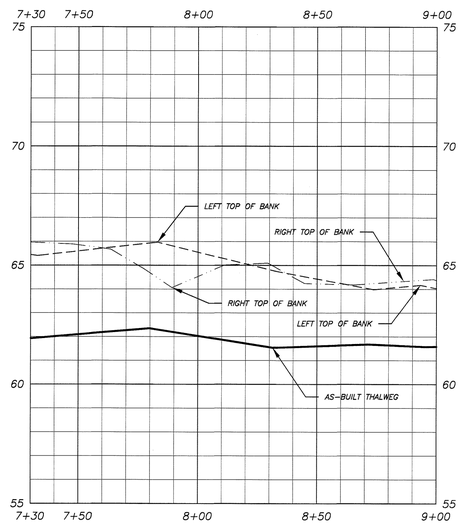
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'	DEPARTMENT
DRAWN BY JRW	DATE STARTED 8-17-15
APPROVED JRW	SHEET No. 15 OF 20
DRAWING NAME BEST ASB	DRAWING NO. S15
PROJECT NO. 20120072	





SEAL

SEAL
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4712 JAMES R. WATSON
James R. Watson

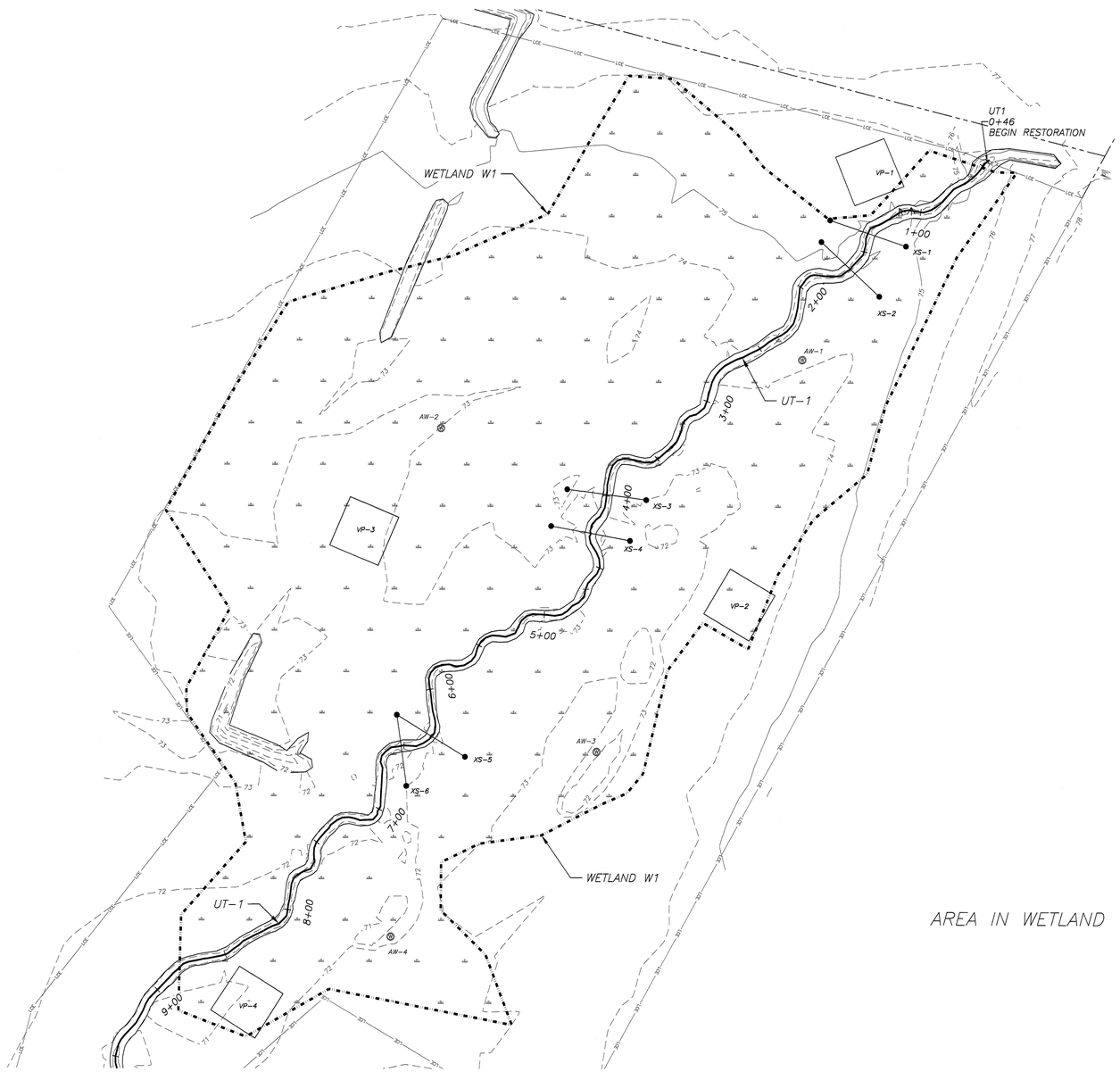
STREAM BASELINE AS-BUILT
UT-8 PLAN & PROFILE (7+30 - 9+00)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 30'	DEPARTMENT
DRAWN BY JRW / DATE STARTED 8-17-15	SHEET No. 16 OF 20
APPROVED JRW	DRAWING NO. S16
DRAWING NAME BEST ASB	
PROJECT NO. 20120072	



MAG (-8.00°)

AREA IN WETLAND W1=3.77 AC.±

0 40' 80'
HORIZONTAL SCALE

SEAL

SEAL
11/6/15
NORTH CAROLINA PROFESSIONAL SEAL L-4712 LAND SURVEYOR JAMES R. WATSON
James R. Watson

WETLAND W1 DETAIL

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

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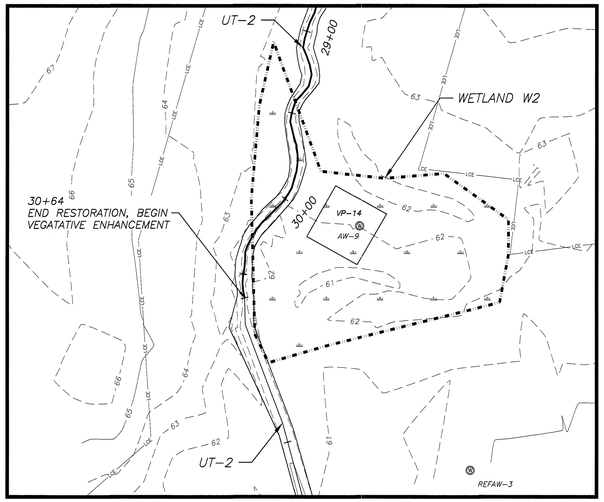
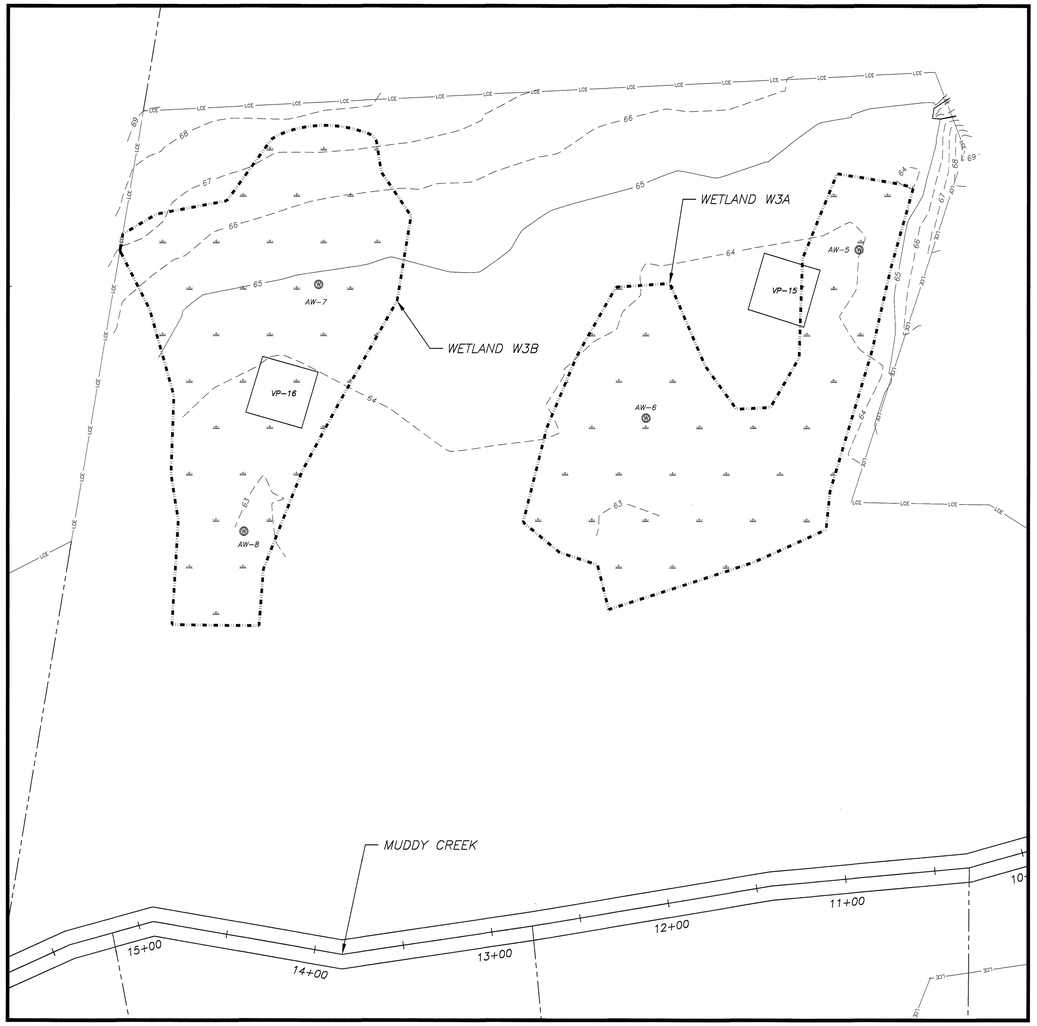
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 40'		DEPARTMENT	
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 17 OF 20	
APPROVED JRW		DRAWING NO. S17	
DRAWING NAME BEST ASB			
PROJECT NO. 20120072			





AREA IN:
WETLAND W2=0.31 AC.±
WETLAND W3A=0.58 AC.±
WETLAND W3B=0.59 AC.±

0 40' 80'
HORIZONTAL SCALE

SEAL

SEAL
11/16/15
NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4712 JAMES R. WATSON
James R. Watson

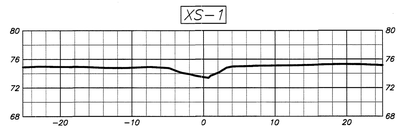
BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

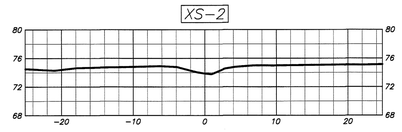
WETLAND W2, W3A, & W3B DETAIL

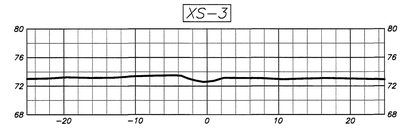
MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
FIRM LIC. # P-0221
EMAIL: surveyor@matrixeast.net

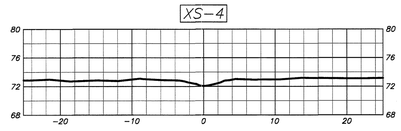
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

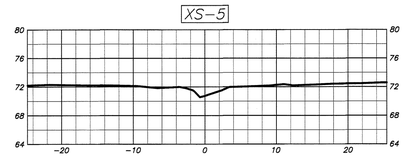
SCALE 1" = 40'		DEPARTMENT
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 18 OF 20
APPROVED JRW		DRAWING NO. **S18**
DRAWING NAME BEST ASB		
PROJECT NO. 20120072		

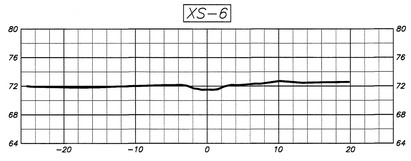


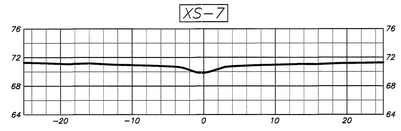


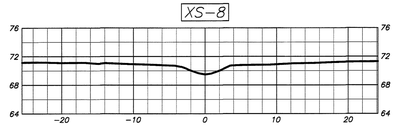


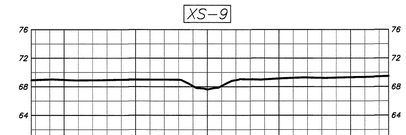


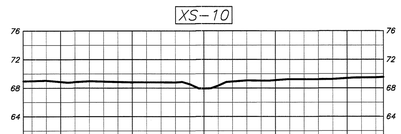


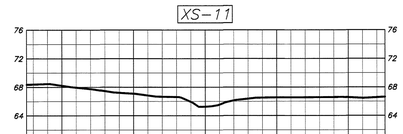


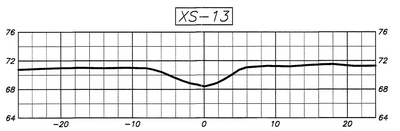


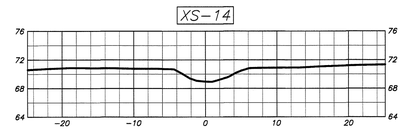


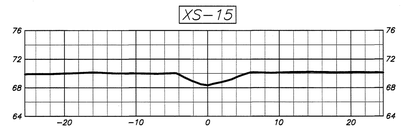


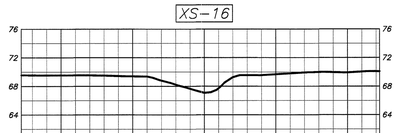


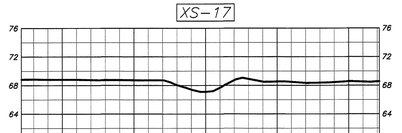


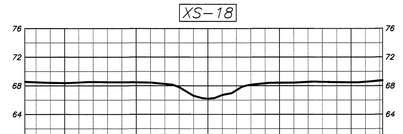


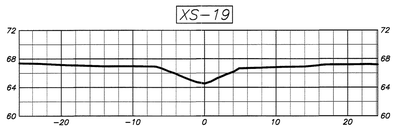


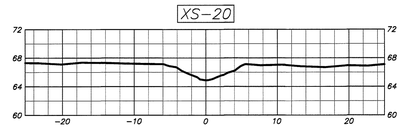


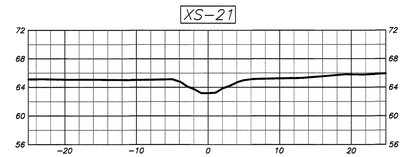












SEAL

SEAL

11/16/15

NORTH CAROLINA PROFESSIONAL SEAL L-4712 LAND SURVEYOR JAMES R. WATSON

James R. Watson

STREAM CROSS-SECTIONS (XS-1 THROUGH XS-21)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC

906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
TEL: 252-522-2500 FAX: 252-522-4747
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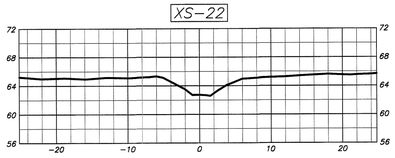
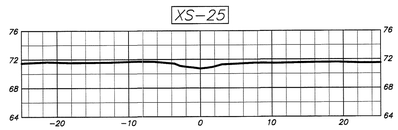
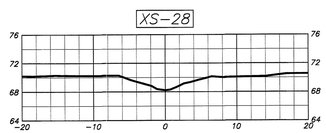
EMAIL: surveyor@matrixeast.net

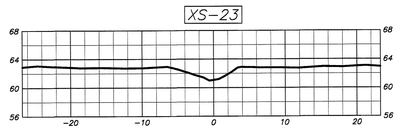
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

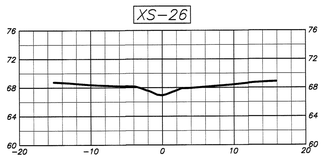
SCALE: 1" = 10'		DEPARTMENT:
DRAWN BY: JRW	DATE STARTED: 8-17-15	SHEET No.: 19 OF 20
APPROVED: JRW		DRAWING NO.: **S19**
DRAWING NAME: BEST ASB		
PROJECT NO.: 20120072		

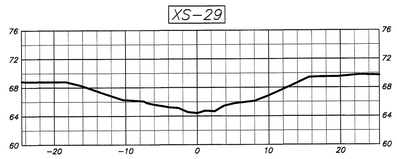


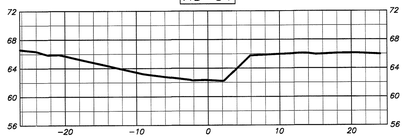


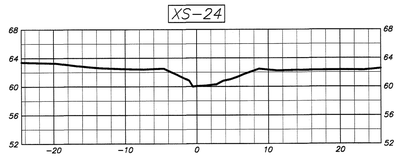


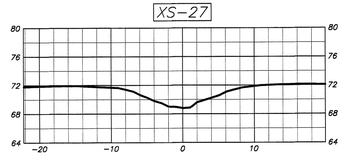


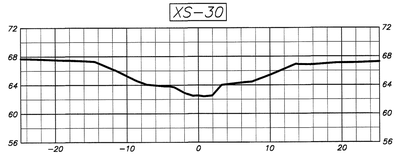


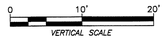


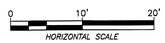












SEAL

SEAL

11/14/15

NORTH CAROLINA PROFESSIONAL LAND SURVEYOR SEAL L-4712 JAMES R. WATSON

James R. Watson

STREAM CROSS-SECTIONS (XS-22 THROUGH XS-31)

BEST STREAM & WETLAND RESTORATION PROJECT DUPLIN COUNTY, N.C.

MATRIX EAST, PLLC

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KINSTON, NC 28501
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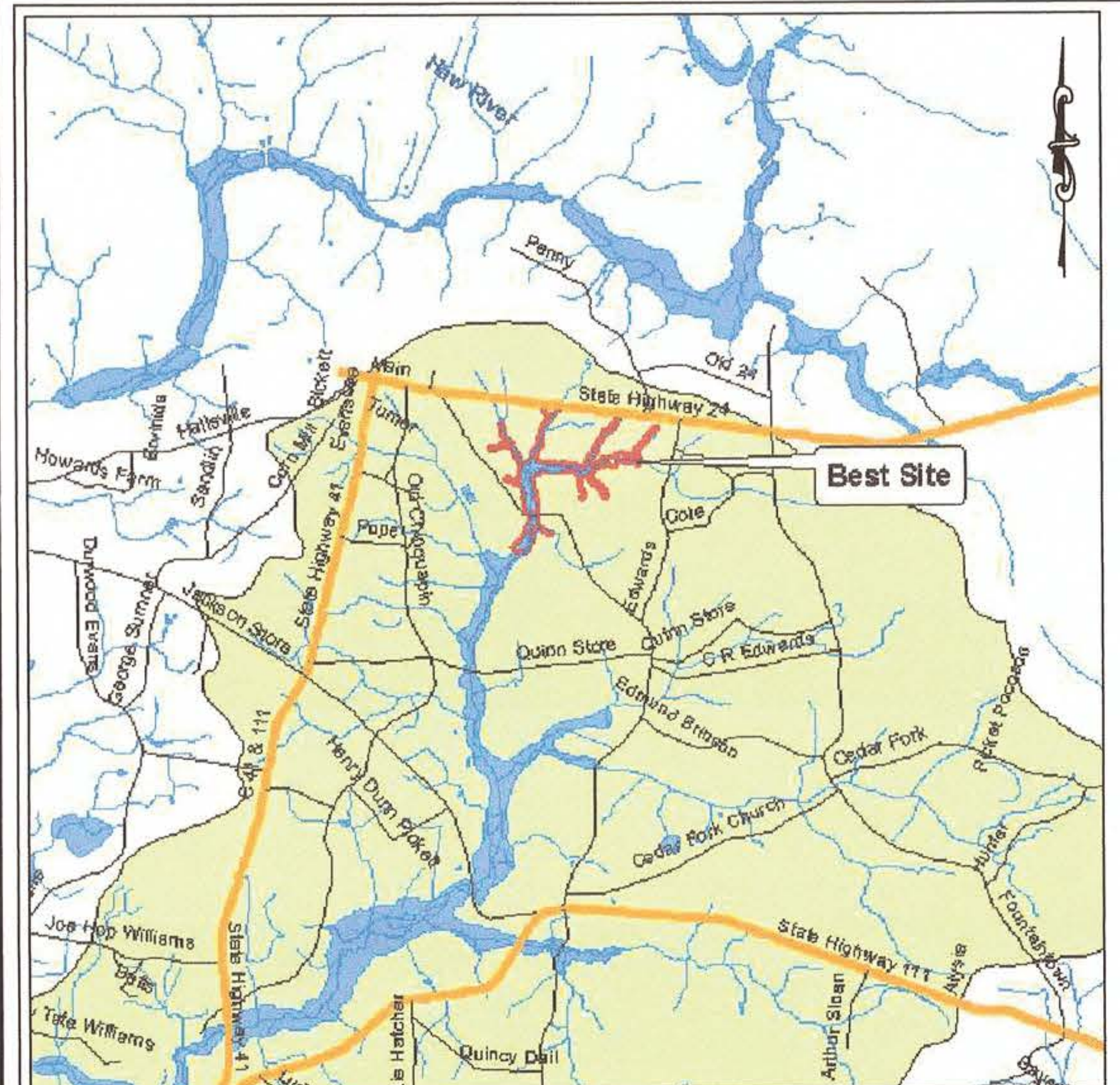
302 JEFFERSON ST., SUITE 110
RALEIGH, N.C. 27605

SCALE 1" = 10'		DEPARTMENT
DRAWN BY JRW	DATE STARTED 8-17-15	SHEET No. 20 OF 20
APPROVED JRW		DRAWING NO. **S20**
DRAWING NAME BEST ASB		
PROJECT NO. 20120072		



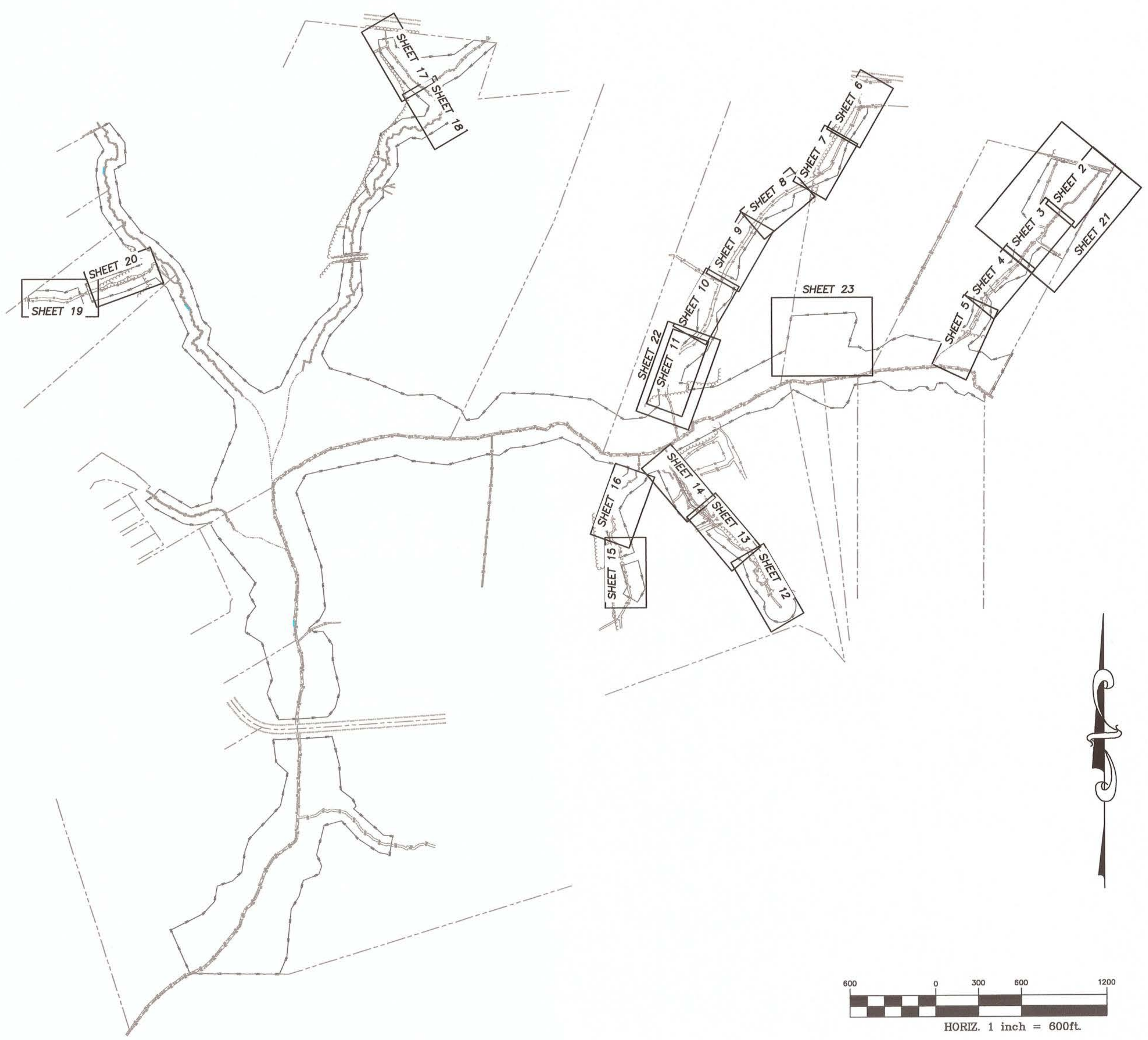
VICINITY MAP
NTS

BEST STREAM & WETLAND RESTORATION PROJECT

DUPLIN COUNTY, NORTH CAROLINA
CAPE FEAR RIVER BASIN CU 03030007
DECEMBER 2015
NC DMS PROJECT #: 95353

RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
302 JEFFERSON ST, SUITE 110
RALEIGH, NC 27605

Resource Environmental Solutions



Sheet List Table

Sheet Number	Sheet Title
1	COVER
2	REACH UT-1 PLAN & PROFILE
3	REACH UT-1 PLAN & PROFILE
4	REACH UT-1 PLAN & PROFILE
5	REACH UT-1 PLAN & PROFILE
6	REACH UT-2 PLAN & PROFILE
7	REACH UT-2 PLAN & PROFILE
8	REACH UT-2 PLAN & PROFILE
9	REACH UT-2 PLAN & PROFILE
10	REACH UT-2 PLAN & PROFILE
11	REACH UT-2 PLAN & PROFILE
12	REACH UT-3 PLAN & PROFILE
13	REACH UT-3 PLAN & PROFILE
14	REACH UT-3 PLAN & PROFILE
15	REACH UT-4 PLAN & PROFILE
16	REACH UT-4 PLAN & PROFILE
17	REACH UT-6 PLAN & PROFILE
18	REACH UT-6 PLAN & PROFILE
19	REACH UT-8 PLAN & PROFILE
20	REACH UT-8 PLAN & PROFILE
21	WETLAND 1
22	WETLAND 2
23	WETLAND 3

AS-BUILT SURVEY PREPARED BY:
MATRIX EAST, PLLC
906 N. QUEEN ST., SUITE A
KINSTON, NC 28501
(252)522-2500

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 12/10/15
PROFESSIONAL SEAL

- RECORD DRAWINGS -

WK DICKSON
community infrastructure consultants
720 CORPORATE CENTER DRIVE
RALEIGH, NC 27607
(t)919-782-0495
(f)919-782-9672
WWW.WKDICKSON.COM
LICENSE NO.

PRINCIPAL: SW
PROJ. MGR.: SS
CAD TECH: FM

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

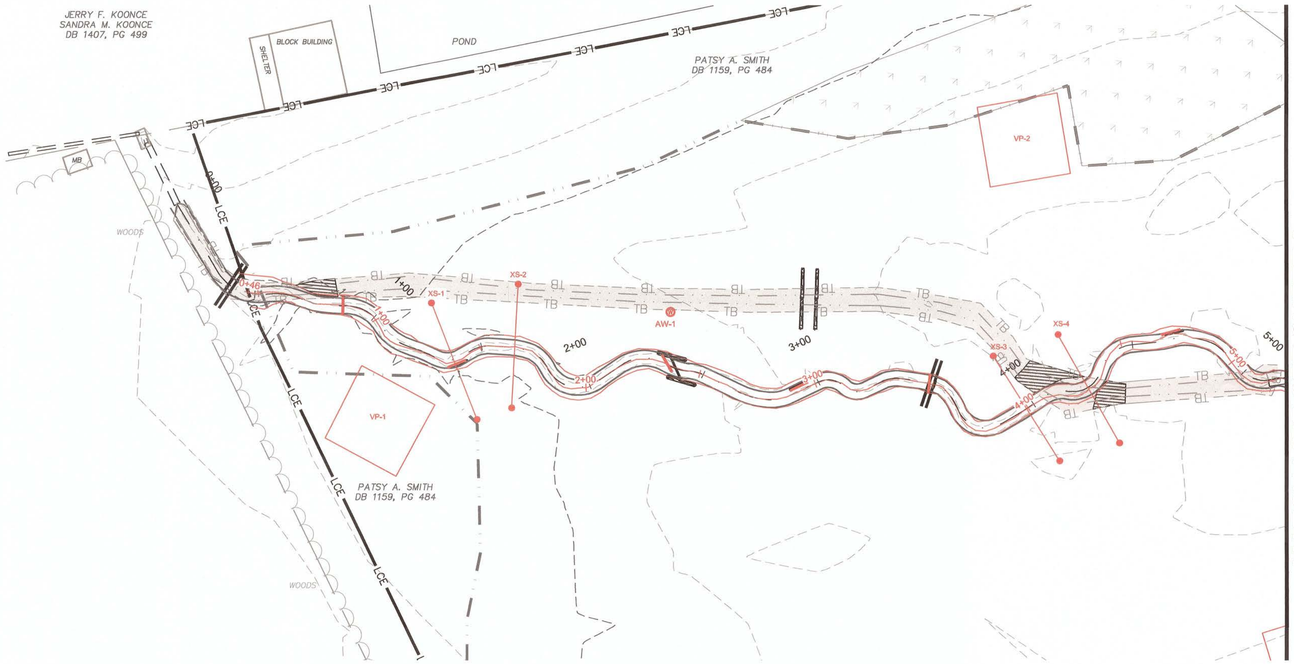
PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS

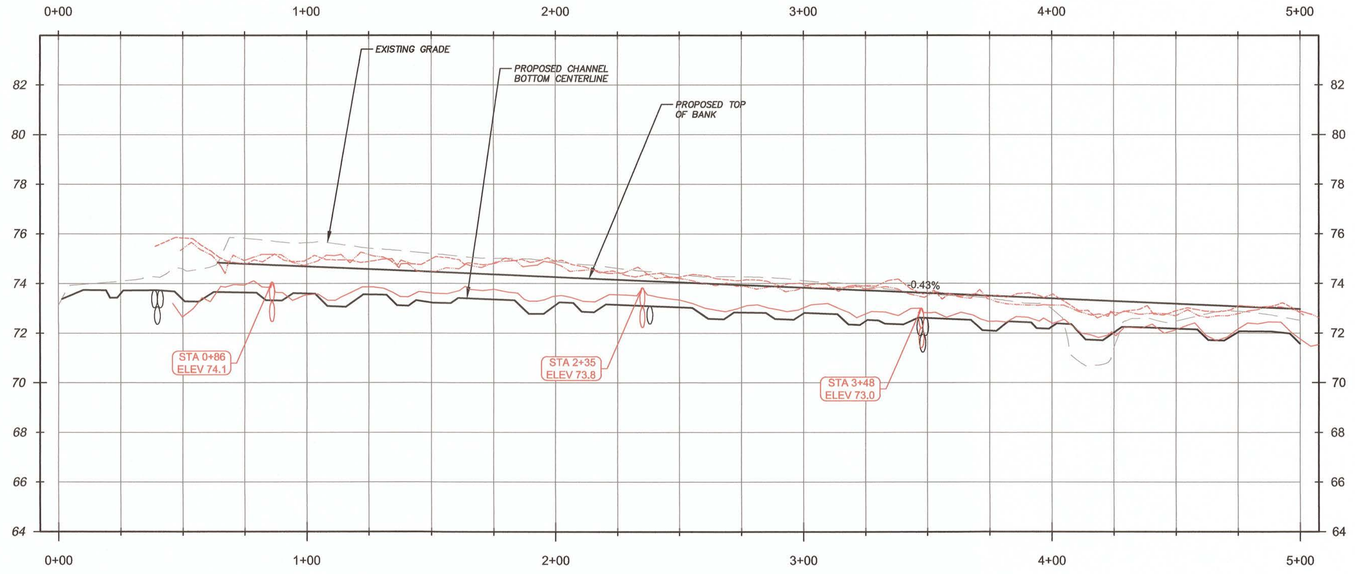
DRAWING TITLE:
COVER

DRAWING NUMBER:
1

PLOT DATE: 12/10/2015

WKD PROJ. NO.: 2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
- PROPOSED FILL AREA
- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
LOG GRADE CONTROL	0+39	73.74	---	---	---
LOG TOE	1+35	73.20	1+43	73.2	R
BEDDED LOG STRUCTURE	2+38	73.00	---	---	---
LOG TOE	2+88	72.70	2+96	72.70	L
LOG GRADE CONTROL	3+48	72.60	---	---	---
LOG TOE	4+62	71.80	4+70	71.80	L

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

WK DICKSON
community infrastructure consultants
Transportation + Water Resources
Urban Development + Geomatics
720 Corporate Drive
Raleigh, NC 27607
(v) 919.782.0495
(f) 919.782.9672
www.wkdickson.com
NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER AWN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

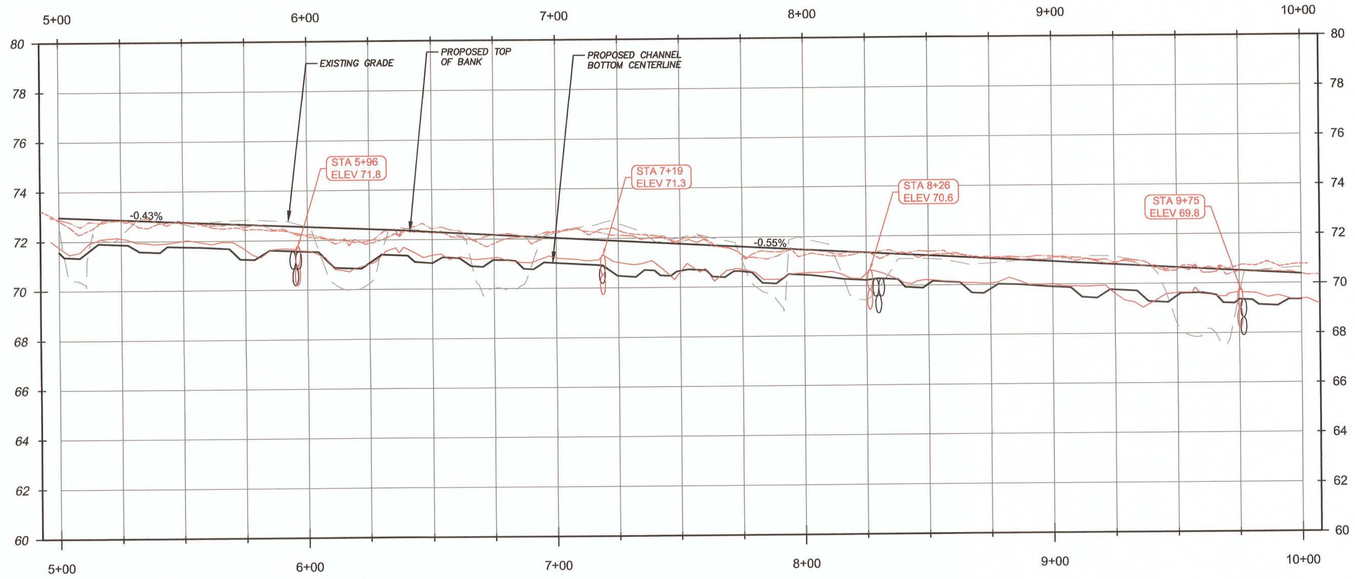
DRAWING TITLE: REACH UT-1 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 2

PROJ. NO.: 2012009200RA



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
- PROPOSED FILL AREA
- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG GRADE CONTROL	5+95	71.50	----	----	----
LOG TOE	6+09	71.10	6+24	71.10	L
BEDDED LOG STRUCTURE	7+18	70.92	----	----	----
LOG TOE	7+24	70.50	7+32	70.50	R
LOG GRADE CONTROL	8+29	70.30	----	----	----
LOG TOE	8+41	70.00	8+49	70.00	R
BEDDED LOG STRUCTURE	9+77	69.34	----	----	----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031435 ANN F. MULLEN 12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

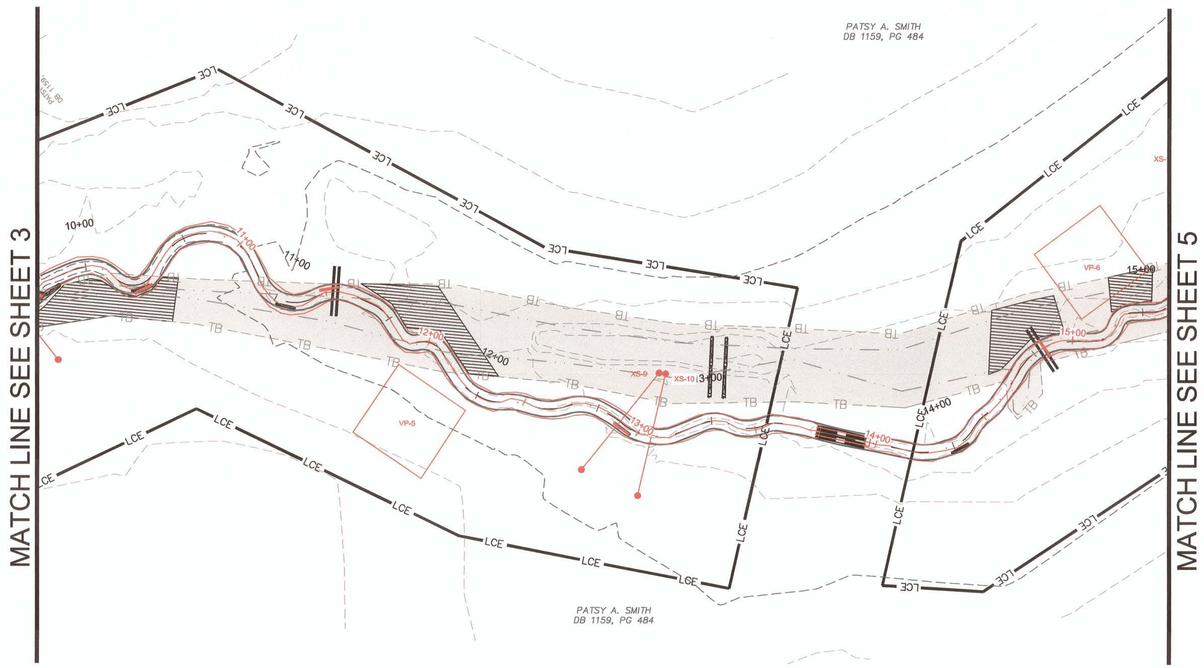
DRAWING TITLE: REACH UT-1 PLAN & PROFILE

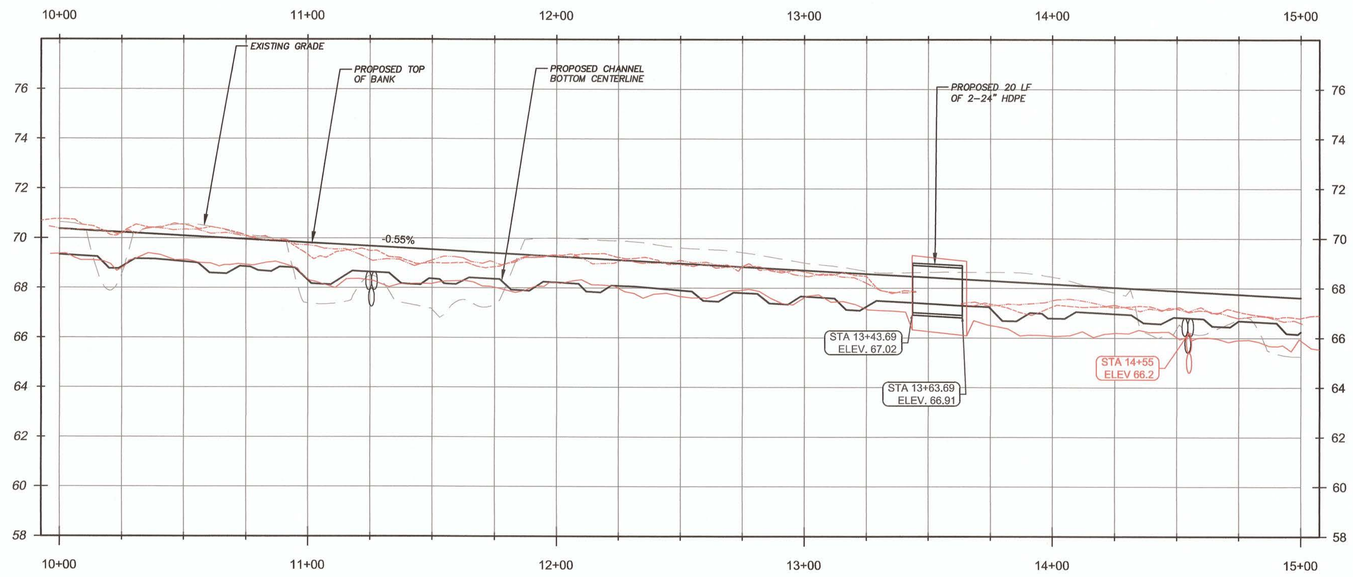
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 3

PROJ. NO.: 2012009200RA





LEGEND

- AS–BUILT CONTOUR MAJOR
- AS–BUILT CONTOUR MINOR
- AS–BUILT CHANNEL LIMITS
- AS–BUILT IN–STREAM STRUCTURE
- EXISTING TOP OF BANK
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- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS–BUILT CHANNEL CENTERLINE (PROFILE)
- AS–BUILT LEFT TOP OF BANK (PROFILE)
- AS–BUILT RIGHT TOP OF BANK (PROFILE)
- AS–BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG TOE	10+23	68.90	10+30	68.90	R
LOG TOE	11+02	68.40	11+10	68.40	R
LOG GRADE CONTROL	11+25	68.64	----	----	----
LOG TOE	12+59	67.65	12+67	67.65	R
LOG TOE	13+99	66.85	14+07	66.85	R
LOG GRADE CONTROL	14+54	66.80	----	----	----

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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031435 ANN F. MULLER 12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

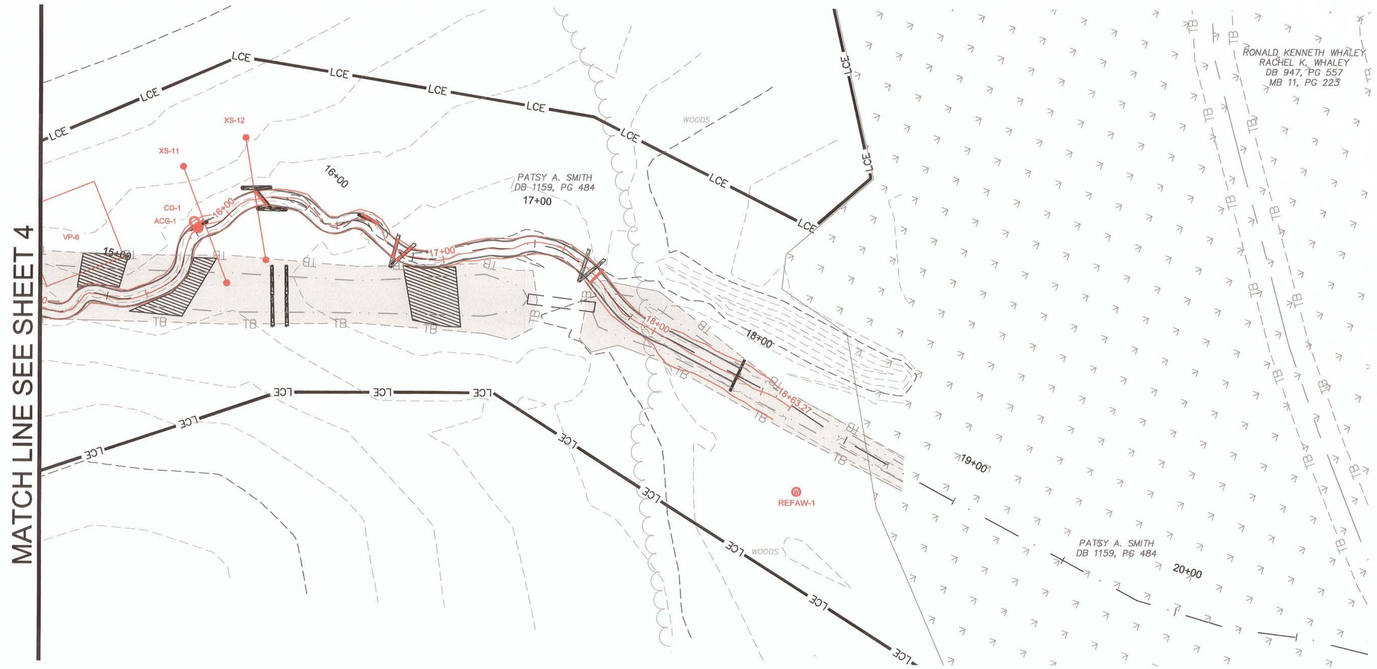
DRAWING TITLE: REACH UT-1 PLAN & PROFILE

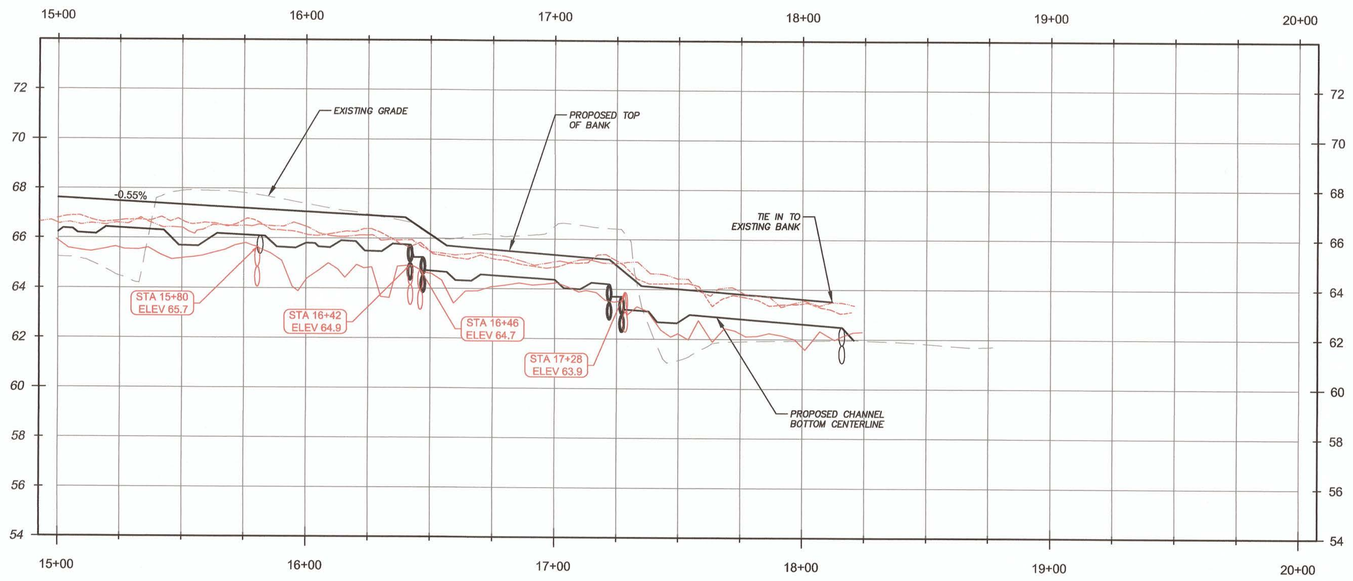
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 4

PROJ. NO.: 2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
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- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
LOG TOE	15+49	65.90	15+57	65.90	L
BEDDED LOG CONTROL	15+81	68.64	----	----	----
LOG TOE	16+23	65.65	16+31	65.65	L
DOUBLE LOG DROP	16+42	65.75	16+47	65.25	----
DOUBLE LOG DROP	17+22	64.20	17+27	63.70	----
LOG STRUCTURE	18+16	62.50	----	----	----

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NORTH CAROLINA PROFESSIONAL SEAL 030436 ENGINEER MINN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

DRAWING TITLE:
REACH LT-1 PLAN & PROFILE

OWNER / 24 HR CONTACT:
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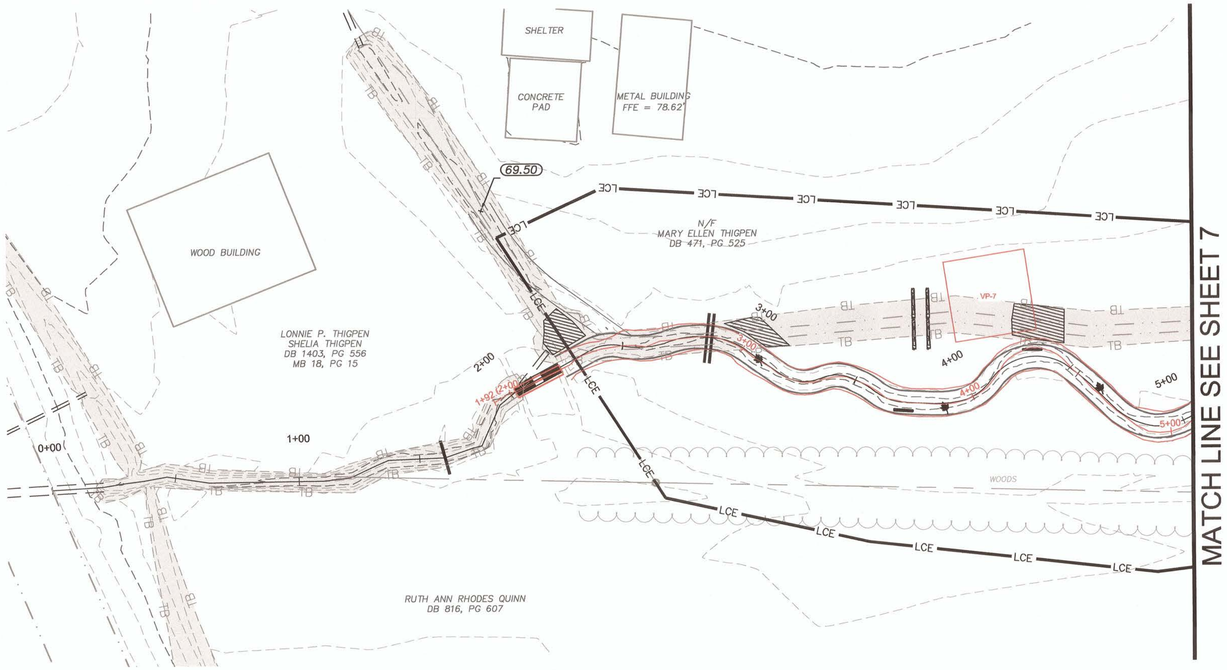
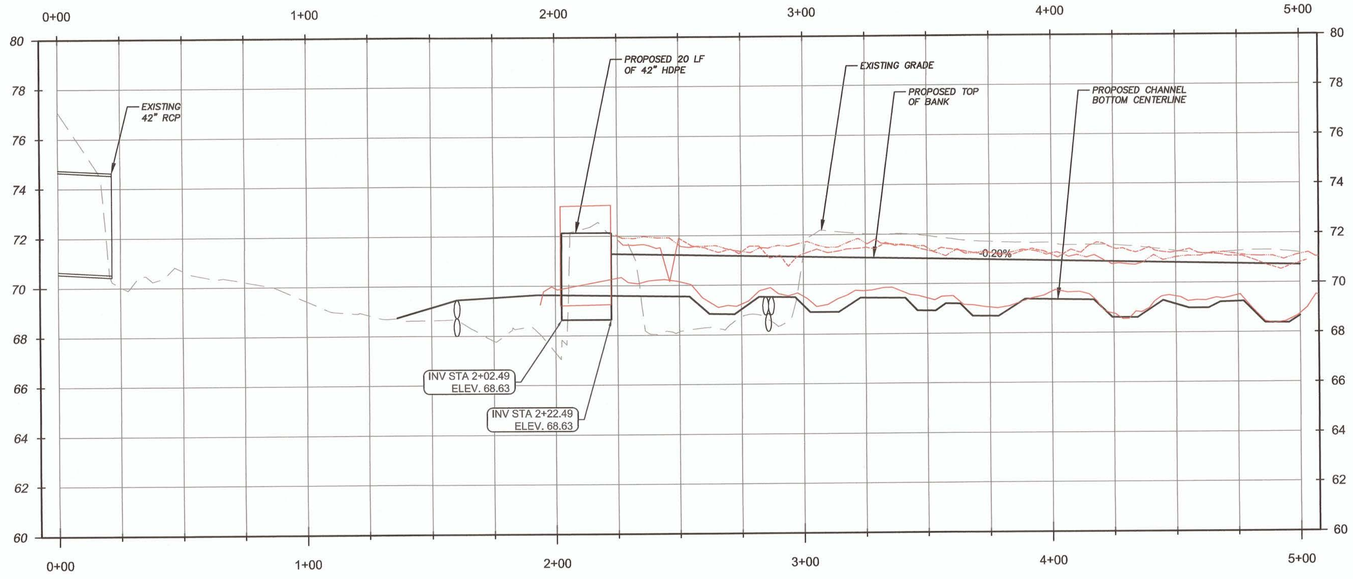
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER:
5

PROJ. NO.:
2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
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- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
LOG STRUCTURE	1+60	69.45	----	----	----
LOG GRADE CONTROL	2+85	69.50	----	----	----
LOG TOE	3+69	68.85	3+77	68.85	R
LOG TOE	4+26	68.80	4+34	68.80	L

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NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION
		REVISIONS:
		RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

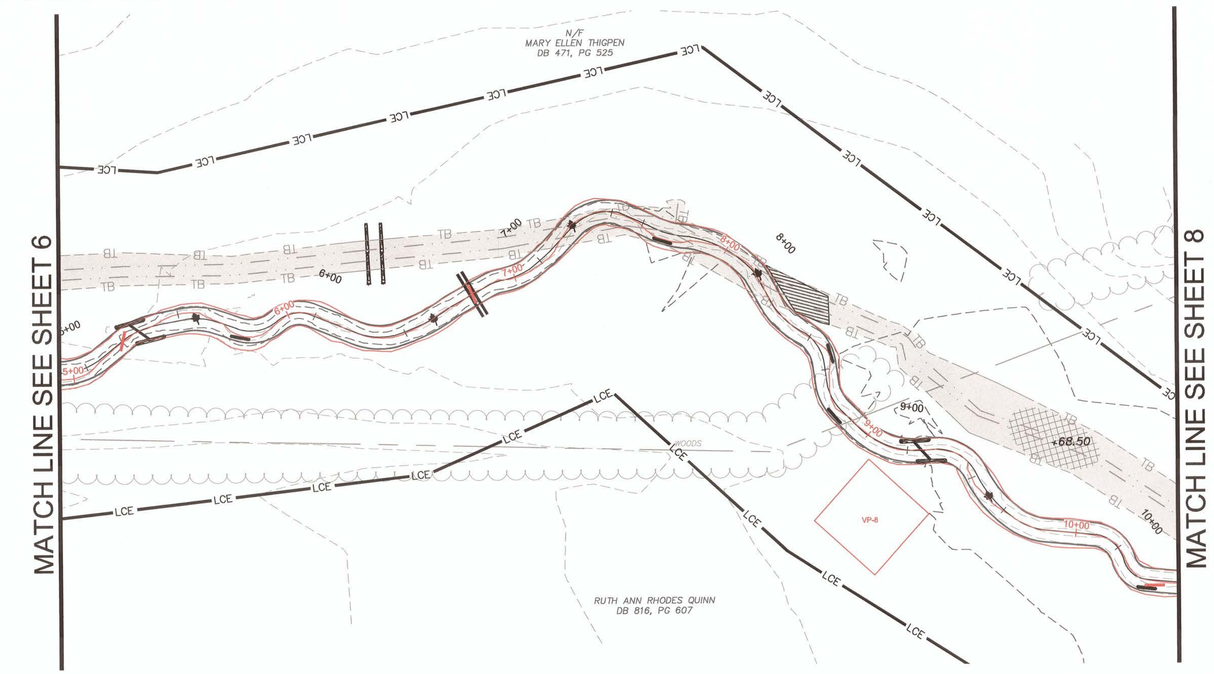
DRAWING TITLE: REACH UT-2 PLAN & PROFILE

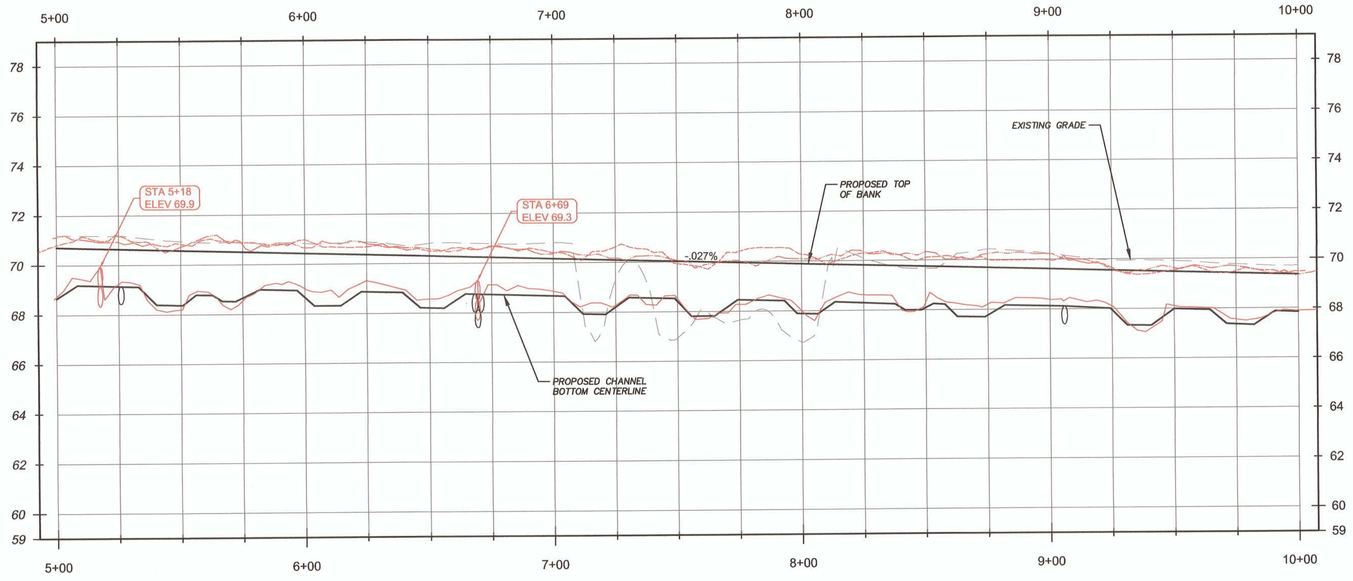
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 6

PROJ. NO.: 2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
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- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
BEDDED LOG STRUCTURE	5+26	69.15	----	----	----
LOG TOE	5+65	68.60	5+73	68.60	R
LOG GRADE CONTROL	6+69	68.75	----	----	----
LOG TOE	7+56	68.00	7+64	68.00	R
LOG TOE	8+41	68.10	8+49	68.10	L
LOG TOE	8+63	67.90	8+71	67.90	R
BEDDED LOG STRUCTURE	9+06	68.10	----	----	----

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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031499 ENGINEER ANN F. MULLEN 12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

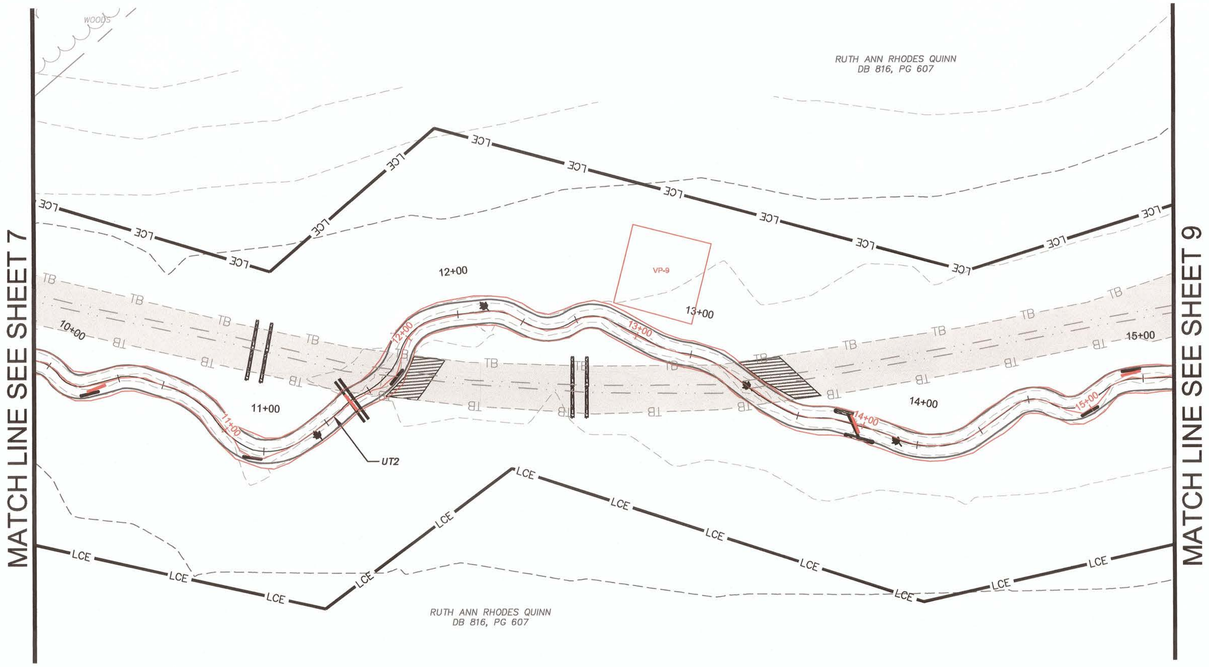
DRAWING TITLE: REACH UT-2 PLAN & PROFILE

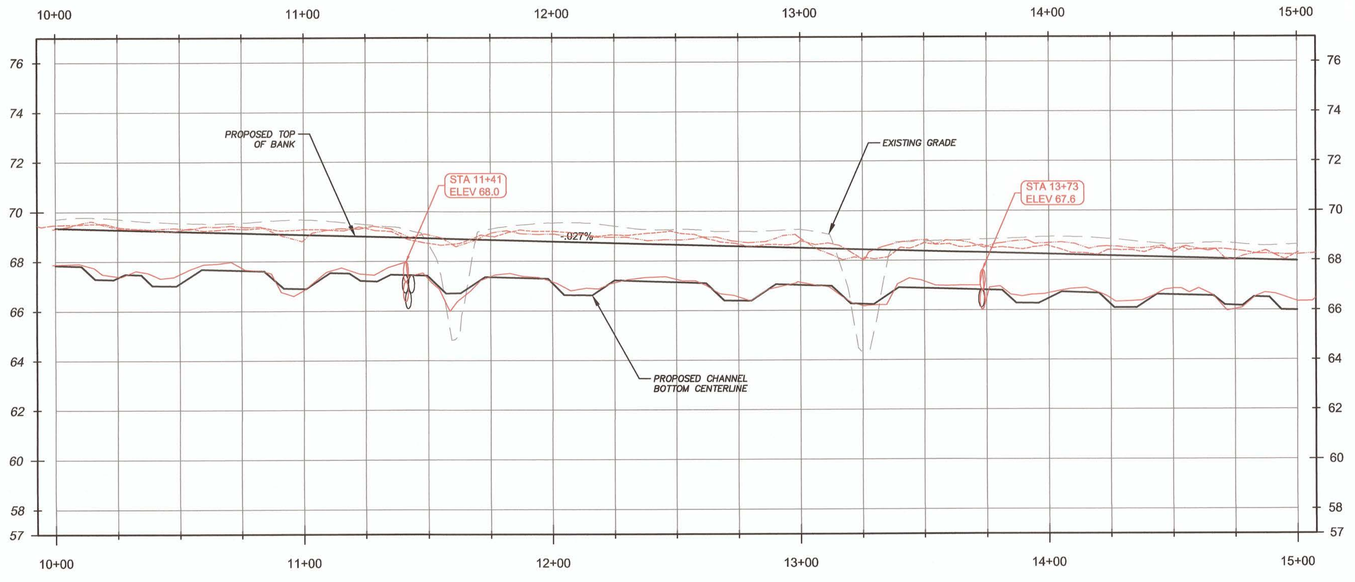
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 7

PROJ. NO.: 2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
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- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG TOE	10+15	67.40	10+23	67.40	R
LOG TOE	10+92	67.15	11+00	67.15	R
LOG GRADE CONTROL	11+42	67.45	-----	-----	-----
LOG TOE	11+57	66.90	11+65	66.90	R
BEDDED LOG STRUCTURE	13+72	66.82	-----	-----	-----
LOG TOE	14+71	66.30	14+79	66.30	R
LOG TOE	14+93	65.15	15+01	65.15	L

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NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
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PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
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RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
DRAWING TITLE: REACH UT-2 PLAN & PROFILE
OWNER / 24 HR CONTACT:
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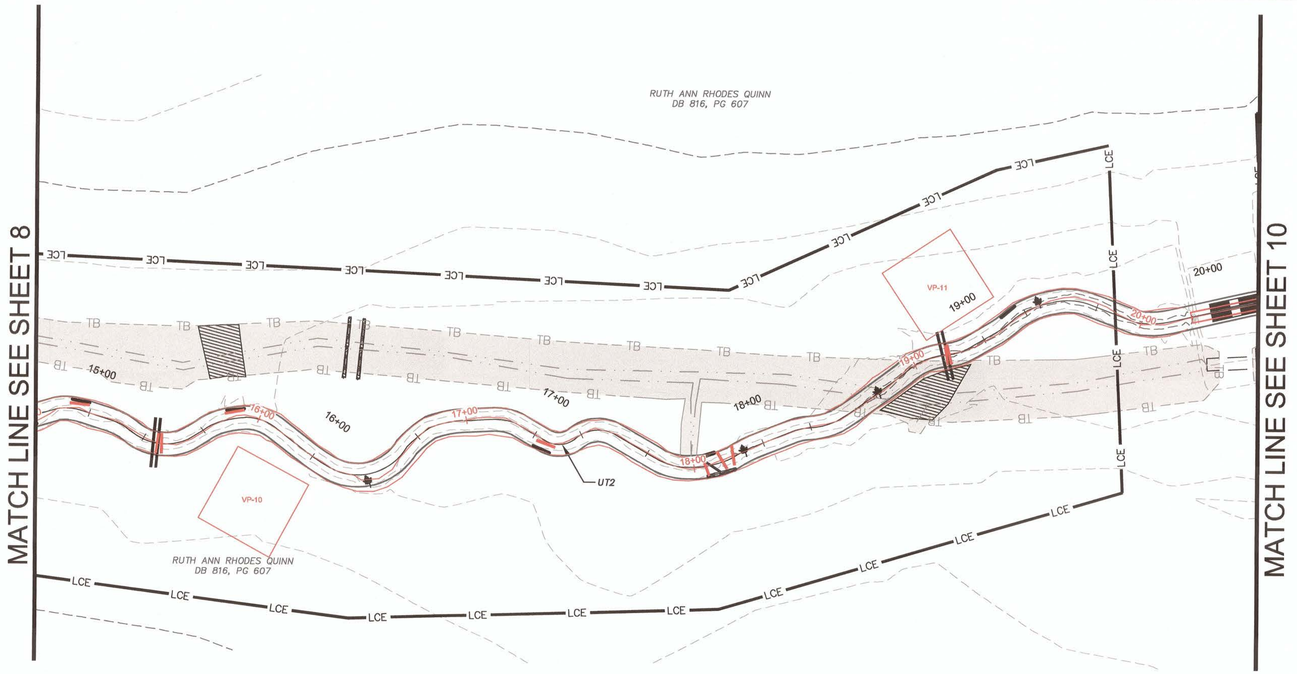
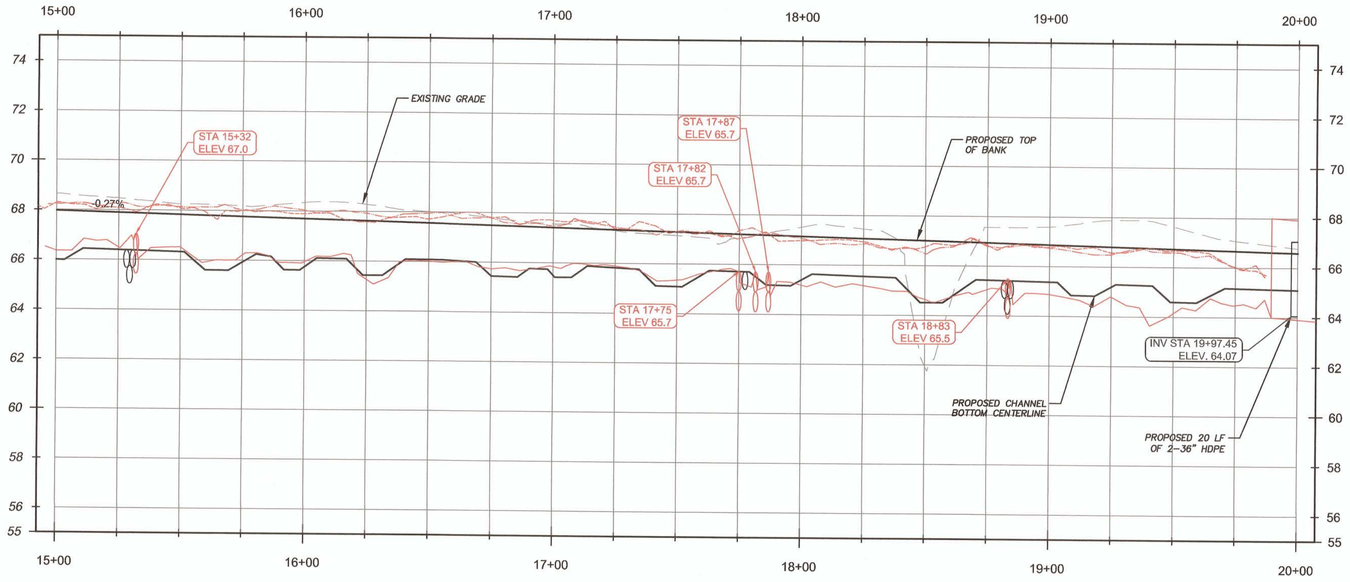
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015
DRAWING NUMBER: 8
PROJ. NO.: 2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
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- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
LOG GRADE CONTROL	15+29	66.39	----	----	----
LOG TOE	15+60	65.80	15+68	65.80	L
LOG TOE	17+00	65.55	17+08	65.55	R
BEDDED LOG STRUCTURE	17+77	65.71	----	----	----
LOG GRADE CONTROL	18+83	65.42	----	----	----
LOG TOE	19+09	65.00	19+17	65.80	L

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Transportation + Water Resources
Urban Development + Geomatics
720 Corporate Drive
Raleigh, NC 27607
(v) 919.782.0495
(f) 919.782.9672
www.wkdickson.com
NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER JOHN F. MULLEN
12/6/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

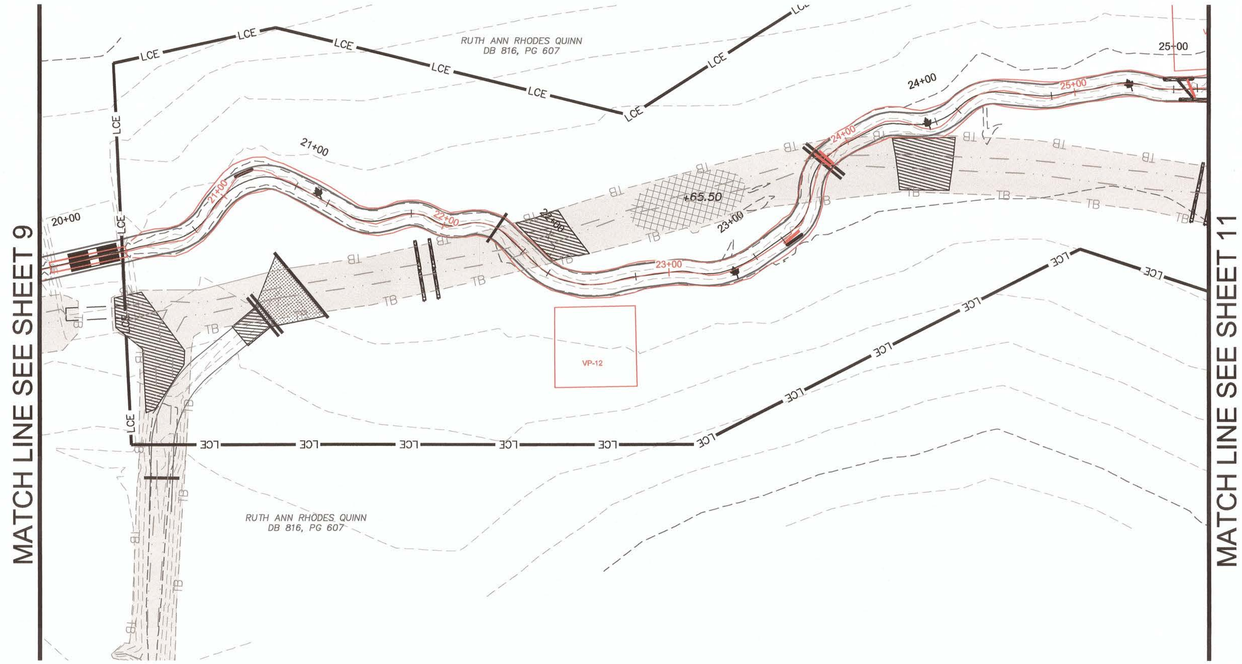
DRAWING TITLE:
REACH UT-2 PLAN & PROFILE

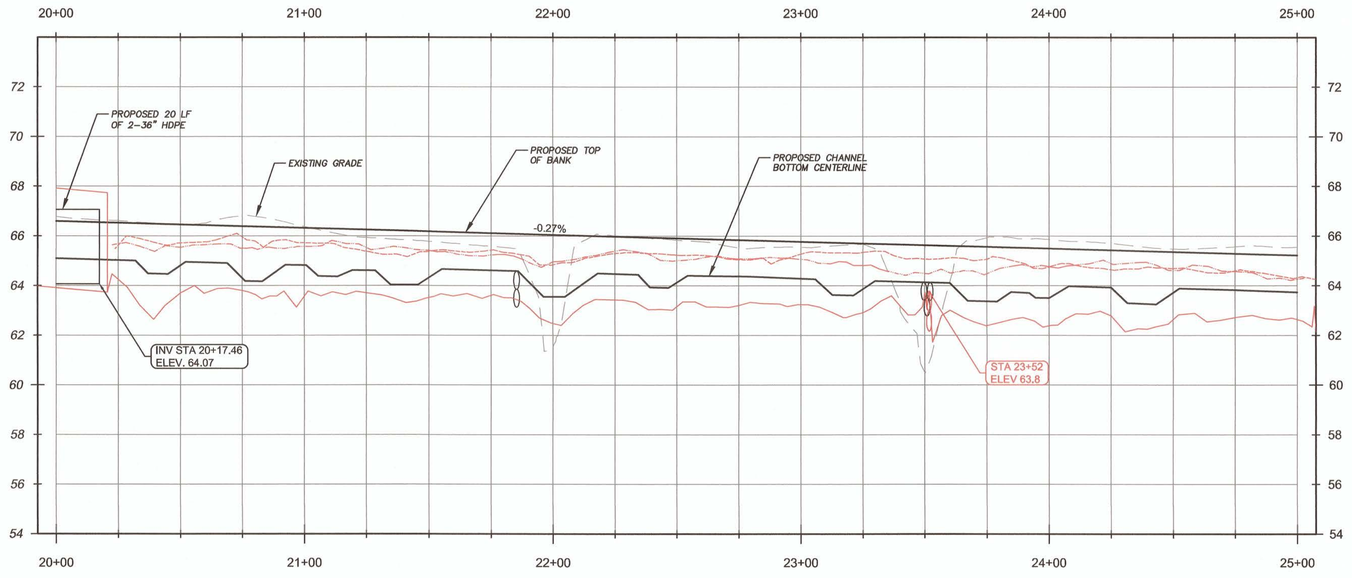
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.:
Q.C. DATE: DEC 2015

DRAWING NUMBER:
9

PROJ. NO.:
2012009200RA





LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
- PROPOSED FILL AREA
- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG TOE	20+76	64.40	20+84	64.40	L
LOG STRUCTURE	21+85	64.60	----	----	----
LOG TOE	23+13	63.80	23+21	63.80	R
LOG GRADE CONTROL	23+50	64.13	----	----	----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

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NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 12/11/15

FULL SCALE: 1"=30 H, 1"=3 V

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/11/15

MARK	DATE	DESCRIPTION

REVISIONS:

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PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

DRAWING TITLE: REACH UT-2 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 10

PROJ. NO.: 2012009200RA

LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
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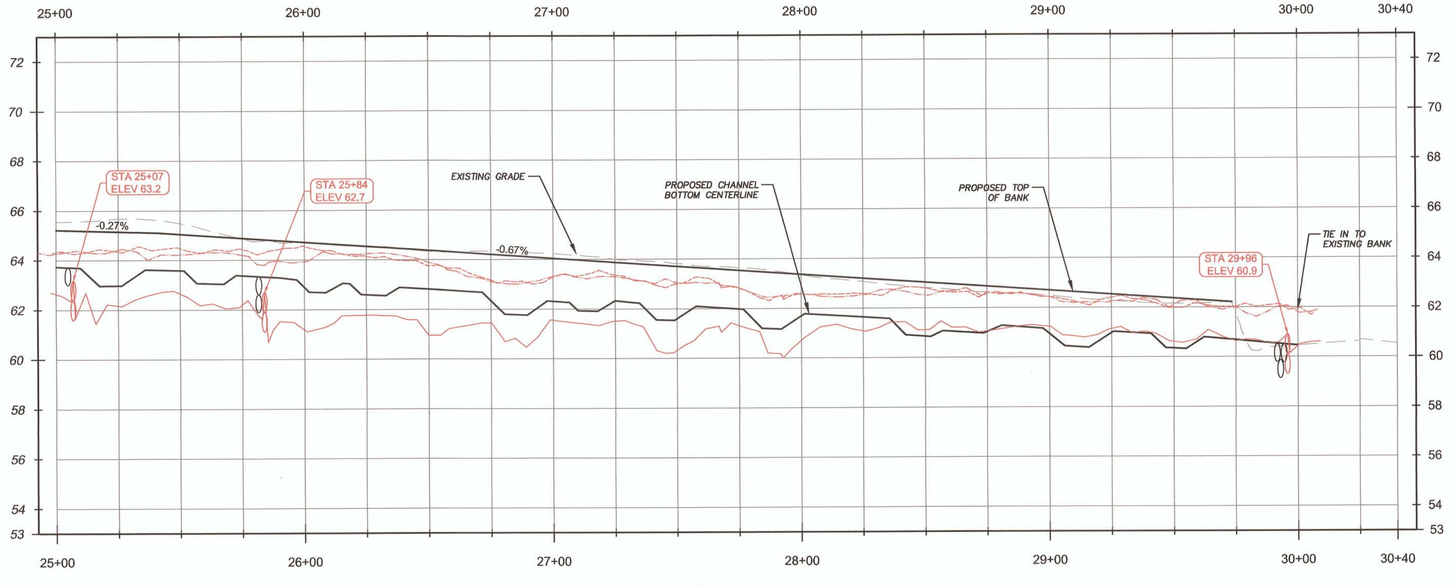
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)



STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
BEDDED LOG STRUCTURE	25+05	63.72	----	----	----
LOG STRUCTURE	25+82	63.34	----	----	----
LOG TOE	26+02	62.90	26+09	62.90	L
LOG TOE	26+81	62.00	26+89	62.00	L
LOG TOE	27+41	61.75	27+49	61.75	R
LOG TOE	27+84	61.45	27+92	61.45	L
LOG TOE	28+67	61.10	28+75	61.10	L
LOG GRADE CONTROL	29+93	60.51	----	----	----

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NORTH CAROLINA PROFESSIONAL SEAL 031438 ENGINEER ANN F. MULLEN 12/10/15

FULL SCALE: 1"=30 H, 1"=3 V

0 30 60

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION
		REVISIONS:
		RELEASED FOR:
		RECORD DRAWINGS

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

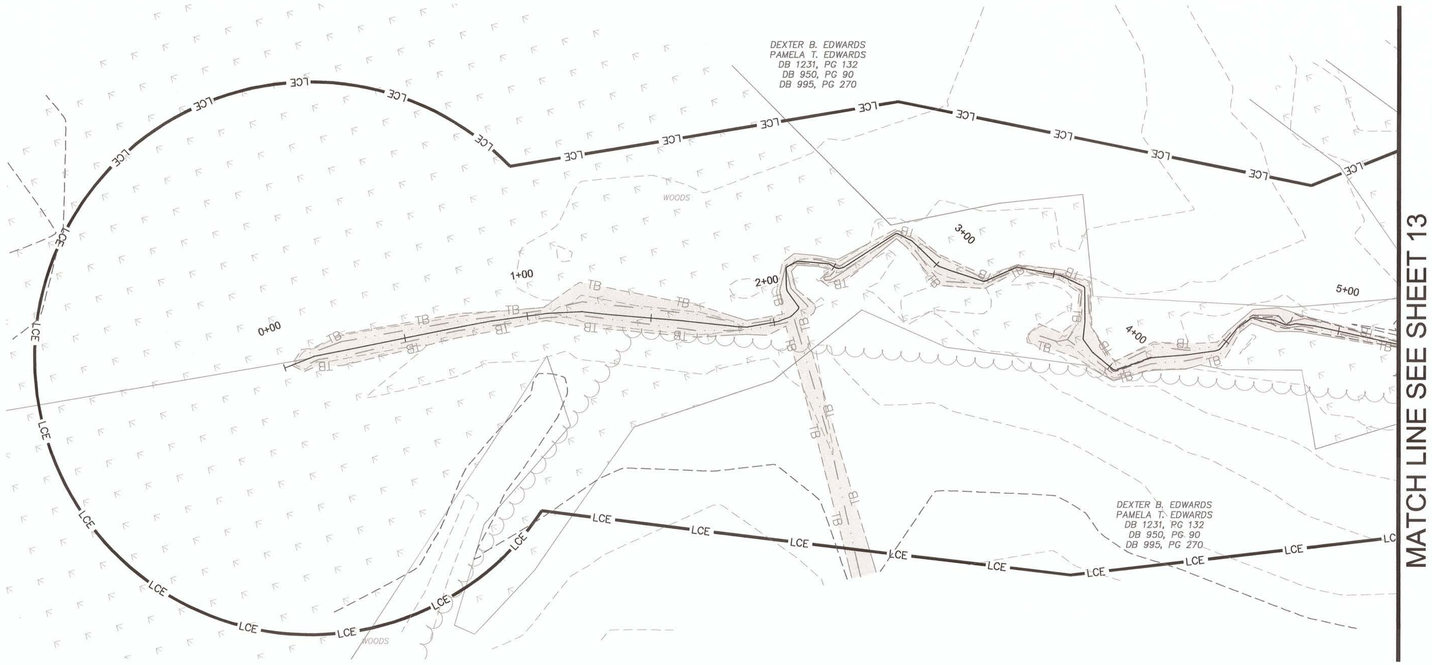
DRAWING TITLE:
REACH UT-2 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

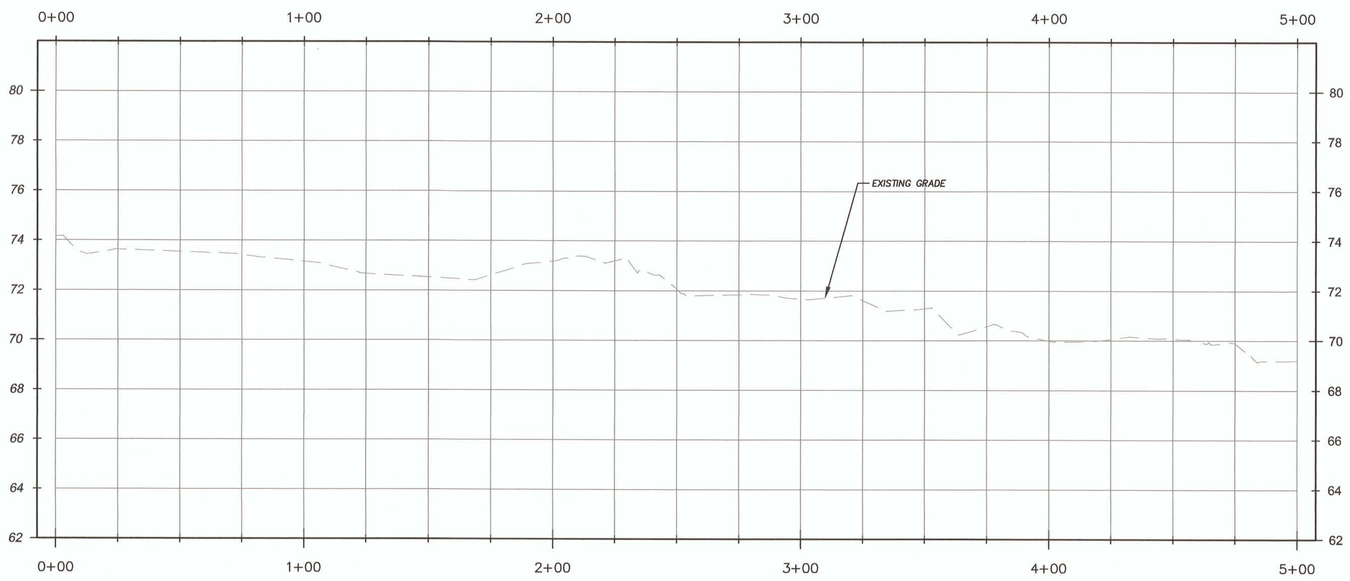
PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER:
11

PROJ. NO.:
2012009200RA



MATCH LINE SEE SHEET 13



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
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- AS-BUILT STRUCTURE (PROFILE)

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NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

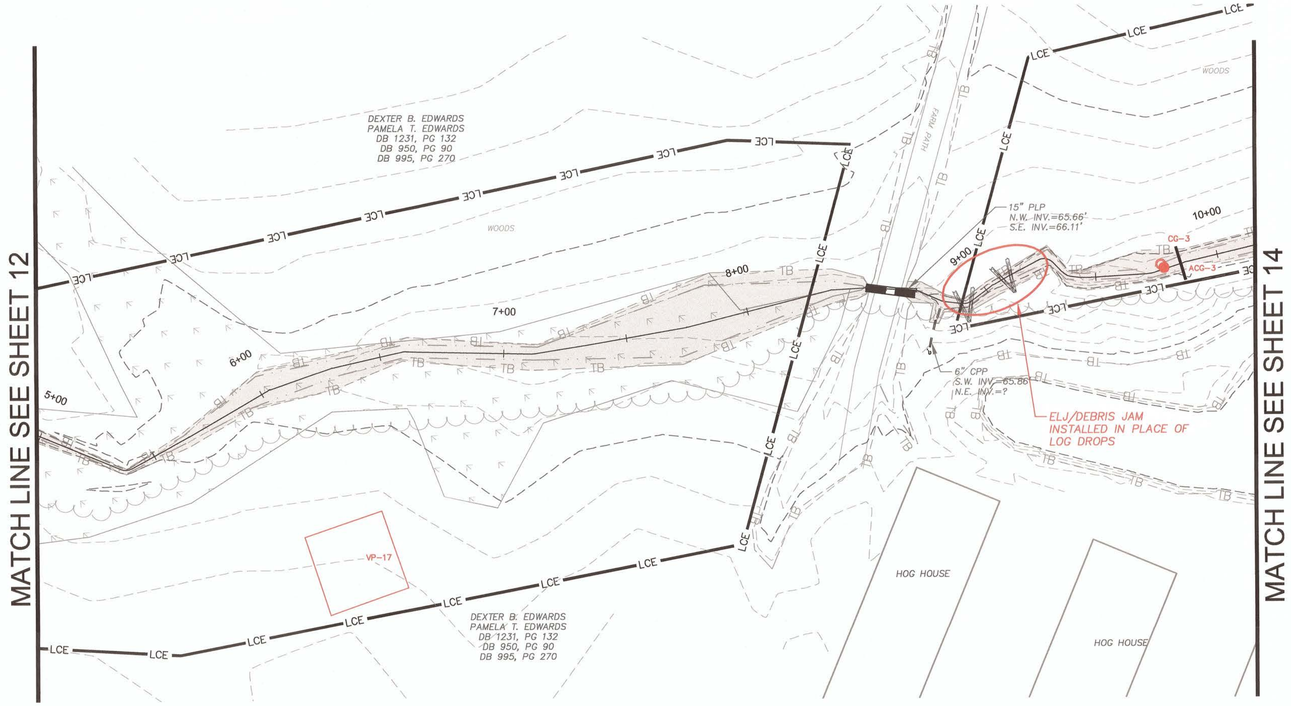
DRAWING TITLE: REACH UT-3 PLAN & PROFILE

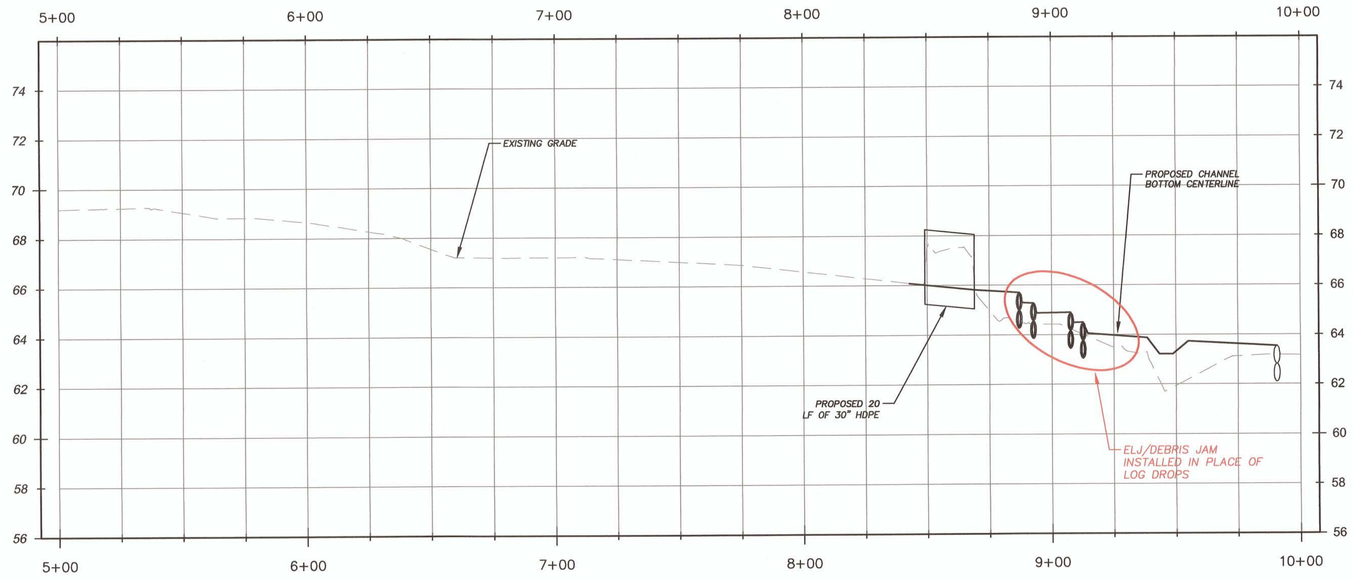
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 12

PROJ. NO.: 2012009200RA





LEGEND

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- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
DOUBLE LOG DROP	8+87	65.70	8+93	65.30	----
DOUBLE LOG DROP	9+08	64.90	9+13	64.50	----
LOG STRUCTURE	9+91	63.50	----	----	----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

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NC. UCENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031435 ANN F. MULLEW 12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:

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PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

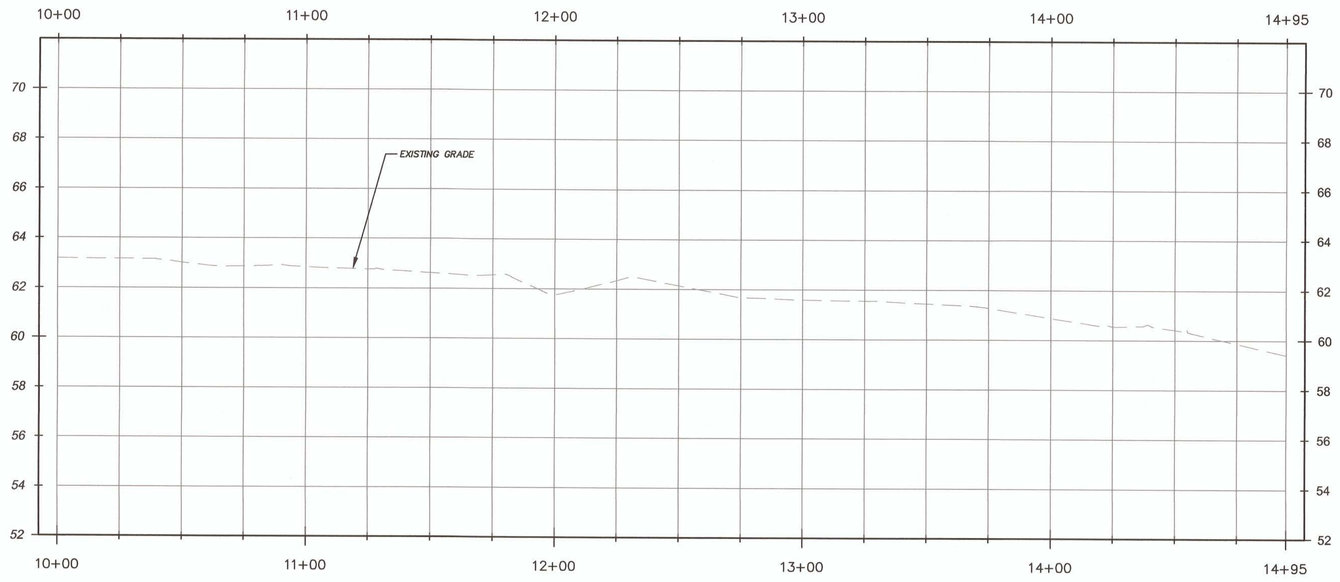
DRAWING TITLE: REACH UT-3 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 13

PROJ. NO.: 2012009200RA



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
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- FLOODPLAIN SILL (PROPOSED)
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- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031439 ENGINEER ANN F. MULLET
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

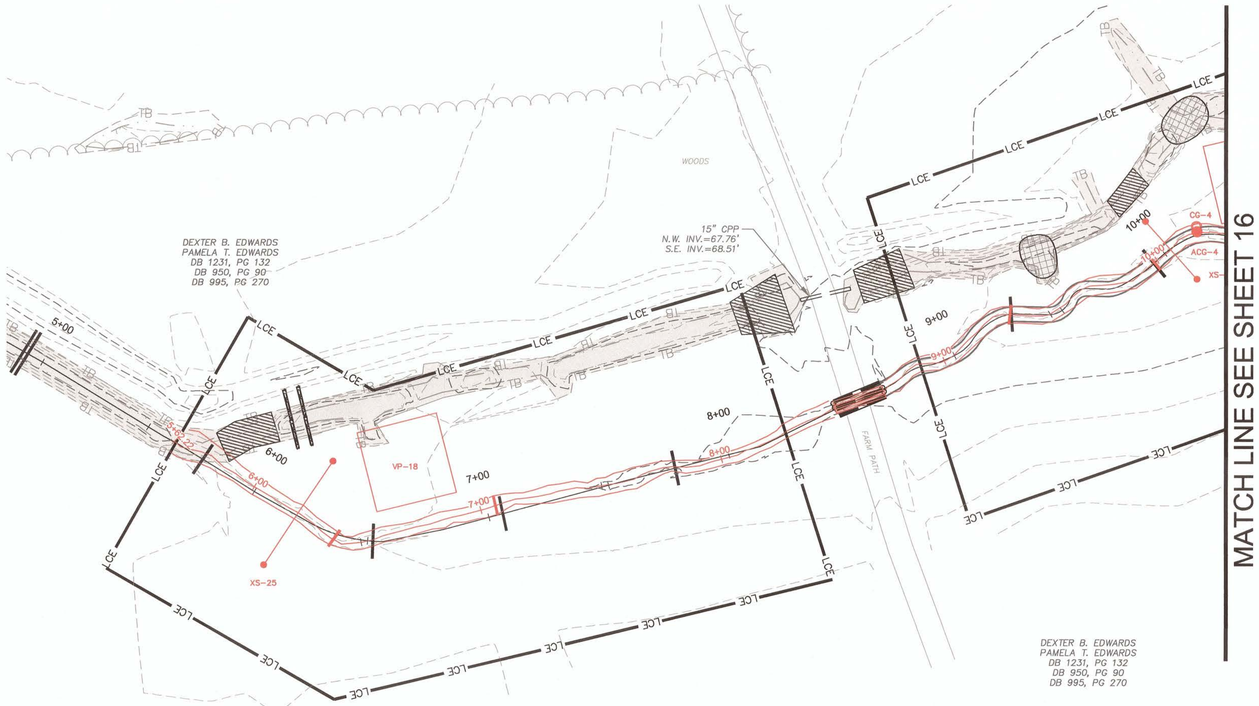
DRAWING TITLE: REACH UT-3 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.:
Q.C. DATE: DEC 2015

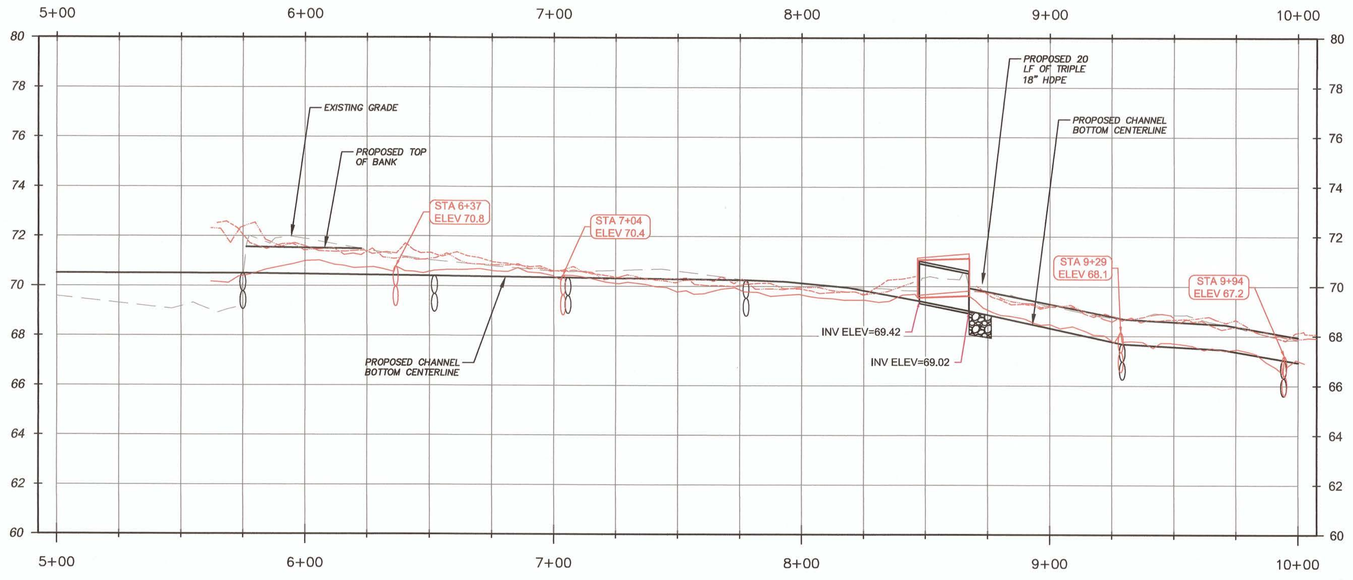
DRAWING NUMBER: 14

PROJ. NO.: 2012009200RA



MATCH LINE SEE SHEET 16

DEXTER B. EDWARDS
PAMELA T. EDWARDS
DB 1231, PG 132
DB 950, PG 90
DB 995, PG 270



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
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- EXISTING TOP OF BANK
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- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
LOG STRUCTURE	5+75	70.50	-----	-----	-----
LOG STRUCTURE	6+52	70.40	-----	-----	-----
LOG STRUCTURE	7+06	70.35	-----	-----	-----
LOG STRUCTURE	7+77	70.20	-----	-----	-----
LOG STRUCTURE	9+29	67.70	-----	-----	-----
LOG STRUCTURE	9+94	67.00	-----	-----	-----

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NORTH CAROLINA PROFESSIONAL SEAL 031495 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

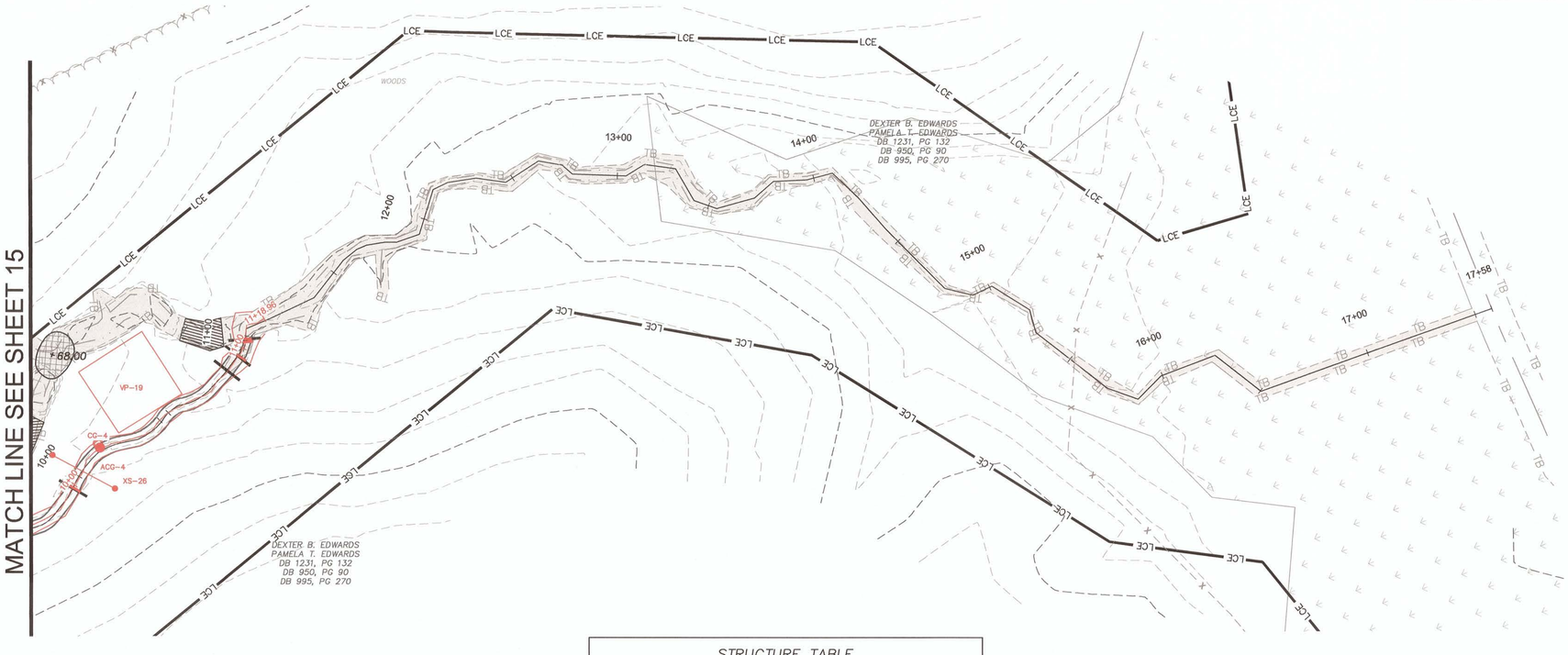
DRAWING TITLE: REACH UT-4 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 15

PROJ. NO.: 2012009200RA



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
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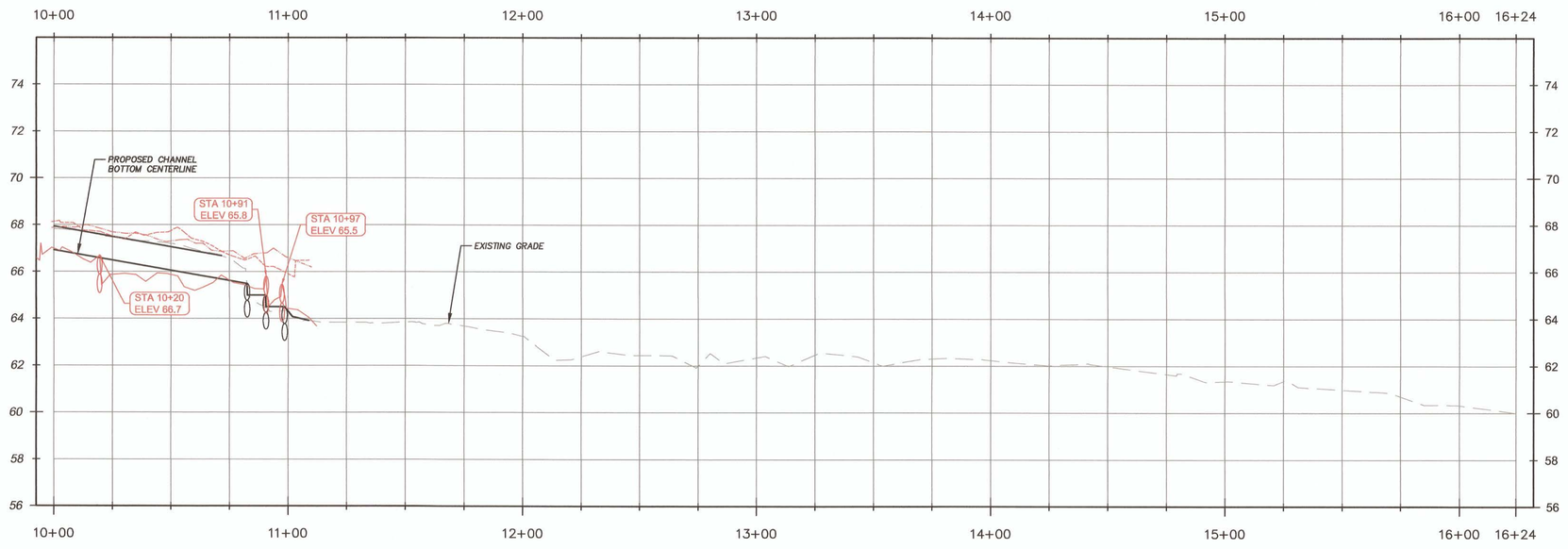
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG STRUCTURE	10+82.5	65.50	-----	-----	-----
LOG STRUCTURE	10+90.5	65.00	-----	-----	-----
LOG STRUCTURE	10+98.5	64.50	-----	-----	-----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM



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NC. UCENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031405 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

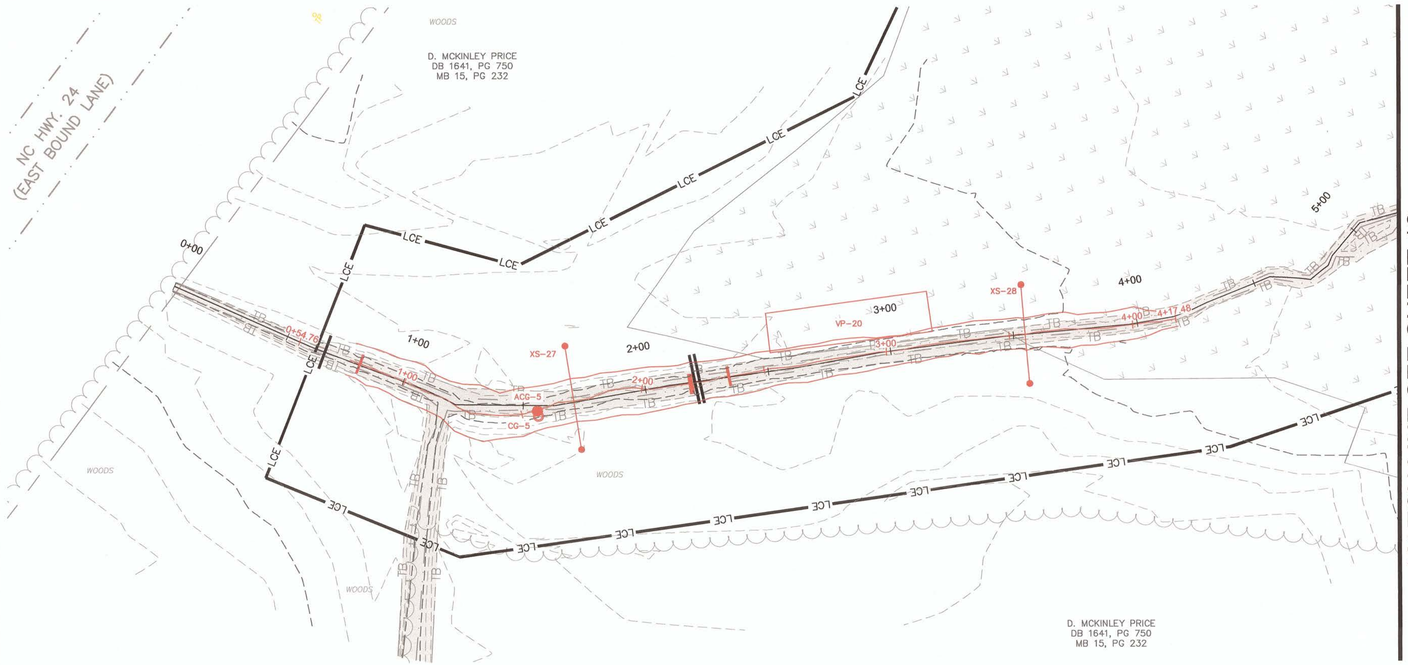
DRAWING TITLE: REACH UT-4 PLAN & PROFILE

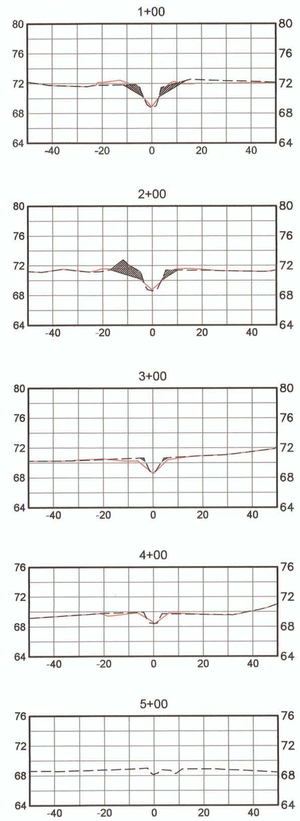
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER: 16

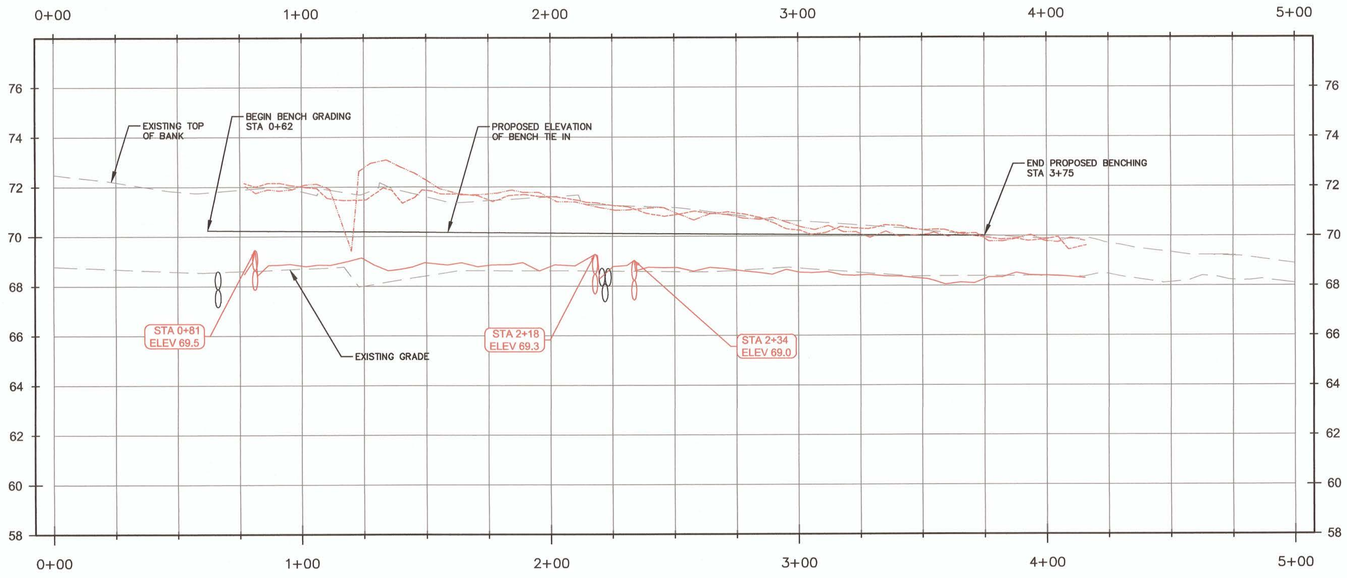
PROJ. NO.: 2012009200RA





UT6 CROSS SECTIONS
(VERTICAL SCALE 1"=10'
HORIZONTAL SCALE 1"=30')

EXISTING GRADE
AS-BUILT GRADE



STRUCTURE TABLE					
STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG STRUCTURE	0+66	68.60	-----	-----	-----
LOG GRADE CONTROL	2+22	68.70	-----	-----	-----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
- PROPOSED FILL AREA
- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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(f) 919.782.9672
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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031496 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION
		REVISIONS:
		RELEASED FOR: RECORD DRAWINGS

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

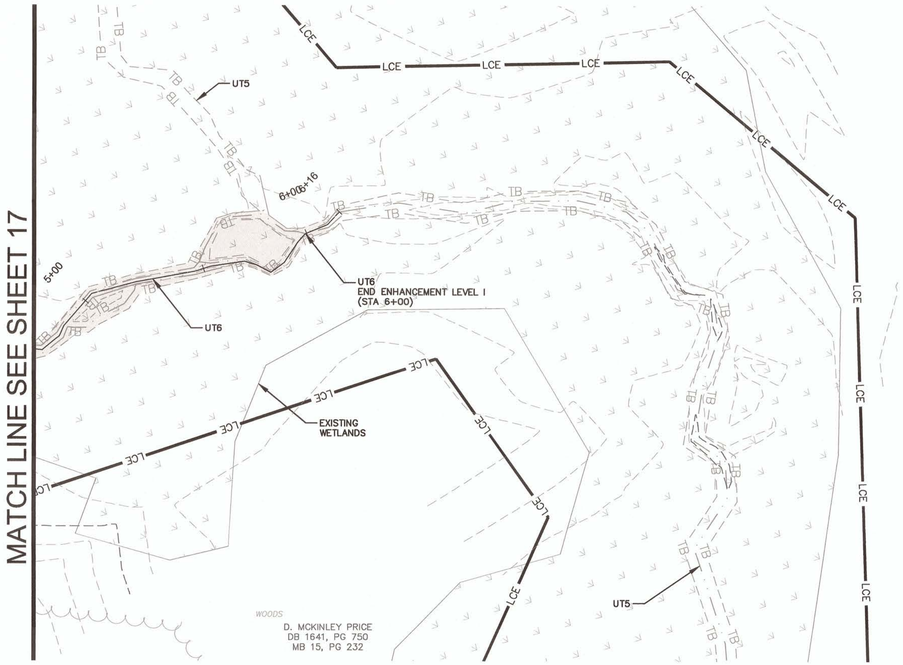
DRAWING TITLE: REACH UT-6 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

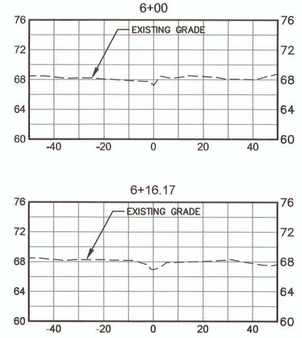
PROJ. DATE: NOV 2014
Q.C.:
Q.C. DATE: DEC 2015

DRAWING NUMBER: 17

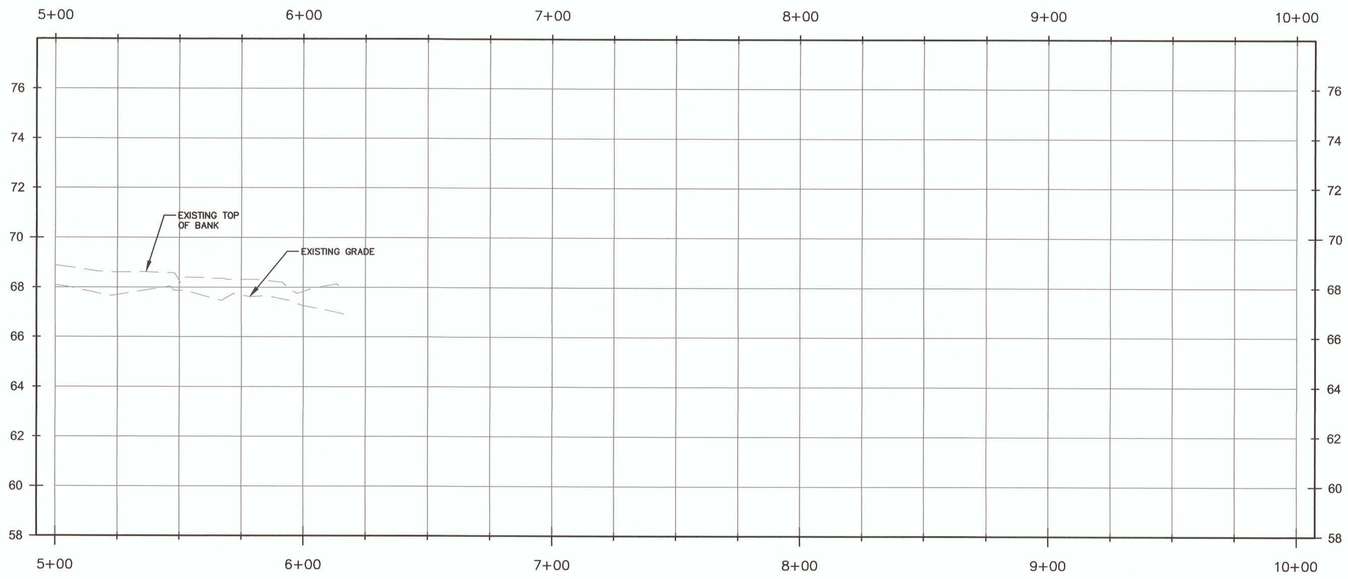
PROJ. NO.: 2012009200RA



D. MCKINLEY PRICE
DB 1641, PG 750
MB 15, PG 232



UT6 CROSS SECTIONS
(VERTICAL SCALE 1"=10'
HORIZONTAL SCALE 1"=30')



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
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- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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NC LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

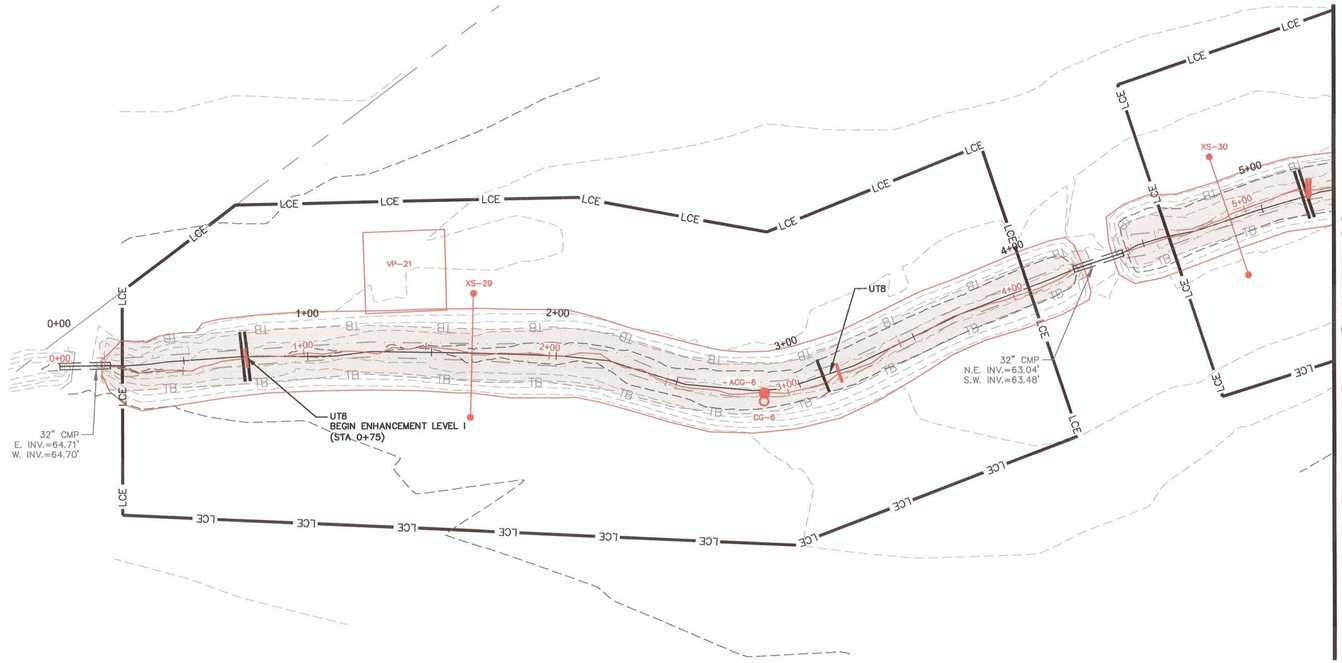
DRAWING TITLE:
REACH UT-6 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

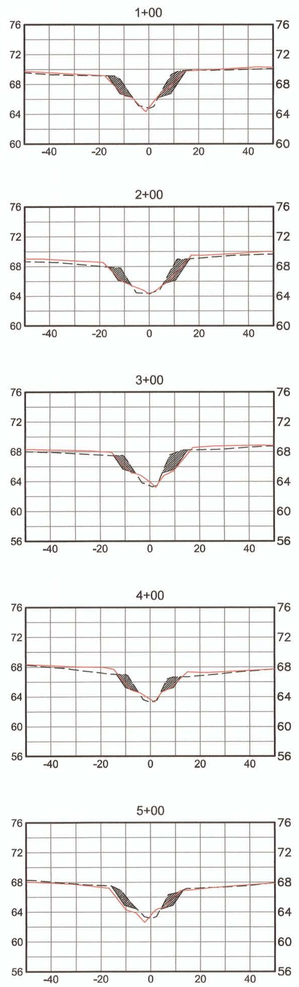
PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER:
18

PROJ. NO.:
2012009200RA

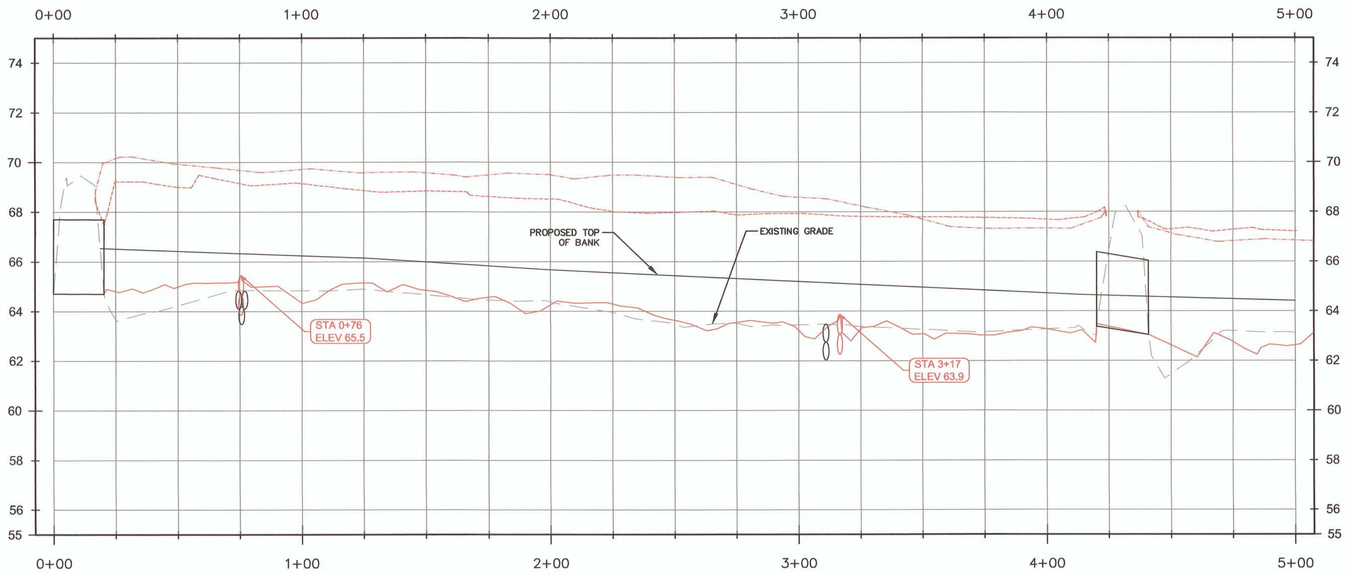


MATCH LINE SEE SHEET 20



UT8 CROSS SECTIONS
(VERTICAL SCALE 1"=10'
HORIZONTAL SCALE 1"=30')

EXISTING GRADE
AS-BUILT GRADE



STRUCTURE TABLE					
STRUCTURE	FROM		TO		BANK
	STA	ELEV	STA	ELEV	
LOG GRADE CONTROL	0+76	64.80	-----	-----	-----
LOG STRUCTURE	3+11	63.50	-----	-----	-----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
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- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
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- FLOODPLAIN SILL (PROPOSED)
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- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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NC. UCENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031435 ENGINEER ANN F. MULLEN 12/10/15

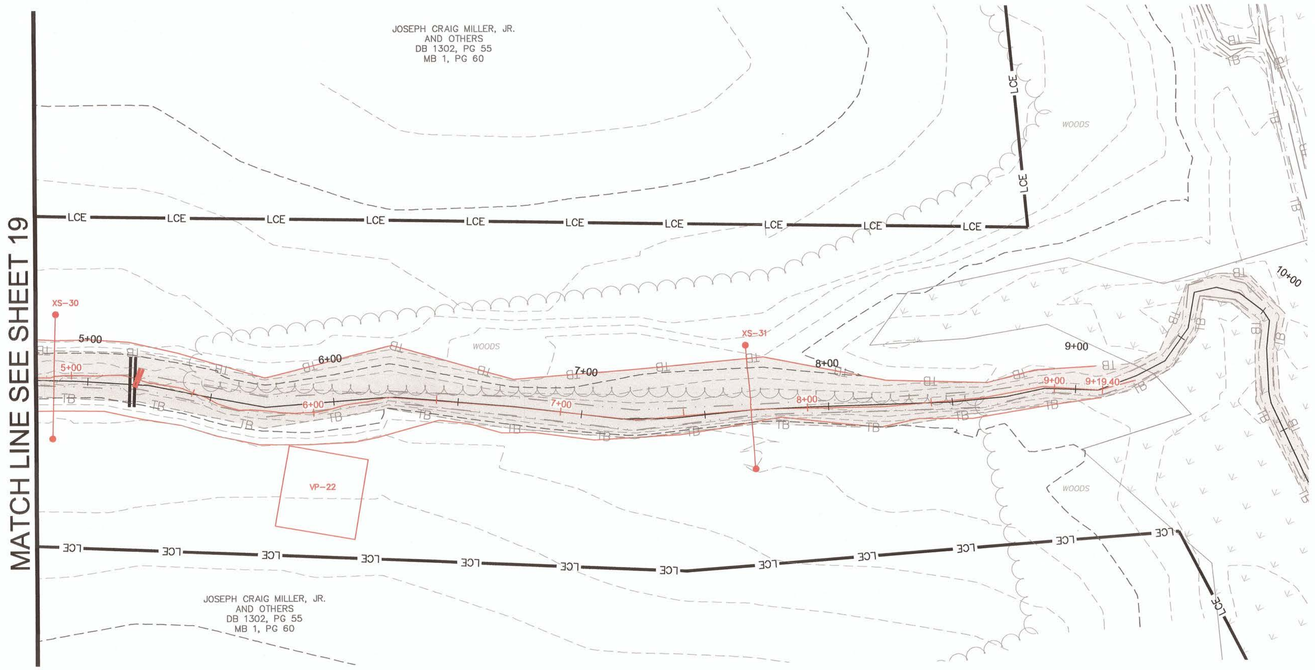
FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

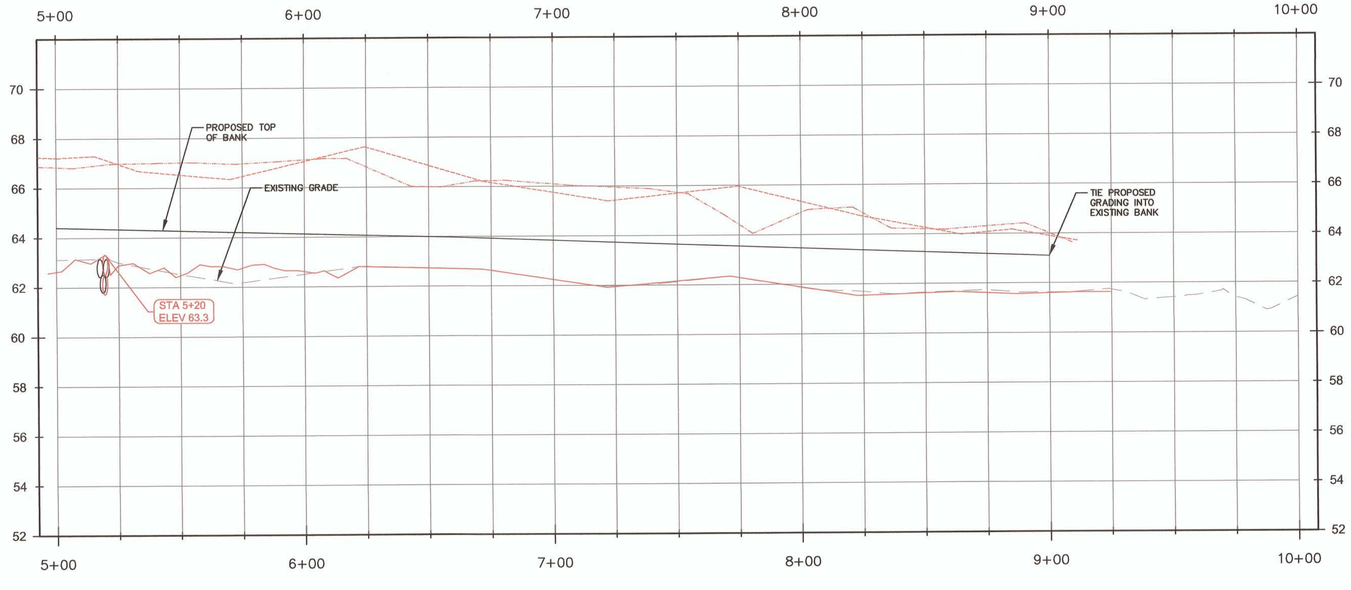
REVISIONS:		
MARK	DATE	DESCRIPTION

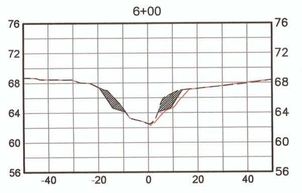
PLOT DATE: 12/10/15
RELEASED FOR: RECORD DRAWINGS

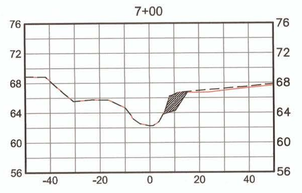
PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC
DRAWING TITLE: REACH UT-8 PLAN & PROFILE
OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

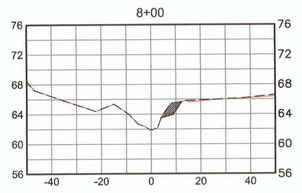
PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015
DRAWING NUMBER: 19
PROJ. NO.: 2012009200RA

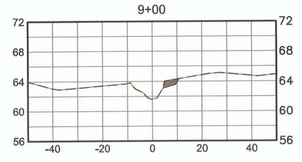


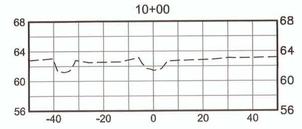












UT8 CROSS SECTIONS
(VERTICAL SCALE 1"=10'
HORIZONTAL SCALE 1"=30')

EXISTING GRADE
AS-BUILT GRADE

LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
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- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

STRUCTURE TABLE

STRUCTURE	FROM STA	FROM ELEV	TO STA	TO ELEV	BANK
LOG GRADE CONTROL	5+19	63.10	-----	-----	----

* RIGHT (R) AND LEFT (L) BANK LOCATIONS ARE REFERENCED LOOKING DOWNSTREAM

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(f) 919.782.9672
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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031435 ANN F. MULLEN 12/10/15

FULL SCALE: 1"=30 H, 1"=3 V
0 30 60
2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR:
RECORD DRAWINGS

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

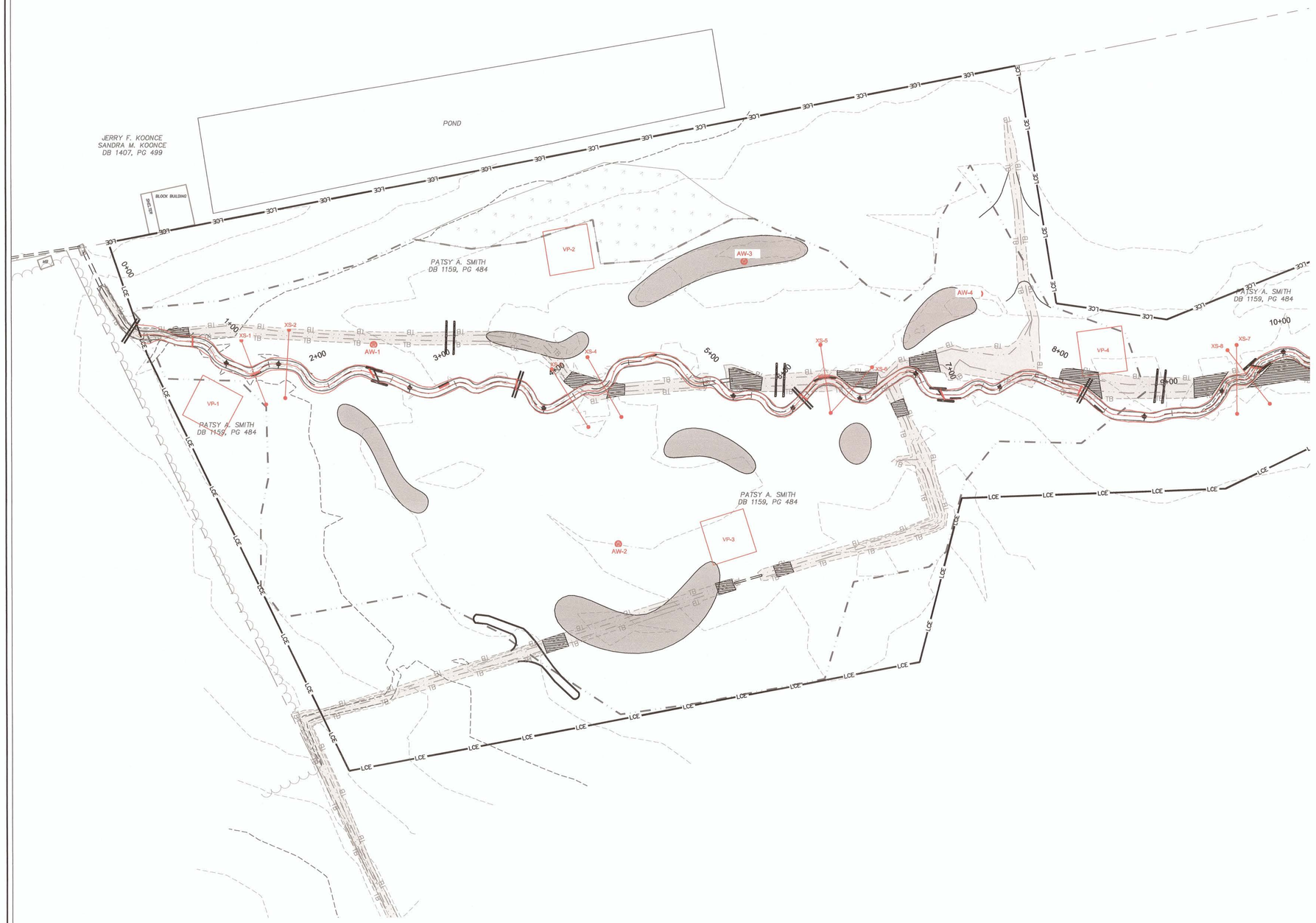
DRAWING TITLE:
REACH UT-8 PLAN & PROFILE

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER:
20

PROJ. NO.:
2012009200RA



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
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- LOG OUTLET STRUCTURE (PROPOSED)
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- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 031435 ANN F. MULLEN 12/10/15

FULL SCALE: 1"=40 H

0 40 80

2" = FULL SCALE
1" = HALF SCALE

PLOT DATE: 12/10/15

MARK	DATE	DESCRIPTION
REVISIONS:		
RELEASED FOR:		
RECORD DRAWINGS		

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

DRAWING TITLE:
WETLAND 1

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER:
21

PROJ. NO.:
2012009200RA

LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
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- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
- PROPOSED FILL AREA
- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
- LOG OUTLET STRUCTURE (PROPOSED)
- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031436 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H
0 30 60
2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION

REVISIONS:

RELEASED FOR:
RECORD DRAWINGS

PLOT DATE:
12/10/15

PROJECT NAME:
BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

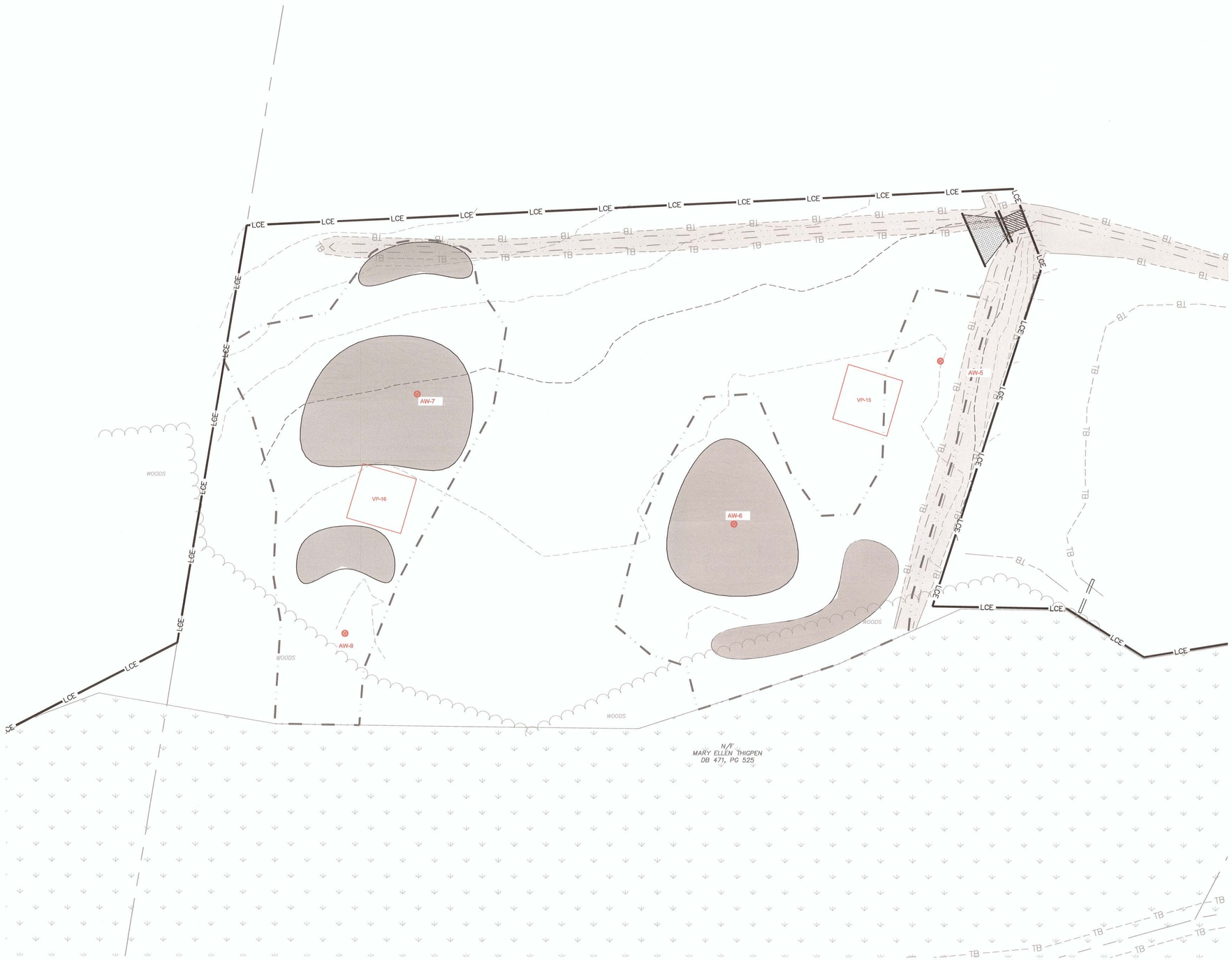
DRAWING TITLE:
WETLAND 2

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

DRAWING NUMBER:
22

PROJ. NO.:
2012009200RA



LEGEND

- AS-BUILT CONTOUR MAJOR
- AS-BUILT CONTOUR MINOR
- AS-BUILT CHANNEL LIMITS
- AS-BUILT IN-STREAM STRUCTURE
- EXISTING TOP OF BANK
- EXISTING BOTTOM OF BANK
- EXISTING (ORIGINAL) CHANNEL FOOTPRINT
- PROPOSED CHANNEL CENTERLINE
- PROPOSED TOP OF BANK
- LIMITS OF PROPOSED CONSERVATION EASEMENT
- LOG TOE PROTECTION (PROPOSED)
- LOG STRUCTURE (PROPOSED)
- LOG GRADE CONTROL STRUCTURE (PROPOSED)
- DOUBLE LOG DROP (PROPOSED)
- PROPOSED TEMPORAL HABITAT AREA
- PROPOSED FILL AREA
- PROPOSED WETLAND
- PROPOSED CHANNEL PLUG
- PROPOSED CHANNEL PLUG W/ OVERFLOW SPILLWAY
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- BEDDED LOG STRUCTURE (PROPOSED)
- FLOODPLAIN SILL (PROPOSED)
- DIFFUSE FLOW STRUCTURE (PROPOSED)
- PROPOSED LOG GRADE CONTROL (PROFILE)
- PROPOSED LOG STRUCTURE (PROFILE)
- PROPOSED DOUBLE LOG DROP (PROFILE)
- PROPOSED BEDDED LOG STRUCTURE (PROFILE)
- AS-BUILT CHANNEL CENTERLINE (PROFILE)
- AS-BUILT LEFT TOP OF BANK (PROFILE)
- AS-BUILT RIGHT TOP OF BANK (PROFILE)
- AS-BUILT STRUCTURE (PROFILE)

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NC. LICENSE NO. F-0374

NORTH CAROLINA PROFESSIONAL SEAL 031405 ENGINEER ANN F. MULLEN
12/10/15

FULL SCALE: 1"=30 H
0 30 60
2" = FULL SCALE
1" = HALF SCALE

MARK	DATE	DESCRIPTION

REVISIONS:
RELEASED FOR: RECORD DRAWINGS
PLOT DATE: 12/10/15

PROJECT NAME: BEST STREAM & WETLAND RESTORATION PROJECT
RECORD DRAWINGS
RESOURCE ENVIRONMENTAL SOLUTIONS, LLC

DRAWING TITLE: WETLAND 3

OWNER / 24 HR CONTACT:
ADDRESS:
PHONE:
MOBILE:

PROJ. DATE: NOV 2014
Q.C.: FM
Q.C. DATE: DEC 2015

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