MITIGATION PLAN – FINAL

Moores Fork Stream Restoration Project
Surry County, North Carolina
EEP Project No. 94709

Upper Yadkin River Basin
Cataloging Unit 03040101

Prepared for:

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699-1652

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EXECUTIVE SUMMARY

The NCDENR Ecosystem Enhancement Program (EEP) provides off-site compensatory wetland and stream mitigation to private sector, state government agencies, municipalities, schools, military bases and other applicants through its In Lieu Fee Programs. EEP is proposing the Moores Fork Stream Restoration Project (project) to fulfill stream mitigation requirements accepted by this program for the Upper Yadkin River Basin (CU 03040101). Through this project, EEP proposes to restore, enhance and preserve approximately 19,587 linear feet (LF) of Moores Fork and thirteen previously unnamed tributaries (UTs), provide livestock fencing and alternative water sources to keep livestock out of the streams, remove invasive plant species across the project, and establish native riparian buffers. Based on preliminary estimates from the design proposed in this Mitigation Plan, the Moores Fork Stream Restoration Project will net 11,610 stream mitigation credits through a combination of restoration, enhancement I and II, and preservation.

This Mitigation Plan describes specific project goals and objectives as they relate to EEP's programmatic goals (including watershed planning), provides baseline data on the existing conditions of Moores Fork and its UTs at the project site, and describes the methodologies that were used to develop the preliminary design. The Mitigation Plan also outlines the performance standards and monitoring protocol that will be used to evaluate the project’s success and describes long term management strategies for protecting and maintaining the restoration site in perpetuity.

This Mitigation Plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- EEP In-Lieu Fee Instrument signed and dated July 28, 2010

These documents govern EEP operations and procedures for the delivery of compensatory mitigation.

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1.0 RESTORATION PROJECT GOALS AND OBJECTIVES

EEP develops River Basin Restoration Priorities (RBRP) to guide its restoration activities within each of the state's 54 cataloging units. RBRPs delineate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds are called Targeted Local Watersheds (TLWs) and receive priority for EEP planning and restoration project funds.

The 2009 Upper Yadkin RBRP (www.nceep.net/services/restplans/Upper_Yadkin_RBRP_2009.pdf) identified the Stewarts Creek 14-digit HUC 03040101110010 as a TLW. Agriculture is the primary land use in the watershed (36% agriculture land cover and only 3% impervious cover) and the RBRP identified degraded riparian buffers as the major stressor to water quality. There are 12 permitted animal operations and 37% of the Stewarts Creek watershed has non-forested riparian buffers. In addition to being located within an EEP TLW, the Moores Fork drainage was identified as a priority subwatershed for stream restoration and agricultural BMPs during the initial Upper Yadkin-Ararat River local watershed planning (LWP) initiative conducted by EEP [EcoEngineering, 2008].

The site assessment phase of the project identified other stressors as well, including elevated water temperatures, excessive nutrient inputs, channel incision, bank erosion and sediment deposition. The Moores Fork Stream Restoration Project was identified as an opportunity to improve water quality and aquatic and terrestrial habitats within the TLW.

The project goals address stressors identified in the TLW and include the following:

- Improve water quality in Moores Fork and the UTs through reductions in sediment and nutrient inputs from local stressors/sources;
- Create conditions for dynamic equilibrium of water and sediment movement between the supply reaches and project reaches;
- Promote floodwater attenuation and secondary functions associated with more frequent and extensive floodwater contact times;
- Improve in-stream habitat by increasing the diversity of bedform features;
- Enhance and protect native riparian vegetation communities; and
- Reduce fecal, nutrient, and sediment loads to project streams by promoting and implementing livestock best management practices.

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

- Restoration of the dimension, pattern, profile of approximately 1,828 LF of Moores Fork and 243 LF of one UT;
- Restoration of the dimension and profile (Enhancement I) of the channel for approximately 2,832 LF of Moores Fork and 3,760 LF of three UTs;
- Limited channel work coupled with livestock exclusion, gully stabilization, invasive species control and buffer planting (Enhancement II) on approximately 761 LF of Moores Fork and 5,884 LF along five UTs;
- Livestock exclusion fencing and other best management practice installations;
- Invasive plant species control measures across the entire project wherever necessary; and
- Preservation of approximately 4,279 LF of relatively un-impacted forested streams in permanent conservation easement.

2.0 SITE SELECTION

2.1 Directions to Site

The Moores Fork project site is located northwest of Mount Airy in Surry County, North Carolina. To access the site from Asheville, take I-40 East towards Statesville to Exit 152B. Merge on I-77 North toward Elkin and travel approximately 49 miles. Take Exit 100 (North Carolina 89) toward Mt. Airy and Galax. Turn right onto North Carolina 89 (West Pine Street) and travel approximately 2 miles. Turn left onto Pine Ridge Road and travel approximately 0.2 mile and turn right onto Horton Road. The project site is located on both sides of Horton Road. A site vicinity map (Figure 1) and USGS topographic map (Figure 2) are attached for review. Latitude and longitude for the site are 36.506671 N and 80.704115 W, respectively.

2.2 Historical Conditions and Future Land Use Trends

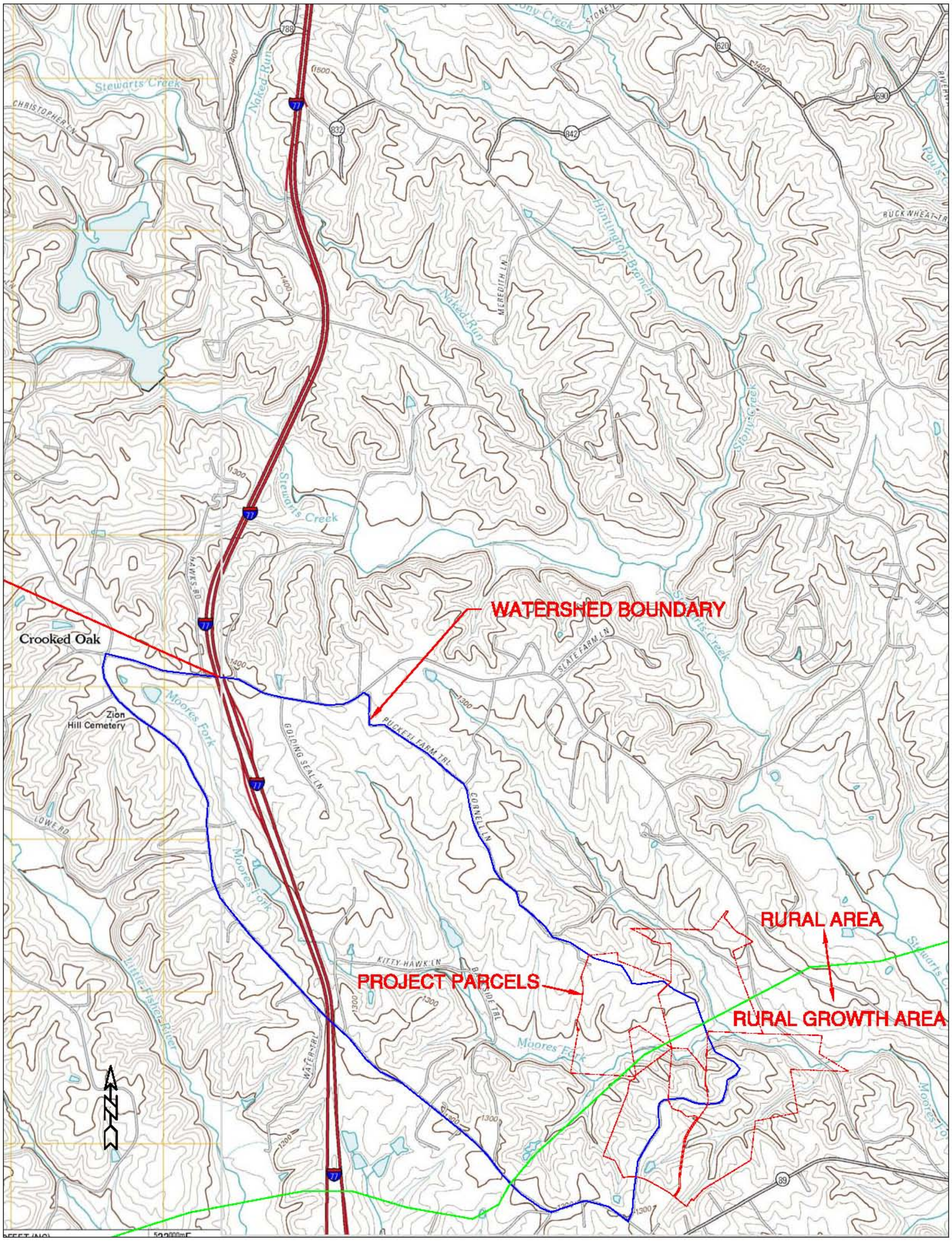
Reference is made in the following discussions to project reaches and design stationing as shown on the attached preliminary plans (Appendix D). The project site falls within five parcels encompassing 461 acres. One of the parcels (11.7 acres) is owned by William L. Horton, Jr. and the other four parcels are owned by Maple Ridge Farm. Maple Ridge Farm is an operating dairy and a portion of the Horton parcel is used as pasture for the dairy cows. An 18-acre area comprised of two outparcels is located near the center of the site. Dairy operations are focused at a cluster of barns, silage pits and small buildings in a 4-acre area near the farm entrance along Horton Road. A few other barns and sheds are located elsewhere on the property.

The majority of the stream length targeted for channel modifications lacks a robust vegetative buffer. Enhancement and preservation are proposed for stream reaches in areas of the site that do contain functional buffers, including much of the Barn Tributary drainage, UTs 6 and 7, portions of the Silage Tributary drainage, and the right floodplain over the downstream half of Moores Fork. Vegetation in the Barn Tributary drainage includes mature trees (greater than 18 inches dbh) and dense mountain laurel. On the downstream Moores Fork floodplain, several trees in the 12 to 18 inches dbh size range are present.

Based on a review of aerial photograph of the project site, land use and the extent of cleared land have not changed significantly since at least 1982 (Figure 5). Between 1948 (Figure 6) and 1982, upland areas in the Corn, Silage and Barn tributary drainages were cleared of trees and converted to pasture or row crop fields. The permanent stream crossings on the project site include a clear-span bridge over Moores Fork near the mid-point of the project reach and two culverts at the upstream and downstream ends of the Corn Tributary. While it is difficult to be certain, the aerial photographs indicate the crossing locations have remained consistent since at least 1982. Judging by the deck materials, the bridge over Moores Fork appears to have been improved or replaced within the past 10 years. The landowners indicated that they have reinforced the stream banks upstream of the abutments on multiple occasions over the past several years.

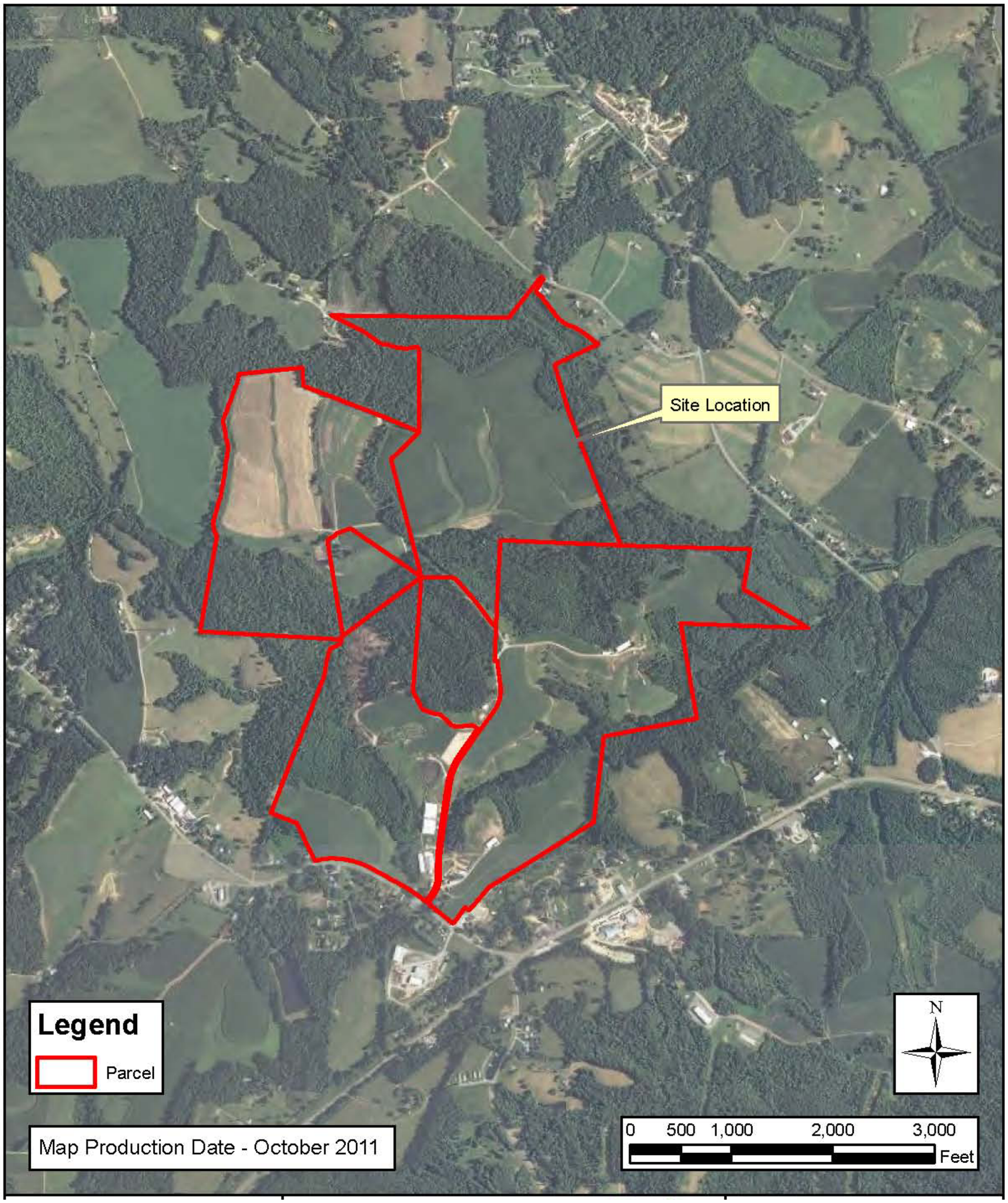
In October 2006, Surry County issued *Land Use Plan 2015* which describes growth, land use changes and future development policies through 2015. The Moores Fork site is located at the divide between a rural land use area and a rural growth area. A rural growth area is defined as being appropriate for medium density residential development. Land to the west of the dividing line, leading to upland areas of the Moores Fork watershed, is designated as rural land, with a best use of agriculture, low density residential, forestry and other similar practices. Technical Memorandum Task 2, Upper Yadkin Basin Local Watershed Plan identified the Moores Fork sub-watershed as a high priority for stream restoration, presumably because of its low population density, agricultural land uses and potential for improvement. Current and projected future land use for this watershed supports an ecosystem investment at this site.

As Shown	**Moores Fork Restoration** **Surry County, NC**	**Figure 1: Site Vicinity Map**

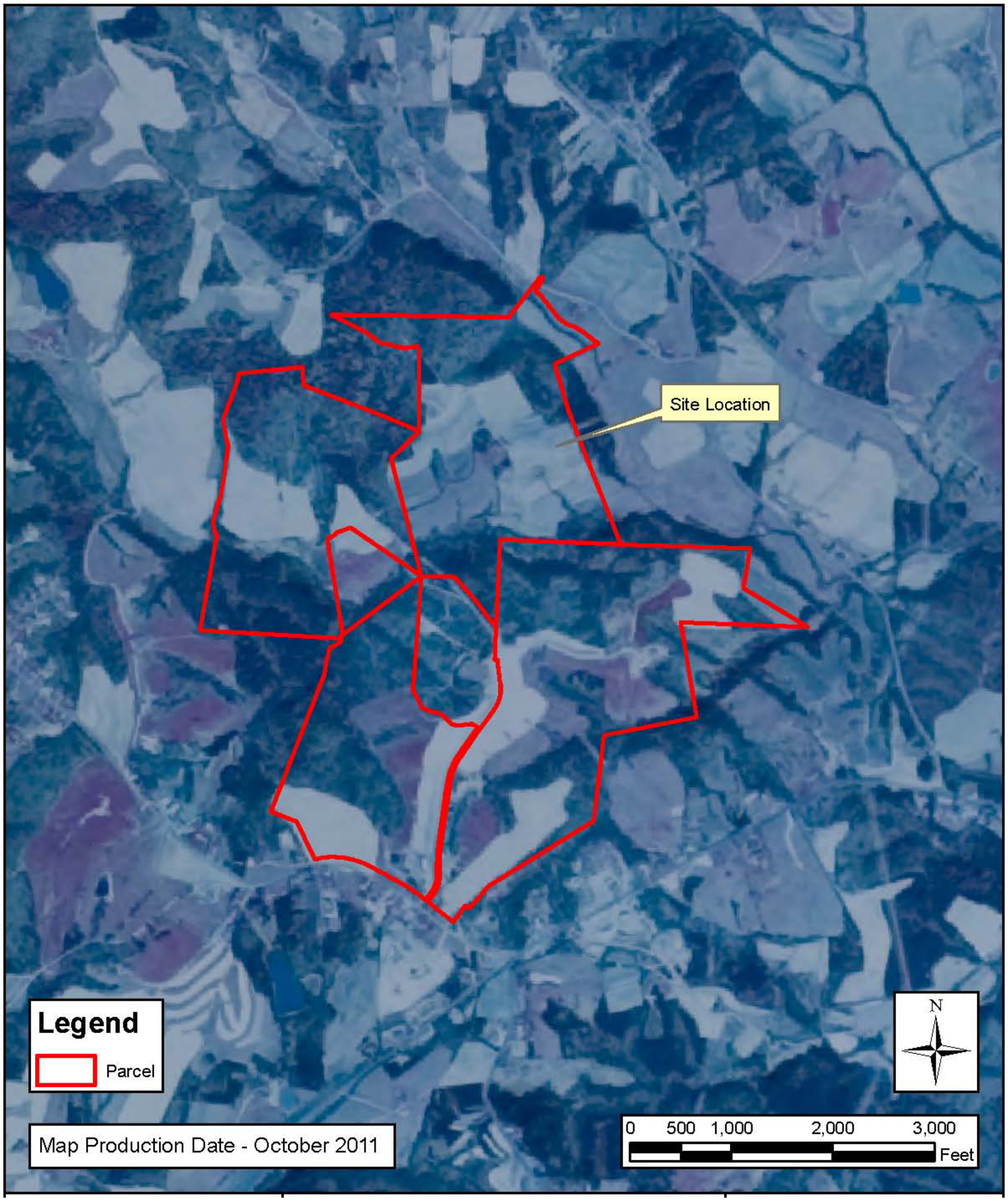


Scale: 1" = 2,500'	Moores Fork Restoration Surry County, NC	Figure 2: Watershed Map

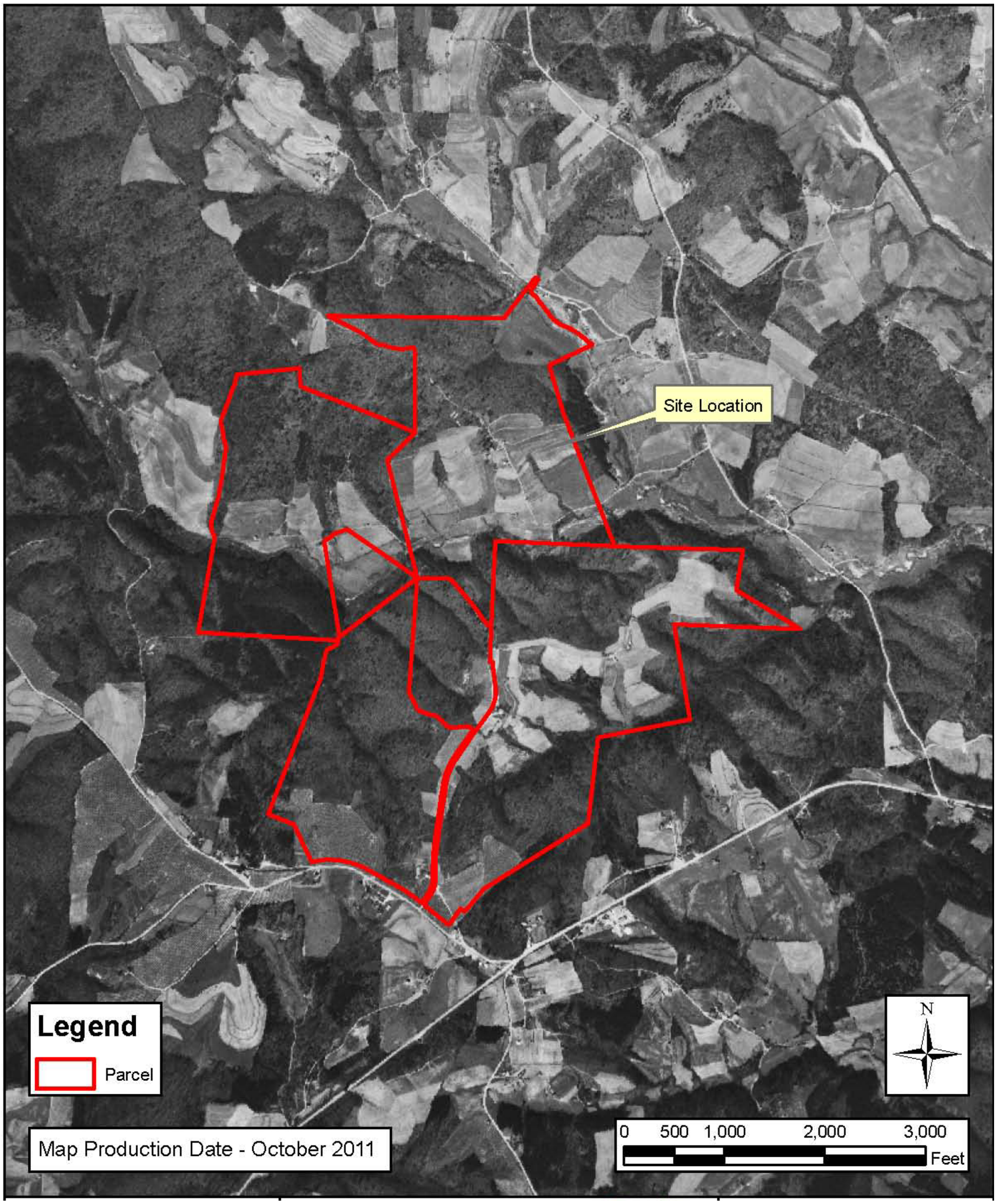
Scale: As Shown	Moores Fork Restoration Surry County, NC	Figure 3: Soils Map



Scale: As Shown	Moores Fork Restoration Surry County, NC	Figure 4: Current Conditions (2010 Aerial)



Scale: As Shown	Moores Fork Restoration Surry County, NC	Figure 5: Historical Conditions (1982 Aerial)



Scale: As Shown	Moores Fork Restoration Surry County, NC	Figure 6: Historical Conditions (1948 Aerial)

2.3 Site Modifications, Stressors and Ecological Services

Throughout the project area site modifications have diminished the ecological services provided by riparian buffers and adjacent floodplains. Dairy and farming operations over the past several decades have deforested riparian buffers and allowed direct livestock access to stream, leading to elevated temperatures and nutrients which are the primary stressors identified for this sub-watershed within the TLW (EcoEngineering, 2008).

Moores Fork has also been impacted by channel straightening and dredging throughout much of the project reach, and levee construction in the upstream 1,800 LF. The levee is located on the left bank, is generally 1 to 2 feet high and has the effect of limiting floodplain access. Widespread bank erosion and mid-channel sediment deposition are visible throughout Moores Fork. With the exception of the upstream 1,700 LF of Moores Fork, cattle currently have direct access to the project streams. The majority of the cattle impacts are located along Moores Fork between stations 17+50 and 36+00, over the downstream half of the Silage Tributary and along both of the Cow Tributaries.

Runoff from barns, fields and silage pits near the headwaters of the Silage Tributary, the Cow Tributaries and UT1 has contributed to the forming of deep gullies. Bank heights of 6 feet or more are common in the upstream 2,000 LF of the Silage Tributary and the upstream 200 LF of UT1, above the intermittent break; bank heights on the Cow Tributaries are generally less than 3 feet. The silage pits will be relocated away from surface waters and measures to manage runoff quantity and quality from upland areas will be incorporated into a farm management plan that will be implemented in conjunction with the stream enhancement efforts.

The Corn Tributary buffers have been impacted by past logging, by recent clearing for an overhead electric line, and by farm road construction, but impacts are generally limited to upland areas well away from the channel. The downstream 100 LF reach of the Corn Tributary is incised and the right bank has been cleared of woody vegetation. The Pond Tributary is impacted by the dam upstream of the project reach, by a culvert on a farm road downstream of the dam, and by cattle feeding area near its confluence with Moores Fork. The primary impacts on the Barn Tributary are associated with a small dam that previously impounded the upstream 150 LF; the dam was breached several years ago, but woody buffer vegetation has yet to establish in the former impoundment and the short reach downstream. Some recent logging has impacted the buffer on the right side of the Barn Tributary, and logging debris is present in the channel in a few locations. The most significant impacts to UT1 are due to runoff from an upland corn field, which has formed two deep gullies above the headwaters and contributed excess fine sediment to the downstream reach.

Non-native plant species, particularly privet, multiflora rose and honeysuckle, are present in wooded areas of the site. The most severely impacted areas are located in the Silage Tributary drainage. The Corn Tributary drainage, and to a lesser extent the Barn Tributary drainage, are also impacted.

Table 1 summarizes stressors and ecological services needing enhancement in the project area.

Table 1. Stressors and Proposed Ecological Service Enhancements

Stressor	Ecological Services Needing Enhancement
Channel incision	Flood attenuation, fine sediment storage, maintenance of stable channel bed and banks
Bank erosion and mid-channel sediment deposition	Equilibrium sediment transport, maintenance of in-stream riffle and pool habitats
Buffer deforestation	Filtration of runoff, thermal regulation, input of organic matter
Invasive, exotic vegetation	Riparian buffer habitat, species diversity
Direct livestock access to streams	Protection of water quality from nutrient inputs.

2.4 Evolutionary Trends

Appendix C includes a two-page inventory map showing areas of significant bank erosion, bar formation, gully formation and debris jams. Moores Fork appears to have been straightened and shifted to the edge of its valley between stations 19+00 and 38+00. There is also evidence of possible channelization or lateral migration between stations 56+00 and 62+00. This assessment is supported by observations of the floodplain topography, which shows low points in the floodplain and wetland areas indicative of relict channel sections offset 100 feet or more from the current channel. Additional supporting data were gathered from five of six hand auger borings in the floodplain that encountered gravel indicative of the one-time creek bed at depths of 3.7 to 4.7 feet below existing grade. Based on a review of aerial photographs, this straightening and/or lateral migration was completed to its current conditions prior to 1948. The shortened stream length and resulting steepening of the channel profile likely set an incision process in motion. Bedrock is visible throughout much of Moores Fork and it appears that the bedrock has limited the depth and extent of channel incision. Observations of a gravel layer in the bank near the downstream end of the project indicate the channel has down-cut 1 to 2 feet.

The channel modifications, incision and subsequent widening have created bank stability and sediment transport problems, particularly when combined with buffer vegetation removal and livestock trampling. Moores Fork appears to be less than halfway on a trajectory from a C-type steam to an F-type stream, as evidenced by the following (refer to project site photographs, section 2.5):

- Extensive, ongoing bank erosion;
- Leaning and fallen trees;
- Channel cross sectional areas up to nearly three times the estimated bankfull areas;
- Bank heights up to twice the bankfull depth; and
- Frequent, large mid-channel sediment bars.

The Soil Survey of Surry County indicates most of the rock in the area strikes northeast-southwest and dips northwest. The dominant soils at the site are in the Fairview series, which are residual sandy clays, the products of in-situ weathering of the parent bedrock. The residual soils are overlain by alluvial soils in the Moores Fork floodplain.

Even the relatively modest incision observed throughout much of the project reach has confined large flows to the channel, which in turn has led to bank erosion, widening and mid-channel sediment deposition. While most obvious in Reach 2 through a pasture immediately upstream of the bridge, this scenario is ongoing in the wooded reaches downstream of the bridge as well. Left unchecked, this process of widening and mid-channel deposition will likely continue as leaning trees fall and expose erodible soils. The evolutionary trend suggests that the stream will migrate laterally and form a new cross section until the system eventually reaches equilibrium with its water and sediment supply.

Flow in the Pond Tributary is affected greatly by the upstream pond located about 200 feet upstream of the project reach; there appears to be a moderate storage volume in the pond to mitigate flood flows to the downstream reach. Downstream of the farm road, the Pond Tributary is badly trampled by cattle, and while an evolutionary trend is difficult to define, this reach will not recover without intervention. The Corn Tributary is generally stable despite being confined in a deep V-shaped valley and impacted by logging debris. Bankfull bench construction and bank sloping are warranted in the short reach at the downstream end to address vertical banks, but the majority of the reach should respond well to debris removal and buffer restoration. The instability over the upstream reach of the Barn Tributary is attributed to the former dam and impoundment. The dam breach is located at the upstream end of a highly incised reach that will continue to erode laterally unless the unstable banks are addressed. At its downstream limit, the Barn Tributary is highly sinuous and suffers from a lack of woody vegetation on the banks, but it is generally stable. A short reach of the Barn Tributary that flows off the property has been excluded from the project.

The upstream 3,000 LF of the Silage Tributary and both Cow tributaries are actively incising through their steep, V-shaped valleys, with numerous headcuts evident in the profiles. It appears that the incision was set in motion by an increase in runoff from adjacent fields and pastures following initial clearing several decades ago.

Landowners indicated that an on-line pond was once present in the Silage Tributary channel, but the precise location of the former pond is not known. Removal of the dam and rapid drawdown of the impoundment may have also initiated some headcut erosion. Given the relatively small size of the watersheds, it is likely that these streams were once shorter and the bank heights much lower than they are now, with hydrology governed by groundwater rather than runoff. It appears that the changing flow regime began the incision and degradation, and buffer deforestation and cattle trampling exacerbated the problems. The upstream end of UT1 exhibits characteristics similar to the Cow tributaries, but the degradation over its downstream reach is less severe.

With the exception of the downstream reach of the Silage Tributary, the streams in this drainage are currently G type streams that are unlikely to recover without intervention. Natural recovery could be expected to hinge on the establishment of volunteer buffer vegetation, but the steam banks and upper slopes appear to lack the geotechnical stability and nutrients necessary for this to happen in the foreseeable future.

The downstream 850 LF of the Silage Tributary flows through a flatter and slightly wider valley; here the evolutionary sequence (C to F) is similar to that observed in Moores Fork, with bank erosion and lateral migration ongoing. As with Moores Fork, this lateral migration will likely continue without intervention.

The other project streams, UT's 2, 3, 6, 7, 8, 9 and 10, are suitable for preservation by virtue of stable morphology and intact buffers. The reaches of UT4 and UT11 on the property are short and hydrologically disconnected from the remainder of the mitigation areas, and are therefore not included in the project. UT5 was originally included in the project but the final boundary survey revealed that it is not on the property, so it has been removed from the project. For a similar reason, a short reach of UT6 was removed from the project as well.

2.5 Project Site Photographs

Moores Fork, looking downstream from station 13+00; mid-channel deposition; levee on left bank; April 20, 2011

Moores Fork; looking downstream from station 18+50; direct cattle access; bank erosion; February 8, 2011

Moores Fork; looking upstream from station 24+00; cattle impacts and buffer deforestation; February 8, 2011

Moores Fork, looking downstream from station 28+00; bank erosion and mid-channel deposition; April 20, 2011

Moores Fork, looking downstream from station 34+00; clear-span bridge, riprap armor; April 20, 2011

Moores Fork, looking downstream from station 42+00; mid-channel deposition, bank erosion; April 20, 2011

 Moores Fork, looking downstream from station 50+00; mid-channel deposition, buffer impacts; bank erosion; April 20, 2011	 Moores Fork, near station 60+00; bank erosion; channel incision; January 16, 2012
 Barn Tributary at downstream end; bank erosion and buffer impacts April 20, 2011	 Barn Tributary at upstream end; former impounded area; February 8, 2011
 Pond Tributary, looking downstream from dam; cattle impacts; February 8, 2011	 Corn Tributary, looking downstream from upstream end; logging damage; February 8, 2011

 Silage Tributary, looking upstream at headwaters; channel incision and bank erosion; February 8, 2011	 Silage Tributary, looking downstream near property line; bank erosion and cattle impacts; April 19, 2011
 Cow Tributary 1, looking downstream; bank erosion, incision and cattle impacts; February 8, 2011	 Cow Tributary 2, looking downstream; bank erosion and channel incision; February 8, 2011
 Barn Tributary, typical buffer impacts and logging debris; January 16, 2012	 UT1, looking upstream near downstream end; sediment impacts, privet; January 16, 2012

3.0 SITE PROTECTION INSTRUMENT

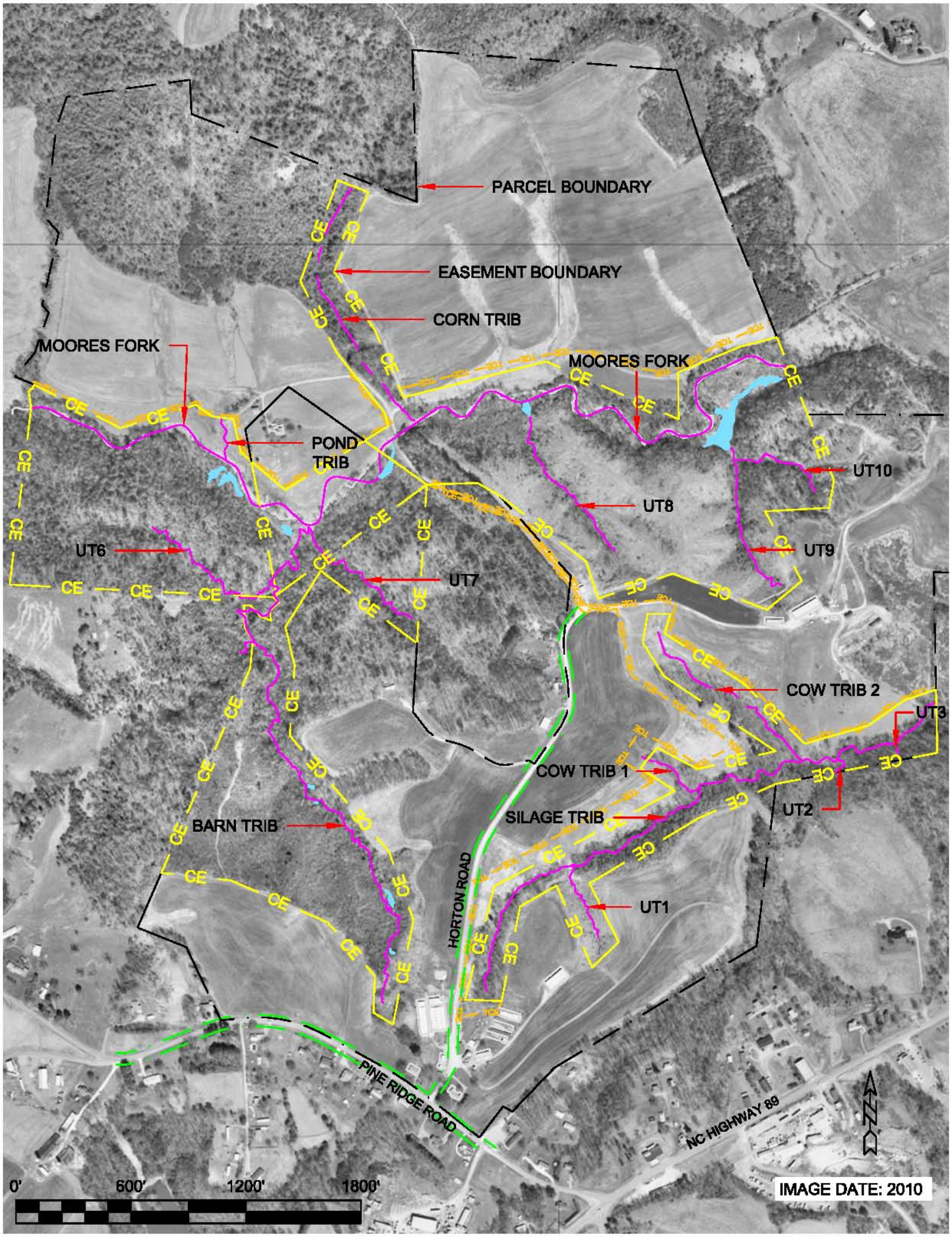
The land required for the construction, management, and stewardship of this mitigation project includes portions of the following parcels. A copy of the land protection instrument(s) will be included in Appendix A upon completion of the documents.

Table 2: Summary of Project Land Parcels and Site Protection Instruments

Tract	Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage protected
A	Maple Ridge Farm & Construction, Inc.	4090-57-5440 4090-39-0783 4090-49-7679	Surry	Conservation Easement	504;1127 504;1134 426;1017	**126.46 ac**
B	Horton, William L Jr. & Laura Horton	4090-39-0783	Surry	Conservation Easement	325;461 REF. 388;41	**7.87 ac**

All site protection instruments require 60-day advance notification to the Corps and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

Figure 7 shows the current parcel boundaries and the proposed conservation easement boundaries.



As Shown	Moores Fork Restoration Surry County, NC	Figure 7: Site Protection Instrument Boundaries

4.0 BASELINE INFORMATION

Table 3: Project Baseline Information (p. 1 of 2)

Project Name	Moores Fork Restoration
County	Surry
Project Area (acres)	~140 (conservation and temporary construction easements)
Project Coordinates (latitude and longitude)	36.506671 N , 80.704115 W

Project Watershed Summary Information

Physiographic Province	Piedmont
River Basin	Yadkin
USGS Hydrologic Unit 8-digit	03040101
USGS Hydrologic Unit 14-digit	03040101100010
DWQ Sub-basin	Pee Dee River Subbasin 03-07-02
Project Drainage Area (acres)	1,527 ac (2.39 sq. miles)
Project Drainage Area Percentage of Impervious Area	<5%
CGIA Land Use Classification	Cropland and Pasture, Confined Animal Operations

Reach Summary Information

Parameters	Reaches 1/2 Moores Fork	Reach 3 Moores Fork	Silage Trib	Cow Trib 1	Cow Trib 2
Existing length of reach (linear feet)	2,397	2,856	3,348	167	767
Valley classification (Rosgen)	VIII	VIII	II / IV	II	II
Drainage area (acres)	1,193	1,527	156	4	16
NCDWQ stream identification score	35	34.5	23.5	20	23.5
NCDWQ Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Morphological Description (Rosgen stream type)	C4	C4	G4/C4	G5	G5
Evolutionary trend	C-F	C-F	G-F	G	G
Underlying mapped soils	CsA, FsE	CsA, FsE	FeD2	FeD2	FeD2
Drainage class	well drained	well drained	well drained	well drained	well drained
Soil Hydric status	not hydric	not hydric	not hydric	not hydric	not hydric
Slope	0.0078	0.0055	0.0297	0.0559	0.0384
FEMA classification	Not in SFHA	Not in SFHA	Not in SFHA	Not in SFHA	Not in SFHA
Native vegetation community	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest
Percent composition of exotic invasive vegetation	40	40	50	<10	<10

Wetland Summary Information

Parameters	Wetland 1	Wetland 2	Wetland 3	Wetland 4
Size of Wetland (acres)	0.49 ac	0.04 ac	0.08 ac	0.15 ac
Wetland Type	riparian non-riverine	riparian non-riverine	riparian non-riverine	riparian non-riverine
Mapped Soil Series	FsE	FsE	CsA	FsE and CsA
Drainage class	well drained	well drained	well drained	well drained
Soil Hydric Status	not hydric	not hydric	not hydric	not hydric
Source of Hydrology	UT9 and UT10	UT8	Toe seep	Toe seep
Hydrologic Impairment	none	none	none	none
Native vegetation community	Dist. Small Stream/ Narrow FP Forest	Dist. Small Stream/ Narrow FP Forest	Dist. Small Stream/ Narrow FP Forest	Dist. Small Stream/ Narrow FP Forest
% composition of invasive vegetation	20	65	<10	<10

Regulatory Considerations

Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States – Section 404	Y	N	
Waters of the United States – Section 401	Y	N	
Endangered Species Act	Y	Y	CE Approved 12/21/11
Historic Preservation Act	N	N/A	
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	N	N/A	
FEMA Floodplain Compliance	N	N/A	
Essential Fisheries Habitat	N	N/A	

Table 3: Project Baseline Information (p. 2 of 2)

Project Name	Moores Fork Restoration
County	Surry
Project Area (acres)	~140 (conservation and temporary construction easements)
Project Coordinates (latitude and longitude)	36.506671 N , 80.704115 W

Project Watershed Summary Information

Physiographic Province	Piedmont
River Basin	Yadkin
USGS Hydrologic Unit 8-digit	03040101
USGS Hydrologic Unit 14-digit	03040101100010
DWQ Sub-basin	Pee Dee River Subbasin 03-07-02
Project Drainage Area (acres)	1,527 ac (2.39 square miles)
Project Drainage Area Percentage of Impervious Area	<5%
CGIA Land Use Classification	Cropland and Pasture, Confined Animal Operations

Reach Summary Information

Parameters	Pond Trib	Barn Trib	Corn Trib	UT1	
Existing length of reach (linear feet)	194	3,498	2,464	466	
Valley classification (Rosgen)	VIII	IV	IV	IV	
Drainage area (acres)	27	184	30	6	
NCDWQ stream identification score	20	36.5	21	23	
NCDWQ Water Quality Classification	WS-IV	WS-IV	WS-IV	WS-IV	
Morphological Description (Rosgen stream type)	B4/5	G4	G4	B4	
Evolutionary trend	B-C-F	G-F	G-F		
Underlying mapped soils	CsA	FeD2, FsE	CsA, FsE	FeD2	
Drainage class	well drained	well drained	well drained	well drained	
Soil Hydric status	not hydric	not hydric	not hydric	not hydric	
Slope	0.0290	0.0250	0.0571	0,04 +/-	
FEMA classification	Not in SFHA	Not in SFHA	Not in SFHA	Not in SFHA	
Native vegetation community	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest	Felsic Mesic Forest	
Percent composition of exotic invasive vegetation	<10	25	60	40	

Wetland Summary Information

Parameters	Wetland 5	Wetland 6		
Size of Wetland (acres)	0.03 ac	0.06 ac		
Wetland Type	riparian non-riverine	riparian non-riverine		
Mapped Soil Series	FeD2	FsE and FeD2		
Drainage class	well drained	well drained		
Soil Hydric Status	not hydric	not hydric		
Source of Hydrology	Toe Seep	Toe seep		
Hydrologic Impairment	none	none		
Native vegetation community	Dist. Small Stream/ Narrow FP Forest	Dist. Small Stream/ Narrow FP Forest		
% composition of invasive vegetation	<10	20		

5.0 DETERMINATION OF CREDITS

Mitigation credits presented in these tables are projections based on site design. Upon completion of site construction, the project components and credits will be revised to be consistent with the as-built conditions. The high end of the credit ratio spectrum for Enhancement Level I was assigned to Moores Fork Reach 3 and Barn Tributary Reach 1, where extensive bank shaping, bankfull bench construction, in-stream structure installation and buffer planting are proposed. Similarly, where gully repairs and extensive farm conservation plan improvements are proposed upland of jurisdictional streams and no credit is requested (Cow Tributaries and UT1), we have assigned the high end of the Enhancement Level II credit ratio spectrum. Descriptions of each reach with proposed treatments are presented Table 4a below.

Table 4a. Reach Descriptions

Reach	Characteristics and Uplift Discussion
Moores Reach 1	Relatively stable bed and banks; bedrock common; well vegetated right bank; levee, livestock fencing and narrow buffer on left bank.
	Uplift gained through buffer planting on left bank and wide conservation easement on forested right bank and upland areas.
Moores Reach 2	Impacted by direct cattle access; widespread bank erosion and mid-channel deposition; some matures trees on right bank and floodplain; small wetland and clear span bridge at downstream end.
	Uplift gained by construction of new off-line channel with in-stream structures and planted buffers. Livestock fencing will be installed. Existing wetland will be protected during construction with fencing.
Moores Reach 3	Impacted by buffer vegetation removal; widespread bank erosion and mid-channel deposition; some matures trees on right bank and floodplain; clear span bridge at upstream end; eroding gullies entering from left floodplain; small wetland on right floodplain near station 44+00.
	Uplift gained mainly by on-line enhancements including extensive bankfull benching, bank sloping, in-stream structures, bioengineering bank treatments and buffer planting. Short off-line reaches will be constructed where appropriate. Existing wetland will be protected during construction with fencing.
Silage Reach 1	Impacted by direct cattle access and vegetation removal; widespread gully incision and bank erosion; some matures trees on both banks and upland areas; invasive species common.
	Uplift gained by on-line enhancement including construction of new step-pool profile, bank shaping, removal of invasive species, buffer planting and relocation of silage pits away from the stream as part of a farm management plan. Livestock fencing will be installed.
Silage Reach 2	Impacted by direct cattle access and vegetation removal; widespread bank erosion; some matures trees on both banks and upland areas; invasive species common.
	Uplift gained by on-line enhancements including isolated bankfull benching, bank sloping, in-stream structures, invasive species removal and buffer planting. Livestock fencing will be installed.
Cow Tributaries 1 and 2	Impacted by direct cattle access and vegetation removal; gully incision and bank erosion; some matures trees on both banks and upland areas.
	Uplift gained by on-line enhancements including, bank sloping, in-stream structures, buffer planting and upland gully stabilization/runoff management. Livestock fencing will be installed.

Table 4a. Reach Descriptions	
Reach	**Characteristics and Uplift Discussion**
Pond	Impacted by direct cattle access and vegetation removal; bank trampling and erosion; no woody buffer vegetation.
	Uplift gained by construction of off-line restored channel with in-stream structures, buffer planting and livestock fencing.
Barn Reach 1	Impacted by past dam/pond construction and vegetation removal; sparse woody buffer vegetation.
	Uplift gained by mainly on-line enhancements including removal of the dam remnants, extensive bankfull benching, bank sloping, in-stream structures, and buffer planting.
Barn Reach 2	Impacted by logging and associated debris stockpiling on right upland areas; some large debris accumulations are present in the channel, causing isolated bank erosion; left bank and upland areas well vegetated; isolated invasive species.
	Uplift gained by removal of debris, isolated bank stabilization, invasive species removal and buffer planting. Buffer width on left upland are generally 200 feet or greater.
Corn Reach 1	Impacted by logging and associated debris stockpiling in upland areas; some debris accumulations and pockets of invasive species are present near the channel and in the buffers.
	Uplift gained by removal of debris, isolated invasive species removal and buffer planting. Buffer widths are generally 70 feet or greater.
Corn Reach 2	Impacted by vegetation removal and channel incision; no woody buffer vegetation on right bank.
	Uplift gained by on-line enhancements including continuous bankfull benching, bank sloping, in-stream structures and buffer planting.
UT1	Impacted by vegetation removal and encroachment of invasive species; gully incision and bank erosion; some matures trees on both banks and upland areas.
	Uplift gained by on-line enhancements including, invasive species removal, buffer planting and upland gully stabilization/runoff management. Livestock fencing will be installed.
Preservation Reaches UTs 2,3,6,7,8,9,10	Buffers generally intact and channel bed and banks in stable forms. Buffer vegetation includes a mix of hardwoods and woody shrubs. Potential encroachment from adjacent fields and pastures threatens to degrade the quality of these streams.
	Uplift gained by protection of intact buffers and streams with conservation easements that extend well beyond the minimum 50-foot top of bank offsets. In several areas, buffer widths exceed 200 feet. Livestock fencing will be installed in areas where pastures are adjacent to easement boundaries. The farm management plan will improve water quality in upland areas by relocating feed lots and silage pits away from surface waters.

With the descriptions of existing conditions and proposed uplifts presented in Table 4a as a basis, Table 4b below presents the proposed mitigation credits for each project reach.

Table 4b: Projected Mitigation Credits

Moores Fork Stream Mitigation
Surry County, North Carolina
EEP Project No. 94709

Stream Mitigation Credits

Type	Restoration	Enhancement I	Enhancement II	Preservation
Total	**2,071**	**5,776**	**2,907**	**856**

Project Components

Project Component -or- Reach ID	Stationing/Location	Existing LF	Approach	Restoration -or- Restoration Equivalent	Proposed LF	Mitigation Ratio
Moores Reach 1	STA 989-1750	761	N/A	EII	761	2.5:1
Moores Reach 2	STA 1750-3578	1,636	P2	R	1,828	1:1
Moores Reach 3	STA 3578-6410	2,856	P2/3	EI	2,832	1:1
Silage Reach 1	STA 1000-1900	900	P1	EI	900	1:1
Silage Reach 2	STA 1900-4348	2,448	P3	EI	2,448	1.5:1
Cow 1	STA 1219-1386	167	P4	EII	167	1.5:1
Cow 2	STA 1331-2098	767	P4	EII	767	1.5:1
Pond	STA 1000-1243	194	P2	R	243	1:1
Barn Reach 1	STA 1000-1300	300	P3	EI	300	1:1
Barn Reach 2	STA 1300-3746; STA 4069-4757	3,134	N/A	EII	3,134	2.5:1
Corn Reach 1	STA 1000-2350	1,350	N/A	EII	1,350	2.5:1
Corn Reach 2	STA 2350-2462	112	P3	EI	112	1:1
UT1	STA 1000-1466	466	N/A	EII	466	2.5:1
Preservation Reaches	UTs 2,3,6,7,8,9,10	4,279	N/A	P	4,279	5:1

Component Summary

Restoration Level	Stream (linear feet)
Restoration	2,071
Enhancement I	6,592
Enhancement II	6,645
Preservation	4,279

6.0 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary US Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of credits will be subject to the criteria described below:

Table 5: Stream Credits Release Schedule

Monitoring Year	Credit Release Activity	Interim Release	Total Released
0	Initial Allocation – see requirements above	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (60%*)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (70%*)
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%*)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%*)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%*)
7	Seventh year monitoring report demonstrates performance standards are being met and project has received closeout approval	10%	90% (100%*)

* A reserve of 10% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met.

6.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan, can be released by the EEP without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the EEP Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

6.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the EEP will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring reports.

7.0 MITIGATION WORK PLAN

7.1 Target Streams

The Moores Fork site affords the opportunity to address the major stressors described in the RBRP for the Stewarts Creek watershed. The project design will enhance (and protect where appropriate) the ecological services threatened by these stressors. The proposed conservation easement boundaries will encompass the six wetlands at the site, but no work is proposed and no wetland mitigation credit is being sought. Table 6 below summarizes the links between each design objective proposed for this project and the ecological service improvements that can be achieved on a reach-by-reach basis. Specific site constraints and design measures for each reach, along with the target Rosgen stream types, are presented in Table 7.

Table 6: Design Objectives and Ecological Services

Design Objective	Enhanced Ecological Services	Project Reach				
		Moores Reach 1	Moores Reach 2	Moores Reach 3	Silage Trib	Cow Trib 1
Breach levee or create bankfull benches; restore stream to floodplain interaction.	a. Flood attenuation b. Fine sediment storage		✓	✓	✓	
Create new channel dimension, pattern and profile	a. Maintenance of stable channel bed and banks. b. Equilibrium sediment transport c. Maintenance of in-stream riffle and pool habitats		✓		✓	
Use in-stream structures and bank grading to promote stability, riffle and pool formation and sediment transport continuity for on-line reaches.	a. Maintenance of stable channel bed and banks. b. Equilibrium sediment transport c. Maintenance of in-stream riffle and pool habitats	✓		✓	✓	
Establish 50-foot wide riparian buffers with diverse group of native species.	a. Filtration of runoff b. Thermal regulation c. Input of organic matter	✓	✓	✓	✓	✓
Eradicate invasive exotic vegetation and seed source; replant buffer areas with native vegetation.	a. Riparian buffer habitat b. Robust species diversity	✓	✓	✓	✓	✓
Install new or additional livestock fencing to restrict livestock access to streams; provide alternative water sources.	a. Protection of water quality from nutrient and pathogen inputs. b. Protection of banks from livestock trampling	✓	✓	✓	✓	✓
Stabilize upland gullies using bioengineering techniques.	a. Maintenance of stable channel bed and banks. b. Protection of water quality from excess sediment inputs.			✓	✓	✓

Table 6: Design Objectives and Ecological Services, continued						
Design Objective	**Enhanced Ecological Services**	**Project Reach**				
		Cow Trib 2	**Pond Trib**	**Barn Trib**	**Corn Trib**	**UT1**
Create bankfull benches; restore stream to floodplain interaction.	a. Flood attenuation b. Fine sediment storage			✓	✓	
Create new channel dimension, pattern and profile	a. Maintenance of stable channel bed and banks. b. Equilibrium sediment transport c. Maintenance of in-stream riffle and pool habitats		✓			
Use in-stream structures and bank grading to promote stability, riffle and pool formation and sediment transport continuity for on-line reaches.	a. Maintenance of stable channel bed and banks. b. Equilibrium sediment transport c. Maintenance of in-stream riffle and pool habitats		✓	✓	✓	
Establish 50-foot wide riparian buffers with diverse group of native species.	a. Filtration of runoff b. Thermal regulation c. Input of organic matter	✓	✓	✓	✓	✓
Eradicate invasive exotic vegetation and seed source; replant buffer areas with native vegetation.	a. Riparian buffer habitat b. Robust species diversity	✓	✓	✓	✓	✓
Install new or additional livestock fencing to restrict livestock access to streams; provide alternative water sources.	a. Protection of water quality from nutrient and pathogen inputs. b. Protection of banks from livestock trampling	✓	✓		✓	✓
Stabilize upland gullies using bioengineering techniques.	a. Maintenance of stable channel bed and banks. b. Protection of water quality from excess sediment inputs.	✓				✓

Table 7. Target Streams, Constraints and Reach-Specific Measures			
Reach	**Target Stream Type (Slope)**	**Constraints**	**Reach-Specific Measures**
Moores R1	C4 (0.009)	Livestock grazing on left bank; bedrock in profile; steep upland slope on right; mature trees	Riparian buffer planting; invasive species removal; livestock fencing
Moores R2	C4 (0.007)	Livestock grazing ; bedrock in profile; mature trees; bridge at downstream end	New off-line channel; in-stream structures; bank grading; bankfull benches; riparian buffers; invasive species removal
Moores R3	C4 (0.007)	Corn field on left bank; bedrock in profile; mature trees; property line at downstream end	In-stream structures; bank grading; bankfull benches; riparian buffers; invasive species removal
Silage Tributary R1	B4 (0.036)	Steep, confined valley; mature trees; pasture on both banks; stormwater inputs	Bioengineering stabilization of upland gullies; new on-line strep-pool channel; in-stream structures; riparian buffers; invasive species removal; runoff controls
Silage Tributary R2	B4-C4 (0.020)	Livestock grazing; bedrock in profile; steep upland slopes; mature trees; property line at downstream end	In-stream structures; bank grading; bankfull benches; riparian buffers; invasive species removal; livestock fencing
Cow Tributaries 1 and 2	B4 (0.038-0.055)	Steep, confined valley; mature trees; pasture on both banks	Bioengineering stabilization of upland gullies; in-stream structures; riparian buffers; invasive species removal; runoff controls
Pond Tributary	C4 (0.018)	Culvert at upstream end; Moores Fork confluence; adjacent pasture	New off-line channel; in-stream structures; bank grading; bankfull benches; riparian buffers
Barn Tributary R1	E4b (0.025)	Steep, confined valley; stormwater inputs; connection to stable downstream reach	In-stream structures; bank grading; bankfull benches; riparian buffers; invasive species removal; runoff controls
Barn Tributary R2	E4b (0.025)	Steep, confined valley; mature trees	Logging debris and invasive species removal; isolated bank repairs; riparian buffers
Corn Tributary R1	B4 (0.02+/-)	Steep, confined valley; mature trees; corn field on both banks; farm roads at upstream and downstream ends	Logging debris and invasive species removal; riparian buffers
Corn Tributary R2	B4 (0.04+/-)	Mature trees on left bank; farm road at upstream end; Moores Fork confluence	In-stream structures; bank grading; bankfull benches; riparian buffers; invasive species removal
UT1	B4 (0.04+/-)	Steep, confined valley; mature trees; upland corn field/pasture	Bioengineering stabilization of upland gullies; invasive species removal; runoff controls

7.2 Target Plant Communities

The target plant community is a more robust and diverse version of the existing Felsic Mesic Forest plant community identified in the upland and relatively undisturbed reaches of the UTs. In upland areas where stream and floodplain grading are not proposed but where invasive exotic plants have encroached, buffer restoration design will include the following:

- Eradication of invasive exotic species;
- Preservation of desirable existing species; and

- Supplemental planting with selected native trees and shrubs to encourage a more diverse version of the target community.

Most of the areas proposed for stream and floodplain grading are currently pasture. The target plant community for these areas will be the same as the upland areas, but species within this community will be selected for their adaptation to streambank and floodplain conditions. Appendix C includes a table with several candidate species for buffer planting.

7.3 Wetlands

Four existing wetlands, wetland 4 between stations 21+00 and 27+00, wetland 3 near station 33+50, wetland 2 near station 44+00 and wetland 1 near station 56+00, are located within or close to proposed stream grading activities along Moores Fork. Wetlands 1 and 4 will not be directly impacted by stream grading and will be clearly marked in the field to protect them from damage during construction. Wetland 3 appears to be a relict channel segment and a roughly 500 square foot area will be impacted by stream restoration. The remainder of this wetland will be enhanced through a planted buffer and improved connection to overbank flows. A roughly 400 square foot area of wetland 2 will be impacted by stream restoration, but as with wetland 3, the remainder of the wetland will be enhanced through improved buffers and floodplain connectivity.

7.4 Design Methodology and Data Analyses

The design methodology incorporated both form-based and analytical approaches, using a combination of statistical relationships and analyses to arrive at a design discharge for each reach. Other primary design criteria, such as cross section dimensions, pattern and profile, are all linked to the design discharge and to each other. The following sections summarize each phase of the methodology; supporting calculations and data are included in Appendix C.

7.4.1 Design Discharge

In order to estimate a range of design discharges for each reach where dimension *and* pattern and/or profile modifications are proposed, we evaluated regional regression equations, analyzed field bankfull indicators using hydraulic models, and considered sediment transport competence using critical discharge for initiation of bed material mobility (where sediment data could be obtained). In addition to evaluating discharge at various surveyed riffle cross sections on the project reaches, we also evaluated the predicted discharge for the Mill Creek reference reach as a check of the analysis methodology. As indicated in Table 8, there is considerable spread in the predicted design discharge values. The USGS 2-year estimate typically provides an upper bound on the bankfull discharge while the critical discharge estimates typically provide a lower bound.

The critical discharge estimates are at the low end of the range for all project reaches where suitable samples could be obtained. The North Carolina Piedmont regional curve estimates are also at the low end of the discharge range. Our selected design values are based primarily on hydraulic models that include surveyed cross sections with reliable bankfull indicators, in each case a well-defined bench with evidence of relatively recent flow. A reach-wide HEC-RAS model, which accounts for floodplain and channel roughness, allowed us to adjust discharge until the stage matched the stable bankfull indicators. We also used the model to check for other possible geomorphic features (scour lines, changes in bank angle, etc.) using the range of predicted discharges and were unable to identify any reliable indicators of the bankfull stage in the surveyed cross sections other than those that were first identified in the field. Discharge estimates are sensitive to roughness estimates; we assigned channel and floodplain roughness values based on USGS guidance based on stream dimensions, bed materials and vegetation on the banks and floodplain. We are confident in the modeled discharges because they are based on site-specific measurements rather than predictions based on average regional conditions or empirical formulae. Our selected design values are relatively close to the USGS 2-year regional estimates.

As discussed in Section 7.4.2, the design attempts to create sediment transport continuity with upstream supply reaches so as to address widespread mid-channel deposition as is evident throughout Moores Fork. As indicated graphically in Appendix C, the reach of Moores Fork immediately upstream of the project limits has greater transport capacity than the impacted sections within the project reach (M1.3 and M1.5) but fairly close to the existing stable cross sections (M1.1, M1.6, M1.7, M1.9 and M1.10) up to the bankfull stage. These stable cross sections appear to have adjusted shape and dimension to be in better balance with the supply reach than the unstable cross sections, likely because of more robust bank vegetation and more frequent floodplain access. The design attempts to mimic these cross sections. We evaluated a design discharge based on regional relationships and critical discharge estimates and our analyses indicate that such a design would lead to even more sediment transport imbalance than currently exists because the resulting smaller cross section would have significantly less competence and capacity than the supply reach.

We have considered contributing factors to explain the wide spread between predicted regional curve and "measured" discharges. We also surveyed additional cross sections and profiles near the upstream limits of Moores Fork and these surveys confirm our measurements and predictions in the supply reach and project reaches. Our observations in the Moores Fork watershed indicate that the differences between the regional curve and measured discharges are likely attributable to relatively low infiltration rates caused by soil compaction in pastures, shallow bedrock, steep upland areas and impervious surfaces along the Interstate 77 corridor.

Table 8: Design Discharge Estimates (cfs)

Design Reach	NC Rural Piedmont Regional Curve	USGS 2-year NC HR1	Hydraulic Models using Field Indicators (RM and RAS)	Critical Discharge (Pavement D_{84})	Critical Discharge (Bar D_{100})	Selected Design Value
Moores Rch 1	139	237	270-350	185-190	101	250
Moores Rch 2/3	166	278	220-350	170-185	56	260
Silage Trib. Rch 1	14	29	51	n/a	n/a	24
Silage Trib. Rch 2	32	63	n/a	n/a	n/a	60
Pond Trib.	9	20	n/a	n/a	n/a	19
Barn Trib.	3	8	18	n/a	n/a	11
Mill Creek R.R.	284	385	191-196	173-270	77-87	N/A

On reaches of the Silage and Pond Tributaries, reliable bankfull indicators could not be located and estimates based on field indicators could not be made. We did not perform hydraulic or sediment transport analyses for reaches where pattern or profile are not proposed to be changed.

The smaller project reaches (Silage, Pond, Barn and Corn Tributaries) were either so heavily impacted by cattle or small enough in cross section to make pebble counts infeasible. In order to gather some sediment size data for these streams, representative bar samples were collected and analyzed; the Pond Tributary is so heavily trampled that even bar sampling was not feasible.

7.4.2 Sediment Transport

As part of our sediment transport evaluations, we considered landscape position and the connections between the various reaches, with a focus on Moores Fork. A qualitative assessment of Moores Fork at the project site and the reach upstream reveals the following general conditions:

- The reach immediately upstream is a both a source of sediment to the project reaches (through hillslope and bank erosion processes) and a transport reach. Sediment export appears to be balanced with supply; the reach has a bedrock controlled profile, a steep, rocky hillside on the right bank and exposed, unstable soils on the left bank.

- Reach 1 is primarily a transport reach, similar in profile to the upstream reach with somewhat more prominent bars, some of which are influenced by in-stream woody debris.
- Reach 2 is primarily a storage reach, but extensive bank erosion provides a source of fine sediment to the system. Lateral erosion has allowed large mid-channel and lateral bars to form.
- Reach 3 has storage, source and transport sub-reaches, with several large bars (storage), widespread bank erosion and hillslope colluvium (source) and bedrock controlled bed and banks (transport).

Given the presence of mid-channel sediment deposition and abundant bedrock in the bed, aggradation is more of a concern that degradation for Moores Fork. Our Moores Fork sediment transport analyses were targeted on developing design strategies to accommodate excess sediment supply

Table 8 above summarizes sediment transport *competence* analyses; supporting data are included in Appendix C. Our analyses indicate the design streams (in terms of cross section and profile) will transport the size of the large bed materials sampled at the site. We also evaluated sediment transport *capacity* and *continuity* between the supply and design reaches, using unit stream power as the indicator parameter. We compared stream power over a range of stages up to and above the bankfull stage to check if continuity was achieved. Hydraulic models (HEC-RAS and RIVERMorph) of the existing and design conditions were used to support the sediment transport analyses by providing hydraulic parameters such as hydraulic radius, slope, shear stress, and power. Graphical output of these analyses is included in Appendix C.

Slope and cross section size and shape are the factors that determine stream power. There is no realistic opportunity to increase slope in the project reaches to match the supply reach slope, so cross section shape and size become the design focus. As discussed in Section 7.4.3, there are geotechnical stability considerations for cross section design; the design attempts to optimize sediment transport continuity and bank stability.

Analyses indicate that the design unit stream power in the Moores Fork restoration and enhancement reaches is somewhat lower than the supply reach, but close to that of the existing stable cross sections for floods up to the bankfull stage. The decrease in sediment transport capacity from the supply reach to the project reaches suggests that excess sediment may continue to deposit in the project reaches. The design cross section shape and size accounts for this potential by providing space for sediment deposition in advantageous sections of the channel, such as in point bars. The design cross sections also include a subtle 5:1 change in slope at the bankfull elevation to create a modest two-stage channel effect and to accommodate the slightly greater stream power and shear stress from the supply reach.

In-stream vane structures will also be used to reduce the potential for mid-channel deposition in riffles and runs. We expect that sediment loads and the potential for excessive mid-channel deposition will be reduced once upstream banks on the site are stabilized, but off-site reaches will likely continue to deliver a relatively large supply of sediment.

At the Silage Tributary, sediment supply is low and velocities are high, so the main concern in the steep Reach 1 is down-cutting and the key parameter is boundary shear. Comparisons of existing versus design boundary shear for Reach 1 indicate reductions in the design shear at the bankfull stage. At twice the bankfull stage and beyond when valley morphology dictates hydraulic behavior, the design shear is slightly higher than the existing shear, but not enough of a difference to warrant design adjustments. The flatter Silage Tributary Reach 2 and the Pond Tributary are similar to Moores Fork in terms of morphology, and bank erosion and deposition are the main concerns. For both of these reaches, the estimated shear and unit stream power values are similar to the existing cases up to the bankfull stage. Above the bankfull stage, the design values are less than the existing up to about 2.5 times the bankfull stage, at which point valley morphology governs the hydraulics.

The primary design goal for proposed enhancement reach of the Barn Tributary is to provide floodplain access in order to reduce shear on the badly incised banks. Analyses indicate an abrupt decrease in shear at the bankfull stage. The estimated shear increases approaches the reference case at stages of about 2 times bankfull, where valley morphology comes into play.

7.4.3 Cross Section

Design discharge and sediment transport analyses inform the design of cross section dimensions and shapes; cross section dimensions and shapes along with slope govern hydraulic parameters that are relevant to design. Past experience also informs the cross section design. For example, project monitoring over the past several years has indicated that a newly constructed E or C-type channel with a width-depth ratio less than about 10 can lead to stability problems. We evaluated reference cross sections (on Moores Fork and the Corn and Barn Tributaries) as indications of bankfull area and general shape, but the design bank slopes are also governed by geotechnical stability needs during the monitoring period in areas where little or no deep-rooted vegetation will be present for the first few growing seasons. Ratios of pool-to-riffle depth and top width are based in part on reference reach data and in part on past experience.

As noted in the previous section, the design cross sections will accommodate sediment storage within the channel on point bars and/or in lateral bars upstream of vane structures. This stored sediment is available for transport during large flow events, which promotes long-term stability and sediment transport equilibrium. Mobilized sediment in the project reaches will be replaced by sediment from upstream.

7.4.4 Plan and Profile

Plan geometry design is based on multiple factors, chiefly the selected design slope and lateral constraints such as easement boundaries and topography. At a particular plan feature such as a meander bend, geometry is based on a range of dimensionless ratios that have proven to be effective in meeting design objectives while promoting stability. The prime example for plan geometry is radius of curvature ratio; well-vegetated reference reaches (Mill Creek for example) suggest a radius of curvature ratio of 1.0 or less would be desirable, but experience indicates that a ratio less than about 1.8 places undue stresses on newly constructed banks that lack deep rooted vegetation. Reference cross section/reach data are summarized in Appendix C.

We considered reference reaches when developing plan geometry. Our search for a Moores Fork reference reach included upstream reaches of Moores itself and several other streams in relatively undisturbed watersheds, primarily in Surry County. We identified a reach of Mill Creek with a stable meander bend in a valley and with bed materials similar to those found in Moores Fork. As with reference cross sections, reference plan form is useful as a general guide for parameters such as belt width, radius of curvature and pool-pool spacing. However, as with low width-depth ratios in reference cross sections, tight radii and pool spacing in reference reaches often cannot be assigned to a design reach without risk of stability problems in the time while vegetation is becoming established. The selected pattern and profile take into account aquatic habitat needs, stability throughout the monitoring period and space constraints. With pattern being directly linked to profile, we considered profile constraints such as existing bedrock outcrops as well as sediment transport equilibrium when assigning profile grades.

The target stream type for Moores Fork is a moderately sinuous, moderate width-depth ratio C4, which is appropriate for the relatively flat and wide alluvial valley through which it will flow. Reach 3 will be constructed largely within the existing channel, with modest pattern shifts where existing pattern is unstable. In-stream structures will be incorporated in Reach 3 in order to promote sediment transport equilibrium, riffle and pool formation, and enhanced bank stability. Reach 2 will be constructed mainly off-line to position the channel in the low point of the valley and provide better floodplain access on both banks. The overall approach can be described as a hybrid Rosgen Priority 2/3 restoration.

Given its slope and confined valley, the stable morphology for Reach 1 of the Silage Tributary is a step-pool, B4 stream type. For key profile design parameters such as step height, pool width and depth and pool spacing, we consulted the research of Chin and Abrahams, Li and Atkinson. We established the design profile based on the ratio of step height to step length, which was found in stable natural step pool systems to vary from 1 to 2. In order to limit the potential for excess shear stress on the structures and surrounding bed and banks, the step height was capped at 12 inches. Where fish passage is a consideration, step heights will be limited to 6 inches. Because of the highly confined nature of the Silage Tributary and the desire to preserve mature upland trees, addressing eroding banks and incised conditions through bank sloping is not practical. The design solution is to partially fill the channel (3 to 4 feet deep) with clayey soil (compacted in horizontal lifts not exceeding 9 inches in thickness) and create a new channel cross section and step pool profile at a higher elevation. Vegetated upland areas will be protected. The new bed will be reinforced with stone riffles, sized to resist mobilization at flows beyond bankfull. For the purposes of this mitigation plan we are assuming no loss of stream length.

Reach 2 of the Silage Tributary, the Corn Tributary and the Barn Tributary are similar in terms of morphology; each is a relatively steep alluvial channel with significant incision and bank erosion problems with little length to transition to a stable profile end point. The design approaches for these streams are also similar. The channels will be left in their current alignments, banks will be graded to stable slopes, bankfull benches will be constructed and in-stream structures will be used to promote bed and bank stability. Reference cross sections on stable reaches of the Corn and Barn Tributaries were used to size the design cross sections for these streams.

The target stream type for the Pond Tributary is a moderately sinuous, moderate width-depth ratio C4. The project reach begins at the outlet of the culvert where flow drops about 2 feet to a small plunge pool at the existing thalweg. The design profile will start at this existing thalweg elevation, taking advantage of the energy dissipating effects of the pool, and then abandon the badly trampled channel for a new alignment across the floodplain to the east. The downstream end of the profile includes a 1.5-foot high transition to the Moores Fork thalweg, which will be constructed using a grade control structure.

Both of the Cow Tributaries will be stabilized in their current channels, using grade control structures in select locations to address headcut erosion. These reaches are badly trampled by cattle and should respond well to livestock exclusion, both in terms of morphology and buffer vegetation.

The design includes filling and stabilizing gullies at the headwaters of the Silage Tributary, the Cow 1 and Cow 2 Tributaries, UT1 and two runoff conveyances entering Moores Fork Reach 3. The proposed gully stabilization will include upland measures such as temporary silt fences, swales and vegetation to divert and/or redirect runoff away from gullies. Check dams made from riprap, woody brush, recycled crushed concrete, decay resistant logs and other on-site materials will be used to reduce erosive stresses in the gullies and promote long-term healing. Stabilized areas will be planted with species and densities as specified for buffer areas.

7.4.5 In-Stream Structures

In-stream structure types and locations were selected based on design stability, habitat enhancement and sediment transport objectives within each reach. Table 9 below provides a summary of specific objectives for the proposed structures. Data and analyses supporting the sizing of stone for in-stream structures are provided in Appendix C.

Table 9. In-Stream Structures

Structure	Objectives
Geolifts and Brush Mattresses	a. Bank stability at channel plugs and/or confined spaces b. Quickly establish deep rooted bank vegetation
Rock Vane and Log Vane	a. Direct flow toward center of channel b. Promote sediment storage upstream and pool formation downstream
Cross Vane	a. Center flow b. Mitigate over-wide conditions, lessen potential for mid-channel bar formation c. Promote sediment storage upstream and pool formation downstream
Constructed Riffle and Step Structure	a. Set grade in profile b. Provide roughness in bed c. Initiate riffle habitat and sediment transport equilibrium
Root Wad Cluster	a. Enhance bank stability b. Provide bank roughness c. Establish near-bank cover and pool habitat

7.4.6 Farm Management Plan

The Surry Soil and Water Conservation District (SWCD) s developed a Conservation Plan that will be implemented as part of the project. EEP and the SWCD will install a water well that will supply four separate watering stations around the farm. The plan also includes two heavy use areas installed so that livestock can be fed away from all streams during the winter months and a stock trail so the livestock can be moved from pasture to pasture without crossing inside the conservation easement areas. The Conservation Plan Map is included in Appendix D.

8.0 MAINTENANCE PLAN

EEP shall monitor the site on a regular basis and shall conduct a physical inspection of the site a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Table 10. Maintenance Provisions

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Ford Crossing	Ford crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Road Crossing	Road crossings within the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.

9.0 PERFORMANCE STANDARDS

In accordance with the provisions in CFR Title 33, "*performance standards that will be used to assess whether the project is achieving its objectives… and should relate to the objectives … so that the project can be objectively evaluated to determine if it is developing into the desired resource type, providing the expected functions, and attaining any other applicable metrics".*

Table 11 below lists proposed success criteria for channel stability and riparian buffer vegetation. Year to year comparisons for the various parameters will allow adaptive management to be implemented early on in the monitoring period if necessary in order to reduce the risk of widespread problems.

Table 11. Performance Standards	
Parameter	**Metrics/Success Criteria**
Channel Stability	a. Bank height ratio for reaches where BHR is corrected through design and construction shall not exceed 1.2. b. Entrenchment ratio for reaches where ER is corrected through design and construction shall be no less than 2.2. c. The stream project shall remain stable and all other performance standards shall be met through two separate bankfull events, occurring in separate years, during the monitoring years 1 through 7.
Riparian Buffer Vegetation	a. Density of 320 live, planted stems/ac at year 3; 260 live, planted stems/acre at year 5; 210 live, planted stems/acre at year 7; b. Planted vegetation must average 8 feet in height at year 7.

10.0 MONITORING REQUIREMENTS

Annual monitoring data will be reported using the EEP monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, population of EEP databases for analysis, research purposes, and assist in decision making regarding project close-out.

Table 12. Monitoring Requirements			
Required Parameter	**Quantity**	**Frequency**	**Notes**
Pattern and Profile	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	As-Built	Pattern/profile survey will extend for at least 20 bankfull widths per reach. Annual profile surveys only required if channel instability is observed.
Dimension	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	As-Built, Years 1, 2, 3, 5 and 7	A minimum of one representative riffle and pool cross section will be surveyed per reach. Bank pin arrays shall be installed at pool cross sections in restored reaches where bankfull width exceeds 3 feet.
Surface Water Hydrology	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	annual	A crest gauge and/or pressure transducer will be installed on site; the device will be inspected on a quarterly/semi-annual basis to document the occurrence of bankfull events on the project
Vegetation	Quantity and location of vegetation plots will be determined in consultation with EEP	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
Photographs		semi-annual	Reference photographs will be made at selected overviews and near-stream locations.

11.0 LONG-TERM MANAGEMENT PLAN

Upon approval for close-out by the Interagency Review Team (IRT) the site will be transferred to the NCDENR Division of Natural Resource Planning and Conservation's Stewardship Program. This party 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. Endowment funds required to uphold easement and deed restrictions shall be negotiated prior to site transfer to the responsible party.

The NCDENR Division of Natural Resource Planning and Conservation's Stewardship Program currently houses EEP stewardship endowments within the non-reverting, interest-bearing Conservation Lands Stewardship Endowment Account. The use of funds from the Endowment Account is governed by North Carolina General Statute GS 113A-232(d) (3). Interest gained by the endowment fund may be used only for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable. The NCDENR Stewardship Program intends to manage the account as a non-wasting endowment. Only interest generated from the endowment funds will be used to steward the compensatory mitigation sites. Interest funds not used for those purposes will be re-invested in the Endowment Account to offset losses due to inflation.

12.0 ADAPTIVE MANAGEMENT PLAN

Upon completion of site construction, EEP will implement the post-construction monitoring protocols previously defined in this document. Project maintenance will be performed as described previously in this document. If during the course of annual monitoring it is determined the site's ability to achieve site performance standards are jeopardized, EEP will notify the USACE of the need to develop a Plan of Corrective Action. The Plan of Corrective Action may be prepared using in-house technical staff or may require engineering and consulting services. Once the Corrective Action Plan is prepared and finalized EEP will:

1. Notify the USACE as required by the Nationwide 27 permit general conditions.
2. Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE.
3. Obtain other permits as necessary.
4. Implement the Corrective Action Plan.
5. Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

13.0 FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Ecosystem Enhancement Program's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the U.S. Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by EEP. This commitment provides financial assurance for all mitigation projects implemented by the program.

14.0 DEFINITIONS

D_x – with respect to sediment grain size distribution, the grain mean diameter which is larger than x% of the sample distribution

Morphological description – the stream type; stream type is determined by quantifying channel entrenchment, dimension, pattern, profile, and boundary materials; as described in Rosgen, D. (1996), *Applied River Morphology, 2nd edition*

Native vegetation community – a distinct and reoccurring assemblage of populations of plants, animals, bacteria and fungi naturally associated with each other and their population; as described in Schafale, M.P. and Weakley, A. S. (1990), *Classification of the Natural Communities of North Carolina, Third Approximation*

Project Area - includes all protected lands associated with the mitigation project

Priority Levels of Restoration – 1: convert incised stream to new stream at original floodplain elevation; 2: establish new stream and floodplain at existing stream elevation; 3: convert incised stream to new stream type without establishing an active floodplain but providing flood-prone area; 4: stabilize incised stream in place.

15.0 REFERENCES

Abrahams, A. D., G. Li, and J. F. Atkinson (1995), Step-Pool Streams: Adjustment to Maximum Flow Resistance, *Water Resources Research*, 31(10), 2593–2602.

Andrews, E.D. (1984), Bed-material Entrainment and Hydraulic Geometry of Gravel-Bed Rivers in Colorado. *Geol. Soc. of Am. Bull*., 95, 371-378.

Andrews, E.D. and James M. Nankervis. (1995). Effective Discharge and the Design of Channel Maintenance Flows for Gravel-Bed Rivers. *Geophysical Monograph Series*, Vol. 89,151-164.

Barnes, Harry H., Jr. (1967). Roughness Characteristics of Natural Channels. US Geological Survey Water Supply Paper 1849, United States Government Printing Office.

Bathurst, James C. (2007). Effect of Coarse Surface Layer on Bed-Load Transport. *Journal of Hydraulic Engineering*, 33(11), 1192-1205.

Biedenharn, D.S. and R.R. Copeland. (2000). Effective Discharge Calculation, *US Army Corps of Engineers ERDC/CHL CHETN-VIII-4*.

Chin, A. (2002), The Periodic Nature of Step-Pool Mountain Streams. *American Journal of Science,* Vol. 302, 144-167.

Confluence Engineering, PC. (2011). *Environmental Resources Technical Report Final - Moores Fork Restoration Project.*

EcoEngineering (2008), *Technical Memorandum Task 2, Upper Yadkin Basin Local Watershed Plan.*

Harman, et al. (1999). Bankfull Hydraulic Geometry Relationships for North Carolina Streams, *AWRA Wildland Hydrology Symposium Proceedings*, *Journal of Hydraulic Engineering*, AWRA Summer Symposium, Bozeman, MT, 401-408.

Leopold, L.B., Wolman, M.G. and Miller, J.P. (1964). *Fluvial Processes in Geomorphology*, Dover Publications, Inc., New York, NY.

North Carolina Ecosystem Enhancement Program (2009), *Upper Yadkin Pee-Dee River Basin Priorities.*

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

___. (1996). *Applied River Morphology*. Pagosa Springs, CO: Wildland Hydrology Books.

___. (1997). A geomorphological approach to restoration of incised rivers. *Proceedings of the Conference on Management of Landscapes Disturbed by Channel Incision*. Wang, S.S.Y, E.J. Langendoen, and F.D. Shields, Jr., eds. 12-22.

___. (1998). The reference reach - A blueprint for natural channel design (draft). *ASCE Conference on River Restoration*. Denver CO. March, 1998. ASCE. Reston, VA.

___. (2001a). A stream channel stability assessment methodology. *Proceedings of the Federal Interagency Sediment Conference*. Reno, NV. March, 2001.

___. (2001b). The cross-vane, w-weir and j-hook vane structures…their description, design and application for stream stabilization and river restoration. *ASCE conference*. Reno, NV. August, 2001.

Schafale, M.P. and Weakley, A. S. (1990). *Classification of the Natural Communities of North Carolina, Third Approximation,* NC Natural Heritage Program, Raleigh, NC.

Surry County Planning and Development Department (2006). *Land Use Plan 2015; A Ten-Year Vision for Surry County, North Carolina*.

US Army Corps of Engineers Wilmington District (2003). *Stream Mitigation Guidelines*.

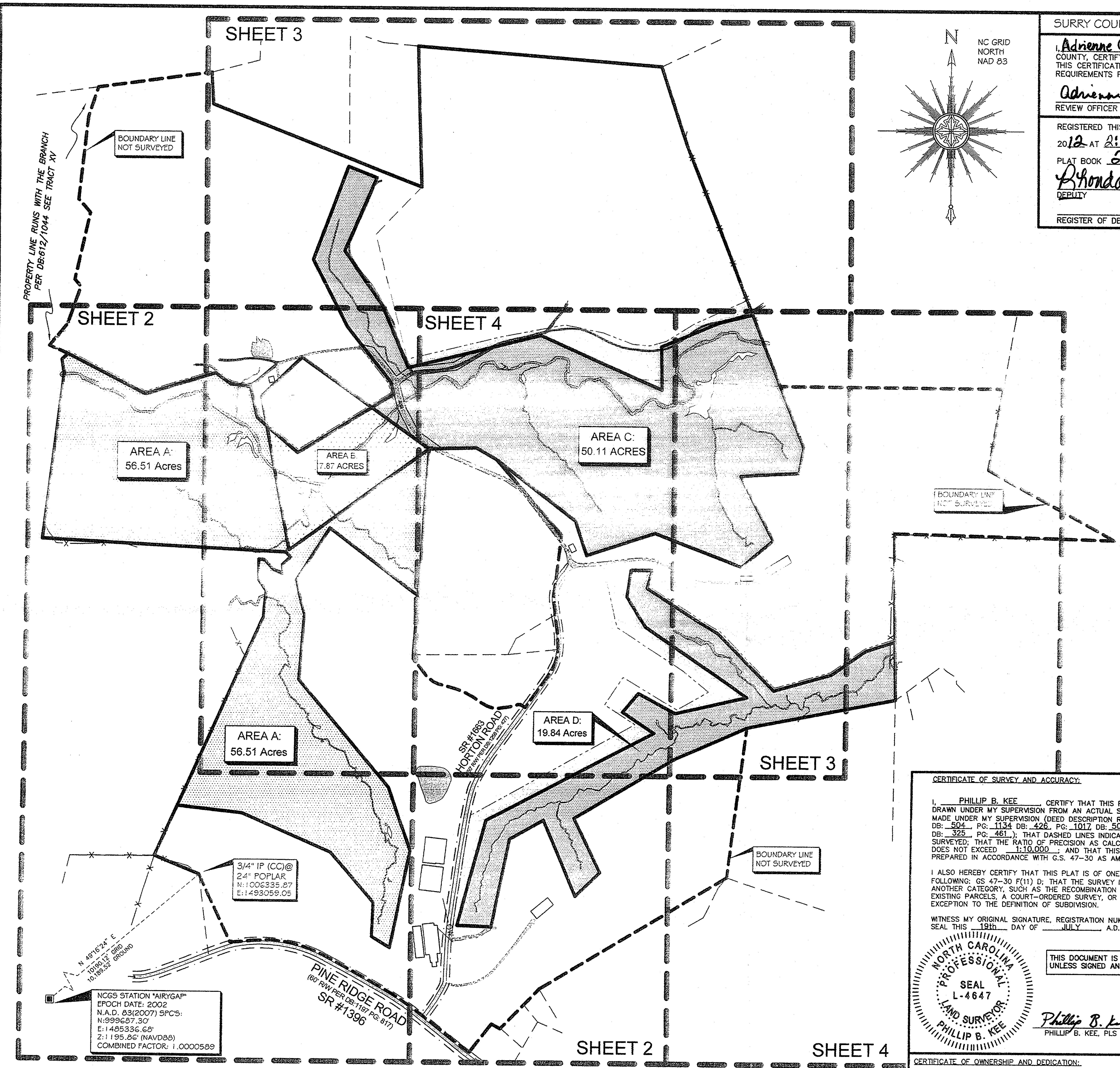
Weaver, J.C., Toby D. Feaster and Anthony J. Gotvald, (2009). “Magnitude and Frequency of Rural Floods in the Southeastern United States, through 2006: Volume 2, North Carolina” *Scientific Investigations Report 2009-5158*, USGS, Nashville, TN.

Young, T.F. and Sanzone, S. (editors). (2002), A framework for assessing and reporting on ecological condition. *Ecological Reporting Panel, Ecological Processes and Effects Committee*. EPA Science Advisory Board. Washington, DC.

APPENDIX A

SITE PROTECTION INSTRUMENTS

PLAT BOOK: 29 PAGE: 31



SURRY COUNTY, NORTH CAROLINA

I, Adrienne Gardner, REVIEW OFFICER FOR SURRY COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED, MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

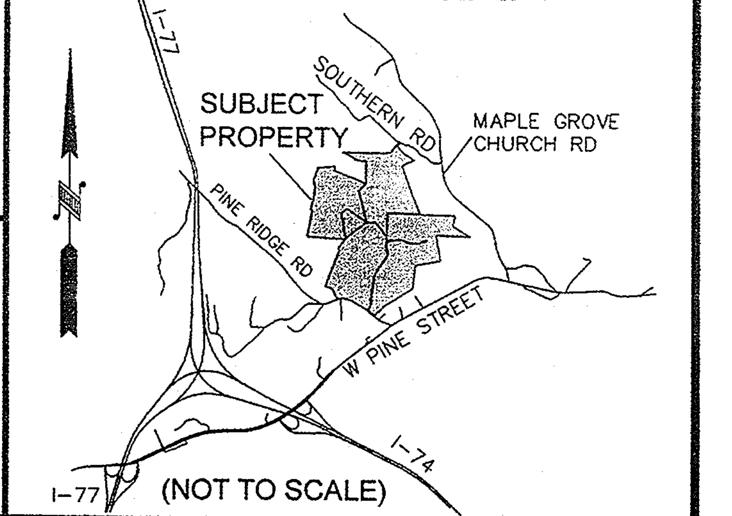
Adrienne J. Gardner 7/26/2012
REVIEW OFFICER DATE

REGISTERED THIS THE 26 DAY OF JULY, 2012 AT 2:55P AND RECORDED IN PLAT BOOK 29 PAGE 31 BY:

Rhonda B Easter
DEPUTY

REGISTER OF DEEDS

VICINITY MAP



(NOT TO SCALE)

LINE	ANGLE	DISTANCE
L1	N 05°32'10" E	150.43'
L2	N 34°29'09" W	76.96'
L3	N 01°08'15" W	115.12'
L4	S 87°14'09" E	33.68'
L5	S 42°40'48" E	75.37'
L6	S 66°59'13" E	59.62'
L7	N 06°06'19" W	51.88'
L8	N 47°13'50" E	62.02'
L9	N 42°43'13" W	38.46'
L10	N 53°40'01" E	19.68'
L11	N 09°09'34" W	80.91'
L12	N 47°42'04" E	33.67'
L13	N 14°45'15" W	16.62'
L14	S 53°45'03" E	103.40'
L15	S 83°11'11" E	111.88'
L16	S 12°51'51" E	179.42'
L17	S 49°46'44" E	302.01'
L18	N 14°48'13" W	70.26'
L19	N 38°40'21" W	398.28'
L20	S 68°43'39" E	171.35'
L21	N 00°45'18" W	244.38'
L22	N 76°01'40" E	192.75'
L23	S 09°30'38" W	146.16'
L24	N 18°24'13" W	204.37'
L25	N 60°19'59" W	132.17'
L26	S 88°07'01" W	264.62'
L27	S 45°47'21" W	197.70'
L28	S 45°47'21" W	118.76'
L29	S 60°18'36" W	219.45'
L30	N 56°43'47" W	214.45'
L31	N 39°23'05" E	137.81'
L32	S 62°01'59" E	238.48'
L33	N 77°02'17" E	417.16'
L34	N 32°29'26" W	203.63'
L35	N 08°48'28" E	154.05'
L36	N 89°43'09" E	120.05'
L37	S 16°11'44" W	107.73'
L38	N 74°11'06" E	342.81'
L39	N 55°00'30" E	235.03'
L40	N 71°51'04" E	172.03'
L41	N 53°01'26" E	222.76'
L42	N 27°58'37" W	170.60'
L43	N 14°48'13" W	88.21'
L44	S 76°25'27" E	73.50'
L45	S 38°40'21" E	206.52'
L46	N 53°36'42" E	81.88'
L47	N 82°43'56" E	259.26'
L48	N 58°58'12" E	104.92'
L49	S 58°58'12" W	261.80'
L50	S 82°43'56" W	257.04'
L51	S 53°36'42" W	80.98'
L52	S 14°48'13" E	131.70'
L53	S 27°58'37" E	154.70'
L54	S 54°43'39" E	169.01'

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77	1007624.717	1496807.730

CERTIFICATE OF SURVEY AND ACCURACY:

I, PHILLIP B. KEE, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION RECORDED IN DB: 504, PG: 1134 DB: 426, PG: 1017, DB: 504, PG: 1127 DB: 325, PG: 461); THAT DASHED LINES INDICATE LINES NOT SURVEYED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; AND THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: GS 47-30 F(11) D; THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 19th DAY OF JULY A.D., 2012.

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED

Phillip B. Kee
PHILLIP B. KEE, PLS NC-4647

CERTIFICATE OF OWNERSHIP AND DEDICATION:

WE HEREBY CERTIFY THAT WE ARE THE OWNER OF THE PROPERTY AS SHOWN AND DESCRIBED HEREON, WHICH WAS CONVEYED TO US BY A DEED RECORDED IN BOOK 504 PAGE 1134, BOOK 426 PAGE 1017, BOOK 504 PAGE 1127 AND BOOK 325 PAGE 461 IN THE SURRY COUNTY REGISTRY. I ALSO HEREBY ACCEPT AND ADOPT THIS RECORD PLAT AND CONSERVATION EASEMENT WITH MY FREE CONSENT AND DEDICATED ALL EASEMENTS, RIGHT OF WAYS AND ACCESS ROADS TO PUBLIC AND/OR PRIVATE USE AS NOTED ON SAID PLAT.

William L Horton Jr. 7-26-12
David J Horton Jr 7-26-12
Laura Horton 7-26-12

FINAL PLAT OF
A CONSERVATION EASEMENT SURVEY FOR:

THE STATE OF NORTH CAROLINA, NC DEPARTMENT OF ADMINISTRATION, ECOSYSTEM ENHANCEMENT PROGRAM,

MOORES FORK-MAPLE RIDGE FARMS

SPO FILE NUMBER:086-X & 086-Y EEP PROJECT ID:94709

CURRENT OWNER LISTED AS: MAPLE RIDGE FARMS, INC. AND WILLIAM LAWRENCE HORTON, JR. AND WIFE, LAURA E. HORTON

PARCEL IDENTIFICATION NUMBER: 4090[illegible]39-0783, 4090[illegible]49-7679, 4090[illegible]57-5440, & 4090[illegible]38-6780

DEED REFERENCES: DB: 504 PG: 1134, DB: 426 PG: 1017 DB: 504 PG: 1127, DB: 325 PG: 461 (REF.388 PG: 41)
STEWARTS CREEK TOWNSHIP, SURRY COUNTY, NORTH CAROLINA

SURVEY BY: RMT,NH,MM,KJ,PBK DRAWN BY: PBK SCALE: 1"=400'
SURVEY DATES: 10/01/11-03/12/12

SHEET #: 1 OF 4 | JOB #: 110106

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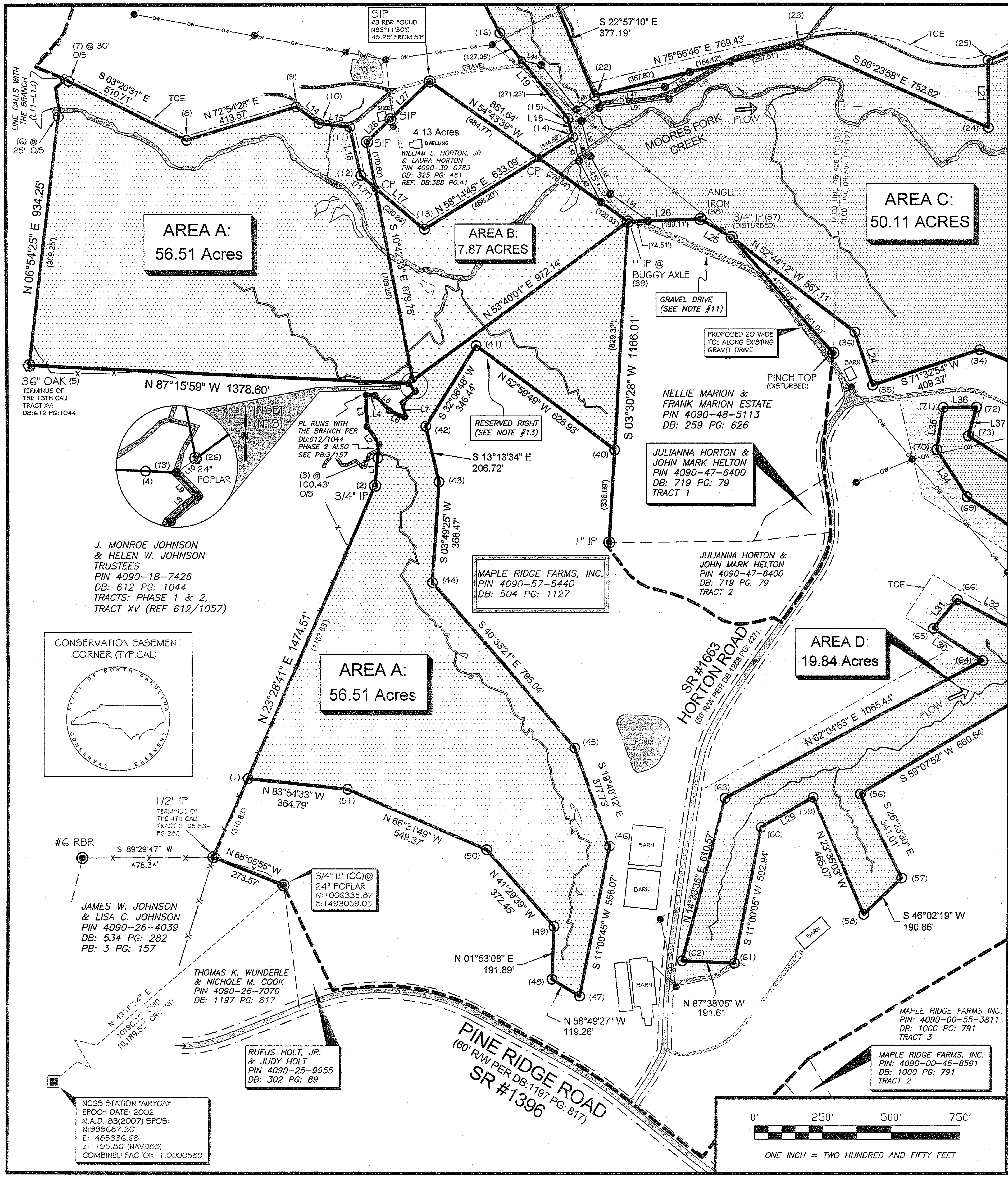
ONE INCH = FOUR HUNDRED FEET

COVER SHEET:
MOORES FORK
MAPLE RIDGE FARMS

TOTAL CONSERVATION EASEMENT AREA = 134.33 ACRES



TOTAL CONSERVATION EASEMENT AREA = 134.33 ACRES

THIS PLAT DOES NOT CREATE A SUBDIVISION OF PROPERTY IN SURRY COUNTY. THE PURPOSE OF THIS SURVEY IS TO IDENTIFY THE CONSERVATION EASEMENT AREAS ONLY. NO TRANSFER OF PROPERTY IS TAKING PLACE.

CONSERVATION EASEMENT ACCESS:

CONSERVATION EASEMENT AREAS TO BE ACCESSED FROM EXISTING ROADS AS SHOWN ON PLAT.

CERTIFICATE OF SURVEY AND ACCURACY:

I, PHILLIP B. KEE, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION RECORDED IN DB: 504, PG: 1134, DB: 426, PG: 1017, DB: 504, PG: 1127, DB: 325, PG: 461, AND PB: 8, PG: 12); THAT DASHED LINES INDICATE LINES NOT SURVEYED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; AND THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: GS 47-30 F(11) D; THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 19th DAY OF JULY, A.D., 2012.

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

Phillip B. Kee
PHILLIP B. KEE, PLS NC-4647

SURRY COUNTY, NORTH CAROLINA

I, Adrienne Gardner REVIEW OFFICER FOR SURRY COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED, MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

Adrienne P. Gardner 7/26/2012
REVIEW OFFICER DATE

REGISTERED THIS THE 26 DAY OF JULY 2012 AT 2:55P AND RECORDED IN PLAT BOOK 29 PAGE 32 BY:
Rhonda B Easter
DEPUTY

REGISTER OF DEEDS

CERTIFICATE OF OWNERSHIP AND DEDICATION:

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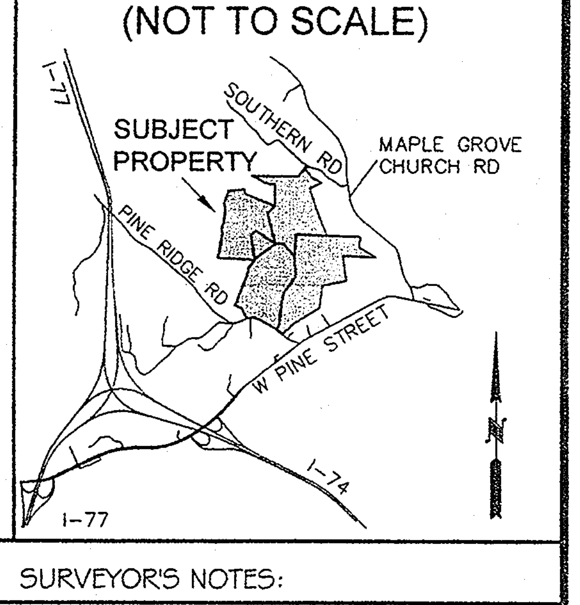
William L. Horton Jr. 7-26-12
David L Horton Jr. 7-26-12
Laura Horton 7-26-12

LEGEND:

BOUNDARY LINE SURVEYED
BOUNDARY LINE NOT SURVEYED
TIE LINE ONLY
ADJOINING DEED LINES
RIGHT OF WAY (R/W)
FENCE LINE
OVERHEAD WIRE
STREAM (SEE NOTE #10)
WETLAND (SEE NOTE#10)
CONSERVATION EASEMENT AREA
SOIL ROADBED
ASPHALT
GRAVEL
TEMPORARY CONSTRUCTION EASEMENT(TCE)
CALCULATED POINT(CP) NOT SET
EXISTING IRON PIN (AS NOTED)
SET 1" IRON PIPE W/CAP (SIP)
#5 REBAR WITH EEP CAP SET
NCGS MONUMENT
UTILITY POLE
NOT TO SCALE (NTS)
NCGS NORTH CAROLINA GEODETIC SURVEY
N.A.D. NORTH AMERICAN DATUM 1983
SPC STATE PLANE COORDINATES
REF. REFERENCE
PL PROPERTY LINE
SR STATE ROAD
CNF CORNER NOT FOUND
IP IRON PIPE
RBR REBAR
CC CONTROL CORNER
CNR CORNER
DB: DEED BOOK
PG: PAGE
PB: PLAT BOOK

NC GRID NORTH NAD 83

VICINITY MAP
(NOT TO SCALE)



SURVEYOR'S NOTES:

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FINAL PLAT OF
A CONSERVATION EASEMENT SURVEY FOR:

THE STATE OF NORTH CAROLINA, NC DEPARTMENT OF ADMINISTRATION, ECOSYSTEM ENHANCEMENT PROGRAM,

MOORES FORK-MAPLE RIDGE FARMS

SPO FILE NUMBER:086-X & 086-Y EEP PROJECT ID:94709

CURRENT OWNER LISTED AS: MAPLE RIDGE FARMS, INC. AND WILLIAM LAWRENCE HORTON, JR. AND WIFE, LAURA E. HORTON

PARCEL IDENTIFICATION NUMBER'S: 4090-39-0783, 4090-49-7679, 4090-57-5440, & 4090-38-6780

DEED REFERENCES: DB: 504 PG: 1134, DB: 426 PG: 1017 DB: 504 PG: 1127, DB: 325 PG: 461 (REF. DB: 388 PG: 41) STEWARTS CREEK TOWNSHIP, SURRY COUNTY, NORTH CAROLINA

SURVEY BY: RMT,NH,MM,KJ,PBK DRAWN BY: PBK
SURVEY DATES: 10/01/11-03/12/12 SCALE : 1"=250'

SHEET #: 2 OF 4 JOB #: 110106

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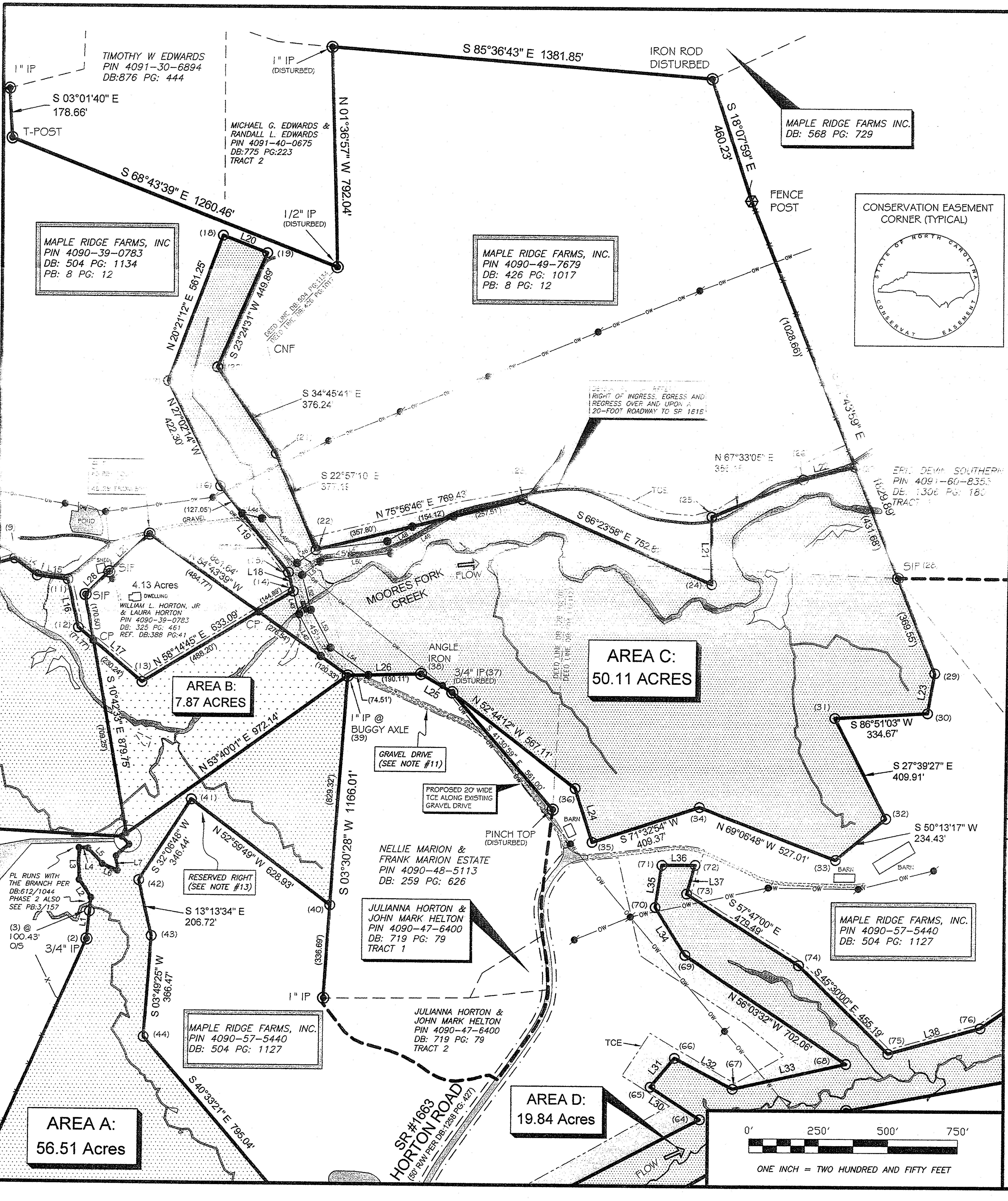

TOTAL CONSERVATION EASEMENT AREA = 134.33 ACRES

THIS PLAT DOES NOT CREATE A SUBDIVISION OF PROPERTY IN SURRY COUNTY. THE PURPOSE OF THIS SURVEY IS TO IDENTIFY THE CONSERVATION EASEMENT AREAS ONLY. NO TRANSFER OF PROPERTY IS TAKING PLACE.

CONSERVATION EASEMENT ACCESS:

CONSERVATION EASEMENT AREAS TO BE ACCESSED FROM EXISTING ROADS AS SHOWN ON PLAT.

CERTIFICATE OF SURVEY AND ACCURACY:

I, PHILLIP B. KEE, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION RECORDED IN DB: 504, PG: 1134, DB: 426, PG: 1017, DB: 504, PG: 1127, DB: 325, PG: 461, AND PB: 8, PG: 12); THAT DASHED LINES INDICATE LINES NOT SURVEYED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; AND THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: GS 47-30 F(11) D; THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 19th DAY OF JULY, A.D., 2012.

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED

NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

Phillip B. Kee
PHILLIP B. KEE, PLS NC-4647

SURRY COUNTY, NORTH CAROLINA

I, Adrienne Gardner, REVIEW OFFICER FOR SURRY COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED, MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

Adrienne J. Gardner 7/26/2012
REVIEW OFFICER DATE

REGISTERED THIS THE 26 DAY OF JULY 2012 AT 2:55P AND RECORDED IN PLAT BOOK 29 PAGE 33 BY:
Rhonda B Easter
DEPUTY

REGISTER OF DEEDS

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N.A.D.	NORTH AMERICAN DATUM 1983
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REF.	REFERENCE
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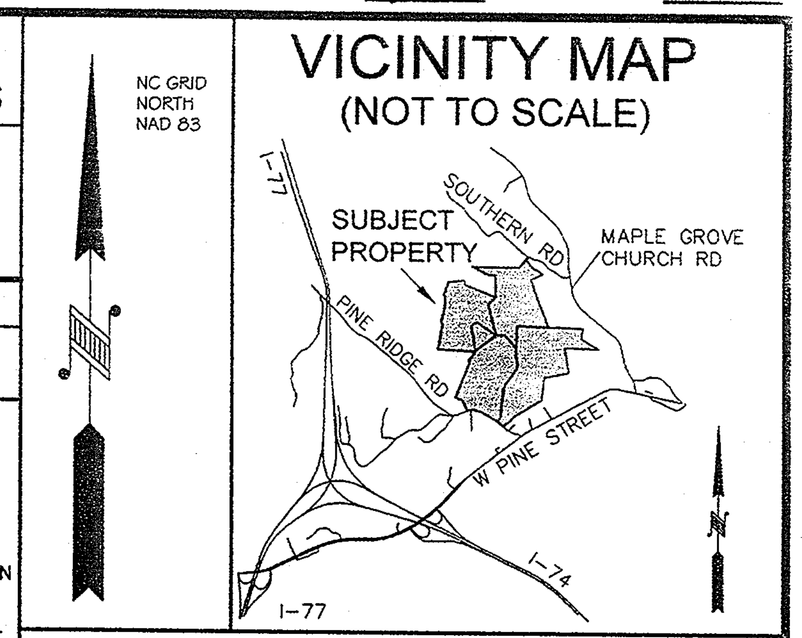

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STEWARTS CREEK TOWNSHIP, SURRY COUNTY, NORTH CAROLINA

SURVEY BY: RMT,NH,MM,KJ,PBK DRAWN BY: PBK
SURVEY DATES: 10/01/11-03/12/12 SCALE : 1"=250'

SHEET #: 3 OF 4	JOB #: 110106

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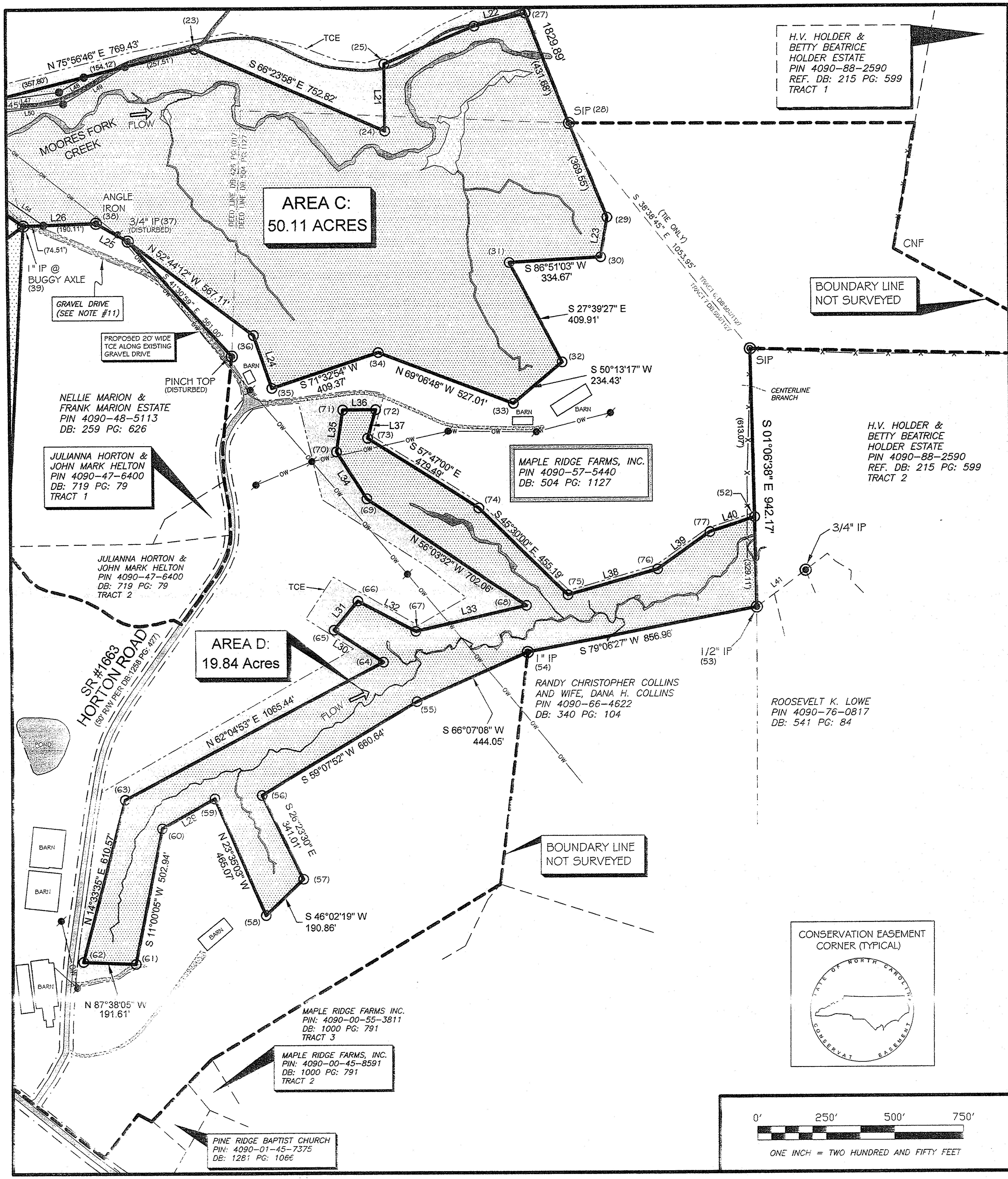

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NORTH CAROLINA PROFESSIONAL SEAL L-4647 LAND SURVEYOR PHILLIP B. KEE

Phillip B. Kee
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SURRY COUNTY, NORTH CAROLINA

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REVIEW OFFICER DATE

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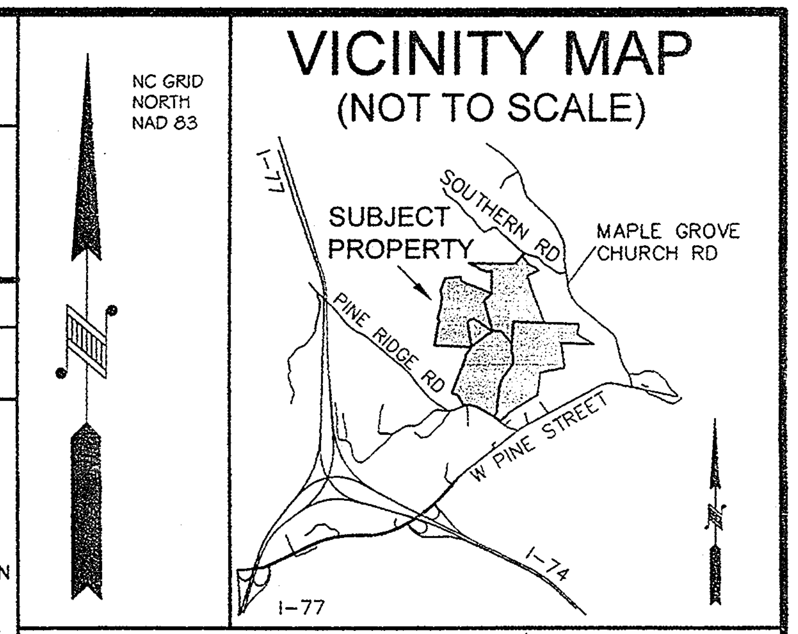

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SURVEY BY: RMT,NH,MM,KJ,PBK DRAWN BY: PBK
SURVEY DATES: 10/01/11-03/12/12 SCALE : 1"=250'

SHEET #: 4 OF 4 JOB #: 110106

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License # C-3039

APPENDIX B

BASELINE INFORMATION

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 29.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 16)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 7.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT10

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 31 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 17)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT9

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 22 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10.5)	**Absent**	**Weak**	**Moderate**	**Strong**
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT8

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 29.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT7
caddisflies

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 27 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 16)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT6

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Sorry	**Longitude:**
Total Points: 38.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 23.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT5
caddisflies

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.11	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 25.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT4

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 20.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT3
bed rock stream bottom has effected overall score

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 33 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 20.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT2
caddisflies

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 23 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 3.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: UT1

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 23.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Silage Trib

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 20 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 8)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Pond Trib

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 35 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 23)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Main stem, mid-reach above road crossing

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 34.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name*:

A. Geomorphology (Subtotal = 22.5)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Main stem, downstream of road crossing.

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 23.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Con Trib #2

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 20 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 10)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Cow Trib #1

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.22.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 21 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 9)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Corn Trib

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 03.23.2011	**Project/Site:** EEP Site Moores Fork	**Latitude:**
Evaluator: R. Newton	**County:** Surry	**Longitude:**
Total Points: 36.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** Cana Quad *e.g. Quad Name:*

A. Geomorphology (Subtotal = 23)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: caddisflies
Barn Trib

Sketch:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Moores Fork - Wetland #1 City/County: Surry Sampling Date: 3.21.11

Applicant/Owner: EEP State: NC Sampling Point: WL #1

Investigator(s): R. Newton, C. Riddle Section, Township, Range: ______

Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): MLRA 136 Lat: 36.510356 Long: -80.715116 Datum: NAD 83

Soil Map Unit Name: FsE - Fairview-Scott knob complex NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- X Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X No ___	Depth (inches): 0-2	
Water Table Present?	Yes X No ___	Depth (inches): 0-6	
Saturation Present? (includes capillary fringe)	Yes X No ___	Depth (inches): 0	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WL#1

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	10	Y	OBL
2. Acer rubrum	10	Y	FAC
3. Betula nigra	10	Y	FACW
4. Carpinus caroliniana	2	N	FAC
5.			
6.			
7.			
8.			
	32 = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1. Sambucus canadensis	5	Y	FACW
2. Ligustrum sinense	5	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	10 = Total Cover		
Herb Stratum (Plot size: ______)			
1. Impatiens capensis	80	Y	FACW
2. Carex spp	50	Y	FACW
3. Juncus effusus	2	N	FACW
4. Typha latifolia	2	N	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	134 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1. Lonicera japonica	5	N	FAC
2. Rosa multiflora	10	Y	UPL
3.			
4.			
5.			
6.			
	15 = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 87.5 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
_X_ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _X_ No ____

Remarks: (Include photo numbers here or on a separate sheet.)

No plots were used to evaluate vegetation. A meandering survey of the entire wetland area was conducted.

SOIL

Sampling Point: WL#1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 4/2	98	5YR 4/6	2	C	PL	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Moores Fork - Wetland #2 City/County: Surry Sampling Date: 3.21.11

Applicant/Owner: EEP State: NC Sampling Point: WL#2

Investigator(s): R. Newton, C. Riddle Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): MLRA 136 Lat: 36.510705 Long: -80.718660 Datum: ______

Soil Map Unit Name: FsE - Fairview - Scott Knob complex NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	**Is the Sampled Area within a Wetland?** Yes X No ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___	
Water Table Present?	Yes ___	No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 10	**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WC#2

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	10	Y	OBL
2. Liriodendron tulipifera	10	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	20 = Total Cover		

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	70	Y	FAC
2. Sambucus canadensis	5	N	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	75 = Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Impatiens capensis	10	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	10 = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	___ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

No plots were used to evaluate vegetation. A meandering survey of the entire wetland area was conducted.

SOIL

Sampling Point: WL#2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 4/3	100						
10-12	10YR 4/2	99	10YR 4/6	1	C	PL	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes X No ____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Moores Fork-Wetland#3 City/County: Surry Sampling Date: 3.23.11

Applicant/Owner: EEP State: NC Sampling Point: WL#3

Investigator(s): R. Newton, C. Riddle Section, Township, Range: ______

Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): MLRA 136 Lat: 36.509053 Long: -80.721189 Datum: NAD83

Soil Map Unit Name: CsA- Colvard + Suches NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ___ Hydric Soil Present? Yes X No ___ Wetland Hydrology Present? Yes X No ___	Is the Sampled Area within a Wetland? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 0-2

Water Table Present? Yes X No ___ Depth (inches): 0-4

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WL#3

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10	Y	FAC
2. Liriodendron tulipifera	20	Y	FAC
3. Betula nigra	10	Y	FACW
4.			
5.			
6.			
7.			
8.			
	40 = Total Cover		

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	____ = Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	____ = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	____	x 1 = ____
FACW species	____	x 2 = ____
FAC species	____	x 3 = ____
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

No plots were used to evaluate vegetation. A meandering survey of the wetland area was conducted.

SOIL

Sampling Point: WL#3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR3/1	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________________

Depth (inches): ______________________

Hydric Soil Present? Yes X No ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Moores Fork - Wetland #4 City/County: Surry Sampling Date: 3.23.11

Applicant/Owner: EEP State: NC Sampling Point: WL#4

Investigator(s): R. Newton, C. Riddle Section, Township, Range: ______

Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): MLRA 136 Lat: 36.509537 Long: -80.724112 Datum: NAD 83

Soil Map Unit Name: FsE - Fairview-Scott Knob complex / CsA - Colvard & Suches NWI classification: PEM1A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ___
Hydric Soil Present?	Yes X	No ___
Wetland Hydrology Present?	Yes X	No ___

Is the Sampled Area within a Wetland? Yes X No ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 0-2
Water Table Present?	Yes X	No ___	Depth (inches): 0-4
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WL-4

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	40	Y	FAC
2. Liriodendron tulipifera	40	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	80 = Total Cover		

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

No plots were used to evaluate vegetation. A meandering survey of the wetland area was conducted.

SOIL

Sampling Point: WC#4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	Gley 1 4/5	100					loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
X Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ 2 cm Muck (A10) **(LRR N)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7)
___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
___ Thin Dark Surface (S9) **(MLRA 147, 148)**
X Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
___ Umbric Surface (F13) **(MLRA 136, 122)**
___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

___ 2 cm Muck (A10) **(MLRA 147)**
___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes X No ____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Moores Fork - Wetland #5 City/County: Surry Sampling Date: 3.23.11

Applicant/Owner: EEP State: NC Sampling Point: WL#5

Investigator(s): R. Newton, C. Riddle Section, Township, Range: ______

Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): MLRA 136 Lat: 36.503444 Long: -80.720966 Datum: NAD 83

Soil Map Unit Name: FeD2 - Fairview NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X No ___	Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present?	Yes X No ___	
Wetland Hydrology Present?	Yes X No ___	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes X No ___ Depth (inches): 10

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 2

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

SOIL

Sampling Point: WL#5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR4/3	100					loam	
6-12	10YR4/2	98	5YR4/6	2	C	PL	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- X Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No ___

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WL#5

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	30	Y	FAC
2. Acer rubrum	20	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	50 = Total Cover		

Sapling/Shrub Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Hamamelis virginiana	30	Y	FACU
2. Ligustrum sinense	5	N	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	35 = Total Cover		

Herb Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. carex sp	60	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	60 = Total Cover		

Woody Vine Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	____	x 1 =	____
FACW species	____	x 2 =	____
FAC species	____	x 3 =	____
FACU species	____	x 4 =	____
UPL species	____	x 5 =	____
Column Totals:	____ (A)		____ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

No plots were used to evaluate vegetation. A meandering survey of the entire wetland area was conducted.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Moores Fork-Wetland #6 City/County: Surry Sampling Date: 3.23.11

Applicant/Owner: EEP State: NC Sampling Point: WL#6

Investigator(s): R.Newton, C. Riddle Section, Township, Range: ______

Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 0-2

Subregion (LRR or MLRA): MLRA 136 Lat: 36.505105 Long: -80.722548 Datum: NAD 83

Soil Map Unit Name: FeD2 - Fairview | FsE - Fairview-Scott knob NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ______	Is the Sampled Area within a Wetland?	Yes X No ______
Hydric Soil Present? Yes X No ______		
Wetland Hydrology Present? Yes X No ______		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- X Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- X Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ______	No X	Depth (inches): ______	
Water Table Present?	Yes X	No ______	Depth (inches): 0-4	
Saturation Present? (includes capillary fringe)	Yes X	No ______	Depth (inches): 0-2	**Wetland Hydrology Present?** Yes X No ______

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: WL #6

Tree Stratum (Plot size: ______)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	30	Y	FAC
2. Liriodendron tulipifera	30	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	60 = Total Cover		
Sapling/Shrub Stratum (Plot size: ______)			
1. Ligustrum sinense	20	Y	FAC
2. Hamamelis virginiana	5	N	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	20 = Total Cover		
Herb Stratum (Plot size: ______)			
1. Impatiens capensis	5	Y	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	5 = Total Cover		
Woody Vine Stratum (Plot size: ______)			
1.			
2.			
3.			
4.			
5.			
6.			
	____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	______	x 1 =	______
FACW species	______	x 2 =	______
FAC species	______	x 3 =	______
FACU species	______	x 4 =	______
UPL species	______	x 5 =	______
Column Totals:	______ (A)		______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: (Include photo numbers here or on a separate sheet.)

No vegetation plots were used to evaluate vegetation. A meandering survey of the entire wetland area was conducted.

SOIL

Sampling Point: WL#6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR4/2	100					loam	
4-11	10YR4/2	99	5YR4/6	1	C	PL	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes X No ______

Remarks:

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Moores Fork Mitigation Project
County Name:	Surry
EEP Number:	94709
Project Sponsor:	Ecosystem Enhancement Program
Project Contact Name:	Julie Cahill
Project Contact Address:	5 Ravenscroft Drive, Asheville, NC 28801
Project Contact E-mail:	julie.cahill@ncdenr.gov
EEP Project Manager:	Julie Cahill

Project Description

For Official Use Only

Reviewed By:

1-27-12 — Julie Cahill

Date — **EEP Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

☐ **Check this box if there are outstanding issues**

Final Approval By:

12-21-11

Date — **For Division Administrator FHWA**

APPENDIX C

MITIGATION WORK PLAN DATA AND ANALYSIS

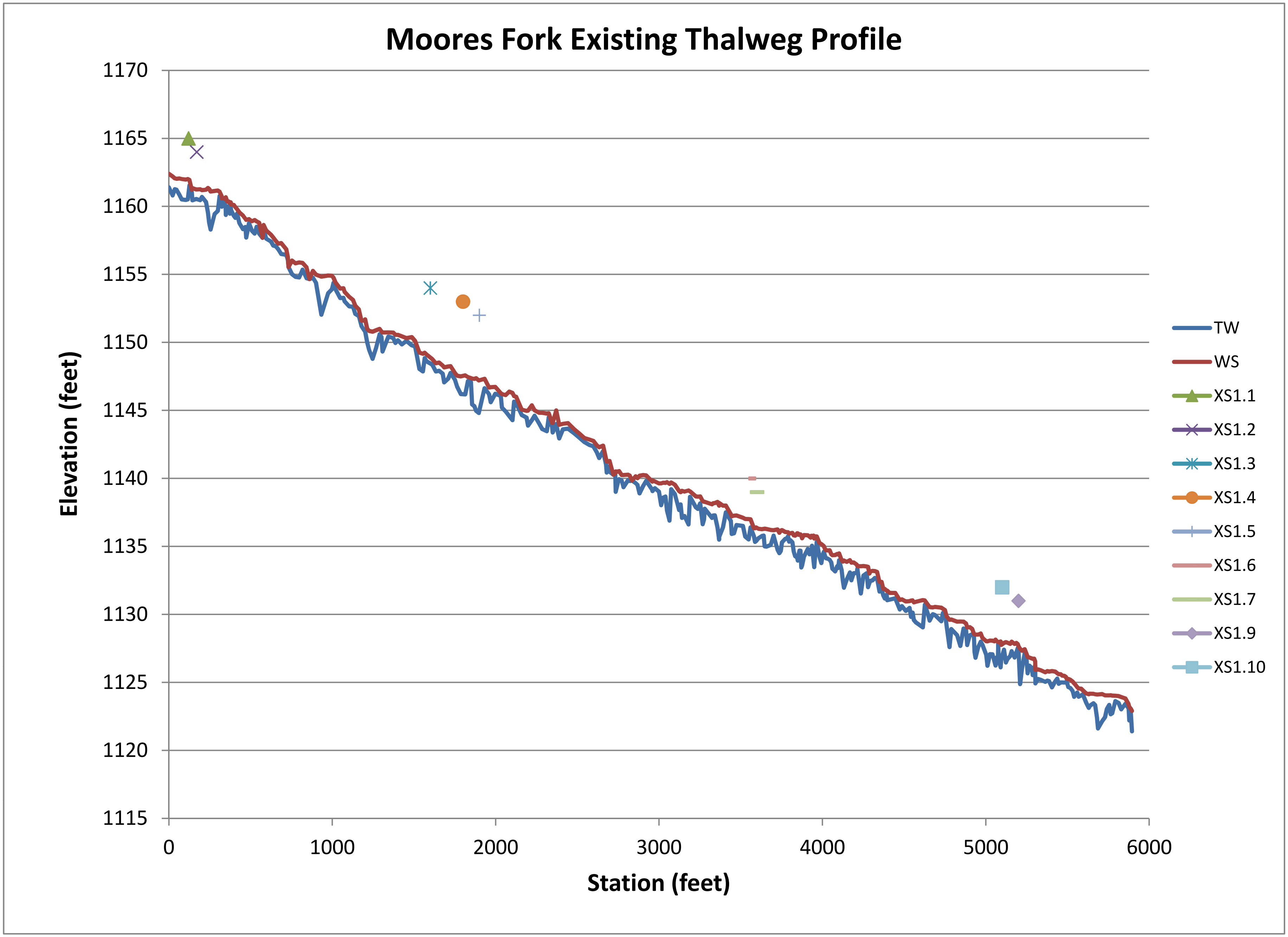
EXISTING CONDITIONS DATA

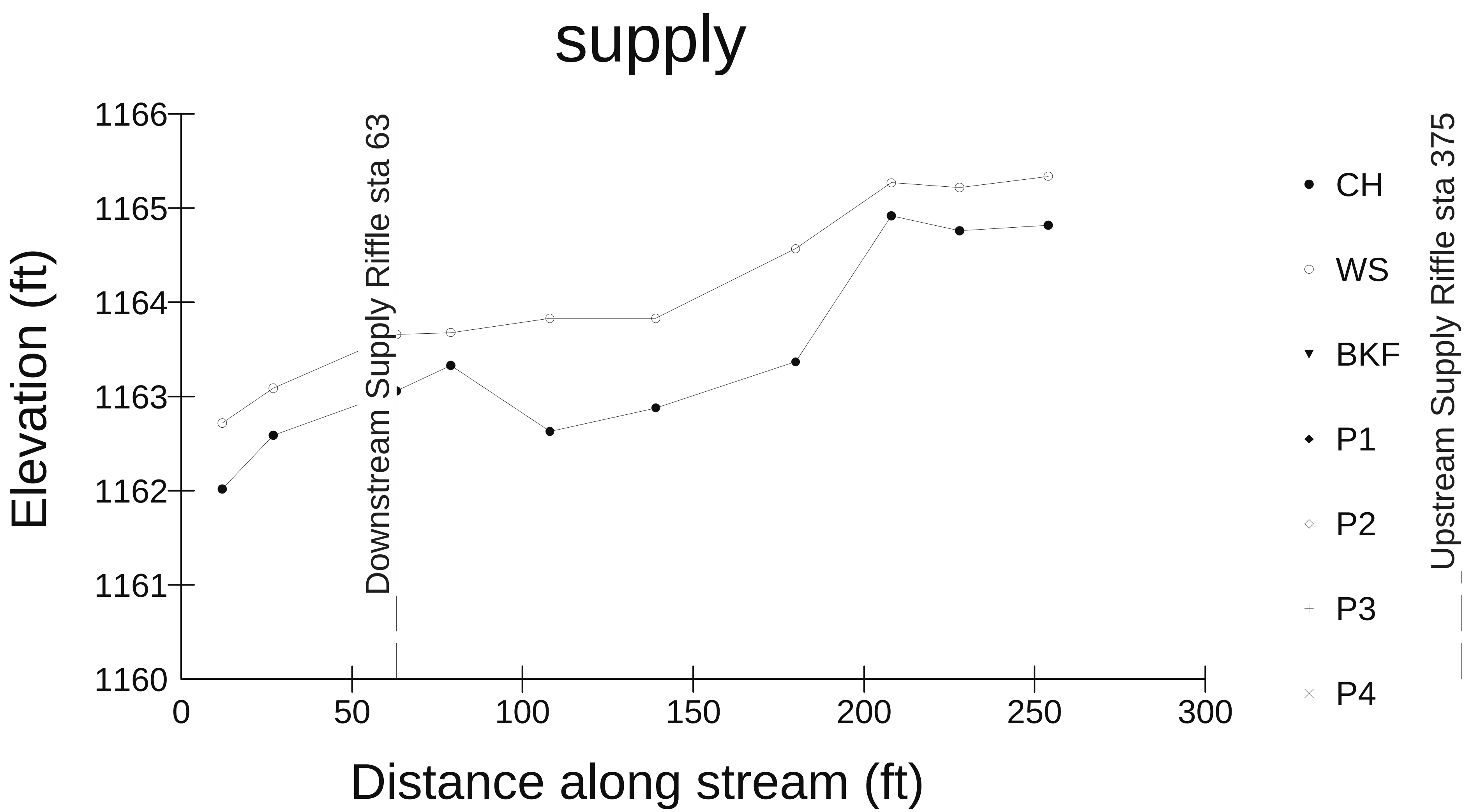
Existing, Design and Reference Morphology Parameters

Parameter	Existing Stream			Design Stream			Reference Stream		
	Min	Median	Max	Min	Median	Max	Min	Median	Max
Stream name	Moores Fork R 1 and 2			Moores Fork R 1 and 2			Mill Branch		
Stream type	C4			C4			C4		
Drainage area, DA (sq mi)	1.89			1.89			5		
Mean riffle depth, d_{bkf} (ft)	1.7	2.2	2.6	2.4			1.9	2.0	2.2
Riffle width, W_{bkf} (ft)	27.3	29.0	30.6	29.0			27.2	30.4	33.6
Width-to-depth ratio, [W_{bkf}/d_{bkf}]	12.0	13.4	15.9	12.1			14.5	15.0	15.6
Riffle cross-section area, A_{bkf} (sq ft)	46.9	62.6	78.2	69.7			50.8	61.6	72.4
Max riffle depth, d_{mbkf} (ft)	3.0	3.2	3.4	0.0	3.4	0.0	2.4	2.5	2.7
Max riffle depth ratio, [d_{mbkf}/d_{bkf}]	1.7	1.5	1.3		1.4		1.3	1.4	1.4
Pool width, W_{bkfp} (ft)	32.7	40.8	48.8	0.0	40.0	0.0	20.1	22.3	24.4
Pool width ratio, [W_{bkfp}/W_{bkf}]	1.2	1.4	1.6		1.4		0.7	0.8	0.9
Pool cross-section area, A_{bkfp} (sq ft)	147.3	153.7	160.1	0.0	124.8	0.0	51.5	53.4	55.4
Pool area ratio, [A_{bkfp}/A_{bkf}]	3.1	2.5	2.0		1.8		1.0	1.1	1.1
Max pool depth, d_{mbkfp} (ft)	5.6	5.6	5.6	0.0	5.0	0.0	3.4	3.5	3.5
Max pool depth ratio, [d_{mbkfp}/d_{bkf}]	3.2	2.6	2.2		2.1		1.8	1.8	1.9
Low bank height, LBH (ft)	3.7	4.3	4.9	0.0	3.4	0.0	2.4	2.5	2.56
Low bank height ratio, [LBH/d_{mbkf}]	1.2	1.4	1.4		1.0		1.0	1.0	1.1
Width flood-prone area, W_{fpa} (ft)	109	123.4	137.7	0	145	0	72.1	72.3	72.5
Entrenchment ratio, ER [W_{fpa}/W_{bkf}]	4.0	4.3	4.5		5.0		2.7	2.7	2.7
Radius of curvature, Rc (ft)	65.8	85.7	102.7	58	87	174	19.6	22.7	25.8
Radius of curvature ratio [Rc/W_{bkf}]	2.4	3.0	3.4	2.0	3.0	6.0	0.7	0.8	0.9
Belt width, W_{blt} (ft)	52	112.7	161	55	93	165	86	86	86
Meander width ratio [W_{blt}/W_{bkf}]	1.9	3.9	5.3	1.9	3.2	5.7	3.2	3.2	3.2
Valley length, VL (ft)	2227			2227			4730		
Stream length, SL (ft)	2393			2578			327		
Valley Elevation Change, VE (ft)	20			20			60		
Stream Elevation Change, SE (ft)	18.5			19.6			3.29		
Valley slope, VS (ft/ft)	0.0090			0.0090			0.0127		
Average water surface slope, S (ft/ft)	0.0077			0.0076			0.0101		
Sinuosity, k = SL/VL (ft/ft)	1.07			1.16			1.26		
Mannings bankfull discharge, Q_{bkf} (cfs)	193.9	297.3	411.4	349.3			251.9	323.1	396.6
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)	4.13	4.75	5.26	5.01			4.96	5.24	5.48
D_{50} riffle (mm)	29			29			40		
D_{50} bar (mm)	12			12			20		
D_{100} bar (mm)	55			55			94		

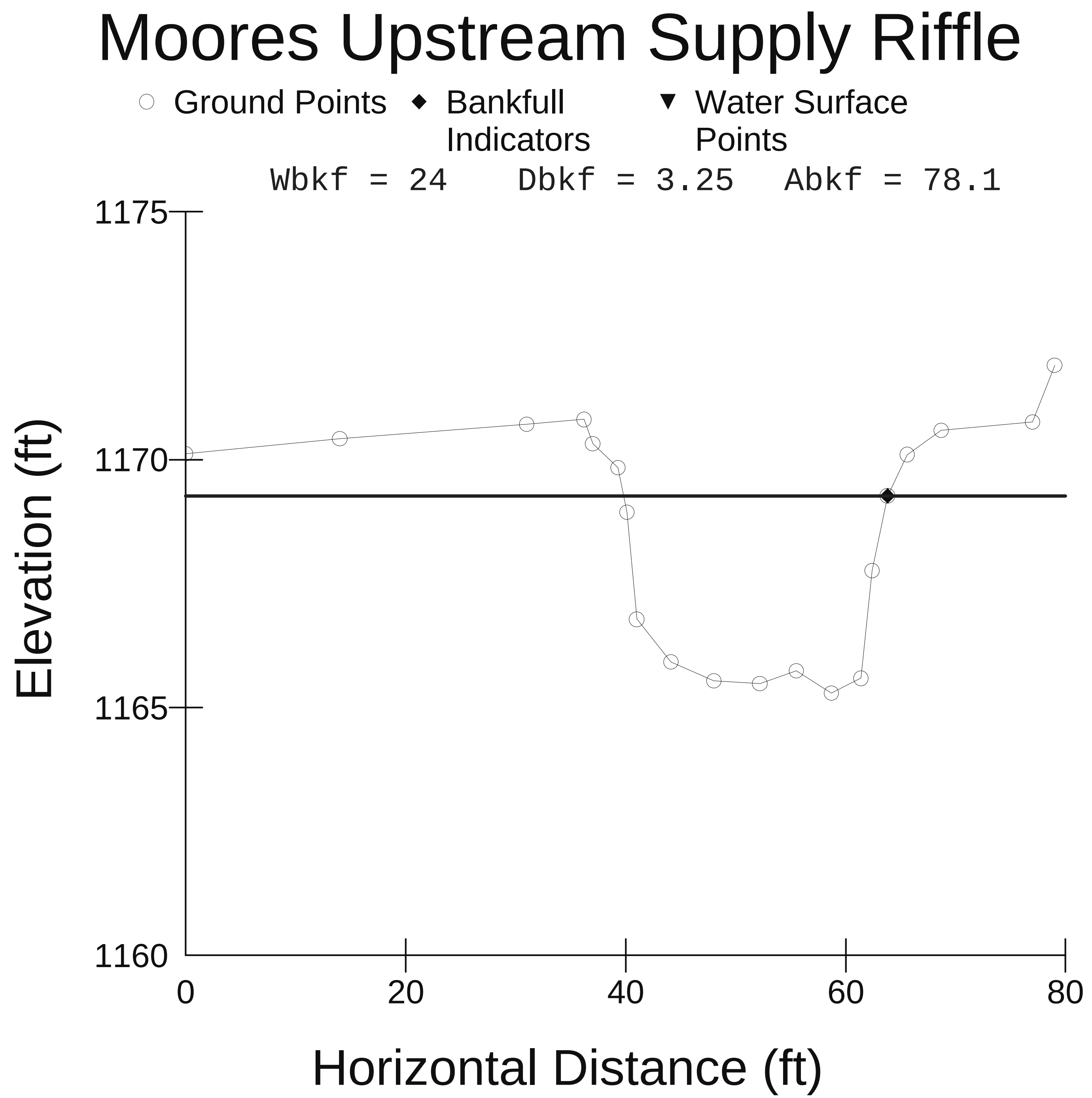
Existing, Design and Reference Morphology Parameters

Parameter	Existing Stream			Design Stream			Reference Stream		
	Min	Median	Max	Min	Median	Max	Min	Median	Max
Stream name	Moores Fork Reach 3			Moores Fork Reach 3			Mill Branch		
Stream type	C4			C4			C4		
Drainage area, DA (sq mi)	2.39			2.39			5		
Mean riffle depth, d_{bkf} (ft)	2.9	2.6	2.3		2.6		1.9	2.0	2.2
Riffle width, W_{bkf} (ft)	24.9	29.6	34.2		31.0		27.2	30.4	33.6
Width-to-depth ratio, $[W_{bkf}/d_{bkf}]$	8.4	11.6	15.1		11.8		14.5	15.0	15.6
Riffle cross-section area, A_{bkf} (sq ft)	73.3	75.5	77.6		81.7		50.8	61.6	72.4
Max riffle depth, d_{mbkf} (ft)	4.0	4.0	4.0		3.8		2.4	2.5	2.7
Max riffle depth ratio, $[d_{mbkf}/d_{bkf}]$	1.4	1.6	1.8		1.4		1.3	1.4	1.4
Pool width, W_{bkfp} (ft)	22.2	24.3	26.4		64.5		20.1	22.3	24.4
Pool width ratio, $[W_{bkfp}/W_{bkf}]$	0.8	0.8	0.9		2.1		0.7	0.8	0.9
Pool cross-section area, A_{bkfp} (sq ft)	66.3	70.0	73.7		145.4		51.5	53.4	55.4
Pool area ratio, $[A_{bkfp}/A_{bkf}]$	0.9	0.9	0.9		1.8		1.0	1.1	1.1
Max pool depth, d_{mbkfp} (ft)	4.5	4.7	4.8		5.5		3.4	3.5	3.5
Max pool depth ratio, $[d_{mbkfp}/d_{bkf}]$	1.5	1.8	2.1		2.1		1.8	1.8	1.9
Low bank height, LBH (ft)	4.95	6.27	7.59		3.8		2.4	2.5	2.56
Low bank height ratio, $[LBH/d_{mbkf}]$	1.2	1.6	1.9		1.0		1.0	1.0	1.1
Width flood-prone area, W_{fpa} (ft)	104	114.5	125		124		72.1	72.3	72.5
Entrenchment ratio, ER $[W_{fpa}/W_{bkf}]$	4.2	3.9	3.7		4.0		2.7	2.7	2.7
Radius of curvature, Rc (ft)	41	62	94	53	62	124	19.6	22.7	25.8
Radius of curvature ratio $[Rc/W_{bkf}]$	1.7	2.1	2.8	1.7	2.0	4.0	0.7	0.8	0.9
Belt width, W_{blt} (ft)	43	123	208	53	127	267	86	86	86
Meander width ratio $[W_{blt}/W_{bkf}]$	1.7	4.1	6.1	1.7	4.1	8.6	3.2	3.2	3.2
Valley length, VL (ft)	2234			2234			4730		
Stream length, SL (ft)	2847			2825			327		
Valley Elevation Change, VE (ft)	16			16			60		
Stream Elevation Change, SE (ft)	19.1			18			3.29		
Valley slope, VS (ft/ft)	0.0072			0.0072			0.0127		
Average water surface slope, S (ft/ft)	0.0067			0.0064			0.0101		
Sinuosity, k = SL/VL (ft/ft)	1.27			1.26			1.26		
Mannings bankfull discharge, Q_{bkf} (cfs)	380.1	370.2	358.4	397.7			251.9	323.1	396.6
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)	5.19	4.91	4.62	4.87			4.96	5.24	5.48
D_{50} riffle (mm)	30			30			40		
D_{50} bar (mm)	14			14			20		
D_{100} bar (mm)	84			84			94		

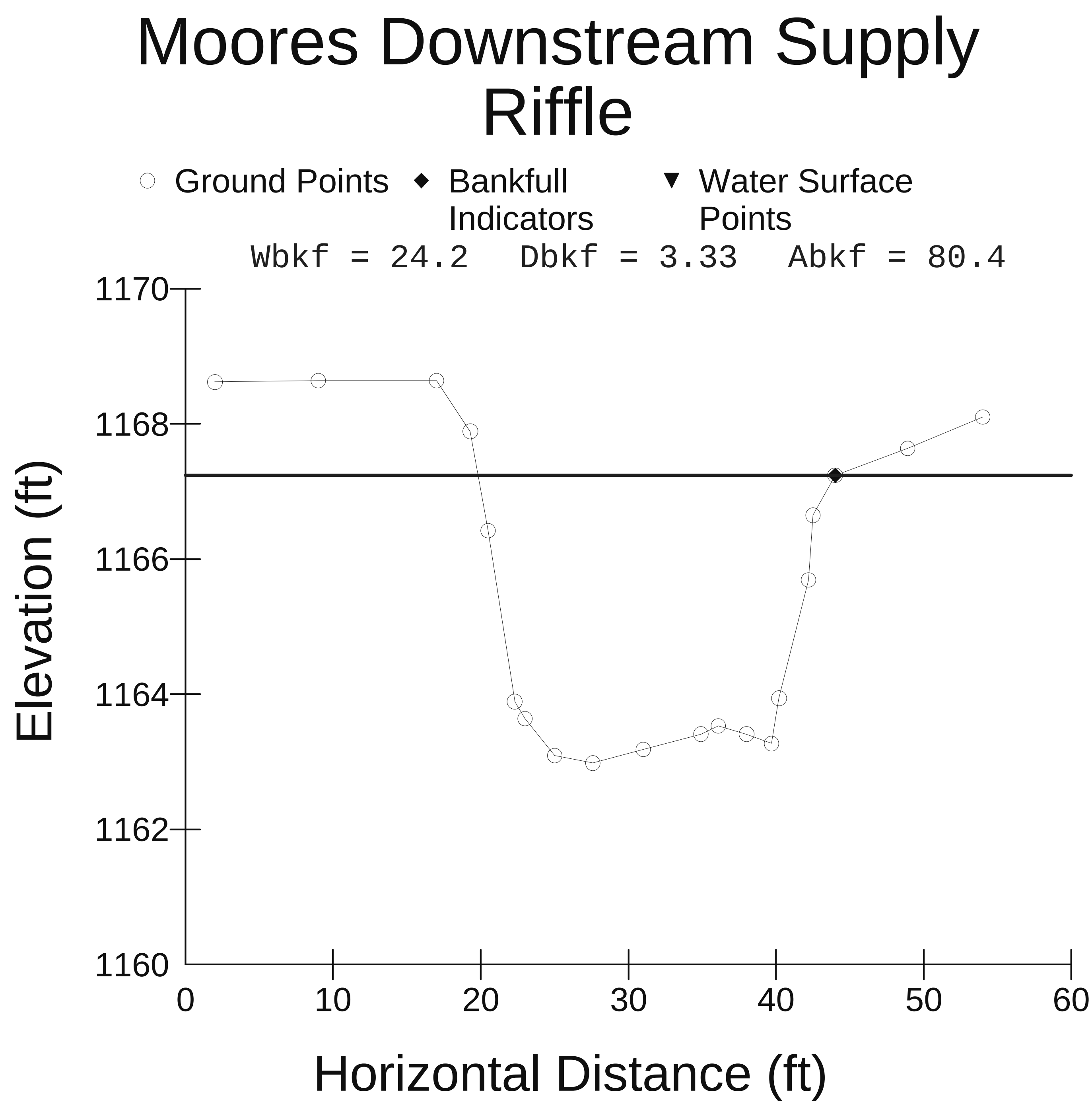

Moores Fork Existing Thalweg Profile
Elevation (feet)
1170
1165
1160
1155
1150
1145
1140
1135
1130
1125
1120
1115
0
1000
2000
3000
4000
5000
6000
Station (feet)
TW
WS
XS1.1
XS1.2
XS1.3
XS1.4
XS1.5
XS1.6
XS1.7
XS1.9
XS1.10



supply
Elevation (ft)
1166
1165
1164
1163
1162
1161
1160
0
50
100
150
200
250
300
Distance along stream (ft)
Downstream Supply Riffle sta 63
Upstream Supply Riffle sta 375
CH
WS
BKF
P1
P2
P3
P4



Moores Upstream Supply Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 24
Dbkf = 3.25
Abkf = 78.1
Elevation (ft)
1175
1170
1165
1160
0
20
40
60
80
Horizontal Distance (ft)


Moores Downstream Supply
Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 24.2   Dbkf = 3.33   Abkf = 80.4
1170
1168
1166
1164
1162
1160
0
10
20
30
40
50
60
Elevation (ft)
Horizontal Distance (ft)

RIVERMORPH PARTICLE SUMMARY

River Name: Moores Fork
Reach Name: Supply
Sample Name: upstream supply riffle
Survey Date: 12/08/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	0	0.00	0.00
0.25 - 0.50	1	0.96	0.96
0.50 - 1.0	0	0.00	0.96
1.0 - 2.0	0	0.00	0.96
2.0 - 4.0	0	0.00	0.96
4.0 - 5.7	1	0.96	1.92
5.7 - 8.0	1	0.96	2.88
8.0 - 11.3	5	4.81	7.69
11.3 - 16.0	11	10.58	18.27
16.0 - 22.6	17	16.35	34.62
22.6 - 32.0	24	23.08	57.69
32 - 45	20	19.23	76.92
45 - 64	15	14.42	91.35
64 - 90	7	6.73	98.08
90 - 128	1	0.96	99.04
128 - 180	0	0.00	99.04
180 - 256	0	0.00	99.04
256 - 362	0	0.00	99.04
362 - 512	0	0.00	99.04
512 - 1024	0	0.00	99.04
1024 - 2048	0	0.00	99.04
Bedrock	1	0.96	100.00

D16 (mm)	14.99
D35 (mm)	22.75
D50 (mm)	28.87
D84 (mm)	54.32
D95 (mm)	78.1
D100 (mm)	Bedrock
Silt/Clay (%)	0
Sand (%)	0.96
Gravel (%)	90.39
Cobble (%)	7.69
Boulder (%)	0
Bedrock (%)	0.96

Total Particles = 104.

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Supply
Sample Name:	lateral bar ds of us riffle
Survey Date:	12/08/2011

SIEVE (mm)	NET WT
31.5	1259.8
16	997
8	434.5
4	220.9
2	148.7
PAN	1076.9

D16 (mm)	0
D35 (mm)	11.13
D50 (mm)	22.66
D84 (mm)	43.3
D95 (mm)	49.28
D100 (mm)	52
Silt/Clay (%)	0
Sand (%)	23.31
Gravel (%)	76.69
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Weight = 4619.2000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	52	244.5
Particle 2:	50	236.9

RIVERMORPH PARTICLE SUMMARY

River Name: Moores Fork
Reach Name: Supply
Sample Name: downstream supply riffle
Survey Date: 12/08/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	0	0.00	0.00
0.25 - 0.50	1	0.96	0.96
0.50 - 1.0	0	0.00	0.96
1.0 - 2.0	0	0.00	0.96
2.0 - 4.0	0	0.00	0.96
4.0 - 5.7	0	0.00	0.96
5.7 - 8.0	2	1.92	2.88
8.0 - 11.3	3	2.88	5.77
11.3 - 16.0	13	12.50	18.27
16.0 - 22.6	9	8.65	26.92
22.6 - 32.0	19	18.27	45.19
32 - 45	15	14.42	59.62
45 - 64	18	17.31	76.92
64 - 90	16	15.38	92.31
90 - 128	2	1.92	94.23
128 - 180	3	2.88	97.12
180 - 256	2	1.92	99.04
256 - 362	1	0.96	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	15.15
D35 (mm)	26.76
D50 (mm)	36.33
D84 (mm)	75.96
D95 (mm)	141.85
D100 (mm)	361.99
Silt/Clay (%)	0
Sand (%)	0.96
Gravel (%)	75.96
Cobble (%)	22.12
Boulder (%)	0.96
Bedrock (%)	0

Total Particles = 104.

RIVERMORPH PARTICLE SUMMARY

River Name: Moores Fork
Reach Name: Supply
Sample Name: point bar ds of ds riffle
Survey Date: 12/08/2011

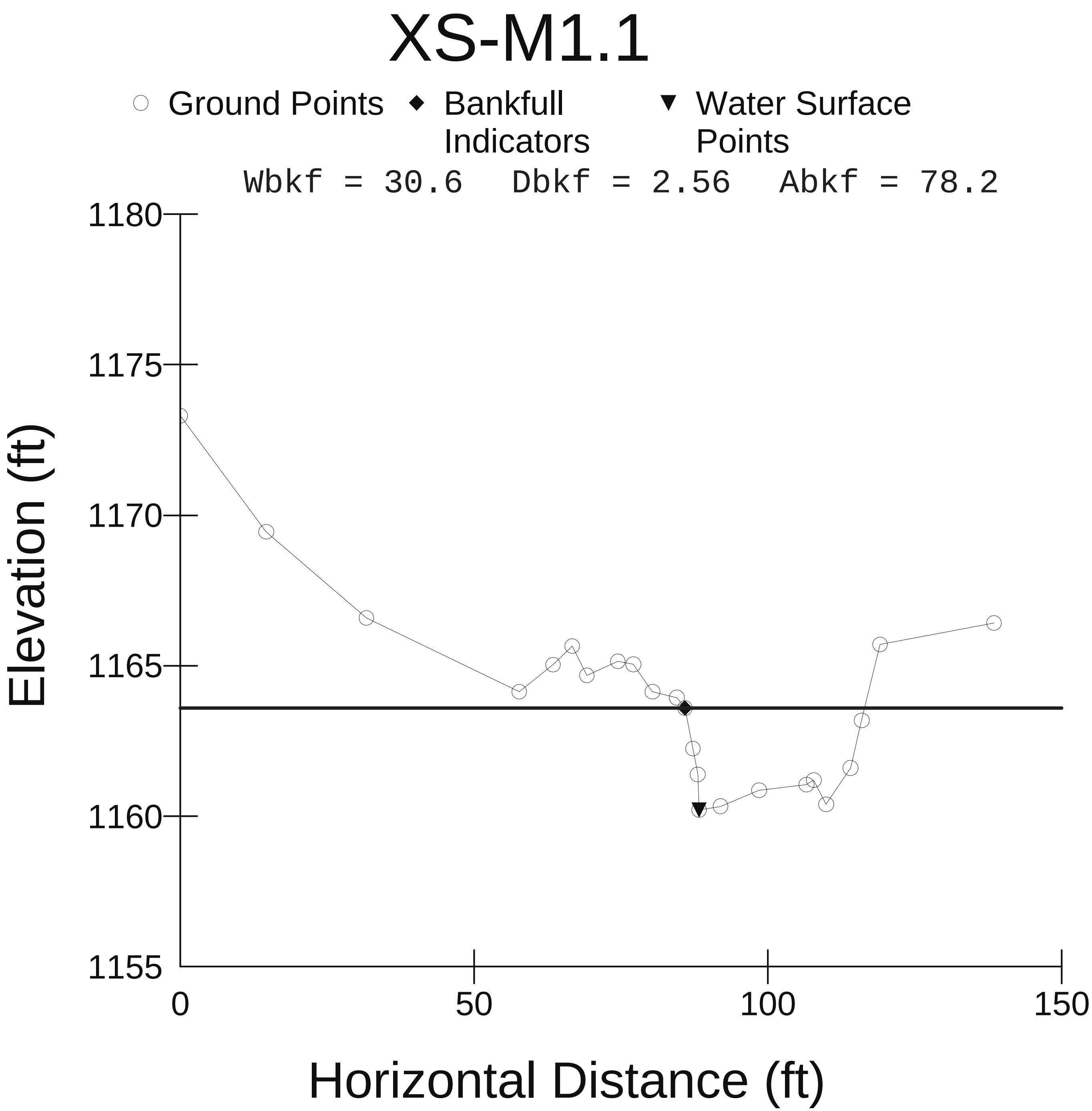
SIEVE (mm)	NET WT
31.5	1413.2
16	1009
8	704.5
4	500.7
2	306.2
PAN	0

D16 (mm)	7.32
D35 (mm)	17.04
D50 (mm)	27.44
D84 (mm)	61.14
D95 (mm)	72.73
D100 (mm)	78
Silt/Clay (%)	0
Sand (%)	0
Gravel (%)	90.37
Cobble (%)	9.63
Boulder (%)	0
Bedrock (%)	0

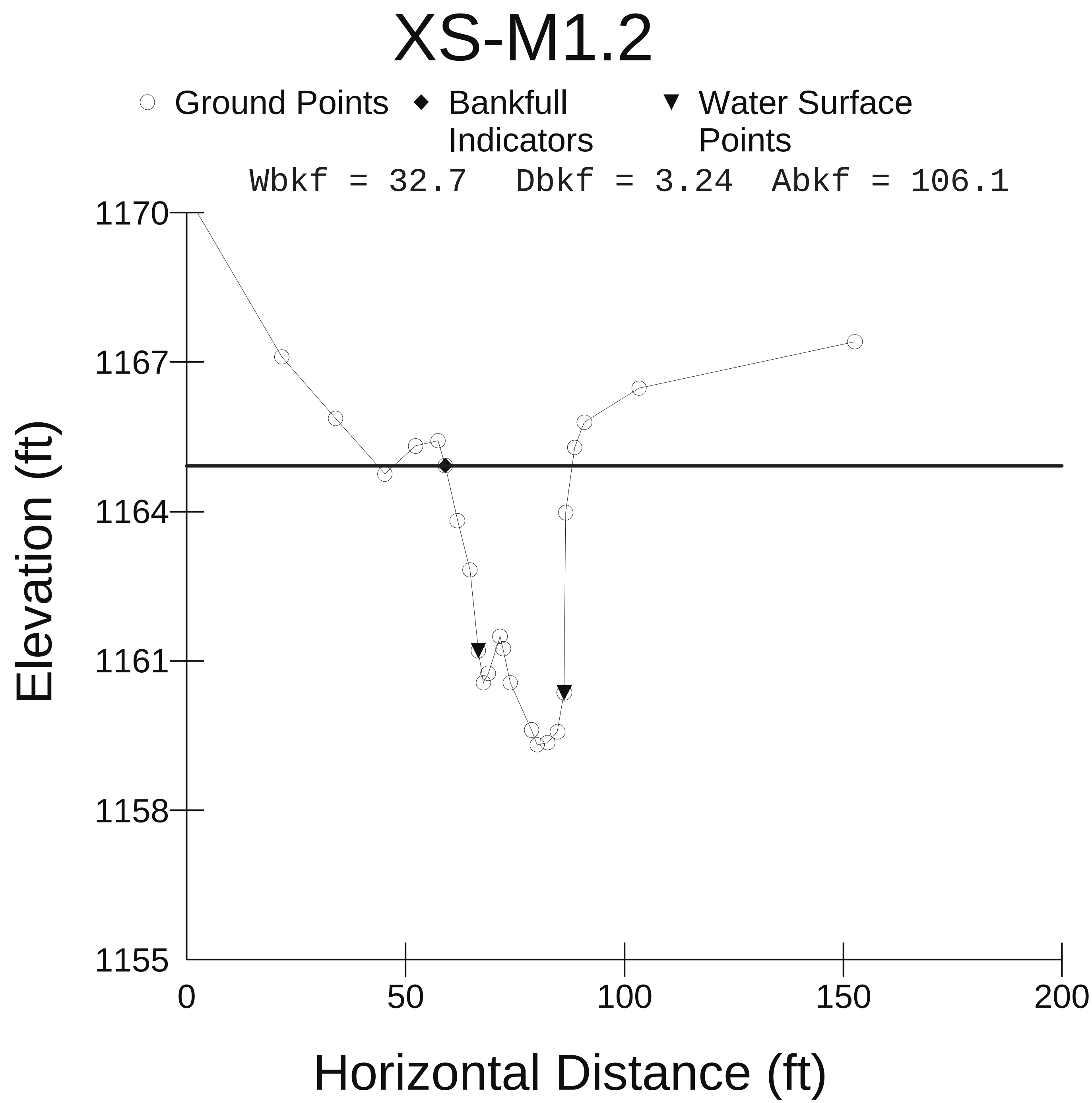
Total Weight = 4511.6000.

Largest Surface Particles:

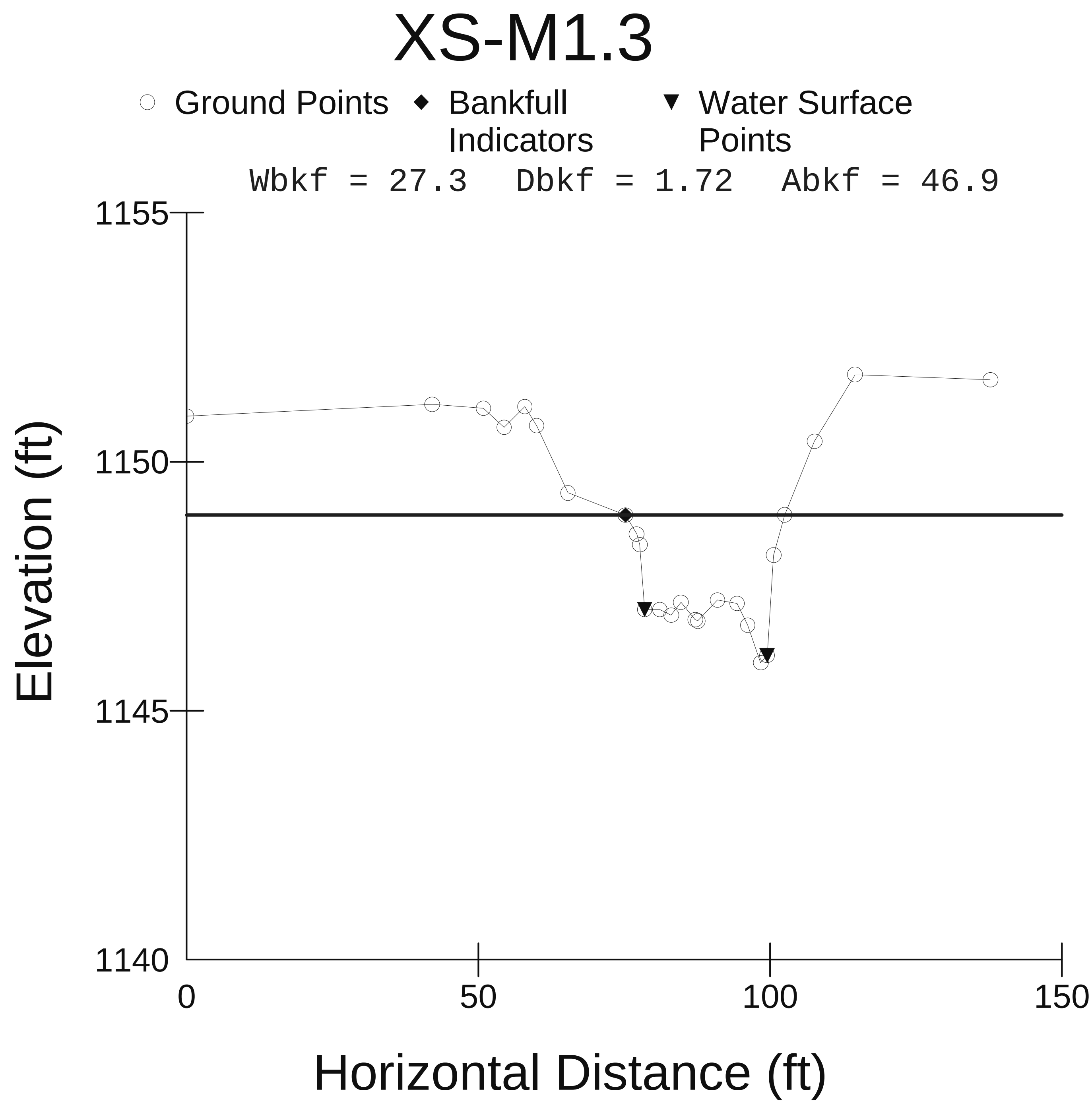
	Size(mm)	Weight
Particle 1:	78	416
Particle 2:	50	162

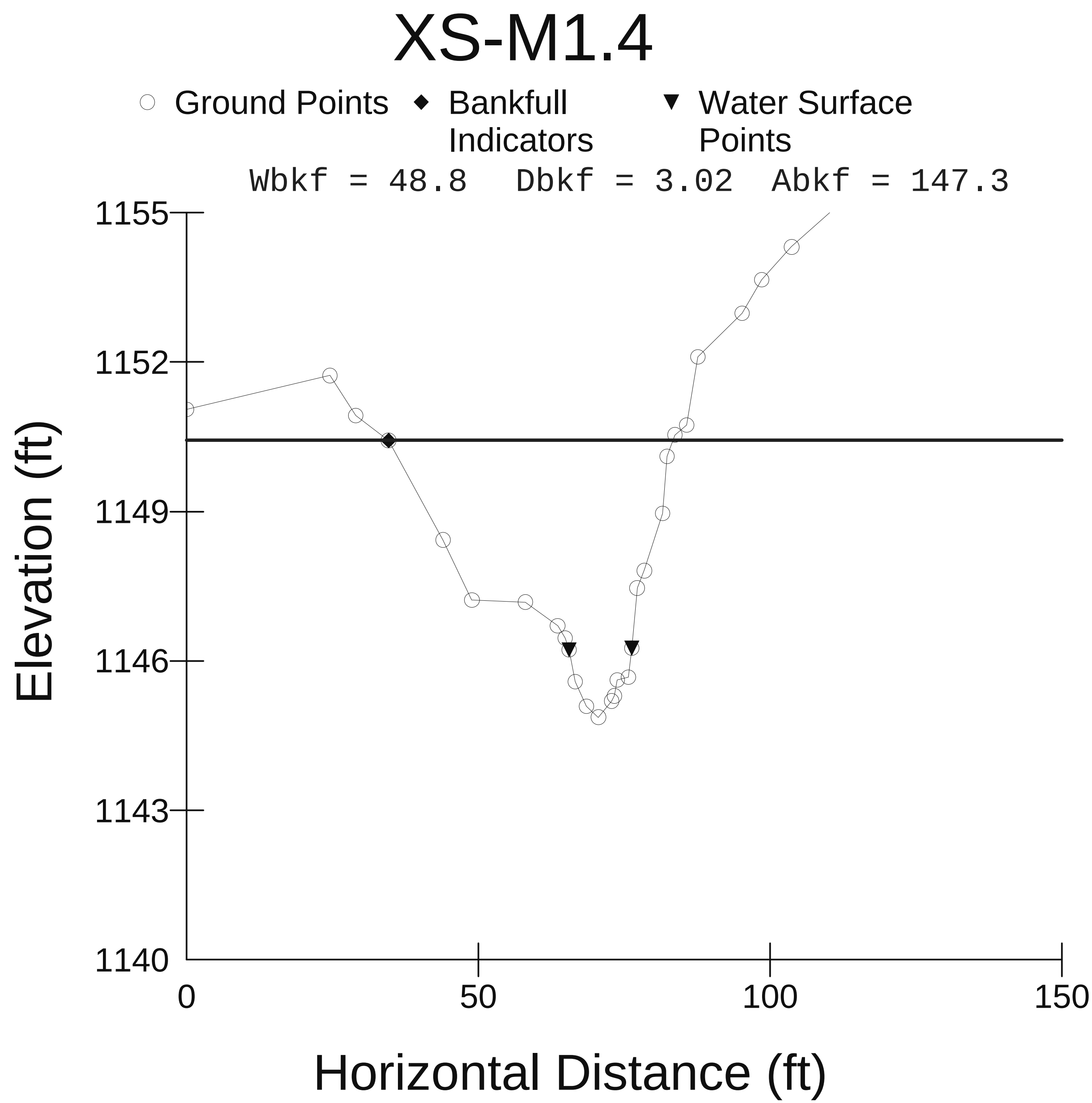


XS-M1.1
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 30.6 Dbkf = 2.56 Abkf = 78.2
1180
1175
1170
1165
1160
1155
Elevation (ft)
0
50
100
150
Horizontal Distance (ft)

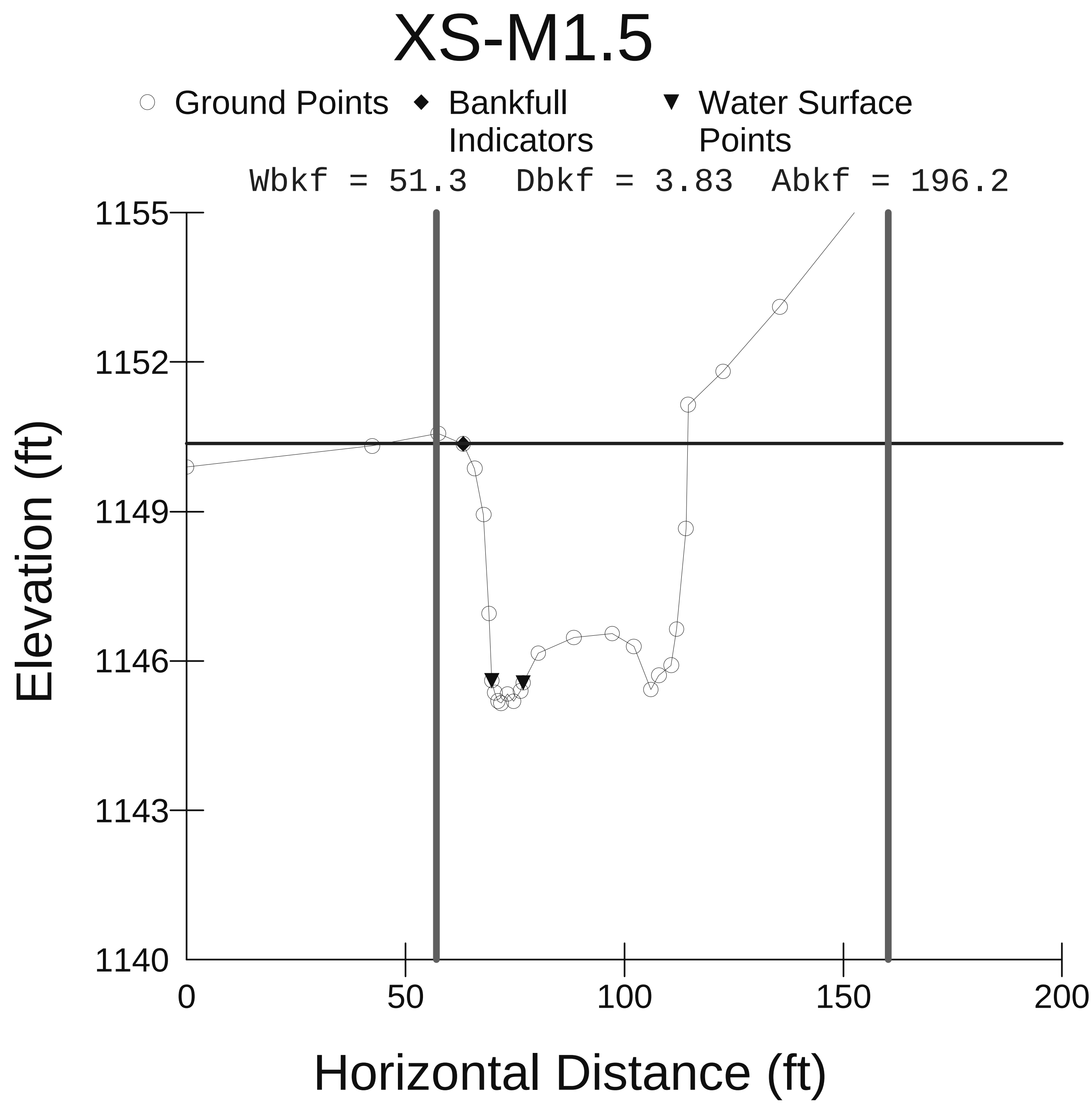


XS-M1.2
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 32.7 Dbkf = 3.24 Abkf = 106.1
Elevation (ft)
1170
1167
1164
1161
1158
1155
0
50
100
150
200
Horizontal Distance (ft)


XS-M1.3
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 27.3 Dbkf = 1.72 Abkf = 46.9
1155
1150
1145
1140
0
50
100
150
Elevation (ft)
Horizontal Distance (ft)

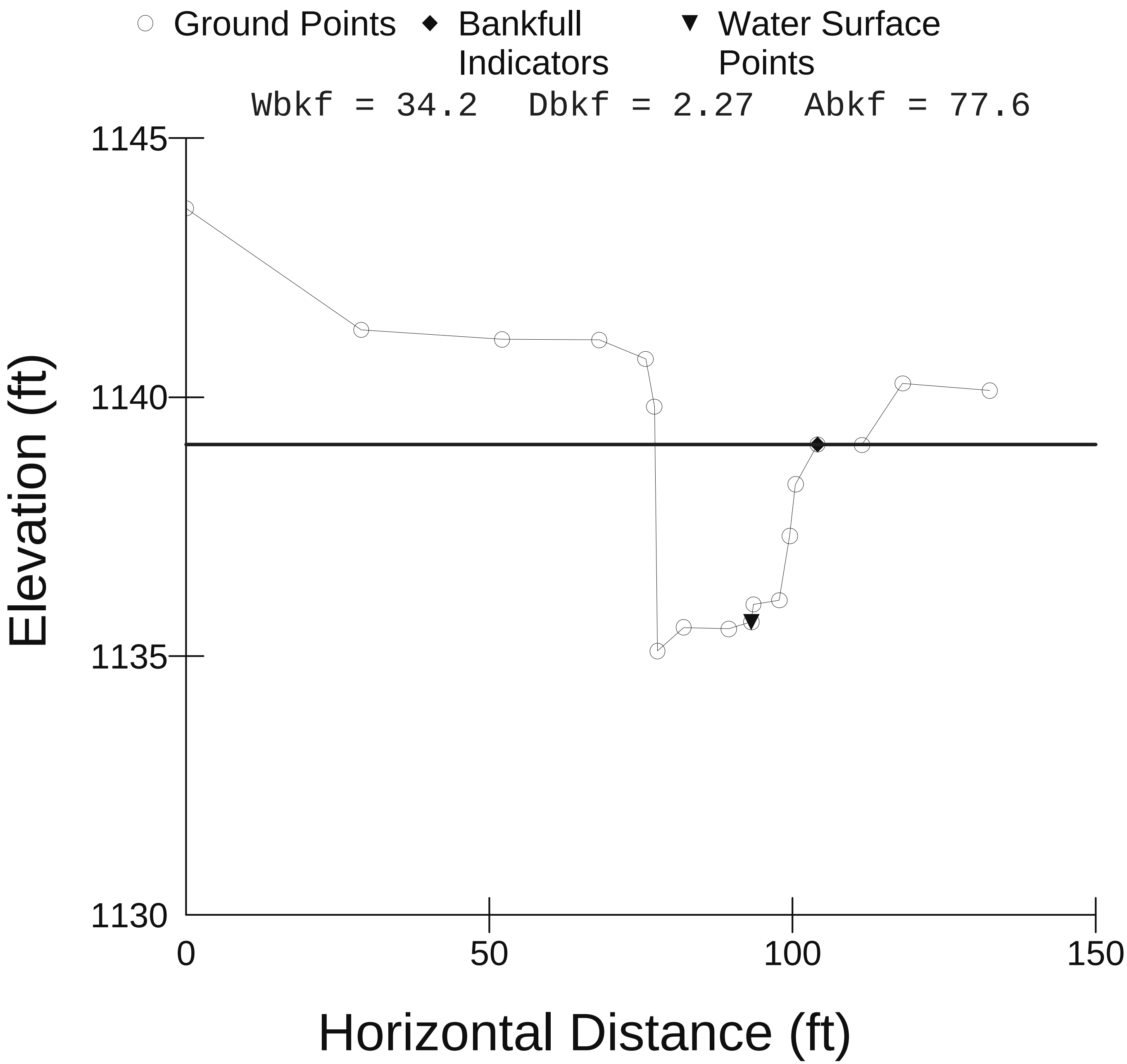


XS-M1.4
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 48.8 Dbkf = 3.02 Abkf = 147.3
1155
1152
1149
1146
1143
1140
Elevation (ft)
0
50
100
150
Horizontal Distance (ft)

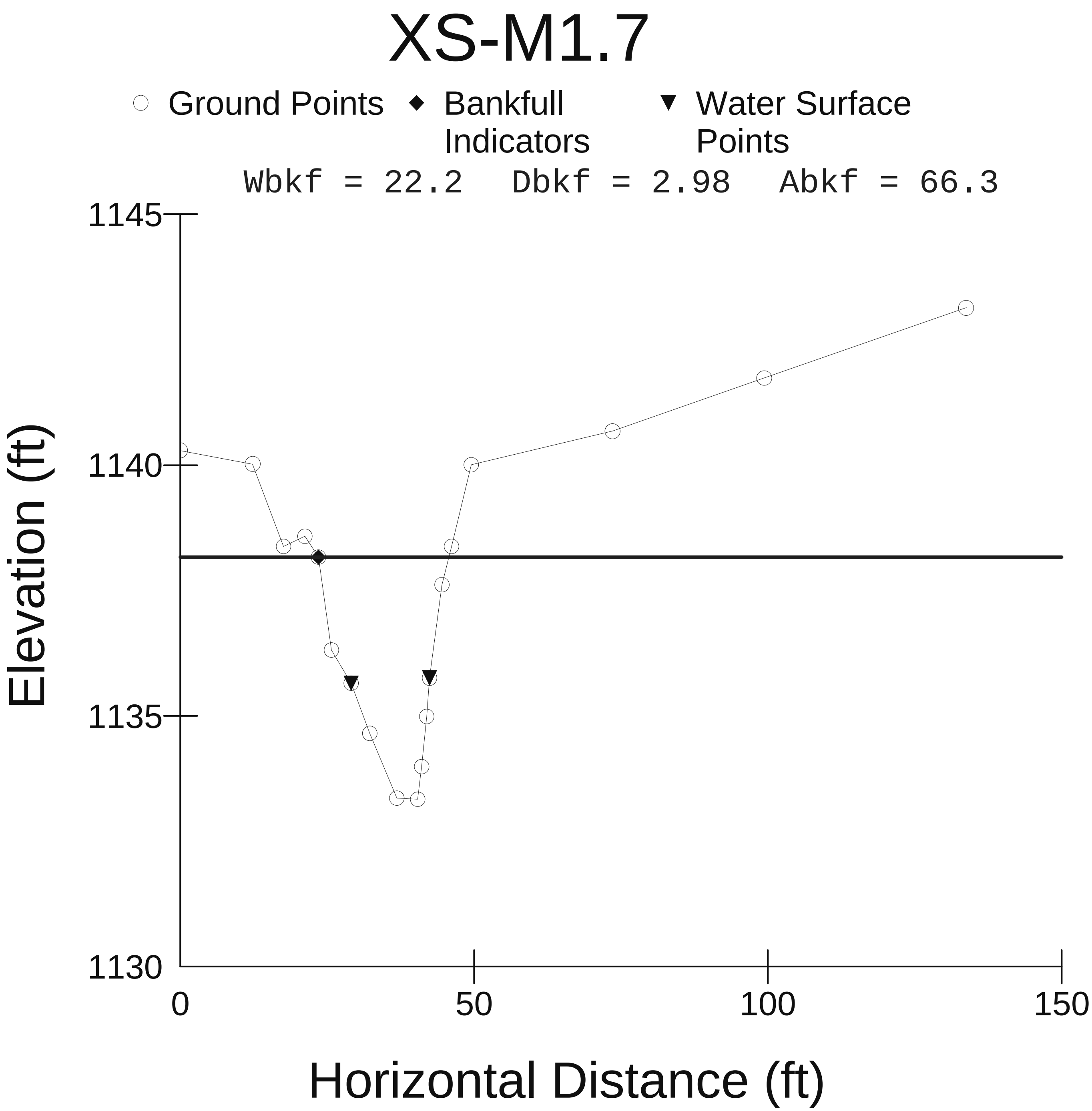


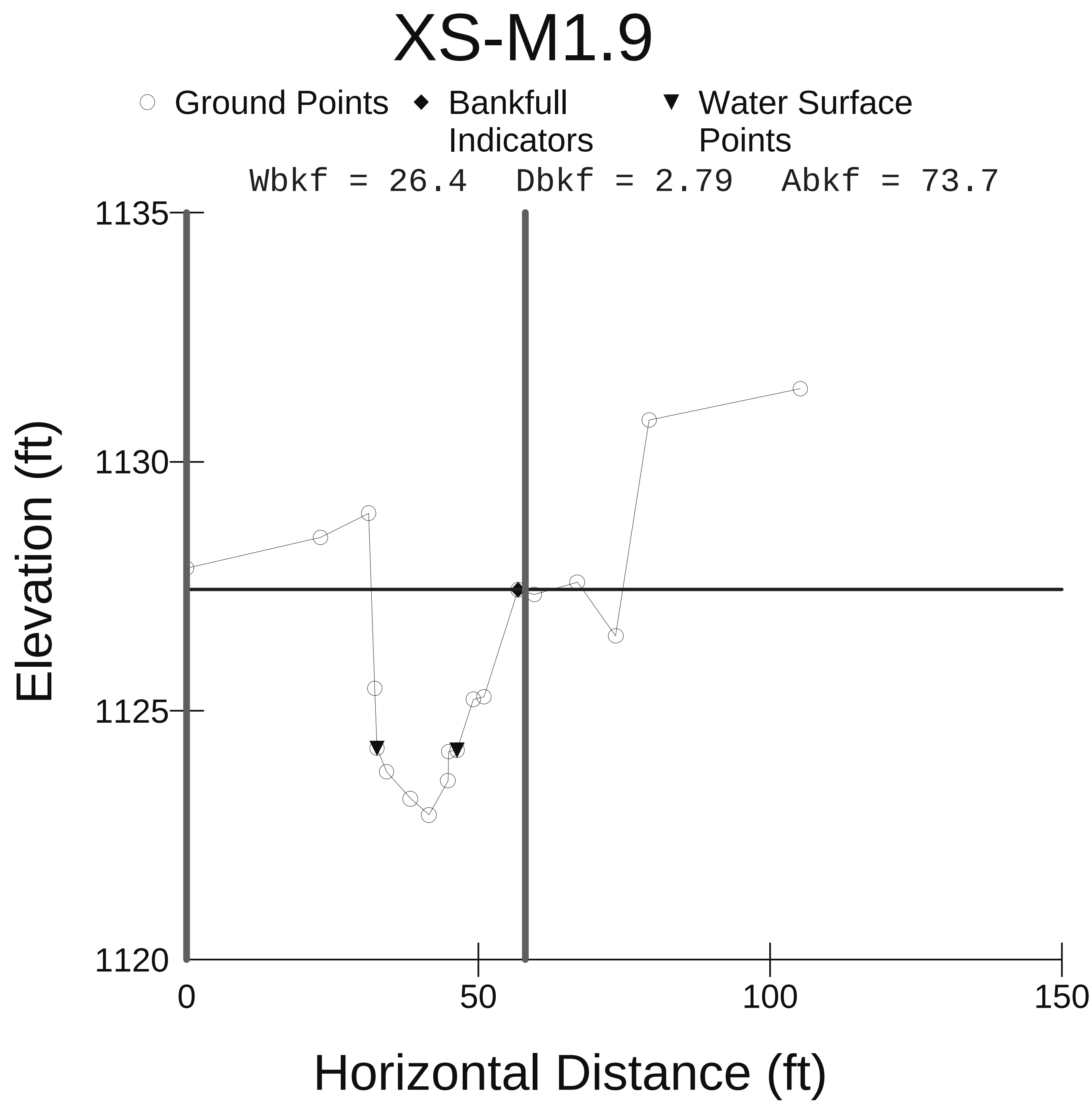
XS-M1.5
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 51.3 Dbkf = 3.83 Abkf = 196.2
Elevation (ft)
1155
1152
1149
1146
1143
1140
0
50
100
150
200
Horizontal Distance (ft)

XS-M1.6

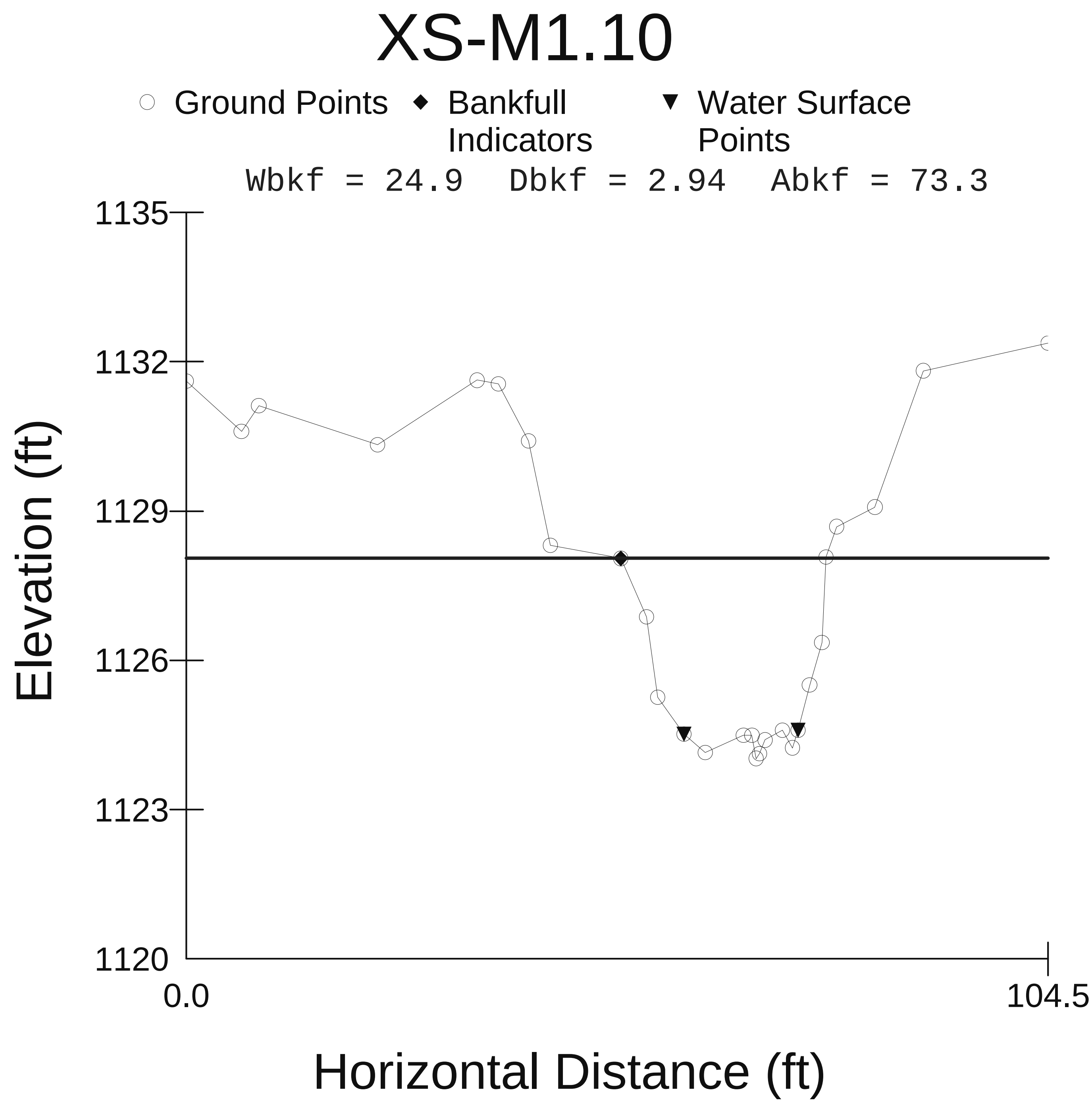


Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 34.2   Dbkf = 2.27   Abkf = 77.6
1145
1140
1135
1130
Elevation (ft)
0
50
100
150
Horizontal Distance (ft)


XS-M1.7
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 22.2 Dbkf = 2.98 Abkf = 66.3
1145
1140
1135
1130
0
50
100
150
Elevation (ft)
Horizontal Distance (ft)



XS-M1.9
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 26.4 Dbkf = 2.79 Abkf = 73.7
1135
1130
1125
1120
Elevation (ft)
0
50
100
150
Horizontal Distance (ft)



XS-M1.10
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 24.9 Dbkf = 2.94 Abkf = 73.3
1135
1132
1129
1126
1123
1120
Elevation (ft)
0.0
104.5
Horizontal Distance (ft)

RIVERMORPH PARTICLE SUMMARY

River Name: Moores Fork
Reach Name: Reach 1
Sample Name: Zig-zag riffle pavement for MF subpave 1
Survey Date: 02/08/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	0	0.00	0.00
0.25 - 0.50	3	2.91	2.91
0.50 - 1.0	1	0.97	3.88
1.0 - 2.0	0	0.00	3.88
2.0 - 4.0	0	0.00	3.88
4.0 - 5.7	3	2.91	6.80
5.7 - 8.0	3	2.91	9.71
8.0 - 11.3	7	6.80	16.50
11.3 - 16.0	5	4.85	21.36
16.0 - 22.6	16	15.53	36.89
22.6 - 32.0	21	20.39	57.28
32 - 45	15	14.56	71.84
45 - 64	11	10.68	82.52
64 - 90	13	12.62	95.15
90 - 128	5	4.85	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	11.06
D35 (mm)	21.8
D50 (mm)	28.64
D84 (mm)	67.05
D95 (mm)	89.69
D100 (mm)	128
Silt/Clay (%)	0
Sand (%)	3.88
Gravel (%)	78.64
Cobble (%)	17.48
Boulder (%)	0
Bedrock (%)	0

Total Particles = 103.

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Reach 1
Sample Name:	Bar sample D/S XS-M1.1
Survey Date:	04/20/2011

SIEVE (mm)	NET WT
31.5	38
16	1322.4
8	967.4
4	482.8
2	222.7
PAN	767.8

D16 (mm)	0
D35 (mm)	7.15
D50 (mm)	12.02
D84 (mm)	25.97
D95 (mm)	31.02
D100 (mm)	55
Silt/Clay (%)	0
Sand (%)	19.6
Gravel (%)	80.4
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Weight = 3918.0000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	55	57.7
Particle 2:	53	59.2

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Reach 1
Sample Name:	Subpavement 1
Survey Date:	02/08/2011

SIEVE (mm)	NET WT
31.5	143.6
16	812.6
8	506.9
4	166.3
2	85.5
PAN	366.6

D16 (mm)	4.61
D35 (mm)	14.73
D50 (mm)	23
D84 (mm)	81.25
D95 (mm)	109.95
D100 (mm)	123
Silt/Clay (%)	0
Sand (%)	12.28
Gravel (%)	70.9
Cobble (%)	16.82
Boulder (%)	0
Bedrock (%)	0

Total Weight = 2984.4000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	123	673.8
Particle 2:	110	229.1

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Reach 2
Sample Name:	Zig-zag riffle pavement for MF subpave 2
Survey Date:	02/08/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	0	0.00	0.00
0.25 - 0.50	0	0.00	0.00
0.50 - 1.0	0	0.00	0.00
1.0 - 2.0	1	1.00	1.00
2.0 - 4.0	0	0.00	1.00
4.0 - 5.7	0	0.00	1.00
5.7 - 8.0	1	1.00	2.00
8.0 - 11.3	5	5.00	7.00
11.3 - 16.0	8	8.00	15.00
16.0 - 22.6	19	19.00	34.00
22.6 - 32.0	21	21.00	55.00
32 - 45	34	34.00	89.00
45 - 64	10	10.00	99.00
64 - 90	1	1.00	100.00
90 - 128	0	0.00	100.00
128 - 180	0	0.00	100.00
180 - 256	0	0.00	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	16.35
D35 (mm)	23.05
D50 (mm)	29.76
D84 (mm)	43.09
D95 (mm)	56.4
D100 (mm)	90
Silt/Clay (%)	0
Sand (%)	1
Gravel (%)	98
Cobble (%)	1
Boulder (%)	0
Bedrock (%)	0

Total Particles = 100.

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Reach 2
Sample Name:	Subpavement 2
Survey Date:	02/08/2011

SIEVE (mm)	NET WT
31.5	470.7
16	775.3
8	496.4
4	298.1
2	148.4
PAN	845.2

D16 (mm)	0
D35 (mm)	6.51
D50 (mm)	14.37
D84 (mm)	49.02
D95 (mm)	73.07
D100 (mm)	84
Silt/Clay (%)	0
Sand (%)	25.05
Gravel (%)	68.29
Cobble (%)	6.66
Boulder (%)	0
Bedrock (%)	0

Total Weight = 3373.6000.

Largest Surface Particles:

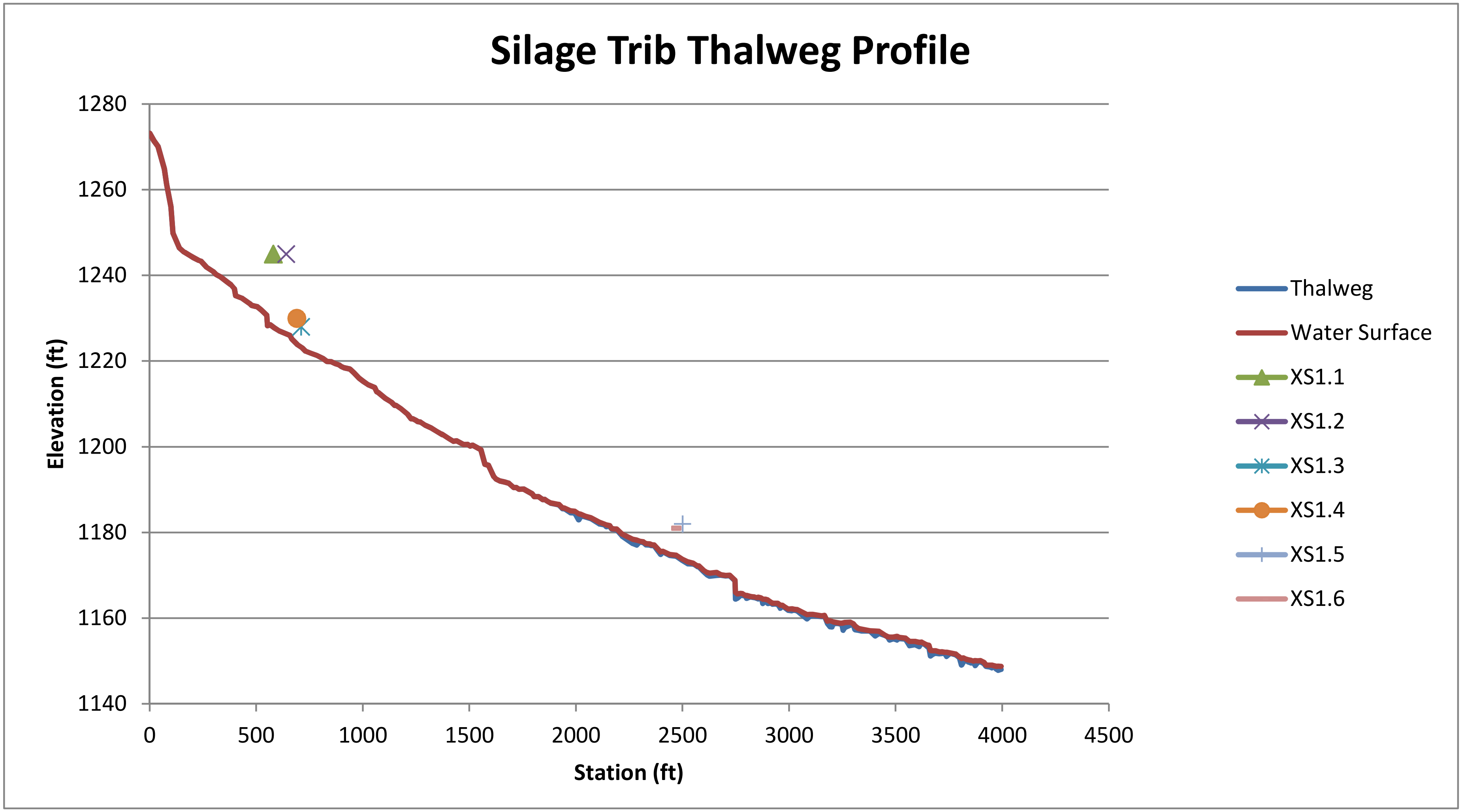
	Size(mm)	Weight
Particle 1:	84	214.1
Particle 2:	52	125.4

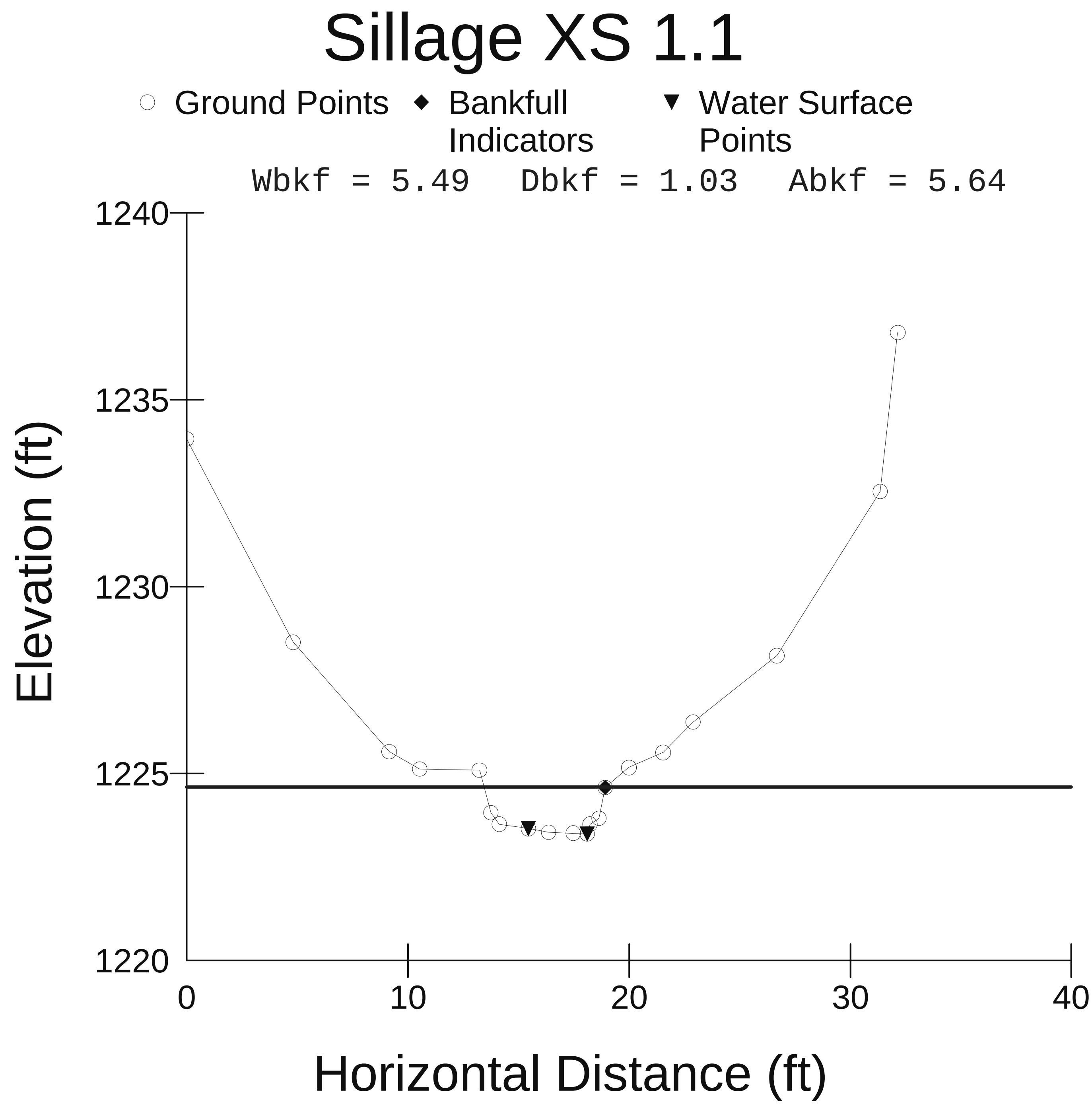
Existing and Design Morphology Parameters

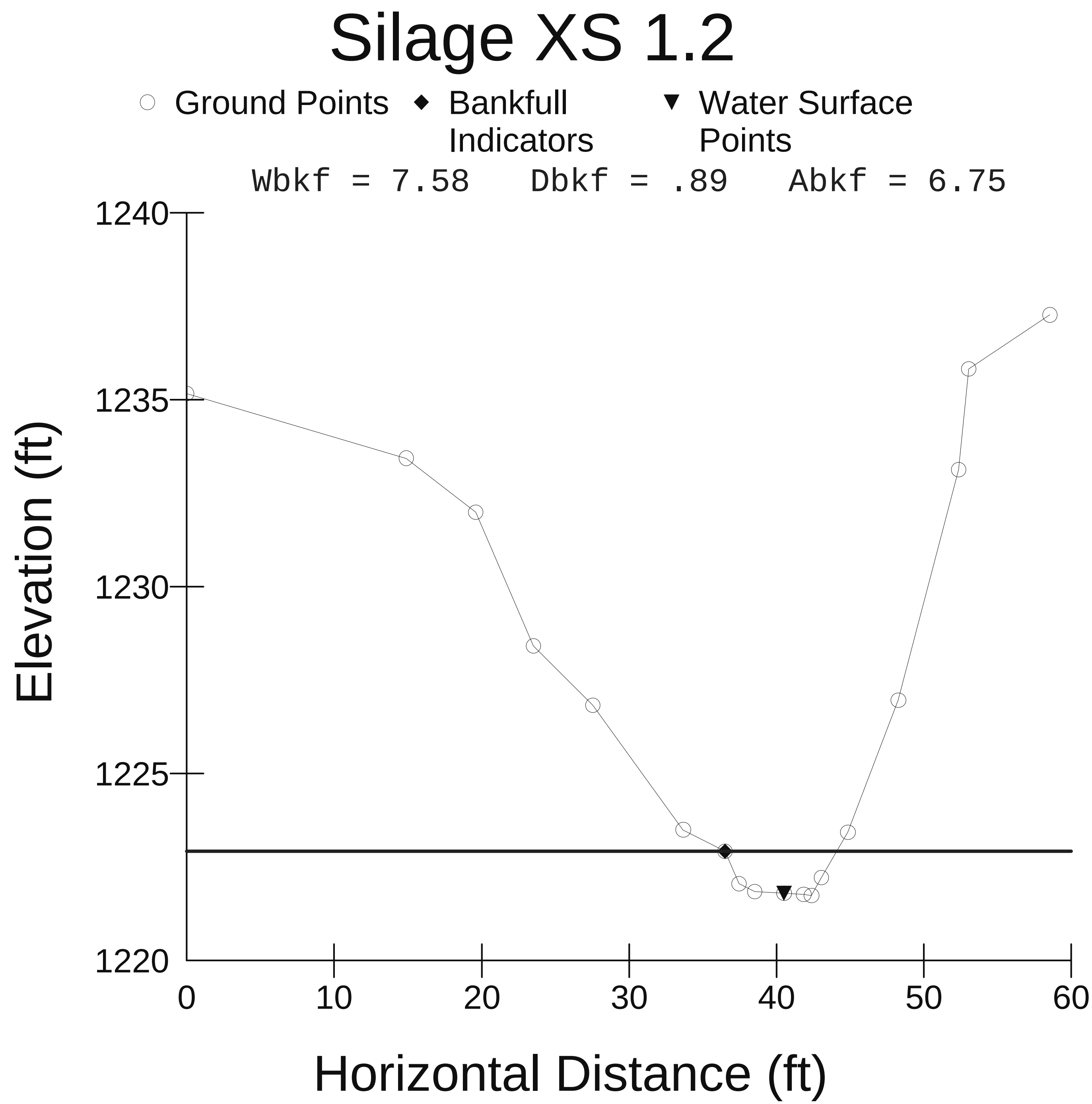
Parameter	Existing Stream			Design Stream
	Min	Median	Max	Design Values
Stream name	Silage Trib U/S (10+00-34+80)			Silage Trib R1
Stream type	G4/B4			B4
Drainage area, DA (sq mi)	0.07			0.07
Mean riffle depth, d_{bkf} (ft)	0.8	1.0	1.2	0.6
Riffle width, W_{bkf} (ft)	6.7	6.8	6.9	8.8
Width-to-depth ratio, $[W_{bkf}/d_{bkf}]$	5.7	6.6	8.0	15.1
Riffle cross-section area, A_{bkf} (sq ft)	5.6	7.0	8.4	5.1
Max riffle depth, d_{mbkf} (ft)	1.2	1.4	1.7	0.8
Max riffle depth ratio, $[d_{mbkf}/d_{bkf}]$	1.4	1.4	1.4	1.4
Pool width, W_{bkfp} (ft)	7.6	7.9	8.1	12.4
Pool width ratio, $[W_{bkfp}/W_{bkf}]$	1.1	1.2	1.2	1.4
Pool cross-section area, A_{bkfp} (sq ft)	6.8	7.4	8.0	11.2
Pool area ratio, $[A_{bkfp}/A_{bkf}]$	1.2	1.1	1.0	2.2
Max pool depth, d_{mbkfp} (ft)	1.2	1.5	1.7	1.4
Max pool depth ratio, $[d_{mbkfp}/d_{bkf}]$	1.4	1.4	1.4	2.4
Low bank height, LBH (ft)	1.4	1.7	1.9	0.8
Low bank height ratio, $[LBH/d_{mbkf}]$	1.0	1.1	1.6	1.0
Width flood-prone area, W_{fpa} (ft)	11	13.5	16	19
Entrenchment ratio, ER $[W_{fpa}/W_{bkf}]$	1.6	2.0	2.3	2.2
Valley length, VL (ft)	2233			2233
Stream length, SL (ft)	2480			2480
Valley Elevation Change, VE (ft)	82.7			82.7
Stream Elevation Change, SE (ft)	88.5			88.5
Valley slope, VS (ft/ft)	0.0370			0.0370
Average water surface slope, S (ft/ft)	0.0357			0.0357
Sinuosity, k = SL/VL (ft/ft)	1.11			1.11
Mannings bankfull discharge, Q_{bkf} (cfs)	30.2	42.1	55.1	23.0
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)	5.39	6.02	6.56	4.50
D_{50} bar (mm)	4			4
D_{100} bar (mm)	63			63

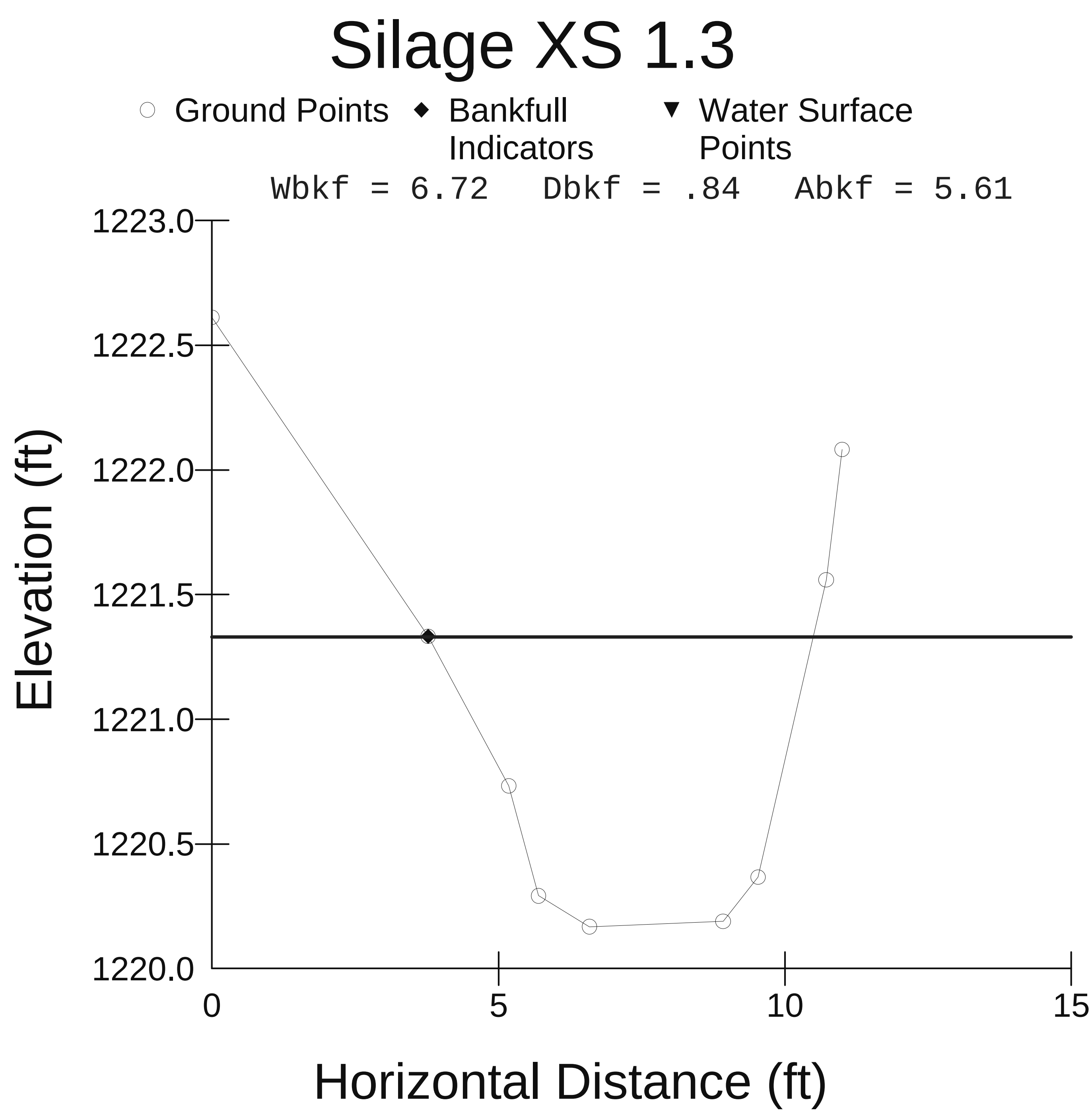
Existing and Design Morphology Parameters

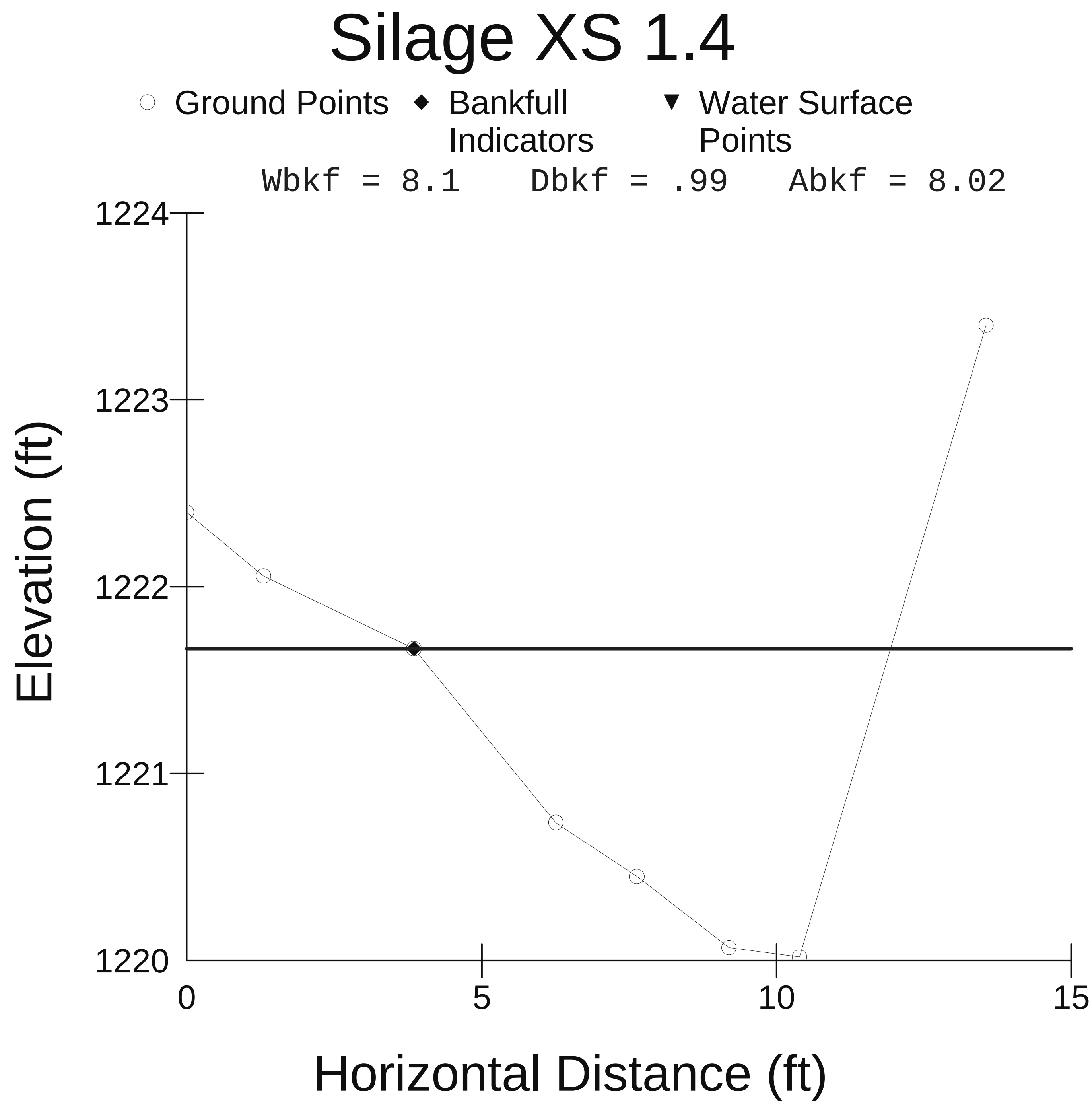
Parameter	Existing Stream			Design Stream
	Min	Median	Max	Design Values
Stream name	Silage Trib R2 (34+80-43+48)			Silage Trib R2
Stream type	E4			E4
Drainage area, DA (sq mi)	0.24			0.24
Mean riffle depth, d_{bkf} (ft)		1.7		1.0
Riffle width, W_{bkf} (ft)		18.2		12.5
Width-to-depth ratio, [W_{bkf}/d_{bkf}]		10.5		11.9
Riffle cross-section area, A_{bkf} (sq ft)		31.6		13.1
Max riffle depth, d_{mbkf} (ft)		2.3		1.5
Max riffle depth ratio, [d_{mbkf}/d_{bkf}]		1.3		1.4
Pool width, W_{bkfp} (ft)		28.6		20.0
Pool width ratio, [W_{bkfp}/W_{bkf}]		1.6		1.6
Pool cross-section area, A_{bkfp} (sq ft)		44.5		31.2
Pool area ratio, [A_{bkfp}/A_{bkf}]		1.4		2.4
Max pool depth, d_{mbkfp} (ft)		3.5		2.5
Max pool depth ratio, [d_{mbkfp}/d_{bkf}]		2.0		2.4
Low bank height, LBH (ft)		3.1		1.5
Low bank height ratio, [LBH/d_{mbkf}]		1.4		1.0
Width flood-prone area, W_{fpa} (ft)		100.0		28
Entrenchment ratio, ER [W_{fpa}/W_{bkf}]		5.5		2.2
Valley length, VL (ft)	722			722
Stream length, SL (ft)	868			868
Valley Elevation Change, VE (ft)	15.3			15.3
Stream Elevation Change, SE (ft)	14.78			14.78
Valley slope, VS (ft/ft)	0.0212			0.0212
Average water surface slope, S (ft/ft)	0.0170			0.0170
Sinuosity, k = SL/VL (ft/ft)	1.20			1.20
Mannings bankfull discharge, Q_{bkf} (cfs)		197.5		59.2
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)		6.25		4.52
D_{50} bar (mm)	23			23
D_{100} bar (mm)	105			105

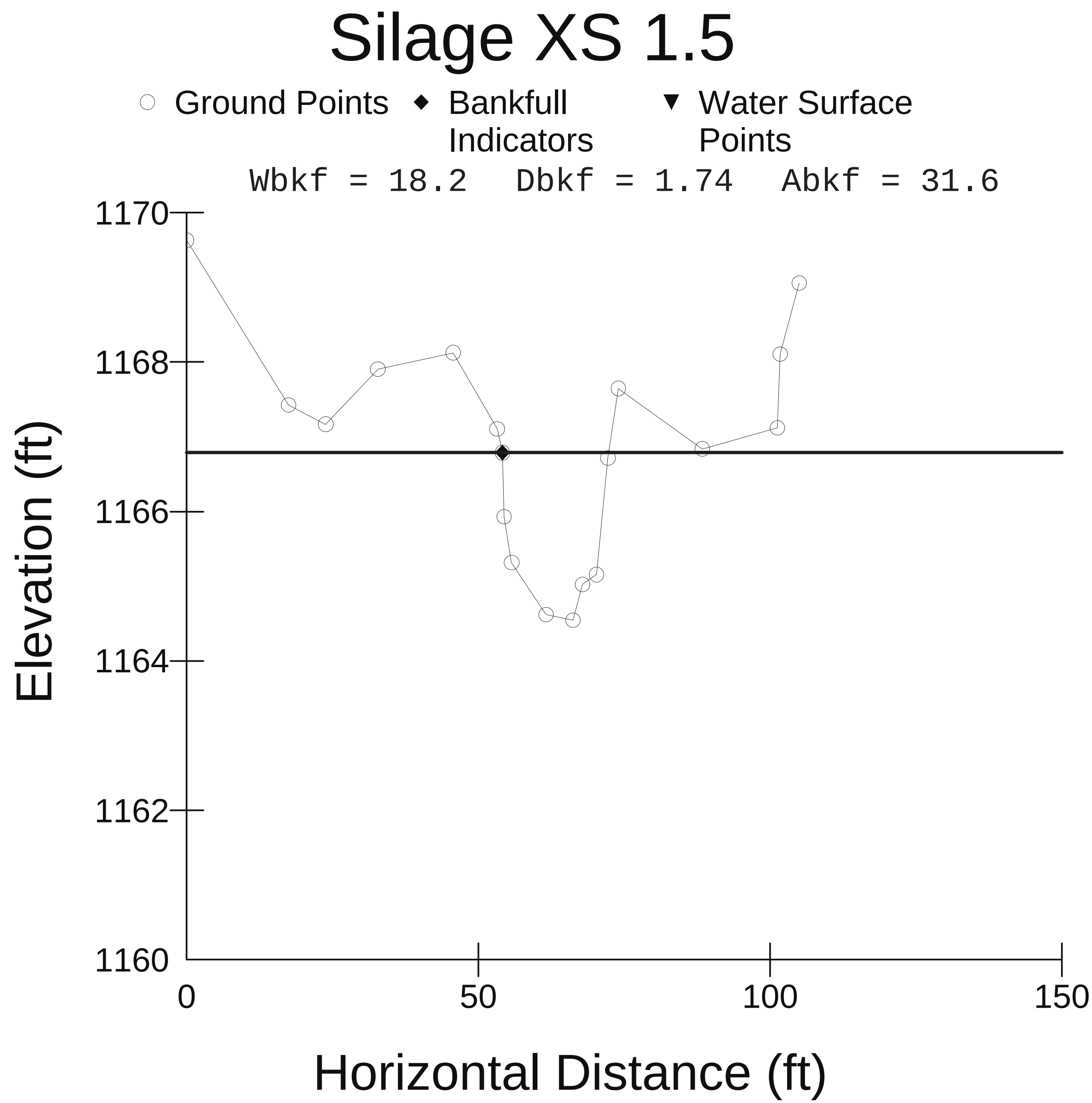

Silage Trib Thalweg Profile
1280
1260
1240
1220
1200
1180
1160
1140
Elevation (ft)
0
500
1000
1500
2000
2500
3000
3500
4000
4500
Station (ft)
Thalweg
Water Surface
XS1.1
XS1.2
XS1.3
XS1.4
XS1.5
XS1.6


Sillage XS 1.1
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 5.49   Dbkf = 1.03   Abkf = 5.64
1240
1235
1230
1225
1220
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)

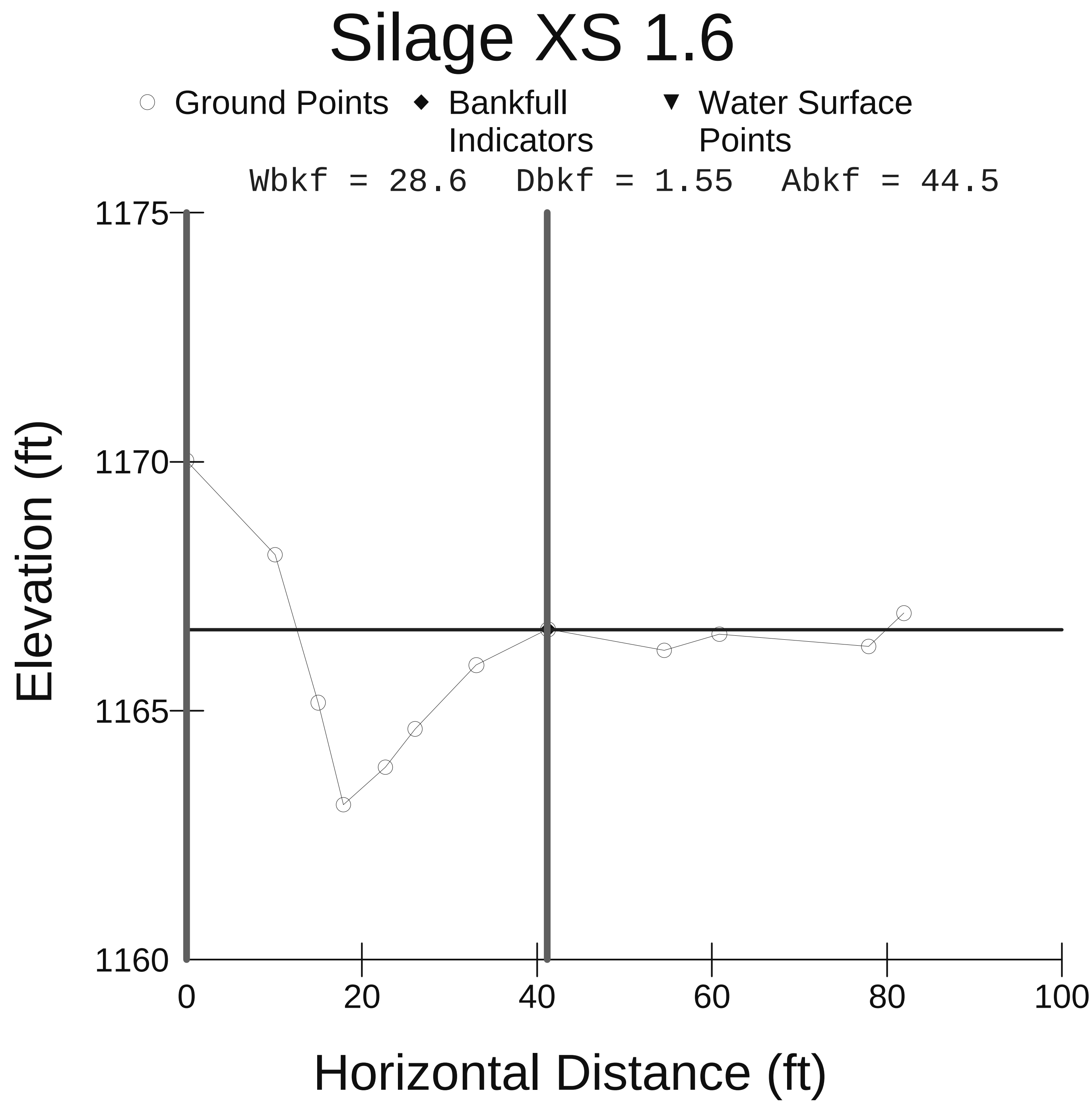

Silage XS 1.2
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 7.58   Dbkf = .89   Abkf = 6.75
1240
1235
1230
1225
1220
0
10
20
30
40
50
60
Elevation (ft)
Horizontal Distance (ft)


Silage XS 1.3
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.72   Dbkf = .84   Abkf = 5.61
1223.0
1222.5
1222.0
1221.5
1221.0
1220.5
1220.0
Elevation (ft)
0
5
10
15
Horizontal Distance (ft)


Silage XS 1.4
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 8.1 Dbkf = .99 Abkf = 8.02
1224
1223
1222
1221
1220
0
5
10
15
Elevation (ft)
Horizontal Distance (ft)



Silage XS 1.5
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 18.2 Dbkf = 1.74 Abkf = 31.6
1170
1168
1166
1164
1162
1160
0
50
100
150
Elevation (ft)
Horizontal Distance (ft)



Silage XS 1.6
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 28.6 Dbkf = 1.55 Abkf = 44.5
1175
1170
1165
1160
Elevation (ft)
0
20
40
60
80
100
Horizontal Distance (ft)

RIVERMORPH PARTICLE SUMMARY

River Name: Moores Fork
Reach Name: Silage Trib
Sample Name: Silage Trib - bar sample NR pool xs1.2
Survey Date: 04/19/2011

SIEVE (mm)	NET WT
31.5	52.7
16	582.8
8	889.2
4	526.1
2	383.2
PAN	1872.6

D16 (mm)	0
D35 (mm)	0
D50 (mm)	3.81
D84 (mm)	17.55
D95 (mm)	30.54
D100 (mm)	63
Silt/Clay (%)	0
Sand (%)	42.18
Gravel (%)	57.82
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Weight = 4439.8000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	63	75
Particle 2:	56	58.2

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Silage Trib
Sample Name:	Silage Trib Bar D/S XS1.6
Survey Date:	04/19/2011

SIEVE (mm)	NET WT
31.5	1517.6
16	1329.4
8	643.8
4	264.8
2	155.9
PAN	1132.2

D16 (mm)	0
D35 (mm)	12.72
D50 (mm)	22.58
D84 (mm)	72.47
D95 (mm)	94.83
D100 (mm)	105
Silt/Clay (%)	0
Sand (%)	20.5
Gravel (%)	64.63
Cobble (%)	14.86
Boulder (%)	0
Bedrock (%)	0

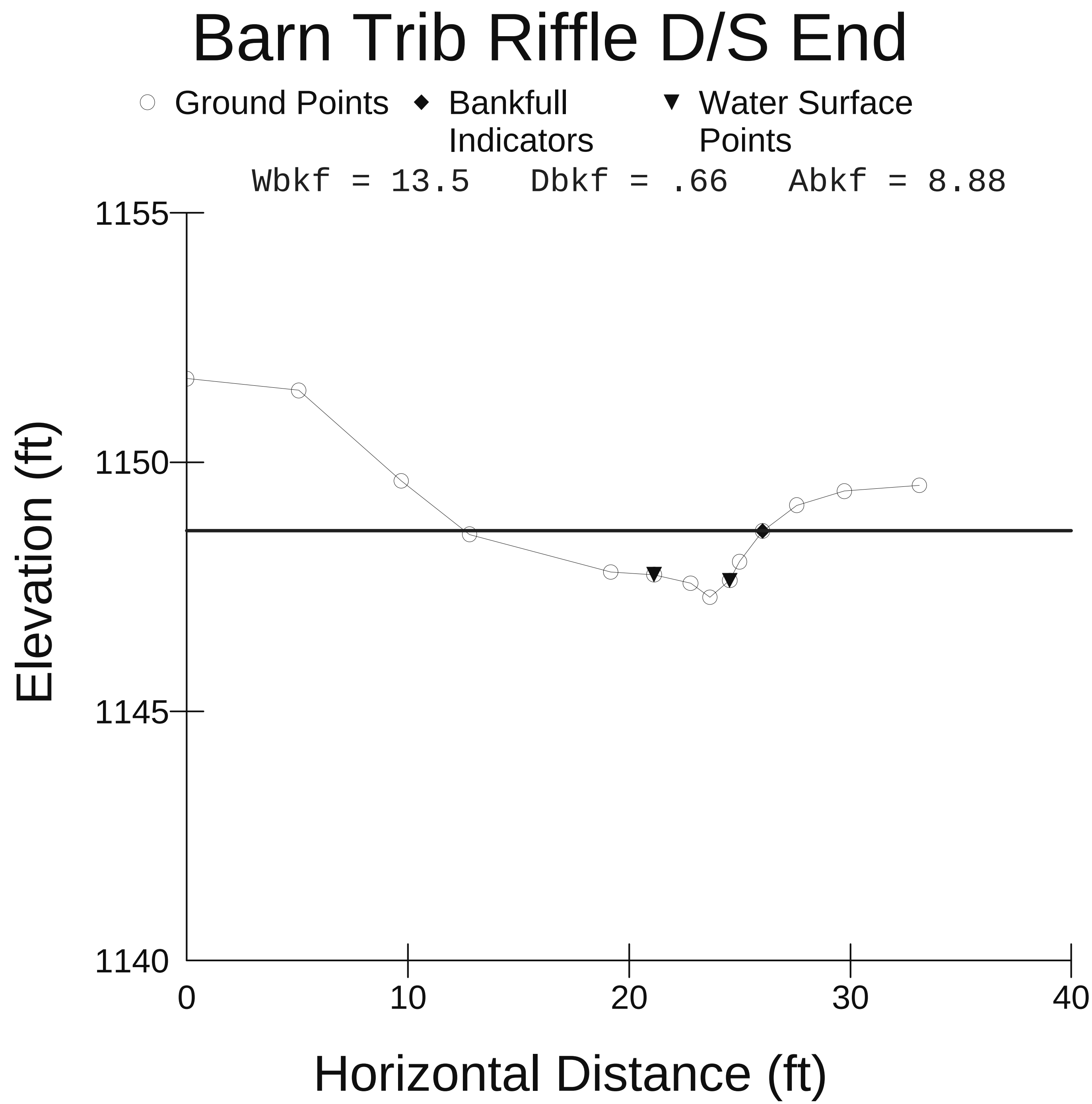
Total Weight = 5522.4000.

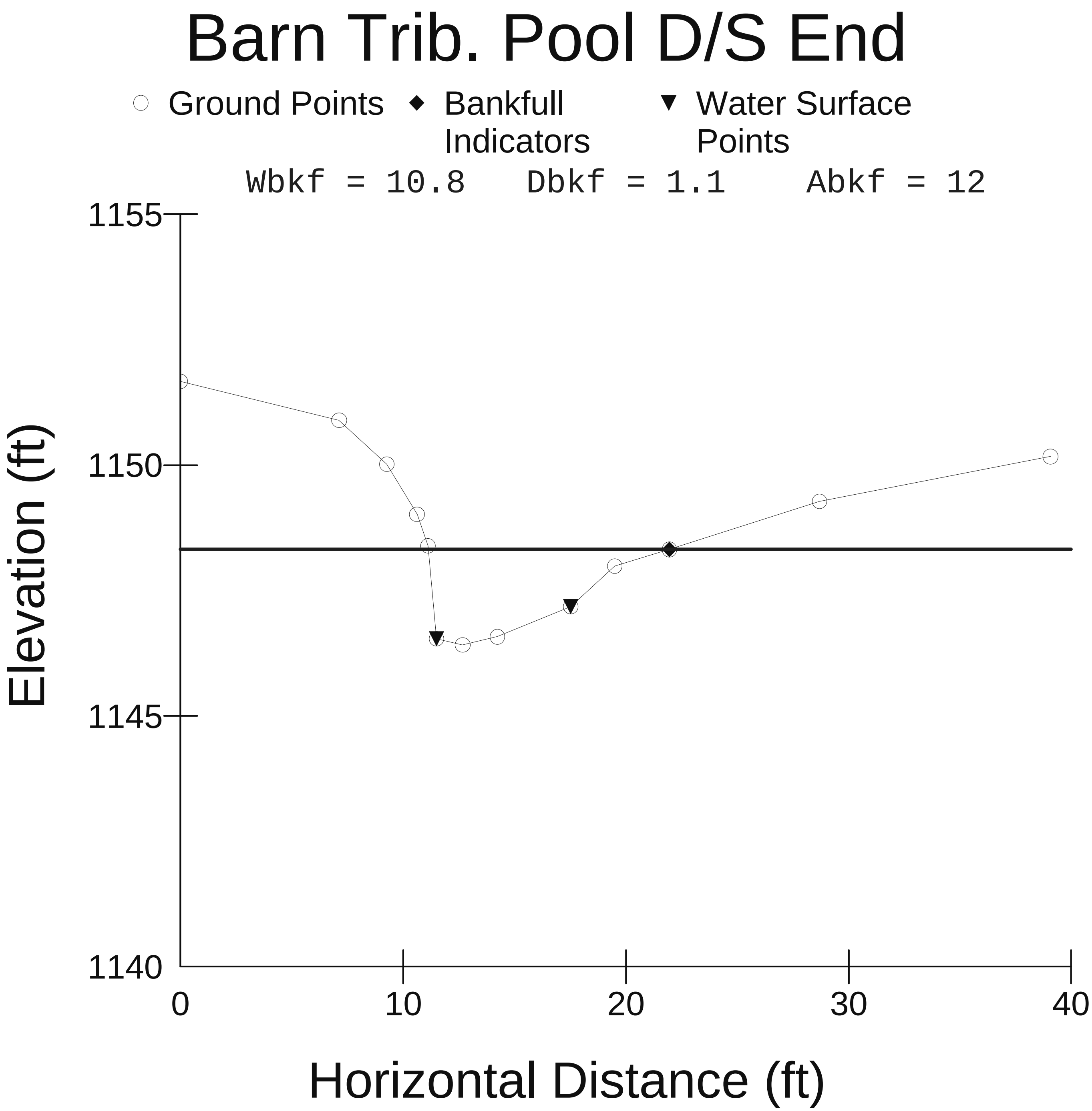
Largest Surface Particles:

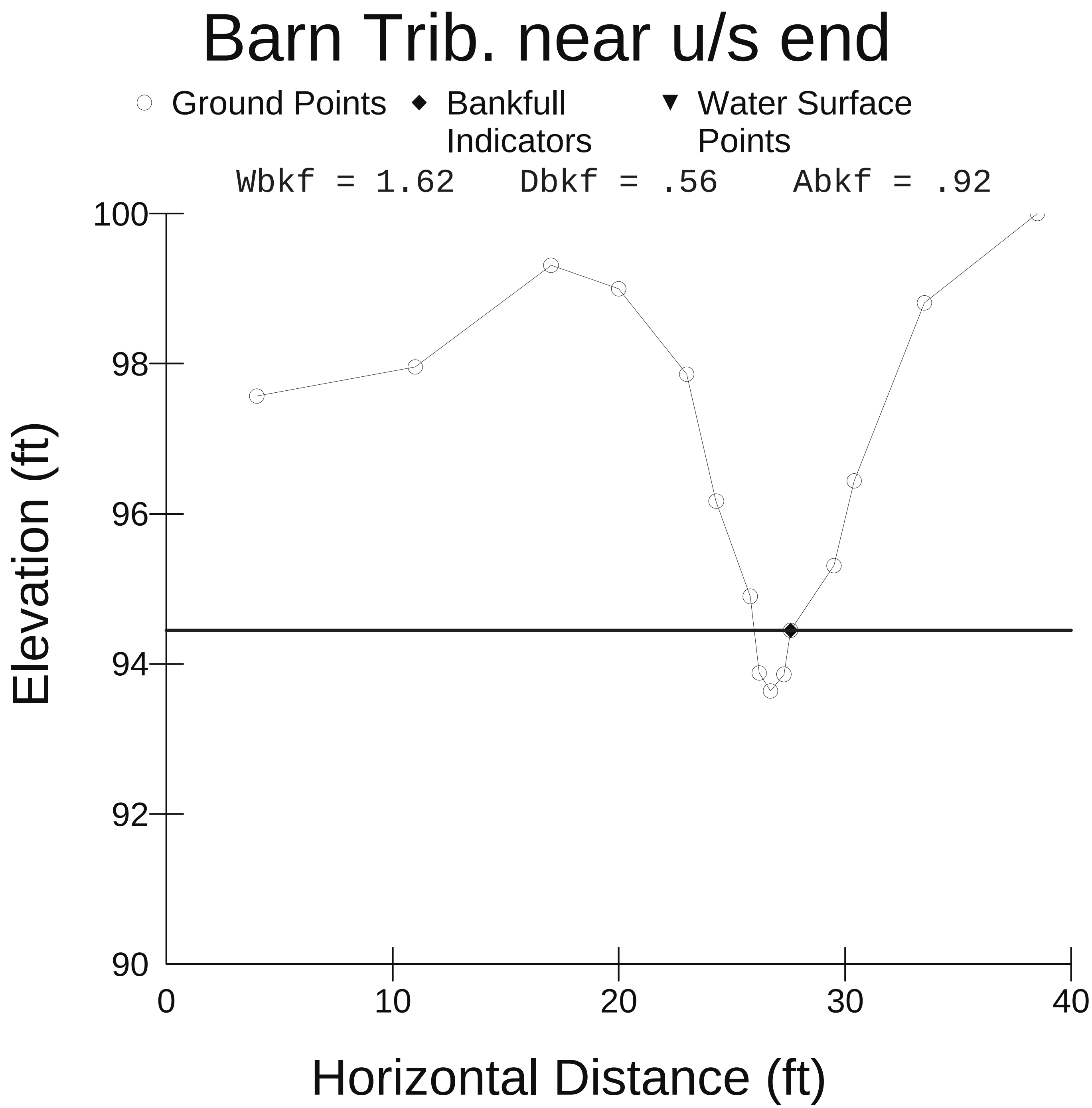
	Size(mm)	Weight
Particle 1:	105	286.7
Particle 2:	87	192

Existing, Design and Reference Morphology Parameters

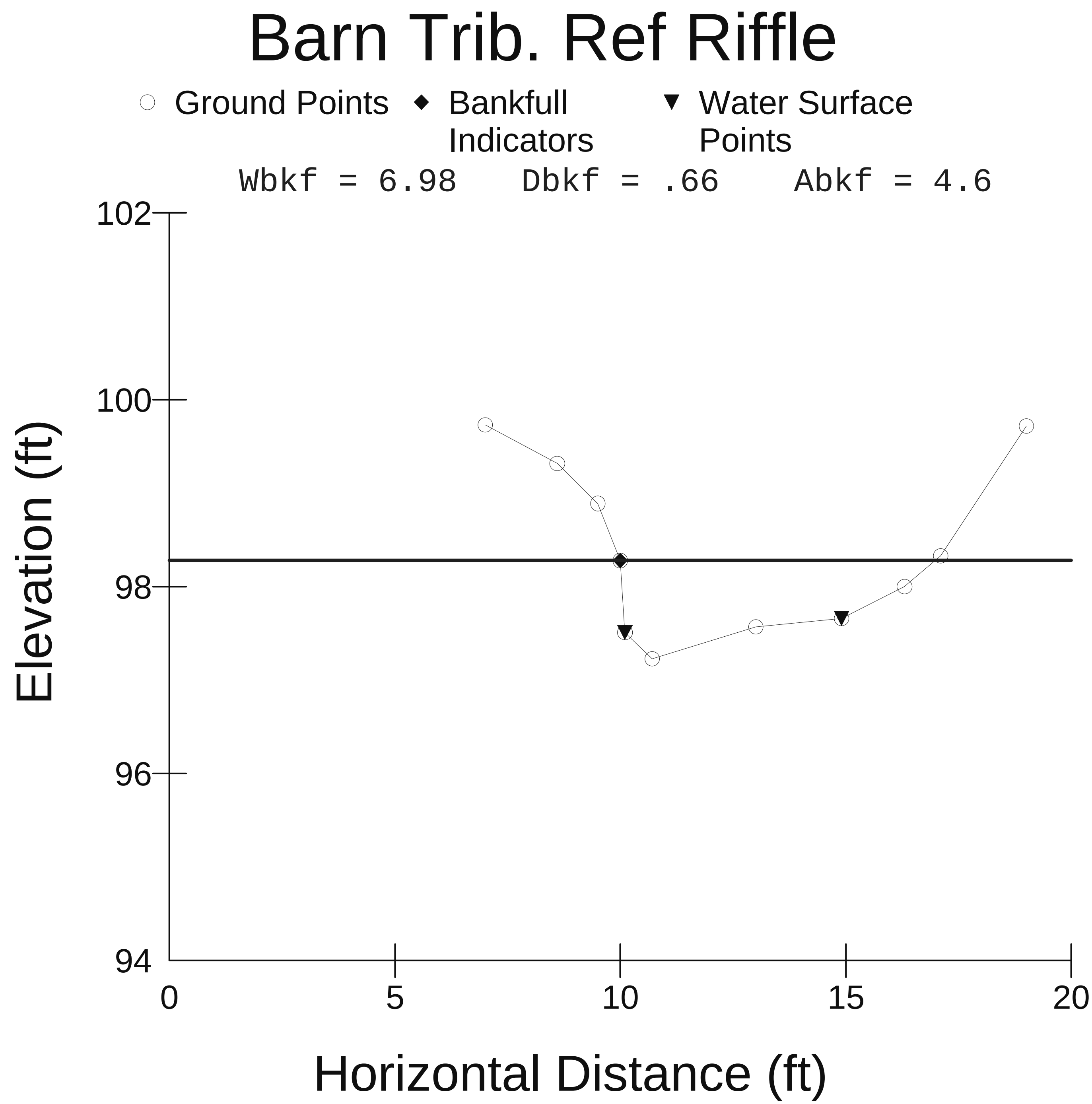
Parameter	Existing Stream			Design Stream			Reference Stream		
	Min	Median	Max	Min	Median	Max	Min	Median	Max
Stream name		Barn Trib			Barn Trib			Barn Trib Preservation Rch	
Stream type		G4			E4b			B4	
Drainage area, DA (sq mi)		0.01			0.01			0.08	
Mean riffle depth, d_{bkf} (ft)		0.6			0.5			0.7	
Riffle width, W_{bkf} (ft)		1.6			6.0			7.0	
Width-to-depth ratio, $[W_{bkf}/d_{bkf}]$		2.9			11.3			10.6	
Riffle cross-section area, A_{bkf} (sq ft)		0.9			3.2			4.6	
Max riffle depth, d_{mbkf} (ft)		0.8			0.8			1.1	
Max riffle depth ratio, $[d_{mbkf}/d_{bkf}]$		1.4			1.5			1.6	
Mean pool depth, d_{bkfp} (ft)					0.6			0.76	
Mean pool depth ratio, $[d_{bkfp}/d_{bkf}]$					1.2			1.2	
Pool width, W_{bkfp} (ft)					9.0			6.37	
Pool width ratio, $[W_{bkfp}/W_{bkf}]$					1.5			0.9	
Pool cross-section area, A_{bkfp} (sq ft)					5.5			4.85	
Pool area ratio, $[A_{bkfp}/A_{bkf}]$					1.7			1.1	
Max pool depth, d_{mbkfp} (ft)					1.0			1.15	
Max pool depth ratio, $[d_{mbkfp}/d_{bkf}]$					1.9			1.7	
Low bank height, LBH (ft)		6.17			0.8			1.66	
Low bank height ratio, $[LBH/d_{mbkf}]$		7.6			1.0			1.6	
Width flood-prone area, W_{fpa} (ft)		4			19			9.9	
Entrenchment ratio, ER $[W_{fpa}/W_{bkf}]$		2.5			3.2			1.4	
Valley length, VL (ft)		622			622			622	
Stream length, SL (ft)		250			250			84	
Valley Elevation Change, VE (ft)		20			20			20	
Stream Elevation Change, SE (ft)		5.14			5.14			1.77	
Valley slope, VS (ft/ft)		0.0322			0.0322			0.0322	
Average water surface slope, S (ft/ft)		0.0206			0.0206			0.0211	
Sinuosity, k = VS/S		1.56			1.56			1.53	
Mannings bankfull discharge, Q_{bkf} (cfs)		2.5			10.6			17.7	
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)		2.70			3.31			3.84	
D_{50} bar (mm)		sampling not feasible						46	
D_{100} bar (mm)								66	

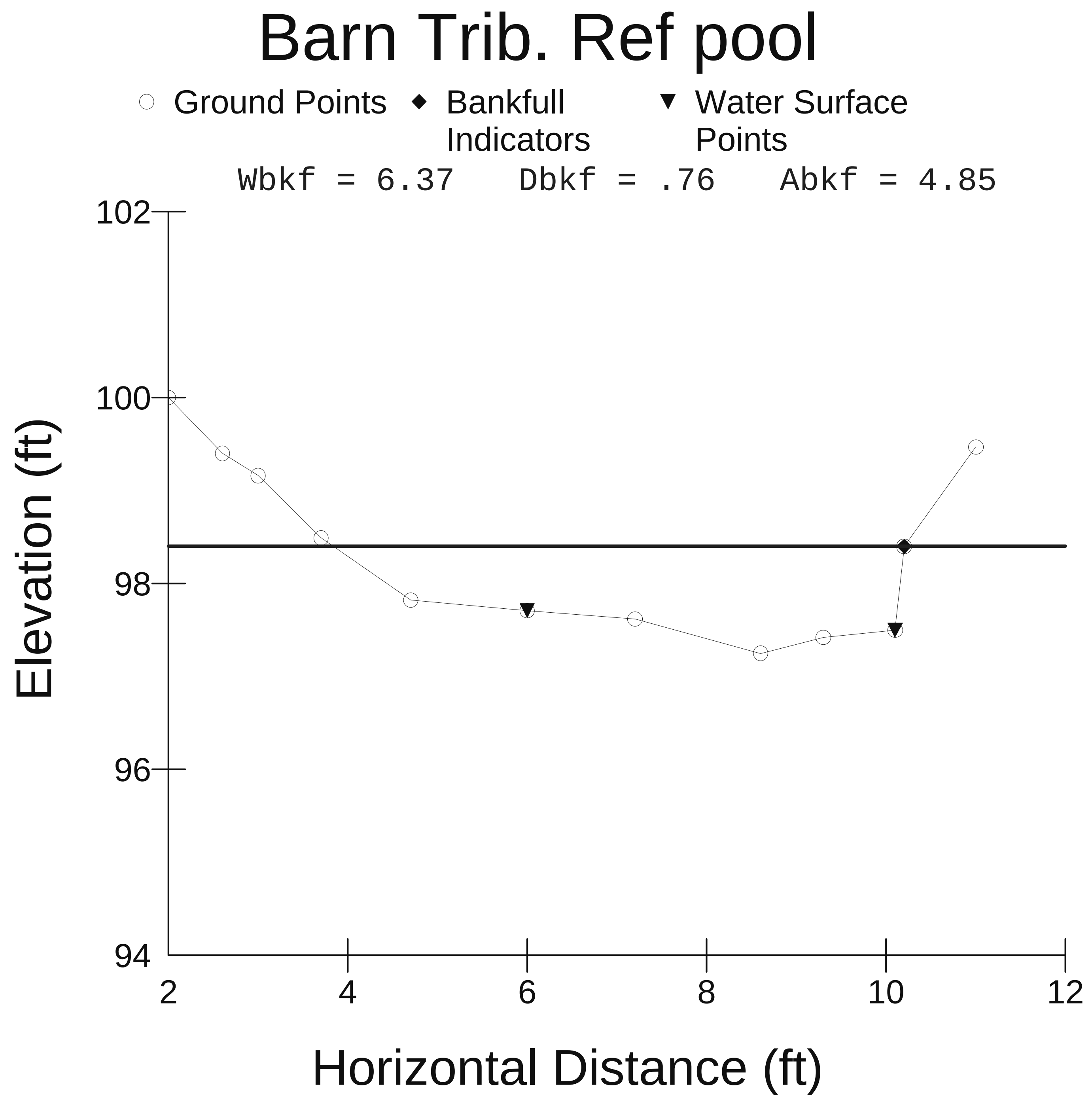

Barn Trib Riffle D/S End
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 13.5   Dbkf = .66   Abkf = 8.88
1155
1150
1145
1140
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)


Barn Trib. Pool D/S End
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 10.8
Dbkf = 1.1
Abkf = 12
1155
1150
1145
1140
0
10
20
30
40
Elevation (ft)
Horizontal Distance (ft)

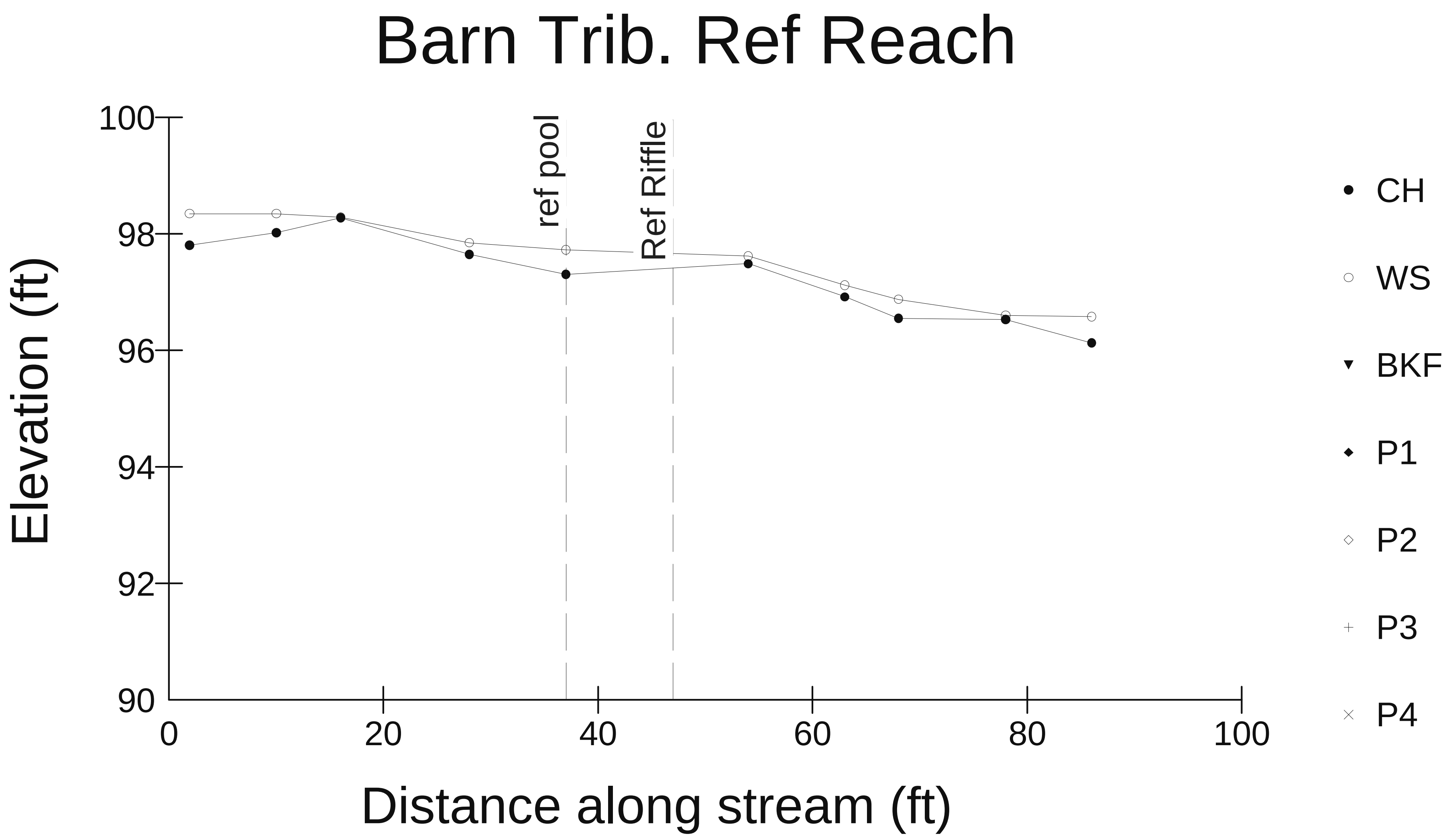


Barn Trib. near u/s end
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 1.62
Dbkf = .56
Abkf = .92
100
98
96
94
92
90
Elevation (ft)
0
10
20
30
40
Horizontal Distance (ft)


Barn Trib. Ref Riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.98
Dbkf = .66
Abkf = 4.6
Elevation (ft)
102
100
98
96
94
0
5
10
15
20
Horizontal Distance (ft)



Barn Trib. Ref pool
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 6.37   Dbkf = .76   Abkf = 4.85
102
100
98
96
94
Elevation (ft)
2
4
6
8
10
12
Horizontal Distance (ft)


Barn Trib. Ref Reach
Elevation (ft)
100
98
96
94
92
90
0
20
40
60
80
100
Distance along stream (ft)
ref pool
Ref Riffle
CH
WS
BKF
P1
P2
P3
P4

RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Barn Trib
Sample Name:	bar sample ref reach
Survey Date:	01/16/2012

SIEVE (mm)	NET WT
45	192
16	92.5
8	233.6
4	193.9
2	91.4
PAN	255.8

D16 (mm)	0
D35 (mm)	6.12
D50 (mm)	11.48
D84 (mm)	55.16
D95 (mm)	61.93
D100 (mm)	65
Silt/Clay (%)	0
Sand (%)	19.9
Gravel (%)	78.73
Cobble (%)	1.37
Boulder (%)	0
Bedrock (%)	0

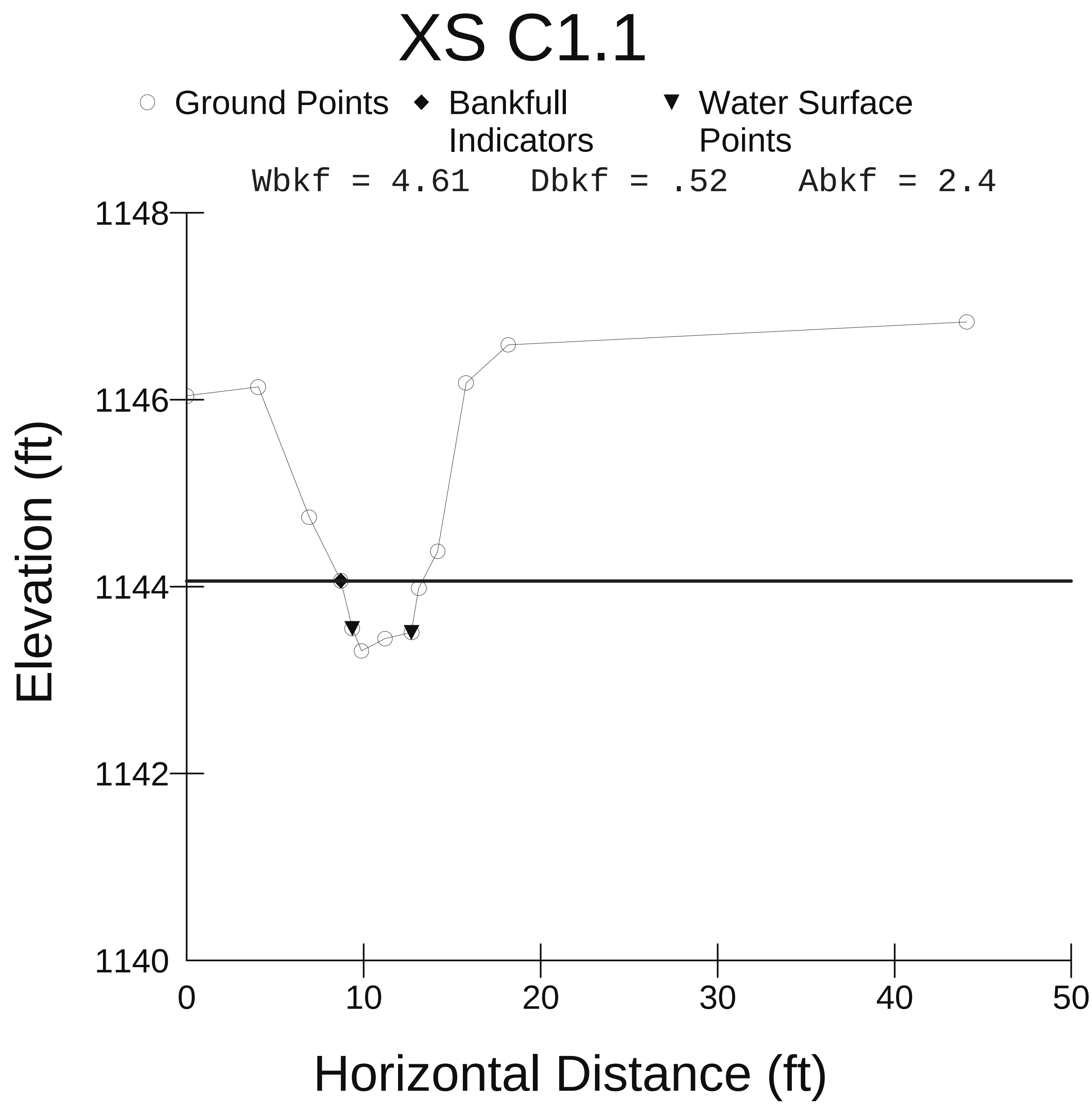
Total Weight = 1285.2000.

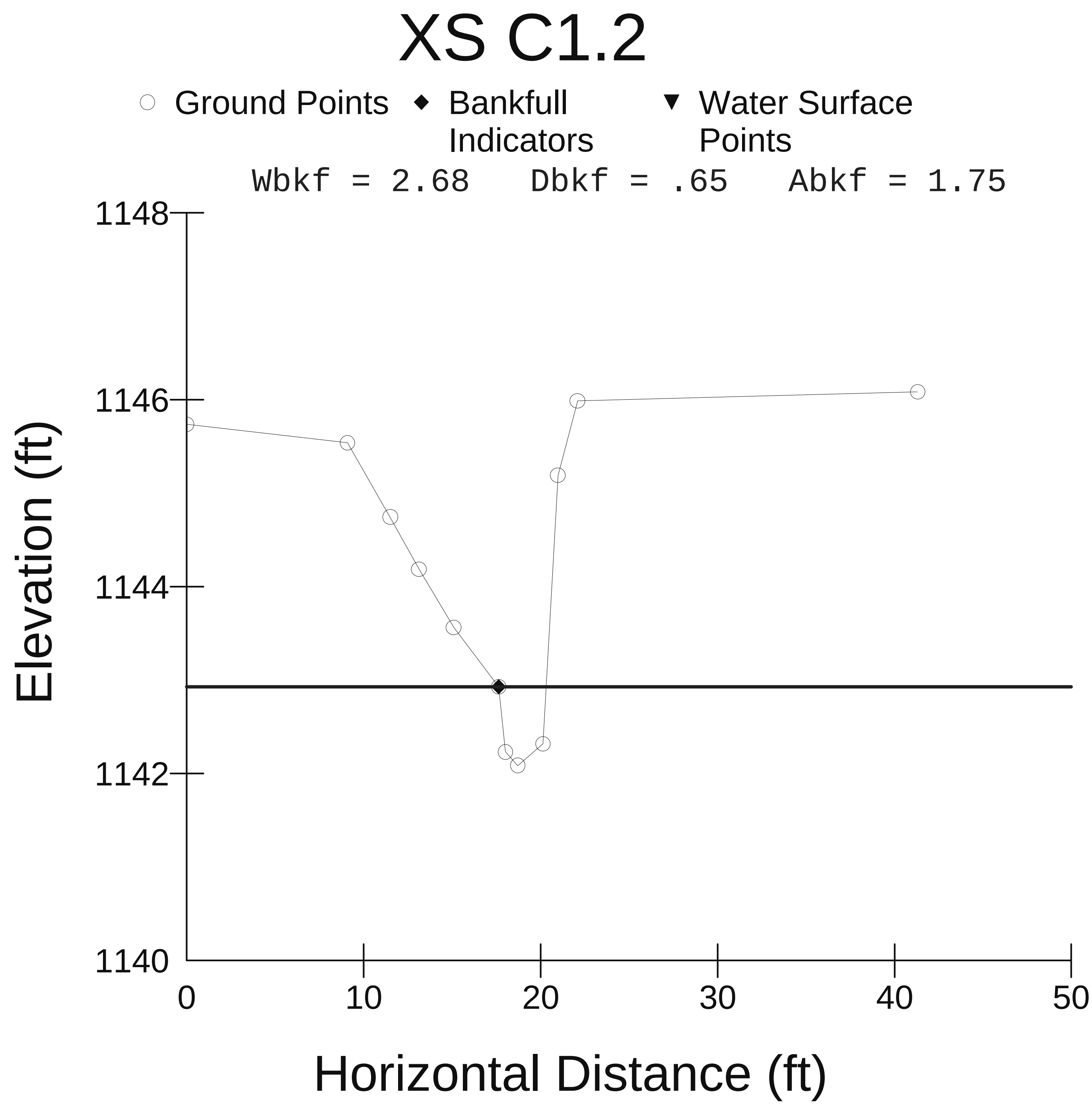
Largest Surface Particles:

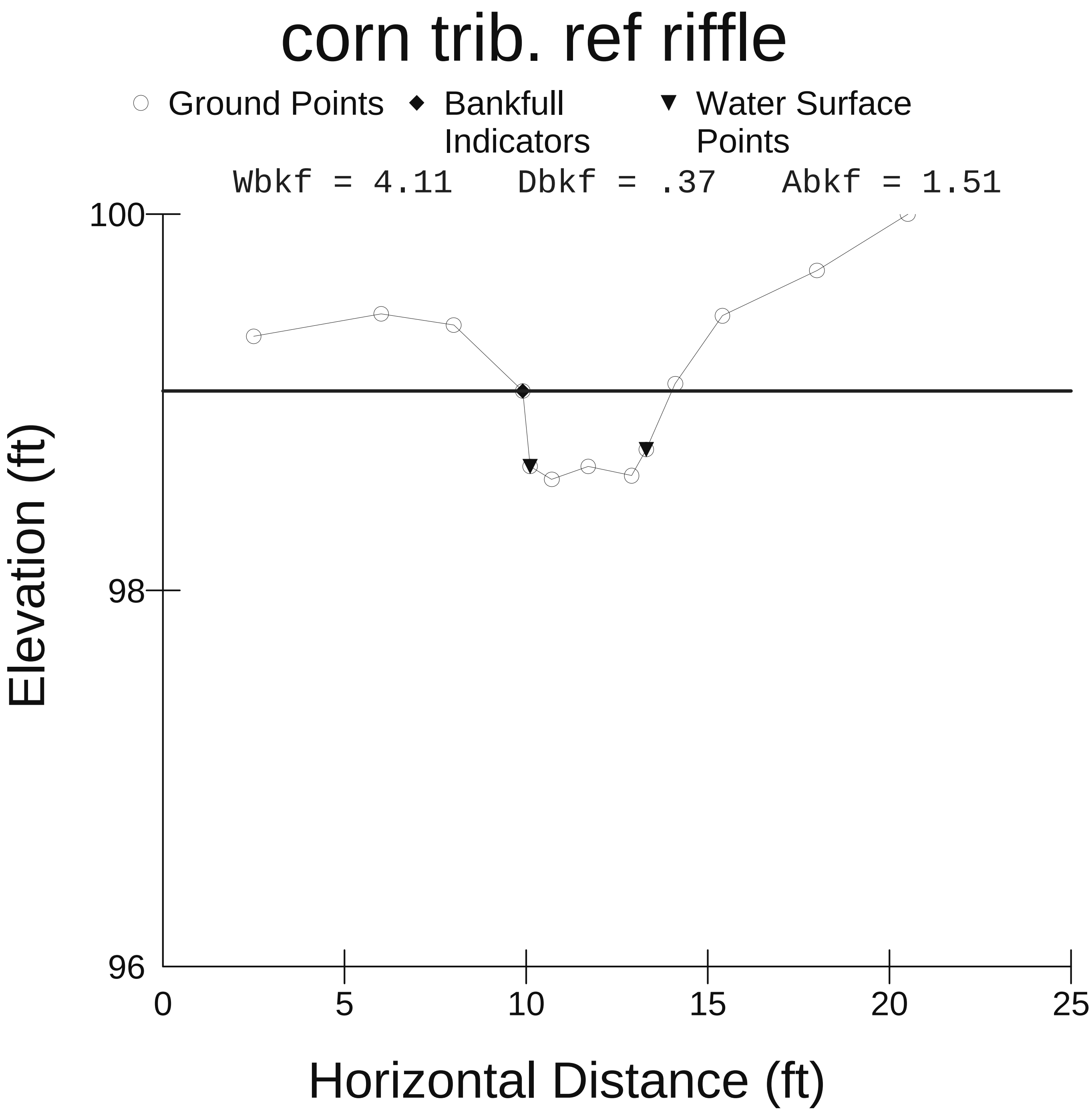
	Size(mm)	Weight
Particle 1:	65	192
Particle 2:	24	34

Existing, Design and Reference Morphology Parameters

Parameter	Existing Stream			Design Stream			Reference Stream		
	Min	Median	Max	Min	Median	Max	Min	Median	Max
Stream name		Corn Trib			Corn Trib			Corn Trib Preservation Rch	
Stream type		G4			B4			E4b	
Drainage area, DA (sq mi)		0.05			0.05			0.05	
Mean riffle depth, d_{bkf} (ft)		0.5			0.4			0.4	
Riffle width, W_{bkf} (ft)		4.6			6.6			4.1	
Width-to-depth ratio, $[W_{bkf}/d_{bkf}]$		8.9			15.1			11.2	
Riffle cross-section area, A_{bkf} (sq ft)		2.4			2.9			1.5	
Max riffle depth, d_{mbkf} (ft)		0.7			0.6			0.5	
Max riffle depth ratio, $[d_{mbkf}/d_{bkf}]$		1.4			1.4			1.3	
Mean pool depth, d_{bkfp} (ft)		0.7			0.7				
Mean pool depth ratio, $[d_{bkfp}/d_{bkf}]$					1.5				
Pool cross-section area, A_{bkfp} (sq ft)		1.8			6.0				
Pool area ratio, $[A_{bkfp}/A_{bkf}]$					2.1				
Max pool depth, d_{mbkfp} (ft)		0.8			1.0				
Max pool depth ratio, $[d_{mbkfp}/d_{bkf}]$					2.3				
Low bank height, LBH (ft)		2.82			0.6			0.82	
Low bank height ratio, $[LBH/d_{mbkf}]$		3.8			1.0			1.7	
Width flood-prone area, W_{fpa} (ft)		7.8			20			13.7	
Entrenchment ratio, ER $[W_{fpa}/W_{bkf}]$		1.7			3.0			3.3	
Valley length, VL (ft)		84			84				
Stream length, SL (ft)		97			97			28	
Valley Elevation Change, VE (ft)		3.3			3.3				
Stream Elevation Change, SE (ft)		5.5			5.5			0.68	
Valley slope, VS (ft/ft)		0.0393			0.0393				
Average water surface slope, S (ft/ft)		0.0567			0.0567			0.0243	
Sinuosity		1.15			1.15				
Mannings bankfull discharge, Q_{bkf} (cfs)		12.0			13.5			4.0	
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)		5.01			4.70			2.67	
D_{50} bar (mm)		sampling not feasible						46	
D_{100} bar (mm)								66	


XS C1.1
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 4.61   Dbkf = .52   Abkf = 2.4
1148
1146
1144
1142
1140
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)


XS C1.2
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 2.68   Dbkf = .65   Abkf = 1.75
1148
1146
1144
1142
1140
Elevation (ft)
0
10
20
30
40
50
Horizontal Distance (ft)



corn trib. ref riffle
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 4.11
Dbkf = .37
Abkf = 1.51
100
98
96
Elevation (ft)
0
5
10
15
20
25
Horizontal Distance (ft)

RIVERMORPH PARTICLE SUMMARY

River Name: Moores Fork
Reach Name: Corn Trib
Sample Name: bar sample us farm road
Survey Date: 01/20/2012

SIEVE (mm)	NET WT
63	182.4
45	893.2
31.5	48
16	729
8	307
4	173.9
2	110.9
PAN	311.9

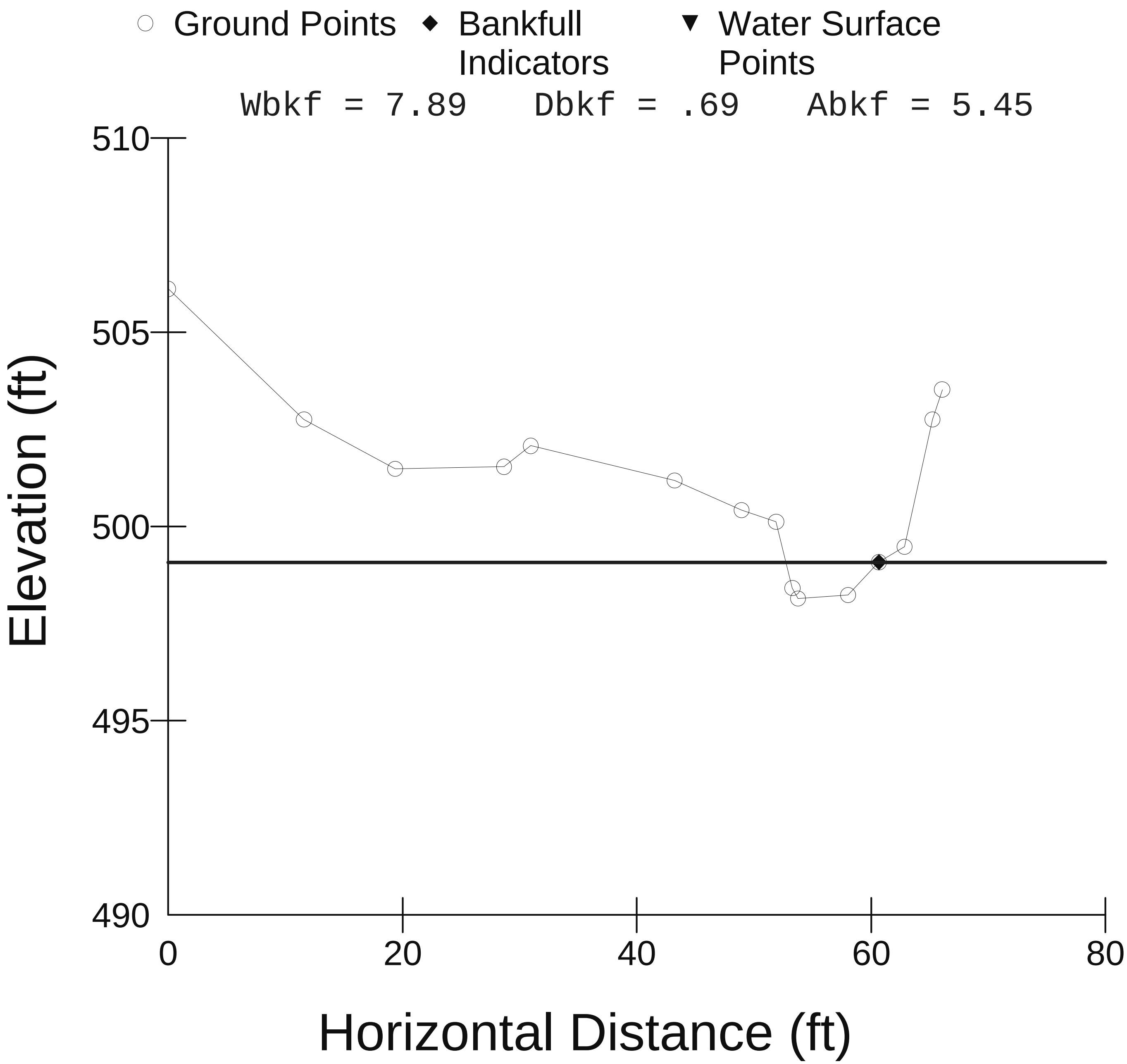
D16 (mm)	7.01
D35 (mm)	22.54
D50 (mm)	46
D84 (mm)	62.62
D95 (mm)	62.2
D100 (mm)	66
Silt/Clay (%)	0
Sand (%)	9.01
Gravel (%)	90.99
Cobble (%)	0
Boulder (%)	0
Bedrock (%)	0

Total Weight = 3460.2000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	62	521.5
Particle 2:	66	182.4

Cow Trib 2 Riffle



RIVERMORPH PARTICLE SUMMARY

River Name:	Moores Fork
Reach Name:	Cow Trib 2
Sample Name:	Bar sample D/S riffle XS-Cow Trib1.1
Survey Date:	04/19/2011

SIEVE (mm)	NET WT
16	296
8	391.3
4	281.1
2	206.2
PAN	886.8

D16 (mm)	0
D35 (mm)	0
D50 (mm)	4.54
D84 (mm)	33.34
D95 (mm)	65.42
D100 (mm)	80
Silt/Clay (%)	0
Sand (%)	39.21
Gravel (%)	57.75
Cobble (%)	3.04
Boulder (%)	0
Bedrock (%)	0

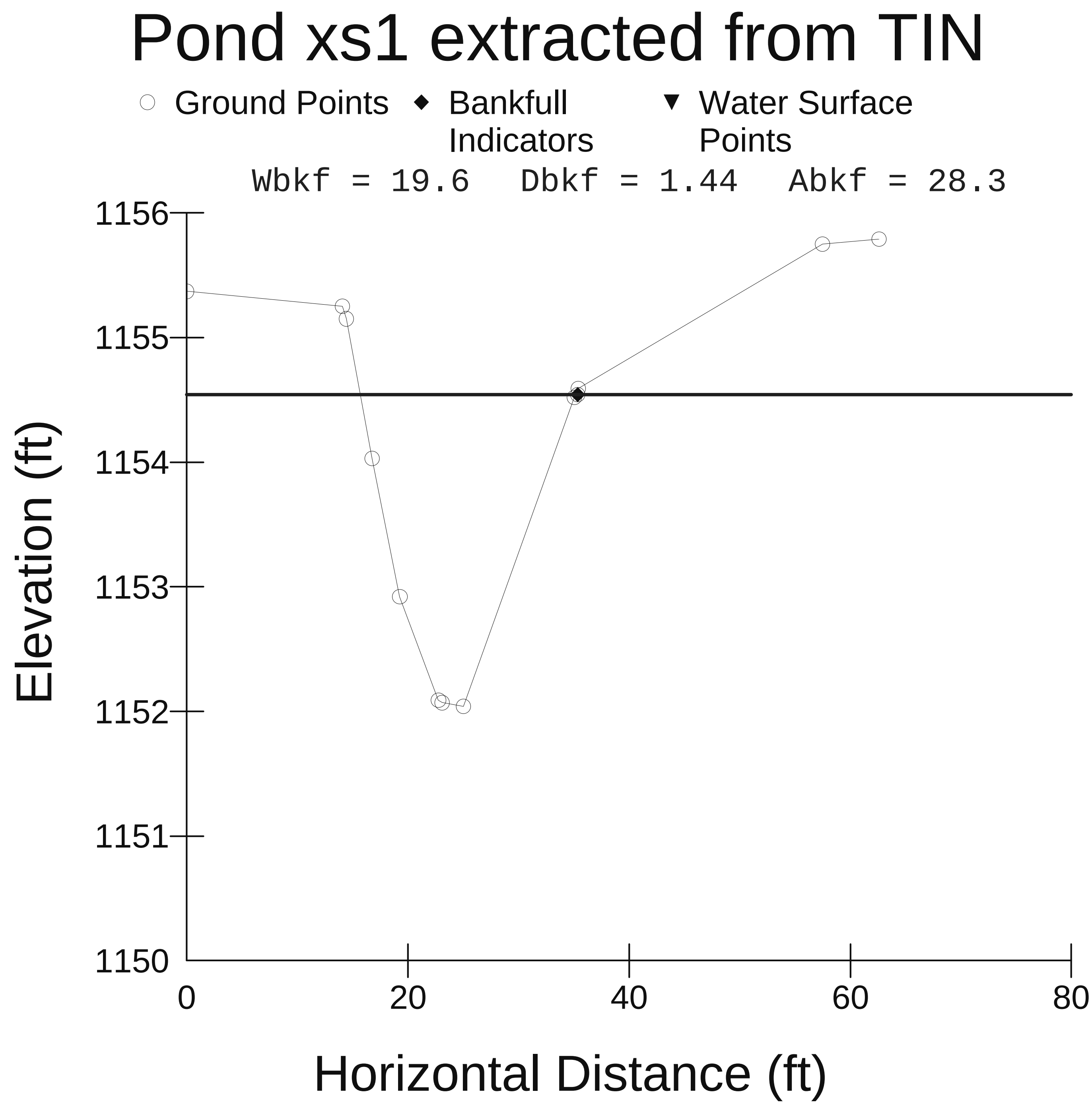
Total Weight = 2261.7000.

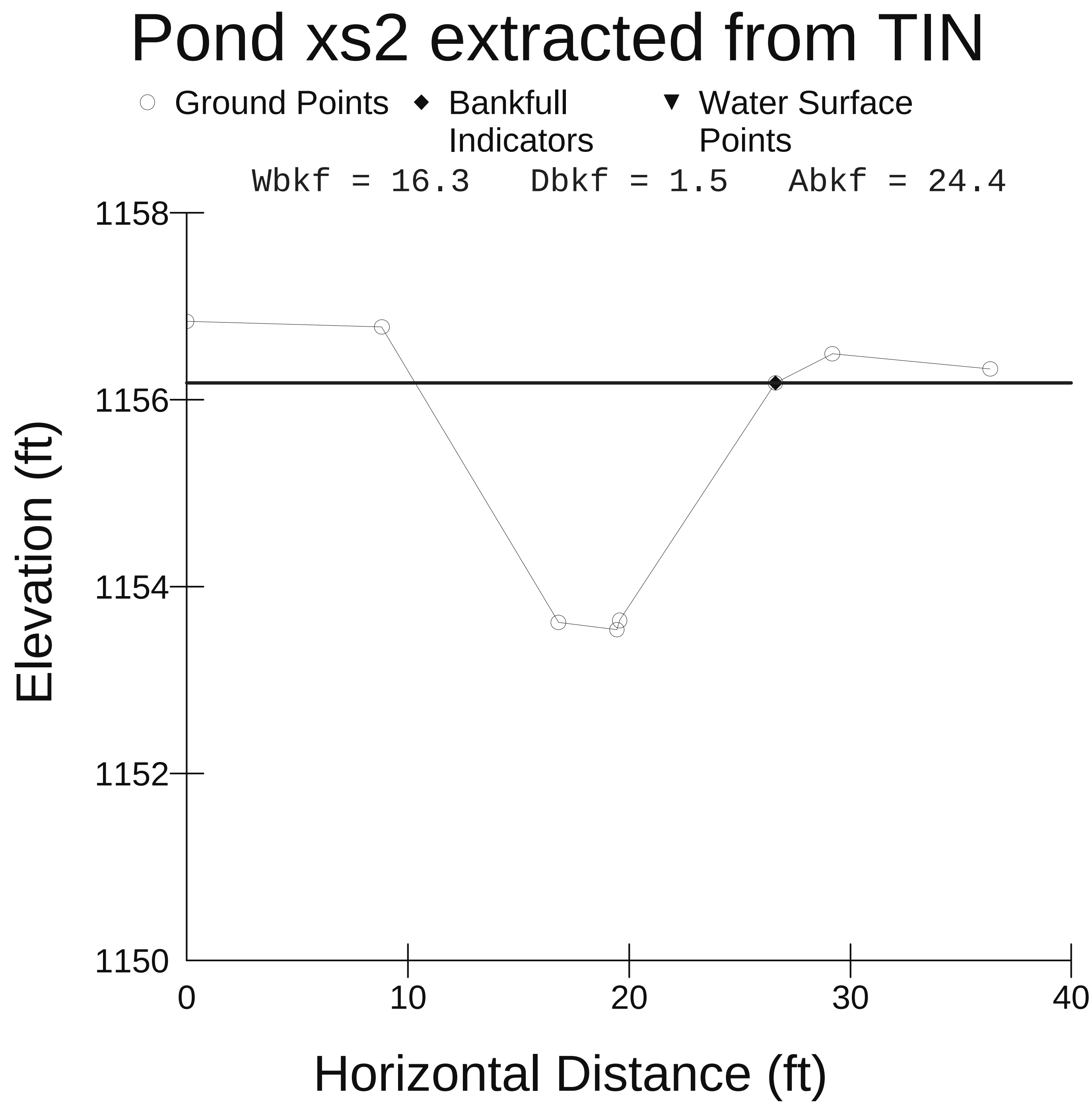
Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	80	154.5
Particle 2:	55	45.8

Existing , Design and Reference Morphology Parameters

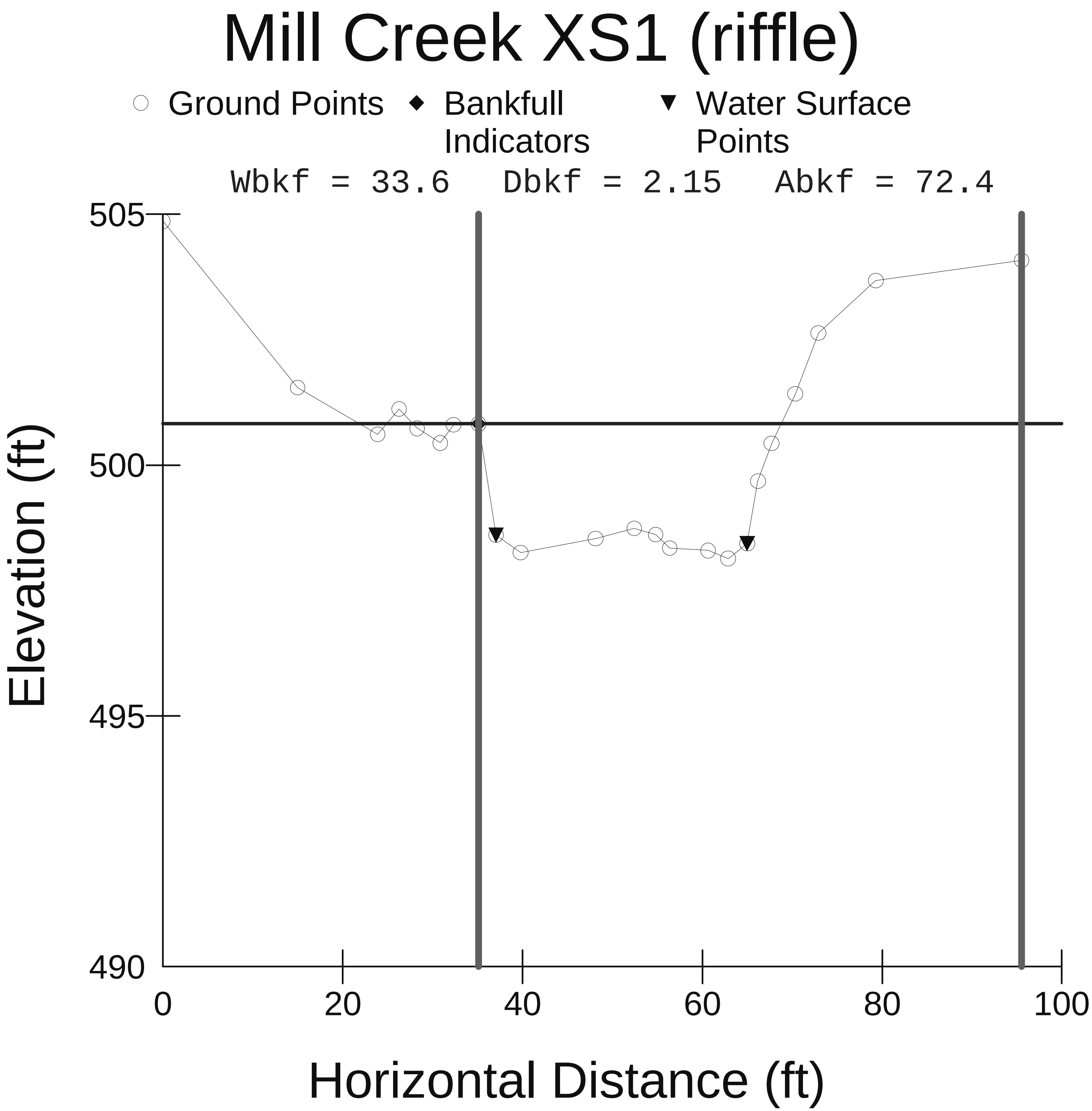
Parameter	Existing Stream			Design Stream			Reference Stream		
	Min	Median	Max	Min	Median	Max	Min	Median	Max
Stream name		Pond Trib			Pond Trib			Barn Trib Preservation Rch	
Stream type		C4b (trampled)			C4b			E4b	
Drainage area, DA (sq mi)		0.04			0.04			0.08	
Mean riffle depth, d_{bkf} (ft)		1.5			0.7			0.7	
Riffle width, W_{bkf} (ft)		16.3			8.0			7.0	
Width-to-depth ratio, $[W_{bkf}/d_{bkf}]$		10.9			11.6			10.6	
Riffle cross-section area, A_{bkf} (sq ft)		24.4			5.5			4.6	
Max riffle depth, d_{mbkf} (ft)		2.6			1.0			1.1	
Max riffle depth ratio, $[d_{mbkf}/d_{bkf}]$		1.8			1.5			1.6	
Mean pool depth, d_{bkfp} (ft)					0.9			0.76	
Mean pool depth ratio, $[d_{bkfp}/d_{bkf}]$					1.4			1.2	
Pool width, W_{bkfp} (ft)					12.0			6.37	
Pool width ratio, $[W_{bkfp}/W_{bkf}]$					1.5			0.9	
Pool cross-section area, A_{bkfp} (sq ft)					11.3			4.85	
Pool area ratio, $[A_{bkfp}/A_{bkf}]$					2.1			1.1	
Max pool depth, d_{mbkfp} (ft)					1.5			1.15	
Max pool depth ratio, $[d_{mbkfp}/d_{bkf}]$					2.2			1.7	
Low bank height, LBH (ft)		2.95			1.0			1.66	
Low bank height ratio, $[LBH/d_{mbkf}]$		1.1			1.0			1.6	
Width flood-prone area, W_{fpa} (ft)		50			25			9.9	
Entrenchment ratio, ER $[W_{fpa}/W_{bkf}]$		3.1			3.1			1.4	
Valley length, VL (ft)		187			187			622	
Stream length, SL (ft)		194			243			84	
Valley Elevation Change, VE (ft)		7			7			20	
Stream Elevation Change, SE (ft)		5.63			5.5			1.77	
Valley slope, VS (ft/ft)		0.0374			0.0374			0.0322	
Average water surface slope, S (ft/ft)		0.0290			0.0226			0.0211	
Sinuosity, k = VS/S		1.29			1.65			1.53	
Mannings bankfull discharge, Q_{bkf} (cfs)		181.4			21.6			16.8	
Mannings bkf velocity, u_{bkf} = Q/A (ft/s)		7.43			3.93			3.65	
D_{50} bar (mm)		sampling not feasible							
D_{100} bar (mm)									

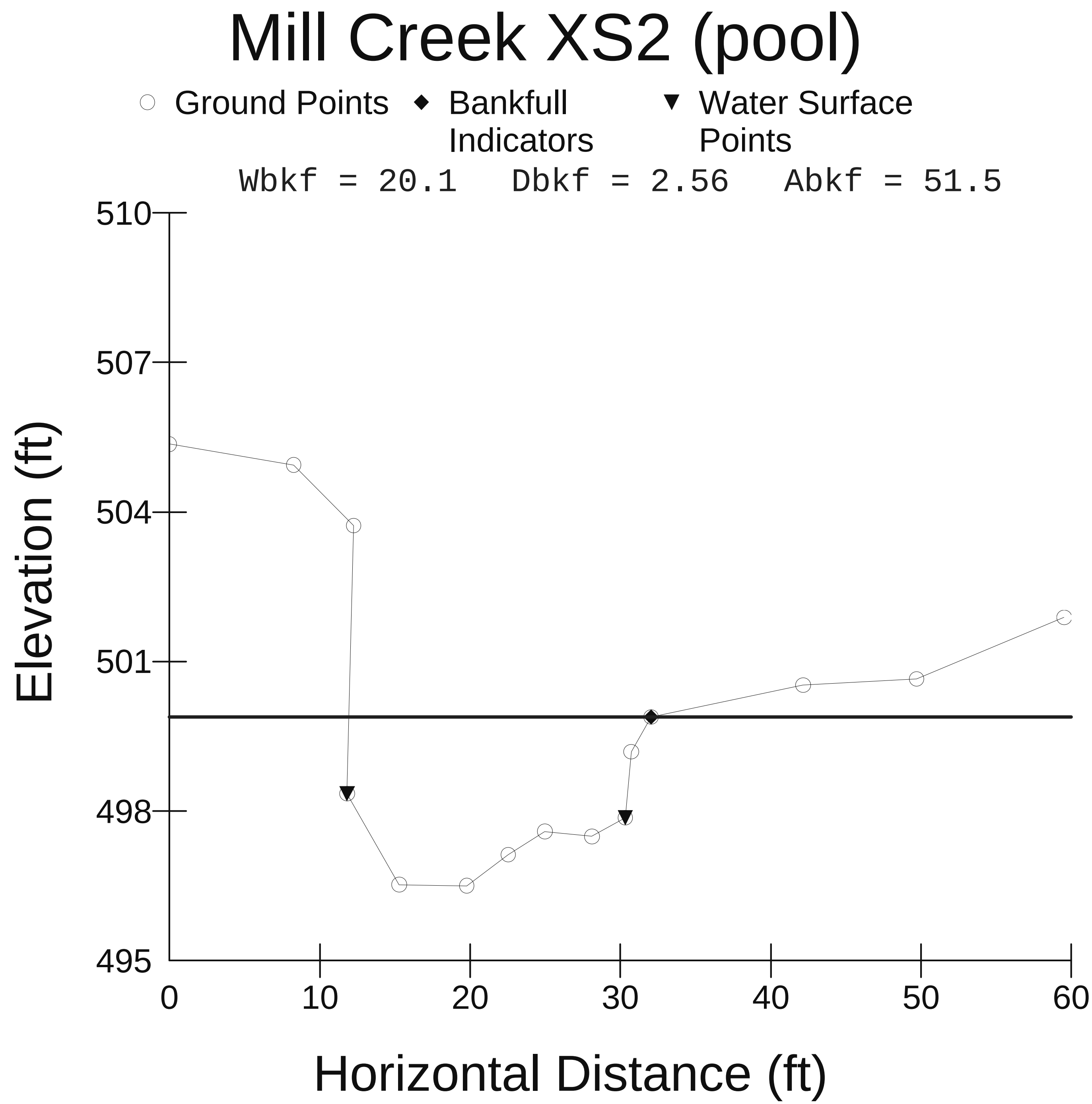

Pond xs1 extracted from TIN
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 19.6   Dbkf = 1.44   Abkf = 28.3
1156
1155
1154
1153
1152
1151
1150
Elevation (ft)
0
20
40
60
80
Horizontal Distance (ft)


Pond xs2 extracted from TIN
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 16.3   Dbkf = 1.5   Abkf = 24.4
1158
1156
1154
1152
1150
0
10
20
30
40
Elevation (ft)
Horizontal Distance (ft)

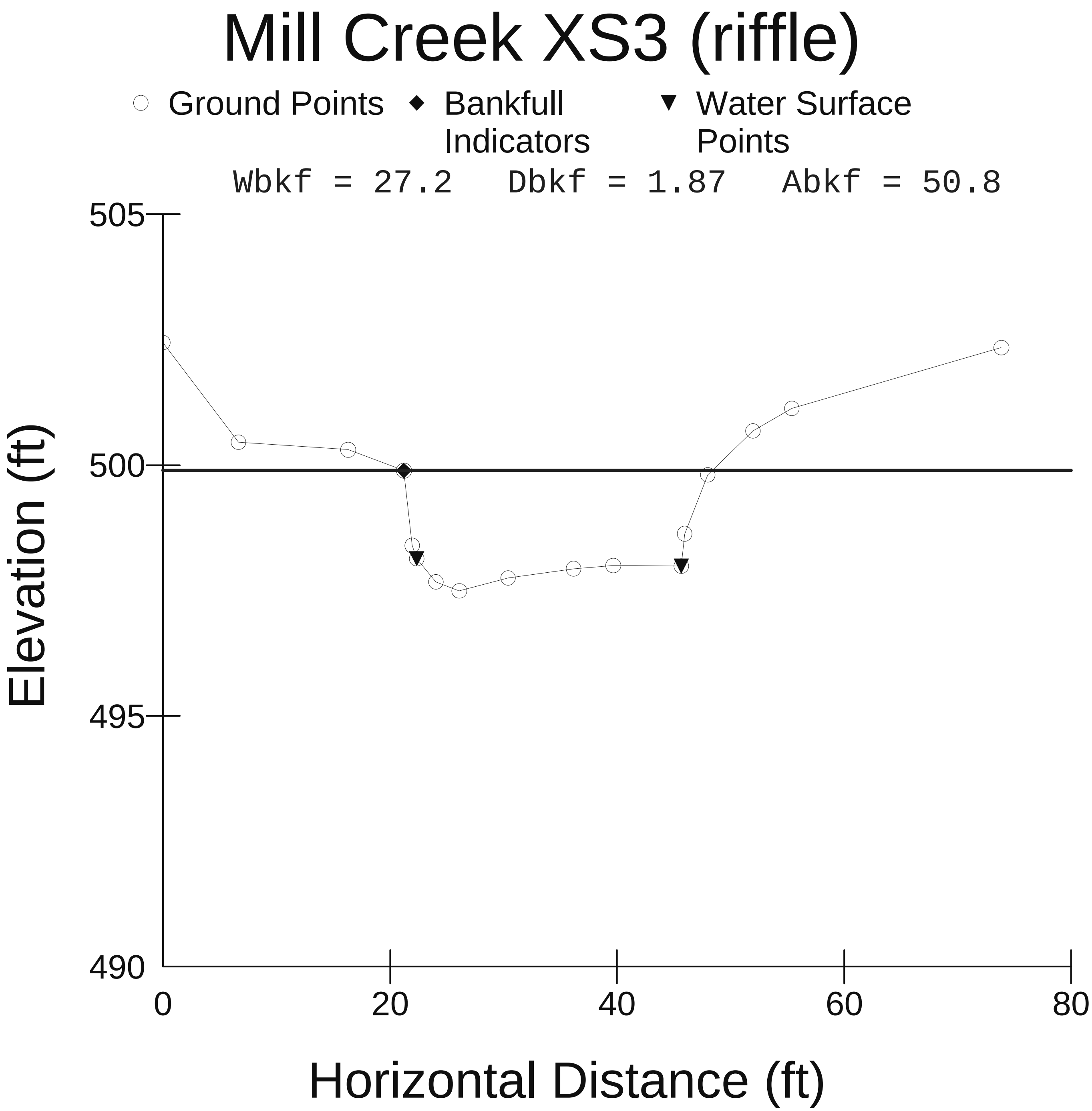
Hand Auger Boring Summary
Moores Fork Mitigation

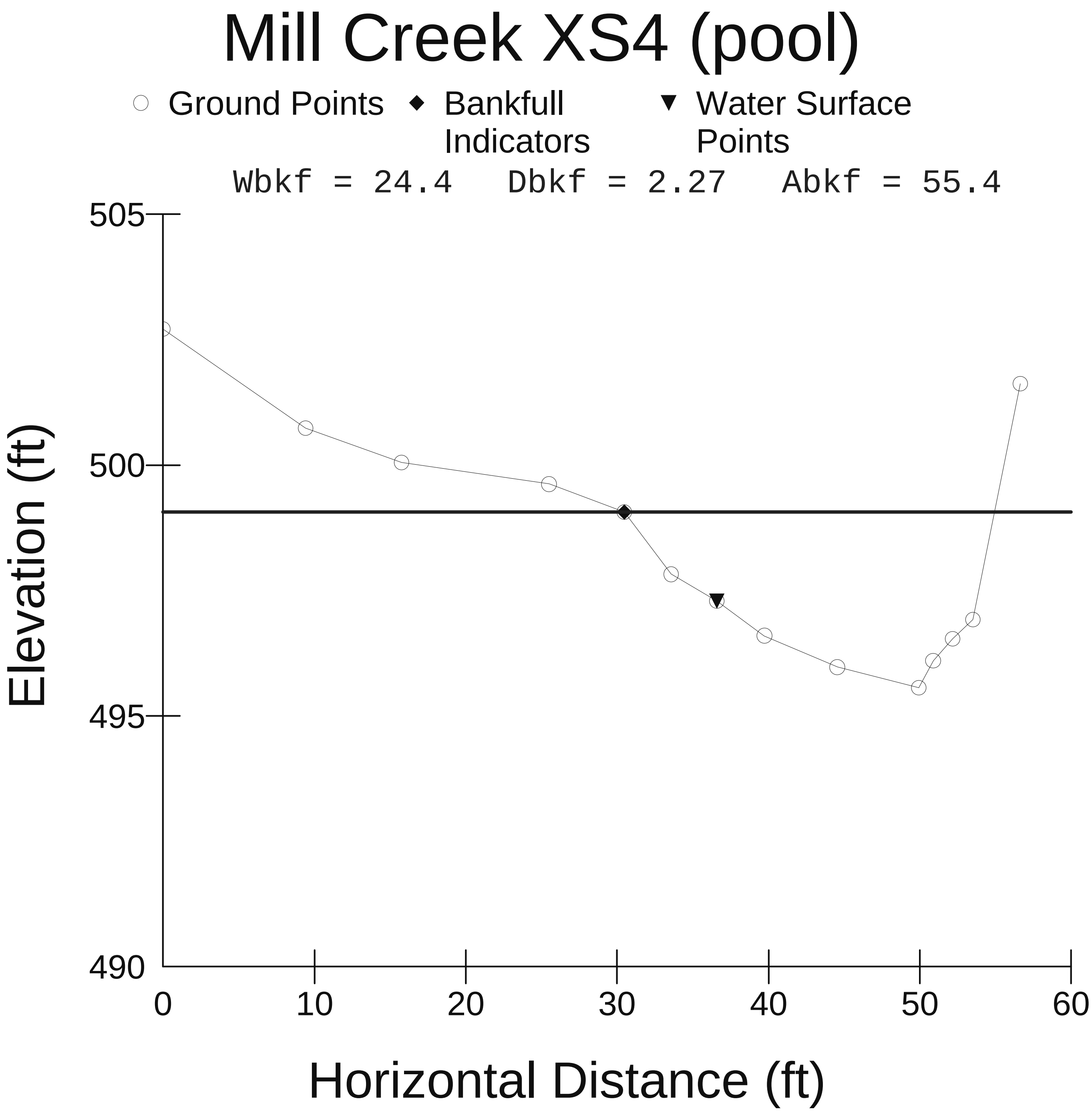
HA-1	left floodplain Moores Fork
0-0.3'	Topsoil
0.3' - 4.0'	Tan silty sand, moist to wet
4.0' - 4.7'	Gray silty sand, gw at 4.05'
4.7'	Refusal on gravel
N:	1008973.98
E:	1493995.67
Z:	1147.229
HA-2	left floodplain Moores Fork
0-0.4'	Topsoil
0.4' - 2.0'	Tan and gray clayey sand, moist
2.0' - 3.9'	Mottled gray and tan sandy clay, wood debris and gw at 2.5'
3.9'	Refusal on gravel
N:	1008815.35
E:	1493810.43
Z:	1148.637
HA-3	left floodplain Moores Fork
0-0.3'	Topsoil
0.4' - 2.2'	Red-brown silty sand, moist
2.2' - 3.0'	Red-brown and gray silt sandy, moist
3.0' - 3.7'	Red-brown and gray coarse sand and gravel, wet
3.7'	Refusal on gravel
N:	1008678.56
E:	1493574.92
Z:	1152.159
HA-4	right floodplain Moores Fork near 59+00
0-3.5'	Brown to tan, silty fine sand, moist
3.5' - 4.4'	Tan and light gray silty fine sand, wet
4.4'	Refusal on gravel or rock
Max depth at adjacent channel ~ 6.8'	
HA-5	right floodplain Moores Fork near 60+80
0 - 0.1'	topsoil
0.1' -3.8'	Brown to tan, silty fine sand, moist
3.8' - 5.0'	Tan and light gray silty fine sand, moist
5.0'	HA terminated
HA-6	right floodplain Moores Fork near 61+50
0-2.6'	Tan, silty fine sand/sandy silt, moist
2.6' - 3.7'	Tan and light gray silty fine sand/sandy silt, moist
3.7' - 4.1'	Gray sandy medium gravel, rounded, wet
4.1'	Refusal on gravel
Max depth at adjacent channel ~ 6.5'	


Mill Creek XS1 (riffle)
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 33.6   Dbkf = 2.15   Abkf = 72.4
505
500
495
490
Elevation (ft)
0
20
40
60
80
100
Horizontal Distance (ft)

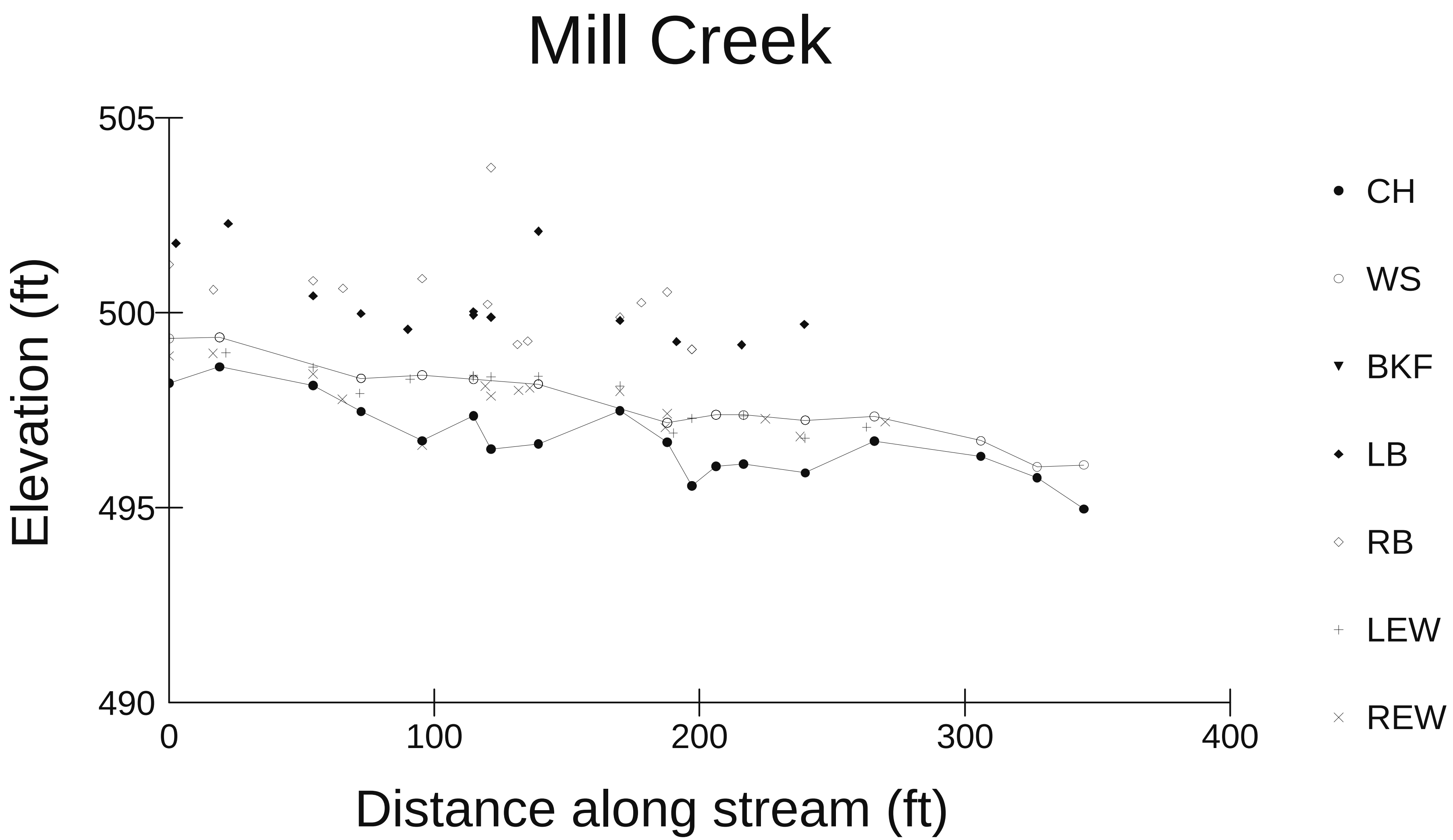


Mill Creek XS2 (pool)
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 20.1   Dbkf = 2.56   Abkf = 51.5
510
507
504
501
498
495
Elevation (ft)
0
10
20
30
40
50
60
Horizontal Distance (ft)


Mill Creek XS3 (riffle)
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 27.2   Dbkf = 1.87   Abkf = 50.8
505
500
495
490
Elevation (ft)
0
20
40
60
80
Horizontal Distance (ft)



Mill Creek XS4 (pool)
Ground Points
Bankfull Indicators
Water Surface Points
Wbkf = 24.4   Dbkf = 2.27   Abkf = 55.4
505
500
495
490
0
10
20
30
40
50
60
Elevation (ft)
Horizontal Distance (ft)


Mill Creek
Elevation (ft)
505
500
495
490
0
100
200
300
400
Distance along stream (ft)
CH
WS
BKF
LB
RB
LEW
REW

RIVERMORPH PARTICLE SUMMARY

River Name: Mill Creek
Reach Name: Reach 1
Sample Name: subpavement - riffle 1
Survey Date: 04/19/2011

SIEVE (mm)	NET WT
31.5	1581
16	1714.4
8	839.1
4	424.7
2	331.6
PAN	1120.2

D16 (mm)	0
D35 (mm)	11.37
D50 (mm)	20.25
D84 (mm)	61.19
D95 (mm)	83.75
D100 (mm)	94
Silt/Clay (%)	0
Sand (%)	17.58
Gravel (%)	71.7
Cobble (%)	10.72
Boulder (%)	0
Bedrock (%)	0

Total Weight = 6372.1000.

Largest Surface Particles:

	Size(mm)	Weight
Particle 1:	94	220.1
Particle 2:	80	141

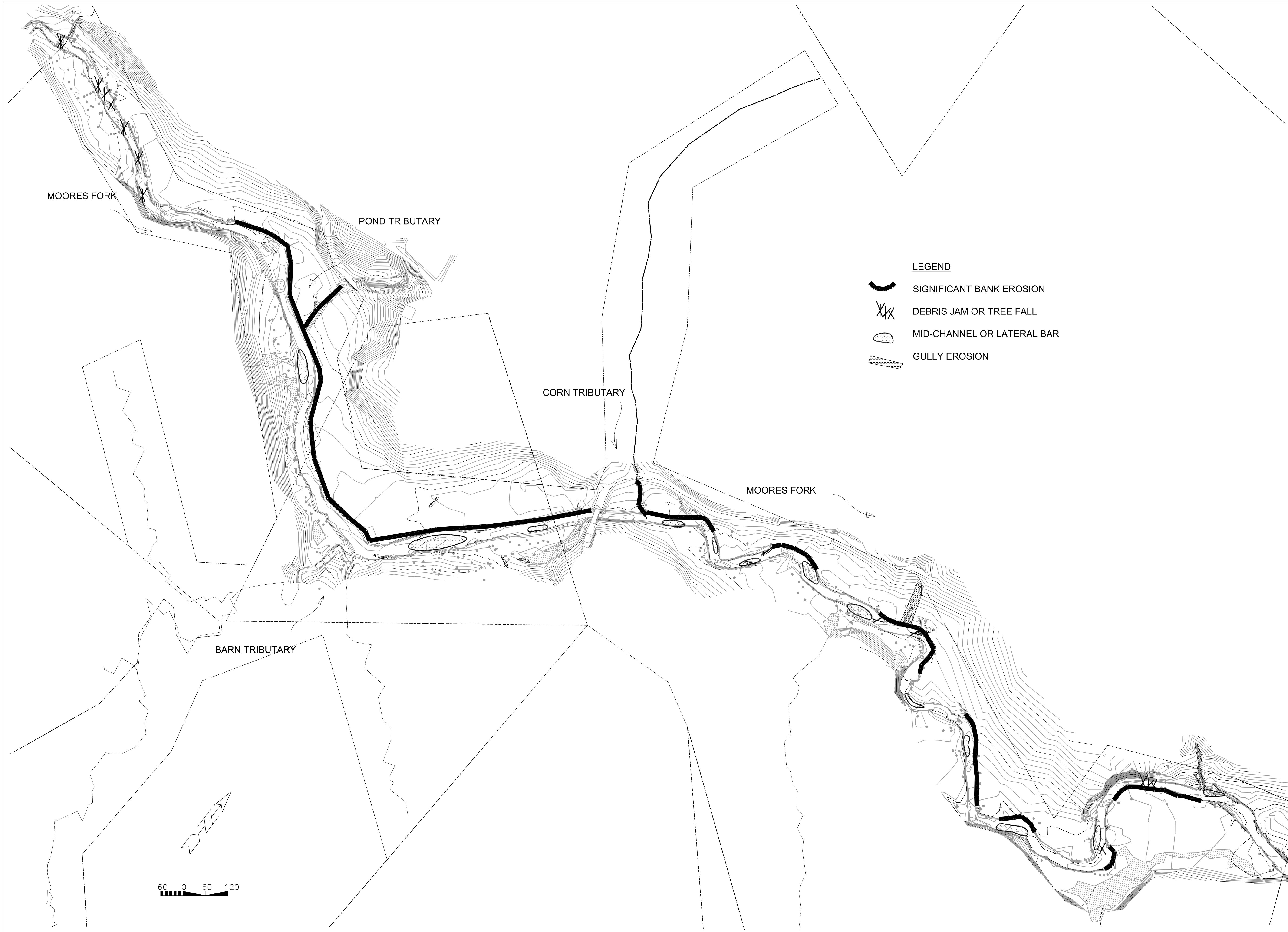
RIVERMORPH PARTICLE SUMMARY

River Name: Mill Creek
Reach Name: Reach 1
Sample Name: Zigzag riffle at bar sample 1
Survey Date: 04/19/2011

Size (mm)	TOT #	ITEM %	CUM %
0 - 0.062	0	0.00	0.00
0.062 - 0.125	0	0.00	0.00
0.125 - 0.25	6	5.45	5.45
0.25 - 0.50	1	0.91	6.36
0.50 - 1.0	0	0.00	6.36
1.0 - 2.0	1	0.91	7.27
2.0 - 4.0	0	0.00	7.27
4.0 - 5.7	0	0.00	7.27
5.7 - 8.0	3	2.73	10.00
8.0 - 11.3	3	2.73	12.73
11.3 - 16.0	6	5.45	18.18
16.0 - 22.6	11	10.00	28.18
22.6 - 32.0	16	14.55	42.73
32 - 45	13	11.82	54.55
45 - 64	16	14.55	69.09
64 - 90	17	15.45	84.55
90 - 128	11	10.00	94.55
128 - 180	5	4.55	99.09
180 - 256	1	0.91	100.00
256 - 362	0	0.00	100.00
362 - 512	0	0.00	100.00
512 - 1024	0	0.00	100.00
1024 - 2048	0	0.00	100.00
Bedrock	0	0.00	100.00

D16 (mm)	14.12
D35 (mm)	27.01
D50 (mm)	40
D84 (mm)	89.08
D95 (mm)	133.15
D100 (mm)	255.99
Silt/Clay (%)	0
Sand (%)	7.27
Gravel (%)	61.82
Cobble (%)	30.91
Boulder (%)	0
Bedrock (%)	0

Total Particles = 110.



A			
B			
C			
	DESCRIPTION	DATE	APP.

REVISIONS

CONFLUENCE
ENGINEERING, PC
16 Broad Street
Asheville, North Carolina 28801
Phone: 828.255.5530
confluence-eng.com

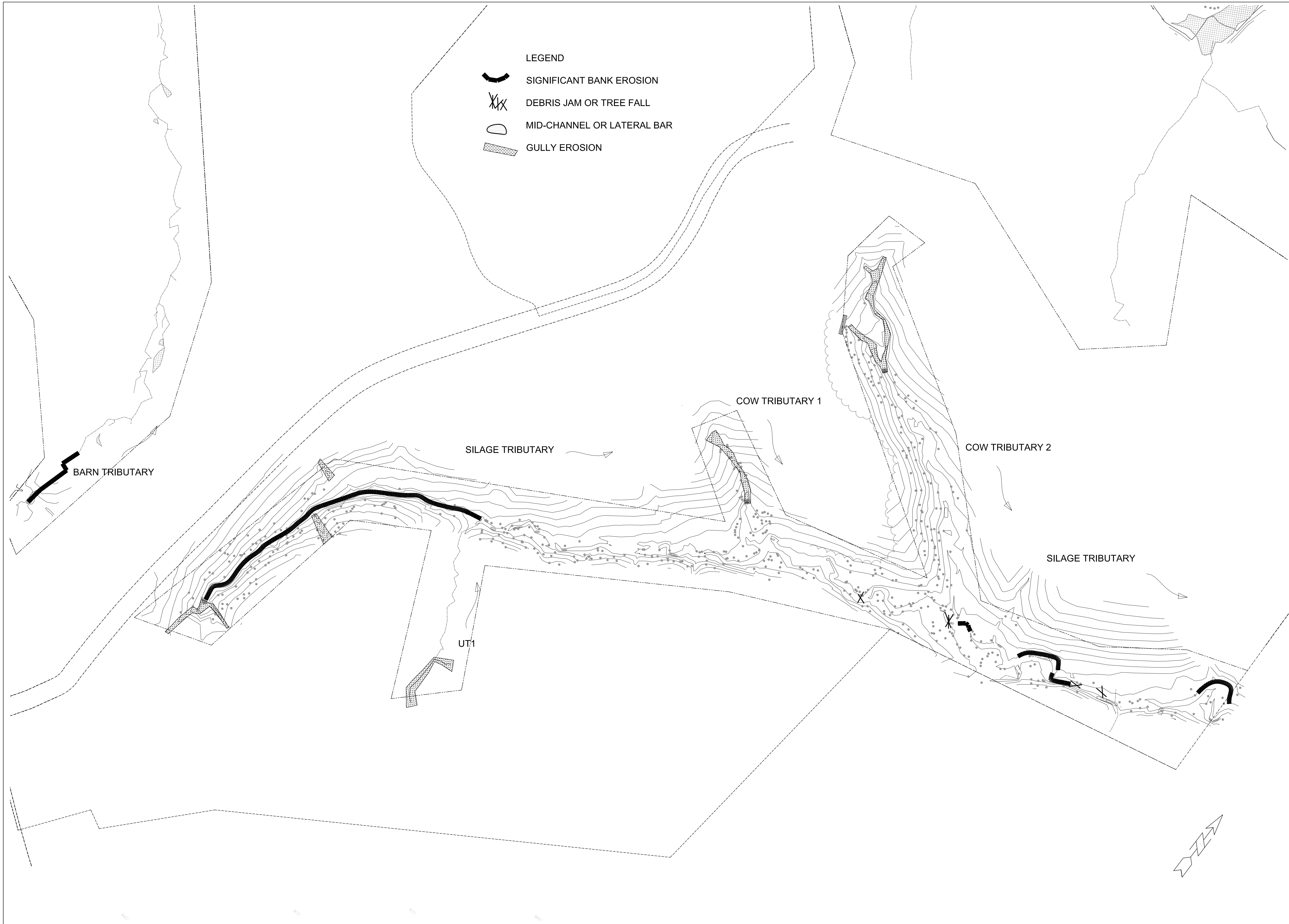
MOORES FORK MITIGATION
SURRY COUNTY, NC

DATE: MARCH 2012

SCALE: 1" = 240'

EXISTING CONDITIONS INVENTORY

SHEET 1 OF 2



A			
B			
C			
	DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22208 ANDREW DAVID

PRELIMINARY PLANS

CONFLUENCE
ENGINEERING, PC
16 Broad Street
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MOORES FORK MITIGATION
SURRY COUNTY, NC

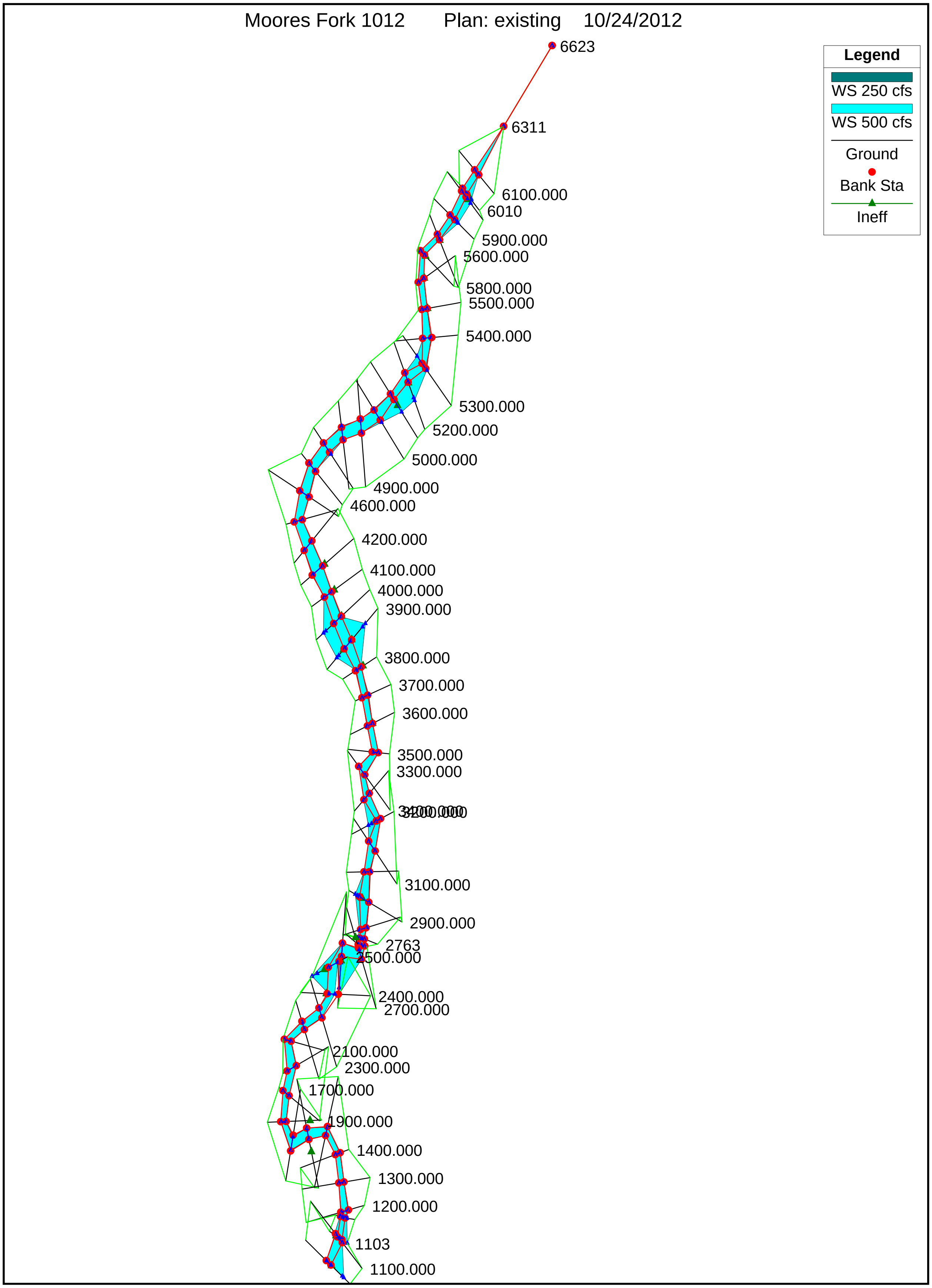
DATE: MARCH 2012

SCALE: 1" = 240'

EXISTING CONDITIONS INVENTORY

SHEET 2 OF 2

HYDRAULIC ANALYSES


Moores Fork 1012 Plan: existing 10/24/2012
Legend
WS 250 cfs
WS 500 cfs
Ground
Bank Sta
Ineff
6623
6311
6100.000
6010
5900.000
5600.000
5800.000
5500.000
5400.000
5300.000
5200.000
5000.000
4900.000
4600.000
4200.000
4100.000
4000.000
3900.000
3800.000
3700.000
3600.000
3500.000
3300.000
3400.000
3200.000
3100.000
2900.000
2763
2500.000
2400.000
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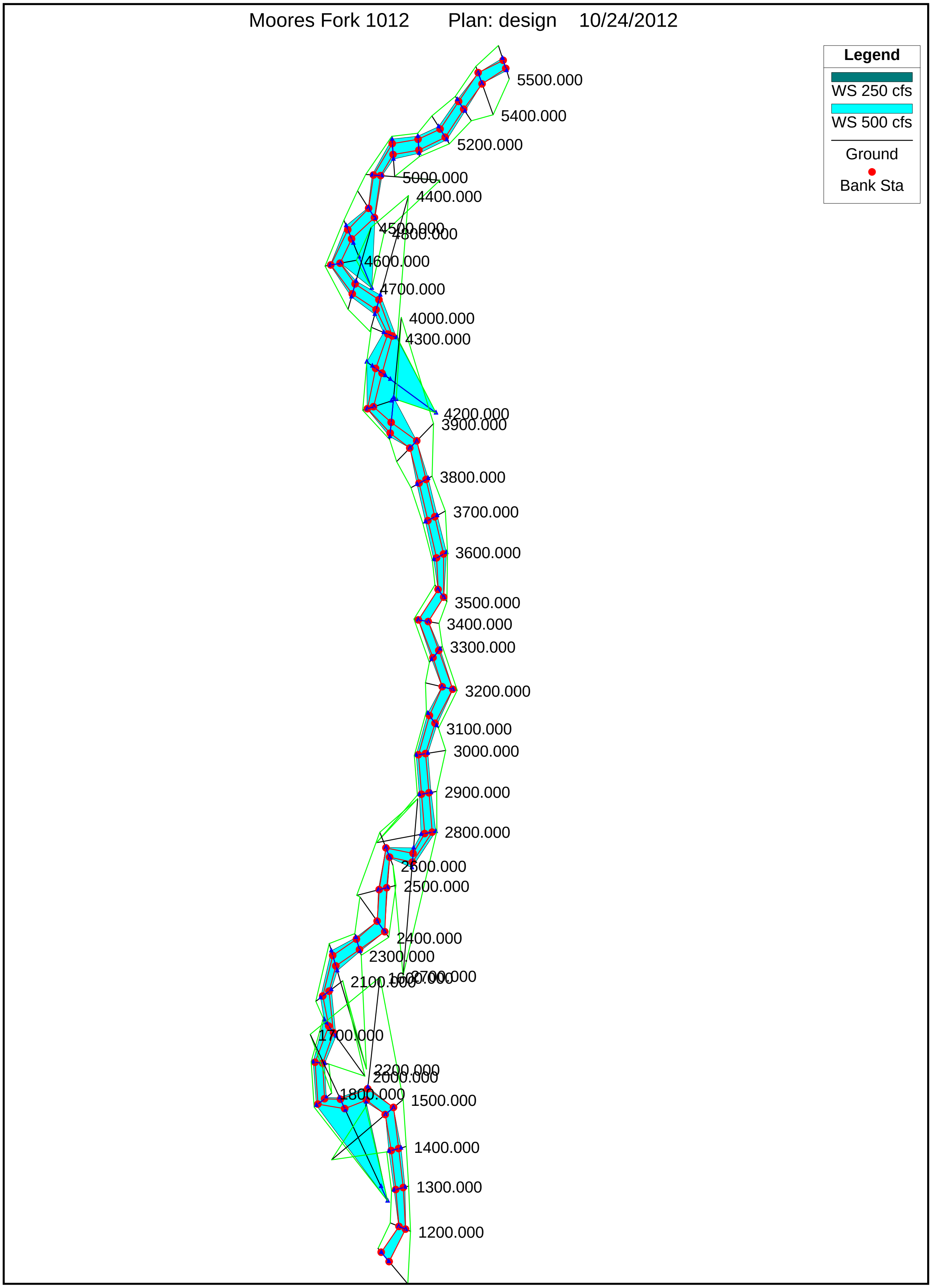
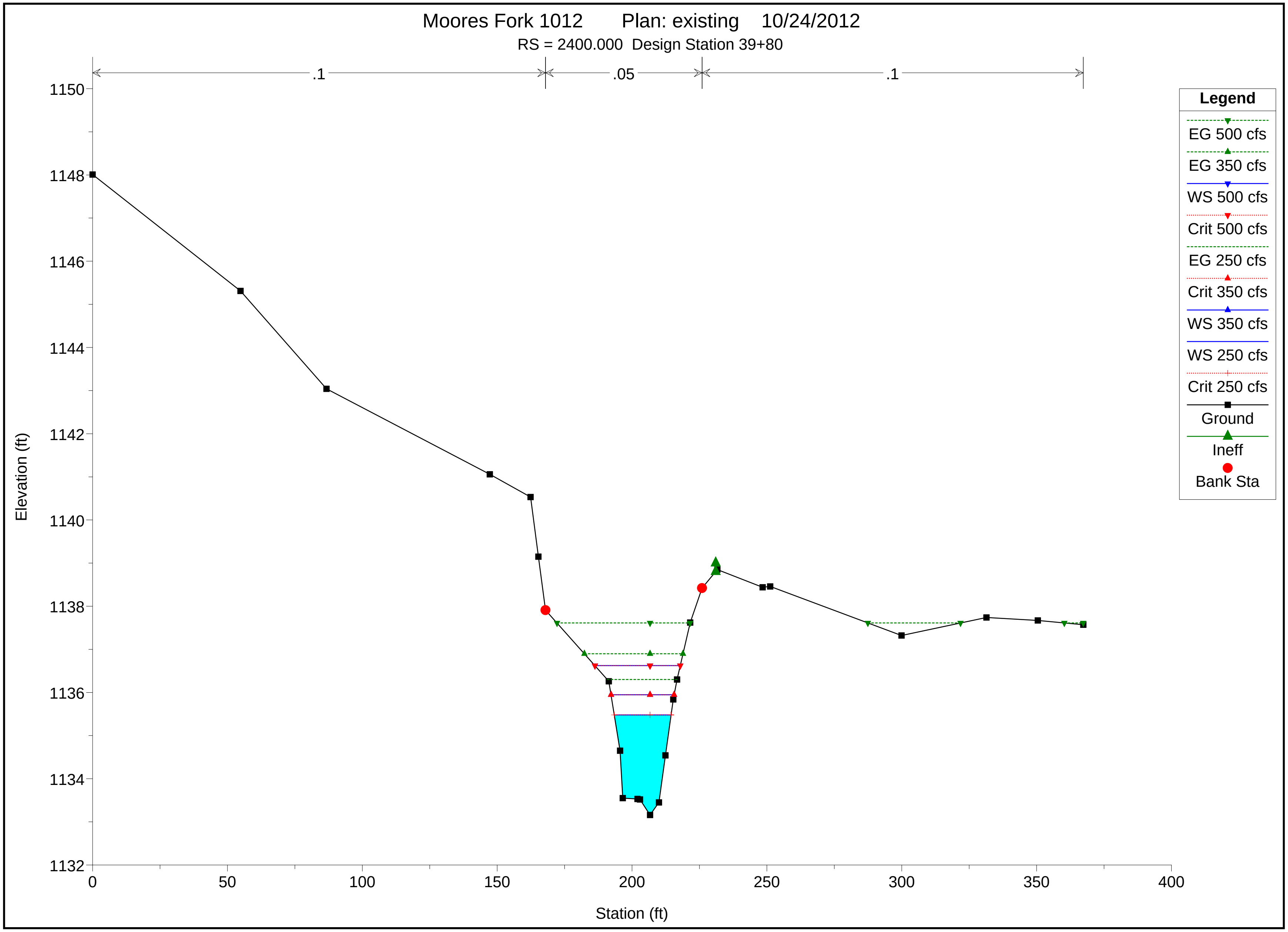
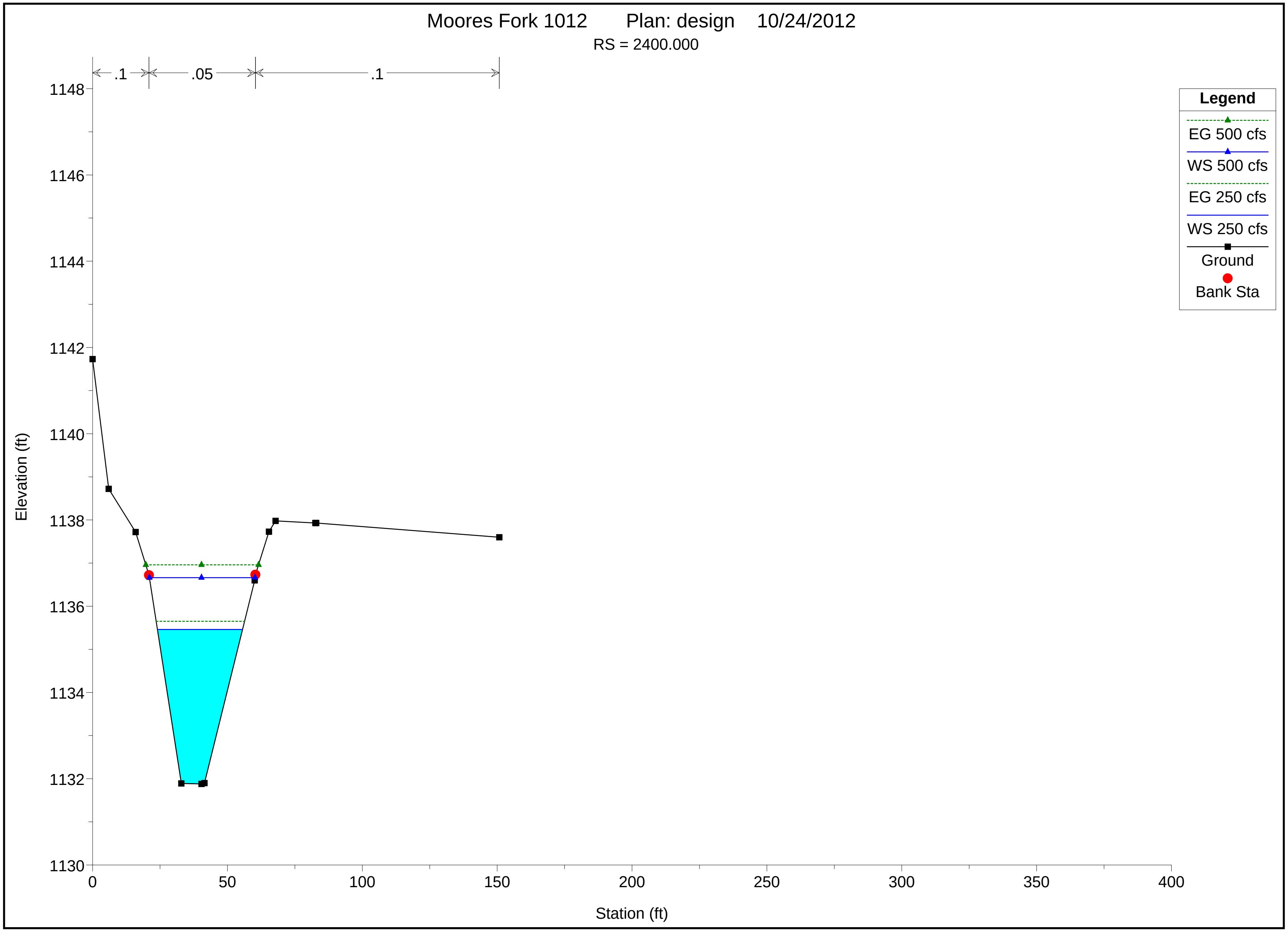
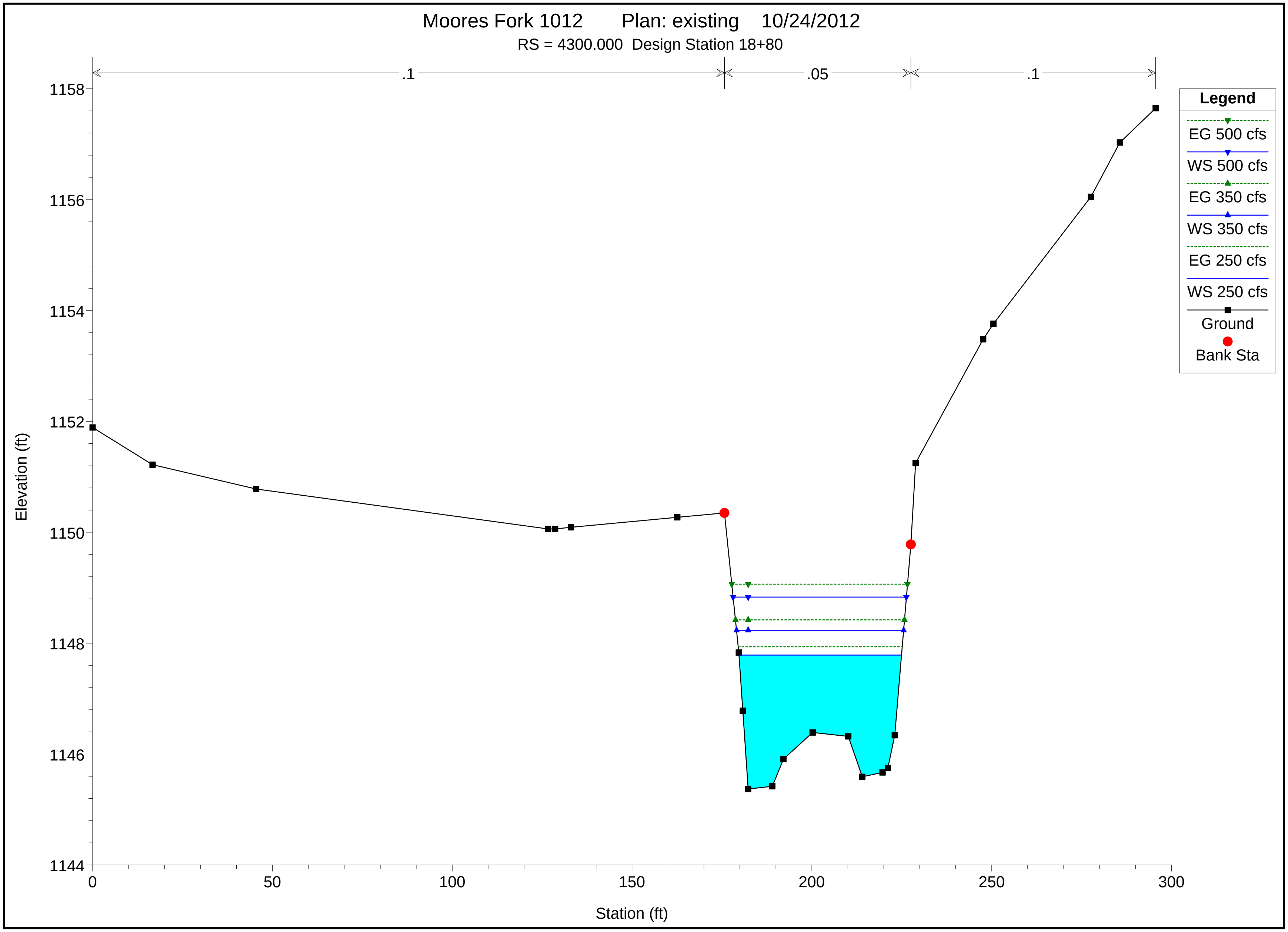
2100.000
2300.000
1700.000
1900.000
1400.000
1300.000
1200.000
1103
1100.000

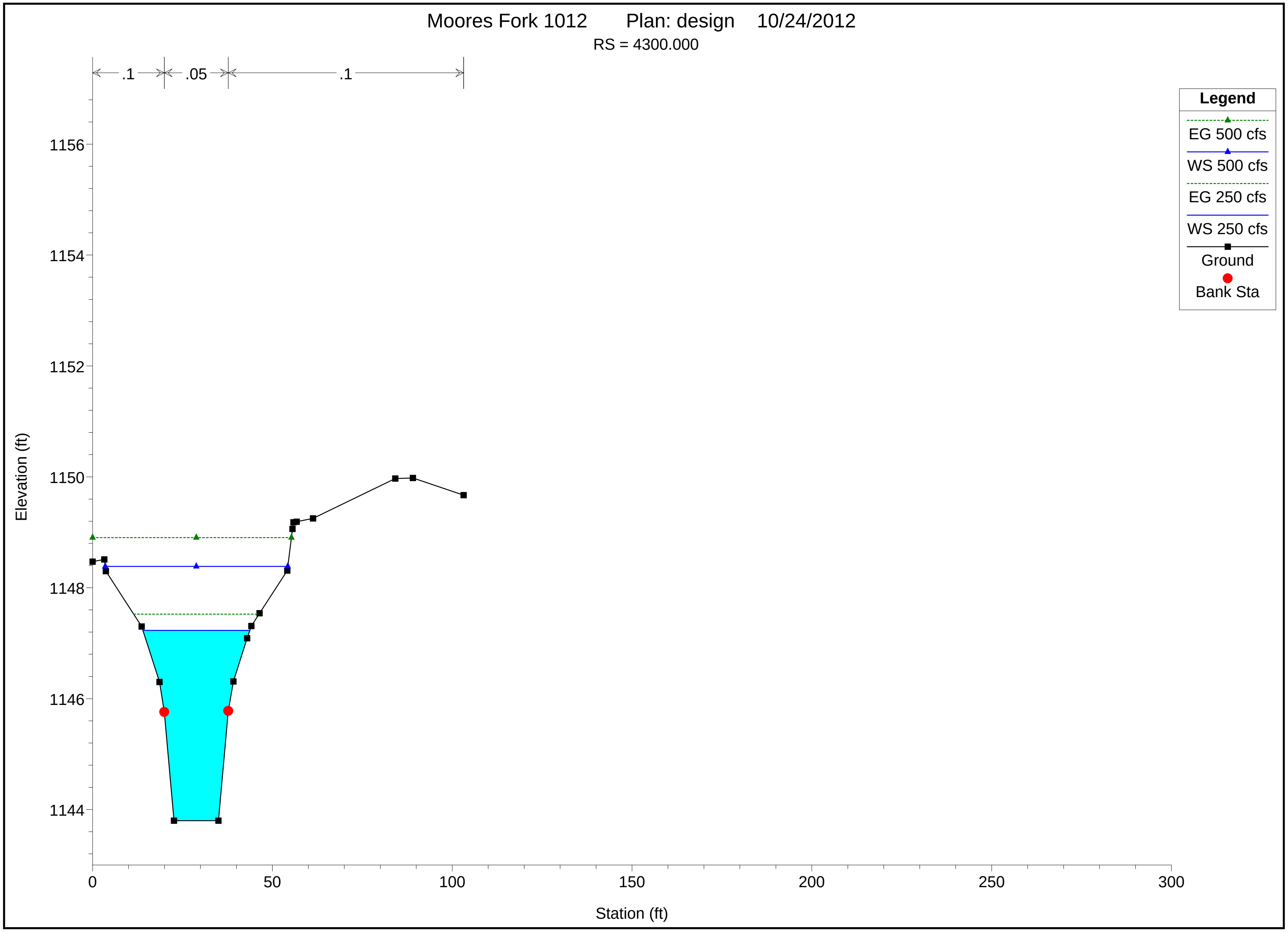

Moores Fork 1012 Plan: design 10/24/2012
Legend
WS 250 cfs
WS 500 cfs
Ground
Bank Sta
5500.000
5400.000
5200.000
5000.000
4400.000
4500.000
4800.000
4600.000
4700.000
4000.000
4300.000
4200.000
3900.000
3800.000
3700.000
3600.000
3500.000
3400.000
3300.000
3200.000
3100.000
3000.000
2900.000
2800.000
2600.000
2500.000
2400.000
2300.000
2100.000
1600.000
2700.000
1700.000
2200.000
2000.000
1800.000
1500.000
1400.000
1300.000
1200.000


Moores Fork 1012 Plan: existing 10/24/2012
RS = 2400.000 Design Station 39+80
.1
.05
.1
Legend
EG 500 cfs
EG 350 cfs
WS 500 cfs
Crit 500 cfs
EG 250 cfs
Crit 350 cfs
WS 350 cfs
WS 250 cfs
Crit 250 cfs
Ground
Ineff
Bank Sta
Elevation (ft)
1150
1148
1146
1144
1142
1140
1138
1136
1134
1132
0
50
100
150
200
250
300
350
400
Station (ft)

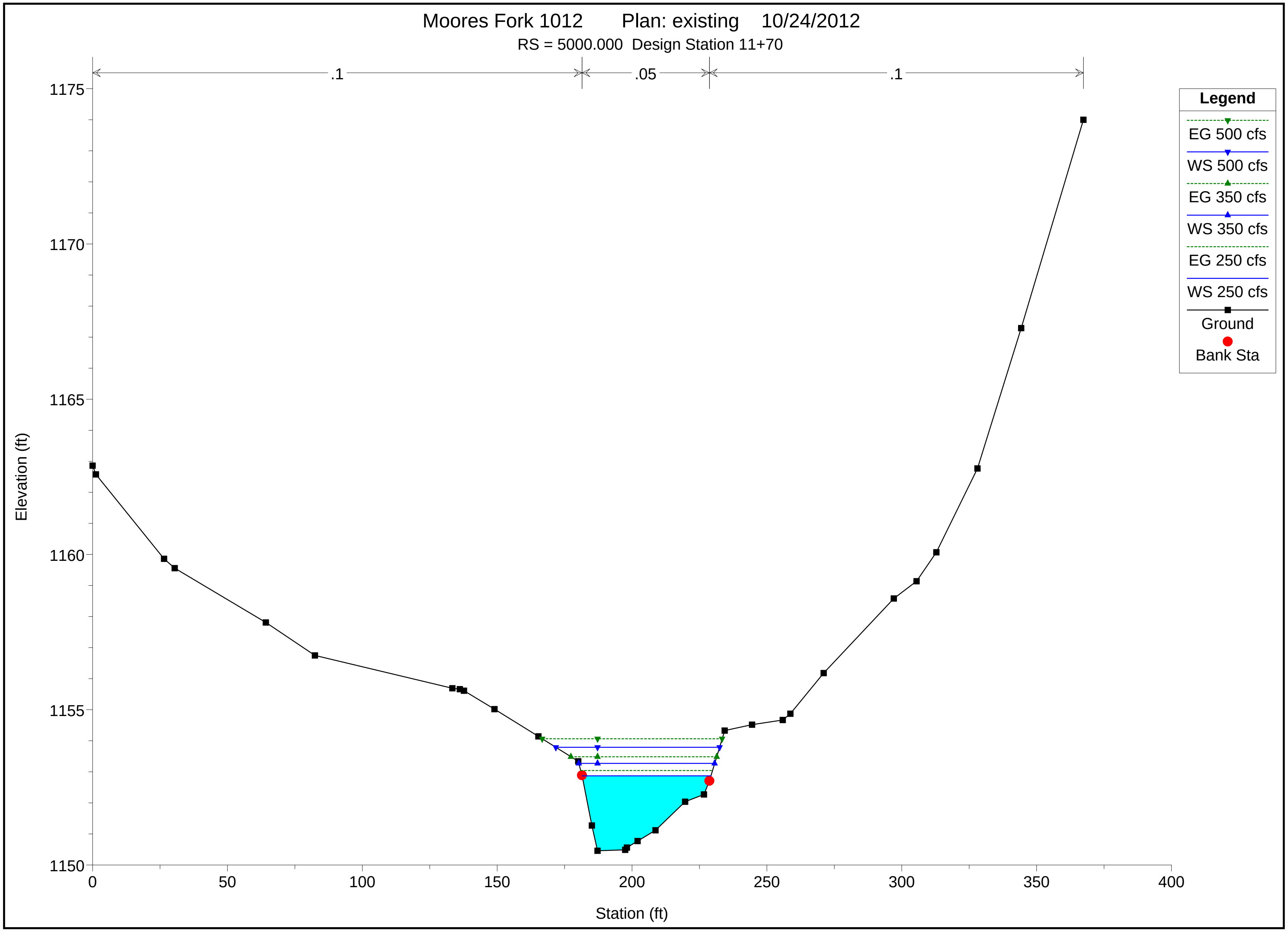

Moores Fork 1012 Plan: design 10/24/2012
RS = 2400.000
.1
.05
.1
Legend
EG 500 cfs
WS 500 cfs
EG 250 cfs
WS 250 cfs
Ground
Bank Sta
Elevation (ft)
1148
1146
1144
1142
1140
1138
1136
1134
1132
1130
0
50
100
150
200
250
300
350
400
Station (ft)



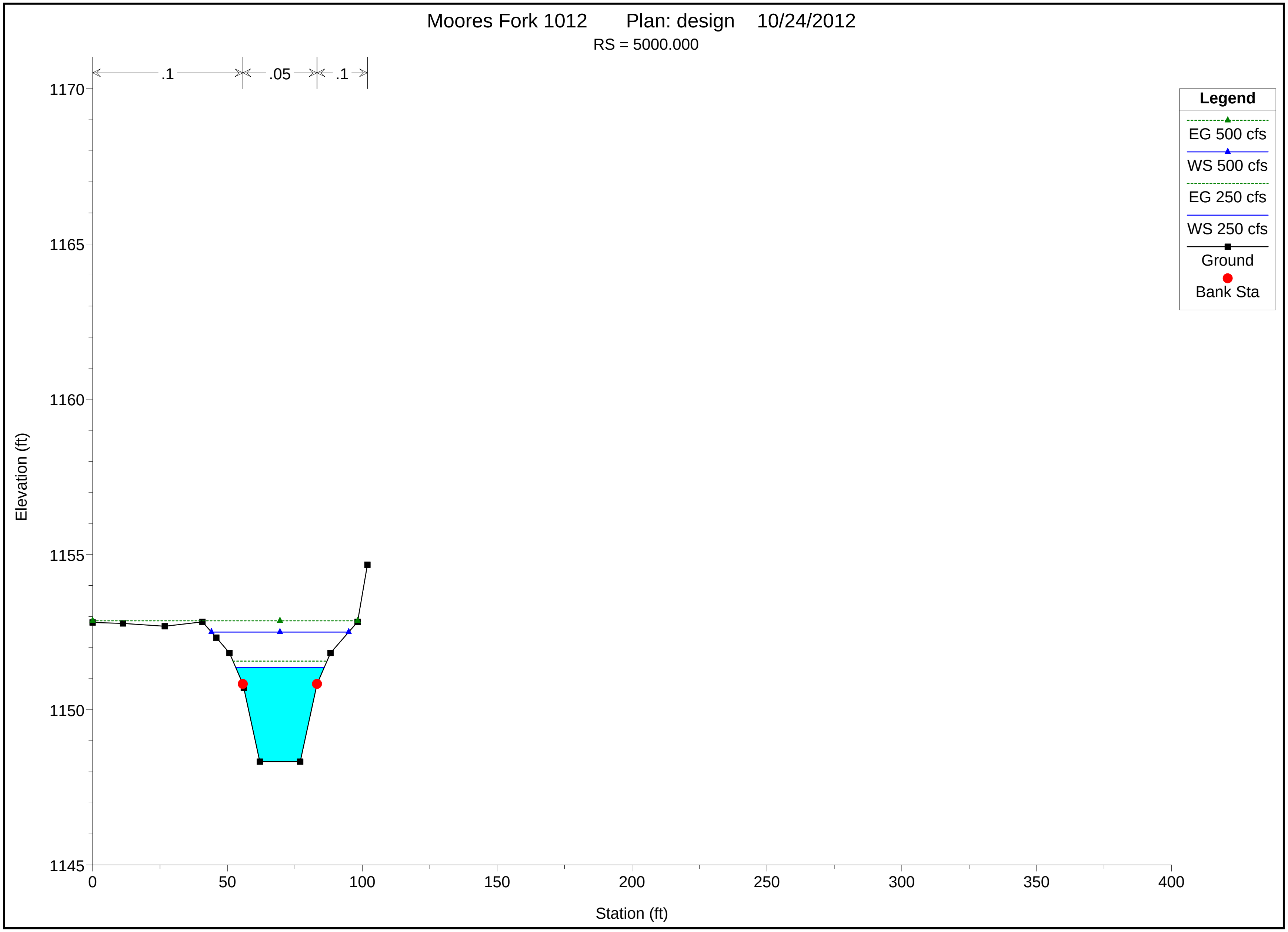
Moores Fork 1012 Plan: existing 10/24/2012
RS = 4300.000 Design Station 18+80
.1
.05
.1
Legend
EG 500 cfs
WS 500 cfs
EG 350 cfs
WS 350 cfs
EG 250 cfs
WS 250 cfs
Ground
Bank Sta
Elevation (ft)
1144
1146
1148
1150
1152
1154
1156
1158
Station (ft)
0
50
100
150
200
250
300



Moores Fork 1012 Plan: design 10/24/2012
RS = 4300.000
.1
.05
.1
Legend
EG 500 cfs
WS 500 cfs
EG 250 cfs
WS 250 cfs
Ground
Bank Sta
Elevation (ft)
1156
1154
1152
1150
1148
1146
1144
0
50
100
150
200
250
300
Station (ft)

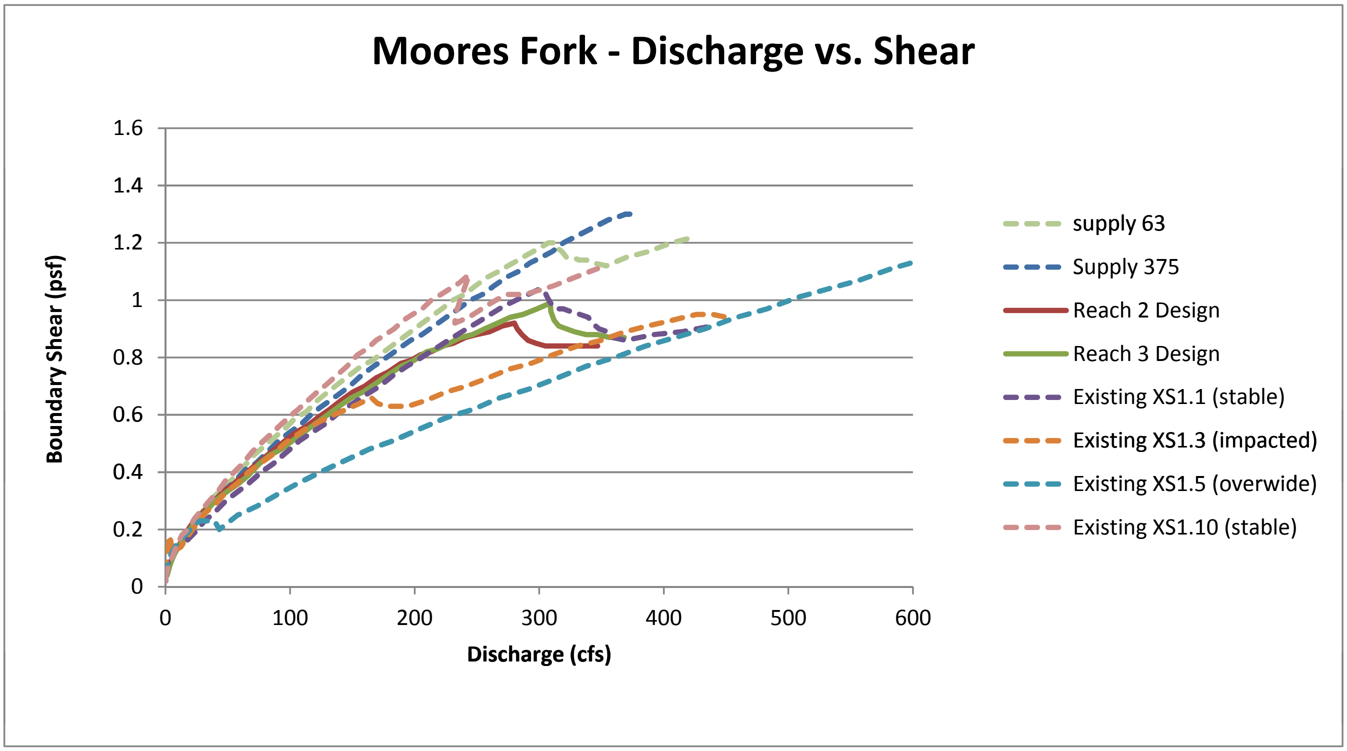


Moores Fork 1012 Plan: existing 10/24/2012
RS = 5000.000 Design Station 11+70
.1
.05
.1
Legend
EG 500 cfs
WS 500 cfs
EG 350 cfs
WS 350 cfs
EG 250 cfs
WS 250 cfs
Ground
Bank Sta
Elevation (ft)
1175
1170
1165
1160
1155
1150
0
50
100
150
200
250
300
350
400
Station (ft)

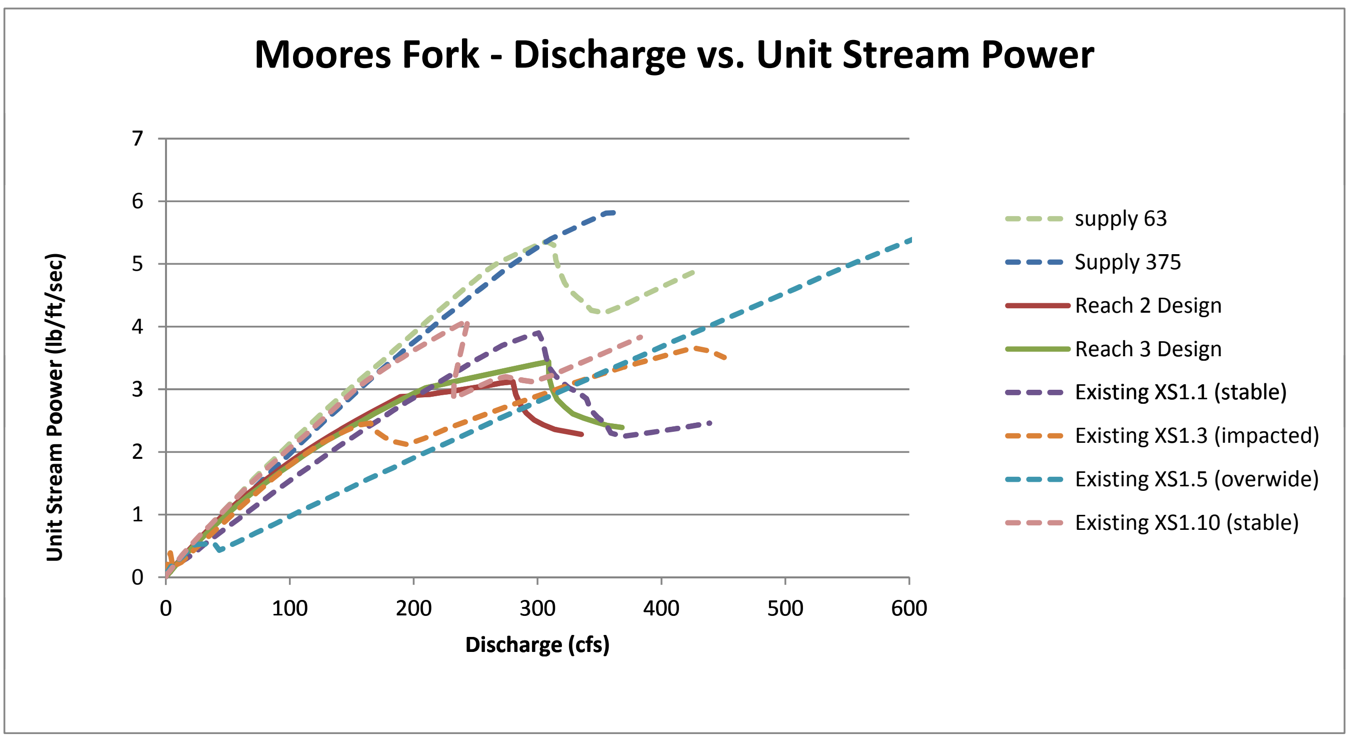


Moores Fork 1012 Plan: design 10/24/2012
RS = 5000.000
.1
.05
.1
Legend
EG 500 cfs
WS 500 cfs
EG 250 cfs
WS 250 cfs
Ground
Bank Sta
Elevation (ft)
1170
1165
1160
1155
1150
1145
0
50
100
150
200
250
300
350
400
Station (ft)

SECTION DESIGN AND SEDIMENT TRANSPORT



Moores Fork - Discharge vs. Shear
Boundary Shear (psf)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
100
200
300
400
500
600
Discharge (cfs)
supply 63
Supply 375
Reach 2 Design
Reach 3 Design
Existing XS1.1 (stable)
Existing XS1.3 (impacted)
Existing XS1.5 (overwide)
Existing XS1.10 (stable)



Moores Fork - Discharge vs. Unit Stream Power
Unit Stream Poower (lb/ft/sec)
7
6
5
4
3
2
1
0
0
100
200
300
400
500
600
Discharge (cfs)
supply 63
Supply 375
Reach 2 Design
Reach 3 Design
Existing XS1.1 (stable)
Existing XS1.3 (impacted)
Existing XS1.5 (overwide)
Existing XS1.10 (stable)

Andrews (1984) and Andrews and Nankervis (1995)

tci* = 0.0834(di/d'50)-0.872 applies if di/d'50 ranges from 3 to 7
tci* = 0.0384(di/d'50)-0.887 if di/d'50 is 1.3 to 3.0

di = d50 of riffle pavement (from zigzag), mm
d'50 = d50 of sub-pavement (bar sample), mm

d = tci*((rsand-rh20)/rh20)*Di)/s

d = mean bankfull depth of water (ft) needed to move largest particle

rsand =	2.65 g/cc	specific gravity of sand
rh20 =	1.00 g/cc	specific gravity of water
Di =	largest particle found in bar or subpavement sample (ft)	
s =	average (bankfull) water surface slope	

MOORES FORK REACHES 1 AND 2

For supply reach samples loc. 1 (bar)

di	29	mm			
d'50	23	mm			
di/d'50	1.26087				
tci* =	0.031263				
Di	52	mm	=	0.17	ft
s	0.0113	ft/ft			
d =	0.78	ft			

For sample near 30+00 (bar)

di	29	mm			
d'50	12	mm			
di/d'50	2.416667				
tci* =	0.017556				
Di	55	mm	=	0.18	ft
s	0.0064	ft/ft			
d =	0.82	ft			

For supply reach samples loc. 2 (bar)

di	36	mm			
d'50	27	mm			
di/d'50	1.333333				
tci* =	0.029752				
Di	78	mm	=	0.26	ft
s	0.0113	ft/ft			
d =	1.11	ft			

For sample near 30+00 (subpavement)

di	29	mm			
d'50	23	mm			
di/d'50	1.26087				
tci* =	0.031263				
Di	123	mm	=	0.40	ft
s	0.0064	ft/ft			
d =	3.25	ft			

from stage report in RM w/ d_{bkf} = d, q_{ci} ~ 101 cfs
us xs

from stage report in RM w/ d_{bkf} = d, q_{ci} ~ 732 cfs xs1.1

Bathurst et al (1987)

$q_{cD50} = (0.15g^{0.5}D_{50}^{1.5})/(s^{1.12})$ D in ft
$q_{ci} = q_{cD50}(D_i/D_{50})^b$
$b = 1.5(D_{84}/D_{16})^{-1}$

MOORES FORK REACHES 1 AND 2

Moores 1 Pebble Count

D_{50} =	0.029	m	0.09512	ft
D_{84} =	0.067	m	0.21976	ft
D_{16} =	0.011	m	0.03608	ft
s =	0.0064			
q_{cD50} =	7.153283	cfs		
b =	0.246269			
q_{ci} =	8.791593	cfs/ft		

Section	Active Channel Width (ft)	q_{ci} (cfs) =
M1.1	21.63	190
M1.3	21	185

Moores Supply Pebble Count 1

D_{50} =	0.029	m	0.09512	ft
D_{84} =	0.054	m	0.17712	ft
D_{16} =	0.015	m	0.0492	ft
s =	0.0113			
q_{cD50} =	3.784244	cfs		
b =	0.416667			
q_{ci} =	4.903174	cfs/ft		

Section	Active Channel Width (ft)	q_{ci} (cfs) =
us xs	17.3	152

Moores Supply Pebble Count 2

D_{50} =	0.036	m	0.11808	ft
D_{84} =	0.076	m	0.24928	ft
D_{16} =	0.015	m	0.0492	ft
s =	0.0113			
q_{cD50} =	5.234026	cfs		
b =	0.296053			
q_{ci} =	6.529925	cfs/ft		

Section	Active Channel Width (ft)	q_{ci} (cfs) =
ds xs	17.2	151

Check discharge for initiation of Phase 2 transport using **Bathurst (2007)** equations:

$q_{c2} = 0.0513\ g^{0.5}\ D_{50}^{1.5}\ S^{-1.2}$ units of cms; D (m) of the surface material from pebble count

$q_{c2} = 0.0133\ g^{0.5}\ D_{84}^{1.5}\ S^{-1.23}$ g = 9.81 m/s^2

MOORES FORK REACHES 1 AND 2

From Moores Supply Reach loc. 1:

D_{50} = 0.029 m
D_{84} = 0.054 m
S = 0.0113

Bottom Width (active channel) = 17.3 ft

qc2, D_{50} =	0.172 $m^3/s/m$	0.052 cms/ft =	1.852 cfs/ft	32 cfs
qc2, D_{84} =	0.130 $m^3/s/m$	0.040 cms/ft =	1.396 cfs/ft	24 cfs

From Moores Supply Reach loc. 2:

D_{50} = 0.036 m
D_{84} = 0.076 m
S = 0.0113
Bottom Width (active channel) = 17.2 ft

qc2, D_{50} =	0.238073736 $m^3/s/m$	0.0725835 cms/ft =	2.561292 cfs/ft	44 cfs
qc2, D_{84} =	0.216580847 $m^3/s/m$	0.0660307 cms/ft =	2.330063 cfs/ft	40 cfs

From Moores M1.1

D_{50} = 0.029 m
D_{84} = 0.067 m
S = 0.00640
Bottom Width (active channel) = 21.63 ft

qc2, D_{50} =	0.340512373 $m^3/s/m$	0.1038147 cms/ft =	3.663368 cfs/ft	79 cfs
qc2, D_{84} =	0.360742226 $m^3/s/m$	0.1099824 cms/ft =	3.881009 cfs/ft	84 cfs

From Moores M1.3

D_{50} = 0.029 m
D_{84} = 0.067 m
S = 0.00640
Bottom Width (active channel) = 21 ft

qc2, D_{50} =	0.340512373 $m^3/s/m$	0.1038147 cms/ft =	3.663368 cfs/ft	77 cfs
qc2, D_{84} =	0.360742226 $m^3/s/m$	0.1099824 cms/ft =	3.881009 cfs/ft	82 cfs

Andrews (1984) and Andrews and Nankervis (1995)

tci* = 0.0834(di/d'50)-0.872 applies if di/d'50 ranges from 3 to 7
tci* = 0.0384(di/d'50)-0.887 if di/d'50 is 1.3 to 3.0

di = d50 of riffle pavement (from zigzag), mm
d'50 = d50 of sub-pavement (bar sample), mm

MOORES FORK REACH 3

d = tci*((rsand-rh20)/rh20)*Di)/s

d = mean bankfull depth of water (ft) needed to move largest particle

rsand =	2.65 g/cc	specific gravity of sand
rh20 =	1.00 g/cc	specific gravity of water
Di =	largest particle found in bar or subpavement sample (ft)	
s =	average (bankfull) water surface slope	

For sample location near 48+00

di	29.8	mm			
d'50	14.4	mm			
di/d'50	2.069444				
tci* =	0.020145				
Di	84	mm	=	0.275591	ft
s	0.0064	ft/ft			
d =	1.431322	ft			

from stage report in RM w/ d_{bkf} = d, q_{ci} ~	56	cfs	xs 1.6
	56		xs1.10

Bathurst et al (1987)

$q_{cD50} = (0.15g^{0.5}D_{50}^{1.5})/(s^{1.12})$ D in ft
$q_{ci} = q_{cD50}(D_i/D_{50})^b$
$b = 1.5(D_{84}/D_{16})^{-1}$

MOORES FORK REACH 3

Moores Pebble Count near 48+00

D_{50} =	0.03	m	0.0984	ft
D_{84} =	0.043	m	0.14104	ft
D_{16} =	0.016	m	0.05248	ft
s =	0.0064			
q_{cD50} =	7.526452	cfs		
b =	0.55814			
q_{ci} =	9.201398	cfs/ft		

Section	Active Channel Width (ft)	q_{ci} (cfs) =
M1.6	20.1	185
M1.10	18.5	170

Sample near 48+00

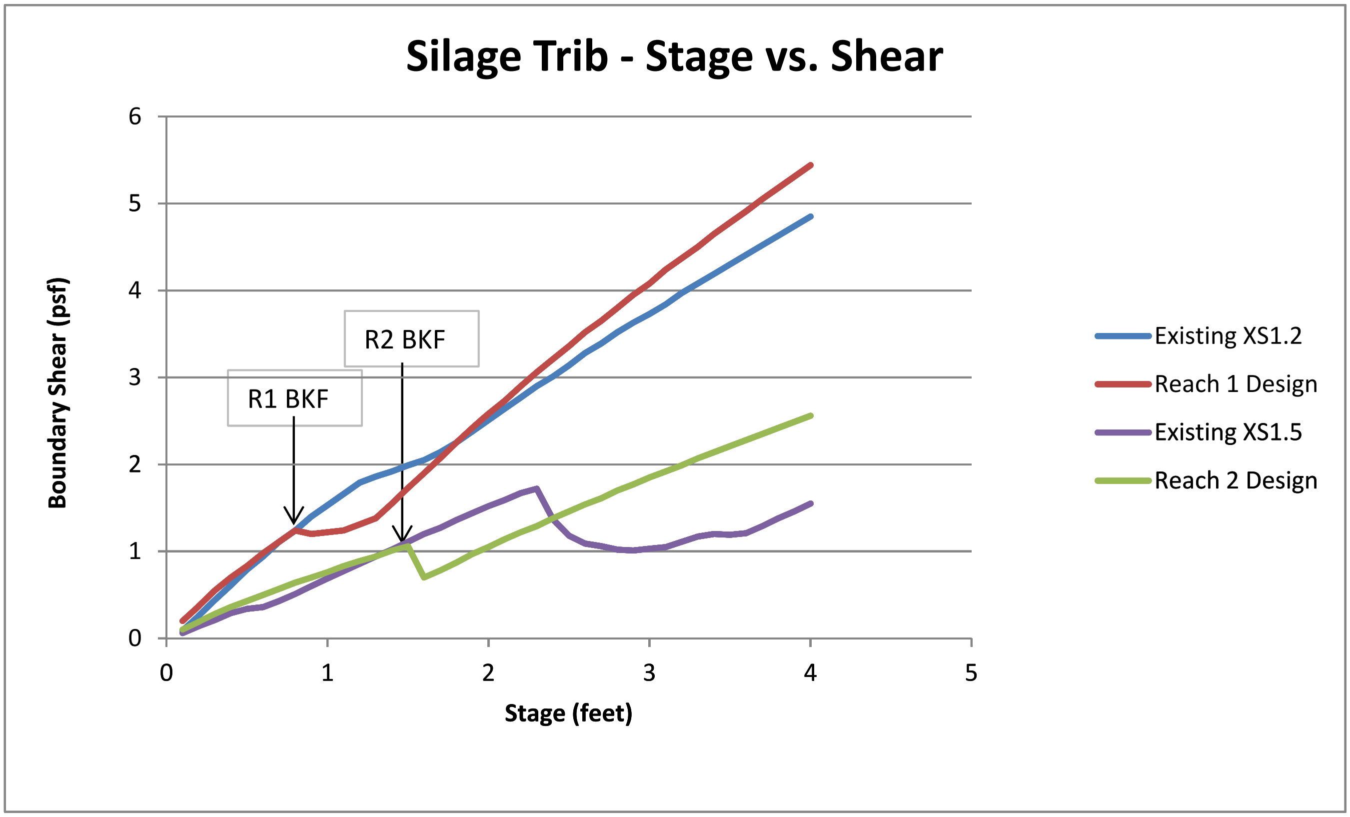
D_{50} =	0.029	m	0.09512	ft
D_{84} =	0.054	m	0.17712	ft
D_{16} =	0.015	m	0.0492	ft
s =	0.0113			
q_{cD50} =	3.784244	cfs		
b =	0.416667			
q_{ci} =	4.903174	cfs/ft		

Section	Active Channel Width (ft)	q_{ci} (cfs) =
us xs	17.3	159

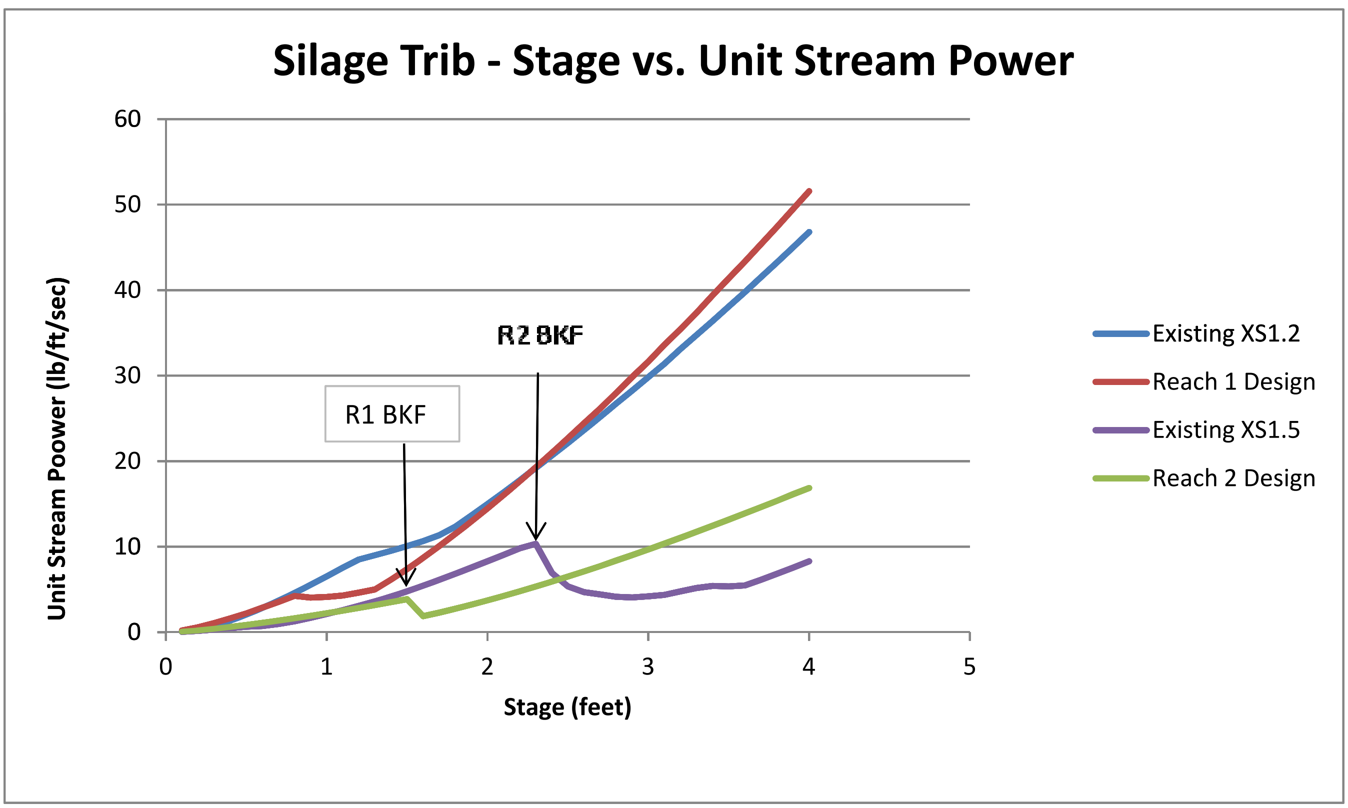
Moores Supply Pebble Count 2

D_{50} =	0.036	m	0.11808	ft
D_{84} =	0.076	m	0.24928	ft
D_{16} =	0.015	m	0.0492	ft
s =	0.0113			
q_{cD50} =	5.234026	cfs		
b =	0.296053			
q_{ci} =	6.529925	cfs/ft		

Section	Active Channel Width (ft)	q_{ci} (cfs) =
ds xs	17.2	158



Silage Trib - Stage vs. Shear
Boundary Shear (psf)
Stage (feet)
R1 BKF
R2 BKF
Existing XS1.2
Reach 1 Design
Existing XS1.5
Reach 2 Design



Silage Trib - Stage vs. Unit Stream Power
Unit Stream Poower (lb/ft/sec)
Stage (feet)
R1 BKF
R2 BKF
Existing XS1.2
Reach 1 Design
Existing XS1.5
Reach 2 Design

SILAGE TRIBUTARY - REACH 1

Area Calculation

		point	x coord	y coord	x (m)	y (m)
Right Bank Slope, x:1	3	LTER	0	100	0	30.4878
Left Bank Slope, x:1	3	LTOETER	0	100	0	30.4878
Max Depth (ft)	0.8	LTOB	0	100	0	30.4878
Bottom Width (ft)	4	LTOE	2.4	99.2	0.731707	30.2439
Area	5.12	TW	4.4	99.2	1.341463	30.2439
Bankfull Width (ft)	8.8	RTOE	6.4	99.2	1.95122	30.2439
Bankfull Depth (ft)	0.581818	RTOB	8.8	100	2.682927	30.4878
W/D ratio	15.125	RTOETER	8.8	100	2.682927	30.4878
Ave Width (ft) =		RTER	8.8	100	2.682927	30.4878

Regional Curve Estimate Silage Trib Rch 1

DA (sq. mi.)	0.07
NC Mountains (area)	3.651426
NC Mountains (discharge)	13.79533
NC rural Piedmont (area)	3.621011
NC rural Piedmont (discharge)	13.55095
USGS 2 year discharge	
NC Hydro Area 1	28.95127
SW Appalachian (area)	5.194893
SW Appalachian (discharge)	21.11035

Discharge Calculation overall reach

Q = 1.49/n R2/3 s1/2 A

WP (ft)	9.059644
R (ft)	0.565144
design slope	0.035
Channel n	0.04
Q (cfs)	24.34314
W (power)	6.041526

gRs =	1.234274	psf				
largest particle from Shields ~	180	mm	Rosgen Data	bar sample 1		
				d84 =	18	mm
	7	inches		d100 =	63	mm
				d50 =	4	mm

pool

Right Bank Slope, x:1	3		
Left Bank Slope, x:1	3	width ratio =	1.409091
Max Depth (ft)	1.4	depth ratio =	2.40625
Bottom Width (ft)	4	area ratio =	2.242188
Area	11.48	14	
Bankfull Width (ft)	12.4	10	
pt bar tob o/s	6.2		
outside bank tob o/s	6.2		

SILAGE TRIBUTARY - REACH 2

Area Calculation

		point	x coord	y coord	x (m)	y (m)
Right Bank Slope, x:1	2.5	LTER	0	100	0	30.4878
Left Bank Slope, x:1	2.5	LTOETER	0	100	0	30.4878
Max Depth (ft)	1.5	LTOB	0	100	0	30.4878
Bottom Width (ft)	5	LTOE	3.75	98.5	1.143293	30.03049
Area	13.125	TW	6.25	98.5	1.905488	30.03049
Bankfull Width (ft)	12.5	RTOE	8.75	98.5	2.667683	30.03049
Bankfull Depth (ft)	1.05	RTOB	12.5	100	3.810976	30.4878
W/D ratio	11.90476	RTOETER	12.5	100	3.810976	30.4878
Ave Width (ft) =		RTER	12.5	100	3.810976	30.4878

Regional Curve Estimate silage trib reach 2

DA (sq. mi.)	0.24
NC Mountains (area)	8.291025
NC Mountains (discharge)	34.49669
NC rural Piedmont (area)	8.221966
NC rural Piedmont (discharge)	32.2898
USGS 2 year discharge	
NC Hydro Area 1	63.32532
SW Appalachian (area)	12.09821
SW Appalachian (discharge)	52.15588

Discharge Calculation overall reach

Q = 1.49/n R2/3 s1/2 A

WP (ft)	13.07775
R (ft)	1.003613
design slope	0.016
Channel n	0.04
Q (cfs)	61.99191
W (power)	4.951418

design tw slope = 0.016

gRs = 1.002007 psf

largest particle from Shields ~ 150 mm

Rosgen Data

bar sample 2

d84 =	72	mm
d100 =	105	mm
d50 =	23	mm

on-line pool

Right Bank Slope, x:1	3.5		
Left Bank Slope, x:1	2.5	width ratio =	1.6
Max Depth (ft)	2.5	depth ratio =	2.380952
Bottom Width (ft)	5	area ratio =	2.380952
Area	31.25	14	
Bankfull Width (ft)	20	10	
pt bar tob o/s	11.25		
outside bank tob o/s	8.75		

SILAGE TRIBUTARY - REACH 1

Rock Sizing Formulae

Corps (1994) for

$D_{30} = 1.95S^{0.555}q^{.67}/g^{.33}$

$q = Q_{bkf}/b$

Qbkf =	24	cfs		
b =	4	ft		
q =	6	cfs/ft		
flow concentration factor	1.25			
g =	32.2	ft/s^2		
S =	0.035			
D_{30} =	0.372	ft		
	4.466	inches	Class B - min. = 5 inches	
D_{85}/D_{15} <=	2			

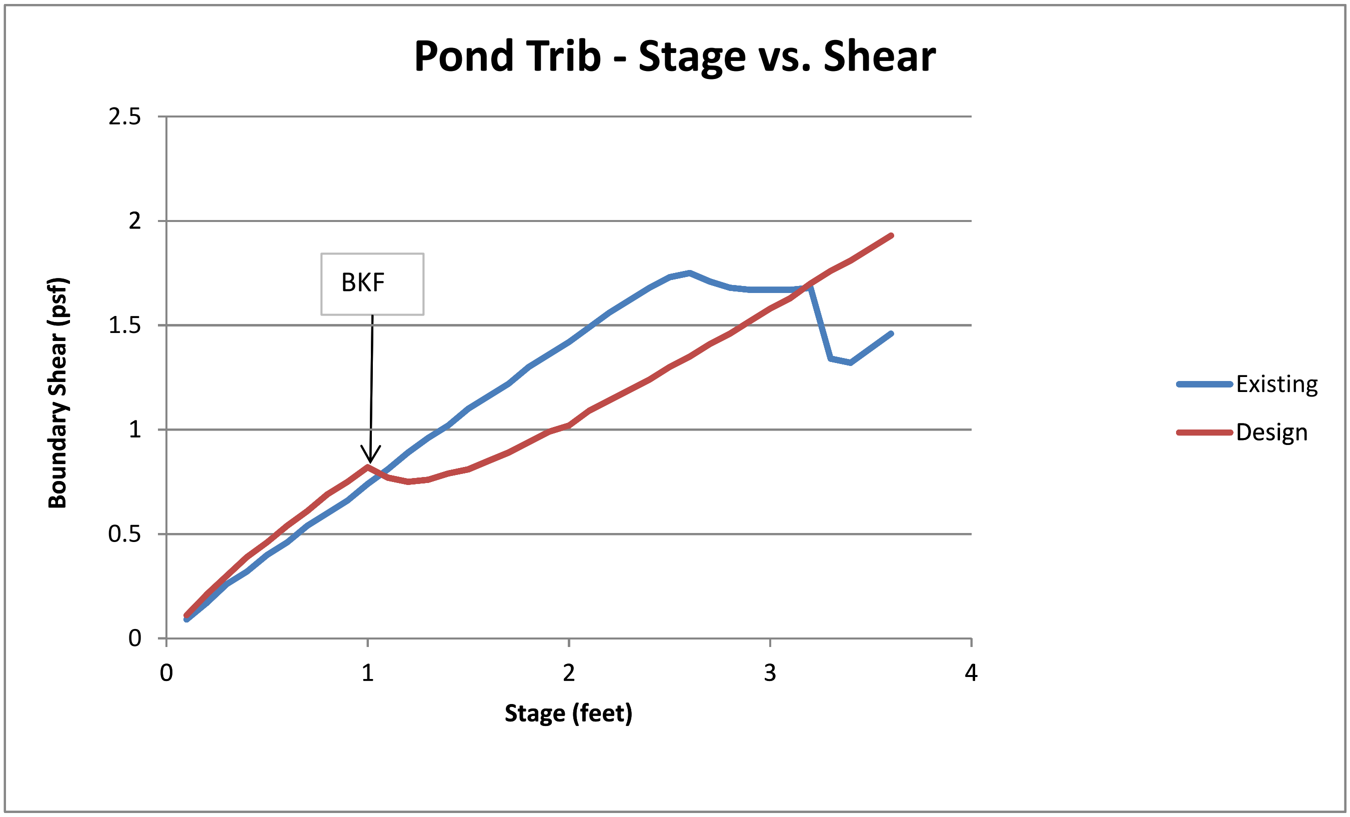
Robinson et al (1998)

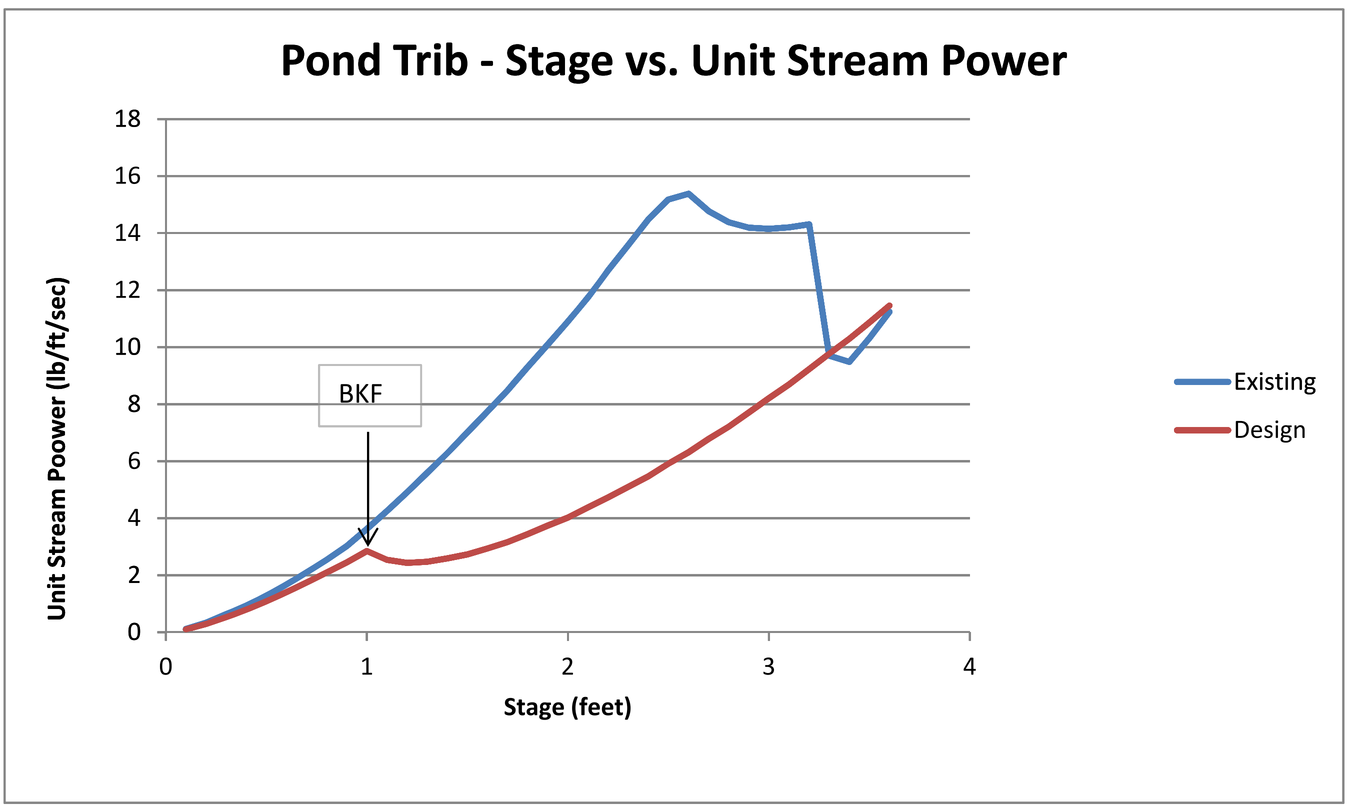
$q = 0.52D_{50}^{1.89}S_0^{-1.5}$ for $S_0 < 0.10$

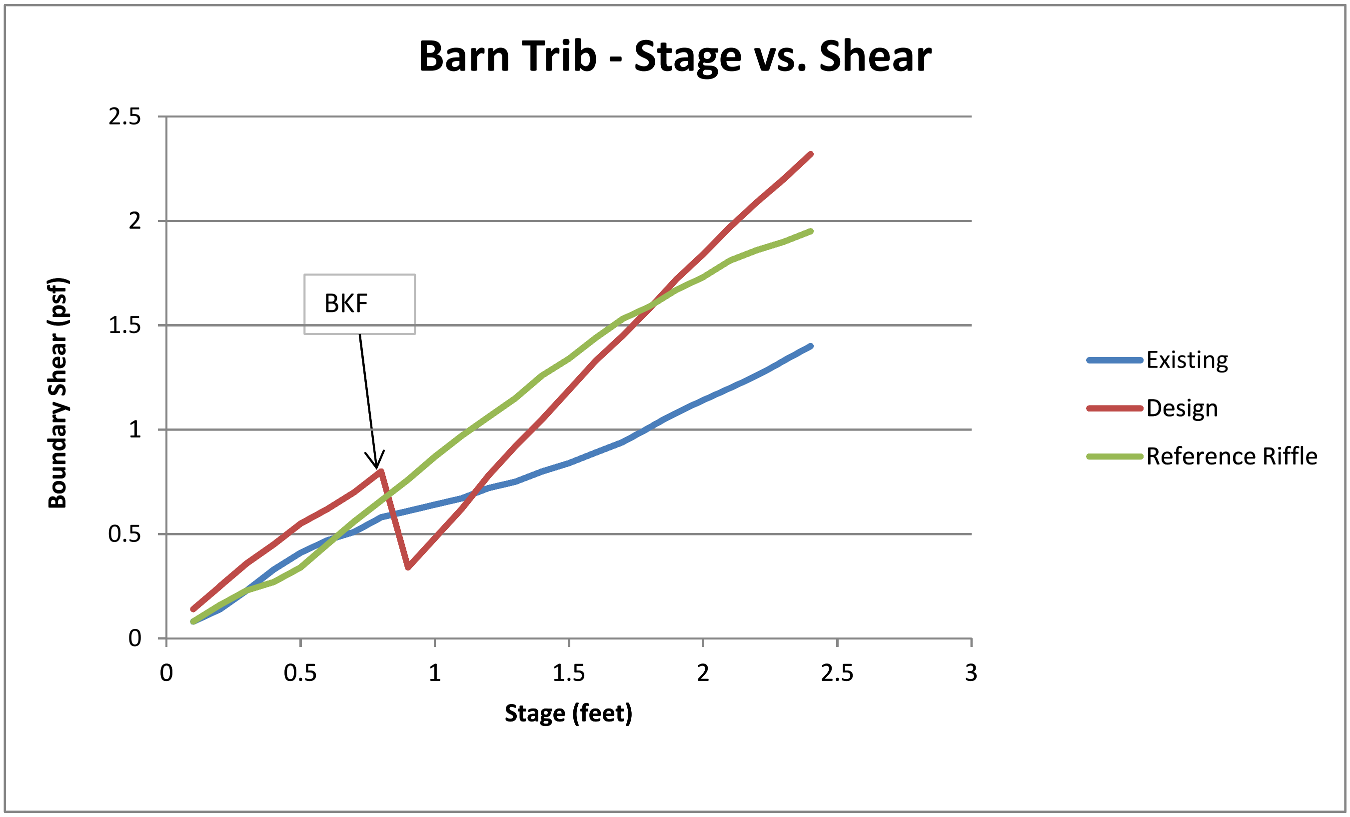
q = highest stable unit discharge angular riprap with $t = 2D_{50}$

try D_{50} =	0.67	ft	Class B d50 = 8 inches	
S_0 =	0.035			
q =	37.25484	cfs/ft	q =	149 cfs

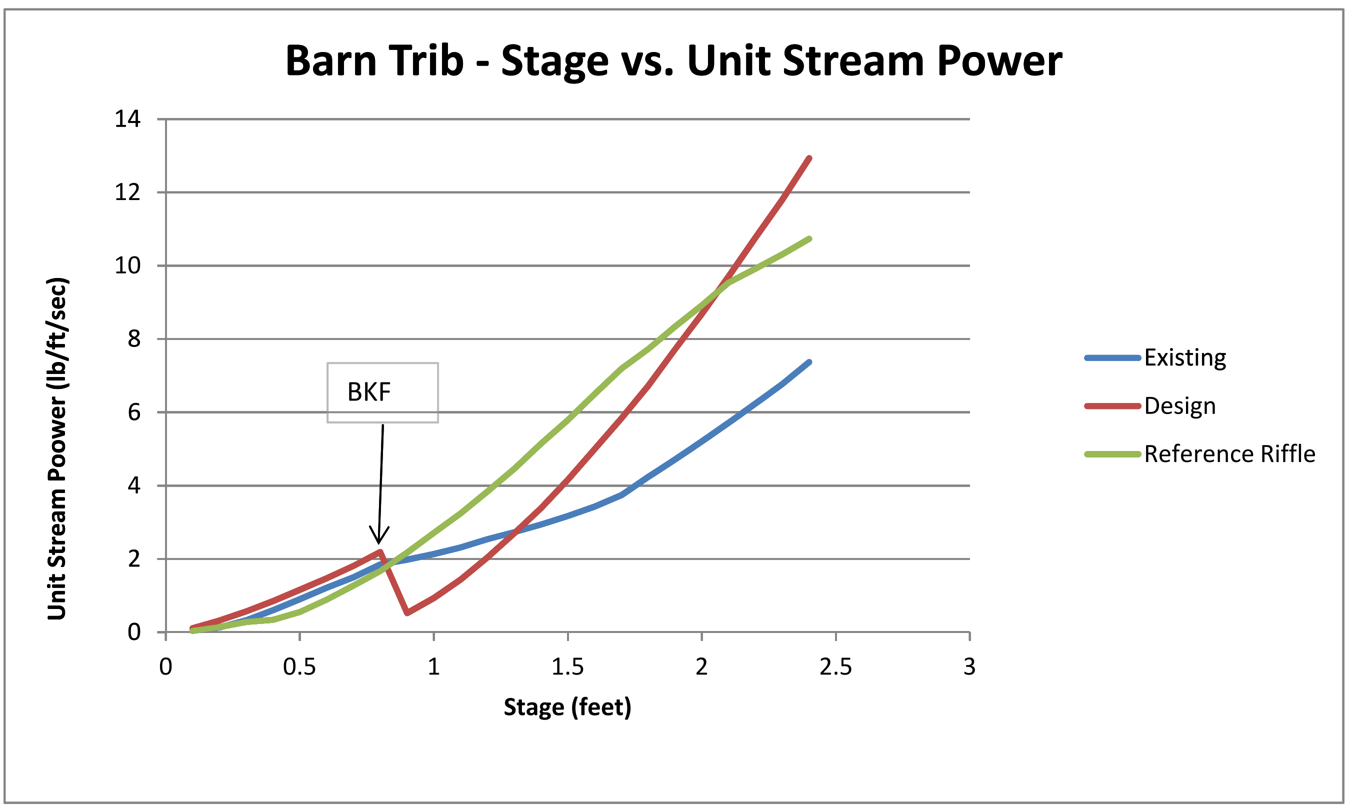
So, while formulae do not produce same stable discharge, Class B riprap works for both. Boulder and log steps considerably larger.


Pond Trib - Stage vs. Shear
Boundary Shear (psf)
2.5
2
1.5
1
0.5
0
0
1
2
3
4
Stage (feet)
BKF
Existing
Design


Pond Trib - Stage vs. Unit Stream Power
Unit Stream Poower (lb/ft/sec)
18
16
14
12
10
8
6
4
2
0
0
1
2
3
4
Stage (feet)
BKF
Existing
Design



Barn Trib - Stage vs. Shear
Boundary Shear (psf)
Stage (feet)
BKF
Existing
Design
Reference Riffle
0
0.5
1
1.5
2
2.5
3



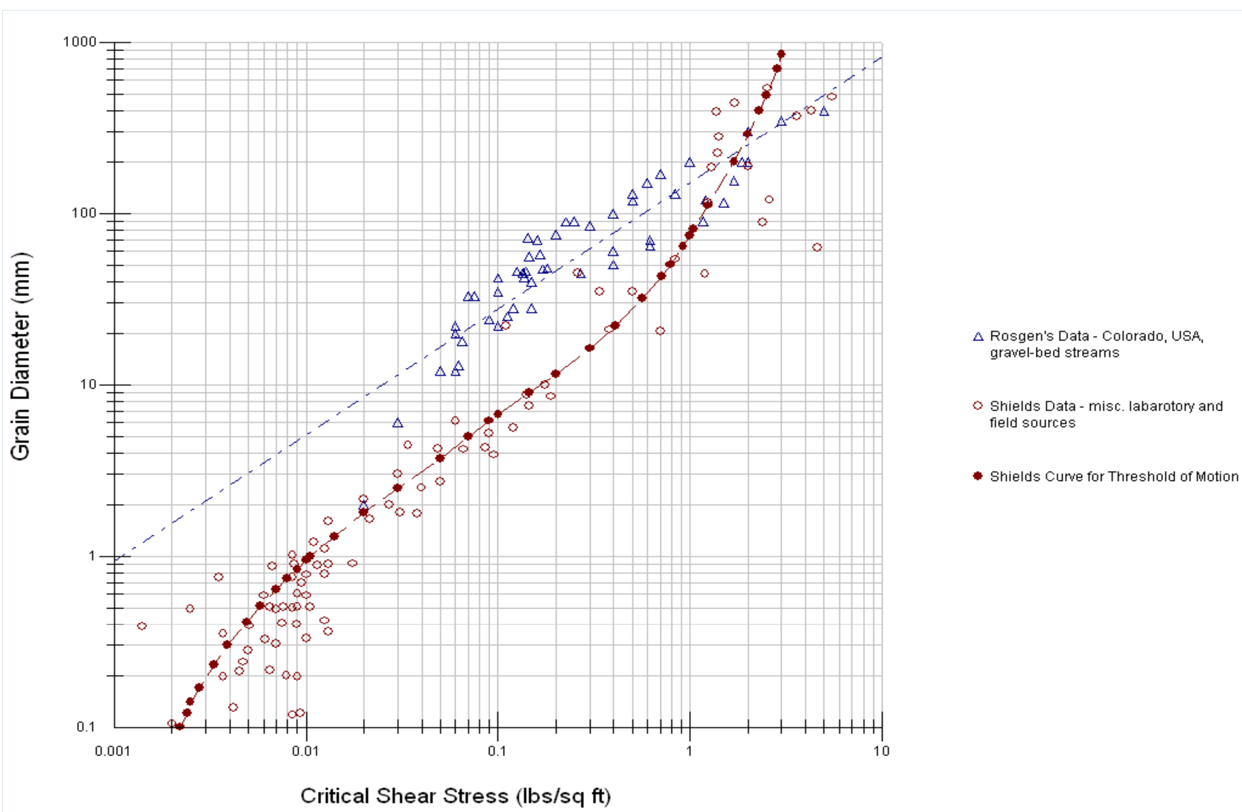
Barn Trib - Stage vs. Unit Stream Power
Unit Stream Poower (lb/ft/sec)
Stage (feet)
BKF
Existing
Design
Reference Riffle
0
2
4
6
8
10
12
14
0.5
1
1.5
2.5
3

Moores Fork Riparian Tree & Shrub Planting

Common Name	Scientific Name	Stratum	Indicator Status
ZONE 1 - Upper Streambank			
Elderberry	*Sambucus canadensis*	Understory	FACW-
Silky Dogwood	*Cornus amomum*	Understory	FACW+
Black Willow	*Salix nigra*	Midstory	OBL
Silky Willow	*Salix sericea*	Understory	OBL
ZONE 2 - Floodplain			
Tulip Poplar	*Liriodendron tulipifera*	Canopy	FAC
Sycamore	*Platanus occidentalis*	Overstory	FACW-
Eastern Redbud	*Cercis candaensis*	Sub-Canopy	FACU
Silky Dogwood	*Cornus amomum*	Understory	FACW+
Hophornbeam	*Ostrya virginiana*	Sub-Canopy	FACU-
Pawpaw	*Asimina triloba*	Sub-Canopy	FAC
American Beautyberry	*Callicarpa americana*	Tall Shrub	FACU-
ZONE 3 - Floodplain & Terrace			
White Oak	*Quercus alba*	Canopy	FACU
Swamp Chestnut Oak	*Quercus michauxii*	Canopy	FACW+
Blackgum	*Nyssa sylvatica* Marsh.	Canopy	FAC
Winged Elm	*Ulmus alata*	Sub-Canopy	FACU+
Persimmon	*Diosypros virginana*	Tall Shrub	FAC
Witch Hazel	*Hamamelis virginiana*	Understory	FACU
Ironwood	*Carpinus caroliniana*	Midstory	FAC
Black Haw	*Viburnum prunifolium*	Understory	FACU

Check of in-stream structure particle mobility				10/24/2012		
Reach	**Discharge**	**Shear (psf) ***	**Particle Diam. Shield's Curve, Rosgen data (mm)**	**Particle Diam. Shield's Curve, Rosgen data (in)**	**Constructed Riffle D50 (in)**	**Rock Vane/Step Median Boulder Size (in)**
Moores	bankfull	0.72	120	4.7		
R 1&2	2xbankfull	1.13	170	6.7		
					8	
Moores	bankfull	0.66	110	4.3		
R 3	2xbankfull	0.96	150	5.9		
Silage R1	bankfull	1.22	180	7.1		
	2xbankfull	1.65	220	8.7		24
					N/A	
Silage R2	bankfull	0.87	160	6.3		
	2xbankfull	1.25	180	7.1		
Pond	bankfull	0.85	150	5.9	8	
	2xbankfull	0.81	140	5.5		

* From stage shear calcs (RAS and RIVERMorph)



APPENDIX D

FARM MANAGEMENT PLAN

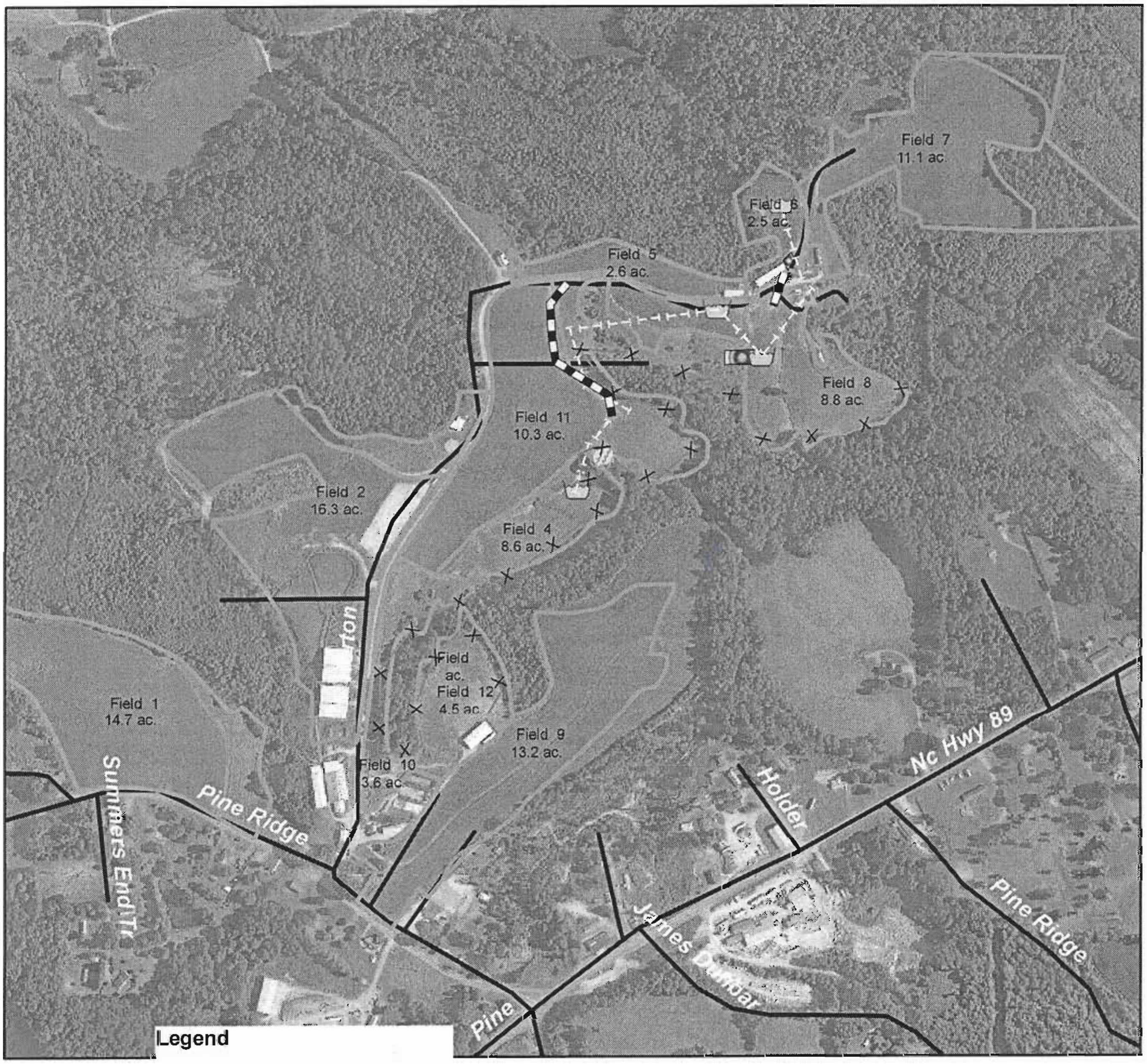
PRELIMINARY PLANS

Conservation Plan Map

Date: 2/15/2012

Customer(s): MAPLE RIDGE FARMS
District: SURRY SOIL & WATER CONSERVATION DISTRICT
Approximate Acres: 96.2

Field Office: DOBSON SERVICE CENTER
Agency: NRCS
Assisted By: Tony Davis
State and County: NC, ALLEGHANY



Legend

- Animal Trails and Walkways
- Fence
- Pipeline
- Stream Crossing
- Water Well
- Watering Facility
- Heavy Use Area Protection
- EEP

360 0 360 720 1,080 1,440 Feet

N

PRELIMINARY PLANS

MOORES FORK RESTORATION PROJECT

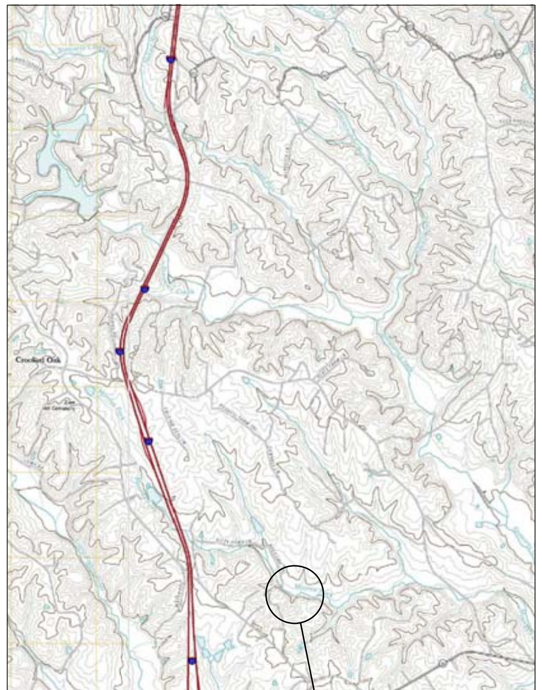
EEP PROJECT NO.	SHEET	TOTAL
94709	T1	25

SYM	DESCRIPTION	DATE	APPROVED
A	CONCEPT PLANS	5/2011	
B	PRELIMINARY PLANS	1/2012	
C	DRAFT FINAL MP	3/2012	
D	FINAL MP	11/2012	
E			

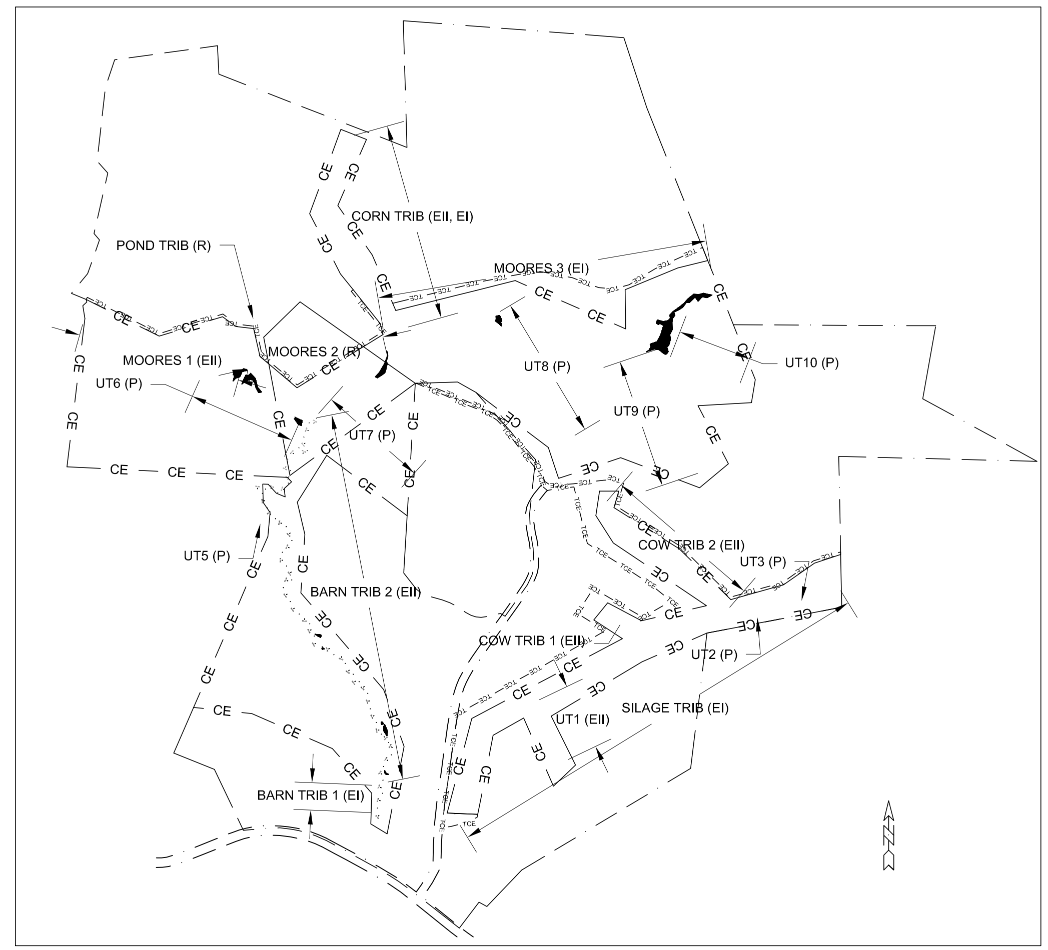
REVISIONS

STREAM NAMES: MOORES FORK AND UNNAMED TRIBUTARIES
LOCATION: SURRY COUNTY, NORTH CAROLINA

PRELIMINARY PLANS
NOT FOR CONSTRUCTION



VICINITY MAP
NOT TO SCALE



INDEX OF SHEETS

T1: TITLE
T2: NOTES AND SYMBOLS
T3: SHEET INDEX
P1-P11: STREAM PLANS
P12: EASEMENT MARKING PLAN
P13: CONSTRUCTION ACCESS PLAN
TS1-TS2: TYPICAL SECTIONS
D1-D7: DETAILS

EEP PROJECT NO. 94709

GRAPHIC SCALES

80 40 0 80 160
PLAN (EXCEPT AS NOTED)

80 40 0 80 160
PROFILE (HORZ.)

8 4 0 8 16
PROFILE (VERT.)

Prepared By:

CONFLUENCE
ENGINEERING, PC
16 Broad Street
Asheville, North Carolina 28801
Phone: 828.255.5530
confluence-eng.com

PROJECTED START DATE:

COMPLETION DATE:

DESIGN

APPROVAL

PROJECT ENGINEER

SIGNATURE

Prepared for:

Ecosystem Enhancement PROGRAM

CONSTRUCTION SEQUENCE OF EVENTS

Phase 1: Mobilization and General Site Preparation

1. Mobilize equipment and materials to the site. Locate limits of disturbance.
2. Establish construction entrances/exits and staging areas as shown on the plans. Access to the site will be via Horton Road and existing farm paths. Existing stream crossings (culverts and bridge) shall be used during construction. Install additional temporary stream crossings on Moores Fork as needed to access work areas.
3. Establish construction haul routes using existing farm paths to the extent feasible. Minimize disturbance beyond immediate haul routes and grading limits. Stabilize haul route surfaces with stone and filter fabric as necessary.
4. Hardwood trees 12 inches dbh and larger that require removal per the plans shall be salvaged for on-site use as in-stream structures. Attention shall be paid to the specified trunk lengths of log and root wad structures shown on the plans.
5. The stems and root masses of exotic invasive species (multi flora rose, Chinese privet, etc.) generated during grading operations shall be burned on site or disposed in approved off site locations.
6. Any stockpiled materials not used for backfill within 30 days of excavation shall be stabilized with temporary seed and straw mulch

Phase 2: Off-Line Channel Construction

1. Perform sod mat cutting within grading limits and stockpile separate from backfill soil for later use on stream banks and planting areas. Limit stripping to those areas that will be graded within 3 days to minimize softening and degradation of subgrade soils under construction traffic.
2. When excavating new off-line channel, leave plugs of existing bank material in place at upstream and downstream ends. Base flow shall be maintained in the existing channel until new channel is fully stabilized with sod mats, seeding and structures riffles
3. Complete in-stream structure installation and bank stabilization on the new channel. Transplant sod mats. Seed and mat banks where sod mat transplanting is not feasible. Stockpile excavated soils between new channel and existing channel for later backfilling. Silt fence shall be installed on the creek side of all stockpiles.
4. Working from the top of the existing stream banks, excavate gravel and cobble bar sediment and stockpile separately for use in constructed riffles and other structures
5. Once the new channel is stabilized, complete tie ins from existing to new channel, taking precautions to limit introduction of soil to live stream. Diverting water into the new channel shall proceed according to the following steps
    a. Remove plug at downstream end of new off-line channel
    b. Setup pump- around operation above upstream tie-in.
    c. Grade online stream channel to proper dimensions and profile and tie -in to new offline channel.
    d. Backfill abandoned channel upstream to downstream, using stockpiled soil, compacted in lifts not to exceed 12 inches in thickness. Stabilize with straw mulch, temporary and permanent seed.

Phase 3: On-Line Channel Construction

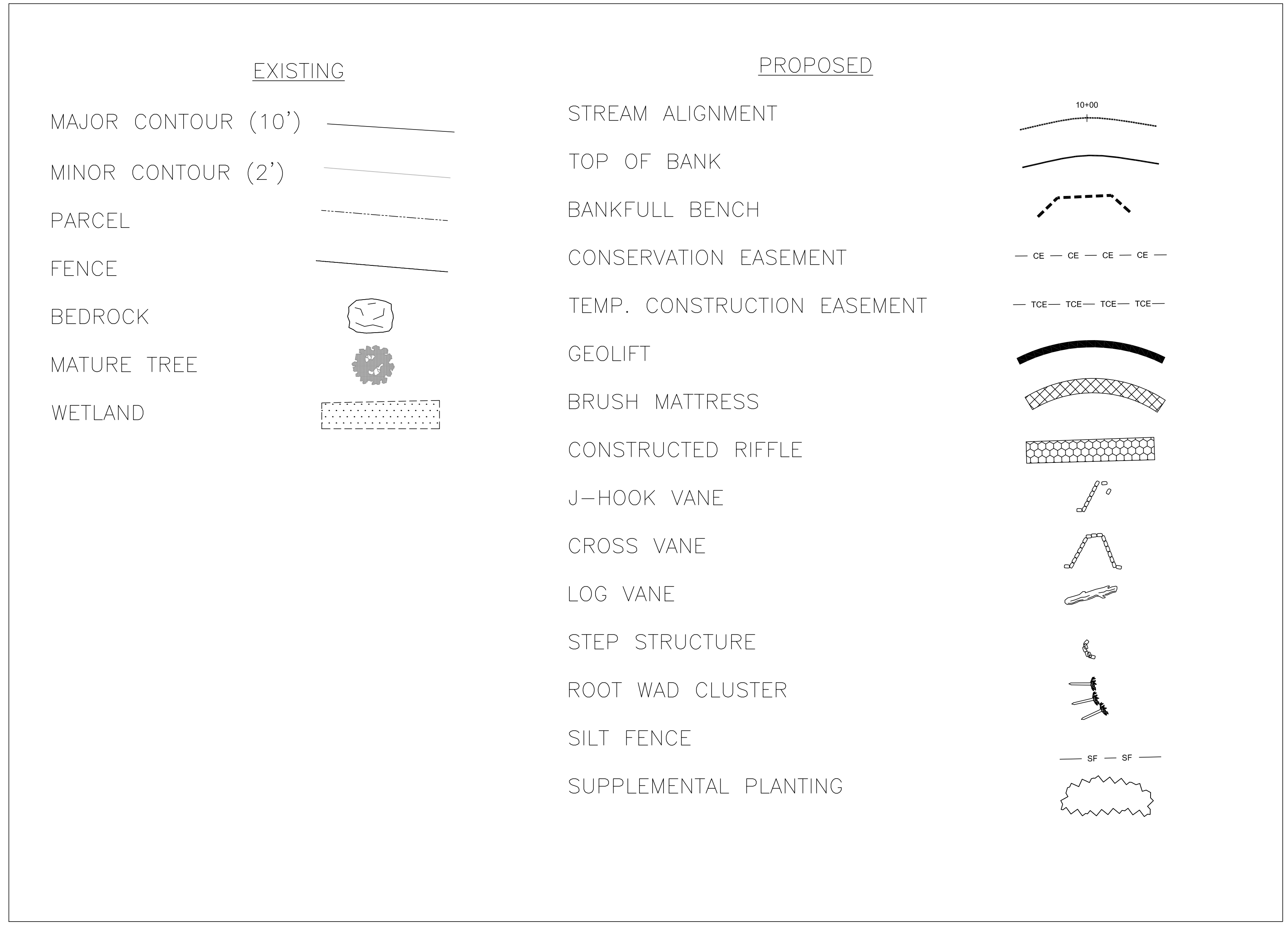
1. Base flow shall be diverted per the plans using a single diversion setup if feasible. Install temporary sand bag coffer dams upstream and downstream of work area. Install pump, suction and discharge lines, and divert flow around tie-in area. Install dewatering pump as necessary and discharge through silt bag.
2. Perform earthwork, in-stream structure installation, geo-lifts, seeding, mulching and matting per the plans. Salvage gravel and cobble sediment for use in constructed riffles and other structures.
2. Permanently dispose of excavated material in approved upland or off- site area. Silt fence shall be installed on the creek side of all temporary stockpiles.
3. Temporarily dismantle flow diversion prior to flood event that exceeds capacity of diversion, ensuring that work areas are fully stabilized.
4. Once restored channel is fully stabilized, dismantle pumps, discharge lines and coffer dams and return flow to restored channel.

Phase 4: Demobilization

1. Upon completion of stream and floodplain grading operations, silt fences shall be removed, construction entrances/exits shall be removed, and the construction haul routes shall be graded, seeded and mulched as needed to restore them to their pre-project conditions.
2. Upon demobilization of equipment and materials, the staging areas shall be restored to their pre project conditions.

Phase 4a: Planting

1. Site planting, including live stakes and bare root trees and shrubs shall be completed after grading and in-stream structure operations are complete and during the dormant season (November to April).



A				
B				
C				
		DESCRIPTION	DATE	APP.

REVISIONS

PRELIMINARY PLANS

CONFLUENCE
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Phone: 828.255.5530
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MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

DATE: NOV. 2012

SCALE: NTS

NOTES AND SYMBOLS

SHEET T2 OF 25

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS

PRELIMINARY PLANS

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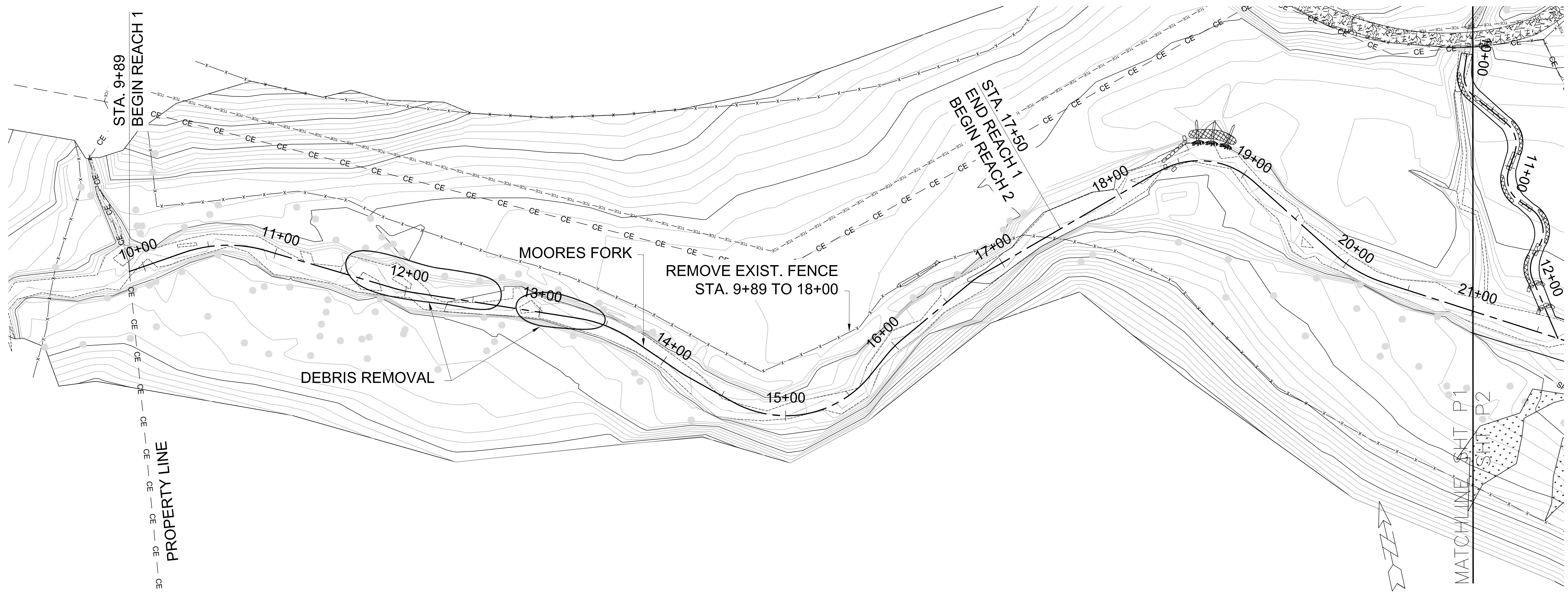
confluence-eng.com

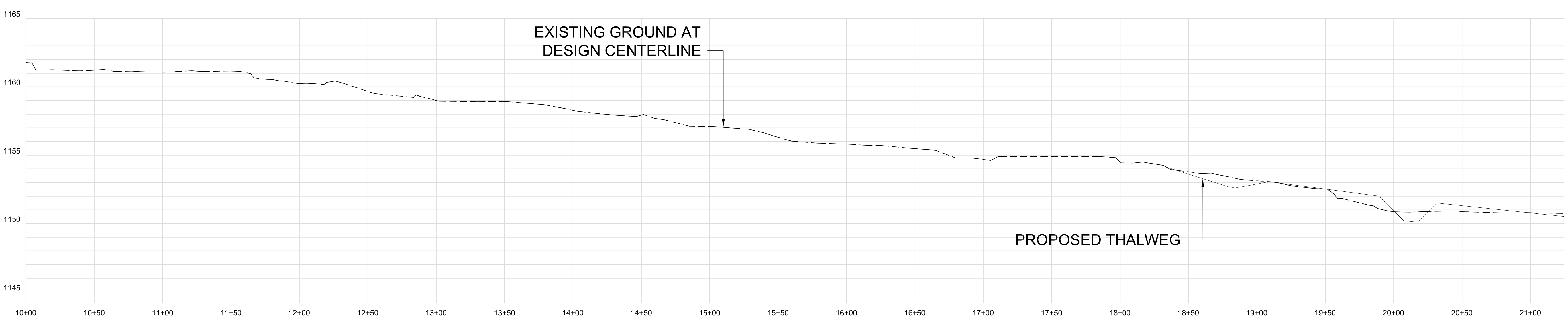
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

DATE: NOV. 2012
SCALE: 1" = 500'

SHEET INDEX

SHEET T3 OF 25





MOORES FORK PROFILE 1:80

	DESCRIPTION	DATE	APP.
A	R1/R2 BREAK	0712	AB
B			
C			

REVISIONS

NORTH CAROLINA PROFESSIONAL SEAL ENGINEER ANDREW DAVID

PRELIMINARY PLANS

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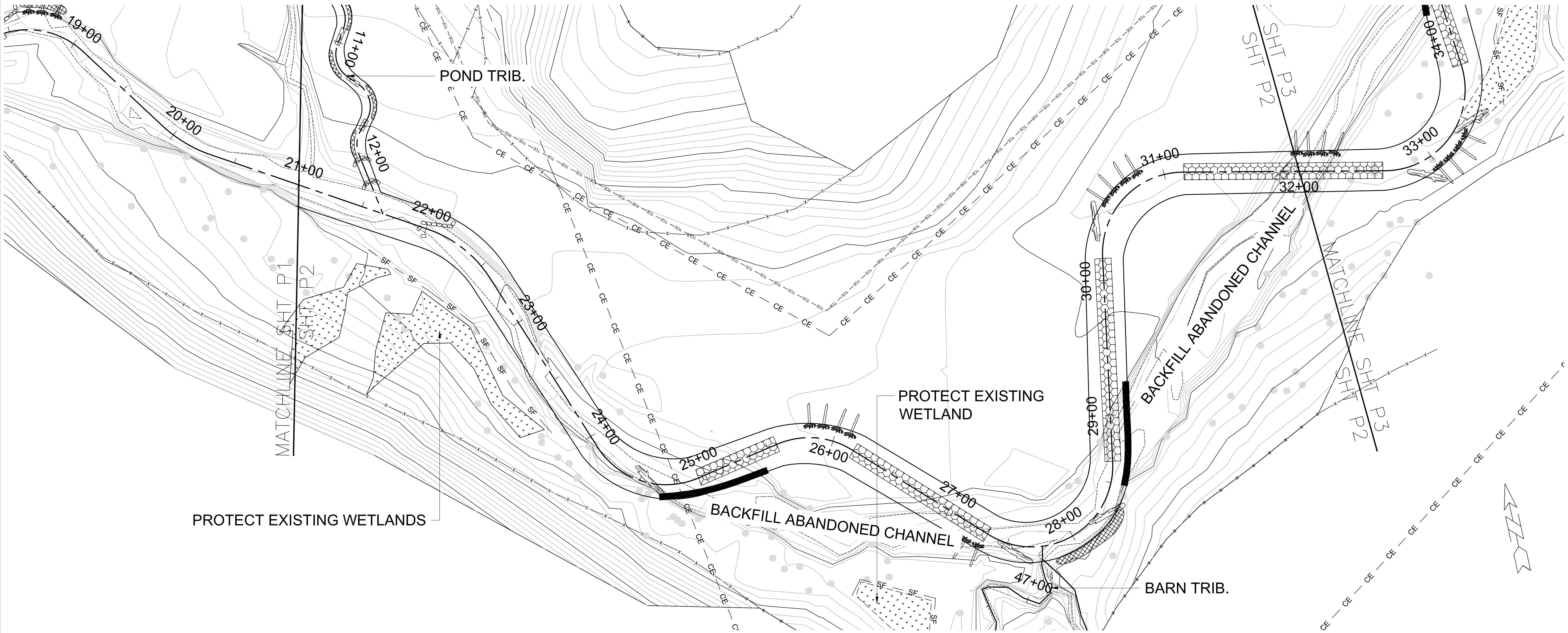
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

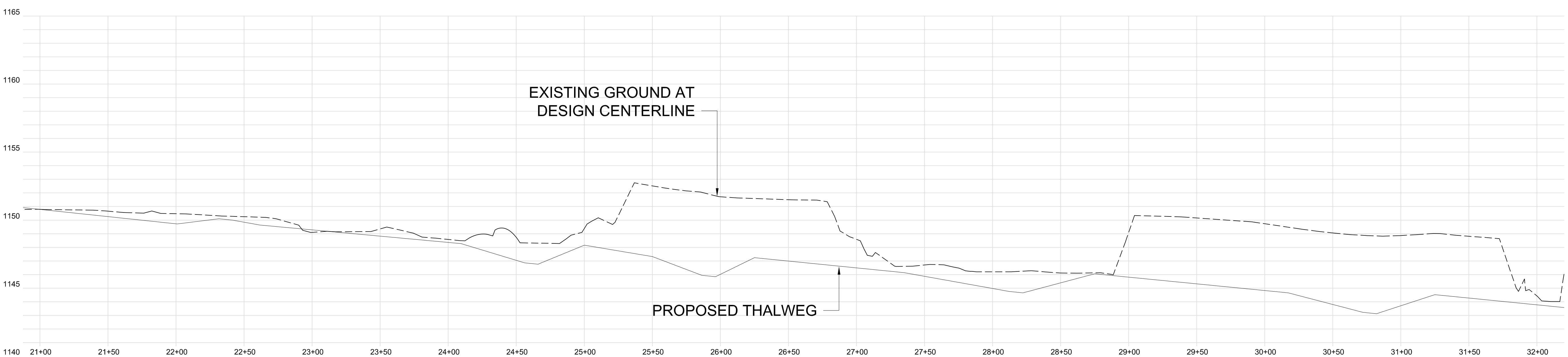
STA. 9+89 TO 21+00

DATE: NOV. 2012

SCALE: 1" = 80'

MOORES FORK
PLAN & PROFILE





MOORES FORK PROFILE 1:80

A	B	C		
			DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22208 ANDREW DAVID

PRELIMINARY PLANS

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confluence-eng.com

MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

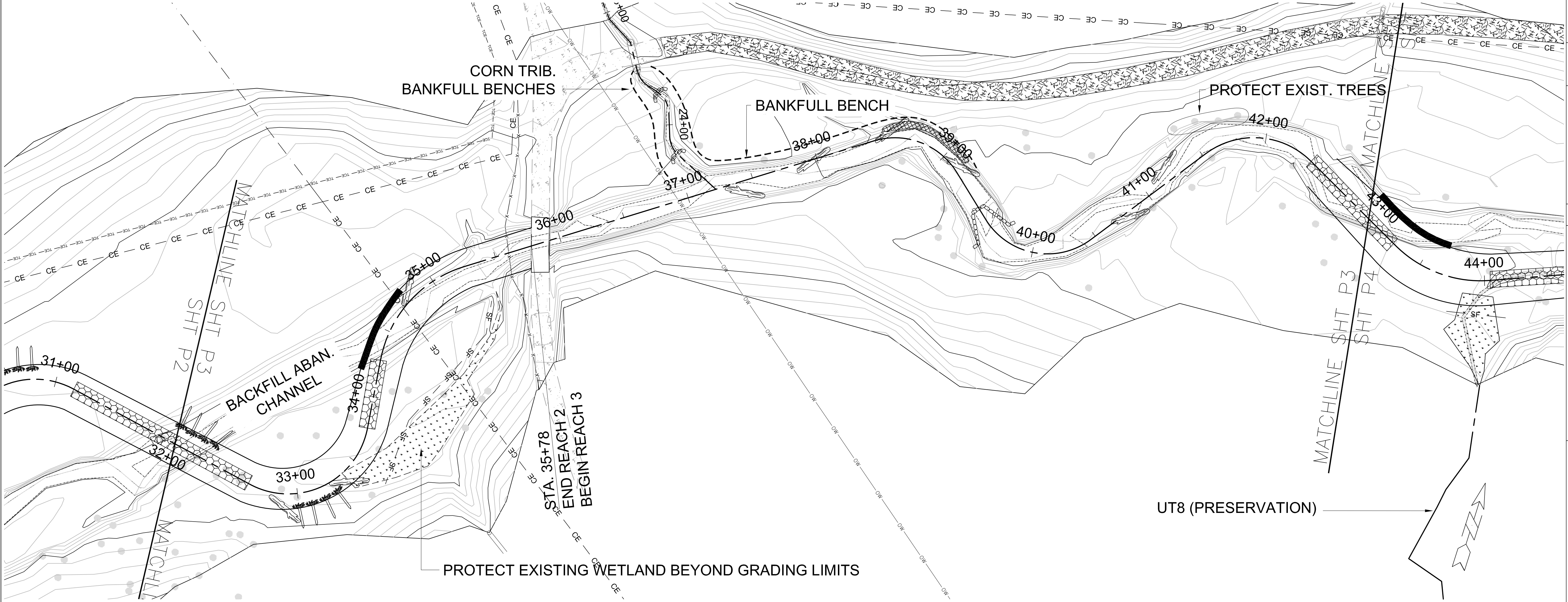
STA. 21+00 TO 32+00

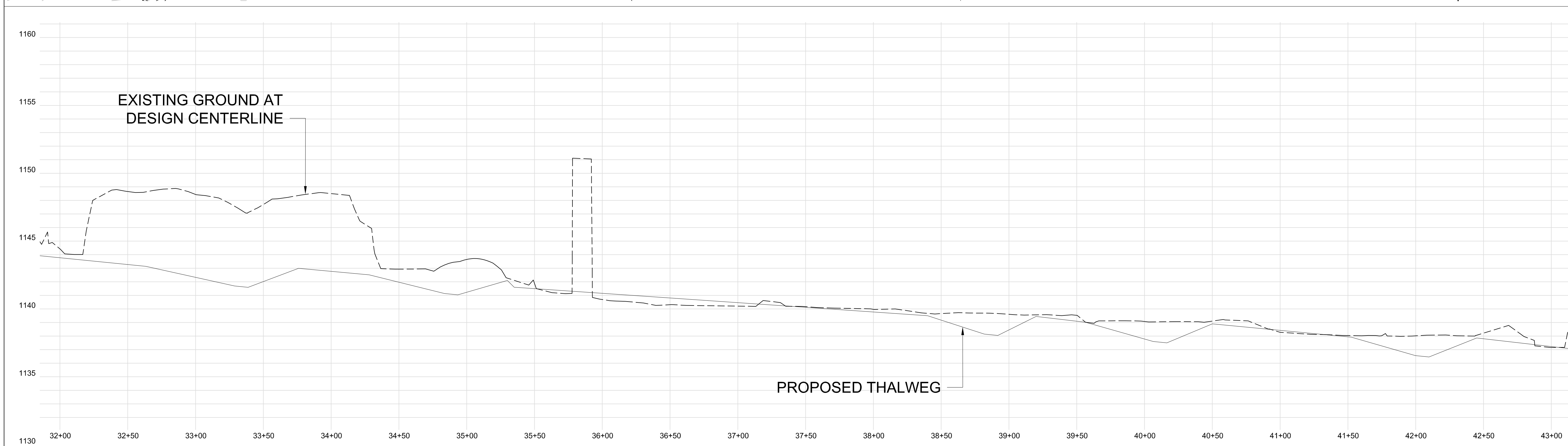
DATE: NOV. 2012

SCALE: 1" = 80'

MOORES FORK
PLAN & PROFILE

SHEET P2 OF 25





MOORES FORK PROFILE 1:80

A			
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C			
	DESCRIPTION	DATE	APP.

REVISIONS

PRELIMINARY PLANS

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MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

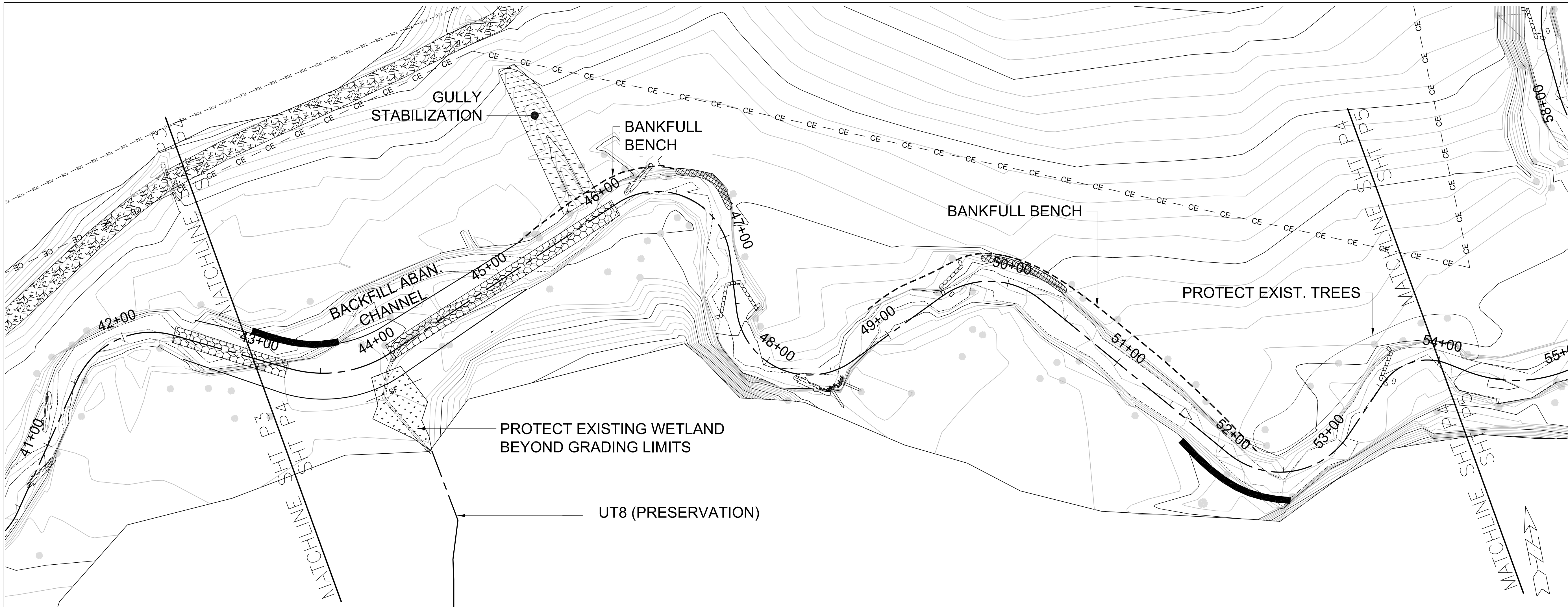
STA. 32+00 TO 43+00

DATE: NOV. 2012

SCALE: 1" = 80'

MOORES FORK
PLAN & PROFILE

SHEET P3 OF 25



MOORES FORK PROFILE 1:80

A			
B			
C			
	DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22209 ANDREW DAVID

PRELIMINARY PLANS

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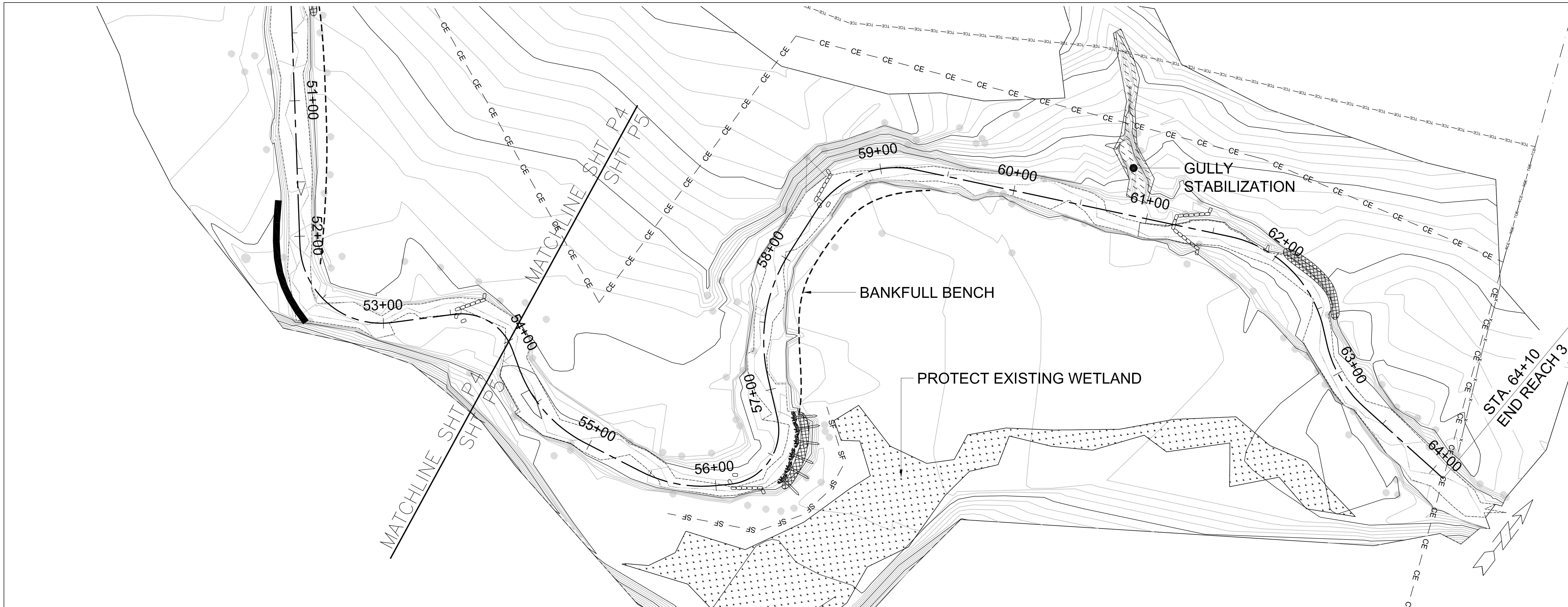
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

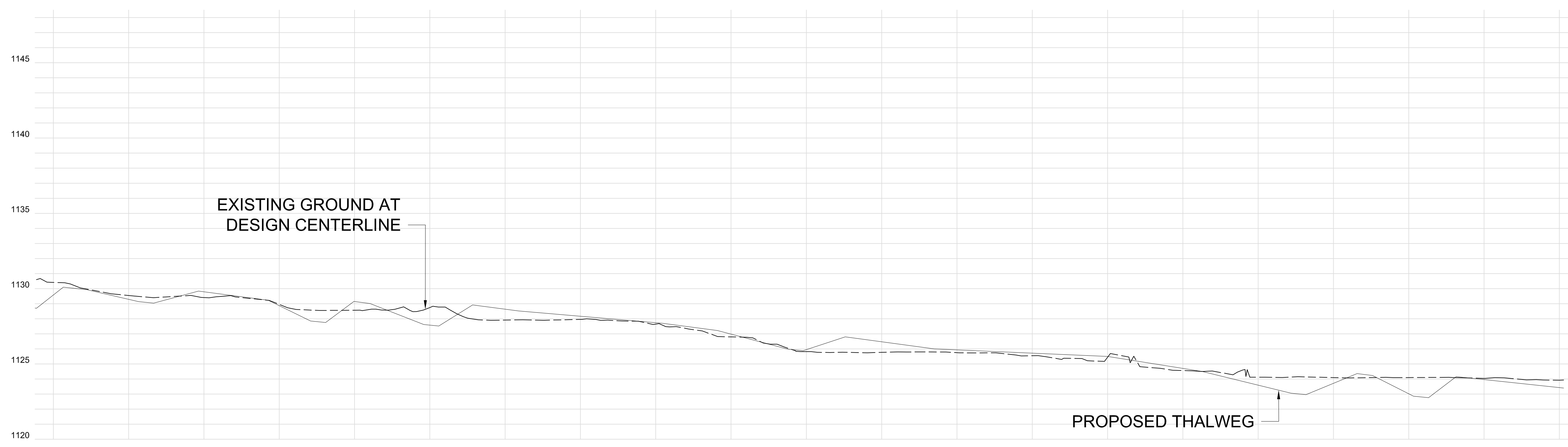
STA. 43+00 TO 54+00

DATE: NOV. 2012
SCALE: 1" = 80'

MOORES FORK
PLAN & PROFILE

SHEET P4 OF 25





MOORES FORK PROFILE 1:80

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS

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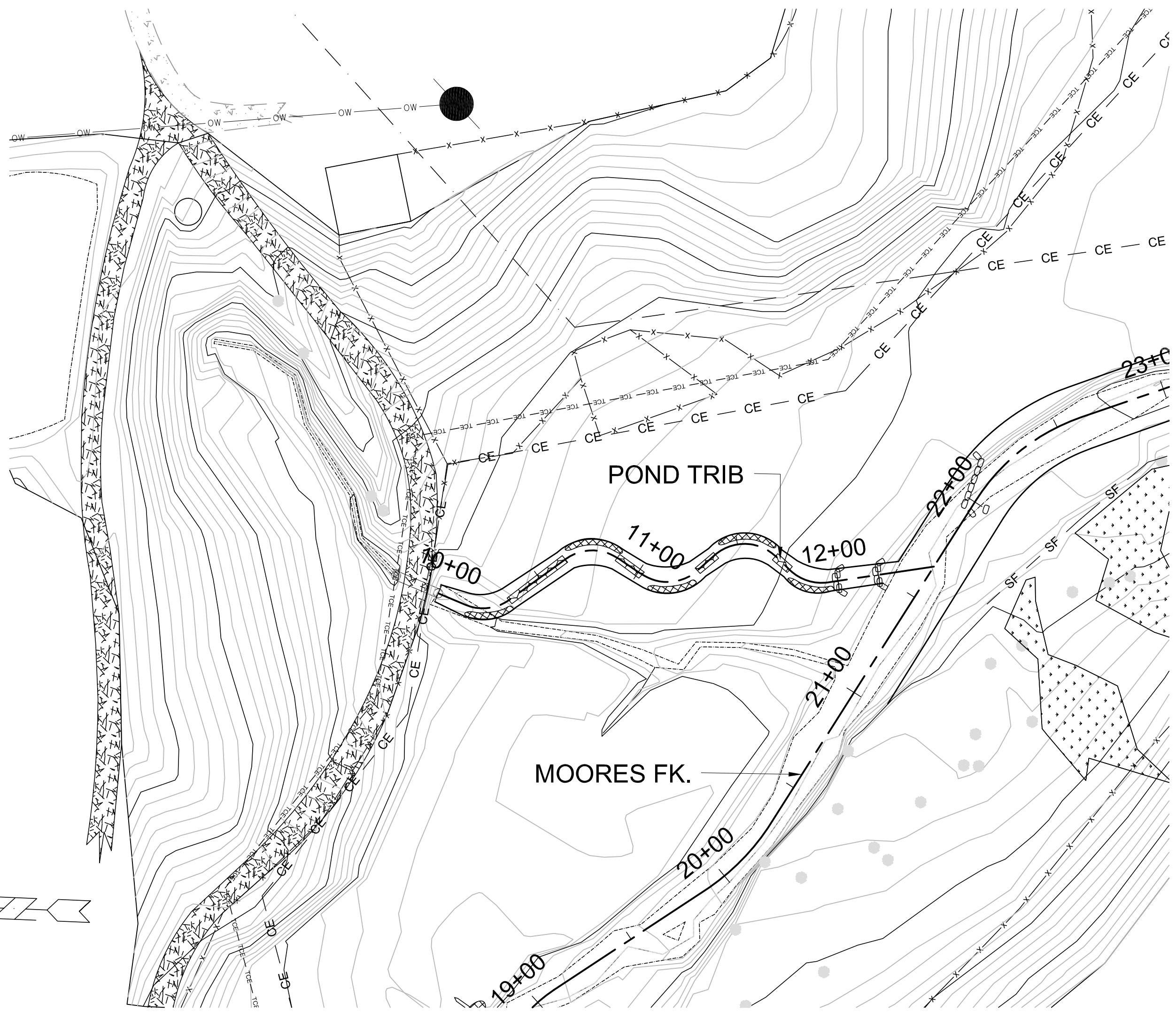
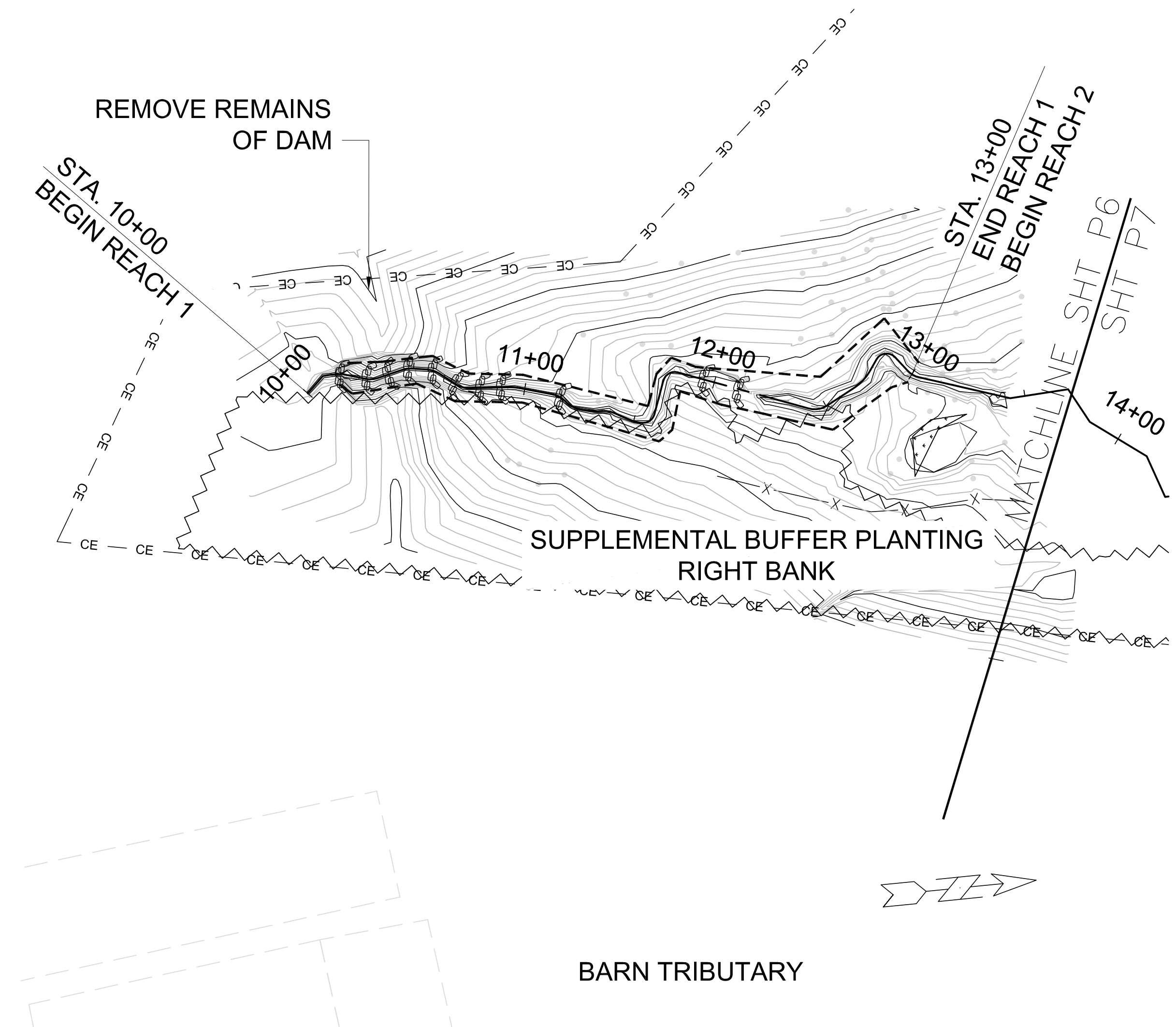
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

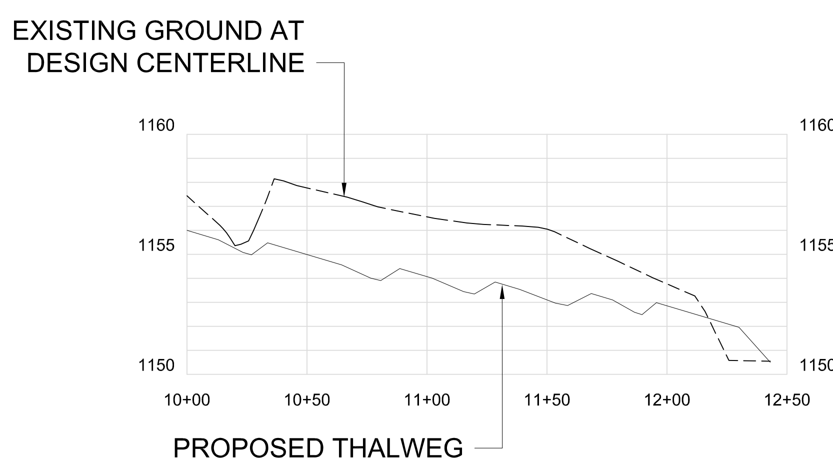
STA. 54+00 TO 64+10

DATE: NOV. 2012
SCALE: 1" = 80'

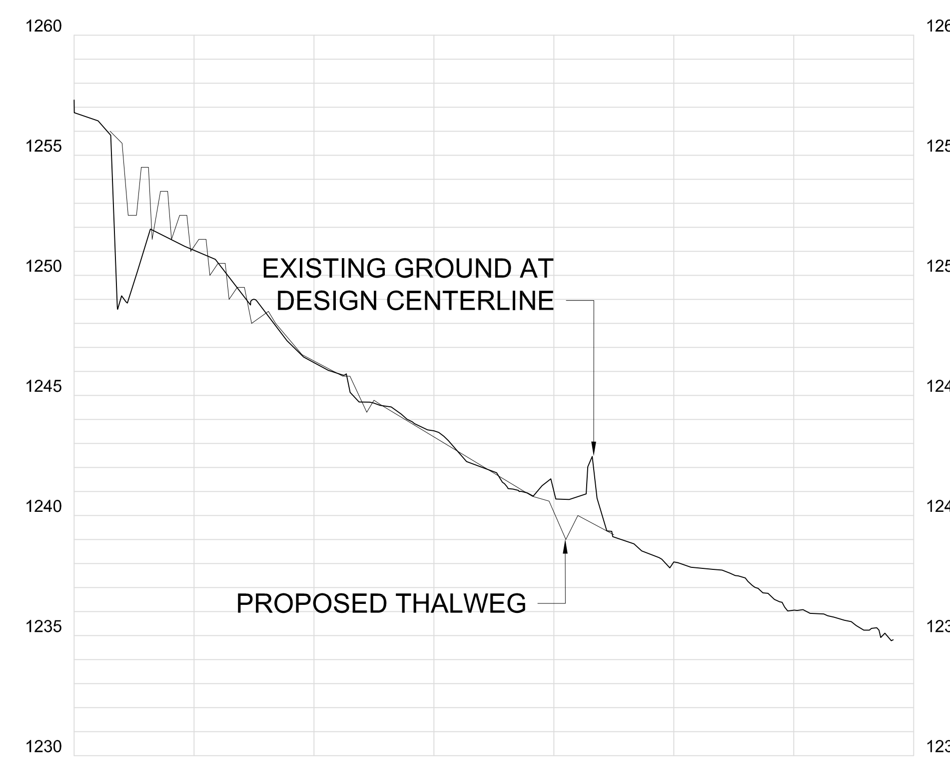
MOORES FORK
PLAN & PROFILE







POND TRIB PROFILE 1:80



BARN TRIB PROFILE 1:80

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22209 ANDREW DAVID KIRBY

PRELIMINARY PLANS

CONFLUENCE
ENGINEERING, PC
16 Broad Street
Asheville, North Carolina 28801
Phone: 828.255.5530
confluence-eng.com

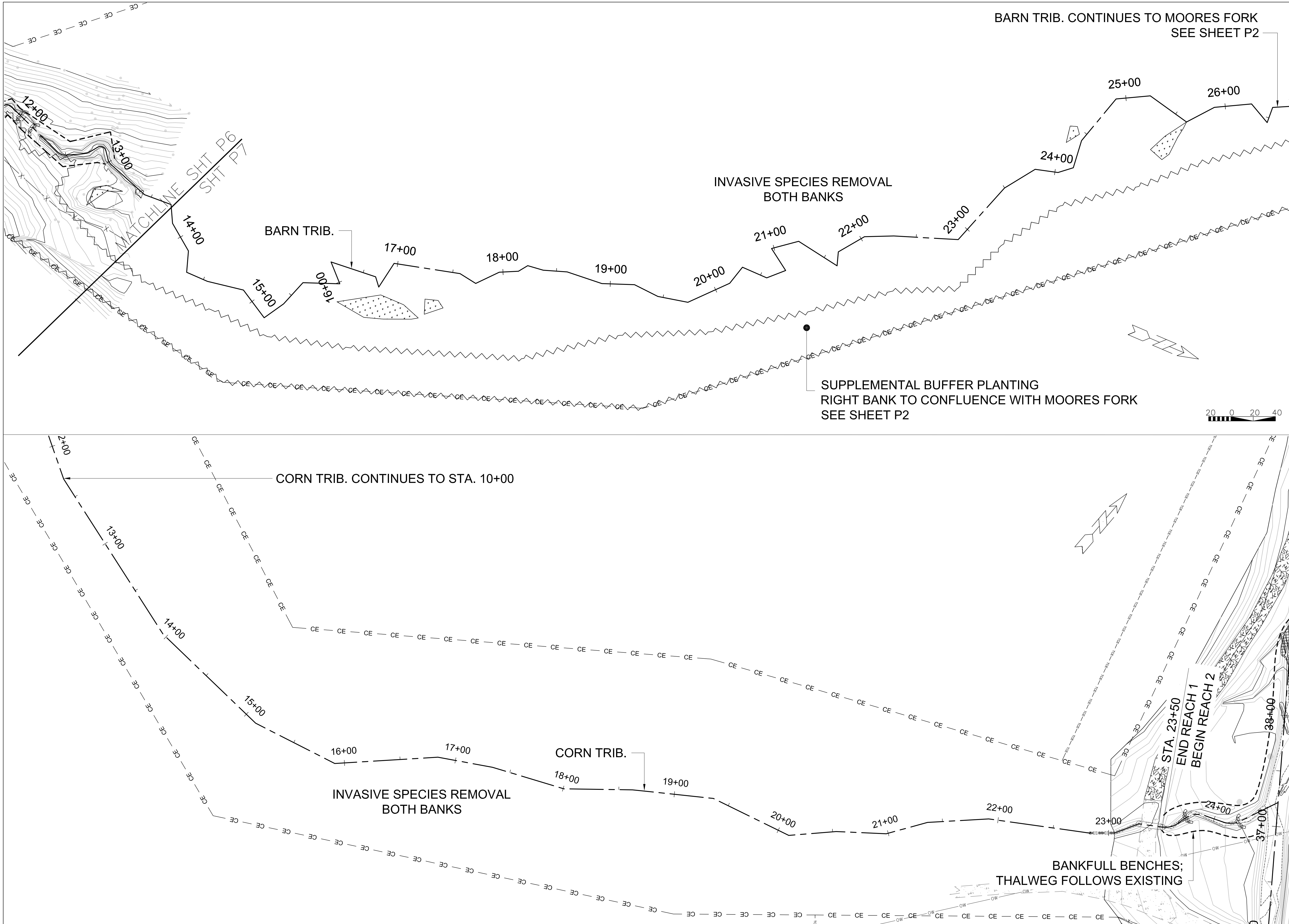
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

DATE: NOV. 2012

SCALE: 1" = 80'

POND AND BARN TRIBS PLAN & PROFILE

SHEET P6 OF 25



A			
B			
C			
	DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22209 ANDREW DAVID YOKLEY
PRELIMINARY PLANS

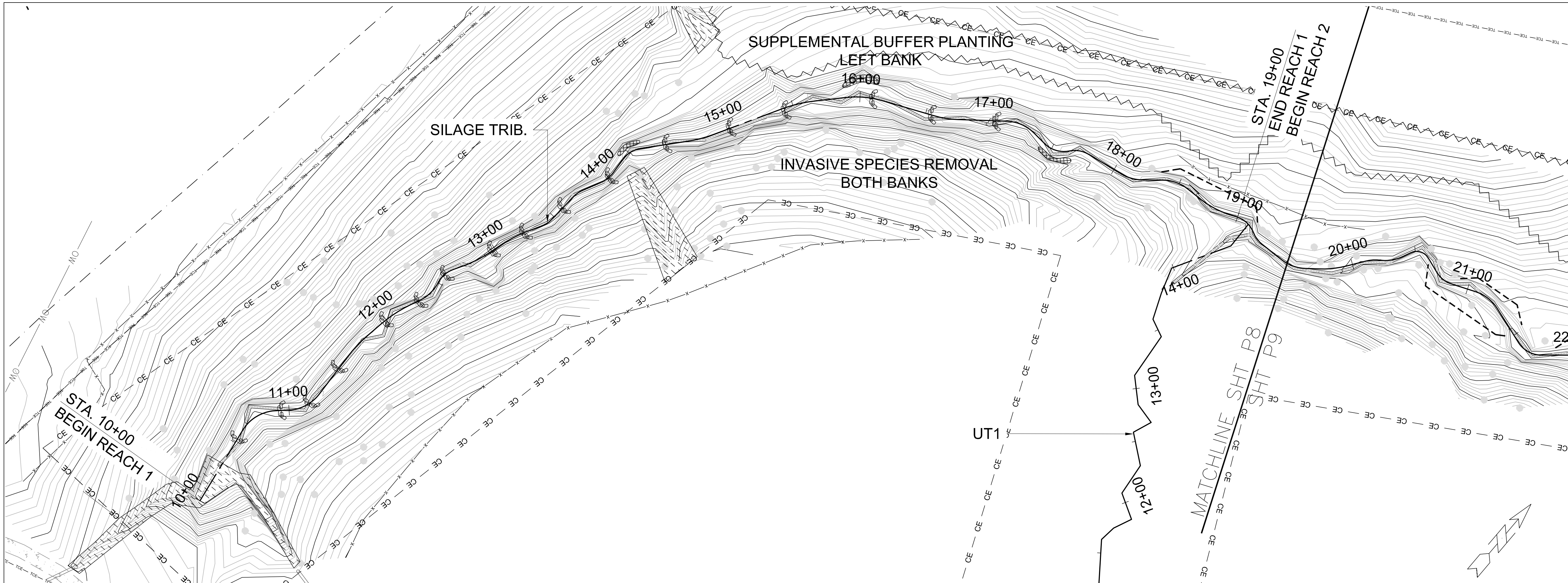
CONFLUENCE
ENGINEERING, PC
16 Broad Street
Asheville, North Carolina 28801
Phone: 828.255.5530
confluence-eng.com

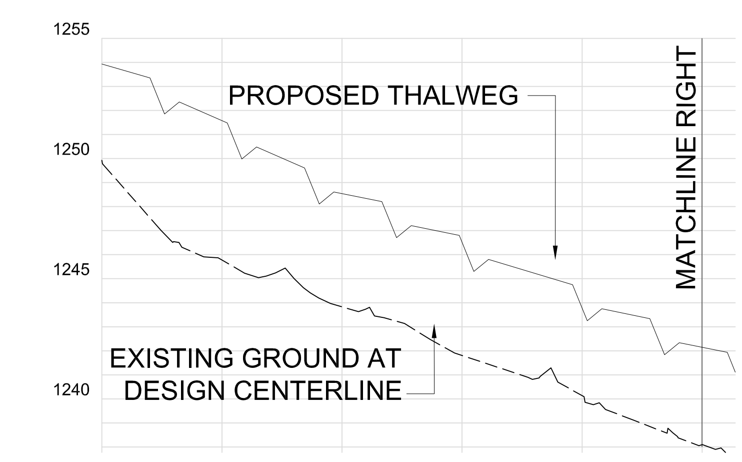
MOORES FORK RESTORATION PROJECT SURRY COUNTY, NC

DATE: NOV. 2012

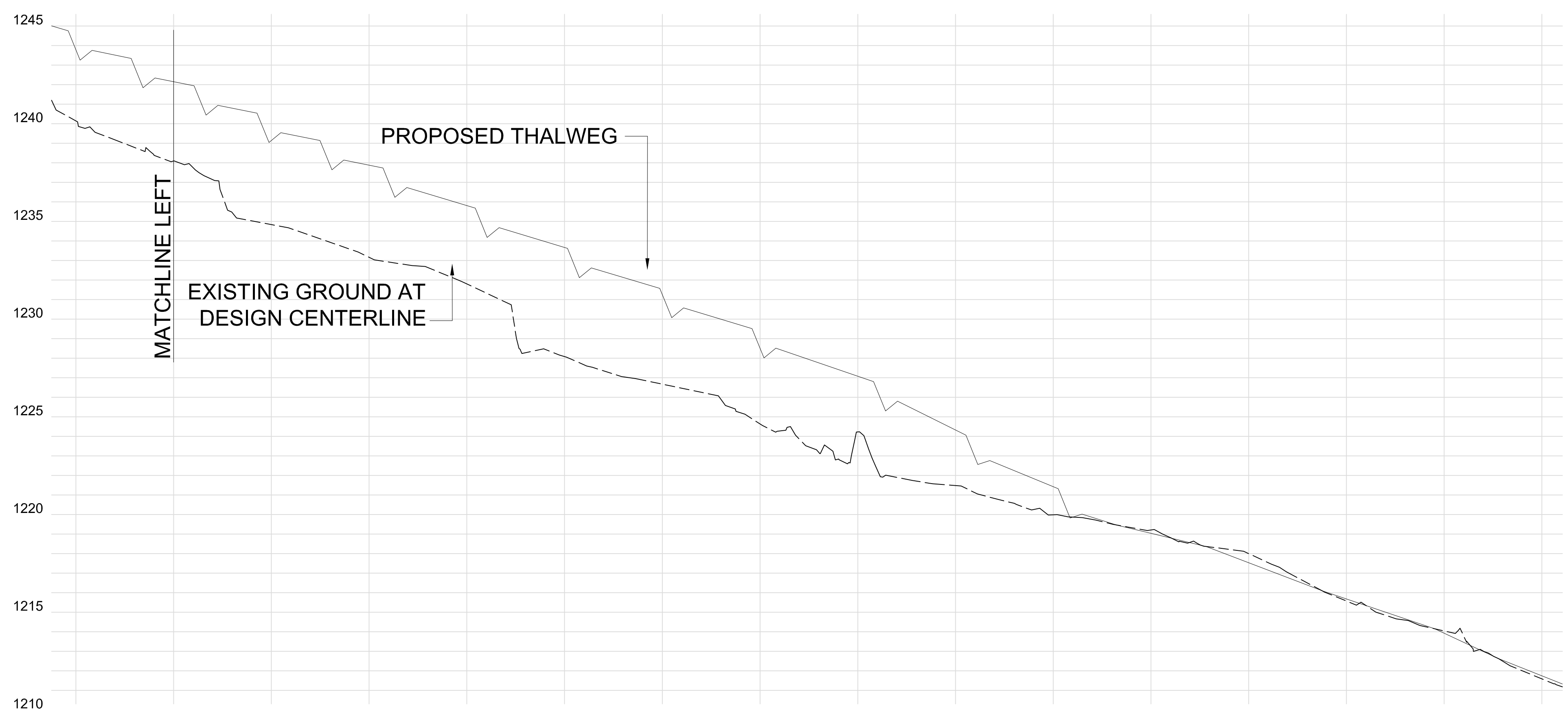
SCALE: 1" = 80'

BARN AND CORN TRIBS. PLAN





SILAGE TRIB PROFILE 1:80



	DESCRIPTION	DATE	APP.
A			
B			
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REVISIONS

PRELIMINARY PLANS

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16 Broad Street
Asheville, North Carolina 28801
Phone: 828.255.5530
confluence-eng.com

MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

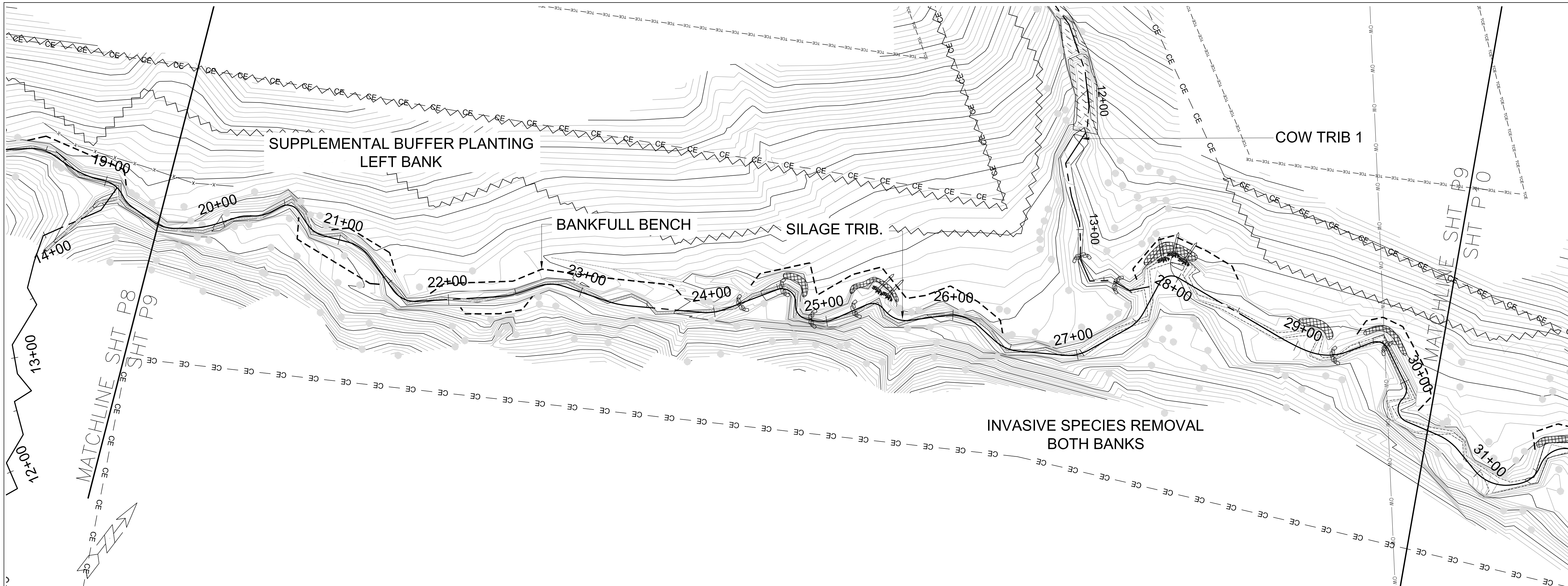
STA. 10+00 TO 19+50

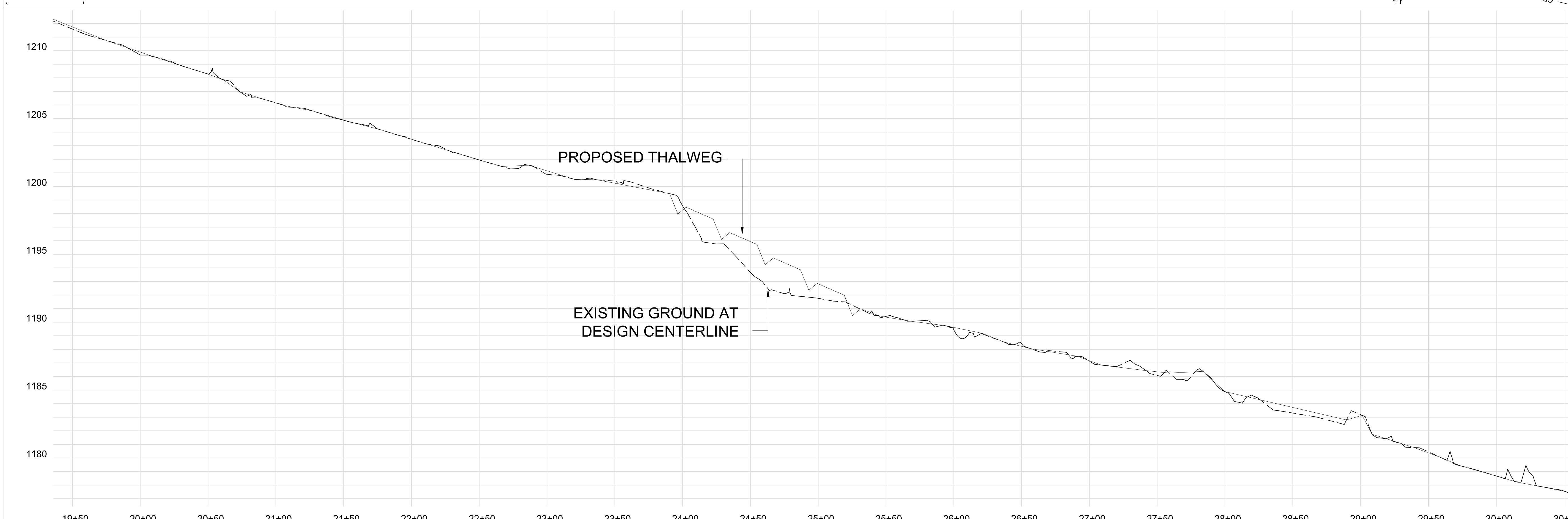
DATE: NOV. 2012

SCALE: 1" = 80'

SILAGE TRIB
PLAN & PROFILE

SHEET P8 OF 25





SILAGE TRIB PROFILE 1:80

A			
B			
C			
	DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL
ANDREW DAVID
PRELIMINARY PLANS

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Asheville, North Carolina 28801
Phone: 828.255.5530
confluence-eng.com

MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

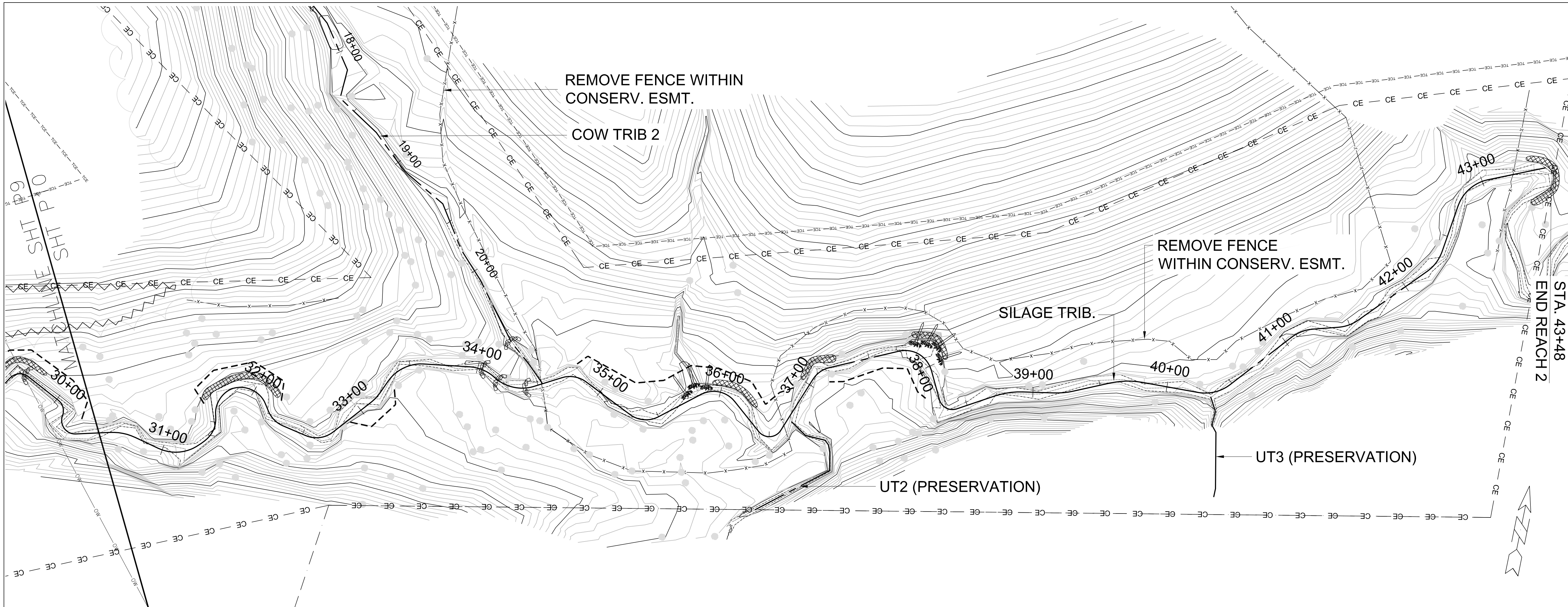
STA. 19+50 TO 30+50

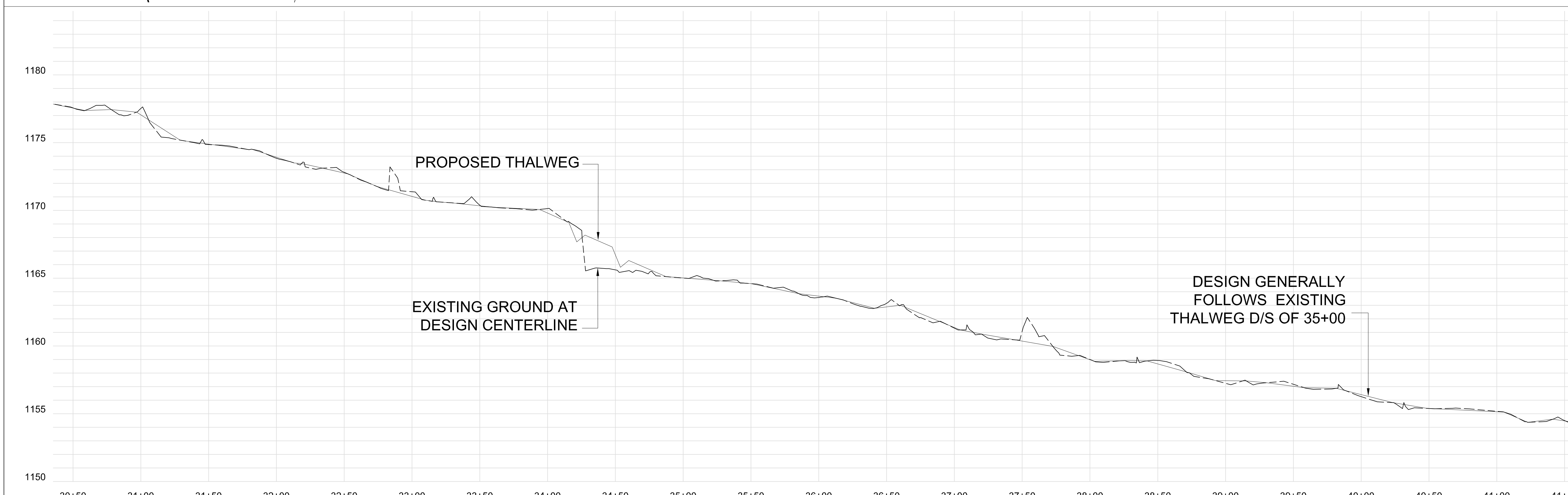
DATE: NOV. 2012

SCALE: 1" = 80'

SILAGE TRIB
PLAN & PROFILE

SHEET P9 OF 25





SILAGE TRIB PROFILE 1:80

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS

NORTH CAROLINA PROFESSIONAL SEAL 22200 ENGINEER ANDREW DAVID

PRELIMINARY PLANS

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MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

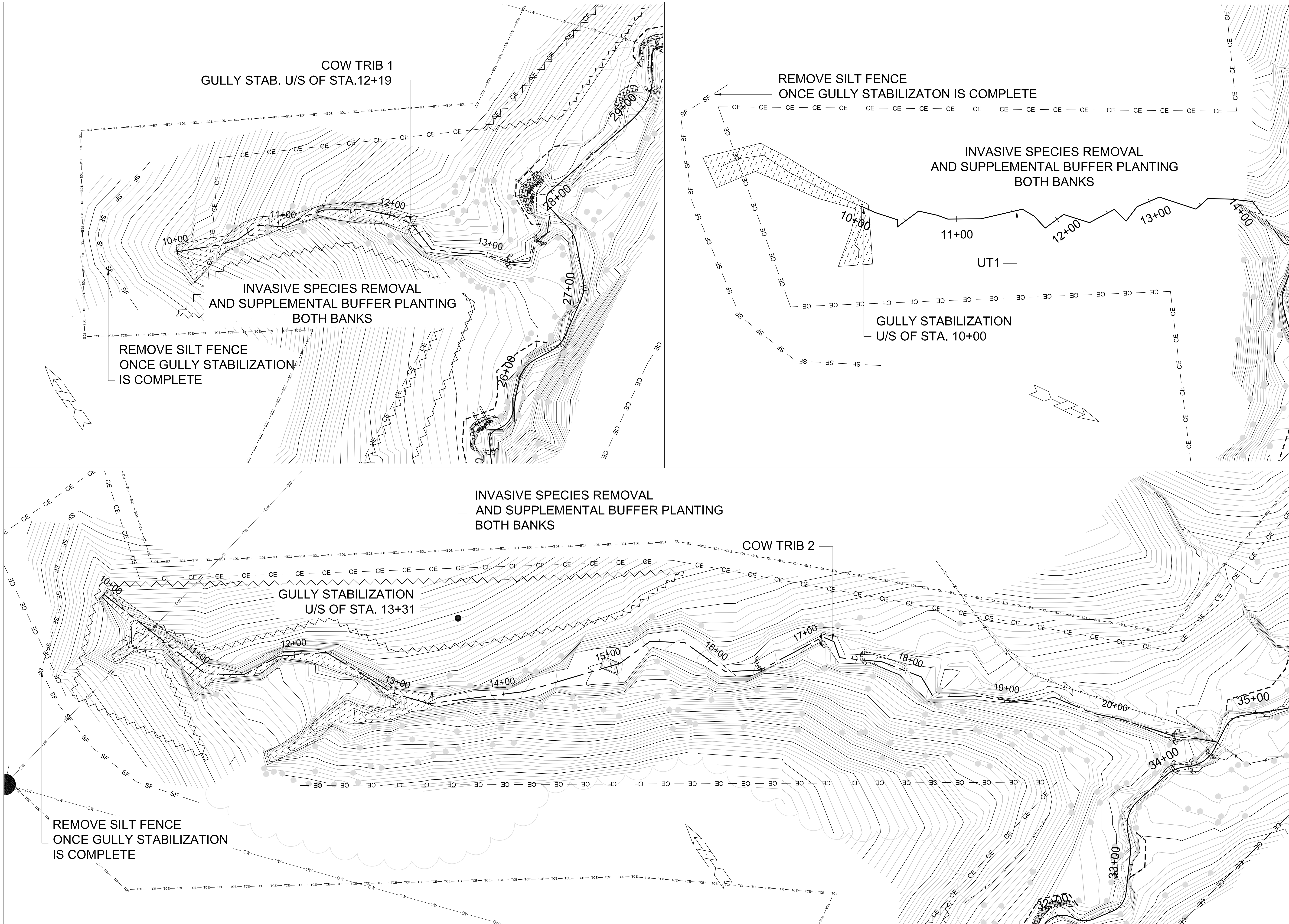
STA. 30+50 TO 43+48

DATE: NOV. 2012

SCALE: 1" = 80'

SILAGE TRIB
PLAN & PROFILE

SHEET P10 OF 25



A	DIVERSION	0712	AB
B			
C			
	DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22200 ANDREW DAVID ... PRELIMINARY PLANS

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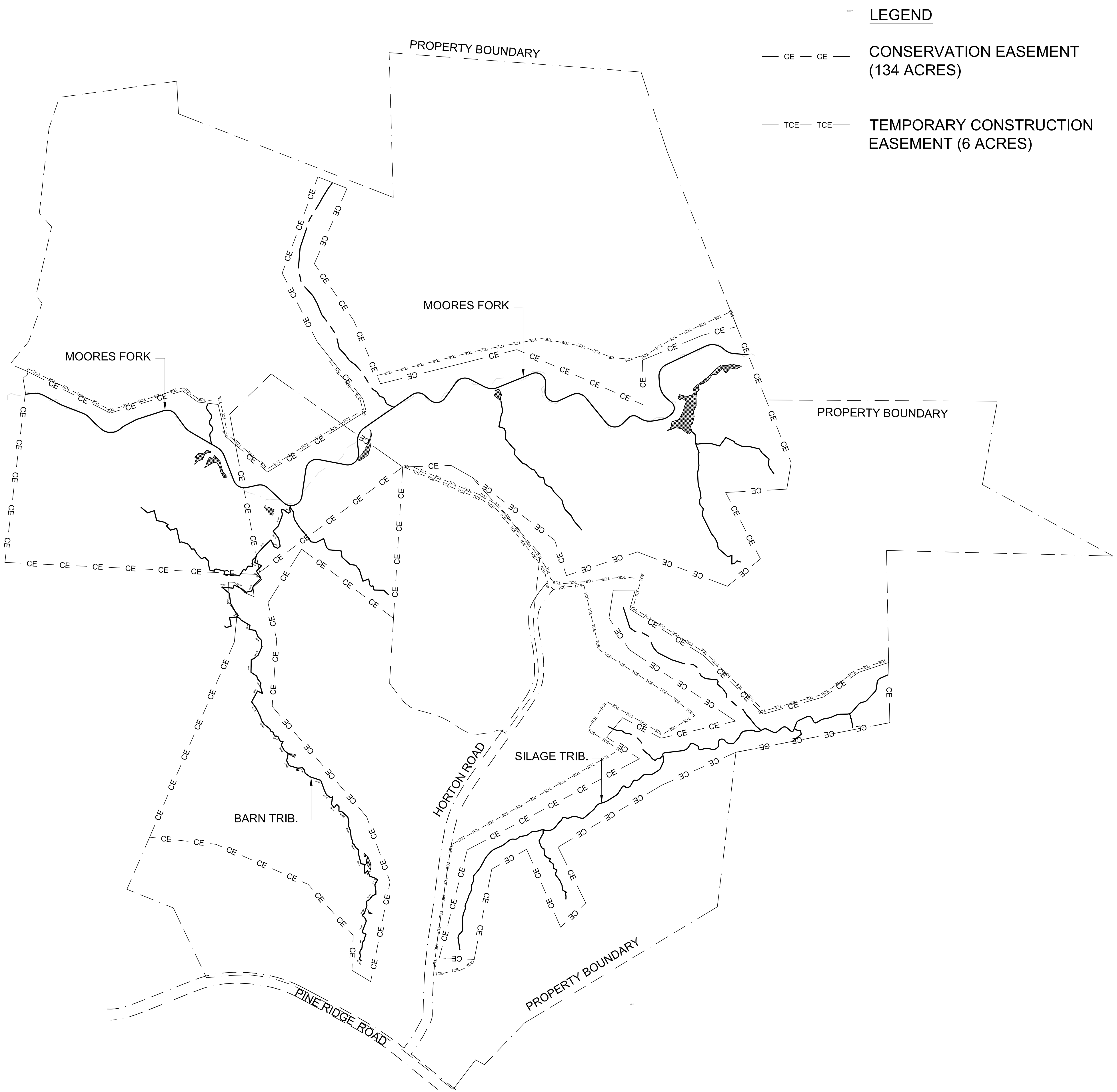
RESTORATION PROJECT
SURRY COUNTY, NC

DATE: NOV. 2012

SCALE: 1" = 80'

COW TRIBS 1& 2;
UT1
PLAN



	DESCRIPTION	DATE	APP.
A			
B			
C			

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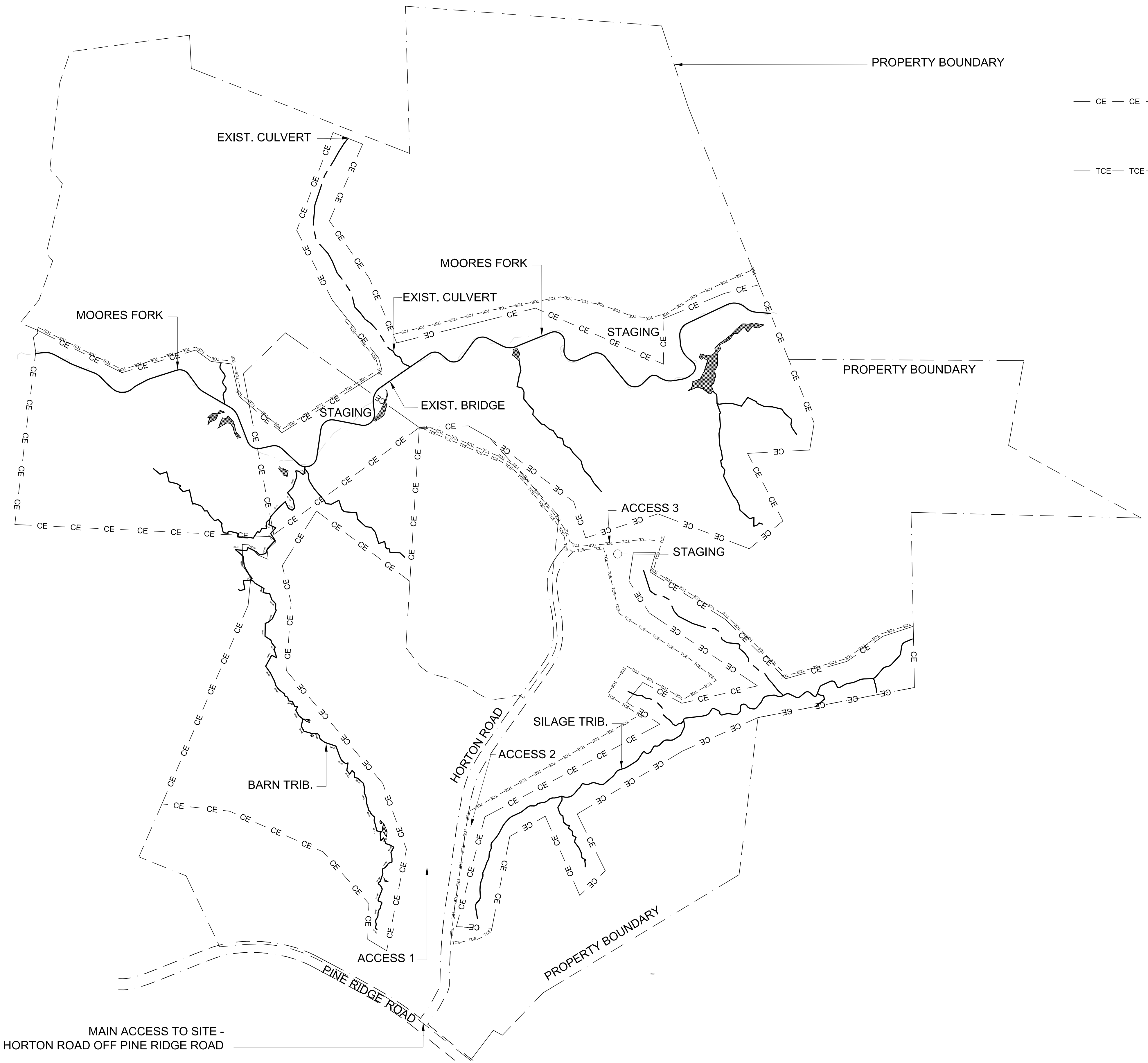
SURRY COUNTY, NC

DATE: NOV. 2012
SCALE: 1" = 600'

EASEMENT BOUNDARY MARKING PLAN

SHEET P12 OF 25



LEGEND

— CE — CE — CONSERVATION EASEMENT (134 ACRES)

— TCE — TCE — TEMPORARY CONSTRUCTION EASEMENT (6 ACRES)

	DESCRIPTION	DATE	APP.
A			
B			
C			

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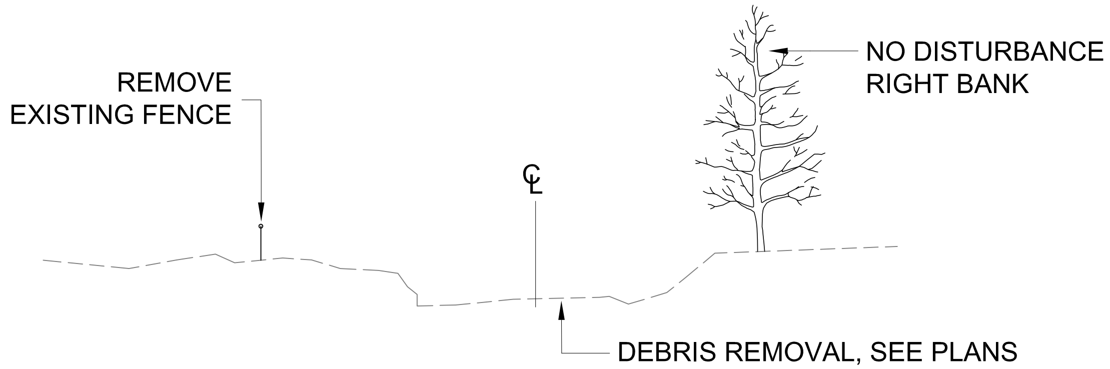
DATE: NOV. 2012
SCALE: 1" = 600'

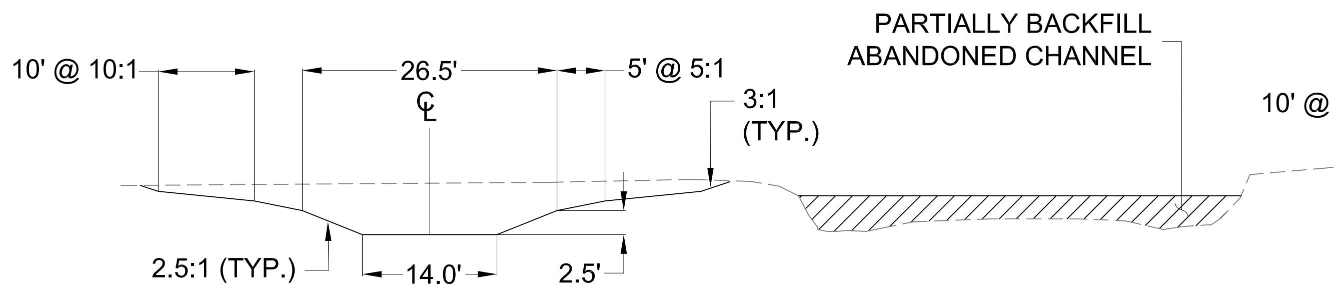
CONSTRUCTION
ACCESS PLAN

SHEET P13 OF 25

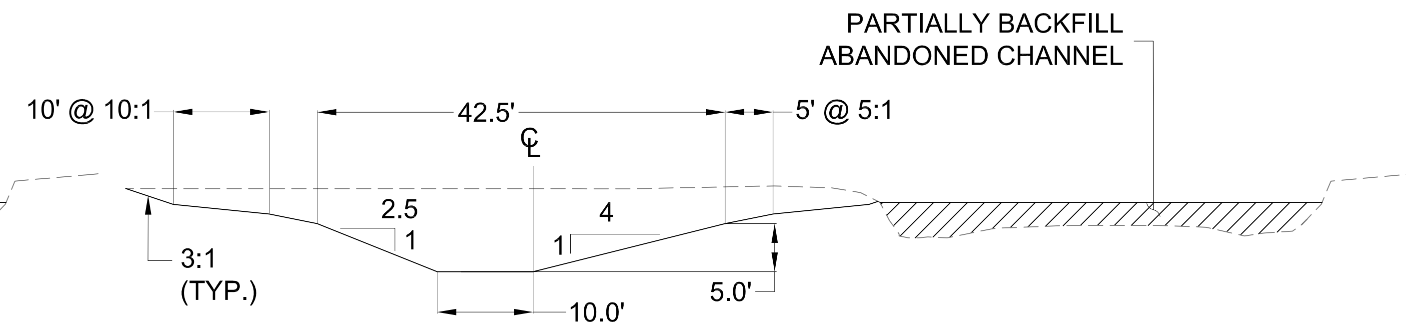


1 / TS1 TYPICAL SECTION
MOORES FORK REACH 1

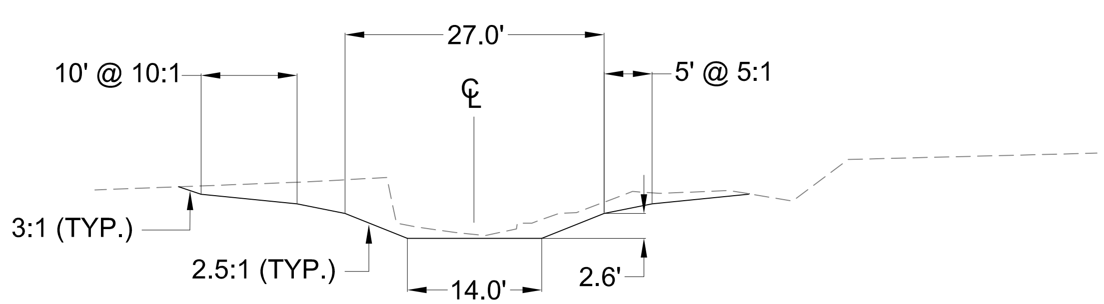
NOTES:
1. BANKS OF ON-LINE REACHES SHALL BE ROUGHENED PERPENDICULAR TO SLOPE, COVERED WITH 2" LAYER OF TOPSOIL, SEEDED, MULCHED AND MATTED WITH 780 G/SM COIR FIBER MATTING.
2. BANKS OF OFF-LINE REACHES SHALL BE ROUGHENED PERPENDICULAR TO SLOPE AND COVERED WITH SOD MATS.
3. TERRACE SLOPES TO BE ROUGHENED PERPENDICULAR TO SLOPE, SEEDED AND MULCHED.



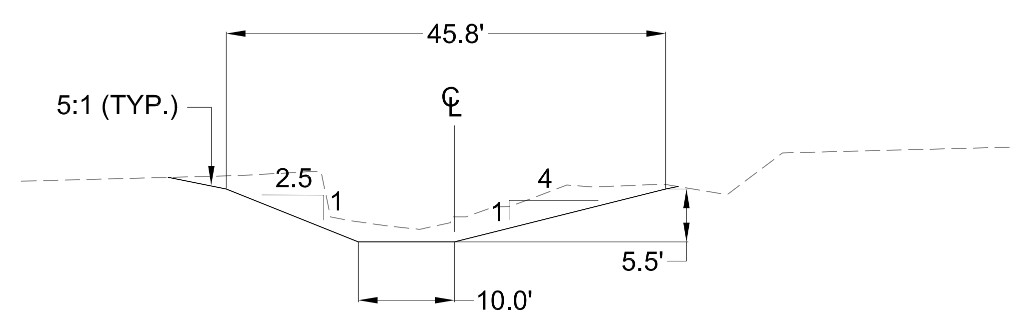
2 / TS1 TYPICAL RIFFLE SECTION
MOORES FORK REACH 2



3 / TS1 TYPICAL POOL SECTION
MOORES FORK REACH 2



4 / TS1 TYPICAL RIFFLE SECTION
MOORES FORK REACH 3



5 / TS1 TYPICAL POOL SECTION
MOORES FORK REACH 3

LEGEND
EXISTING
PROPOSED

REV.	DIMS	DESCRIPTION	DATE	APP.
A	1012 AB			
B				
C				

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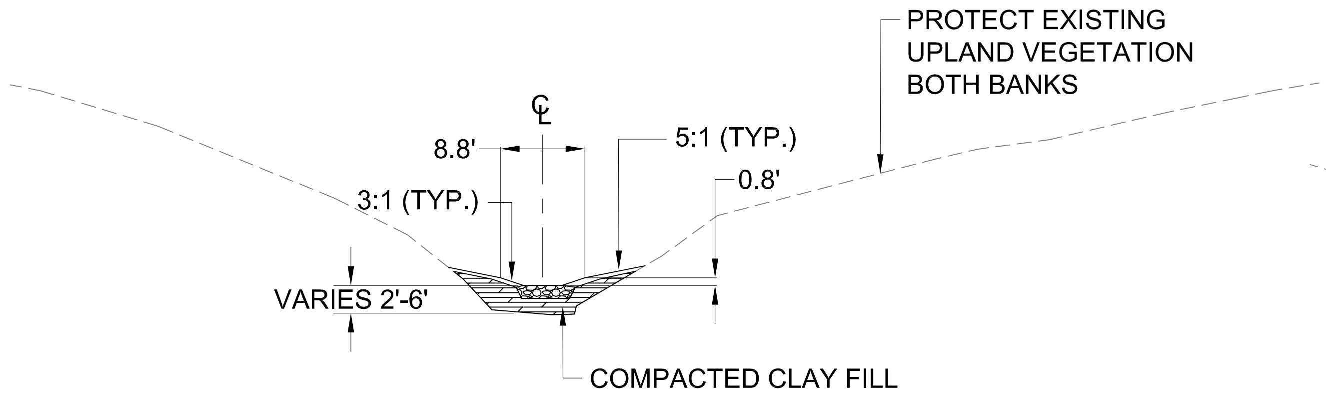
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

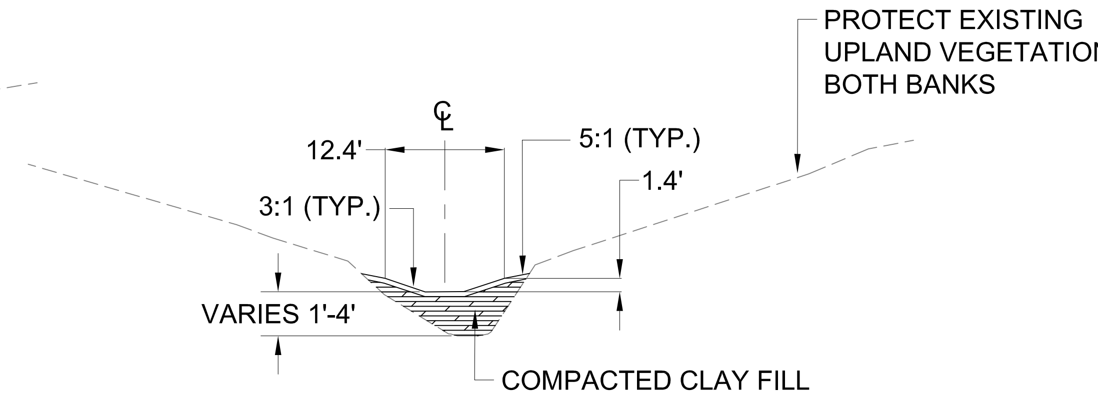
DATE: NOV. 2012
SCALE: 1" = 20'

TYPICAL
SECTIONS

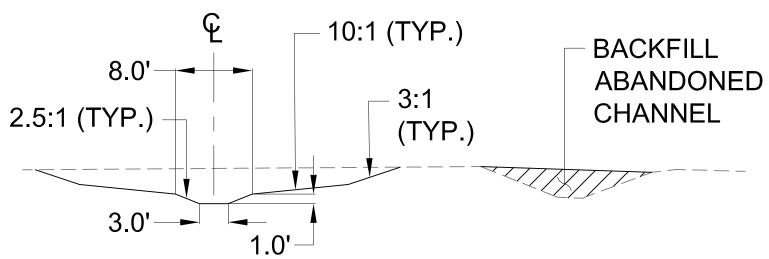
SHEET TS1 OF 25



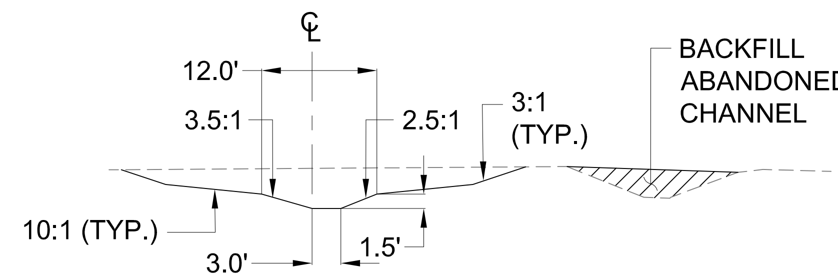
1 / TS2 TYPICAL RIFFLE SECTION
SILAGE TRIB REACH 1



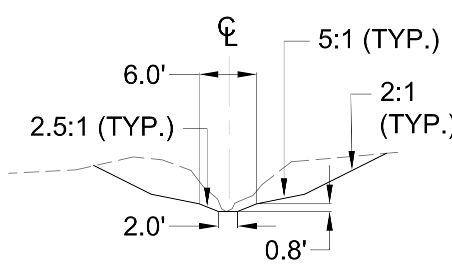
2 / TS2 TYPICAL POOL SECTION
SILAGE TRIB REACH 1



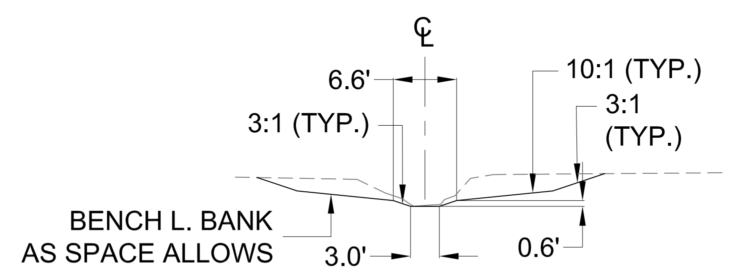
3 / TS2 TYPICAL RIFFLE SECTION
POND TRIB



4 / TS2 TYPICAL POOL SECTION
POND TRIB



5 / TS2 TYPICAL SECTION
BARN TRIB



6 / TS2 TYPICAL SECTION
CORN TRIB

LEGEND

EXISTING

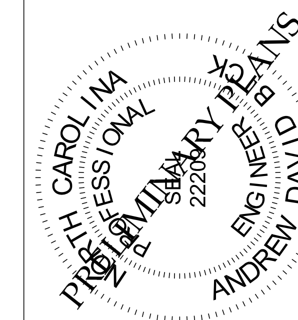
PROPOSED

NOTES:

1. BANKS OF ON-LINE REACHES SHALL BE ROUGHENED PERPENDICULAR TO SLOPE, COVERED WITH 2" LAYER OF TOPSOIL, SEEDED, MULCHED AND MATTED WITH 780 G/SM COIR FIBER MATTING.
2. BANKS OF OFF-LINE REACHES SHALL BE ROUGHENED PERPENDICULAR TO SLOPE AND COVERED WITH SOD MATS.
3. TERRACE SLOPES TO BE ROUGHENED PERPENDICULAR TO SLOPE, SEEDED AND MULCHED.

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS



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MOORES FORK
RESTORATION PROJECT
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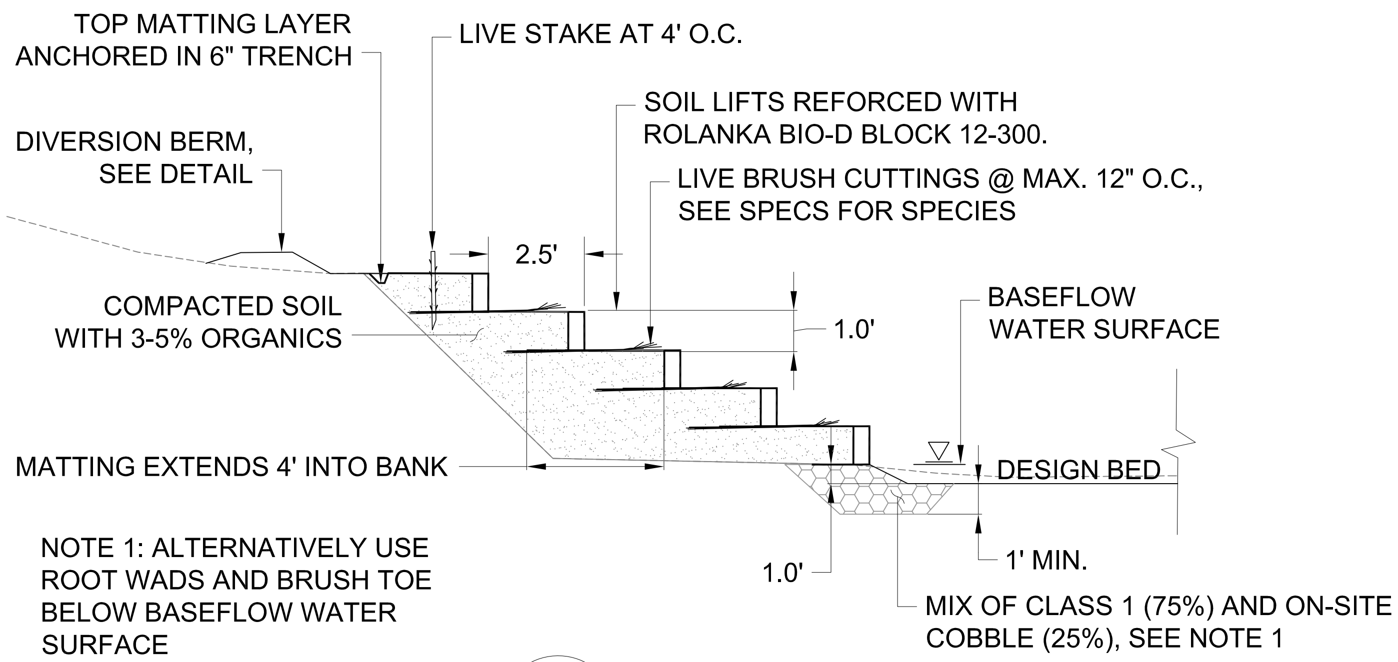
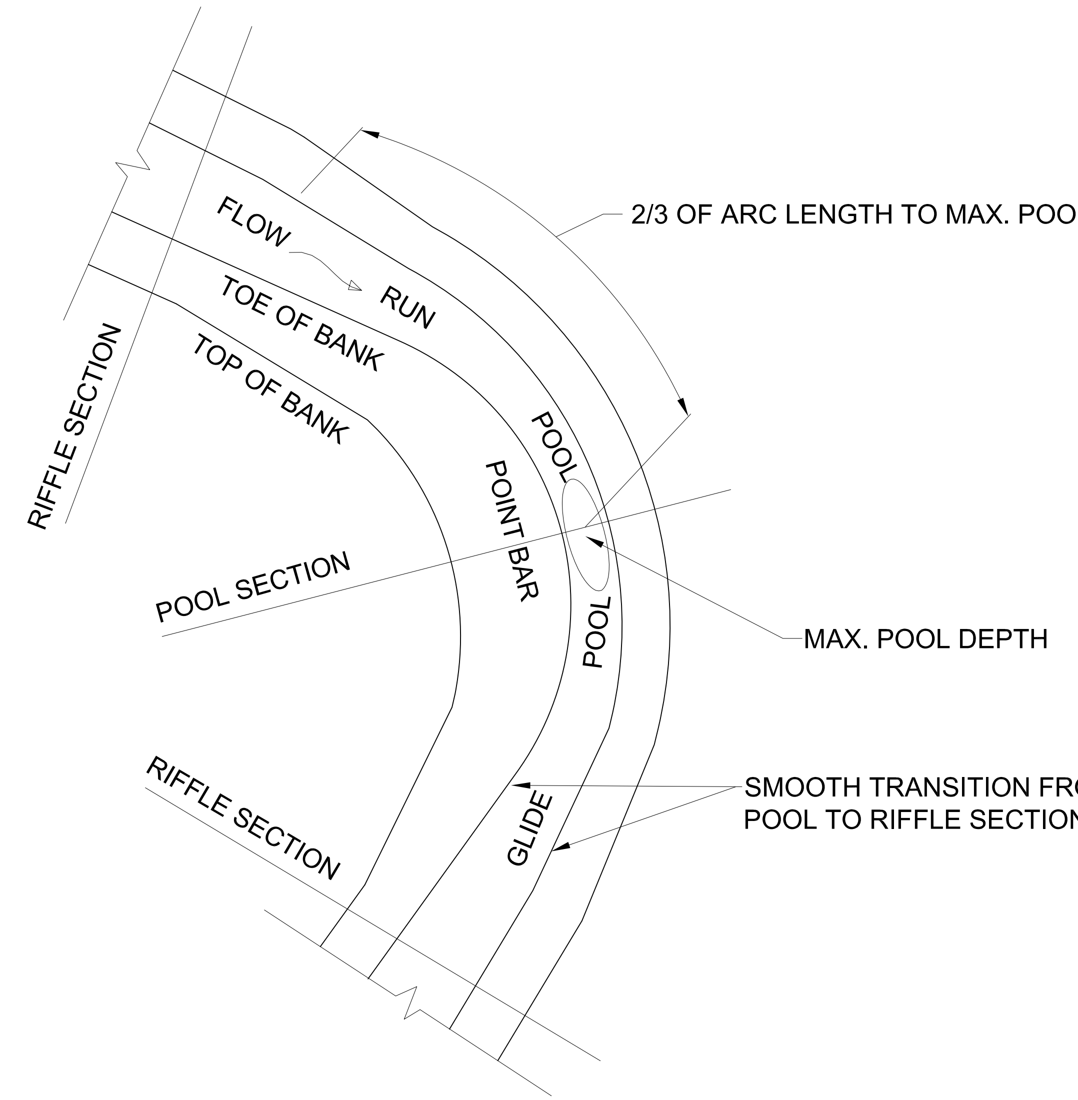
DATE: NOV. 2012
SCALE: 1" = 20'

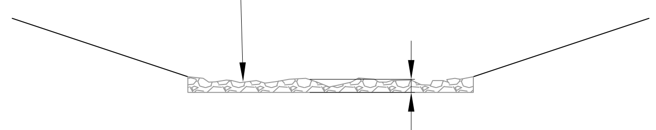
TYPICAL SECTIONS



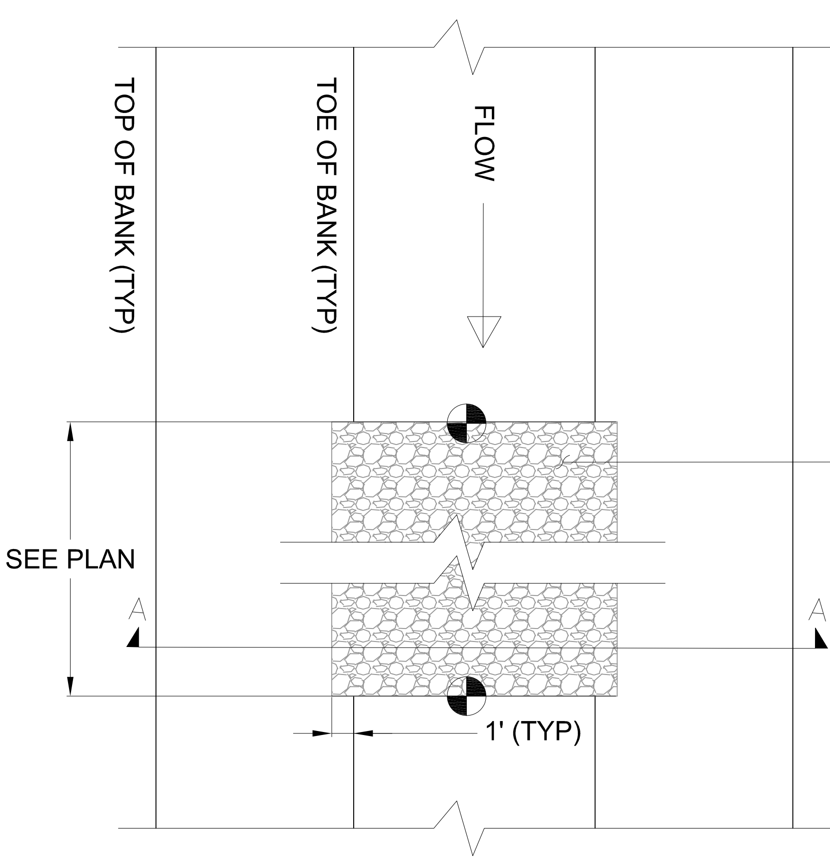
1
D1
GEOLIFTS
NTS



2
D1
RIFFLE-POOL TRANSITIONS
NTS



SECTION A-A'



PLAN

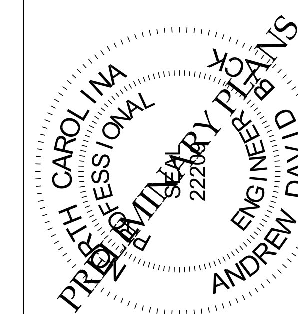
3
D1
CONSTRUCTED RIFFLE
NTS

MOORES FORK STRUCTURES		
STRUCTURE	STATION	ELEVATION
TBD	TBD	TBD

MOORES FORK STRUCTURES		
STRUCTURE	U/S STATION	ELEVATION
TBD	TBD	TBD
SILAGE TRIBUTARY STRUCTURES		
STEP	10+00 - 34+50	SEE PROFILE
POND TRIBUTARY STRUCTURES		
RIFFLES	10+30 - 11+70	SEE PROFILE
STEPS	12+00 - 12+30	SEE PROFILE
BARN AND COW TRIBUTARIES STRUCTURES		
STEPS		SEE PROFILES

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS



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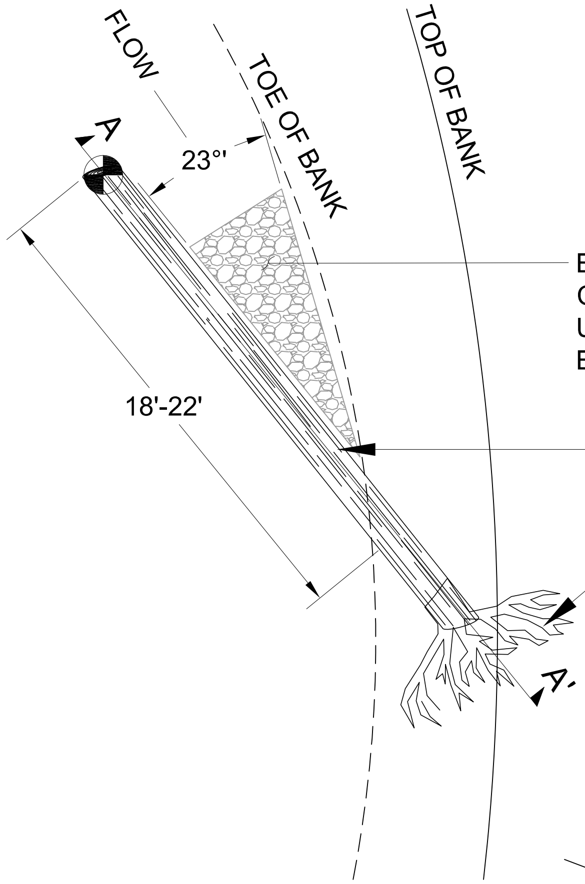
MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

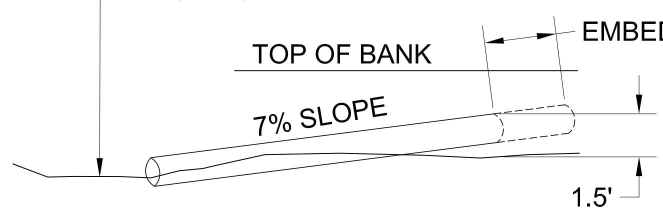
DATE: NOV. 2012
SCALE: NTS

STRUCTURE
DETAILS

SHEET D1 OF 25

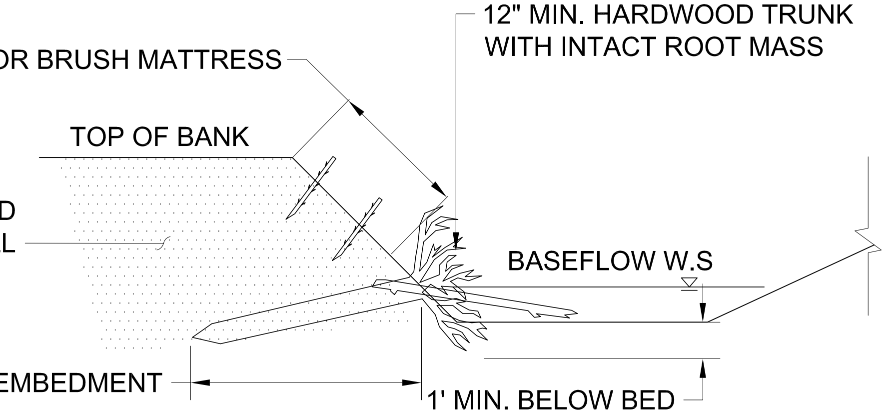


PLAN (AT HEAD OF POOL)

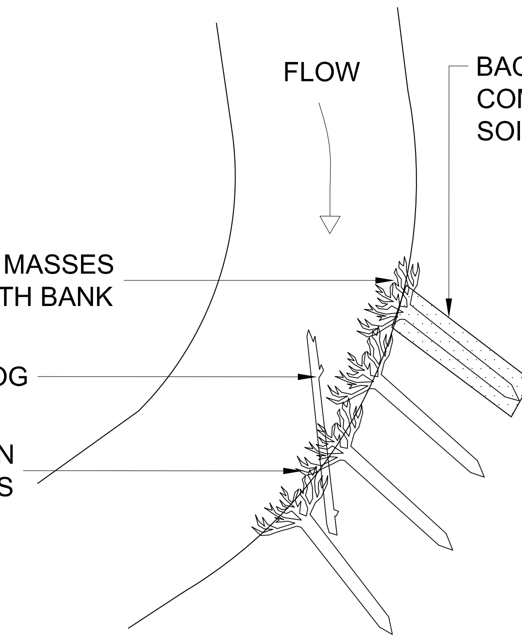


PROFILE A-A'

1 / D2 LOG VANE
NTS



SECTION

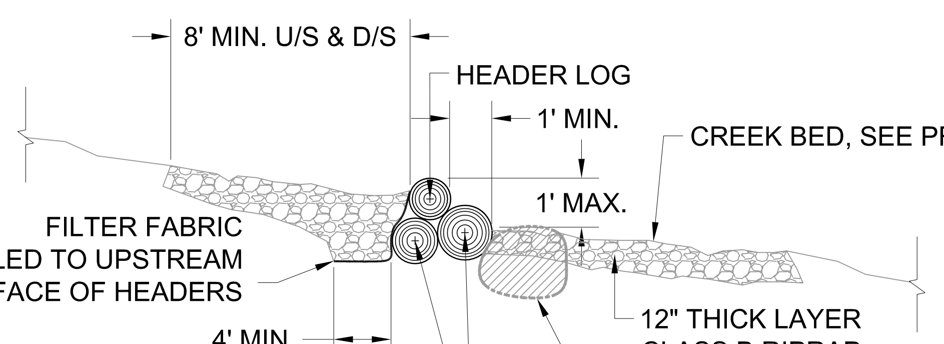


PLAN

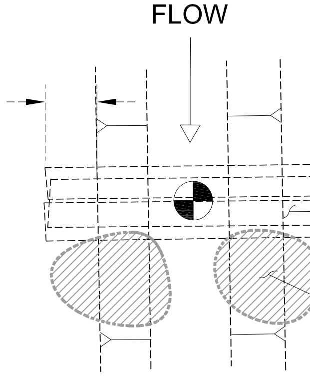
ROOT WAD INSTALLATION NOTES:

1. DRIVEN ROOT WADS
   ATTEMPT TO PUSH SHARPENED TRUNK INTO BANK WITHOUT DAMAGE TO ROOT MASS.
2. TRENCHED ROOT WADS
   IF THE ROOTWAD CANNOT BE DRIVEN INTO THE BANK, EXCAVATE NARROW TRENCH, PLACE ROOT WAD AND TRUNK, AND BACKFILL WITH COMPACTED ON-SITE SOIL.

2 / D2 ROOT WADS
NTS



SECTION



PLAN
(RIPRAP NOT SHOWN FOR CLARITY)

STEP STRUCTURE NOTES:

1. TRENCH LOGS MINIMUM 2' INTO BANK ON BOTH SIDES AND BACKFILL WITH COMPACTED ON-SITE SOIL. MINIMIZE DISTURBANCE TO BANKS BEYOND STRUCTURE LIMITS.
2. BOULDERS MUST HAVE MINIMUM DIMENSIONS OF 1.5'X2'X3'.

3 / D2 LOG STEP
NTS

ELEVATION POINT IN STRUCTURE TABLE

REV.	STEP HT.	1012	AB
A			
B			
C			

DESCRIPTION	DATE	APP.

REVISIONS

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22209 ANDREW DAVID ... PRELIMINARY PLANS

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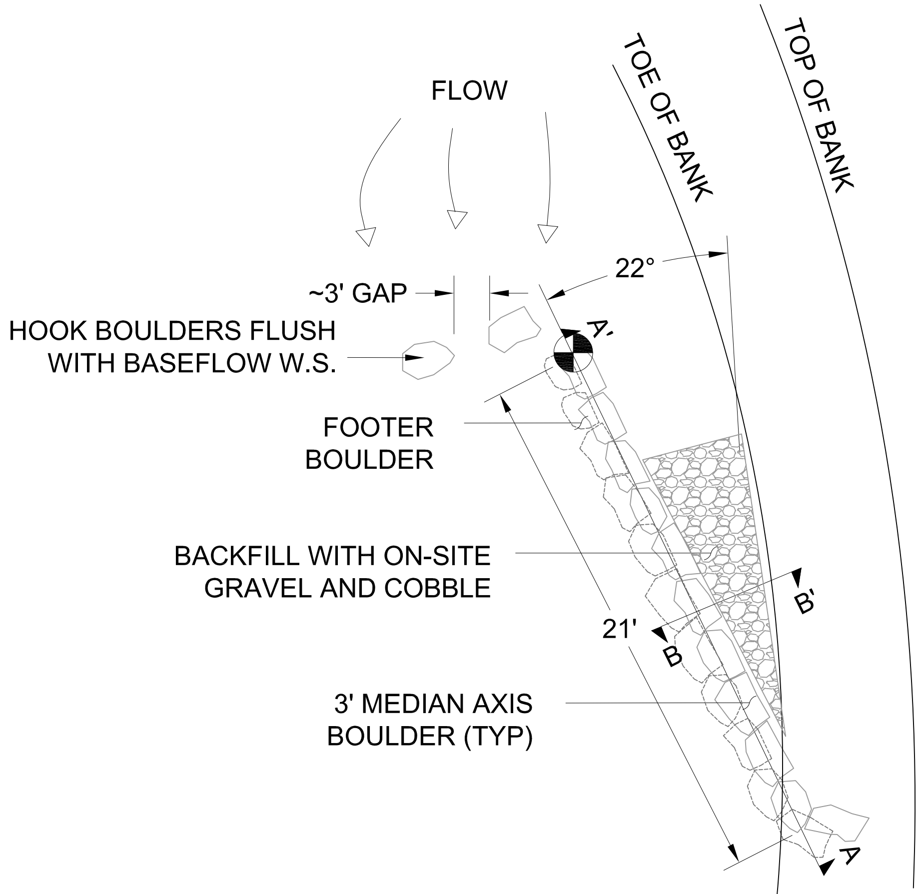
RESTORATION PROJECT
SURRY COUNTY, NC

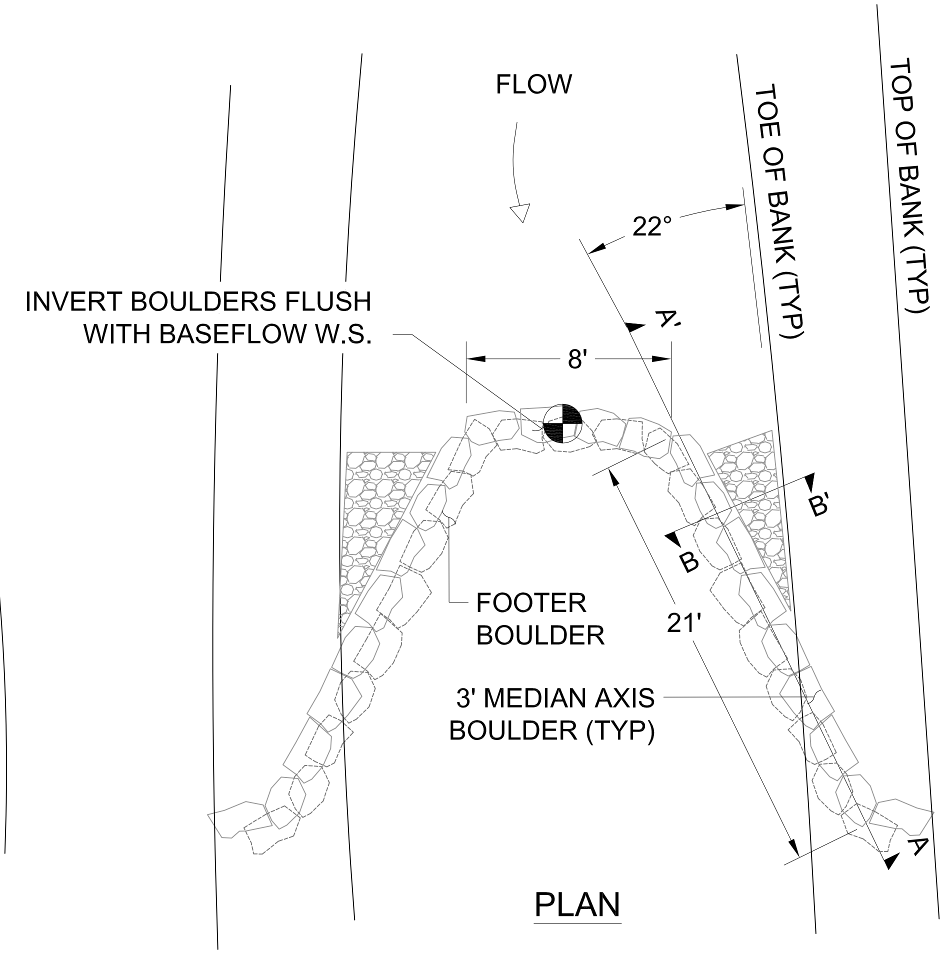
DATE: NOV. 2012
SCALE: NTS

STRUCTURE DETAILS

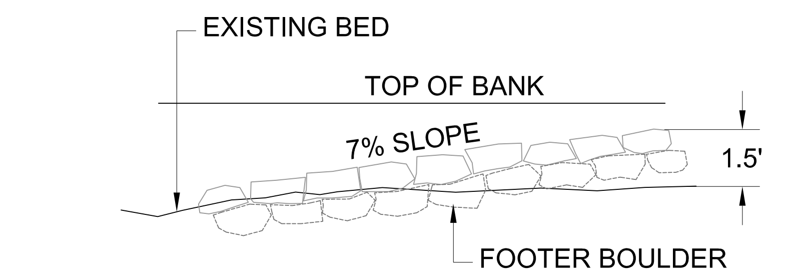
SHEET D2 OF 25



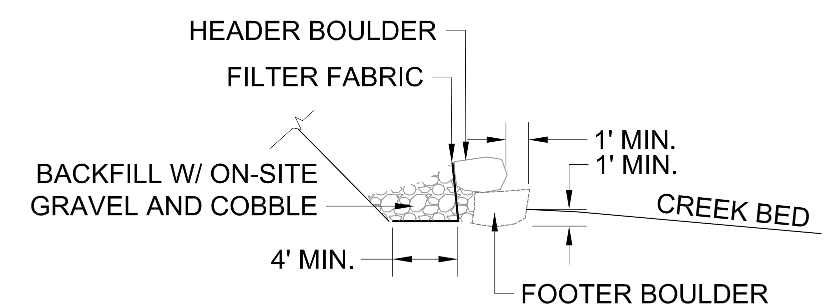
PLAN



PLAN



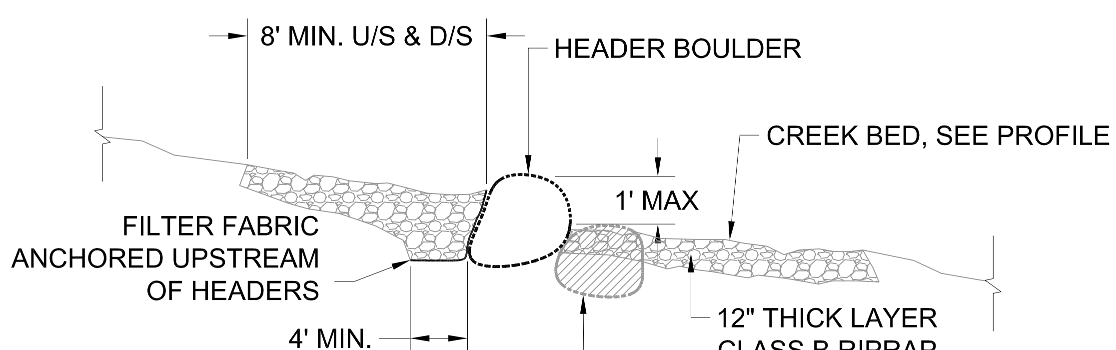
PROFILE A-A'



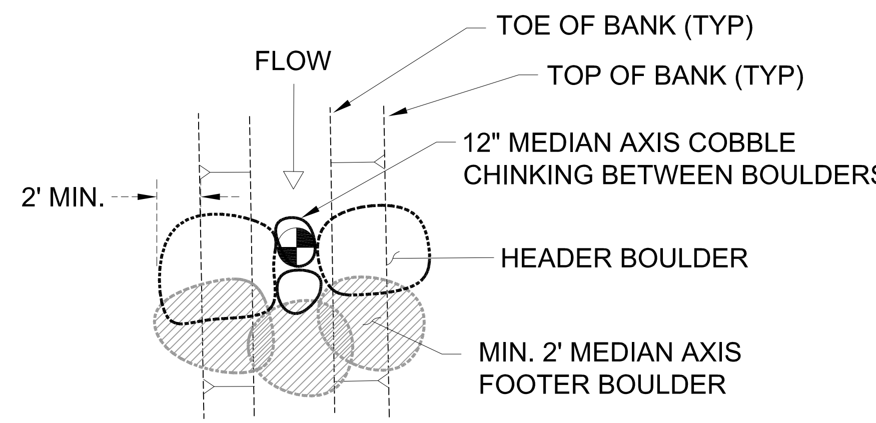
SECTION B-B'

1	BOULDER J-HOOK VANE
D3	NTS

2	BOULDER CROSS VANE
D3	NTS



SECTION



PLAN
(RIPRAP NOT SHOWN FOR CLARITY)

3	BOULDER STEP
D3	NTS

ELEVATION POINT IN STRUCTURE TABLE

REV.	DESCRIPTION	DATE	APP.
A	STEP HT.	1012	AB
B			
C			

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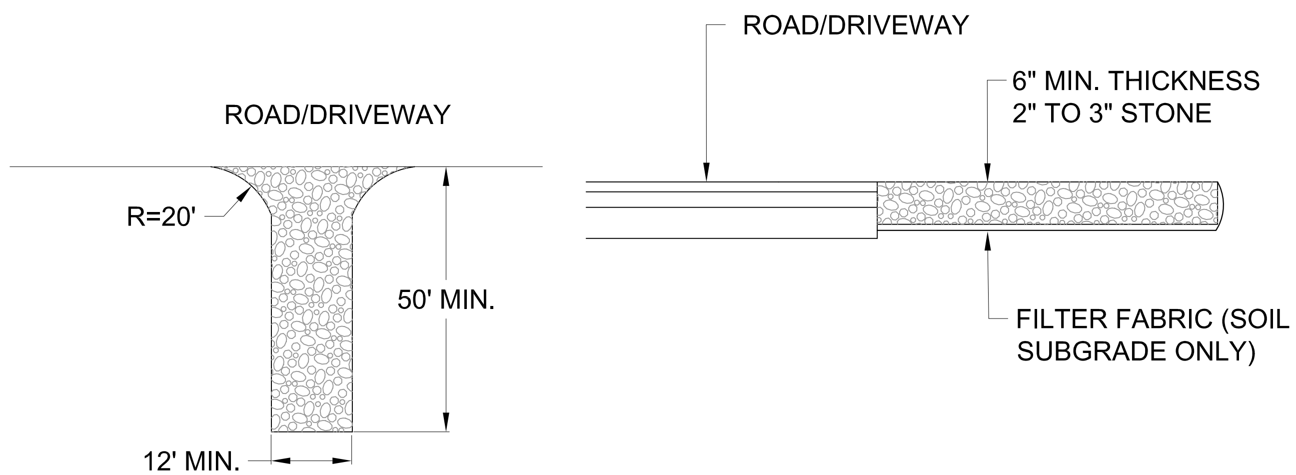
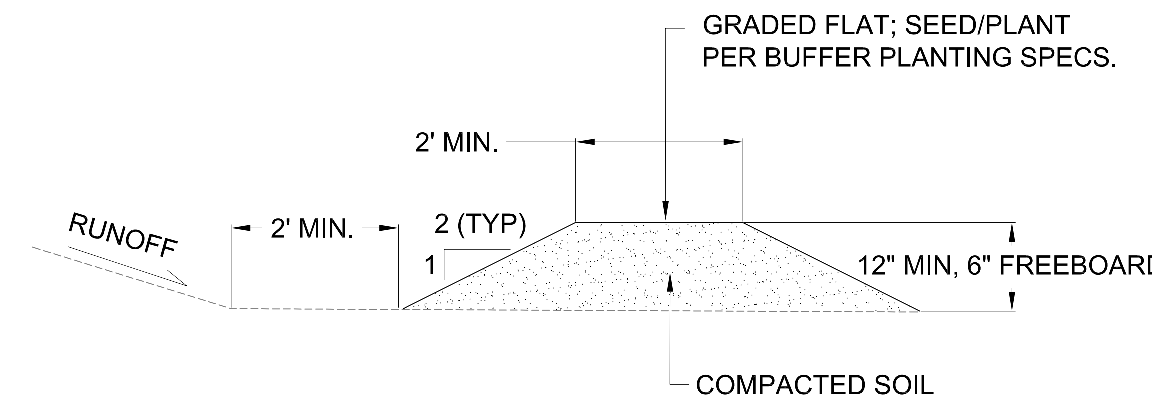
SCALE: NTS

STRUCTURE DETAILS

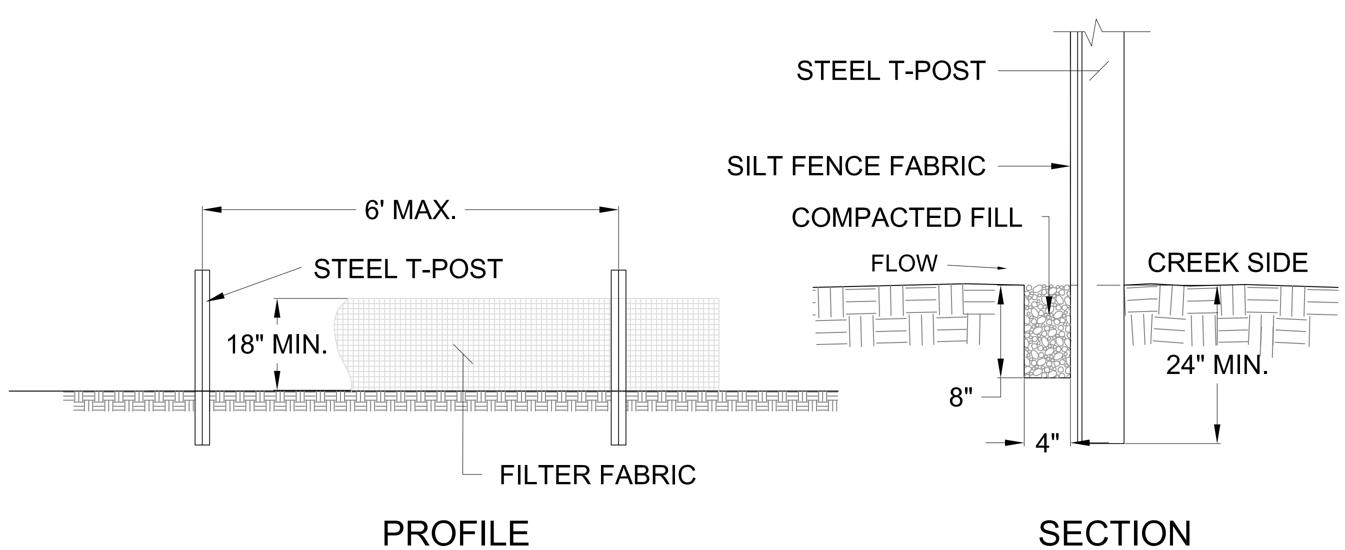
SHEET D3 OF 25



1 / D4 CONSTRUCTION ENTRANCE/EXIT
NTS

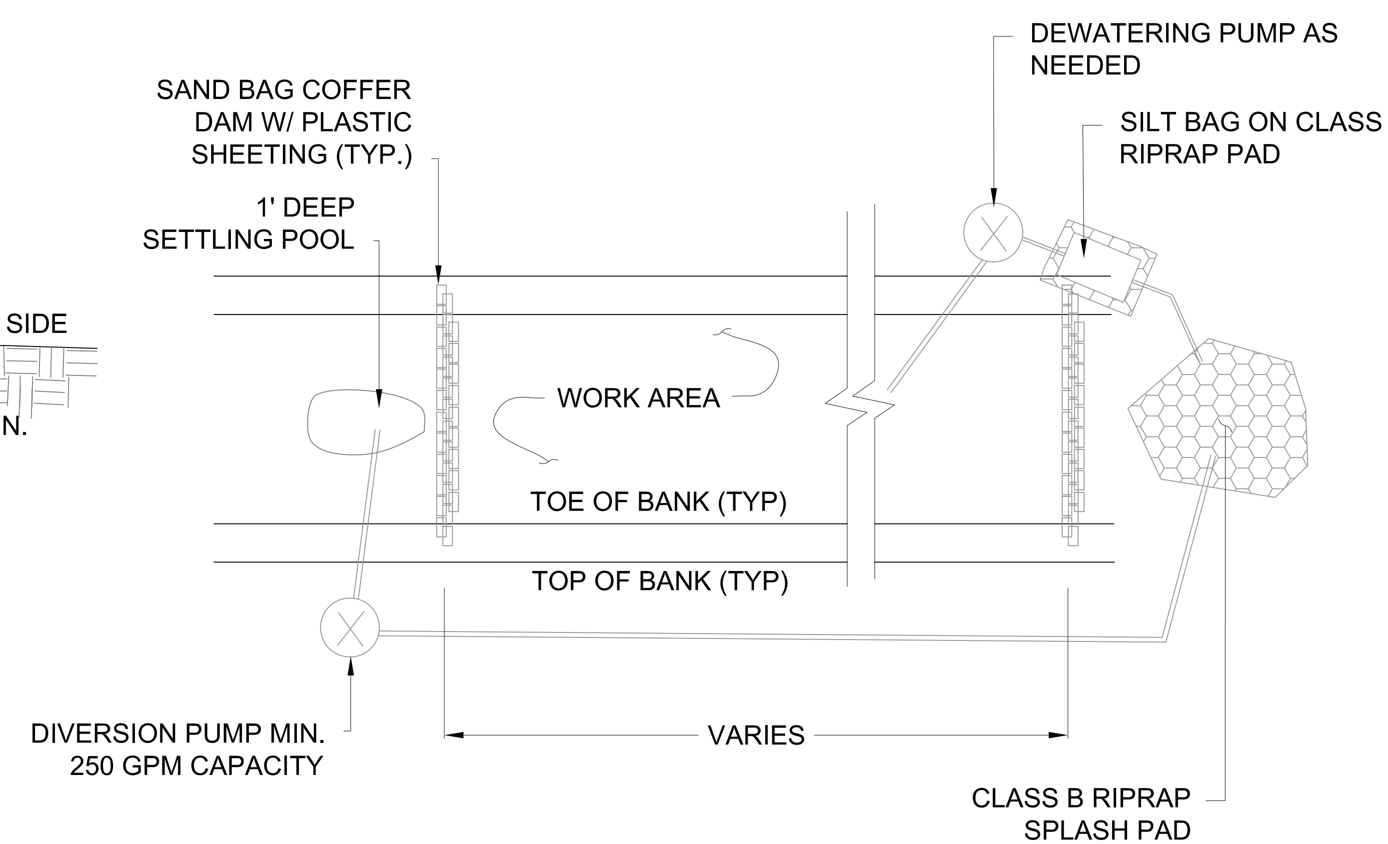


2 / D4 DIVERSION
NTS



NOTES:
1. SILT FENCE SHALL BE PLACED ON STREAM SIDE OF ALL STOCKPILES.
2. SILT FENCE SHALL BE REMOVED UPON COMPLETION OF EARTHWORK.

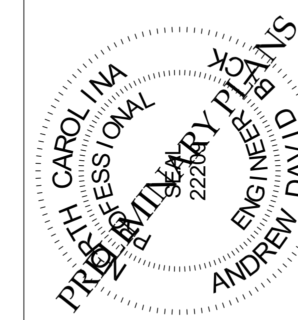
3 / D4 SILT FENCE
NTS



4 / D4 FLOW DIVERSION
NTS

A	DIVERSION	0712	AB	
B				
C				
	DESCRIPTION	DATE	APP.	

REVISIONS



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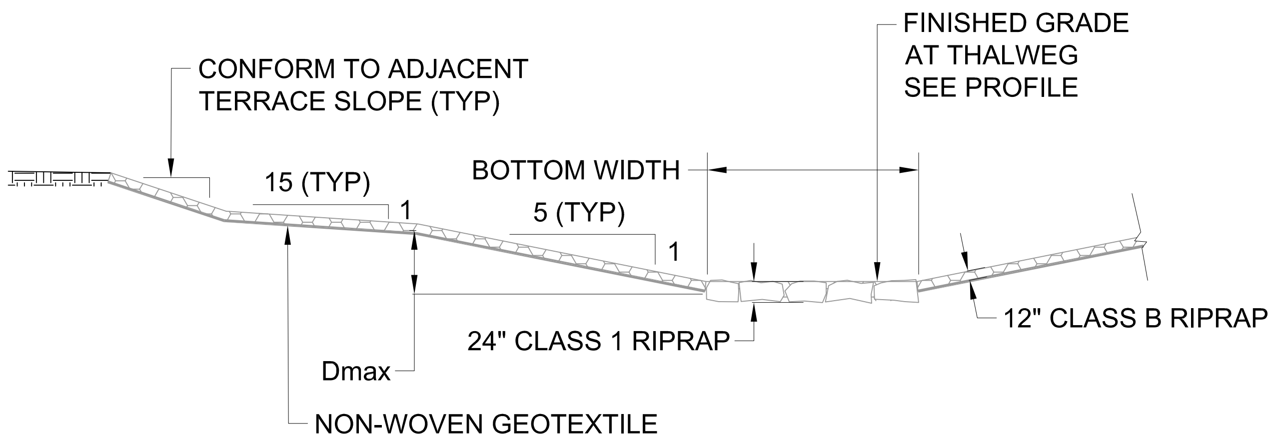
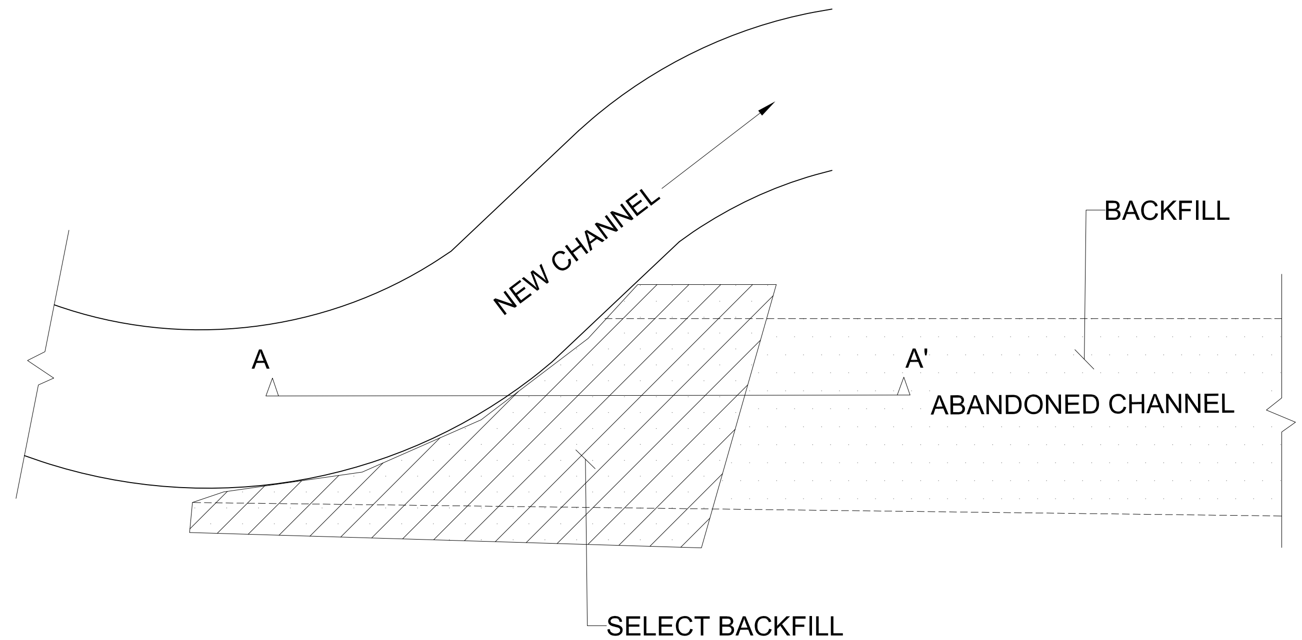
E&S DETAILS

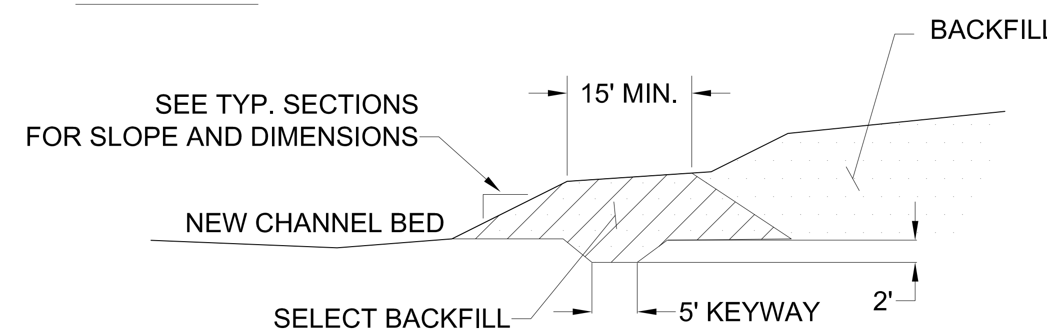


1 / D5 FORD CROSSING

NTS



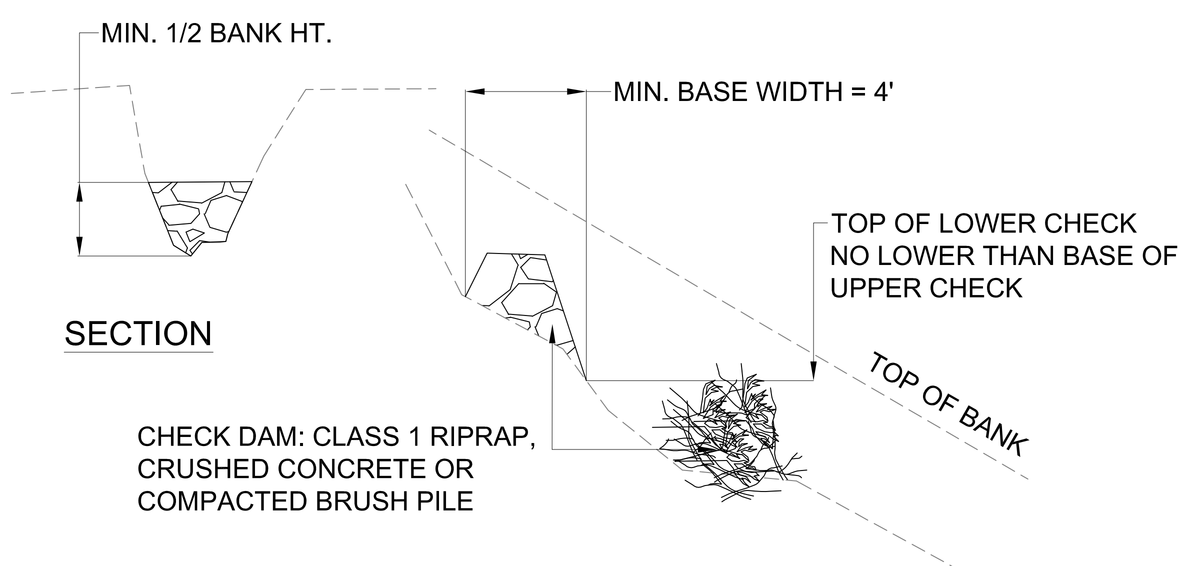
PLAN VIEW



SECTION A-A'

2 / D5 CHANNEL PLUG

NTS

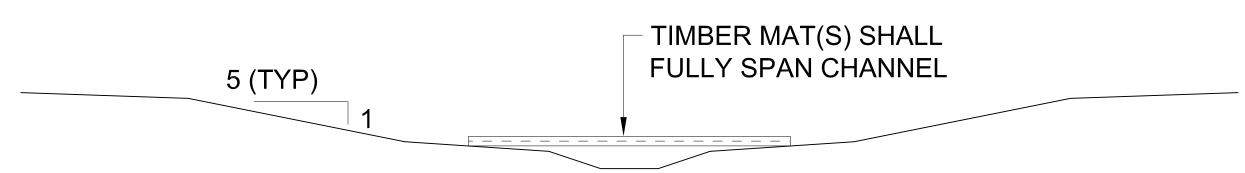


PROFILE

3 / D5 GULLY STABILIZATION

NTS

NOTES:
1. BRUSH MAY NOT BE FROM NON-NATIVE SPECIES.
2. AT LEAST EVERY THIRD CHECK DAM SHALL BE RIPRAP.



SECTION

4 / D5 TEMPORARY STREAM CROSSING

NTS

A			
B			
C			
	DESCRIPTION	DATE	APP.

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DATE: NOV. 2012
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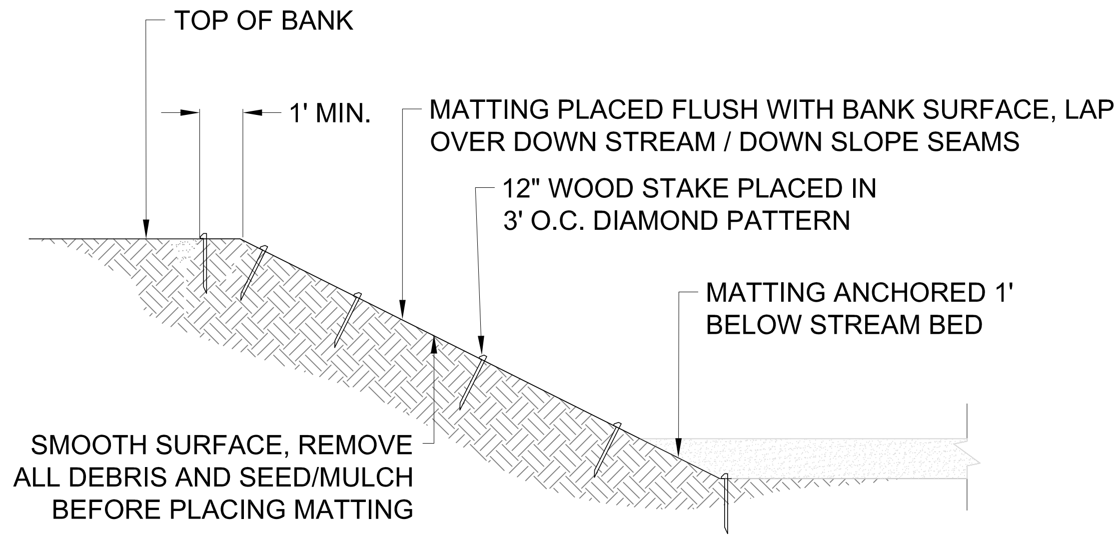
E&S
DETAILS

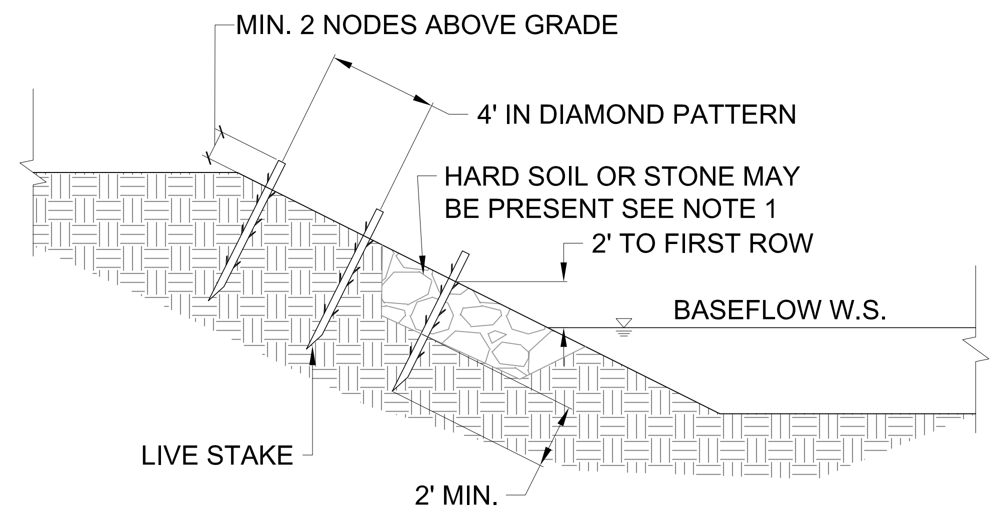
SHEET D5 OF 25



SECTION

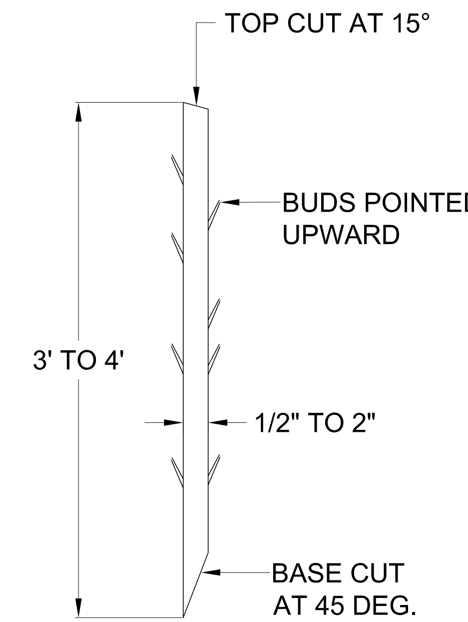
NOTE:
1. MATTING SHALL BE COIR FIBER, 780 GRAMS/SQ. METER WITH NOMINAL 0.50 INCH OPENING SIZE.

1 / D6 — EROSION CONTROL MATTING
NTS



SECTION

NOTES:
1. FORM PILOT HOLE THROUGH HARD SOIL OR STONE TO PREVENT DAMAGE TO STAKE.
2. LIVE STAKE MIX TO INCLUDE AT LEAST TWO OF THE FOLLOWING SPECIES: SILKY DOGWOOD, SILKY WILLOW, ELDERBERRY, BUTTONBUSH.



LIVE STAKE DETAIL

2 / D6 — LIVE STAKING
NTS

PERMANENT SEED MIX *

* APPLIED AT 0.5 LB/1,000 SF TO ALL DISTURBED AREAS

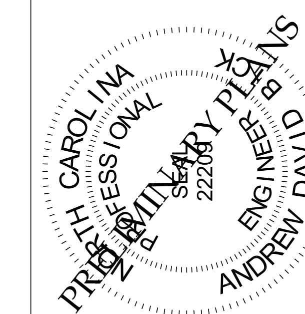
Common Name	Scientific Name	Percentage
Switchgrass	Panicum virgatum	30
Virginia Wild Rye	Elymus virginicus	30
Deer Tongue	Panicum clandestinum	15
Golden Tickseed	Coreopsis tinctoria	5
Showy Tickseed	Bidens aristosa	5
Ironweed	Vernonia gigantea	5
Fox Sedge	Carex vulpinoidea	10
TOTAL		100

TEMPORARY SEED MIX
(APPLIED WITH PERMANENT MIX)

Application Dates	Common Name	Rate (lb/1,000 sf)
August 15 to May 1	Rye Grain	1.0
May 1 to August 15	Browntop Millet	0.3

	DESCRIPTION	DATE	APP.
A			
B			
C			

REVISIONS



CONFLUENCE
ENGINEERING, PC
16 Broad Street
Asheville, North Carolina 28801
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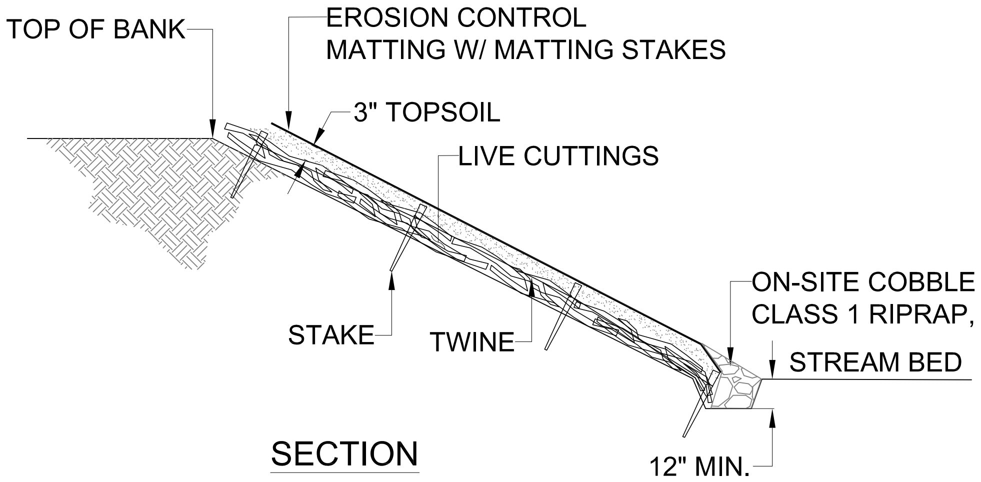
confluence-eng.com

MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

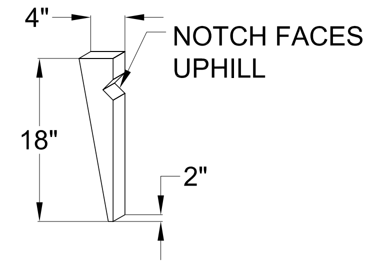
DATE: NOV. 2012
SCALE: NTS

E&S
DETAILS

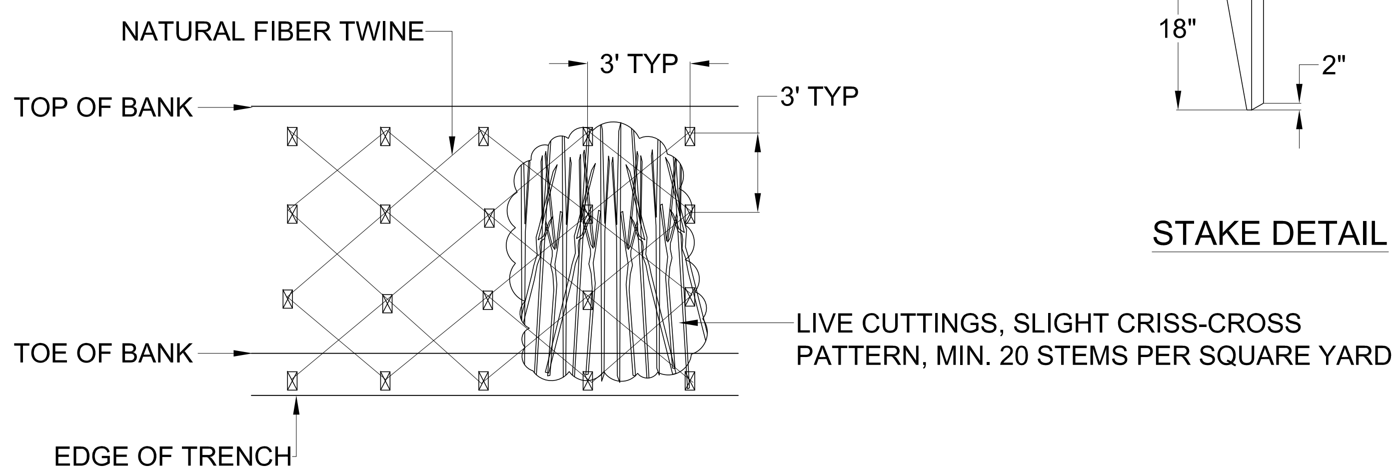
SHEET D6 OF 25



SECTION



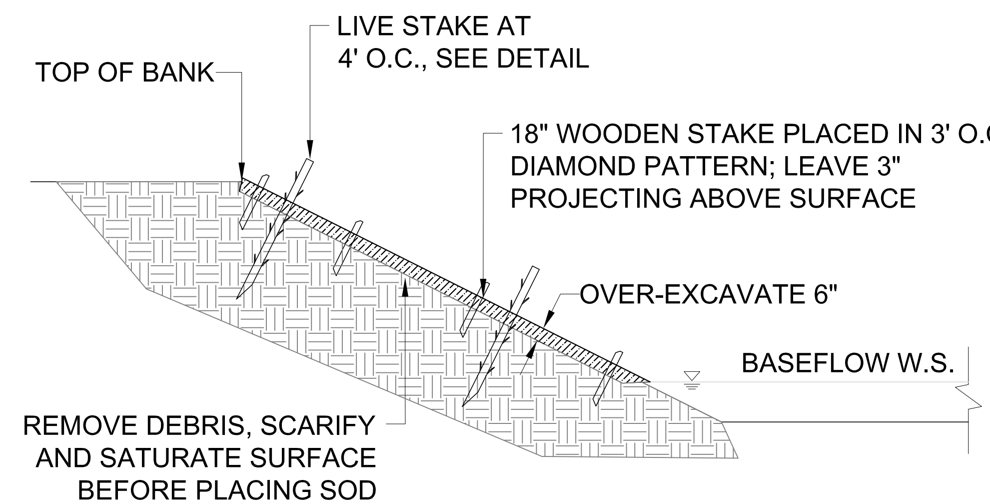
STAKE DETAIL



PLAN

1 / D7 — BRUSH MATTRESS

NTS



SECTION

2 / D7 — SOD MAT TRANSPLANT

NTS

NOTES:
1. EXCAVATE 12" DEEP TRENCH AT TOE OF BANK.
2. LAY LIVE CUTTINGS OVER SUBGRADE AS SHOWN.
3. DRIVE STAKES HALFWAY INTO BANK BETWEEN CUTTINGS. WRAP TWINE AROUND STAKES AND OVER CUTTINGS TIGHTLY. DRIVE STAKES FURTHER TO TIGHTEN TWINE AND SECURE CUTTINGS TO SLOPE.
4. FILL VOIDS BETWEEN CUTTINGS WITH LOOSE TOPSOIL.
5. INSTALL EROSION CONTROL MATTING OVER TOPSOIL, USING 18" LONG MATTING STAKES.
6. PLACE STONE TOE OVER END OF MATTRESS AND MATTING.
7. WHEN SPECIFIED ON MOORES FORK, BRUSH MATTRESS EXTENDS FROM TOP OF ROOT WADS TO TOP OF BANK UNLESS NOTED OTHERWISE.

A	B	C	DESCRIPTION	DATE	APP.

REVISIONS

PRELIMINARY PLANS

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MOORES FORK
RESTORATION PROJECT
SURRY COUNTY, NC

DATE: NOV. 2012

SCALE: NTS

DETAILS

APPENDIX E

AGENCY COMMENT LETTERS

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Tugwell October 3, 2012

MEMORANDUM FOR RECORD

SUBJECT: NCIRT Comments During 30-day Mitigation Plan Review

Purpose: The comments and responses listed below were posted to the NCEEP Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCEEP Project Name: Moores Fork Stream Mitigation Project, Surry County, NC

USACE AID#: SAW- 2011-02257

30-Day Comment Deadline: September 29, 2012 (Second Review Period)

1. Eric Kulz, NCDWQ, August 29, 2012:
   - The revisions to the technical part of the proposal are acceptable to DWQ. DWQ still does not feel that the plan adequately justifies increased E1 and E2 ratios based on the descriptions of the proposed activities and potential uplift described in Table 4a and the report text. DWQ will defer to the chair of the IRT for the final decision on credit yield for this project.

   Response by Julie Cahill, NCEEP, September 26, 2012: This is addressing Eric Kulz comment on 8/29/12, EEP is not proposing any ratios relative to treatments/uplifts that weren’t agreed to during the 7/13/12 Moores Fork IRT meeting.

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Tugwell May 29, 2012

MEMORANDUM FOR RECORD

SUBJECT: NCIRT Comments During 30-day Mitigation Plan Review

Purpose: The comments and responses listed below were posted to the NCEEP Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCEEP Project Name: Moores Fork Stream Mitigation Project, Surry County, NC

USACE AID#: SAW- 2011-02257

30-Day Comment Deadline: May 29, 2012 (originally May 11, 2012, but NCEEP agreed to an 18-day extension)

1. Todd Tugwell, USACE, May 25, 2012:
   - Stream preservation ratios are proposed at 5:1, which appear to be high for some of the proposed streams where buffers are not mature or have been logged recently, such as much of Barn Trib.
   - The description of the approach to each tributary needs to be further clarified so that each reach is addressed separately to describe the conditions, objectives, and activities proposed to correct the conditions. These descriptions should provide a justification for the credit ratios, since the ratios for several of the streams appear higher than justified by the proposed activities, with Enhancement I ratios of 1:1 and Enhancement II ratios of 1.5:1. The justification for these ratios, which should be based on the proposed ecological uplift, needs to be explicitly explained in the mitigation plan under the description for the proposed actions to be taken on the associated reach. In particular, the reaches listed below do not appear to justify the proposed credit ratio:
     - Moores Reach 1 is listed as EI with a ratio of 1:1, yet much of the upstream portion of this reach has vegetation on both sides and during the site visit, no cattle access to this section was noted. In general, the wooded portion of this reach was in decent condition, with enhancement potential limited to providing breaks in the berm along the north side of the channel and planting/preserving a full buffer.
     - Moores Reach 3 is listed as E1 with a ratio of 1:1, but several long stretches of the channel do not appear to be proposed for any modification.

- The planting plan includes *Juglans nigra*, which can have an allelopathic effect on surrounding vegetation. We recommend this species be removed from the planting list.
- The design discharge for the proposed channels is substantially higher than the regional curve predicts. Justification for this was provided in the mitigation plan, which stated that "As noted in the previous section, the design cross sections will accommodate sediment storage within the channel on point bars and/or in lateral bars upstream of vane structures. This stored sediment is available for transport during large flow events, which promotes long-term stability and sediment transport equilibrium." (Section 7.3.3, Page 26) We are concerned that constructing a larger channel cross section than is appropriate for the drainage area just to make room for sediment could restrict the access of the channel to the floodplain and lead to channel instability. Also, if the source of excess sediment is not address, sediment inputs to the system will continue even once the additional cross sectional space has been filled with sediment. Please provide additional justification to address these concerns.
- The plan states "For practical purposes based on available stone and log sizes, the step height was capped at 16 inches." (Section 7.3.4, Page 27) We believe that 16-inch steps will potentially cause both aquatic passage limitations and structural instability. Please consider revising or provide more detail to explain why this is not possible.
- Table 11 on Page 30 identifies the proposed success criteria (performance standards) for the project. The proposed standards are much more comprehensive than what is required by the 2003 Stream Mitigation Guidelines. Many of the standards do not appear to be enforceable or able to demonstrate the proposed ecological service enhancement. Additionally, many of proposed standards are not supported by any monitoring requirement. In particular, the stated success criteria are of concern:
    - For the riparian buffer habitat density and diversity states "<20% non-native species at year 5, based on measurements of aerial extent", which can be interpreted to mean that up to 20% aerial coverage of an invasive species is acceptable.
    - For the maintenance of stable channel bed and banks, the standards allows up to a 20% change in both cross sectional area and width-depth ratio in single year, which may be a substantial change, particularly on a large stream.
    - For thermal regulations, the project is unlikely to result in a change to water temperature, so any standard for thermal regulation is likely to fail. Additionally, taking two temperature measurements over the course of 5 years is not sufficient to make a determination that the project has reduced water temperature.
    - For filtration of runoff, "evidence of floating debris or fine sediment on buffer vegetation at least twice by year 5" is more a measurement of overbank occurrence than runoff.
- The use of level spreaders is proposed in the plans and is briefly discussed on page 27, but no explanation is provided to demonstrate the need or benefit of these structures. See additional comments by NCDWQ.
- The site vicinity map (Figure 1) appears to show Barn Trib as a restoration reach, while Table 4 shows Barn Trib as an enhancement I reach. It would also be helpful if the plan set and Figure 1 would identify the proposed type of work for each reach.

- Please provide information on the potential impact (fill, drainage, etc.) to existing wetlands located adjacent to Moores Fork. See additional comments by NCDWQ.

  NCEEP Response: None

2. Travis Wilson, NCWRC, May 29, 2012:
   - Oversizing channel dimensions to promote sediment deposition in the channel is risky and often leads to buried channel features and habitat. If appropriate, assess the potential to promote sediment deposition in the floodplain by lowering the bankfull elevation.
   - Several success criteria are problematic: 20% variance for stability is generous and could identity instability, temperature measurements are inconclusive and unnecessary, and 20% allowance for non-native vegetation is too high specifically since removal of these species is a design objective.
   - Furthermore we concur with comments provide by NCDWQ and USACE.

   NCEEP Response: None

3. Sue Homewood, NCDWQ, May 10, 2012:
   - The Division will need more detailed justification for credit ratios that are proposed for the highest end of the typical ranges.
   - The Division would like to see the proposed credit ratios called out on the plan sheets for each reach/tributary.
   - The Division requests details on whether work on Moores Fork 2 at Station 33+00 and MF3 at Stat 44+00 can be done with minimal disturbance to adjacent wetlands.
   - The Division will need a detailed construction sequence on how work will be accomplished on the Silage Trib. The Division is concerned about efforts to restore the Silage Trib without addressing the nutrients entering the channel from the adjacent Silage runoff.
   - The Division does not recommend use of a concave level spreader, and strongly recommends against the use of a level spreader across swales, draws or channels that will re-concentrate the stormwater.
   - The Division is not comfortable with 20% invasive coverage by aerial extent as a performance standard.

   NCEEP Response: None

Moores Fork Stream Mitigation Project, Surry County, NC
IRT Comments and Responses
Review Periods 1 and 2

1. **Todd Tugwell, USACE, 5/25/12:**

- Stream preservation ratios are proposed at 5:1, which appear to be high for some of the proposed streams where buffers are not mature or have been logged recently, such as much of Barn Trib.

Response: EI and EII are proposed for the Barn Trib; see Table 4a. Preservation reaches generally have greater than 50-foot wide buffers. Livestock fencing and a comprehensive farm management plan, which includes relocation of feed lots and silage pits, will further protect preservation reaches.

- The description of the approach to each tributary needs to be further clarified so that each reach is addressed separately to describe the conditions, objectives, and activities proposed to correct the conditions. These descriptions should provide a justification for the credit ratios, since the ratios for several of the streams appear higher than justified by the proposed activities, with Enhancement I ratios of 1:1 and Enhancement II ratios of 1.5:1. The justification for these ratios, which should be based on the proposed ecological uplift, needs to be explicitly explained in the mitigation plan under the description for the proposed actions to be taken on the associated reach. In particular, the reaches listed below do not appear to justify the proposed credit ratio:
    - o Moores Reach 1 is listed as EI with a ratio of 1:1, yet much of the upstream portion of this reach has vegetation on both sides and during the site visit, no cattle access to this section was noted. In general, the wooded portion of this reach was in decent condition, with enhancement potential limited to providing breaks in the berm along the north side of the channel and planting/preserving a full buffer.

    - o Moores Reach 3 is listed as E1 with a ratio of 1:1, but several long stretches of the channel do not appear to be proposed for any modification.

Response: Based on discussions during the 7/13/12 IRT meeting, EII is now proposed for Moores Reach 1 at a ratio of 2.5:1. As presented in Table 4a, extensive in-stream work will be performed on Moores Reach 3 and a ratio of 1:1 is justified.

- The planting plan includes Juglans nigra, which can have an allelopathic effect on surrounding vegetation. We recommend this species be removed from the planting list.

Response: It has been removed from the list.

- The design discharge for the proposed channels is substantially higher than the regional curve predicts. Justification for this was provided in the mitigation plan, which stated that "As noted in the previous section, the design cross sections will accommodate sediment storage within the channel on point bars and/or in lateral bars upstream of vane structures. This stored sediment is available for transport during large flow events, which promotes long-term stability and sediment transport equilibrium." (Section 7.3.3, Page 26) We are concerned that constructing a larger channel cross section than is appropriate for the drainage area just to make room for sediment could restrict the access of the channel to the floodplain and lead to channel instability. Also, if the source of excess sediment is not address, sediment inputs to the system will continue even once the additional cross sectional space has been filled with sediment. Please provide additional justification to address these concerns.

Response: See Section 7.4.1 of the final document for a detailed discussion of the design discharge estimation methodology and results. After the 7/13/12 IRT meeting, Confluence conducted further analysis and modeling effort and revised the design discharge in Moores Fork. See Table 8; the design discharge is now close to the USGS 2-year return interval prediction. Sections 7.4.2 and 7.4.3 present sediment transport analyses and cross section design rationale. The revised Moores Fork typical sections include a subtle two-stage channel to promote sediment transport equilibrium.

- The plan states "For practical purposes based on available stone and log sizes, the step height was capped at 16 inches." (Section 7.3.4, Page 27) We believe that 16-inch steps will potentially cause both aquatic passage limitations and structural instability. Please consider revising or provide more detail to explain why this is not possible.

Response: Section 7.4.4 has been revised and the step height for step-pool profiles has been capped at 12 inches. Structure detail drawings (App. D) have been updated accordingly.

- Table 11 on Page 30 identifies the proposed success criteria (performance standards) for the project. The proposed standards are much more comprehensive than what is required by the 2003 Stream Mitigation Guidelines. Many of the standards do not appear to be enforceable or able to demonstrate the proposed ecological service enhancement. Additionally, many of proposed standards are not supported by any monitoring requirement. In particular, the stated success criteria are of concern:
  - For the riparian buffer habitat density and diversity states "<20% non-native species at year 5, based on measurements of aerial extent", which can be interpreted to mean that up to 20% aerial coverage of an invasive species is acceptable.
  - For the maintenance of stable channel bed and banks, the standards allows up to a 20% change in both cross sectional area and width-depth ratio in single year, which may be a substantial change, particularly on a large stream.
  - For thermal regulations, the project is unlikely to result in a change to water temperature, so any standard for thermal regulation is likely to fail. Additionally, taking two temperature measurements over the course of 5 years is not sufficient to make a determination that the project has reduced water temperature.
  - For filtration of runoff, "evidence of floating debris or fine sediment on buffer vegetation at least twice by year 5" is more a measurement of overbank occurrence than runoff.

Response: Section 9.0 has been revised to address these comments.

- The use of level spreaders is proposed in the plans and is briefly discussed on page 27, but no explanation is provided to demonstrate the need or benefit of these structures. See additional comments by NCDWQ.

Response: The discussion of gully stabilization is now presented on page 30. Level spreaders have been replaced by temporary silt fences that will help re-direct surface runoff from the headwaters of gully drainages so as to promote vegetation establishment in the gullies. Silt fences will be removed once vegetation is considered robust enough to withstand runoff.

- The site vicinity map (Figure 1) appears to show Barn Trib as a restoration reach, while Table 4 shows Barn Trib as an enhancement I reach. It would also be helpful if the plan set and Figure 1 would identify the proposed type of work for each reach.

Response: Figure 1 has been revised and the plans (App. D) identify treatments per reach

- Please provide information on the potential impact (fill, drainage, etc.) to existing wetlands located adjacent to Moores Fork. See additional comments by NCDWQ.

Response: The final document includes a discussion of wetland impacts and protection measures in Section 7.3.

2. Travis Wilson, NCWRC, 5/59/12:

- Over sizing channel dimensions to promote sediment deposition in the channel is risky and often leads to buried channel features and habitat. If appropriate, assess the potential to promote sediment deposition in the floodplain by lowering the bankfull elevation.

Response: See Section 7.4.1 of the final document for a detailed discussion of the design discharge estimation methodology and results. After the 7/13/12 IRT meeting, Confluence conducted further analysis and modeling effort and revised the design discharge in Moores Fork. See Table 8; the design discharge is now close to the USGS 2-year return interval prediction. Sections 7.4.2 and 7.4.3 present sediment transport analyses and cross section design rationale. The revised Moores Fork typical sections include a subtle two-stage channel to promote sediment transport equilibrium.

- Several success criteria are problematic: 20% variance for stability is generous and could identity instability, temperature measurements are inconclusive and unnecessary, and 20% allowance for non-native vegetation is too high specifically since removal of these species is a design objective.

Response: Section 9.0 has been revised to address these comments.

- Furthermore we concur with comments provide by NCDWQ and USACE.

Response: None.

3. Sue Homewood, NCDWQ, 5/10/12:

- The Division will need more detailed justification for credit ratios that are proposed for the highest end of the typical ranges. The Division would like to see the proposed credit ratios called out on the plan sheets for each reach/tributary.

Response: Tables 4a and 4b have been updated. Figure 1 has been revised and the plans (App. D) identify treatments per reach. We do not believe credit ratios are relevant to construction and will therefore be left off the construction plans.

- The Division requests details on whether work on Moores Fork 2 at Station 33+00 and MF3 at Stat 44+00 can be done with minimal disturbance to adjacent wetlands.

Response: The final document includes a discussion of wetland impacts and protection measures in Section 7.3.

- The Division will need a detailed construction sequence on how work will be accomplished on the Silage Trib. The Division is concerned about efforts to restore the Silage Trib without addressing the nutrients entering the channel from the adjacent Silage runoff.

Response: The final construction plans will include a detailed construction sequence. With regard to nutrients in the silage tributary drainage, the project will include a comprehensive farm management plan (App. D) that includes relocation of the silage pits and feedlots away from surface waters and livestock fencing.

- The Division does not recommend use of a concave level spreader, and strongly recommends against the use of a level spreader across swales, draws or channels that will re-concentrate the stormwater.

Response: The discussion of gully stabilization is now presented on page 30. Level spreaders have been replaced by temporary silt fences that will help re-direct surface runoff from the headwaters of gully drainages so as to promote vegetation establishment in the gullies. Silt fences will be removed once vegetation is considered robust enough to withstand runoff.

- The Division is not comfortable with 20% invasive coverage by aerial extent as a performance standard.

Response: Section 9.0 has been revised to address this comment.

4. Eric Kulz, DWQ, 8/29/12:

- The revisions of the technical part of the proposal are acceptable to DWQ. DWQ still does not feel that the plan adequately justifies increased E1 and E2 ratios based on the descriptions of the proposed activities and their potential uplift described in Table 4a and the report text. DWQ will defer to the chair of the IRT for the final decision on credit yield for this project.

Response: Credit ratios for the various reaches and treatments were discussed at the 7/13/12 IRT meeting. The plan is consistent with credit ratios agreed to at this meeting. Tables 4a and 4b have been updated in the final document.