

**Badin Inn
Stream Restoration
Stanly County, North Carolina
Year 3 Monitoring Report**



Monitoring Year: 2011
Measurement Year 3
As-Built Date 2009
NCEEP Project Number 92666

February 2012

**BADIN INN STREAM RESTORATION
YEAR 3 MONITORING REPORT**

CONDUCTED FOR THE NORTH CAROLINA DEPARTMENT
OF
ENVIRONMENT AND NATURAL RESOURCES

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I. EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Badin Inn project consists of 4,174 linear feet of Priority 1 stream restoration located on the golf course of the Badin Inn Golf Resort and Club in the Town of Badin, North Carolina. Construction on the site was completed in April of 2009. The following report provides the Year 3 monitoring information.

The project consists of a portion of an unnamed tributary to Little Mountain Creek (UT to Little Mountain Creek), a tributary to the Yadkin River. It is located entirely on land owned by the Badin Inn Golf Resort and Club and drains into Little Mountain Creek in Stanly County, North Carolina. The watershed area for this project is 0.5 square miles.

UT to Little Mountain Creek is a 2nd order stream, as several small 1st order tributaries flow into it near the top of the watershed. As it passes through the town, the channel has uniform rectangular dimensions and is lined with concrete. As the primary drainage feature in the Town of Badin, it receives discharge from numerous stormwater pipes from houses and townhouse complexes. The channelization of this stream occurred during the development of Badin by ALCOA during the early 1920's, and has since served as the primary stormwater conveyance system for a portion of the town.

Prior to restoration, the stream entered a much larger, concrete-lined channel that traveled straight down the valley until joining with Little Mountain Creek. The Priority 1 restoration involved removal of the concrete channel and adjustment of the stream dimension, pattern, and profile to allow the stream to more fully transport its water and sediment load. A combination of bedform transformations, channel dimension adjustments, pattern alterations, and structure installations were used to accomplish this. The natural meander patterns were restored and rock grade control vanes were incorporated for aquatic habitat enhancement and bed and bank stability. The tributary was also restored using a Priority 1 restoration. The riparian area also underwent buffer restoration with plantings and is protected with a permanent easement. Construction of the restored channel and planting of the riparian vegetation was completed in April 2009.

The Year 3 monitoring revealed that the stream has remained stable and riparian vegetation is becoming established. No problem areas such as stream bank erosion, unstable structures, excessive aggradation or degradation, or changes in channel morphology were identified. No vegetation problem areas are identified.

II. PROJECT BACKGROUND

A. Location and Setting

The Badin Inn project site is located in the Town of Badin in northeast Stanly County. (Figure 1). The headwaters of the project originate approximately 0.8 miles to the northeast of the restoration site. From the headwaters, UT to Little Mountain Creek flows for

approximately 1.5 miles before emptying into Little Mountain Creek. One tributary enters UT Little Mountain Creek along the Badin Inn project extent.

The watershed of the project stream is approximately 0.5 square miles (346 acres) and is oriented northeast to southwest. The project is located within a conservation easement that occurs on private land owned by Badin Inn Golf Resort and Club. The upper portions of the watershed are comprised of the western slope of a ridgeline in the Uwharrie Mountains chain. Further down, the watershed contains part of the Town of Badin, and includes residential areas, and the Badin Inn Golf Resort and Club, the golf course property on which the project is located. Although the town is small, it possesses a densely developed area of townhouse complexes and houses that were built as residences for the workers of ALCOA, the large aluminum manufacturer that built the Town of Badin in the early part of the twentieth century. Most of this densely developed area lies within the watershed of UT to Little Mountain Creek.

If traveling from the north (Raleigh, Greensboro, Winston-Salem), proceed southwest on NC 49 from Asheboro. After passing over the Yadkin River/Badin Lake, head south on NC 8 until reaching New London, where NC 8 merges with US Highway 52. Shortly after the merger, turn left onto NC 740 towards Badin. In Badin, after passing the ALCOA plant, turn left on Nantahala Street, then turn right on Henderson Street (SR 1720), which becomes Valley Drive. The beginning of the project is on the right, where the road passes through the fairways of the golf course.

If coming from the south (Charlotte), take NC 24/27 towards Albemarle, then in Albemarle proceed north on NC 740 towards Badin. In Badin, turn right on Nantahala Street, then right on Henderson Street (SR 1720), which becomes Valley Drive. The beginning of the project is on the right, where the road passes the fairways of the golf course.

B. Mitigation Structures and Objectives

The Priority 1 restoration involved removal of the concrete lining and construction of a stream with a proper dimension, pattern, and profile to allow the stream to more fully transport its water and sediment load. A combination of bedform transformations, channel dimension and pattern restoration, and structure installations were used to restore the stream. Natural meander patterns were added and rock grade control vanes were incorporated for aquatic habitat enhancement and bed and bank stability. The tributary was restored using Priority 1 restoration. The Priority 1 restoration involved converting the concrete-lined channel into a sinuous channel that meanders for a total of 4,174 linear feet of stream as measured along the centerline (Table I). A riparian buffer was planted in April 2009 and is protected by a Conservation Easement. This monitoring report follows the template of Version 1.2 to keep reporting consistent with the MY1 report (also in Version 1.2).

The project had the goal of accomplishing the following objectives:

1. Restore 3,994 linear feet of UT to Little Mountain Creek and 180 linear feet of a small unnamed tributary to Little Mountain Creek.
2. Provide a stable stream channel that neither aggrades nor degrades while maintaining its dimension, pattern, and profile with the capacity to transport its watershed's water and sediment load.
3. Improve water quality and reduce erosion by stabilizing the stream banks.
4. Reconnect the stream to its floodplain.
5. Improve aquatic habitat with the use of natural material stabilization structures such as root wads, rock vanes, woody debris, and a riparian buffer.
6. Provide aesthetic value, wildlife habitat, and bank stability through the creation or enhancement of a riparian zone.

**Table I. Project Restoration Components
Badin Inn Stream Restoration - EEP Project No. 92666**

Project Component or Reach ID	Existing Feet/Acres	Type	Approach	Footage or Acreage	Mitigation Ratio	Mitigation Units	Stationing	Comment
UT to Little Mountain Creek	3,540 feet	R	PI	3,994 feet	1.0	3,994	10+00 - 50+22	Construction started 28 feet from the start of stationing
Tributary	141 feet	R	PI	180 feet	1.0	180	10+00 - 11+80	
Mitigation Unit Summations								
Stream (lf)	Riparian Wetland (Ac)	Nonriparian Wetland (Ac)	Total Wetland (Ac)	Buffer (Ac)	Comment			
4,174	NA	NA	NA	0.0				

R = Restoration
PI = Priority I

C. Project History and Background

The Badin Inn Stream Restoration Project is located in the Town of Badin in Stanly County, North Carolina and is situated entirely within the golf course of the Badin Inn Golf Resort and Club (Figure 1). The project site encompasses a perennial, unnamed tributary to Little Mountain Creek (UT to Little Mountain Creek) and a small, first-order intermittent tributary of UT to Little Mountain Creek (Tributary) and the associated floodplain through which these channels flow. Prior to restoration, the channel of UT to Little Mountain Creek consisted of approximately 3,700 feet of a concrete-lined and straightened perennial stream that had been in its altered state for nearly a century. The Tributary consisted of approximately 141 feet of an intermittent channel routed through a culvert from where it entered the golf course property until it's confluence with UT to Little Mountain Creek.

UT to Little Mountain Creek is a 2nd order stream, as several small 1st order tributaries flow into it near the top of the watershed. As it passes through the town, the channel has uniform rectangular dimensions and is lined with concrete. As the primary drainage feature in the Town of Badin, it receives discharge from numerous stormwater pipes from houses and townhouse complexes. The channelization of this stream occurred during the development of Badin by ALCOA during the early 1920's, and has since served as the primary stormwater conveyance system for a portion of the town. Where the stream enters the Badin Inn Golf Resort and Club golf course, the stream is confined to a narrow, stone-lined channel for roughly 700 feet. It continues in this form until reaching the conservation easement and the upstream end of the project reach, after passing through a 48" culvert under Henderson Street (State Road 1720).

Prior to restoration, the stream entered a much larger, concrete-lined channel at this point, which traveled straight down the valley until joining with Little Mountain Creek. An intermittent tributary that was routed underground through a culvert entered the main channel approximately 500 feet downstream of the beginning of the project. The relict floodplain of the pre-restoration channel was covered by fairways of the Badin Inn Golf Resort and Club golf course, and some modification to the valley had been done to create bunkers, greens and tee boxes. In addition, a network of drains, pipes and irrigation systems had been installed within the valley, and numerous stormwater outfalls discharged into the stream.

The project is located in the Yadkin River Basin 8-digit Catalogue Unit 03040104 and the 14-digit hydrological unit 03040104010010. This watershed was identified by the NC Ecosystem Enhancement Program (EEP) as a Targeted Local Watershed and is also classified by the NC Division of Water Quality (NCDWQ) as a Water Supply Watershed (WSIV). The receiving stream, Little Mountain Creek, is listed on the 303(d) list for biological impairment (NCDENR, 2008).

The project site is located in the Carolina Slate Belt ecoregion (Griffith *et. al*, 2002). The primary adjacent land use throughout the project watershed consists of managed herbaceous areas (which consists mainly of the Badin Inn golf course), developed areas, including much of the residential areas of the Town of Badin, and forested areas on the slopes above the town.

Table II. Project Activity and Reporting History Badin Inn Stream Restoration - EEP Project No. 92666		
Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	9/1/2007	July 2008
Final Design – 90%	July 2008	December 2008
Construction	NA	April 2009
Temporary S&E mix applied to entire project area	NA	4/1/2009
Permanent seed mix applied to entire project area	NA	4/1/2009
Containerized, B&B, and livestake plantings	4/1/2009	4/1/2009
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	July 2009	August 2009
Year 1 Monitoring	January 2010	January 2010
Year 2 Monitoring	February 2011	March 2011
Year 3 Monitoring	November 2011	December 2011
Year 4 Monitoring		
Year 5 Monitoring		
Year 5+ Monitoring		

Figure 1. Vicinity Map

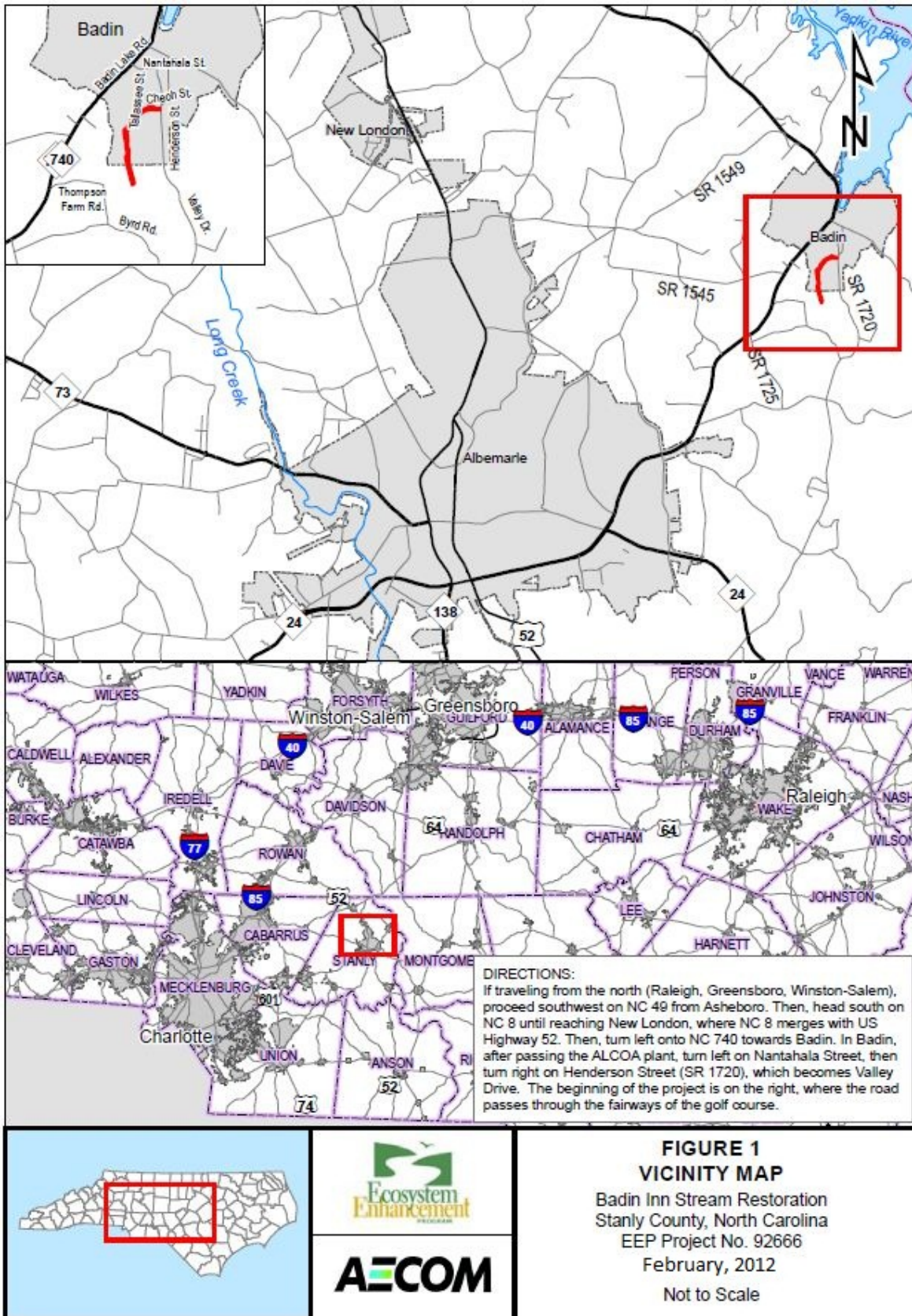


Table III. Project Contacts Table			
Badin Inn Stream Restoration - EEP Project No. 92666			
Designer	AECOM 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 Phone: (919) 854-6200		
Construction Contractor	River Works, Inc. 8000 Regency Parkway, Suite 200 Cary, NC 27511 Phone: (919) 459-9001		
Survey Contractor	AECOM 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 Phone: (919) 854-6200		
Planting Contractor	Efird Landscaping, Inc 42759 Greenview Dr. Albemarle, NC 28001 Phone: (704) 985-6559		
Seeding Contractor	Efird Landscaping, Inc 42759 Greenview Dr. Albemarle, NC 28001 Phone: (704) 985-6559		
Seed Mix Sources	Mellow Marsh Farm, Inc. 1312 Woody Store Rd. Siler City, NC 27344 Phone: (919) 742-1200		
Nursery Stock Suppliers	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Arborgen LLC 5594 Highway 38 Blenheim, SC 29516 Phone: (843) 528-9669</td> <td style="width: 50%; border: none;">Carolina Wetland Services 550 E. Westinghouse Blvd. Charlotte, NC 28273 Phone: (704) 527-1177</td> </tr> </table>	Arborgen LLC 5594 Highway 38 Blenheim, SC 29516 Phone: (843) 528-9669	Carolina Wetland Services 550 E. Westinghouse Blvd. Charlotte, NC 28273 Phone: (704) 527-1177
Arborgen LLC 5594 Highway 38 Blenheim, SC 29516 Phone: (843) 528-9669	Carolina Wetland Services 550 E. Westinghouse Blvd. Charlotte, NC 28273 Phone: (704) 527-1177		
Monitoring Performers	AECOM 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607		
Stream Monitoring	AECOM Phone: (919) 854-6200		
Vegetation Monitoring	AECOM Phone: (919) 854-6200		

**Table IV. Project Background Table
Badin Inn Stream Restoration/ Project No. 92666**

	UT to Little Mountain Creek	Tributary
Project County	Stanly County	Stanly County
Drainage Area	0.5 sq miles	0.05 sq. miles
Drainage impervious cover estimate (%)	5%	15%
Stream order	2nd	1st
Physiographic Region	Piedmont	Piedmont
Ecoregion	Carolina Slate Belt	Carolina Slate Belt
Rosgen Classification of As-built	C4	C
Cowardin Classification	Riverine	Riverine
Dominant soil types	Oakboro/Kirksey Silt loams	Oakboro/Kirksey Silt loams
Reference site ID	Spencer Creek and UT Meadow Fork	Spencer Creek and UT Meadow Fork
USGS HUC for Project and Reference	03040104 (Project) 03040101 (UT Meadow Fork) 03040103 (Spencer Creek)	03040104 (Project) 03040101 (UT Meadow Fork) 03040103 (Spencer Creek)
NCDWQ Sub-basin for Project and Reference	NA	NA
NCDWQ classification for Project and Reference	WS-IV (UT Little Mountain Creek) C (Spencer Creek) B Tr+ (UT Meadow Fork)	WS-IV (UT Little Mountain Creek) C (Spencer Creek) B Tr+ (UT Meadow Fork)
Any portion of any project segment 303(d) listed?	No	No
Any portion of any project upstream of a 303d listed segment	Yes	Yes
Reasons for 303d listing or stressor	Low dissolved oxygen and high conductivity	Low dissolved oxygen and high conductivity
% of project easement fenced	100	100

III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

Vegetation success is based on the criteria established in the USACE Stream Mitigation Guidelines (2003). Planted stem density minimums of 320 stems/acre through year three, 288 stems/acre in year four, and 260 stems/acre in year five are required. Vegetation monitoring was performed using the CVS-EEP Level 2 protocol.

1. Vegetative Problem Areas

No vegetation problem areas were noted during Year 3 monitoring. As a whole the vegetation plantings have been very successful and only a few minor areas of concern were noted where survival has been less than optimal. In previous years vegetation problem areas noted were associated with two separate circumstances. The first circumstance was areas where golf course maintenance (mowing) encroached into the riparian buffer. This mowing

is no longer posing a problem in the easement due to exclusionary fencing that was installed in the spring.

The second circumstance was associated with sparse vegetative growth occurring under large, mature, pre-existing trees in three locations. These areas were replanted in the spring of 2011 to increase the density of vegetation. Due to the shade from the existing trees, survival of the plantings was less than optimal. This situation is not likely to change unless the large trees were removed which would be counter-productive. Although these areas are not developing a dense undergrowth of shrubby vegetation we are no longer considering them problem areas since the trees in these locations represent an approximate basal area of 116 sq. ft/acre which is within the range of a mature forest. The ground surface is covered with leaf mulch and some herbaceous vegetation is becoming established. No surface erosion is present. The current site conditions of the areas of large pine and oak trees are similar conditions to what one would expect to find under mature oak-pine forest. Additionally, the nutrient reduction qualities and quality as a buffer are equivalent of a mature vegetated hardwood/pine forest. Because these areas have mature trees, are already providing nutrient reduction, and no erosion is occurring, they will no longer be classified as problem areas. These areas will be closely watched during subsequent monitoring events to ensure that they remain stable.

2. Stem Counts

Baseline vegetation plots were established in April 2009 after vegetative planting was completed. Nine (9) vegetation survival plots were staked out in the floodplain and terrace along UT Little Mountain Creek within the project area. Each plot measured 10m X 10m with an area of 100m². Stems were flagged and counted to establish baseline and yearly stem counts. Year 3 vegetation monitoring was performed on September 26, 2011.

Year 3 monitoring revealed an average of 472 woody stems per acre. This average exceeds the required Year 3 threshold of 320 stems per acre for the project. This average is below the baseline count of 621 woody stems per acre and the Year 2 count of 526 woody stems per acre. The range of stem densities encountered on the mitigation site varied from 243 to 647 stems per acre. Seven of the nine vegetation monitoring plots contain a density greater than the 320 planted stems per acre for the required interim threshold for Year 3. Vegetation diversity is low in some individual plots due to shading from large adjacent trees and possible soil compaction. Plot 4 exhibits a density of 283 stems per acre, the same as last year. Plot 6 fell below the Year 3 threshold and now exhibits a stem density of 243 planted stems per acre. In April 2011 approximately 0.9 acres were replanted with 600 bare root trees and 50 container-sized trees to address low survivability in areas within and adjacent to Plots 4 and 6. These supplemental plantings were not very successful and survival remains low in these areas due to shading and possible soil compaction. There will be no further attempts to replant areas within and adjacent to Plots 4 and 6 since overall stem survival for the project is well above required minimum densities and previous attempts were unsuccessful. Species counts of 6 or fewer species now occur in seven of the nine sampling plots (Plots 1, 2, 3, 4, 6, 7, and 9). This is up from 5 during the previous year.

Physical damage was much lower in occurrence this year than previous years. One hundred and thirteen (74%) of all stems had no damage visible. Insects caused the majority of damage and in most cases this was minor (10.9%). Deer activity is still occurring in the easement but does not seem to be causing much of a problem. Three stems had damage that appeared to be a result of human trampling. Though this number is low, it is still likely that

**Table V. Vegetation Plot Stem Count Summary
Badin Inn Stream Restoration/ Project No. 92666**

Species		Plots*									MY3 Totals	MY2 Totals	MY1 Totals	Baseline Totals
Scientific Name	Common Name	01	02	03	04	05	06	07	08	09				
Shrubs														
<i>Sambucus canadensis</i>	Elderberry					1					1	1	1	5
<i>Callicarpa americana</i>	American Beautyberry	2	1			3		4	1	7	18	15	15	16
<i>Prunus americana</i>	American plum		1								1	3	1	1
	Total Shrubs	2	2	0	0	4	0	4	1	7	20	19	17	22
Trees														
<i>Cercis canadensis</i>	Redbud			2	1		3	3	2		11	15	23	22
<i>Carpinus caroliniana</i>	Ironwood	1	1								2	7	3	4
<i>Quercus alba</i>	White oak	4		1		1			1		7	5	4	4
<i>Quercus nigra</i>	Water oak										0	0	2	2
<i>Quercus velutina</i>	Black oak			2							2	2	5	6
<i>Nyssa sylvatica</i>	Black gum				1		1				2	5	6	7
<i>Asimina triloba</i>	Paw Paw					1				8	9	11	9	10
<i>Quercus phellos</i>	Willow oak			2	1			1			4	4	5	3
<i>Cornus florida</i>	Flowering dogwood					1					1	3	4	6
<i>Castanea pumila</i>	Chinquapin			4		2			3		9	17	34	32
<i>Diospyros virginiana</i>	American persimmon		1	4	4	2	1	2	3		17	11	11	11
<i>Morus rubra</i>	Red mulberry	2	2	1				5			10	6	5	5
<i>Betula nigra</i>	River birch						1		1		2	4	2	3
<i>Fraxinus pennsylvanica</i>	Green ash										0	1	1	0
<i>Robiniana pseudoacacia</i>	Black locust		7								7	5	0	0
<i>Hamamelis virginiana</i>	Witchhazel								1		1	0	2	0
<i>Crataegus</i>	Hawthorn species										0	1	0	0
<i>Ulmus rubra</i>	Slippery elm					1					1	0	2	0
<i>Quercus sp.</i>	Oak species										0	1	0	0
<i>Unknown</i>											0	0	0	0
	Total Trees	7	11	16	7	8	6	11	11	8	85	98	118	116
TABLE SUMMARY														
	<i>Total Woody Stems</i>	9	13	16	7	12	6	15	12	15	106	117	134	138
	% Shrubs	22%	15%	0%	0%	33%	0%	27%	8%	47%	19%	16%	13%	16%
	% Trees	78%	85%	100%	100%	67%	100%	73%	92%	53%	80%	84%	87%	84%
Current Density														
	Shrubs per acre	81	81	0	0	162	0	162	40	283	90	85	76	99
	Shrubs per hectare	200	200	0	0	400	0	400	100	700	222	211	189	244
	Trees per acre	283	445	647	283	324	243	445	445	324	382	441	531	522
	Trees per hectare	700	1100	1600	700	800	600	1100	1100	800	944	1089	1311	1289
	Total stems per acre	364	526	647	283	486	243	607	486	607	472	526	607	621
	Total stems per hectare	900	1300	1600	700	1200	600	1500	1200	1500	1167	1300	1500	1533

some of the dead and missing stems are a result of trampling. This is an ongoing problem and golf balls are commonly found in the easement indicating that golfers frequently hit wayward shots and likely spend time searching for their ball. Sturdier fencing was installed this spring and has reduced the golf course maintenance machinery intrusions in the easement but doesn't impede people from searching for missing golf balls in the easement.

The soft rush (*Juncus effuses*) plugs and live stakes remain healthy and the live stakes are exhibiting rapid growth with little evidence of difficulty. Some of the shrubs that have developed from the willow (*Salix sp.*) live stakes have reached heights of over 15 feet tall. Native dog fennel (*Eupatorium capillifolium*), river birch (*Betula nigra*), loblolly pine (*Pinus taeda*), and sweetgum (*Liquidambar styraciflua*) have begun colonizing the easement.

B. Stream Assessment

The stream remains in excellent condition. No problem areas were noted this year. Overall, the stream is remaining close to as-built morphology and no signs of bank or structure instability were noted. The slight degradation noted in the MY2 report in the left floodplain of the riffle at Cross Section 9 has remained stable since last year. Slight changes from as-built morphology are to be expected as time progresses and ultimate stability is achieved.

1. Morphometric Criteria

Considering the 5 year timeframe of standard mitigation monitoring, restored streams should demonstrate morphologic stability in order to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the several months that follow construction and some change/variation subsequent to that is to also be expected. However, the observed change should not indicate a high rate or be unidirectional over time such that a robust trend is evident. If some trend is evident, it should be very modest or indicate migration to another stable form. Examples of the latter include depositional processes resulting in the development of constructive features on the banks and floodplain, such as an inner berm, slight channel narrowing, modest natural levees, and general floodplain deposition. Annual variation is to be expected, but over time this should demonstrate maintenance around some acceptable central tendency while also demonstrating consistency or a reduction in the amplitude of variation. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed over the monitoring period.

For channel dimension, cross-sectional overlays and key parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modest overall change and patterns of variation that are in keeping with above. For the channels' profile, the reach under assessment should not demonstrate any consistent trends in thalweg aggradation or degradation over any significant continuous portion of its length. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against

the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with maintenance around design/As-built distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallow with greater water surface slopes. Substrate measurements should indicate the progression towards, or the maintenance of, the known distributions from the design phase.

Cross-section and longitudinal surveys were completed on November 22, 2011. Ten cross-sections and approximately 4,022 linear feet of UT Little Mountain Creek and 180 linear feet of the unnamed tributary were surveyed. A bed material analysis was also performed on November 22, 2011 and photographs were taken at all permanent photo points.

A monitoring baseline was established in the Year 0 monitoring effort, and was stationed from 10+00 at the culvert under Valley Drive to 50+22 at the end of the constructed portion of the project, in order to facilitate future monitoring efforts by different monitoring groups. The stationing of this baseline is used to identify locations along the restored portion of UT Little Mountain Creek throughout this report. Tributary stationing is the same in the monitoring as the construction documents.

The assessment included the survey of ten cross-sections, as well as the longitudinal profile. Cross-sections are marked with rebar and are located at the following locations:

- Cross-Section #1. UT Little Mountain Creek, Station 47+67, riffle
- Cross-Section #2. UT Little Mountain Creek, Station 43+05, pool
- Cross-Section #3. UT Little Mountain Creek, Station 38+26, riffle
- Cross-Section #4. UT Little Mountain Creek, Station 33+72, riffle
- Cross-Section #5. UT Little Mountain Creek, Station 29+78, pool
- Cross-Section #6. UT Little Mountain Creek, Station 25+39, riffle
- Cross-Section #7. UT Little Mountain Creek, Station 20+45, pool
- Cross-Section #8. UT Little Mountain Creek, Station 16+50, pool
- Cross-Section #9. UT Little Mountain Creek, Station 13+61, riffle
- Cross-Section #10. Tributary, Station 12+85, Station 10+85, riffle

Survey data collected during future monitoring periods may vary depending on actual rod placement and alignment; however, from this point forward this information should remain similar in overall appearance.

2. Hydrologic Criteria

Monitoring requirements state that at least two bankfull events must be documented through the five-year monitoring period. To assist in documenting bankfull events a stream crest gauge was installed on UT Little Mountain Creek. One previously documented bankfull event occurred on December 25, 2009 following a heavy rainfall event. A second bankfull event occurred prior to September 30, 2010 and was documented by the observation of wrack deposits and vegetation lying flat as a result of flooding. Photo 1 from the 2011 monitoring

year offers evidence of a recent bankfull event prior to the November 22, 2011 monitoring event. Photo 1 shows a photo of vegetation laying flat as a result of flooding.

Table VI. Verification of Bankfull Events Badin Inn Stream Restoration/ Project No. 92666			
Date of Data Collection	Date of Occurrence	Method	Photo # (if applicable)
2009	12-25-09	Photographed on-site	MY1 Report
2010	Before 9-30-10	Photographed on-site	MY2 Report
2011	Before 9-26-11	Photographed on-site	Photo 1



Photo 1. Photo evidence of bankfull event prior to 09-26-11.

Table VII. Categorical Stream Feature Visual Stability Assessment Badin Inn Stream Mitigation Site/Project No. 92666					
Feature	Initial	MY-01	MY-02	MY-03	MY-04
A. Riffles	100%	99%	100%	100%	
B. Pools	100%	100%	100%	100%	
C. Thalweg	100%	100%	100%	100%	
D. Meanders	100%	100%	100%	100%	
E. Bed General	100%	100%	100%	100%	
F. Vanes/J Hooks etc.	100%	100%	100%	100%	
G. Wads and Boulders	100%	100%	100%	100%	

IV. METHODOLOGY

The survey of the cross-sections and longitudinal profile were performed using RTK survey-grade GPS and/or total station survey equipment to detect thalweg, bankfull, and water surface elevations of the UT to Little Mountain Creek. A monitoring baseline was established in the Year 0 monitoring effort, and was stationed from the downstream end of the constructed portion of the project upstream to approximately station 10+00, in order to facilitate future monitoring efforts by different monitoring groups. The stationing of this baseline is used to identify locations along the restored portion of UT Little Mountain Creek throughout this report. The entire length of the tributary is surveyed annually as well. Baseline cross sections were established for ten cross sections. During monitoring year 1, it was found that one or more pins were “removed” from cross sections 5 and 8. These missing pins were reset and the monitoring year 1 data will be used as the new baseline data for these two cross sections.

Data was entered into the stream morphology applications program, Rivermorph, to obtain the dimensions of the cross sections and parameters applicable to the longitudinal profile. Reports generated by Rivermorph are used in this report to display and summarize stream survey data.

Table VIII. Baseline Stream Data Summary
Badin Inn Stream Restoration - EEP Project No. 92666
Reach I (4,174 feet)

Parameter	Gauge	Regional Curve			Pre-Existing Condition			Reference Reach UT to Meadow Fork Creek			Reference Reach Spencer Creek			Design UT to Little Mountain Creek			Design Tributary			As-Built UT to Little Mountain Creek			As-Built Tributary		
		Min	Max	Med	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Dimension and Substrate - Riffle																									
Bankfull Width (ft)	NA									11.81			12.3			10			5.6	9.4	11.6	10.9			6.29
Floodprone Width (ft)																				44.5	53.4	48.7			46.9
Bankfull Cross Sectional Area (ft ²)	NA									15.34			10.8			7			3.2	7.2	9	8.0			2.64
Bankfull Mean Depth (ft)	NA									1.3			0.88			0.7			0.57	0.65	0.8	0.73			0.42
Bankfull Max Depth (ft)	NA					2.5				2.11			1.8			1			0.7	1.04	1.25	1.19			0.56
Width/Depth Ratio	NA									9.08			13.98			14.3			9.82	12.17	17.89	14.99			14.98
Entrenchment Ratio	NA									28.11			>2.2			>2.2			>2.2	3.97	5.37	4.49			7.45
Bank Height Ratio	NA							1.03	1.05	1.04			1.1			1			1			1			1
Wetted Perimeter (ft)	NA																								
Hydraulic Radius (ft)	NA																								
Pattern																									
Channel Beltwidth (ft)								22	57.1	37.2	24	52	38	18.6	48.3	33.4	10.4	27.1	18.7	18.6	48.3	33.5	10.4	27.1	18.7
Radius of Curvature (ft)								18	42.8	25	5.4	22.1	12.9	22.1	42.3	32.2	12.4	23.7	18.0	22.1	42.3	32.2	12.4	23.7	18.03
Meander Wavelength (ft)								78.5	149.9	107.1	54	196	125	43.9	159.3	101.6	24.6	89.2	56.9	43.9	159.4	101.6	24.6	89.2	56.9
Meander Width Ratio								1.86	4.83	3.15	1.95	4.23	3.09	1.86	4.83	3.35	1.86	4.83	3.35	1.86	4.83	3.35	1.86	4.83	3.35
Profile																									
Riffle Length (ft)														14.3	154.4	49.0	18.9	28.5	24.8	18.2	121.0	54.0	17.2	22.5	20.9
Riffle Slope (ft/ft)								0.011	0.021	0.017	0.02	0.036	0.026	0.012	0.037	0.019	0.022	0.04	0.03	0.0053	0.0205	0.0143	0.0162	0.0505	0.0275
Pool Length (ft)								12.9	20.8	18.0	9.3	23.9	17.8	18.3	31	24.6	10.2	17.3	13.8	14.8	41.8	22.1	10.9	25.7	16.3
Pool Spacing (ft)								79.4	96.9	88.2	13	46.5	24.2	68.4	83.1	75.7	5.9	21.1	13.5	36.3	148.0	66.6	36.6	39.7	38.1
Substrate																									
d50(mm)	NA																								
d84 (mm)	NA																								
Additional Reach Parameters																									

NOT APPLICABLE - STREAM IS COMPLETELY MODIFIED

Valley length (ft)					3540			200			235			3820			157									
Channel length (ft)					3540			288			266			3994			180			3994			180			
Sinuosity (ft)					1			1.4			1.1			1.33			1.03			1.33			1.03			
Water Surface Slope (Channel) (ft/ft)	NA				0.0178			0.0122			0.0132			0.0134			0.0147			0.012			0.012			
BF slope (ft/ft)	NA				0.0178			0.0122			0.0132			0.0134			0.0147			0.012			0.012			
Rosgen Classification	NA				NA			E4			C4			C4			C4			C4			C4			
Habitat Index					N/A			N/A			N/A			N/A			N/A			N/A			N/A			
Macrobenthos					N/A			N/A			N/A			N/A			N/A			N/A			N/A			

Table IX. Morphology and Hydraulic Monitoring Summary
Badin Inn Stream Restoration/ EEP Project No. 92666
Reach 1 (4,174 feet)

Parameter	Cross Section 1					Cross Section 2					Cross Section 3					Cross Section 4					Cross Section 5					
	Riffle					Pool					Riffle					Riffle					Pool					
Dimension	MY1*	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	
BF Width (ft)	11.58	11.81	11.94			10.38	12.34	8.5			10.47	9.97	9.97			9.9	10.1	10.15			7.59	9.29	10.08			
Floodprone Width (ft) (approx)	50.0	52.6	52.6			40.5	44.8	44.2			45.9	53.7	51.5			44.9	46.8	47.2			40.3	51.1	51.6			
BF Cross-Sectional Area (ft ²)	6.5	9.46	8.32			7.78	8.28	6.62			5.8	6.02	5.95			6.72	8.08	8.54			8.11	9.36	11.83			
BF Mean Depth (ft)	0.56	0.8	0.7			0.75	0.67	0.78			0.55	0.6	0.6			0.68	0.8	0.84			1.07	1.01	1.17			
BF Max Depth (ft)	1.03	1.36	1.45			1.35	1.47	1.34			0.96	0.96	0.9			1.24	1.18	1.29			1.94	1.98	1.97			
Width/Depth Ratio	20.68	14.76	17.06			13.84	18.42	10.9			19.04	16.62	16.62			14.56	12.62	12.08			7.09	9.2	8.62			
Entrenchment Ratio	4.32	4.46	4.4			3.9	3.63	5.2			4.39	5.39	5.17			4.54	4.64	4.65			5.31	5.51	5.12			
Wetted Perimeter (ft)	11.85	12.19	12.38			10.99	12.77	9.06			10.8	10.27	10.23			10.24	10.6	10.61			9.42	10.17	10.96			
Hydraulic radius (ft)	0.55	0.78	0.67			0.71	0.65	0.73			0.54	0.59	0.58			0.66	0.76	0.8			0.86	0.92	1.08			
Bank Height Ratio (ft/ft)	1	1	1			1	1	1			1	1	1			1	1	1			1	1	1			
Substrate																										
d50 (mm)	29.1	22.6	14.8			9.6	23.5	12.8			8.7	51.3	8			1	9.6	17.1			0.6	18.2	0.1			
d84 (mm)	71.8	128	77.5			34.18	167.9	87.9			45	277.2	45			71.4	139.3	78.5			16	56.4	16			
Parameter	MY-01 (2009)				MY-02 (2010)				MY-03 (2011)				MY-04 (2012)				MY-05 (2013)				MY+ (2014)					
Pattern	Min	Max	Med		Min	Max	Med		Min	Max	Med		Min	Max	Med		Min	Max	Med		Min	Max	Med			
Channel Beltwidth (ft)	18.6	48.3	33.4		18.6	48.3	33.4		18.6	48.3	33.4															
Radius of Curvature (ft)	22.1	42.3	32.2		22.1	42.3	32.2		22.1	42.3	32.2															
Meander Wavelength (ft)	43.9	159.3	101.6		43.9	159.3	101.6		43.9	159.3	101.6															
Meander Width Ratio	1.86	4.83	3.35		1.86	4.83	3.35		1.86	4.83	3.35															
Profile																										
Riffle Length (ft)	18.2	121.0	54.0		35.2	151.3	92.2		12.5	90.1	41.7															
Riffle Slope (ft/ft)	0.0053	0.0205	0.014		0.0090	0.0359	0.0179		0.0083	0.0263	0.0171															
Pool length (ft)	14.8	41.9	22.1		23.9	47.2	32.2		18.7	61.8	32.7															
Pool spacing (ft)	36.3	148.1	66.6		58.6	151.3	92.2		48.3	115.3	69.4															
Additional Reach Parameters																										
Valley Length (ft)	3820				3820				3820																	
Channel Length (ft)	3994				3994				3994																	
Sinuosity	1.33				1.33				1.33																	
Water Surface Slope (ft/ft)	0.012				0.012				0.012																	
BF Slope (ft/ft)	0.012				0.012				0.012																	
Rosgen Classification	C4				C4				C4																	
Habitat Index																										
Macrobenthos																										

Table IX. Morphology and Hydraulic Monitoring Summary
Badin Inn Stream Restoration/ EEP Project No. 92666
Reach 1 (4,174 feet)

Parameter	Cross Section 6					Cross Section 7					Cross Section 8					Cross Section 9					Cross Section 10				
	Riffle					Pool					Pool					Riffle					Tributary - Riffle				
Dimension	MY1*	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	10.54	9.92	9.94			16.38	14.42	12.07			8.87	13.88	8.54			10.12	11.06	9.81			5.77	8.28	7.07		
Floodprone Width (ft) (approx)	39.5	52.5	53			40.0	40.5	40.5			49.3	60.0	62.5			39.7	47.3	48.8			46.9	47.9	48		
BF Cross-Sectional Area (ft ²)	7.57	7.58	7.66			20.01	18.54	16.01			5.19	14.56	12.26			8.87	9.63	8.41			1.97	3.33	3.11		
BF Mean Depth (ft)	0.72	0.76	0.77			1.22	1.29	1.33			0.58	1.05	1.44			0.88	0.87	0.86			0.34	0.4	0.44		
BF Max Depth (ft)	1.11	1.12	1.13			2.49	2.53	2.47			1.93	2.28	2.67			1.31	1.53	1.47			0.6	0.66	0.71		
Width/Depth Ratio	14.64	13.05	12.91			13.43	11.18	9.08			15.29	13.22	5.93			11.5	11.31	11.41			16.97	20.7	16.0		
Entrenchment Ratio	3.75	5.29	5.33			2.44	1.62	3.36			5.56	4.32	7.32			3.93	4.27	4.98			8.12	5.79	6.79		
Wetted Perimeter (ft)	11.02	10.3	10.32			17.35	15.68	13.48			10.19	14.97	10.28			10.68	11.88	10.44			5.99	8.48	7.32		
Hydraulic radius (ft)	0.69	0.74	0.74			1.15	1.18	1.19			0.51	0.97	1.19			0.83	0.81	0.81			0.33	0.39	0.42		
Bank Height Ratio (ft/ft)	1	1	1			1	1	1			1	1	1			1	1	1			1	1	1		
Substrate																									
d50 (mm)	31.37	40.36	20.95			0.06	0.04	8.83			0.05	0.05	0.06			38.5	0.04	26.9			13.18	92.71	25.3		
d84 (mm)	62.54	77.98	44			18.93	18.78	32			5.7	48.24	16			80.71	19.3	83.4			33.86	167.81	52.1		
Parameter	MY-01 (2009)			MY-02 (2010)			MY-03 (2011)			MY-04 (2012)			MY-05 (2013)			MY+ (2014)									
Pattern	Min	Max	Med		Min	Max	Med		Min	Max	Med		Min	Max	Med		Min	Max	Med		Min	Max	Med		
Channel Beltwidth (ft)																									
Radius of Curvature (ft)																									
Meander Wavelength (ft)																									
Meander Width Ratio																									
Profile																									
Riffle Length (ft)																									
Riffle Slope (ft/ft)																									
Pool length (ft)																									
Pool spacing (ft)																									
Additional Reach Parameters																									
Valley Length (ft)																									
Channel Length (ft)																									
Sinuosity																									
Water Surface Slope (ft/ft)																									
BF Slope (ft/ft)																									
Rosgen Classification																									
Habitat Index																									
Macrobenthos																									

APPENDIX A

1. Vegetation Data Tables

- Table 1. Vegetation Metadata

- Table 2. Vegetation Vigor by Species

- Table 3. Vegetation Damage by Species

- Table 4. Vegetation Damage by Plot

- Table 5. Stem Count by Plot and Species

- Table 6. Vegetation Problem Areas Tables

2. Vegetation Monitoring Plot Photos

Badin Inn Stream Restoration Site
 Year 3 Monitoring Report
 Appendix A-1
 Vegetation Data Tables

Table 1. Vegetation Metadata
Badin Inn Stream Restoration/ EEP No. 92666
Appendix A

Report	
Prepared By	Kevin Lapp
Date Prepared	12/5/2011 14:03
database name	AECOM-2008-0.mdb
database	
location	Q:\99255\Monitoring\Vegetation
computer name	USRAL3LT064
file size	45125632
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
	Description of database file, the report worksheets, and a summary of project(s) and project data.
Metadata	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, planted	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Proj, total stems	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Plots	Frequency distribution of vigor classes for stems for all plots.
Vigor	Frequency distribution of vigor classes listed by species.
Vigor by Spp	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage	Damage values tallied by type for each species.
Damage by Spp	Damage values tallied by type for each plot.
Damage by Plot	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	
PROJECT SUMMARY-----	
Project Code	92666
project Name	Badin Inn
Description	
River Basin	Yadkin-Pee Dee
length(ft)	4174
stream-to-edge width (ft)	42
area (sq m)	32570
Required Plots (calculated)	9
Sampled Plots	0

Badin Inn Stream Restoration Site
Year 3 Monitoring Report
Appendix A-1
Vegetation Data Tables

Table 2. Vegetation Vigor by Species								
Badin Inn Stream Restoration/ EEP No. 92666								
Appendix A								
	Species	4	3	2	1	0	Missing	Unknown
	Asimina triloba	4	3	2			2	
	Betula nigra	2						
	Callicarpa americana	9	5	4			1	
	Castanea pumila	4	1		1		1	
	Cornus florida		1					
	Diospyros virginiana	7	3	4			1	
	Fraxinus pennsylvanica							
	Nyssa sylvatica	2					2	
	Prunus americana						2	
	Quercus alba	5		1				
	Quercus nigra						2	
	Quercus phellos	3						
	Quercus velutina							
	Robinia pseudoacacia	2	3	1	1		1	
	Sambucus canadensis	1						
	Ulmus rubra							
	Morus rubra	2	3	3	1		3	
	Carpinus caroliniana				1		4	
	Cercis canadensis		4	4	1			
	Hamamelis virginiana		1					
	Crataegus						1	
	Prunus serotina		1					
TOT:	22	41	25	19	5		20	

Badin Inn Stream Restoration Site
Year 3 Monitoring Report
Appendix A-1
Vegetation Data Tables

Table 3. Vegetation Damage by Species Badin Inn Stream Restoration/ EEP No. 92666 Appendix A									
	SPECIES	All Damage Categories	No Damage	Other damage	Human Trampled	Insects	Other/Unknown Animal	Site Too Dry	Unknown
	<i>Asimina triloba</i>	11	4			5		1	1
	<i>Betula nigra</i>	4	4						
	<i>Callicarpa americana</i>	20	13	3	1	2	1		
	<i>Carpinus caroliniana</i>	5	4	1					
	<i>Castanea pumila</i>	25	23				1	1	
	<i>Cercis canadensis</i>	18	14	1		2		1	
	<i>Cornus florida</i>	2	1	1					
	<i>Crataegus</i>	1	1						
	<i>Diospyros virginiana</i>	18	12	2		1	3		
	<i>Fraxinus pennsylvanica</i>	1	1						
	<i>Hamamelis virginiana</i>	1	1						
	<i>Morus rubra</i>	15	8			2	5		
	<i>Nyssa sylvatica</i>	6	6						
	<i>Prunus americana</i>	2	2						
	<i>Prunus serotina</i>	1			1				
	<i>Quercus alba</i>	7	6			1			
	<i>Quercus nigra</i>	2	2						
	<i>Quercus phellos</i>	4	4						
	<i>Quercus velutina</i>	3	3						
	<i>Robinia pseudoacacia</i>	8	3	1	1	3			
	<i>Sambucus canadensis</i>	1				1			
	<i>Ulmus rubra</i>	1	1						
TOT:	22	156	113	9	3	17	10	3	1

Badin Inn Stream Restoration Site
 Year 3 Monitoring Report
 Appendix A-1
 Vegetation Data Tables

Table 4. Vegetation Damage by Plot Badin Inn Stream Restoration/ EEP No. 92666 Appendix A									
	PLOT	All Damage Categories	No Damage	Other damage	Human Trampled	Insects	Other/Unknown Animal	Site Too Dry	Unknown
	92666-01-0001-year:3	18	14	1	1	1	1		
	92666-01-0002-year:3	23	12	3	2	5	1		
	92666-01-0003-year:3	21	21						
	92666-01-0004-year:3	12	10			1	1		
	92666-01-0005-year:3	15	8	2		2	2	1	
	92666-01-0006-year:3	14	13				1		
	92666-01-0007-year:3	23	17	1			4	1	
	92666-01-0008-year:3	14	11			2		1	
	92666-01-0009-year:3	16	7	2		6			1
TOT:	9	156	113	9	3	17	10	3	1

Badin Inn Stream Restoration Site
Year 3 Monitoring Report
Appendix A-1
Vegetation Data Tables

Table 5. Stem Count by Plot and Species Badin Inn Stream Restoration/ EEP No. 92666 Appendix A													
	Species	Total Planted Stems	# plots	Avg# stems	Plot 92666-01-0001-year:2	Plot 92666-01-0002-year:2	Plot 92666-01-0003-year:2	Plot 92666-01-0004-year:2	Plot 92666-01-0005-year:2	Plot 92666-01-0006-year:2	Plot 92666-01-0007-year:2	Plot 92666-01-0008-year:2	Plot 92666-01-0009-year:2
	<i>Asimina triloba</i>	9	2	4.5					1				8
	<i>Betula nigra</i>	2	2	1						1		1	
	<i>Callicarpa americana</i>	18	6	3	2	1			3		4	1	7
	<i>Carpinus caroliniana</i>	1	1	1	1								
	<i>Castanea pumila</i>	6	3	2			1		2			3	
	<i>Cercis canadensis</i>	9	5	1.8		1		1		2	3	2	
	<i>Cornus florida</i>	1	1	1					1				
	<i>Diospyros virginiana</i>	14	7	2		1	1	4	2	1	2	3	
	<i>Hamamelis virginiana</i>	1	1	1								1	
	<i>Morus rubra</i>	9	3	3	2	2					5		
	<i>Nyssa sylvatica</i>	2	2	1				1		1			
	<i>Prunus americana</i>	1	1	1		1							
	<i>Quercus alba</i>	6	3	2	4				1			1	
	<i>Quercus phellos</i>	3	3	1			1	1			1		
	<i>Robinia pseudoacacia</i>	7	1	7		7							
	<i>Sambucus canadensis</i>	1	1	1					1				
TOT:	16	90	16		9	13	3	7	11	5	15	12	15

Badin Inn Stream Restoration Site
Year 3 Monitoring Report
Appendix A-1
Vegetation Data Tables

Table 6. Vegetation Problem Areas Badin Inn Stream Restoration/ EEP No. 92666 Appendix A			
Feature/Issue	Station#/Range	Probable Cause	Photo #
None identified	N/A	N/A	N/A

Badin Inn Stream Restoration Site
Year 3 Monitoring Report
Appendix A-2
Vegetation Sampling Plot Photos



Vegetation Plot 1 facing 210°.



Vegetation Plot 2 facing 150°.



Vegetation Plot 3 facing 210°.



Vegetation Plot 4 facing 160°.



Vegetation Plot 5 facing 180°.



Vegetation Plot 6 facing 260°.

Badin Inn Stream Restoration Site
Year 3 Monitoring Report
Appendix A-2
Vegetation Sampling Plot Photos



Vegetation Plot 7 facing 260°.



Vegetation Plot 8 facing 310°.



Vegetation Plot 9 facing 340°.

APPENDIX B

1. Stream Problem Areas Plan View (not included, incorporated into Appendix C)
2. Table B.1. Stream Problem Areas Table
3. Representative Stream Problem Area Photos
4. Stream Photo Station Photos
5. Table B.2. Visual Morphological Stability Assessment
6. Annual Overlays of Cross Section Plots
7. Annual Overlays of Longitudinal Plots
8. Annual Overlays of Pebble Count Frequency Distribution Plots

Badin Inn Stream Restoration Site
 Mitigation Report
 Appendix B-2
 Stream Problem Areas Table

B-1 Stream Problem Areas Plan View has been incorporated into Appendix C (Integrated Plan View)

Table B.1. Stream Problem Areas Badin Inn Stream Restoration/ EEP No. 92666 Appendix B			
Feature/Issue	Station#/Range	Probable Cause	Photo #
<i>None Observed</i>			

Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-3
Stream Problem Area Photos

None Taken

Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-4
Stream Photo-Station Photos



Photo Point 1. Upstream From Cross Section 1.



Photo Point 1. Downstream from Cross Section 1.



Photo Point 2. Upstream from Cross Section 2.



Photo Point 2. Downstream from Cross Section 2.



Photo Point 3. Upstream from Cross Section 3.



Photo Point 3. Downstream from Cross Section 3.

Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-4
Stream Photo-Station Photos



Photo Point 4. Upstream from Cross Section 4.



Photo Point 4. Downstream from Cross Section 4.



Photo Point 5. Upstream from Cross Section 5.



Photo Point 5. Downstream from Cross Section 5.



Photo Point 6. Upstream from Cross Section 6.



Photo Point 6. Downstream from Cross Section 6.

Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-4
Stream Photo-Station Photos



Photo Point 7. Upstream from Cross Section 7.



Photo Point 7. Downstream from Cross Section 7.



Photo Point 8. Upstream from Cross Section 8.



Photo Point 8. Downstream from Cross Section 8.



Photo Point 9. Upstream from Cross Section 9.



Photo Point 9. Downstream from Cross Section 9.

Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-4
Stream Photo-Station Photos



Photo Point 10. Upstream from
Tributary Cross Section.



Photo Point 10. Downstream from
Tributary Cross Section.

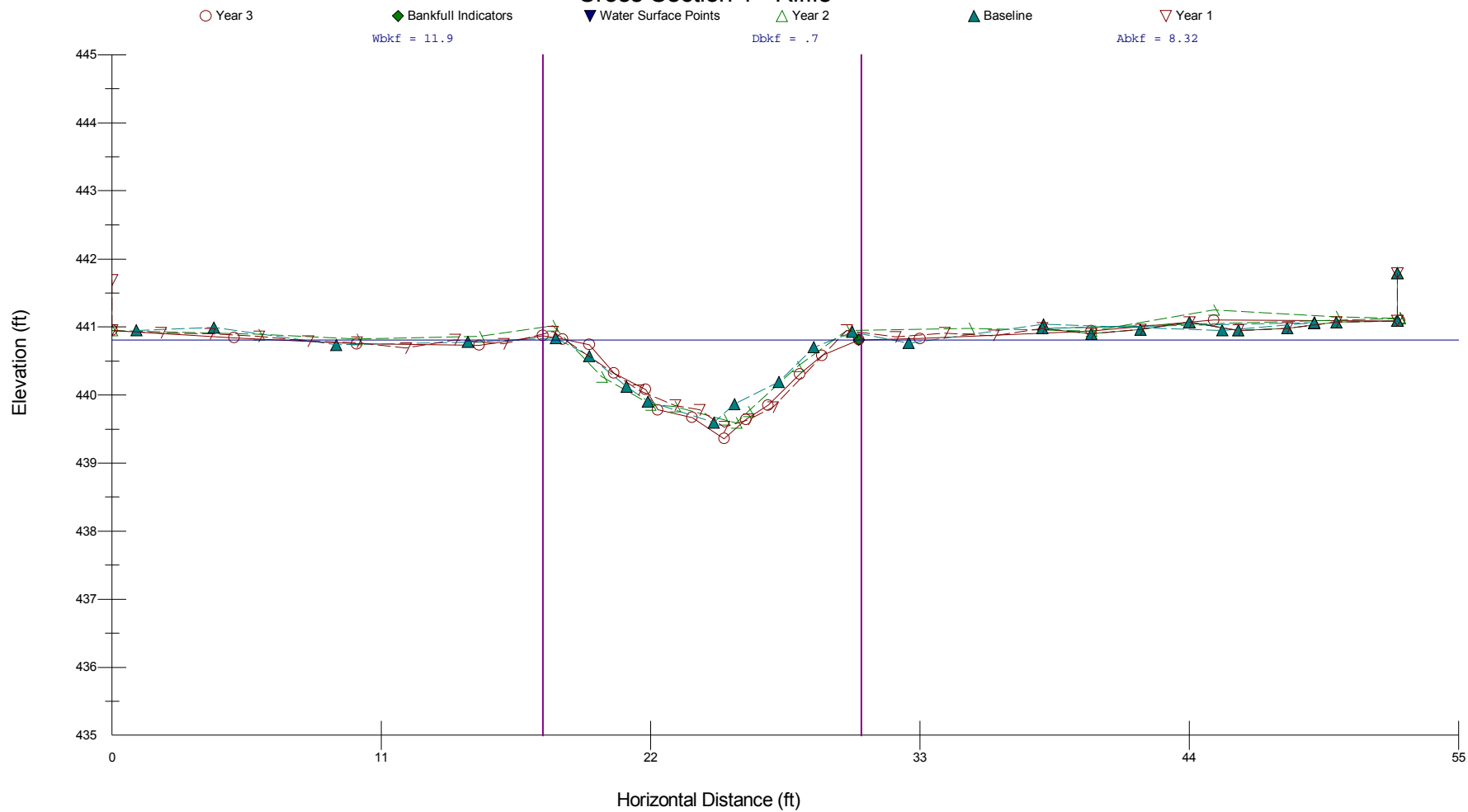
Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-5
Visual Morphological Stability Assessment

Table B2. Visual Morphological Stability Assessment Badin Inn Stream Restoration/ EEP Number 92666 UT Little Mountain Creek/ 4,022 feet						
Feature Category	Metric (Per As-built and reference baselines)	# Stable Number Perform. as Intended	Total No. per As-built	Total Number/ feet in unstable state	% Perform. in stable condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	58	58	NA	100	100
	2. Armor stable (e.g. no displacement)	58	58	0	100	100
	3. Facet grade appears stable	58	58	NA	100	100
	4. Minimal evidence of embedding/fining	58	58	NA	100	100
	5. Length appropriate	58	58	NA	100	100
B. Pools	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	58	58	NA	100	100
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	NA	NA	NA	NA	NA
	3. Length appropriate?	58	58	NA	100	100
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	NA	NA	NA	NA	NA
	2. Downstream of meander (glide/inflection) centering?	NA	NA	NA	NA	NA
D. Meanders	1. Outer bend in state of limited/controlled erosion?	44	44	NA	100	100
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	NA	100	100
	3. Apparent Rc within spec?	44	44	NA	100	100
	4. Sufficient floodplain access and relief?	44	44	NA	100	100
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA		100	100
	2. Channel bed degradation - areas of increasing down-cutting or headcutting	NA	NA		100	100
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA		100	100
G. Vanes	1. Free of back or arm scour?	17	17	NA	100	100
	2. Height appropriate?	17	17	NA	100	100
	3. Angle and geometry appear appropriate?	17	17	NA	100	100
	4. Free of piping or other structural failures?	17	17	NA	100	100
H. Wads/ Boulders	1. Free of scour?	NA	NA	NA	NA	NA
	2. Footing stable?	NA	NA	NA	NA	NA

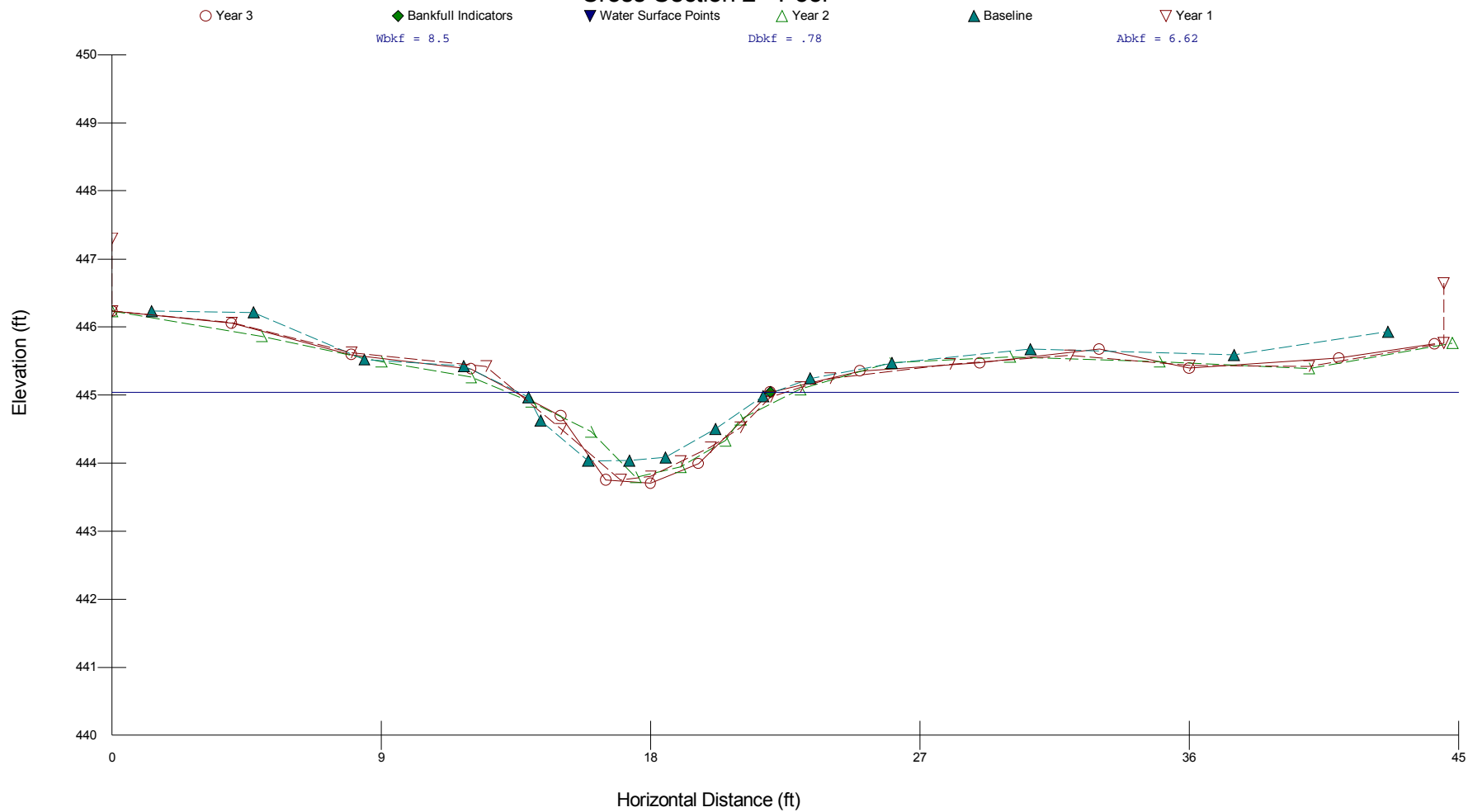
Badin Inn Stream Restoration Site
Mitigation Report
Appendix B-5
Visual Morphological Stability Assessment

Table B2. Visual Morphological Stability Assessment Badin Inn Stream Restoration/ EEP Number 92666 Tributary/ 180 feet						
Feature Category	Metric (Per As-built and reference baselines)	# Stable Number Perform. as Intended	Total No. per As-built	Total Number/ feet in unstable state	% Perform. in stable condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	4	4	NA	100	100
	2. Armor stable (e.g. no displacement)	4	4	0	100	100
	3. Facet grade appears stable	4	4	NA	100	100
	4. Minimal evidence of embedding/fining	4	4	NA	100	100
	5. Length appropriate	4	4	NA	100	100
B. Pools	1. Present? (e.g. not subject to severe aggrad. Or migrat.?)	4	4	NA	100	100
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	NA	NA	NA	NA	NA
	3. Length appropriate?	4	4	NA	100	100
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	NA	NA	NA	NA	NA
	2. Downstream of meander (glide/inflection) centering?	NA	NA	NA	NA	NA
D. Meanders	1. Outer bend in state of limited/controlled erosion?	4	4	NA	100	100
	2. Of those eroding, # w/concomitant point bar formation?	NA	NA	NA	100	100
	3. Apparent Rc within spec?	4	4	NA	100	100
	4. Sufficient floodplain access and relief?	4	4	NA	100	100
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	NA	100	100
	2. Channel bed degradation - areas of increasing down-cutting or headcutting	NA	NA	NA	100	100
F. Bank	1. Actively eroding, wasting, or slumping bank	NA	NA	NA	100	100
G. Vanes	1. Free of back or arm scour?	NA	NA	NA	NA	NA
	2. Height appropriate?	NA	NA	NA	NA	NA
	3. Angle and geometry appear appropriate?	NA	NA	NA	NA	NA
	4. Free of piping or other structural failures?	NA	NA	NA	NA	NA
H. Wads/ Boulders	1. Free of scour?	NA	NA	NA	NA	NA
	2. Footing stable?	NA	NA	NA	NA	NA

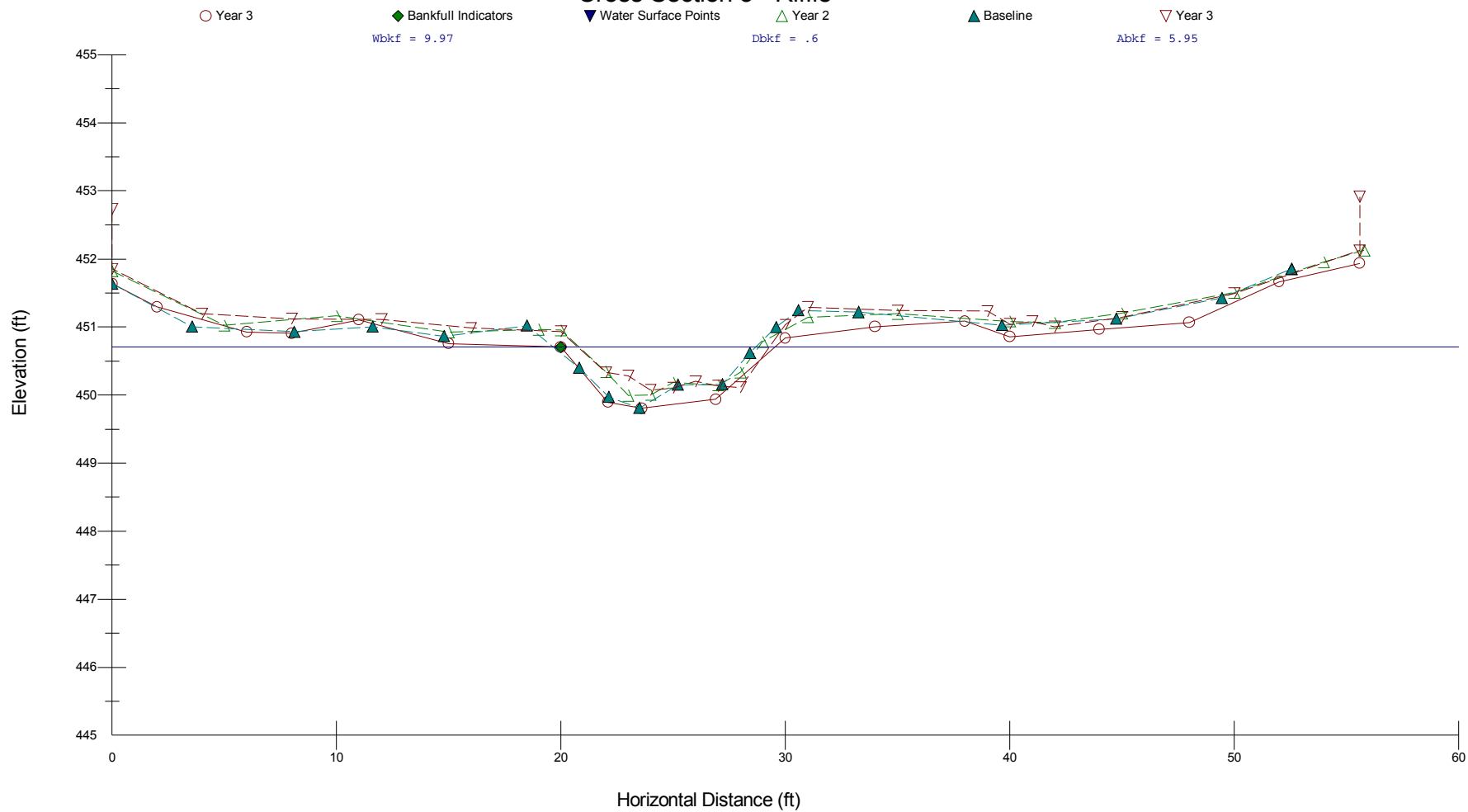
Cross Section 1 - Riffle



Cross Section 2 - Pool



Cross Section 3 - Riffle

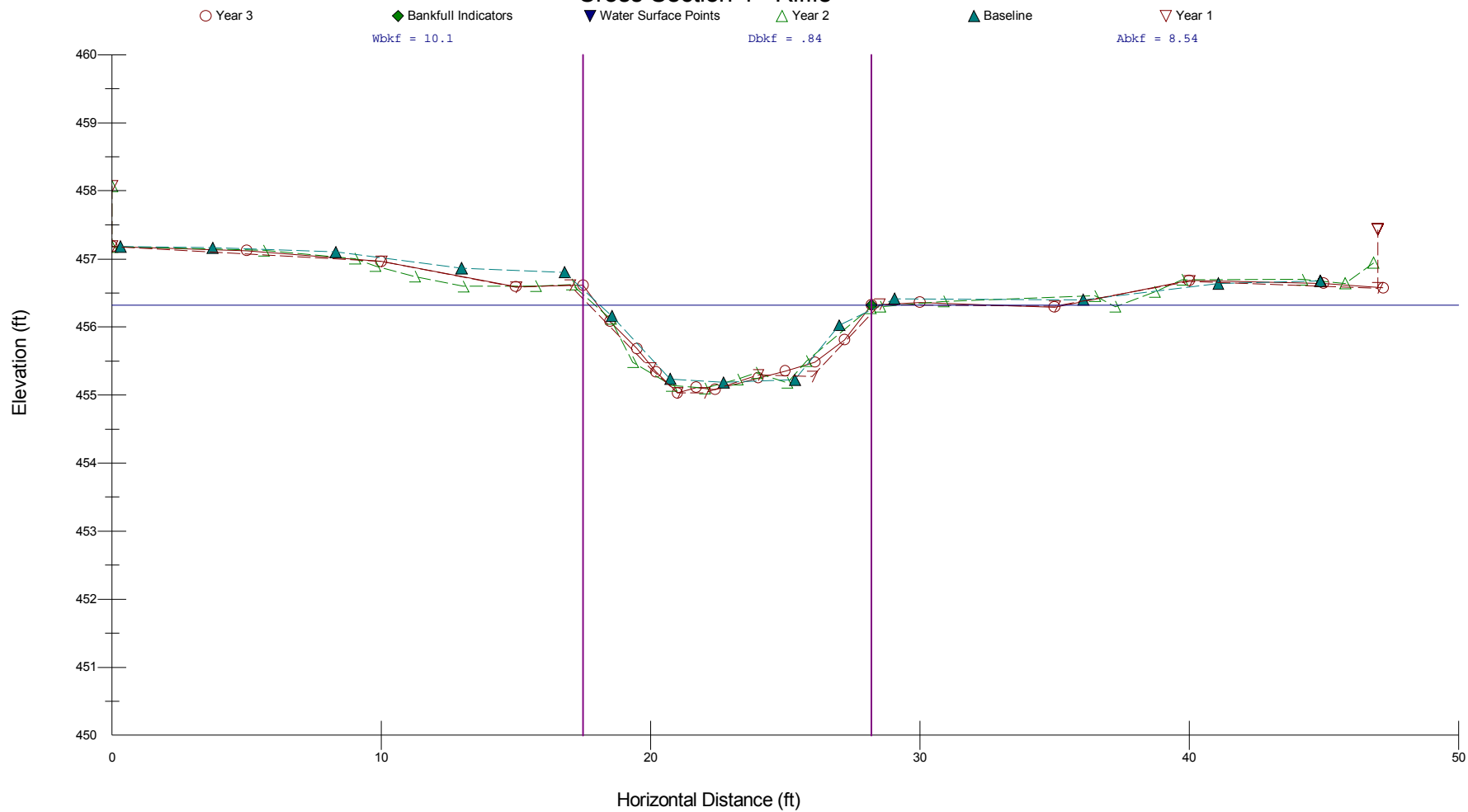


Bankfull Indicators
Wbkf = 9.97

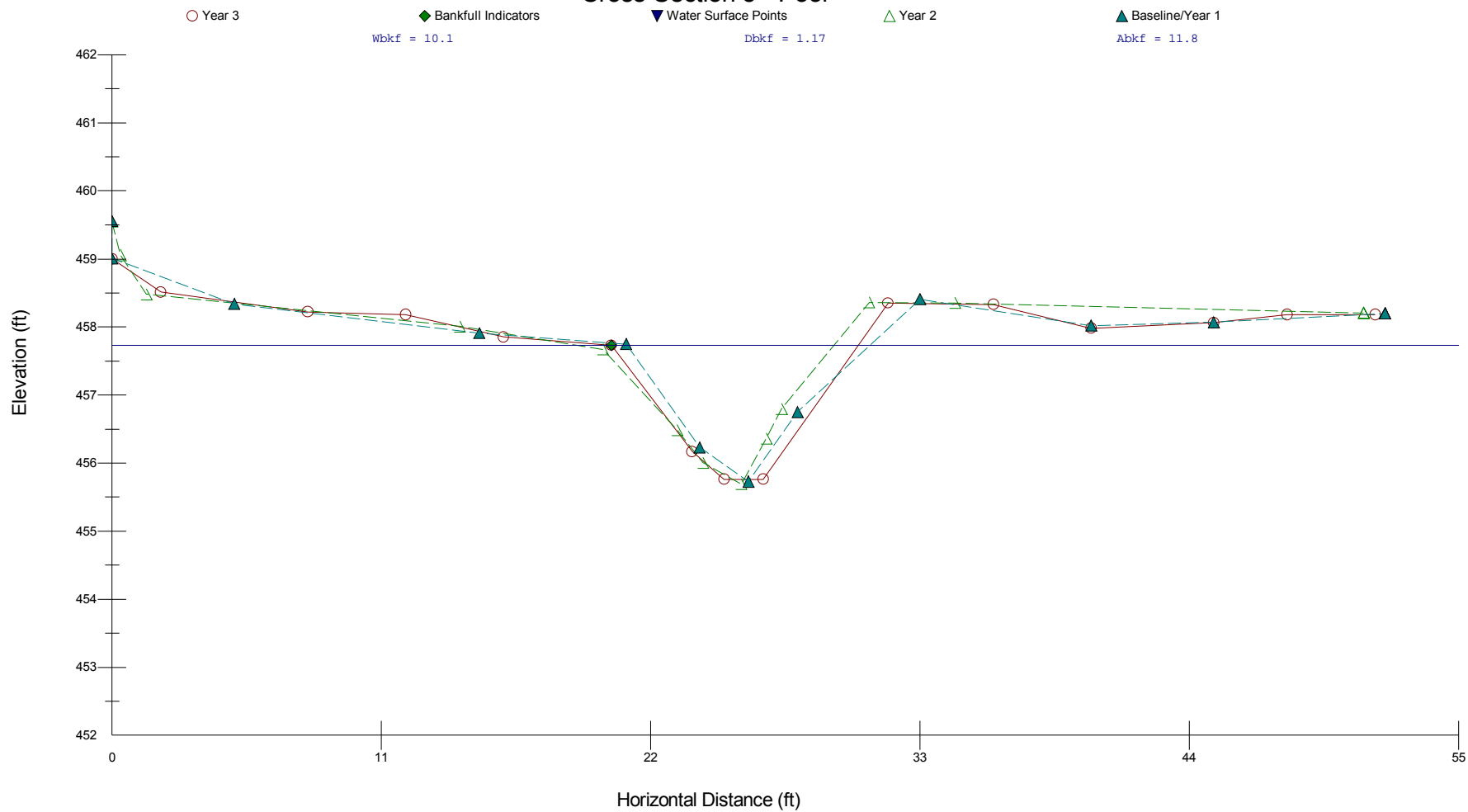
Water Surface Points
Dbkf = .6

Year 3
Abkf = 5.95

Cross Section 4 - Riffle

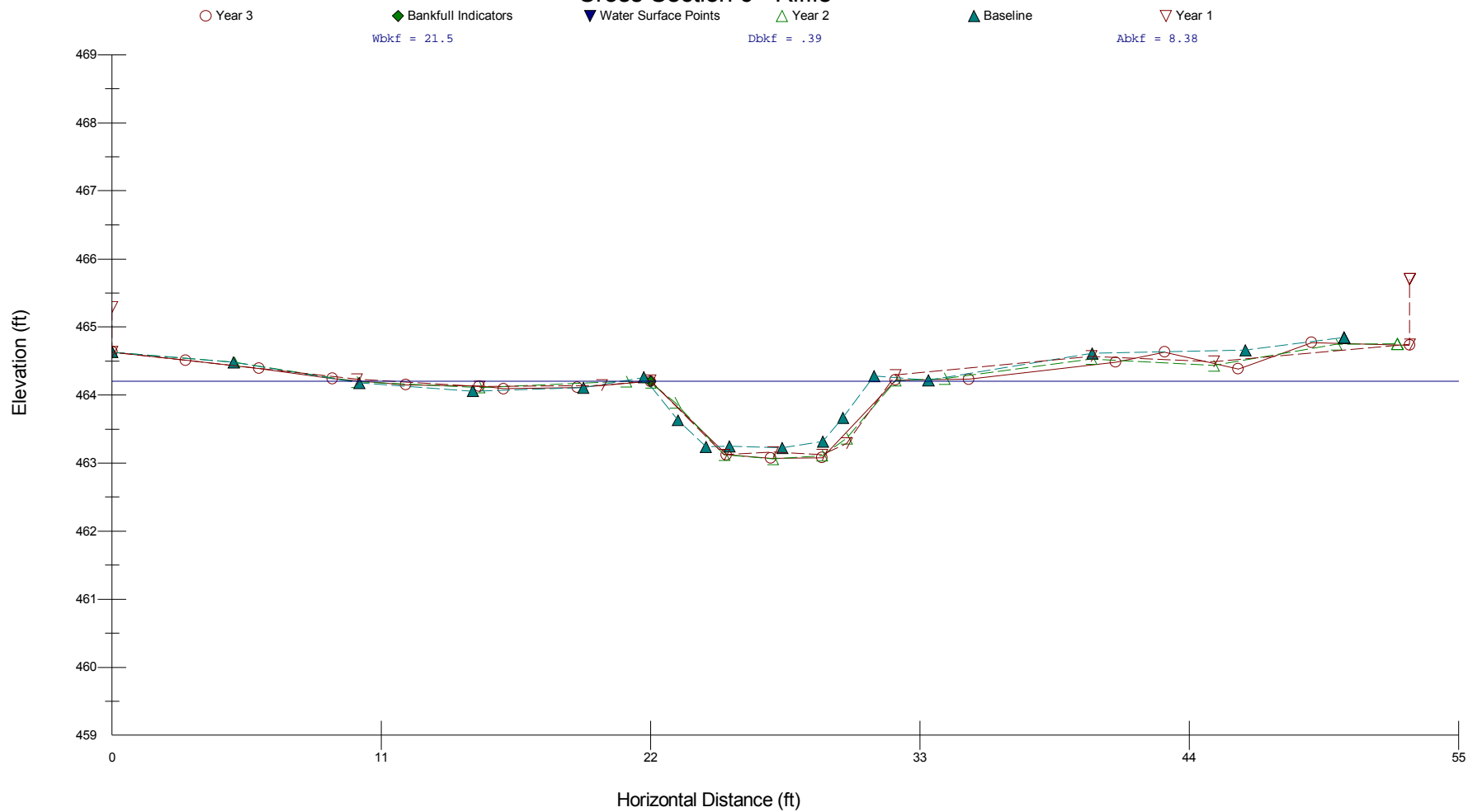


Cross Section 5 - Pool



Note: Cross-section location reset in Year 1 and is used as baseline

Cross Section 6 - Riffle



○ Year 3

◆ Bankfull Indicators

▼ Water Surface Points

△ Year 2

▲ Baseline

▽ Year 1

Wbkf = 21.5

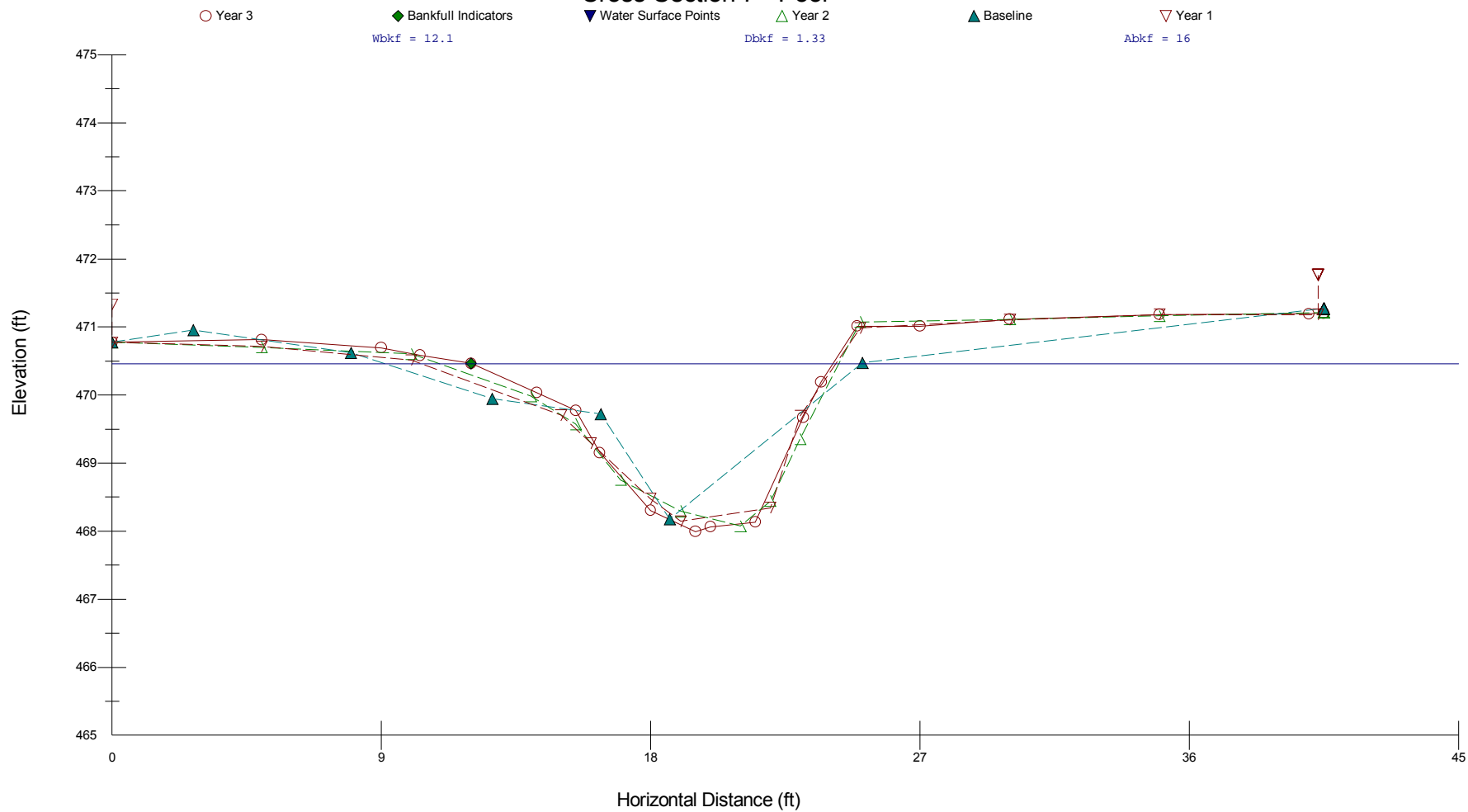
Dbkf = .39

Abkf = 8.38

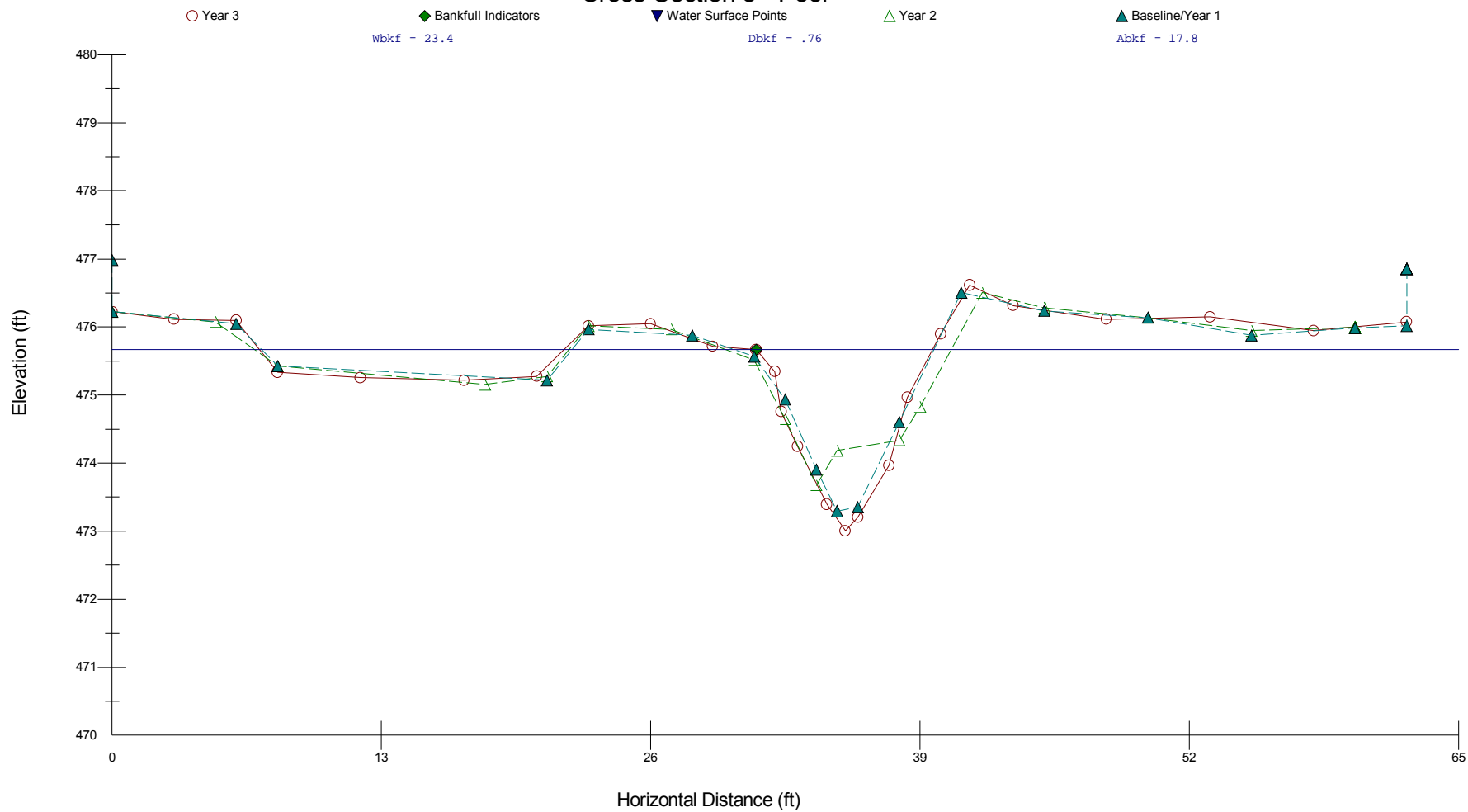
Elevation (ft)

Horizontal Distance (ft)

Cross Section 7 - Pool

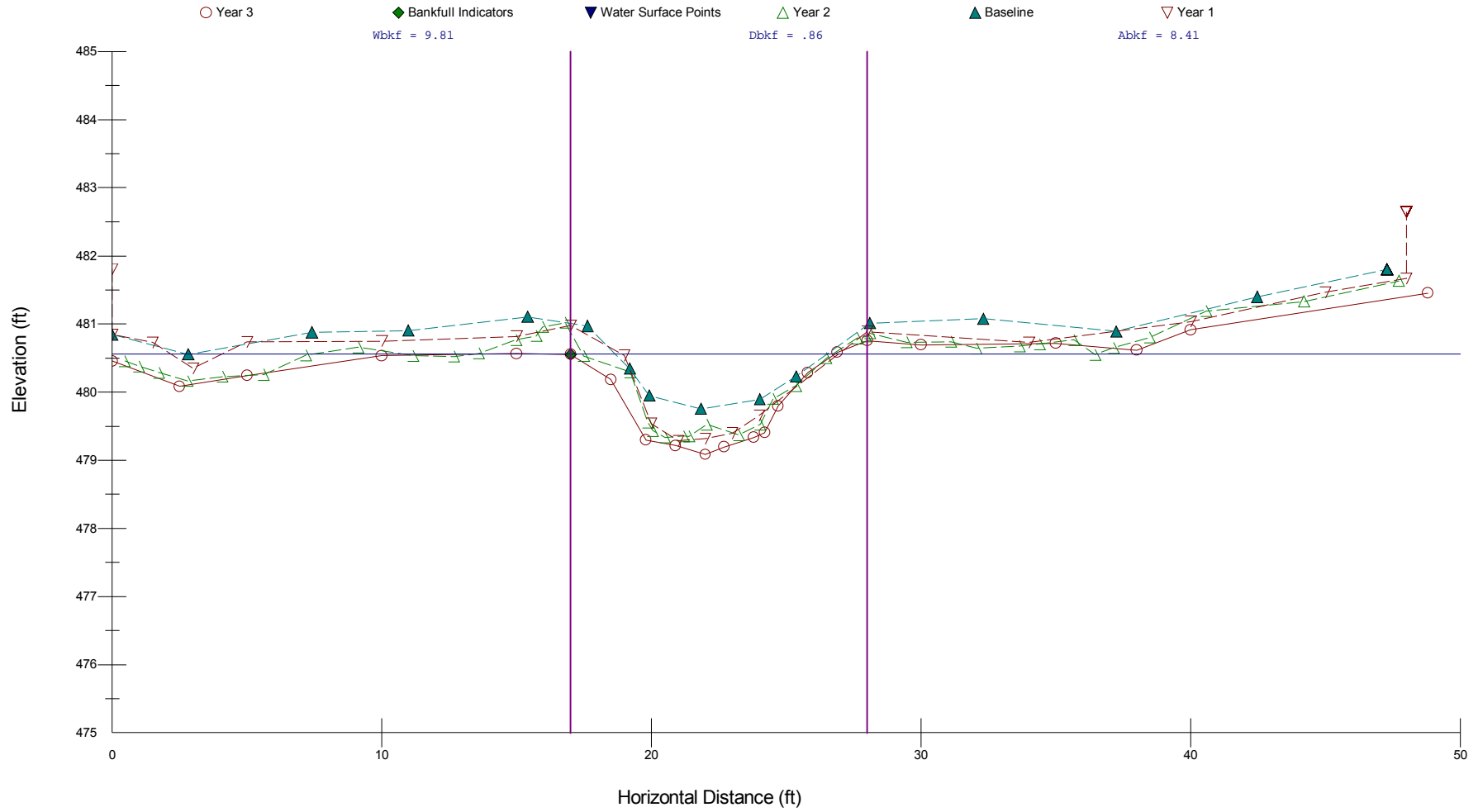


Cross Section 8 - Pool

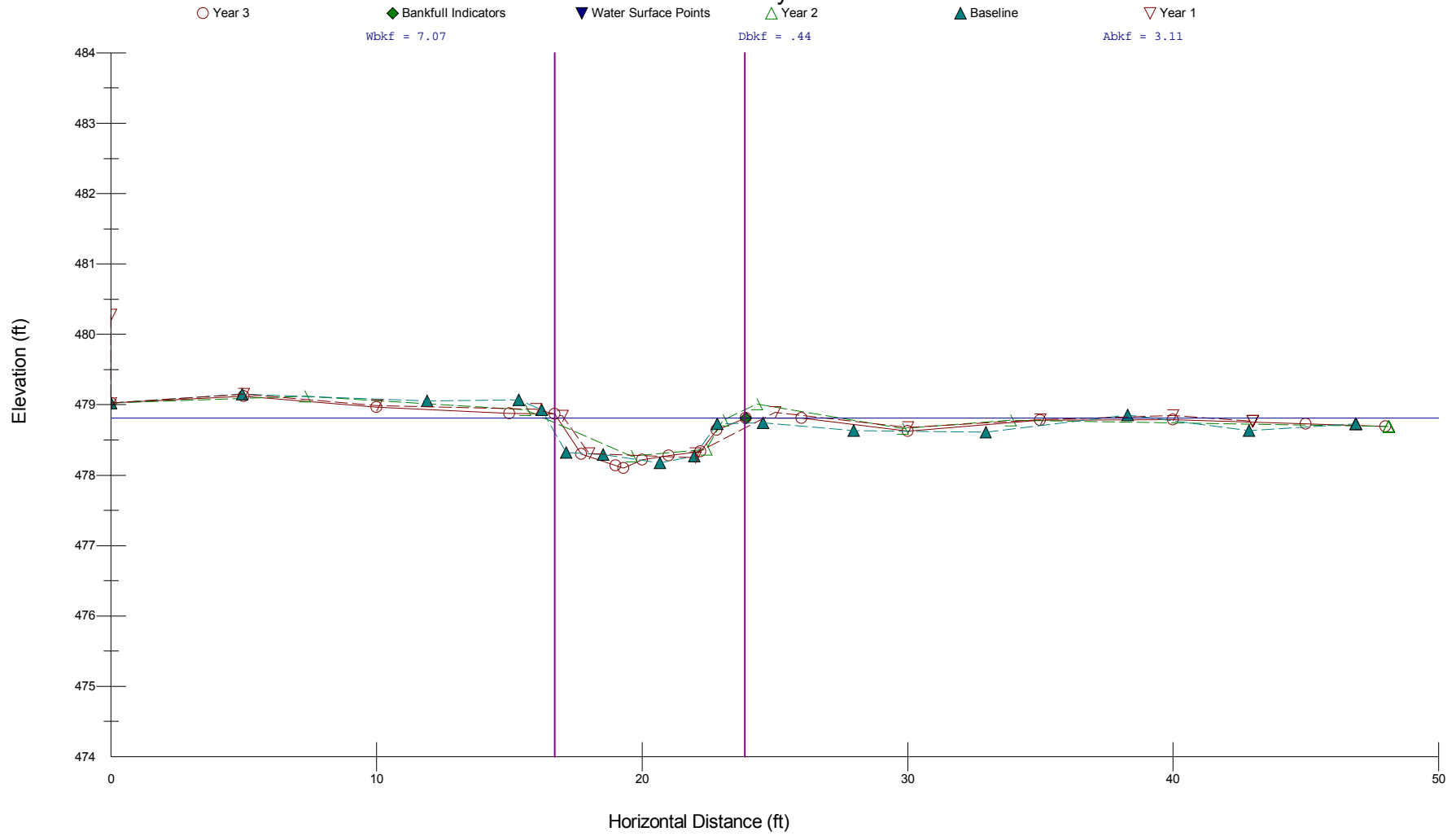


Note: Cross-section location reset in Year 1 and is used as baseline

Cross Section 9 - Riffle



Cross Section Tributary - Riffle

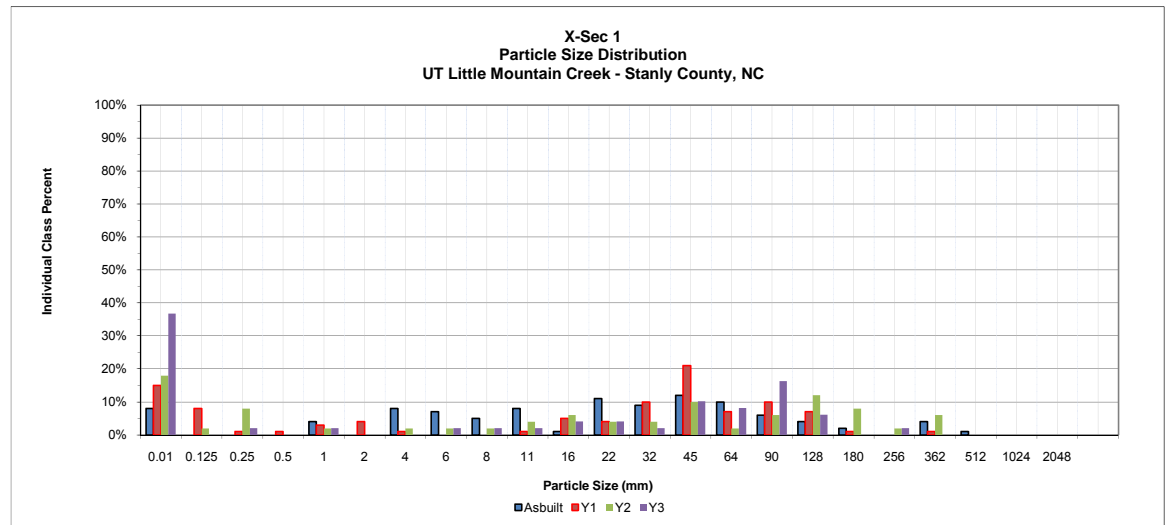
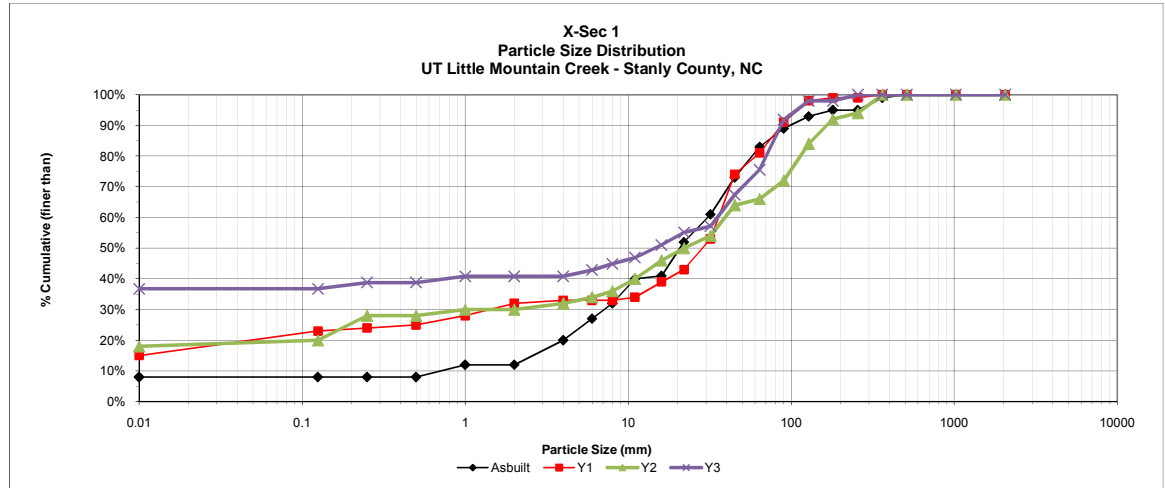


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 1
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	36	37%	37%
S	Very Fine	.062 - .125	0	0%	37%
	Fine	.125 - .25	2	2%	39%
N	Medium	.25 - .50	0	0%	39%
D	Coarse	.50 - 1.0	2	2%	41%
S	Very Coarse	1.0 - 2.0	0	0%	41%
G	Very Fine	2.0 - 4.0	0	0%	41%
	Fine	4.0 - 5.7	2	2%	43%
R	Fine	5.7 - 8.0	2	2%	45%
A	Medium	8.0 - 11.3	2	2%	47%
V	Medium	11.3 - 16.0	4	4%	51%
E	Coarse	16.0 - 22.6	4	4%	55%
L	Coarse	22.6 - 32.0	2	2%	57%
S	Very Coarse	32.0 - 45.0	10	10%	67%
C	Very Coarse	45.0 - 64.0	8	8%	76%
	Small	64 - 90	16	16%	92%
O	Small	90 - 128	6	6%	98%
B	Large	128 - 180	0	0%	98%
L	Large	180 - 256	2	2%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			98	100%	

Summary Data	
D50	14.83
D84	77.52
D95	109.62

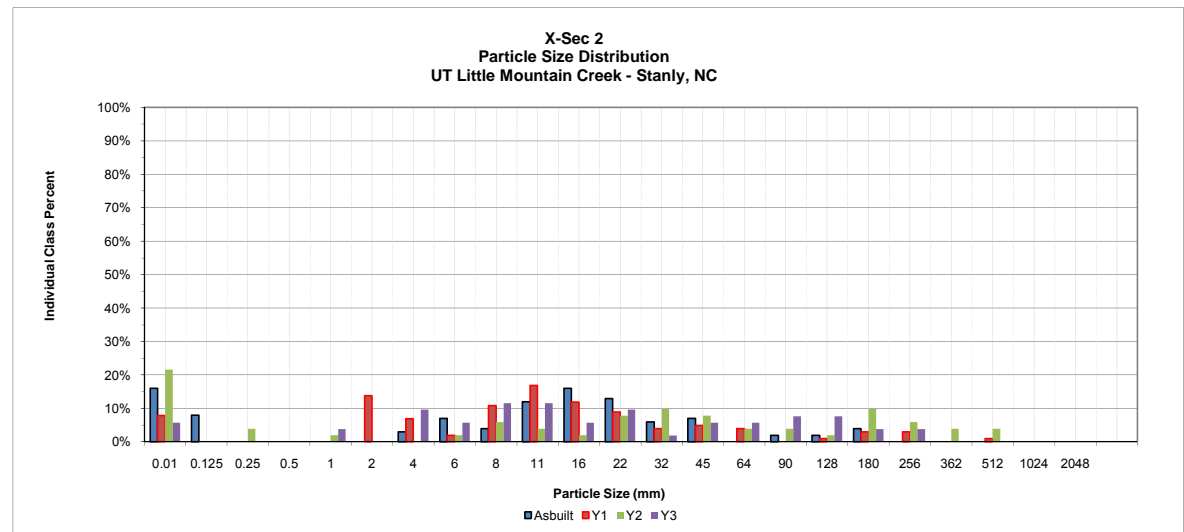
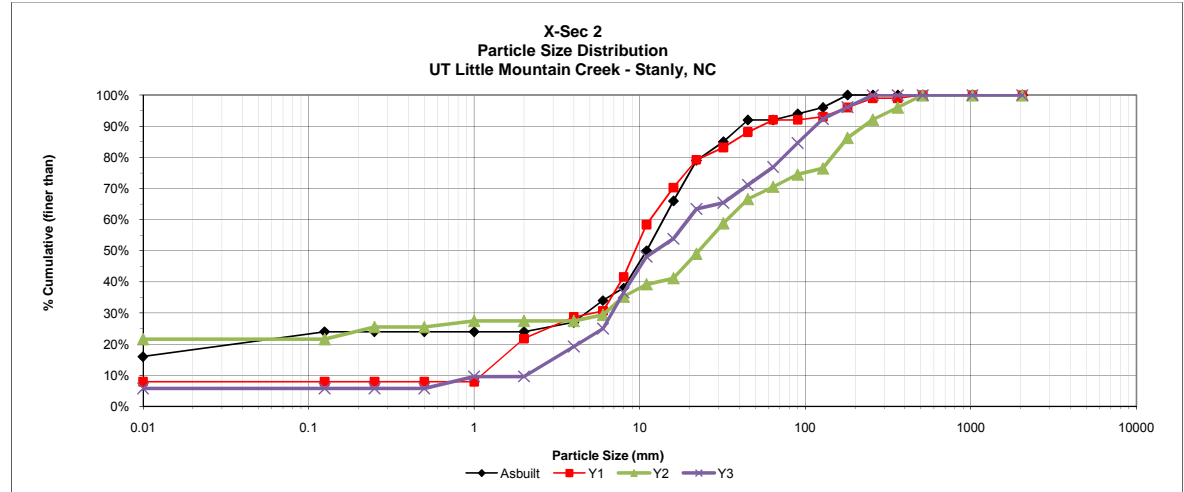


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 2
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	6	6%	6%
S	Very Fine	.062 - .125	0	0%	6%
	Fine	.125 - .25	0	0%	6%
A	Medium	.25 - .50	0	0%	6%
N	Coarse	.50 - 1.0	4	4%	10%
D	Very Coarse	1.0 - 2.0	0	0%	10%
S	Very Fine	2.0 - 4.0	10	10%	19%
	Fine	4.0 - 5.7	6	6%	25%
G	Fine	5.7 - 8.0	12	12%	37%
R	Medium	8.0 - 11.3	12	12%	48%
A	Medium	11.3 - 16.0	6	6%	54%
V	Coarse	16.0 - 22.6	10	10%	63%
E	Coarse	22.6 - 32.0	2	2%	65%
L	Coarse	22.6 - 32.0	2	2%	65%
S	Very Coarse	32.0 - 45.0	6	6%	71%
	Very Coarse	45.0 - 64.0	6	6%	77%
C	Small	64 - 90	8	8%	85%
	Small	90 - 128	8	8%	92%
O	Small	90 - 128	8	8%	92%
B	Large	128 - 180	4	4%	96%
	Large	180 - 256	4	4%	100%
L	Large	180 - 256	4	4%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			104	100%	

Summary Data	
D50	12.86
D84	87.91
D95	164.43

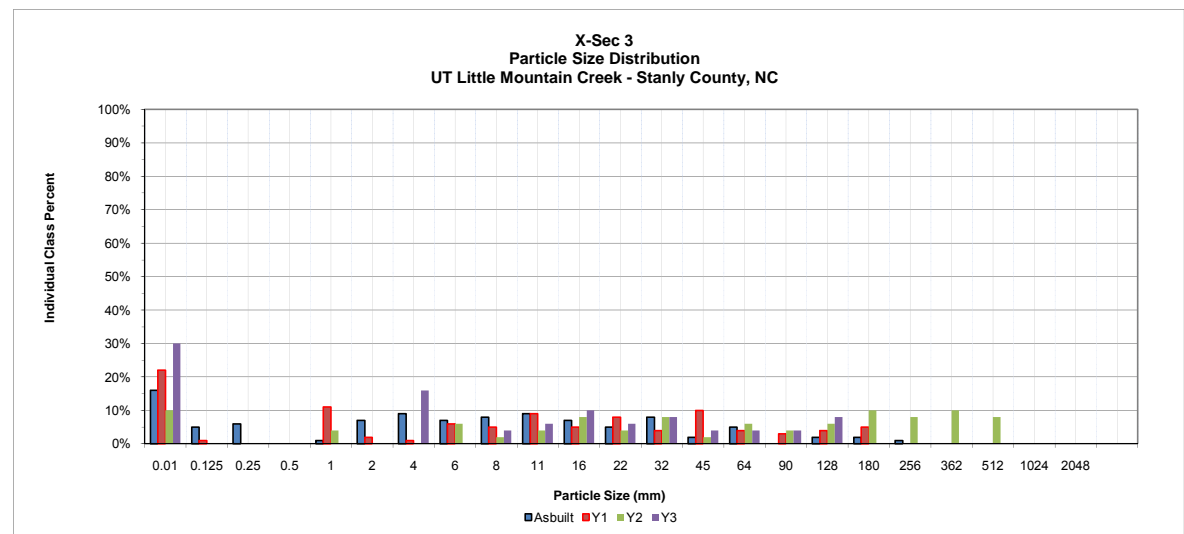
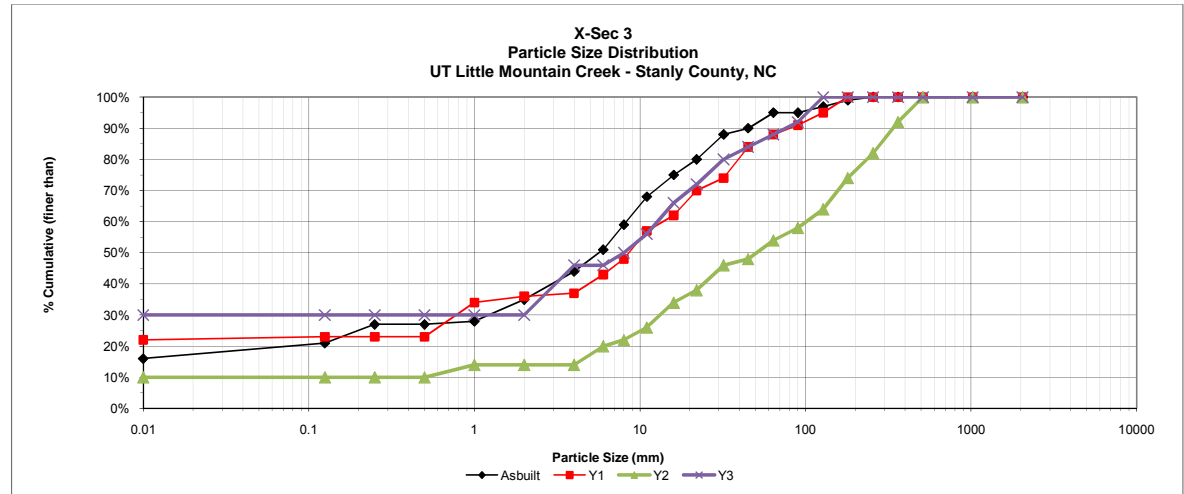


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 3
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	30	30%	30%
S	Very Fine	.062 - .125	0	0%	30%
	Fine	.125 - .25	0	0%	30%
A	Medium	.25 - .50	0	0%	30%
	Coarse	.50 - 1.0	0	0%	30%
S	Very Coarse	1.0 - 2.0	0	0%	30%
G	Very Fine	2.0 - 4.0	16	16%	46%
	Fine	4.0 - 5.7	0	0%	46%
R	Fine	5.7 - 8.0	4	4%	50%
	Medium	8.0 - 11.3	6	6%	56%
V	Medium	11.3 - 16.0	10	10%	66%
	Coarse	16.0 - 22.6	6	6%	72%
E	Coarse	22.6 - 32.0	8	8%	80%
	Very Coarse	32.0 - 45.0	4	4%	84%
L	Very Coarse	45.0 - 64.0	4	4%	88%
C	Small	64 - 90	4	4%	92%
	Small	90 - 128	8	8%	100%
O	Large	128 - 180	0	0%	100%
	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
	Medium	512 - 1024	0	0%	100%
D	Lrg- Very Lrg	1024 - 2048	0	0%	100%
	Bedrock		0	0%	100%
Totals			100	100%	

Summary Data	
D50	8
D84	45
D95	104.25

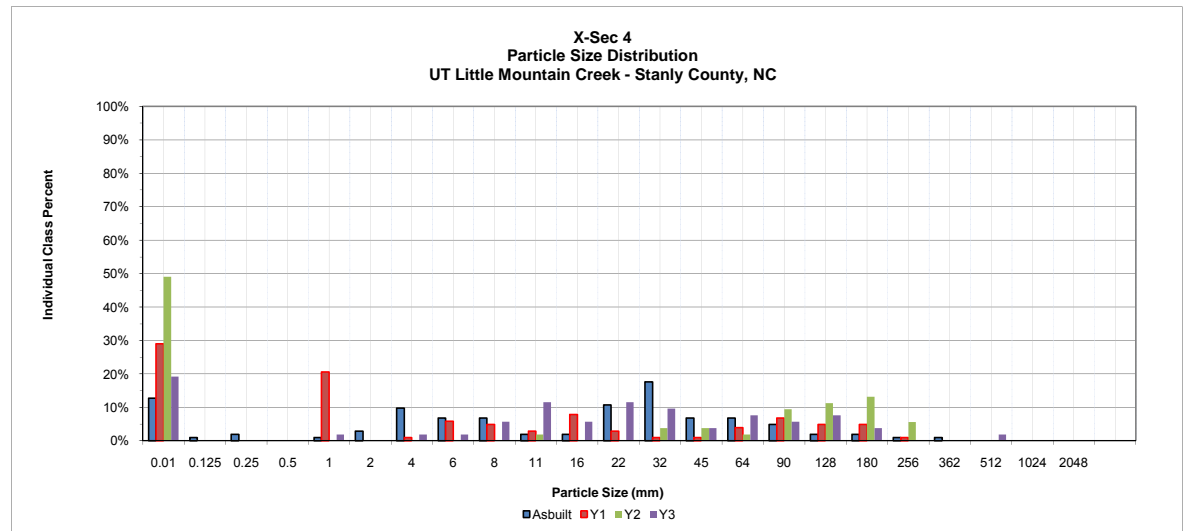
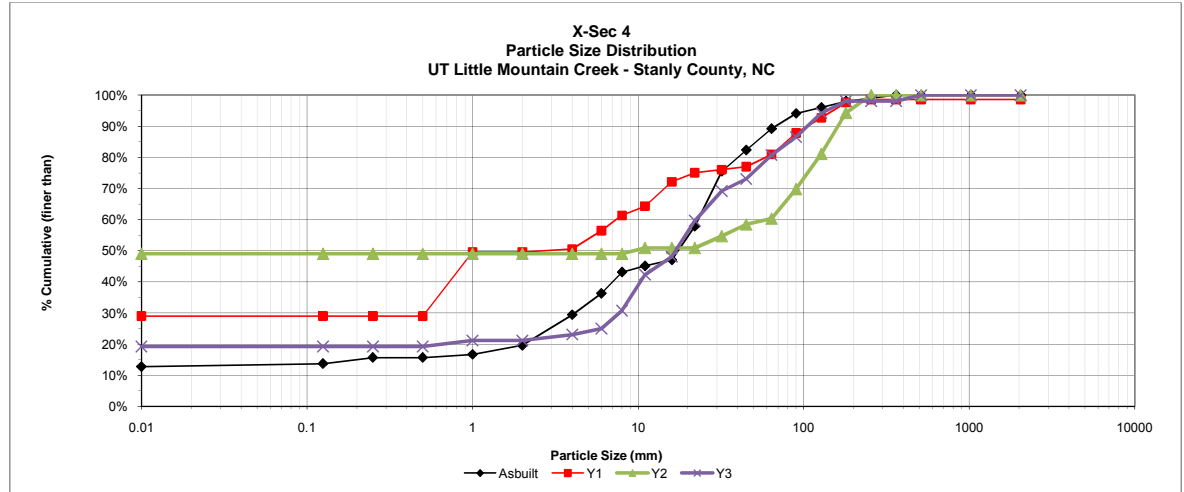


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 4
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	20	19%	19%
S	Very Fine	.062 - .125	0	0%	19%
A	Fine	.125 - .25	0	0%	19%
N	Medium	.25 - .50	0	0%	19%
D	Coarse	.50 - 1.0	2	2%	21%
S	Very Coarse	1.0 - 2.0	0	0%	21%
G	Very Fine	2.0 - 4.0	2	2%	23%
	Fine	4.0 - 5.7	2	2%	25%
R	Fine	5.7 - 8.0	6	6%	31%
A	Medium	8.0 - 11.3	12	12%	42%
V	Medium	11.3 - 16.0	6	6%	48%
E	Coarse	16.0 - 22.6	12	12%	60%
L	Coarse	22.6 - 32.0	10	10%	69%
S	Very Coarse	32.0 - 45.0	4	4%	73%
	Very Coarse	45.0 - 64.0	8	8%	81%
C	Small	64 - 90	6	6%	87%
	Small	90 - 128	8	8%	94%
B	Large	128 - 180	4	4%	98%
	Large	180 - 256	0	0%	98%
B	Small	256 - 362	0	0%	98%
L	Small	362 - 512	2	2%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg - Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			104	100%	

Summary Data	
D50	17.1
D84	78.55
D95	138.4

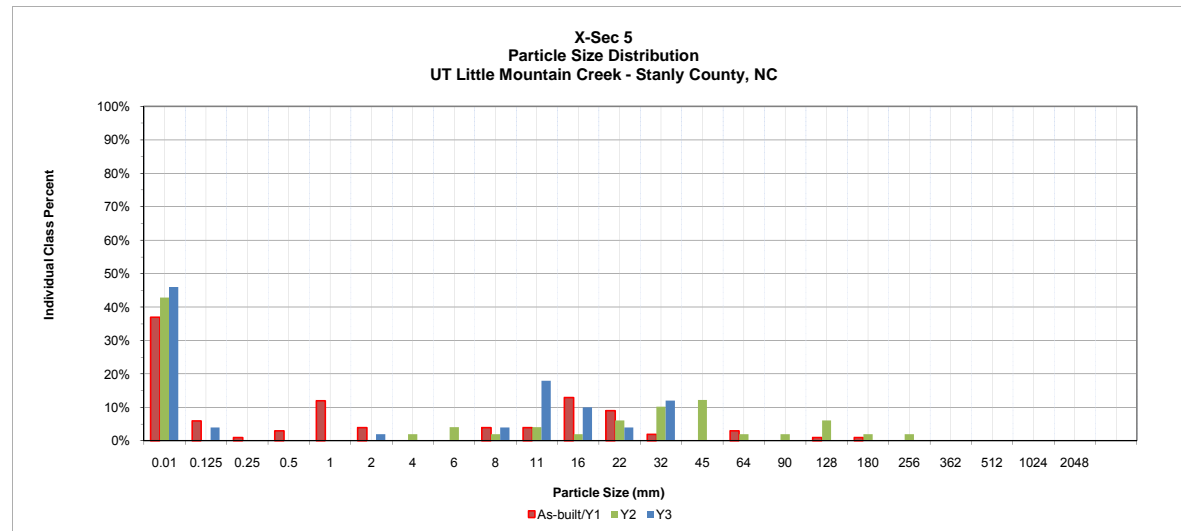
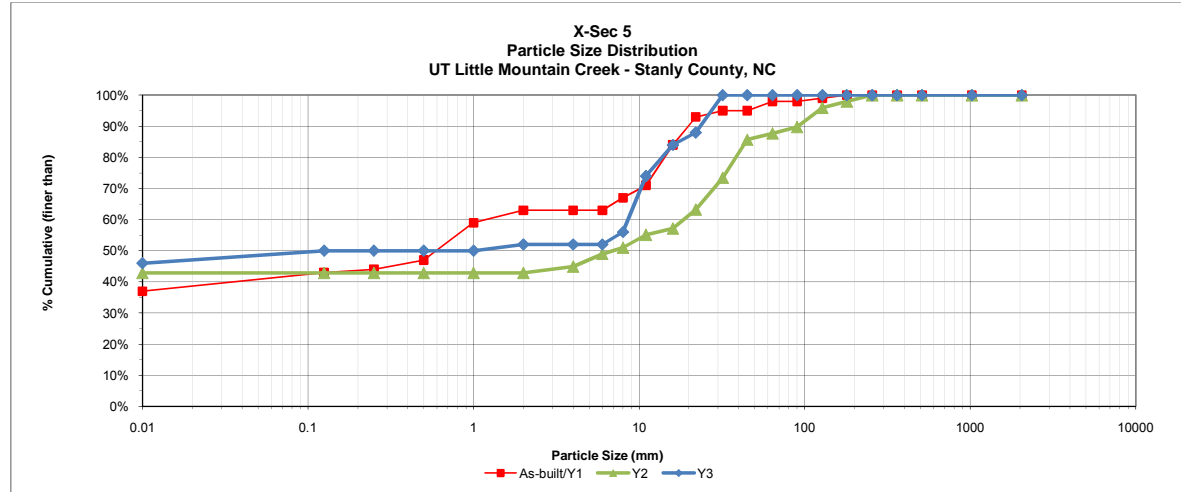


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 5
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	46	46%	46%
S	Very Fine	.062 - .125	4	4%	50%
	Fine	.125 - .25	0	0%	50%
A	Medium	.25 - .50	0	0%	50%
N	Coarse	.50 - 1.0	0	0%	50%
D	Very Coarse	1.0 - 2.0	2	2%	52%
G	Very Fine	2.0 - 4.0	0	0%	52%
	Fine	4.0 - 5.7	0	0%	52%
R	Fine	5.7 - 8.0	4	4%	56%
A	Medium	8.0 - 11.3	18	18%	74%
V	Medium	11.3 - 16.0	10	10%	84%
E	Coarse	16.0 - 22.6	4	4%	88%
L	Coarse	22.6 - 32.0	12	12%	100%
S	Very Coarse	32.0 - 45.0	0	0%	100%
	Very Coarse	45.0 - 64.0	0	0%	100%
C	Small	64 - 90	0	0%	100%
	Small	90 - 128	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			100	100%	

Summary Data	
D50	0.13
D84	16
D95	28.08

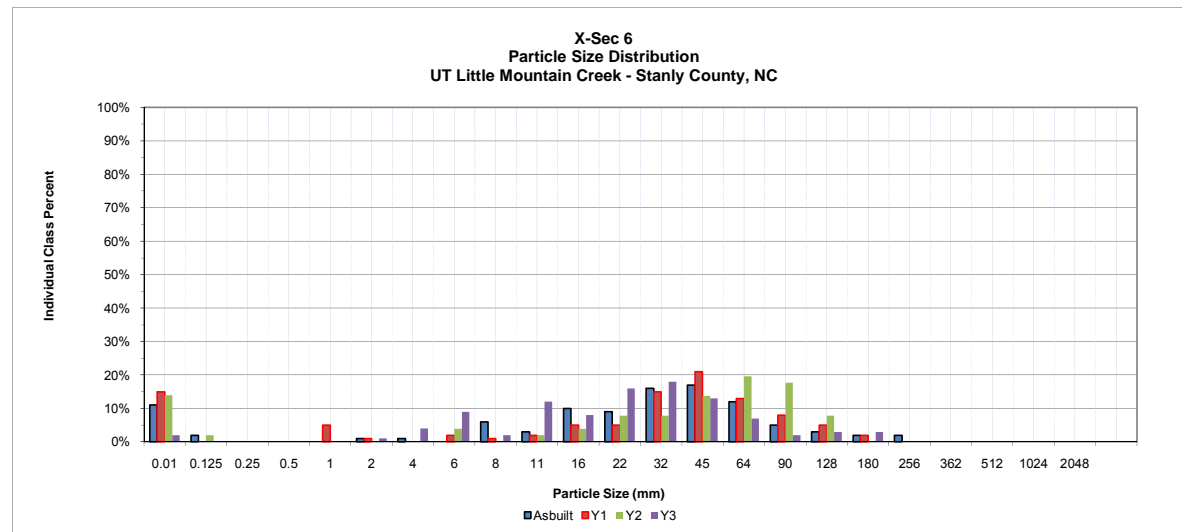
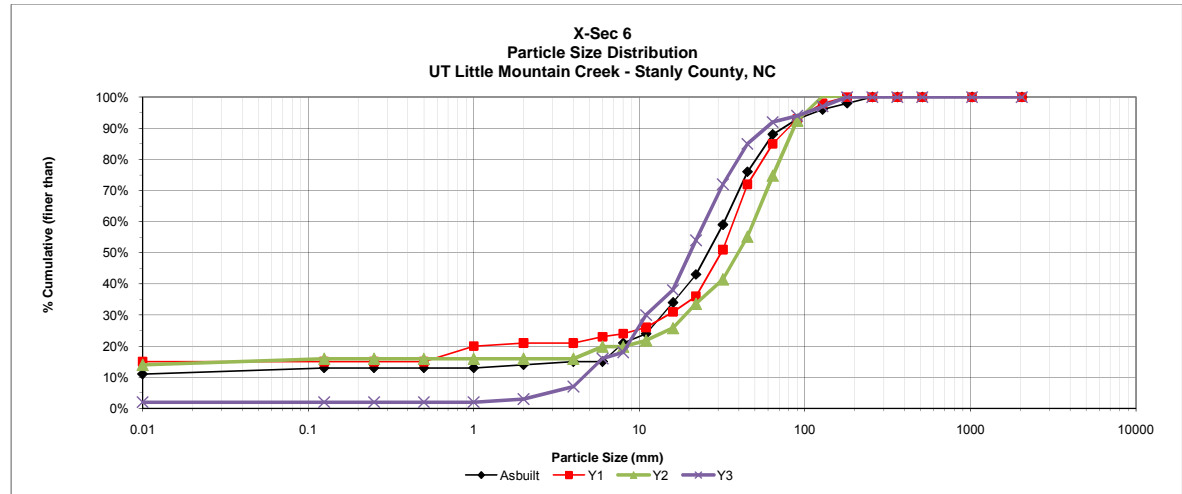


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 6
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	2	2%	2%
S	Very Fine	.062 - .125	0	0%	2%
	Fine	.125 - .25	0	0%	2%
A	Medium	.25 - .50	0	0%	2%
D	Coarse	.50 - 1.0	0	0%	2%
S	Very Coarse	1.0 - 2.0	1	1%	3%
G	Very Fine	2.0 - 4.0	4	4%	7%
	Fine	4.0 - 5.7	9	9%	16%
R	Fine	5.7 - 8.0	2	2%	18%
A	Medium	8.0 - 11.3	12	12%	30%
V	Medium	11.3 - 16.0	8	8%	38%
E	Coarse	16.0 - 22.6	16	16%	54%
L	Coarse	22.6 - 32.0	18	18%	72%
S	Very Coarse	32.0 - 45.0	13	13%	85%
	Very Coarse	45.0 - 64.0	7	7%	92%
C	Small	64 - 90	2	2%	94%
O	Small	90 - 128	3	3%	97%
B	Large	128 - 180	3	3%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			100	100%	

Summary Data	
D50	20.95
D84	44
D95	102.67

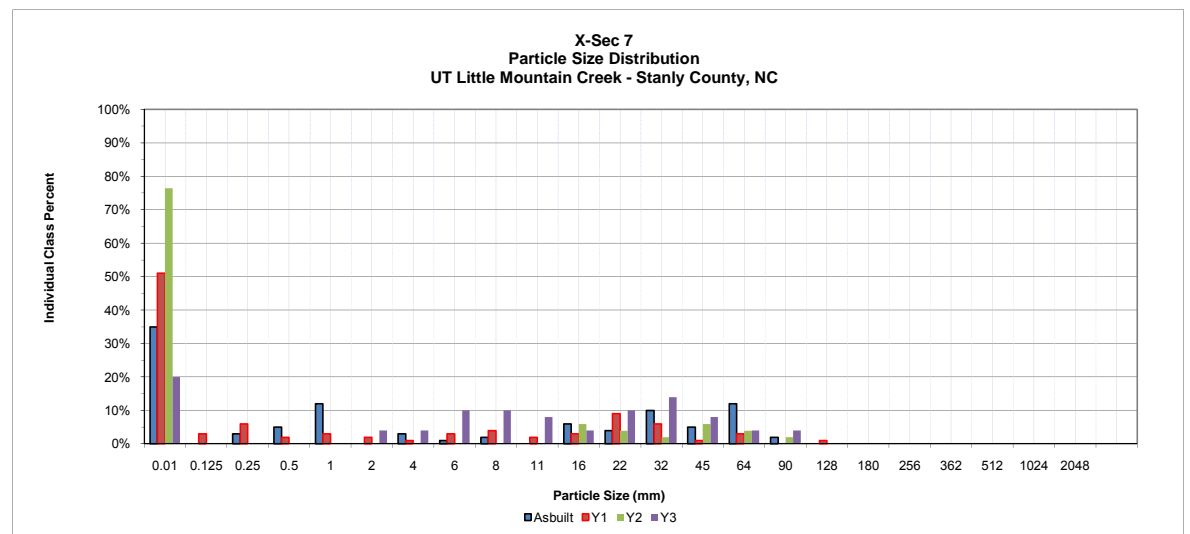
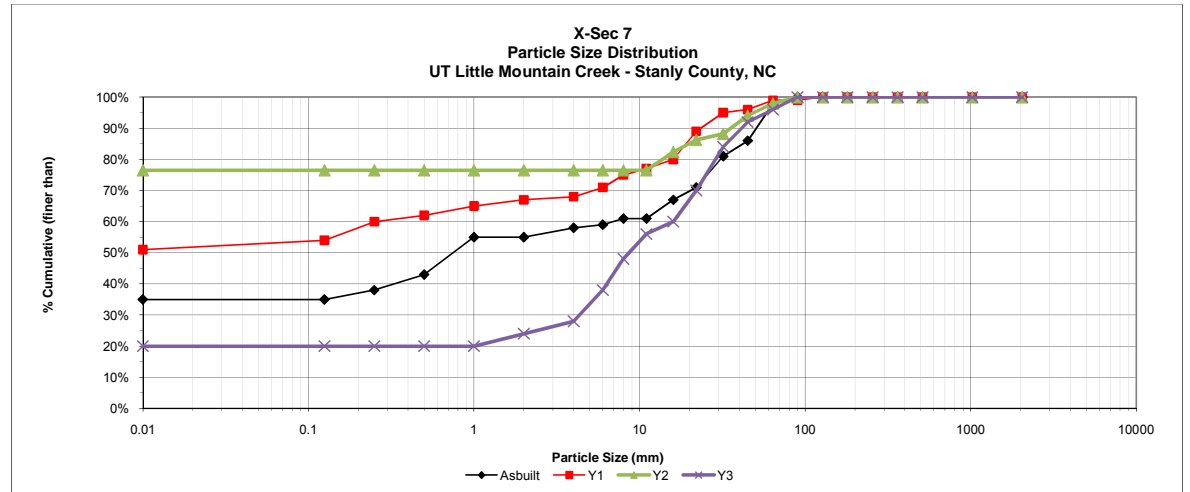


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 7
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	20	20%	20%
S	Very Fine	.062 - .125	0	0%	20%
	Fine	.125 - .25	0	0%	20%
N	Medium	.25 - .50	0	0%	20%
D	Coarse	.50 - 1.0	0	0%	20%
S	Very Coarse	1.0 - 2.0	4	4%	24%
G	Very Fine	2.0 - 4.0	4	4%	28%
	Fine	4.0 - 5.7	10	10%	38%
R	Fine	5.7 - 8.0	10	10%	48%
A	Medium	8.0 - 11.3	8	8%	56%
V	Medium	11.3 - 16.0	4	4%	60%
E	Coarse	16.0 - 22.6	10	10%	70%
L	Coarse	22.6 - 32.0	14	14%	84%
S	Very Coarse	32.0 - 45.0	8	8%	92%
	Very Coarse	45.0 - 64.0	4	4%	96%
C	Small	64 - 90	4	4%	100%
	Small	90 - 128	0	0%	100%
O	Small	90 - 128	0	0%	100%
B	Large	128 - 180	0	0%	100%
	Large	180 - 256	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			100	100%	

Summary Data	
D50	8.83
D84	32
D95	59.25

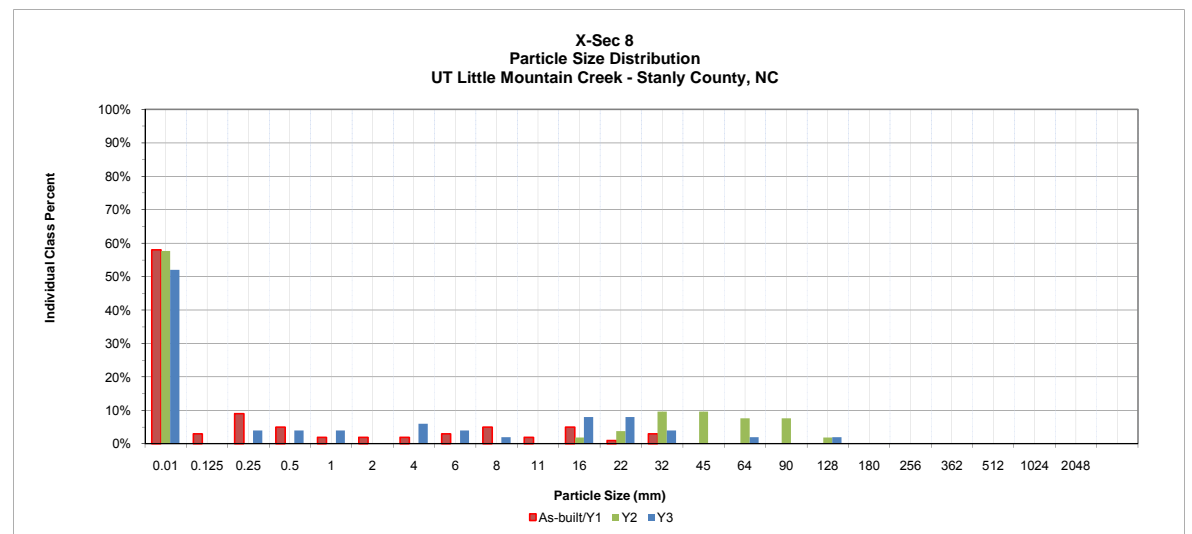
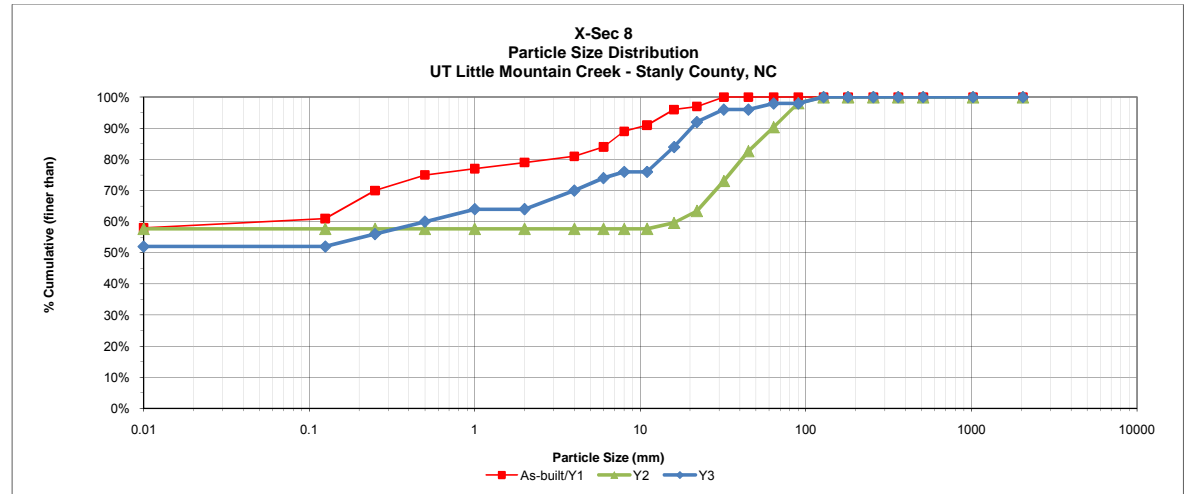


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 8
 Feature: Pool

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	52	52%	52%
S	Very Fine	.062 - .125	0	0%	52%
	Fine	.125 - .25	4	4%	56%
N	Medium	.25 - .50	4	4%	60%
D	Coarse	.50 - 1.0	4	4%	64%
S	Very Coarse	1.0 - 2.0	0	0%	64%
G	Very Fine	2.0 - 4.0	6	6%	70%
	Fine	4.0 - 5.7	4	4%	74%
R	Fine	5.7 - 8.0	2	2%	76%
A	Medium	8.0 - 11.3	0	0%	76%
V	Medium	11.3 - 16.0	8	8%	84%
E	Coarse	16.0 - 22.6	8	8%	92%
L	Coarse	22.6 - 32.0	4	4%	96%
S	Very Coarse	32.0 - 45.0	0	0%	96%
	Very Coarse	45.0 - 64.0	2	2%	98%
C	Small	64 - 90	0	0%	98%
	Small	90 - 128	2	2%	100%
O	Small	90 - 128	2	2%	100%
B	Large	128 - 180	0	0%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			100	100%	

Summary Data	
D50	0.02
D84	0.06
D95	29.65

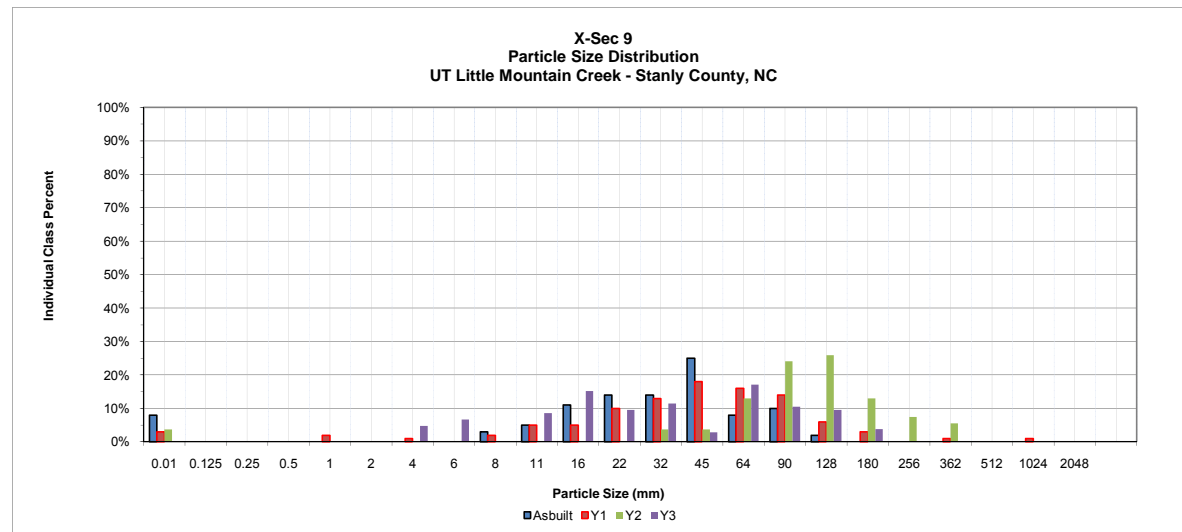
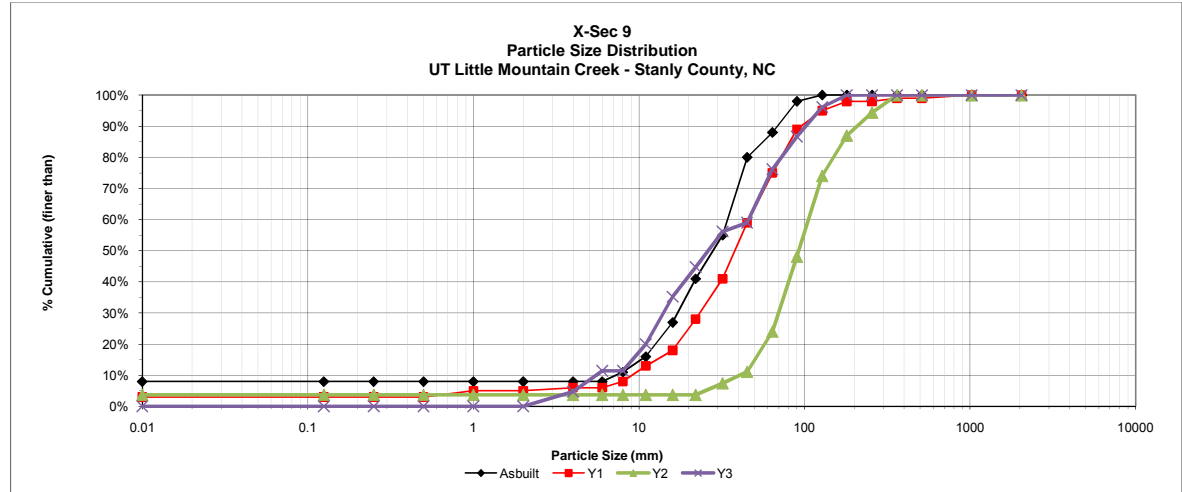


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: 9
 Feature: Riffle

Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	0	0%	0%
S	Very Fine	.062 - .125	0	0%	0%
A	Fine	.125 - .25	0	0%	0%
N	Medium	.25 - .50	0	0%	0%
D	Coarse	.50 - 1.0	0	0%	0%
S	Very Coarse	1.0 - 2.0	0	0%	0%
G	Very Fine	2.0 - 4.0	5	5%	5%
	Fine	4.0 - 5.7	7	7%	11%
	Fine	5.7 - 8.0	0	0%	11%
	Medium	8.0 - 11.3	9	9%	20%
	Medium	11.3 - 16.0	16	15%	35%
E	Coarse	16.0 - 22.6	10	10%	45%
L	Coarse	22.6 - 32.0	12	11%	56%
S	Very Coarse	32.0 - 45.0	3	3%	59%
	Very Coarse	45.0 - 64.0	18	17%	76%
C	Small	64 - 90	11	10%	87%
	Small	90 - 128	10	10%	96%
B	Large	128 - 180	4	4%	100%
L	Large	180 - 256	0	0%	100%
B	Small	256 - 362	0	0%	100%
	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			105	100%	

Summary Data	
D50	26.91
D84	83.38
D95	123.25

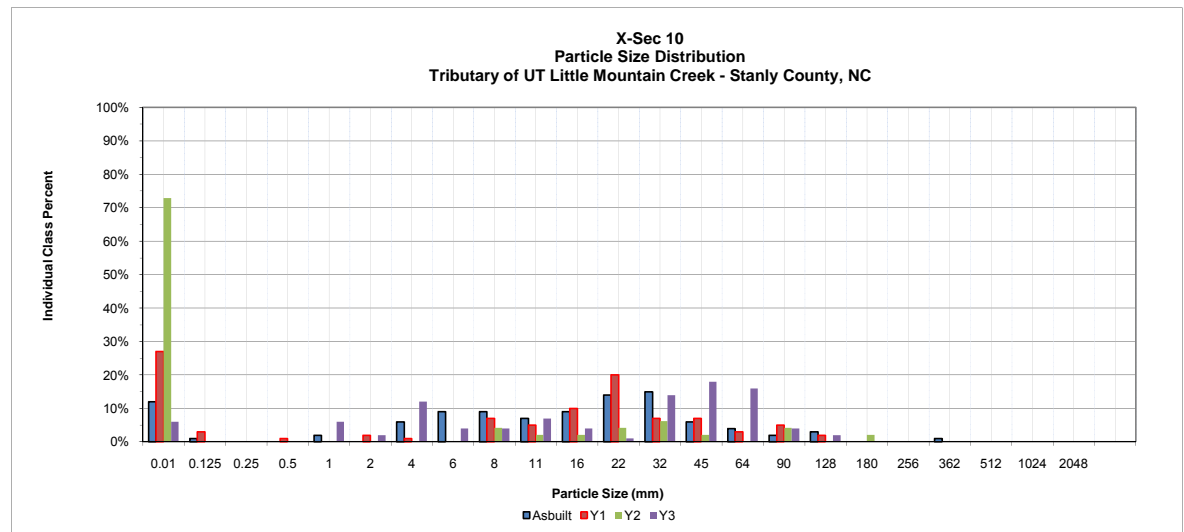
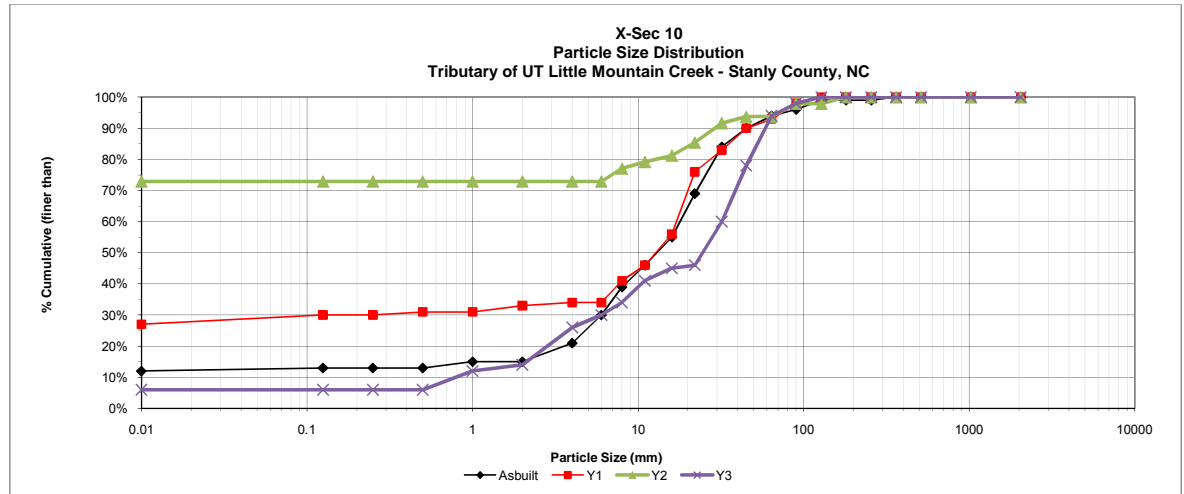


Cross - Section Pebble Count

Project Name : Badin Inn
 Cross Section: Tributary
 Feature: Riffle

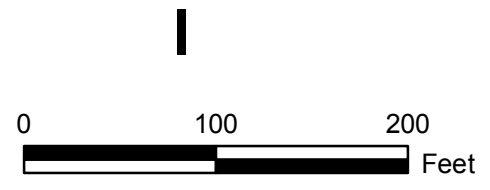
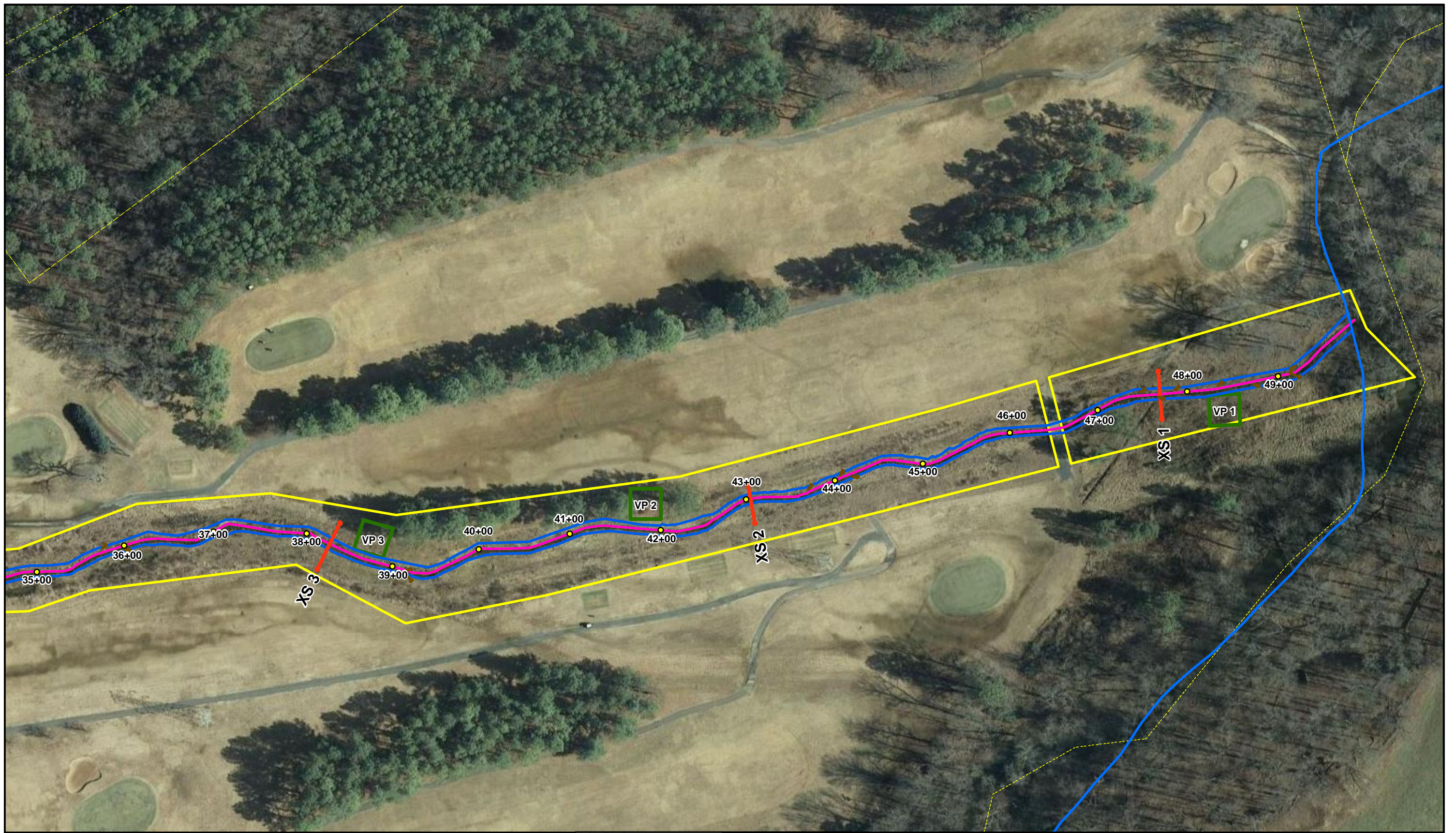
Description	Particle	Millimeter	Total #	Item %	Cum %
S/C	Silt/Clay	< 0.062	6	6%	6%
S	Very Fine	.062 - .125	0	0%	6%
	Fine	.125 - .25	0	0%	6%
A	Medium	.25 - .50	0	0%	6%
N	Coarse	.50 - 1.0	6	6%	12%
D	Very Coarse	1.0 - 2.0	2	2%	14%
S	Very Fine	2.0 - 4.0	12	12%	26%
	Fine	4.0 - 5.7	4	4%	30%
G	Fine	5.7 - 8.0	4	4%	34%
R	Medium	8.0 - 11.3	7	7%	41%
A	Medium	11.3 - 16.0	4	4%	45%
V	Coarse	16.0 - 22.6	1	1%	46%
E	Coarse	22.6 - 32.0	14	14%	60%
L	Very Coarse	32.0 - 45.0	18	18%	78%
S	Very Coarse	45.0 - 64.0	16	16%	94%
C	Small	64 - 90	4	4%	98%
	Small	90 - 128	2	2%	100%
O	Large	128 - 180	0	0%	100%
B	Large	180 - 256	0	0%	100%
L	Small	256 - 362	0	0%	100%
L	Small	362 - 512	0	0%	100%
D	Medium	512 - 1024	0	0%	100%
R	Lrg- Very Lrg	1024 - 2048	0	0%	100%
BDRK	Bedrock		0	0%	100%
Totals			100	100%	

Summary Data	
D50	25.29
D84	52.13
D95	70.5

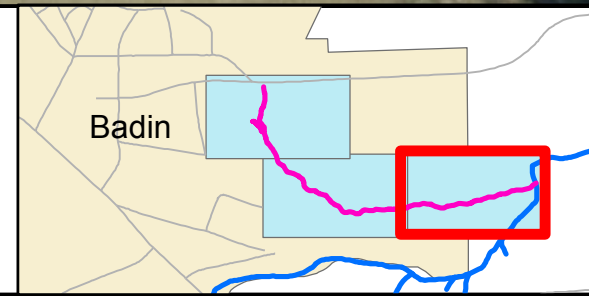


APPENDIX C

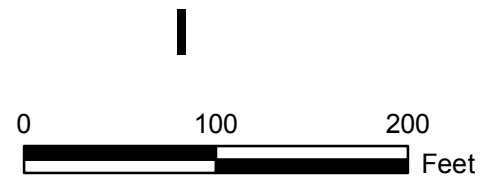
1. Integrated Plan View



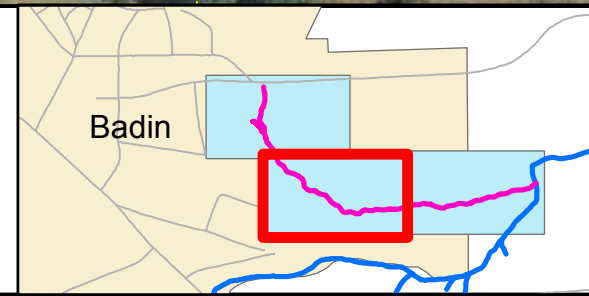
- Legend**
- Stations
 - Structures
 - Roads
 - Cross Sections
 - Restored Bankfull
 - Restored Thalweg
 - Vegetation Plots



APPENDIX C-1 Integrated Plan View		
Date 2-12	Badin Inn Stream Restoration Stanly County, North Carolina	Project No. 92666



- Legend**
- Stations
 - Structures
 - Roads
 - Cross Sections
 - Restored Bankfull
 - Restored Thalweg
 - Vegetation Plots

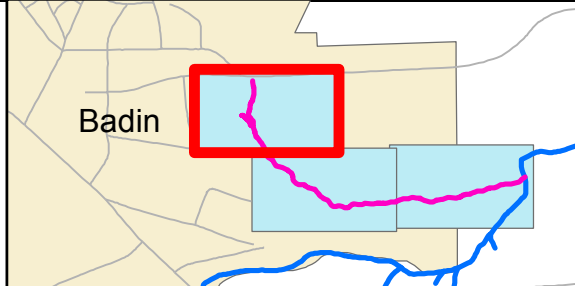
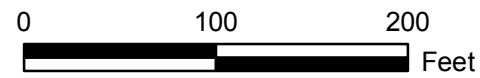


APPENDIX C-2 Integrated Plan View		
Date 2-12	Badin Inn Stream Restoration Stanly County, North Carolina	Project No. 92666



Legend

- Stations
- Structures
- Roads
- Cross Sections
- Restored Bankfull
- Restored Thalweg
- Vegetation Plots



**APPENDIX C-3
Integrated Plan View**

Date
2-12

Badin Inn Stream Restoration
Stanly County, North Carolina

Project No.
92666