

# Baseline Monitoring Document

FINAL

Wells Creek #2 (#92688)

Alamance County



Data Collection Period: March – May 2011

Submission Date: June 20, 2011



North Carolina Department of  
Environment and Natural Resources  
Ecosystem Enhancement Program  
1652 Mail Service Center  
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## 1.0 Executive Summary

Wells Creek #2 is a North Carolina Ecosystem Enhancement Program (EEP) stream mitigation project located near Snow Camp in southern Alamance County, North Carolina. The Project Site is located within the Cape Fear River Basin Cataloging Unit 0303002 and the 03030002050050 local watershed unit (14-digit HUC). EEP identified this HUC as a Targeted Local Watershed in the 2009 Cape Fear River Basin Restoration Priority report. The Project Site consists of two separate reaches located on two separate parcels: a Preservation Reach with two unnamed tributaries to Wells Creek (UT1 and UT2) and an Enhancement Reach with Wells Creek and an unnamed tributary (UT3). The Project Site is located immediately upstream of an existing EEP stream restoration site, Wells Creek (EEP # 414) (Figure 1.0).

The goals of the Wells Creek #2 Stream Enhancement and Preservation Project are to improve water quality and restore riparian habitat. To achieve these goals, the project has the following objectives:

- Reduce direct nutrient loading and fecal coliform inputs into the streams by fencing out cattle and hogs and providing an alternative livestock water system;
- Reduce excess sedimentation into the streams by eliminating livestock impacts from hoof shear to forest floor and stream banks;
- Reestablish and enhance native forested buffers by planting native plants, removing invasive exotic vegetation, and preventing future negative impacts within the buffer;
- Increase surface runoff infiltration and non-point pollutant removal through the vegetated riparian buffer;
- Preserve existing natural, well-established riparian plant communities.

Restoration activities were completed in May 2011 and included installation of exclusion fencing and alternative watering systems (December 2009), invasive species treatment (August-September 2010 and May 2011), and buffer planting (November 2010 and May 2011). There were no significant deviations from the design plan. Baseline monitoring data were collected in April and May 2011. First year monitoring will be done in October and November 2011.

Two vegetation monitoring plots were established and data collected on April 27, 2011. Planted stem density in VP1 was 647 stems/acre and 566 stems/acre for VP2.

Final mitigation assets for the project are 1,897 feet of stream enhancement (E2), 1,616 feet of stream preservation for 1,082 stream mitigation units (SMU), and 12.14 acres permanent conservation easement held by the State of North Carolina. Farm BMPs associated with the Enhancement Reach include 2,610 feet of cattle exclusion fencing, 1,958 feet of hog exclusion fencing, two troughs and water lines for cattle and two troughs and water lines for pigs. Farm BMPs at the Preservation Reach consist of 683 feet of cattle exclusion fencing.

## **2.0 Project Goals, Background, and Attributes**

### ***2.1. Location and Setting***

Wells Creek #2 is a North Carolina Ecosystem Enhancement Program (EEP) stream mitigation project located near Snow Camp in southern Alamance County, North Carolina. The Project Site is located within the Cape Fear River Basin Cataloging Unit 0303002 and the 03030002050050 local watershed unit (14-digit HUC). EEP identified this HUC as a Targeted Local Watershed in the 2009 Cape Fear River Basin Restoration Priority report (NCEEP 2009). The Project Site consists of two separate reaches located on two separate parcels: a Preservation Reach with two unnamed tributaries to Wells Creek (UT1 and UT2) and an Enhancement Reach with Wells Creek and an unnamed tributary (UT3). The Project Site is located immediately upstream of an existing EEP stream restoration site, Wells Creek (EEP # 414) (Figure 1.1).

The project lies in the Piedmont of North Carolina, in the Carolina Slate Belt ecoregion. The Carolina Slate Belt is characterized by wider floodplains, less topographic variation, and more exposed bedrock than other portions of the Piedmont (Griffin, et al 2002; NRCS 2006). Streams in the Carolina Slate Belt typically experience low-flows during the summer (Griffin, et al 2002; NC DWQ 2005).

The Preservation Reach includes two unnamed tributaries to Wells Creek. UT1 is a perennial stream with a rocky substrate. Channel width ranges from eight to 12 feet; overall channel morphology is stable. UT2 is a five-foot wide intermittent stream. Water clarity in both streams is good. Vegetation along this reach is mature Piedmont alluvial forest in the floodplain and oak/hickory on the slopes.

The Enhancement Reach site is a combination of pasture, Piedmont alluvial forest, and oak/hickory forest. As outlined in the 2010 existing conditions report, long-term livestock practices had resulted in disturbed woodlands with limited understory and eroding streambanks caused by hoof shear. Wells Creek is an eight to 15 foot-wide perennial stream with a rocky substrate and some areas of channel instability. UT3 is an intermittent to a perennial stream with eroding banks due to hog access to the site. Water clarity in Wells Creek from the northern edge of the conservation easement to the confluence with UT3 appeared good. Prior to the installation of exclusion fencing that occurred as part of this project, water clarity along UT3 and in Wells Creek downstream of the confluence was fair.

## ***2.2. Project Goals and Objectives***

The goals of the UT Wells Creek #2 Stream Enhancement and Preservation Project are to improve water quality, and restore riparian habitat. To achieve these goals, the project has the following objectives:

- Reduce direct nutrient loading and fecal coliform inputs into the streams by fencing out cattle and hogs and providing an alternative livestock water system;
- Reduce excess sedimentation into the streams by eliminating livestock impacts from hoof shear to forest floor and stream banks;
- Reestablish and enhance native forested buffers by planting native plants, removing invasive exotic vegetation, and preventing future negative impacts within the buffer;
- Increase surface runoff infiltration and non-point pollutant removal through the vegetated riparian buffer;
- Preserve existing natural, well-established riparian plant communities.

## ***2.3. Project Structure, Restoration Type, and Approach***

### **2.3.1. Project Structure**

Final mitigation assets for the project are 1,897 feet of stream enhancement (EII), 1,616 feet of stream preservation for 1,082 stream mitigation units (SMU), and 12.14 acres permanent conservation easement held by the State of North Carolina. Farm BMPs associated with the Enhancement Reach include 2,610 feet of cattle exclusion fencing, 1,958 feet of hog exclusion fencing, two troughs and water lines for cattle and two troughs and water lines for pigs. Farm BMPs at the Preservation Reach consist of 683 feet of cattle exclusion fencing. Details can be found in Figures 1.1-1.4 and in Tables 1.0-1.1 in Appendix A.

### **2.3.2. Restoration Type and Approach**

The enhancement level II stream restoration along Wells Creek and UT3 involved installation of livestock/hog exclusion fencing and a livestock watering system, invasive species treatment, and planting low-density areas. Native species selection was based on existing plant communities and used the Preservation Reach as the reference site. The target plant community for areas along Wells Creek was Piedmont alluvial forest; for the UT3 understory it was Oak-Hickory Forest (Schafale and Weakley 1990). Planting areas were selected based on low woody stem density or lack of mature forest structure. All containerized planting in non-forested areas were planted at a density of 436 stems/acre. In areas with mature canopy, understory species were planted such that the density of existing and planted vegetation will achieve 436 stems/acre. Stream banks on UT3 were planted at a density of 681 stems/acre within 10 feet of the channel. A number of wetland species were installed on a wallowed-out area of UT3. The final planting list can be found in Appendix B.

The approach taken at the Preservation Reach involved installation of livestock/hog exclusion fencing along the eastern boundary of the conservation easement and invasive species removal.

## ***2.4. Project History, Contacts, and Attribute Data***

The final existing conditions report was submitted to the North Carolina Ecosystem Enhancement Program (NCEEP) in March 2010. Planting and invasive species removal occurred between July 2010 and May 2011. Construction closeout is expected to occur in June 2011. There were no significant deviations from the design plan. Baseline monitoring was completed in May 2011. First year monitoring will be done in October and November 2011. The site will be monitored for five years. Table 2.0 in Appendix A outlines the project activity and reporting history. Table 3.0 includes the designer and contractor information. Table 4.0 details the project attributes including watershed size and land uses, dominant soils, and NCDWQ classification.

## **3.0 Success Criteria**

Wells Creek #2 is a stream enhancement level II and preservation project. Success will be based on the establishment and preservation of the riparian plant community and the exclusion of livestock and other farm practices from the riparian buffer and streams.

### ***3.1. Morphologic Parameters and Channel Stability***

This project includes preservation and enhancement level II restoration. No changes were made to the channel dimension, pattern, or profile for any of the reaches associated with this project. Success of enhancement level II reaches will rely on using set photopoints to evaluate stream stability and the absence of further channel degradation.

### ***3.2. Vegetation***

Vegetation data will be collected using the guidelines outlined in the EEP/CVS vegetation monitoring protocol (Lee *et al* 2006). Two vegetation monitoring plots have been established along Wells Creek in the Enhancement Reach (Figure 1.1). Following the 2003 USACE Stream Mitigation Guidelines, vegetation success in the riparian buffer will be based upon an average density of 320 stems per acre at the end of three years of monitoring. A tolerance of 10% mortality rate will be acceptable for year four (288 stems/acre) and year five (260 stems/acre) (USACE 2003). Photos taken at each monitoring plot should indicate maturation of the riparian vegetation.



A qualitative visual assessment of the enhancement and preservation reaches will be performed each year. Areas lacking cover, with low planted-stem density or vigor, or areas experiencing invasive species encroachment will be identified and mapped on the CCPV.

### **3.3. Hydrology**

This is an enhancement level II restoration project and no changes were made to the stream channels and hydrological evaluation is not required or necessary.

## **4.0 Monitoring Plan Guidelines**

Annual data will be collected for the monitoring parameters below for five years after construction, unless otherwise stated or directed as part of the review process. Success criteria for the stream enhancement and preservation project will include photo documentation of riparian buffer and stream stability and condition and the collection of vegetation plot data.

### **4.1. Stream Channel Stability and Geomorphology**

Wells Creek #2 is a stream enhancement level II and preservation project. No changes were made to any stream channels and geomorphic data will not be collected as part of the annual monitoring for this site. Success of enhancement level II reaches will rely on using set photopoints to evaluate stream stability and the absence of further channel degradation.

### **4.2. Vegetation**

Vegetation data will be collected using the guidelines outlined in the EEP/CVS vegetation monitoring protocol (Lee *et al* 2006). Two representative vegetation monitoring plots were established in April 2011 along Wells Creek Enhancement Reach. Each plot is five meters by 20 meters (100 square meters). The four corners of each plot (0,0; 0,20; 5,0; and 5,20) are marked with one-half inch diameter galvanized steel conduit. Level 2 (planted and volunteer woody stems) data collection was performed in all plots. Each planted woody stem location (x and y), height (cm), and live stem diameter (ddh for plants less than 137 cm in height, DBH for woody stems 137 cm or taller) were recorded. All planted stems were identified with pink flagging. Vegetation was identified using Weakley (Weakley 2007). Photos were taken of each vegetation plot from the 0,0 corner. Vegetation data in these plots will be collected in October or November 2011 for the first-year monitoring report.

A qualitative visual assessment of the enhancement and preservation reaches, including permanent photopoints, will be performed each year. Areas lacking cover, with low planted-stem density or vigor, or areas experiencing invasive species encroachment will be identified and mapped on the CCPV.

### ***4.3. Hydrology***

This is an enhancement level II restoration project and no changes were made to the stream channels and hydrological evaluation is not required or necessary.

### ***4.4. Photo Stations***

Sixteen permanent photopoints have been established throughout the site. Photos from the most current monitoring year will be included in the annual report alongside photos taken during the initial existing conditions assessment.

## **5.0 Maintenance and Contingency Plans**

If visual evaluations identify a high priority problem area, or monitoring findings indicate a failure to meet success criteria, then remedial action may be necessary. The appropriate remedial action for any vegetation problem will be resolved on a case-by-case basis. Any remedial action must be approved by EEP.

### ***5.1. Vegetation problems***

Vegetation problems may include planted vegetation not meeting success criteria, persistent barren areas with no herbaceous vegetation, and the presence of invasive species. These problem areas will be mapped as discreet polygons and included in the Current Conditions Plan View as part of the annual vegetation assessment. Upon determining the cause of the problems, the appropriate remedial actions will be initiated with the approval of EEP. These actions may include replanting woody stems, re-seeding, soil nutrient amendments, grading, and herbicide application to remove invasive vegetation.

### ***5.2. Stream problems***

No changes were made to any of the streams associated with this project and no geomorphic data will be collected as part of the annual monitoring. Qualitative assessment will rely primarily on set photopoints to identify any changes to stream stability along the enhancement reaches. The consultant will refer any identified problems to EEP for possible remedial action.

## **6.0 Documenting the As-Built Condition (Baseline)**

### ***6.1. As-built/Record Drawings***

See Appendix C for the As-built drawings.

## **6.2. Baseline Data Collection**

### **6.2.1. Morphological State of the Channel**

As outlined in the 2010 Existing Conditions Report, the Preservation Reach consists of two unnamed tributaries to Wells Creek. UT1 is a perennial stream with a rocky substrate. Channel width ranges from eight to 12 feet; overall channel morphology is stable. UT2 is a five-foot wide intermittent stream that is slightly incised. At the Enhancement Site, Wells Creek is an eight to 15 foot-wide perennial stream with a rocky substrate and some areas of channel instability. UT3 is an intermittent to a perennial stream with eroding banks due to hog access to the site. Photos in the Existing Conditions Report and Figures 2.0-2.7 in this baseline report document typical channel morphology.

Since no changes were made to any stream channels, geomorphic data will not be collected as part of the annual monitoring for this site. Success of enhancement level II reaches will rely on using set photopoints to evaluate stream stability and the absence of further channel degradation. Photos taken during data collection for the Existing Conditions Report will serve as baseline photos. Based on available data, no new areas of channel instability were identified during the spring 2011 site visits.

### **6.2.2. Vegetation**

Two vegetation monitoring plots were established and data collected on April 27, 2011. Photos were taken at the 0,0 corner of each plot. Planted stem density in VP1 was 647 stems/acre and 566 stems/acre for VP2. Vegetation data and photos are found in Appendix B.

### **6.2.3. Photo Documentation**

Fourteen permanent photopoints have been established along the Enhancement Reach and two along the Preservation Reach. Locations were recorded using a sub-meter Trimble GPS. Initial photographs were taken during data collection for the Existing Conditions Report. Post-construction photos were taken on May 9 and May 26, 2011. These photos can be found in Appendix B.

### **6.2.4. Hydrology**

No crest gauge is installed at the site and hydrology is not being evaluated as part of this project.

## References

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R., and MacPherson, T.F. 2002. Ecoregions of North Carolina. U.S. Environmental Protection Agency, Corvallis, OR.

Kaster, Dwight. 1960. Soil Survey—Alamance County, North Carolina. United States Department of Agriculture, Natural Resources Conservation Service. Raleigh, NC.

Lee, Michael TI, R.K. Peet, S.D. Roberts, and T.R. Wentworth (2006). *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (<http://cvs.bio.unc.edu/methods.htm>).

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NC DLR (North Carolina Division of Land Resources). 1985. Geologic map of North Carolina. North Carolina Geological Survey. Department of Natural Resources and Community Development, Raleigh, NC.

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NC EEP (North Carolina Ecosystem Enhancement Program). 2009. Cape Fear River Basin Restoration Priorities 2009. North Carolina Ecosystem Enhancement Program, N.C. Department of Environment and Natural Resources, Raleigh, NC. ([http://www.nceep.net/services/lwps/cape\\_fear/RBRP%20Cape%20Fear%202008.pdf](http://www.nceep.net/services/lwps/cape_fear/RBRP%20Cape%20Fear%202008.pdf))

NRCS (Natural Resources Conservation Service). 2007. Web Soil Survey—Alamance County. Available at: <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>.

Schafale, M.P., and A.S. Weakley. 1990. Classification of the natural communities of North Carolina, third approximation. N.C. Natural Heritage Program, Raleigh, NC.

USACE (2003). *Stream Mitigation Guidelines*. USACOE, USEPA, NCWRC, NCDENR-DWQ.

Weakley, Alan S. 2008. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas: Working Draft of 7 April 2008. University of North Carolina Herbarium, University of NC at Chapel Hill, Chapel Hill, NC.

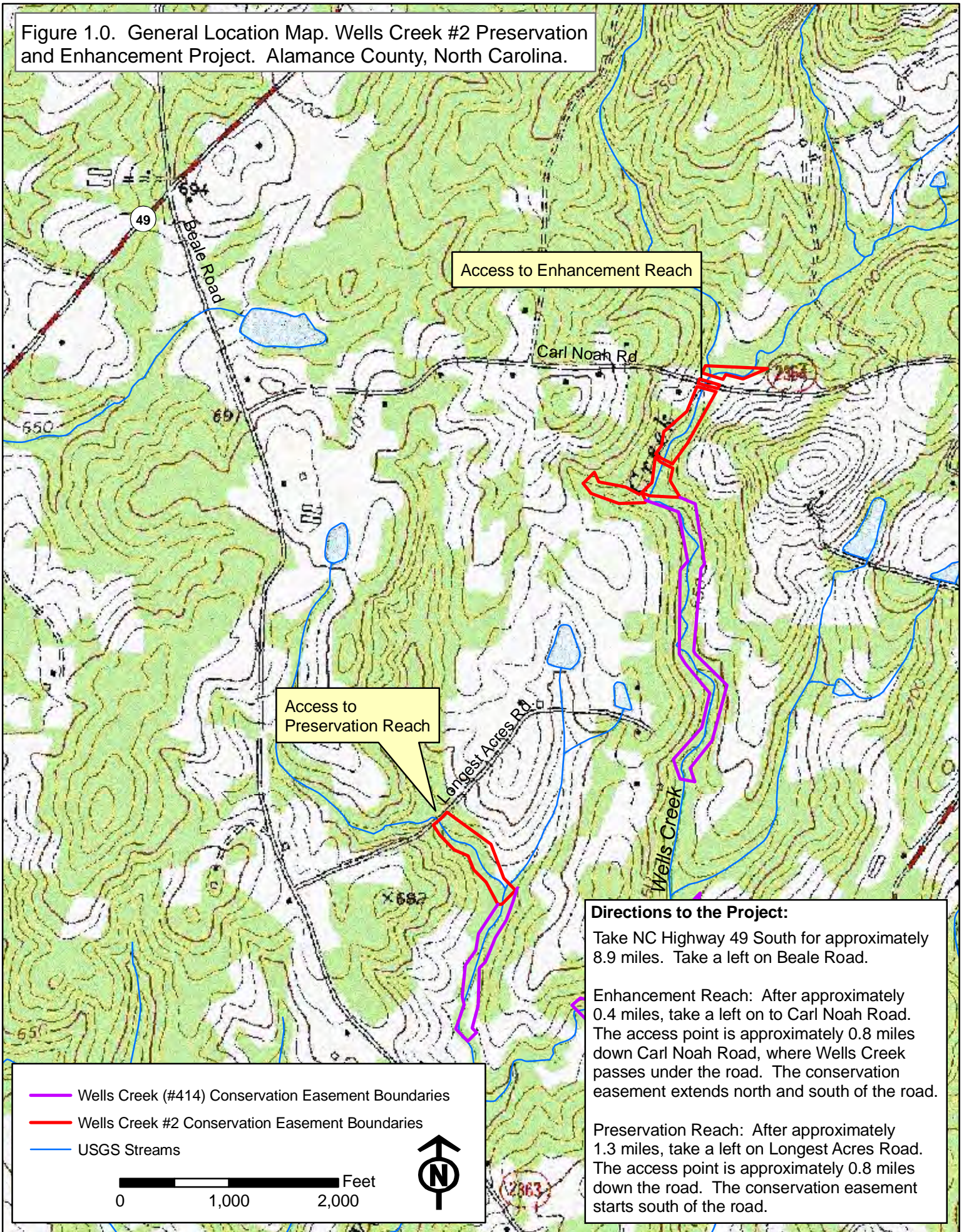
## **Appendix A. Project Vicinity Map and Background Tables**

Figure 1.0	General Vicinity Map and Directions
Figure 1.1-1.4	Project Assets and Photopoint Locations
Table 1.0	Project Restoration Components
Table 1.1	Component Summations
Table 2.0	Project Activity and Reporting History
Table 3.0	Project Contacts Table
Table 4.0	Project Attribute Table





Figure 1.0. General Location Map. Wells Creek #2 Preservation and Enhancement Project. Alamance County, North Carolina.



**Directions to the Project:**

Take NC Highway 49 South for approximately 8.9 miles. Take a left on Beale Road.

**Enhancement Reach:** After approximately 0.4 miles, take a left on to Carl Noah Road. The access point is approximately 0.8 miles down Carl Noah Road, where Wells Creek passes under the road. The conservation easement extends north and south of the road.

**Preservation Reach:** After approximately 1.3 miles, take a left on Longest Acres Road. The access point is approximately 0.8 miles down the road. The conservation easement starts south of the road.



Figure 1.1. Stream Assets, Photopoints, and Vegetation Monitoring Plots. Wells Creek #2 Preservation and Enhancement Project. Alamance County, North Carolina.

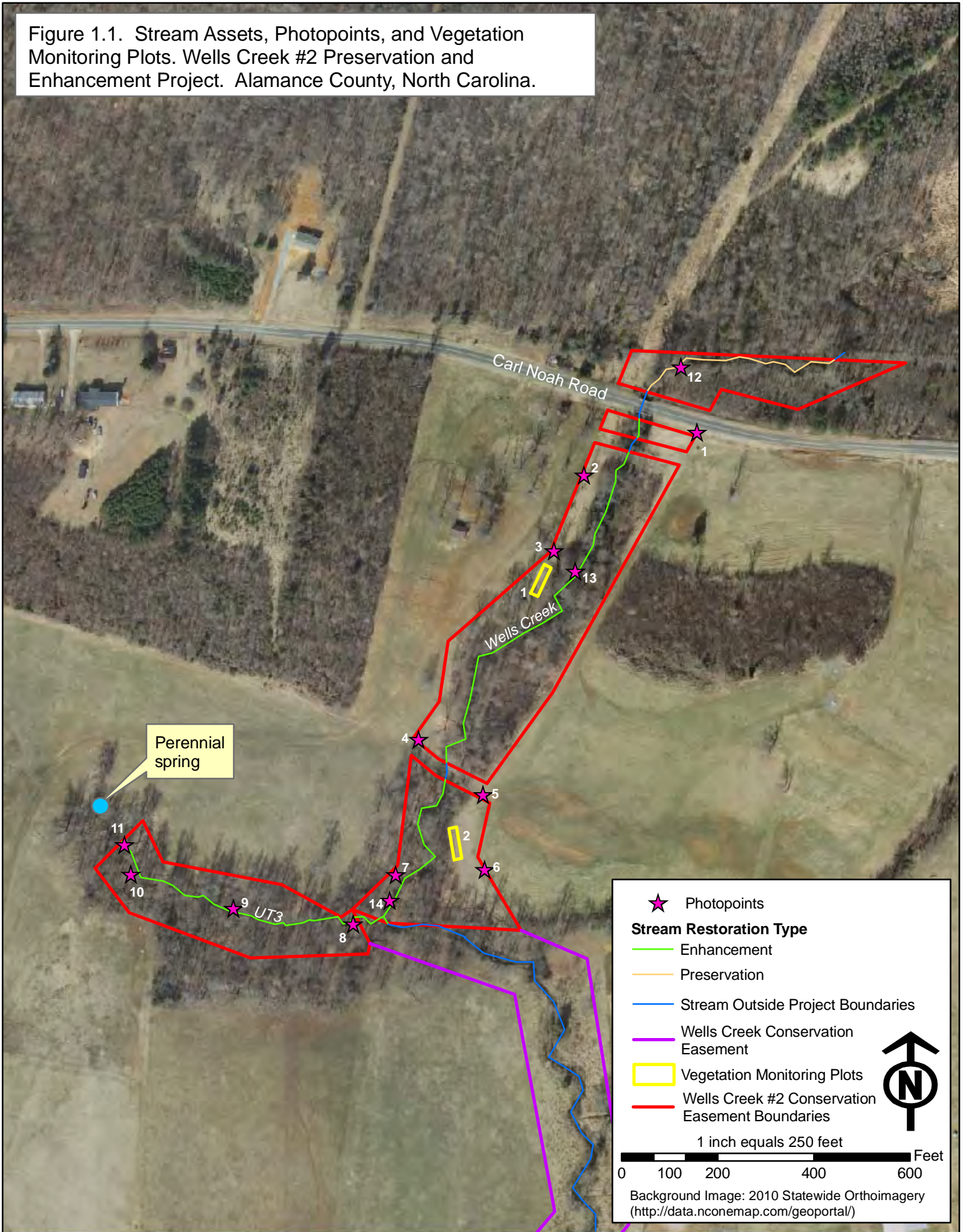




Figure 1.2. Stream Assets and Photopoints--Preservation.  
Wells Creek #2 Preservation and Enhancement Project.  
Alamance County, North Carolina.

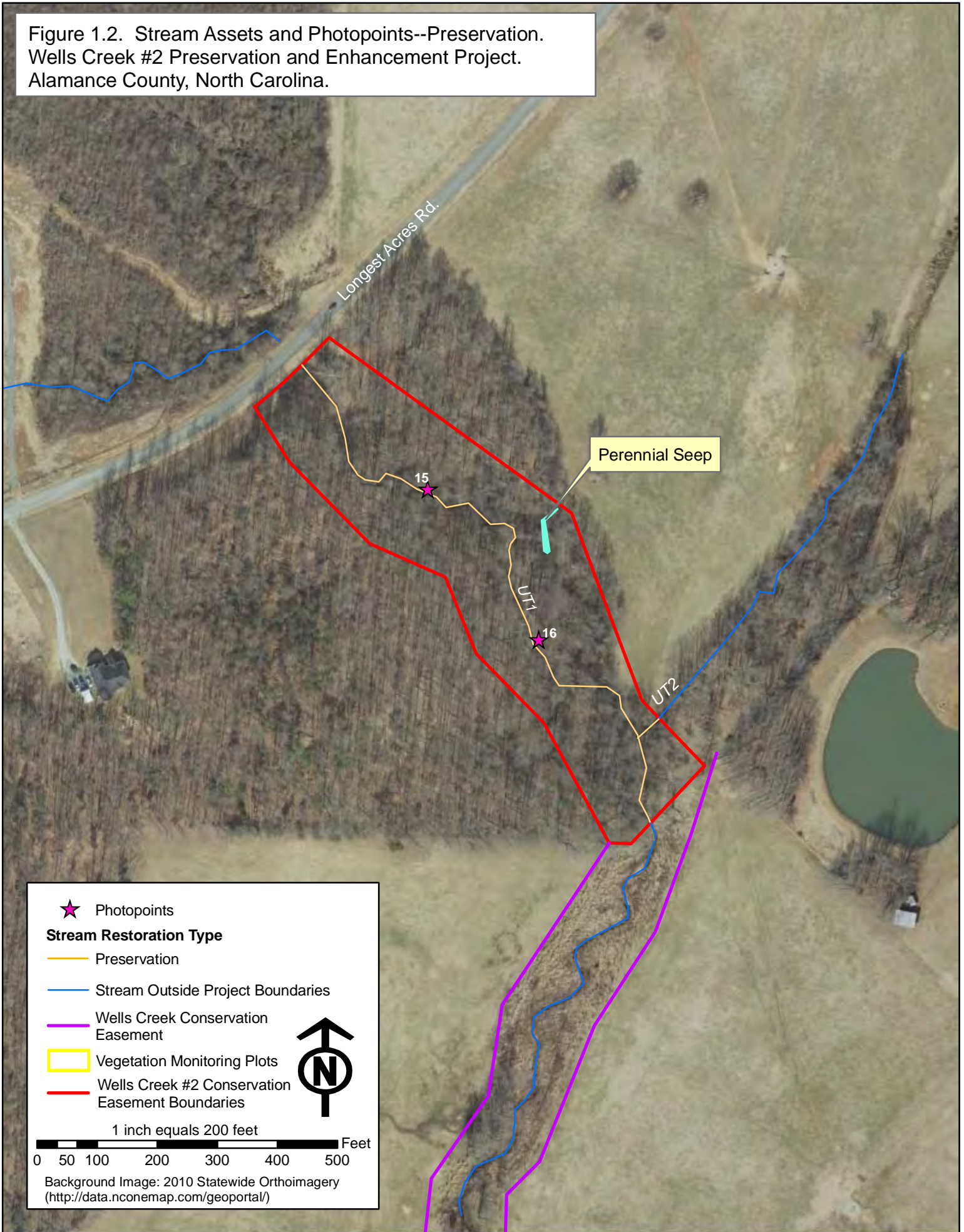




Figure 1.3. Farm BMPs—Enhancement Reach. Wells Creek #2 Preservation and Enhancement Project. Alamance County, North Carolina

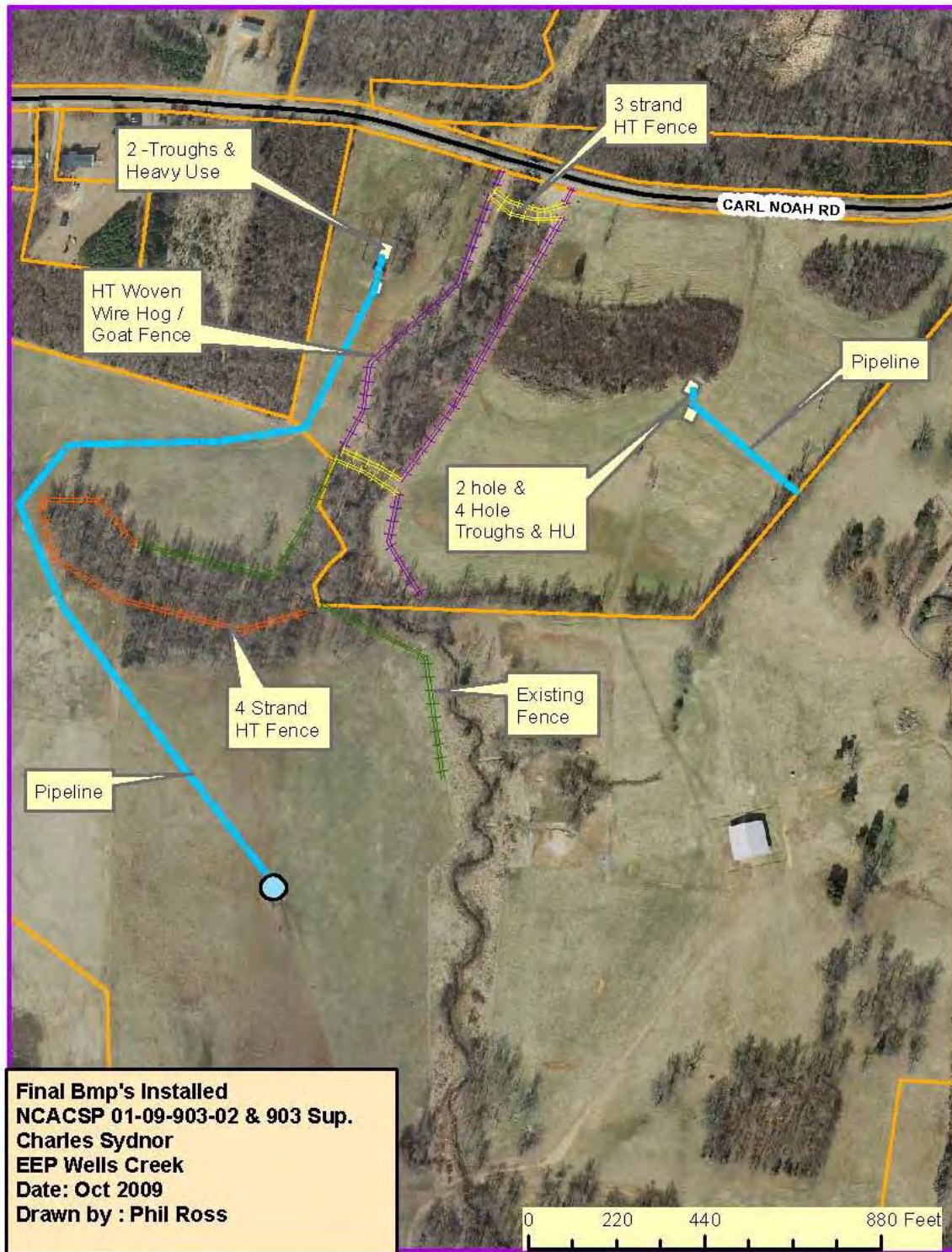


Figure provided by Alamance Soil and Water Conservation District



Figure 1.4. Farm BMPs—Preservation Reach. Wells Creek #2 Preservation and Enhancement Project. Alamance County, North Carolina



Figure provided by Alamance Soil and Water Conservation District

**Table 1.0 Project Components  
Wells Creek #2 (EEP #92688)**

<b>Project Component or Reach ID</b>	<b>Existing Length (ft)</b>	<b>Restoration Level</b>	<b>Approach</b>	<b>Mitigation Length (ft)</b>	<b>Stationing<sup>+</sup></b>	<b>Mitigation Ratio</b>	<b>Stream Mitigation Units</b>	<b>BMP Elements<sup>1</sup></b>	<b>Comment</b>
Wells Creek - Preservation	438	P	n/a	438	00+00 to 04+38	5:1	87		
Wells Creek - Enhancement	1321	E2	n/a	1253*	04+98 to 18+19	2.5:1	501	Cattle fencing, watering system	Invasive vegetation treatment, riparian buffer plantings
UT 3	644	E2	n/a	644	00+00 to 06+44	2.5:1	258	Cattle fencing, watering system	Invasive vegetation treatment, riparian buffer plantings
UT1 - Preservation	1130	P	n/a	1130	00+00 to 11+30	5:1	226	Cattle fencing	Invasive vegetation treatment
UT2 - Preservation	48	P	n/a	48	00+00 to 00+48	5:1	10	Cattle fencing	Invasive vegetation treatment

<sup>1</sup> = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Detention Pond;  
 FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area, O = Other  
 CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

<sup>+</sup> Stationing is estimated based on stream length measurements in ArcGIS. Measured upstream to downstream for each reach.

\* Wells Creek enhancement reach mitigation length does not include two cattle crossings or road crossing at Carl Noah Road.

**Table 1.1. Component Summations  
Wells Creek #2 (EEP #92688)**

Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Mitigation Length (ft) (Ac)	Stationing <sup>+</sup> (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration							
Enhancement							
Enhancement I							
Enhancement II	1897						
Creation							
Preservation	1616						
HQ Preservation							
	<b>3513</b>						
<b>MU Totals</b>	<b>1082</b>						

Non-Applicable

**Table 2. Project Activity and Reporting History  
Wells Creek #2 (#92688) - Baseline Monitoring (2011)**

**Elapsed Time Since Grading Complete: n/a**  
**Elapsed Time Since Planting Complete: 5 months**  
**Number of Reporting Years<sup>1</sup>: 0**

<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Completion or Delivery</b>
Conservation Easement Option Signed	n/a	May 12, 2008
Conservation Easement Survey Plat Recorded	n/a	October 8, 2008
Permanent Conservation Easement Executed & Recorded	n/a	December 31, 2008
Cattle Exclusion Fencing & Livestock Watering System	n/a	December 2009
Existing Conditions Report	January 2010	March 2010
Final Design – Construction Plans	January 2010	April 2010
Containerized plant installations*	n/a	November 2010
Invasive Exotic Vegetation Treatments	January 2010	December 2010
Baseline Monitoring/As-built Baseline Report (Year 0 - baseline)	May 2011	June 2011

\* *Saururus cernuus* and *Lobelia cardinalis* planted within UT3 wetland seep in May 2011.

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

**Table 3. Project Contacts**

**Wells Creek #2 (#92688) - Baseline Monitoring (2011)**

<b>Designer</b>	Robert J. Goldstein & Associates 1221 Corporation Parkway, Ste. 100 Raleigh, NC 27610 Design POC - Sean Doig, (919) 872-1174
<b>Farm BMPs Design</b>	Alamance County SWCD Burlington NC POC - Phil Ross, (336) 228-1753
<b>Planting / Invasives Contractor</b>	Habitat Assessment and Restoration Program 301 McCullough Drive, 4 <sup>th</sup> Floor Charlotte, NC 28262 POC - Karri Blackmon, (704) 841-2841
<b>Nursery Stock Suppliers</b>	Cure Nursery, 919-542-6186  Parks Seed, 800-845-3369  Coastal Plain Conservation Nursery, 252-482-5707  Habitat And Restoration Plants (HARP), 704-841-2841
<b>Monitoring Firm</b>	Robert J. Goldstein & Associates 1221 Corporation Parkway, Ste. 100 Raleigh, NC 27610 Monitoring POC - Sean Doig, (919) 872-1174

**Table 4. Project Attributes  
Wells Creek #2 (#92688) - Baseline Monitoring (2011)**

Project County	Alamance	
Physiographic Region	Piedmont	
Ecoregion	Carolina Slate Belt	
Project River Basin	Cape Fear	
USGS HUC for Project (14 digit)	3030002050050	
NCDWQ Sub-basin for Project	03-06-04	
Within extent of EEP Watershed Plan?	2009 Cape Fear River Basin Restoration Priority report	
WRC Hab Class (Warm, Cool, Cold)	Warm	
% of project easement fenced or demarcated	100%	
Beaver activity observed during design phase?	No	
<b>Restoration Component Attribute Table</b>		
	Preservation	Enhancement
Drainage area	377 acres	958 acres
Stream order	1	1
Restored length (feet)	n/a	n/a
Perennial or Intermittent	Perennial	Intermittent/Perennial
Watershed type (Rural, Urban, Developing etc.)	Rural	Rural
Watershed LULC Distribution (e.g.)		
Residential	4	4
Ag-Row Crop	2	0
Ag-Livestock	57	21
Forested	28	73
Etc.	9	2
Watershed impervious cover (%)	2	2
NCDWQ AU/Index number	16-28-1	16-28-1
NCDWQ classification	C-NSW	C-NSW
303d listed?	No	No
Upstream of a 303d listed segment?	No	No
Reasons for 303d listing or stressor	n/a	n/a
Total acreage of easement	4.62	7.52
Total vegetated acreage within the easement	4.62	6.07
Total planted acreage as part of the restoration	0	2.99 (including areas with existing overstory)
Rosgen classification of pre-existing	n/a	n/a
Rosgen classification of As-built	n/a	n/a
Valley type	n/a	n/a
Valley slope	n/a	n/a
Valley side slope range (e.g. 2-3.%)	n/a	n/a
Valley toe slope range (e.g. 2-3.%)	n/a	n/a
Cowardin classification	n/a	n/a
Trout waters designation	n/a	n/a
Species of concern, endangered etc.? (Y/N)	N	N
Dominant soil series and characteristics		
Series	Colfax	Colfax
Depth	65	65
Clay%	19	19
K	0.17	0.17
T	4	4

Use N/A for items that may not apply. Use "--" for items that are unavailable and "U" for items that are unknown



## **Appendix B.      Vegetation Data and Photos**

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Table 9.0	Final Planting List
Figures 2.0-2.7	Permanent Photo Station Photos
Figure 3.0	Vegetation Plot Photos



Table 5. Vegetation Assessment - Wells Creek #2 (#92688) - Baseline Monitoring (2011)

Planted Acreage<sup>1</sup> 3.04

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	0	0.00	0.0%
<b>Total</b>				0	0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Pattern and Color	0	0.00	0.0%
<b>Cumulative Total</b>				0	0.00	0.0%

Easement Acreage<sup>2</sup> 12.14

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern <sup>4</sup>	Areas or points (if too small to render as polygons at map scale).	1000 SF	Pattern and Color	4	0.26	2.1%
5. Easement Encroachment Areas <sup>3</sup>	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

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

2 = The acreage within the easement boundaries.

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

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

**Table 6. Vegetation Plot Attributes  
Wells Creek #2 (#92688) - Baseline Monitoring (2011)**

Plot ID	Community Type	Planting Zone ID	Reach ID	Associated Gauge(s)	Method	CVS Level
1	Piedmont Alluvial Forest	NA	Wells Creek, Enhancement	NA	CVS	I & II
2	Piedmont Alluvial Forest	NA	Wells Creek, Enhancement	NA	CVS	I & II

**Table 7. CVS Vegetation Metadata Table - Wells Creek #2 (#92688) - Baseline Monitoring (2011)**

<b>Report Prepared By</b>	Sean Doig
<b>Date Prepared</b>	4/28/2011 15:33
<b>database name</b>	cvs-eep-entrytool-v2.2.7.mdb
<b>database location</b>	C:\Documents and Settings\Jessi O'Neal\My Documents\Downloads\cvs-eep-entrytool-v2.2.7
<b>computer name</b>	JESSIO
<b>file size</b>	33820672
<b>DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----</b>	
<b>Metadata</b>	Description of database file, the report worksheets, and a summary of project(s) and project data.
<b>Proj, planted</b>	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
<b>Proj, total stems</b>	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.
<b>Plots</b>	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
<b>Vigor</b>	Frequency distribution of vigor classes for stems for all plots.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Planted Stems by Plot and Spp</b>	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
<b>ALL Stems by Plot and spp</b>	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.
<b>PROJECT SUMMARY-----</b>	
<b>Project Code</b>	92688
<b>project Name</b>	Wells Creek #2
<b>Description</b>	Stream enhancement project in Alamance County
<b>River Basin</b>	Cape Fear
<b>length(ft)</b>	2,026 (Wells Creek and UT3)
<b>stream-to-edge width (ft)</b>	65'-95'
<b>area (sq m)</b>	12,302 sq. meters, 6,677 sq. meters only planted understory
<b>Required Plots (calculated)</b>	3 (per CVS-EEP Access database)
<b>Sampled Plots</b>	2

Table 8. Planted and Total Stem Counts (Species by Plot with Annual Means) - Wells Creek #2 (#92688) - Baseline Monitoring (2011)

	Common Name	Type	Current Data (Baseline 2011)				Annual Means							
			92688-SD-0001		92688-SD-0002		Baseline (2011)		MY1 (2011)		MY2 (2012)		MY3 (2013)	
			P	T	P	T	P	T	P	T	P	T	P	T
<i>Acer rubrum</i>	red maple	T				1		1						
<i>Alnus serrulata</i>	hazel alder	T	3	3				3	3					
<i>Baccharis halimifolia</i>	eastern baccharis	S				1		1						
<i>Carpinus caroliniana</i>	American hornbeam	T				7		7						
<i>Carya cordiformis</i>	bitternut hickory	T				6		6						
<i>Celtis laevigata</i>	sugarberry	T	1	1				1	1					
<i>Diospyros virginiana</i>	common persimmon	T			1	1		1	1					
<i>Fraxinus</i>	ash	T				2		2						
<i>Fraxinus pennsylvanica</i>	green ash	T			2	2		2	2					
<i>Juglans nigra</i>	black walnut	T		1					1					
<i>Lindera benzoin</i>	northern spicebush	S	2	2	4	4		6	6					
<i>Liquidambar styraciflua</i>	sweetgum	T				2		2						
<i>Liriodendron tulipifera</i>	tuliptree	T			3	3		3	3					
<i>Nyssa sylvatica</i>	blackgum	T	3	3				3	3					
<i>Platanus occidentalis</i>	American sycamore	T	1	1				1	1					
<i>Prunus serotina</i>	black cherry	T				1		1						
<i>Quercus michauxii</i>	swamp chestnut oak	T	3	3	2	2		5	5					
<i>Quercus rubra</i>	northern red oak	T			3	3		3	3					
<i>Viburnum dentatum</i>	southern arrowwood	S	3	3				3	3					
	<b>Stem count</b>		16	17	15	35		31	52					
	<b>Size (ares)</b>		1		1		2							
	<b>Size (acres)</b>		0.0247		0.0247		0.0494							
	<b>Species count</b>		7	8	6	13		11	19					
	<b>Stems per ACRE</b>		648	688	607	1417		628	1053					

Type = Tree, Shrub, Livestake

P = Planted

T = Total

Table 9.0. Final Plant List for the Wells Creek #2 Enhancement and Preservation Project (EEP# 92688).

	Minimum RCD	Wetland Indicator Status	Container Size	Zone A		Zone B		Zone C		Zone D	
				Piedmont Alluvial Forest		Oak-Hickory Forest		Stream Side Area (UT3)		In-Channel Wet Fringe	
Acres				1.45		1.25		0.28		0.01	
Species				No. Planted	%	No. Planted	%	No. Planted	%	No. Planted	%
<i>Aesculus sylvatica</i> (Painted buckeye)		FAC	gallon			110	20				
<i>Alnus serrulata</i> (Tag alder)		FACW+	tubeling/ gallon	70	11			30	19		
<i>Asimina triloba</i> (Pawpaw)	3/8"	FAC	gallon	70	11						
<i>Celtis laevigata</i> (Sugarberry)	3/8"	FACW	gallon	35	5						
<i>Cercis canadensis</i> (Eastern redbud)	1/4"	FACU	gallon			55	10				
<i>Chelone glabra</i> (White turtlehead)		OBL	plug							50	63
<i>Corylus americana</i> (American hazelnut)		FACU	3 gallon	20	3						
<i>Diospyros virginiana</i> (Persimmon)	1/4"	FAC	gallon	35	5						
<i>Fraxinus pennsylvanica</i> (Green ash)	3/8"	FACW	gallon	35	5						
<i>Lindera benzoin</i> (Northern spicebush)		FACW	tubeling	70	11			30	19		
<i>Liriodendron tulipifera</i> (Tulip poplar)	3/8"	FAC	gallon	70	11						
<i>Lobelia cardinalis</i> (Cardinal flower)		FACW+	plug							10	13
<i>Nyssa sylvatica</i> (Blackgum)	3/8"	FAC	gallon	35	5	55	10				

	Minimum RCD	Wetland Indicator Status	Container Size	Zone A		Zone B		Zone C		Zone D	
				Piedmont Alluvial Forest		Oak-Hickory Forest		Stream Side Area (UT3)		In-Channel Wet Fringe	
Acres				1.45		1.25		0.28		0.01	
Species				No. Planted	%	No. Planted	%	No. Planted	%	No. Planted	%
<i>Osmunda cinnamomea</i> (Cinnamon fern)		FACW+	plug							7	9
<i>Oxydendrum arboreum</i> (Sourwood)	1/4"	FACU-	gallon			55	10				
<i>Platanus occidentalis</i> (Sycamore)	3/8"	FACW-	gallon	35	5						
<i>Polystichum acrostichoides</i> (Christmas fern)		FAC	plug					40	25		
<i>Prunus serotina</i> (Black cherry)	1/4"	FACU	gallon			55	10				
<i>Quercus michauxii</i> (Swamp chestnut oak)	3/8"	FACW-	gallon	35	5						
<i>Quercus rubra</i> (Northern red oak)	3/8"	FACU	gallon	70	11						
<i>Saururus cernuus</i> (Lizard's tail)		OBL	plug							10	13
<i>Symphoricarpos orbiculatus</i> (Coralberry)		FAC-	tubeling			55	10				
<i>Vaccinium corymbosum</i> (Highbush blueberry)		FACW	tubeling			85	15				
<i>Viburnum dentatum</i> (Southern arrowwood)		FAC	tubeling	70	11	85	15				
<i>Viburnum nudum</i> (Possumhaw viburnum)		FACW+	tubeling					20	13	3	4
<i>Xanthorhiza simplicissima</i> (Yellowroot)		FACW-	tubeling					40	25		



**Figure 2.0. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #1 – Looking Downstream from Easement Boundary (09/16/09)**



**PP #1 – Looking Downstream from Easement Boundary (05/09/11)**



**PP #2 – Looking Downstream (09/16/09)**



**PP #2 – Looking Downstream (05/09/11)**



**Figure 2.1. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #3 – Looking Downstream (09/16/09)**



**PP #3 – Looking Downstream (05/09/11)**



**PP #4 – Looking Down Slope toward Channel (09/16/09)**



**PP #4 – Looking Down Slope toward Channel (05/09/11)**



**Figure 2.2. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #5 – Looking Downstream (09/16/09)**



**PP #5 – Looking Downstream (05/09/11)**



**PP #6 – Looking South toward Channel (09/16/09)**



**PP #6 – Looking South toward Channel (05/09/11)**



**Figure 2.3. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #7 – Looking South beside Channel (09/16/09)**



**PP #7 – Looking South beside Channel (05/09/11)**



**PP #8 – Looking up UT from Fence Post (09/16/09)**



**PP #8 – Looking up UT from Fence Post (05/09/11)**



**Figure 2.4. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #9 – Looking Downstream (09/16/09)**



**PP #9 – Looking Downstream (5/9/11)**



**PP #10 – Looking across Trampled Banks of UT3 (09/16/09)**



**PP #10 – Looking across Trampled Banks of UT3 (05/26/11)**



**Figure 2.5. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #11 – Looking Downstream at Headwaters (09/16/09)**



**PP #11 – Looking Downstream at Headwaters (05/09/11)**



**PP #12 – Wells Creek North of Carl Noah Road (01/03/10)**



**PP #12 – Wells Creek North of Carl Noah Road (5/26/11)**



**Figure 2.6. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #13 – Wells Creek South of Carl Noah Road (01/03/10)**



**PP #13 – Wells Creek South of Carl Noah Road (01/03/10)**



**PP #14 – Confluence of Wells Creek and UT3 (09/16/09)**



**PP #14 – Confluence of Wells Creek and UT3 (09/16/09)**



**Figure 2.7. Stream Photo Station Photo - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**PP #15 – UT#1 Preservation Reach (01/03/10)**



**PP #15 – UT#1 Preservation Reach (05/26/11)**



**PP #16 – UT1 Preservation Reach (01/03/10)**



**PP #16 – UT1 Preservation Reach (05/26/11)**



**Figure 3.0. Vegetation Plot Photos - Wells Creek #2 Stream Restoration - Baseline Monitoring (2011) - Project #92688**



**VP 1 (April 27, 2011)**



**VP 2 (April 27, 2011)**



## **Appendix C. As-Built Plan**

Figure 3.0 As-Built Plan – Enhancement Reach



Figure 3.0. As-Built Plan. Wells Creek #2 Preservation and Enhancement Project. Alamance County, North Carolina.

