

**FINAL
ANNUAL MONITORING REPORT
IRWIN CREEK
RESTORATION SITE
MECKLENBURG COUNTY, NORTH CAROLINA
(EEP Project Number 192, Contract Number 004502)**

Monitoring Year 3 of 5 (2012)



Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina



November 2012

**FINAL
ANNUAL MONITORING REPORT
IRWIN CREEK**

**RESTORATION SITE
MECKLENBURG COUNTY, NORTH CAROLINA
(EEP Project Number 192, Contract Number 004502)**

Monitoring Year 3 of 5 (2012)



Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

Prepared by:
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603

Design Firm:
HDR Engineering, Inc. of the Carolinas
3733 National Drive
Raleigh, North Carolina 27612



November 2012

Table of Contents

1.0 EXECUTIVE SUMMARY	1
2.0 METHODOLOGY	2
2.1 Vegetation Assessment	2
2.2 Wetland Assessment	3
3.0 REFERENCES	3

List of Figures

Figure 1. Vicinity Map	Appendix A
Figure 2. Current Conditions Plan View	Appendix B
Figure 3. Annual Climatic Data vs. 30-year Historic Data	Appendix D

List of Tables

Table 1. Project Components and Mitigation Credits	Appendix A
Table 2. Project Activity and Reporting History	Appendix A
Table 3. Project Contacts Table	Appendix A
Table 4. Project Baseline Information and Attributes	Appendix A
Table 5. Vegetation Condition Assessment Table	Appendix B
Table 6. Vegetation Plot Criteria Attainment	Appendix C
Table 7. CVS Vegetation Plot Metadata	Appendix C
Table 8. Total and Planted Stems by Plot and Species	Appendix C
Table 9. Verification of Bankfull Events	Appendix E
Table 10. Wetland Hydrology Criteria Attainment Summary	Appendix E

Appendices

APPENDIX A. PROJECT VICINITY MAP AND BACKGROUND TABLES

- Figure 1. Vicinity Map
- Table 1. Project Components and Mitigation Credits
- Table 2. Project Activity and Reporting History
- Table 3. Project Contacts Table
- Table 4. Project Baseline Information and Attributes

APPENDIX B. VISUAL ASSESSMENT DATA

- Figure 2. Current Conditions Plan View
- Table 5. Vegetation Condition Assessment Table
- Vegetation Monitoring Plot Photos

APPENDIX C. VEGETATION PLOT DATA

- Table 6. Vegetation Plot Criteria Attainment
- Table 7. CVS Vegetation Plot Metadata
- Table 8. Total and Planted Stems by Plot and Species

APPENDIX D. STREAM SURVEY DATA

- Fixed-Station Photos

APPENDIX E. HYDROLOGY DATA

- Table 9. Verification of Bankfull Events
- Figure 3. Annual Climatic Data vs. 30-year Historic Data
- 2012 (Year 3) Groundwater Gauge Graphs
- Table 10. Wetland Hydrology Criteria Attainment Summary

1.0 EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (EEP) has completed level II stream enhancement and wetland creation at the Irwin Creek Restoration Site (hereafter referred to as the “Site”) to assist in fulfilling stream and wetland mitigation goals in the area. This report (compiled based on EEP’s *Procedural Guidance and Content Requirements for EEP Monitoring Reports* Version 1.4 dated 11/7/11) summarizes data for year 3 (2012) monitoring.

The goals and objectives of this project focus on improving local water quality, habitat, and stream stability. The project approach was designed to provide restoration-oriented improvements to maximize environmental benefits while working within Site constraints, technical guidelines, and availability of funds. These goals were accomplished by the following.

1. Creating a floodplain bench including off-line wetlands to reduce the amount of sediment entering the stream by acting as a repository for soils suspended in the water column during high flow events, providing water storage to further allow sediment to settle out, and slow recharge of stormwater into the groundwater subsurface network.
2. Enhancing vegetation to provide habitat/food sources, shade the stream, filter overland runoff, and remove soil particles and other nutrients from stormwater.
3. Protecting a Site identified in a watershed that is listed as impaired for elevated levels of fecal coliform bacteria and turbidity (NCEEP 2007).

The Site is located on the western side of the City of Charlotte, approximately 2 miles southeast of the Charlotte Douglas International Airport, in Mecklenburg County. The Site is located in United States Geological Survey Hydrologic Unit 03050103020020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-34) of the Catawba River Basin and will service USGS 8-digit Cataloging Unit (CU) 03050103.

The Site is located in an EEP Targeted Local Watershed within the Sugar Creek watershed; this watershed in conjunction with the Little Sugar, McMullen, and McAlpine Creek watersheds in CU 03050103 drain point and nonpoint sources of pollution from the metropolitan center of Charlotte severely impacting aquatic health of the watershed. The waters are listed as impaired for elevated levels of fecal coliform bacteria and turbidity; the main goal in this CU is to provide better stormwater management (NCEEP 2007).

Prior to construction, the Site was located within a FEMA buyout area where several homes were demolished and removed. Surrounding land uses include commercial and residential areas with narrow riparian corridors adjacent to streams; greater than 85-90 percent of the contributing watershed having been cleared and developed.

This project was constructed between the spring and early winter of 2009. The project consisted of enhancement (level II) of 980 linear feet of stream by laying back stream banks, excavating an extensive 90- to 100-foot wide floodplain bench along the entire project stream length, creating 0.5 acres of wetlands within the floodplain bench, and planting with native forest species. Several structures were left at the downstream end of the Site rather than removing them to avoid disturbance to the wetland area and stream banks. In addition, it was verified by HDR Engineering that the structures will not cause an issues

with FEMA and may provide aquatic habitat and grade control. Site activities provide 653 Stream Mitigation Units and 0.17 riparian Riverine Wetland Mitigation Units. The Site is protected by a permanent conservation easement held by the State of North Carolina.

Success criteria for stream enhancement will include 1) success of riparian vegetation and 2) documentation of two bankfull channel events. A crest gauge is located within the Site to assist with documentation of bankfull events (Figure 2, Appendix B). Two bankfull events were documented during the year 3 (2012) monitoring season for a total of six bankfull events.

Vegetation success criteria dictate that an average density of 320 stems per acre must be surviving in the first three monitoring years. Subsequently, 290 stems per acre must be surviving in year 4 and 260 stems per acre in year 5. Stem counts will be based on an average of the evaluated vegetation plots. Based on the number of stems counted, average densities were measured at 817 stems per acre surviving in year 3 (2012). The dominant species identified at the Site were planted stems of silky dogwood (*Cornus amomum*), river birch (*Betula nigra*), sycamore (*Platanus occidentalis*), and green ash (*Fraxinus pennsylvanica*). In addition, each individual vegetation plot met success criteria when counting planted stems alone.

In general herbaceous vegetation within the Site has been slow to establish; however, herbaceous vegetation has filled in most areas that were previously bare. Ball and burlap trees planted immediately after Site construction were in poor health with many dying over the summer of 2010 as the result of dry conditions. Therefore, on March 10, 2011, supplemental planting occurred at the Site and included the following.

- 3 red maple (*Acer rubrum*) (2-inch caliper ball and burlap)
- 2 river birch (*Betula nigra*) (2-inch caliper ball and burlap)
- 1000 bare-root seedlings of river birch (*Betula nigra*), green ash (*Fraxinus pennsylvanica*), sycamore (*Platanus occidentalis*), tag alder (*Alnus serrulata*), tulip poplar (*Liriodendron tulipifera*), and silky dogwood (*Cornus amomum*)

Currently, newly planted and surviving ball and burlap trees are thriving. These issues encompass the majority of the Site and should continue to be monitored closely in subsequent monitoring years.

Success criteria for wetland groundwater hydrology at the Site require inundation or saturation within 12 inches of the ground surface for a consecutive period of 10 percent of the growing season or greater than 23 consecutive days (the growing season in Mecklenburg County begins March 22 and ends November 11 [233 days]). Groundwater hydrology was not successful for either of the groundwater gauges for the year 3 (2012) growing season.

Summary information and data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in tables and figures within this report's appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEPs website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.

2.0 METHODOLOGY

2.1 Vegetation Assessment

Five vegetation plots were established and marked after construction with four foot metal U-bar post demarking the corners with a ten foot, three-quarter inch PVC at the origin. The plots are 10 meters

square and are located randomly within the Site. These plots were surveyed in June for the year 3 (2012) monitoring season using the *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008) (<http://cvs.bio.unc.edu/methods.htm>); results are included in Appendix C. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (Weakley 2007).

2.2 Wetland Assessment

Two groundwater monitoring gauges were installed at the Site within off-line wetlands in June 2010 and have been maintained and monitored throughout the growing seasons. Graphs of groundwater hydrology and precipitation are included in Appendix D.

3.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. *CVS-EEP Protocol for Recording Vegetation, Version 4.2*. (online). Available: <http://cvs.bio.unc.edu/methods.htm>.

National Oceanic and Atmospheric Administration (NOAA). 2004. *Climatology of the United States No. 20; Monthly Station Climate Summaries, 1971-2000*. National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Climatic Data Center, Asheville, North Carolina.

North Carolina Ecosystem Enhancement Program (NCEEP). 2007. *Catawba River Basin Restoration Priorities*. Available: <http://www.nceep.net/services/restplans/RBRPCatawba2007.pdf> [June 2010]. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

Weakley, Alan S. 2007. *Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas* (online). Available: <http://www.herbarium.unc.edu/WeakleysFlora.pdf> [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

Weather Underground. 2011. Station at Charlotte Douglas International Airport (KCLT) in Charlotte, North Carolina. (online). Available: <http://www.wunderground.com/history/airport/KCLT/2011/11/09/CustomHistory.html> [November 9, 2011].

APPENDIX A

PROJECT VICINITY MAP AND BACKGROUND TABLES

Figure 1. Vicinity Map

Table 1. Project Components and Mitigation Credits

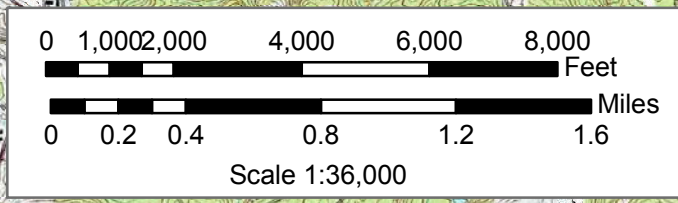
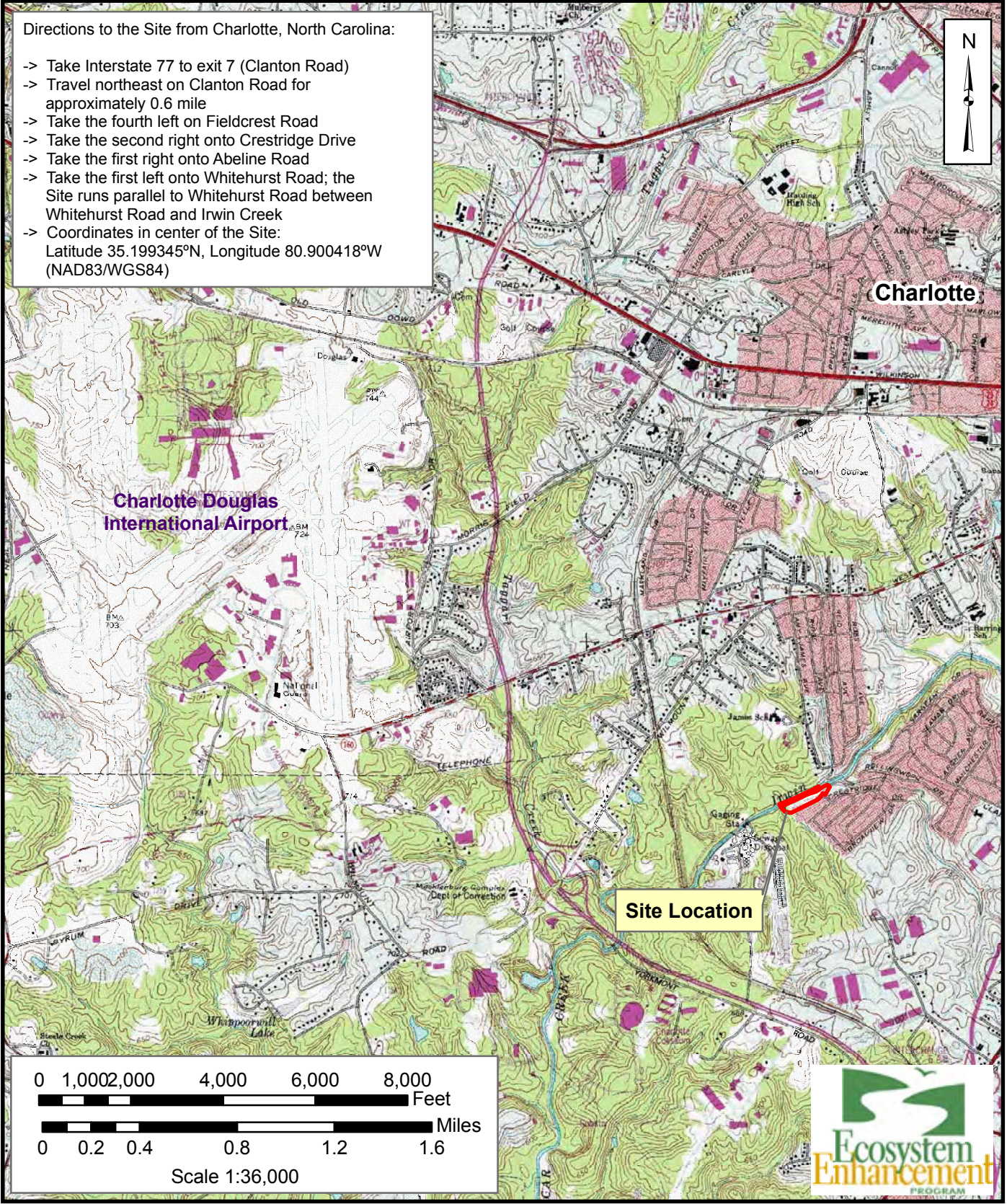
Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Baseline Information and Attributes

Directions to the Site from Charlotte, North Carolina:

- > Take Interstate 77 to exit 7 (Clanton Road)
- > Travel northeast on Clanton Road for approximately 0.6 mile
- > Take the fourth left on Fieldcrest Road
- > Take the second right onto Crestridge Drive
- > Take the first right onto Abeline Road
- > Take the first left onto Whitehurst Road; the Site runs parallel to Whitehurst Road between Whitehurst Road and Irwin Creek
- > Coordinates in center of the Site:
Latitude 35.199345°N, Longitude 80.900418°W
(NAD83/WGS84)




20 Enterprise Street
Suite 7
Raleigh, NC 27607
(919) 215-1693

VICINITY MAP
IRWIN CREEK STREAM RESTORATION SITE
EEP PROJECT NUMBER 192
Mecklenburg County, North Carolina

Dwn. by:	CLF	FIGURE 1
Date:	June 2010	
Project:	10-009	

**Table 1. Project Components and Mitigation Credits
Irwin Creek Restoration Site/EEP Project Number 192**

Mitigation Credits						
Type	Stream			Riverine Riparian Wetland		
	Restoration	Restoration Equivalent	Restoration	Restoration Equivalent	Restoration Equivalent	
Totals	--	653	--	0.17	0.17	
Project Component/ Reach ID	Projects Components					
	Existing Linear Footage/ Acreage	Priority Approach	Restoration/ Restoration Equivalent	Restoration Linear Footage/ Acreage	Mitigation Ratio	Comment
Irwin Creek	980	Level II	Enhancement	980	1.5:1*	Laying back stream banks, excavation of a 90- to 100-foot wide floodplain bench along the entire project, and creation of wetlands within the floodplain bench, and planting with native forest vegetation.
Wetland	0	--	Creation	0.5	3:1	Excavation of depressional wetlands within the floodplain bench and planting with native forest vegetation.
Component Summation						
Restoration Level	Stream (linear footage)			Riparian Wetland (acreage)		
Enhancement (Level II)	980			--		
Creation	--			0.5		
Totals	980			0.5		
Mitigation Units	653 SMU*			0.17 WMUs		

* A ratio of 1.5:1 was used due to the extensive excavation of a 90- to 100-foot wide floodplain bench along the entire project in addition to the incorporation of created wetlands within the floodplain bench area.

**Table 2. Project Activity and Reporting History
Irwin Creek Restoration Site/EEP Project Number 192**

Elapsed Time Since Grading Complete: 2.5 years

Elapsed Time Since Planting Complete: 2 years

Number of Reporting Years: 2

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	--	October 2003
Site Construction and 1st Planting	--	Spring 2009
2nd Planting	--	Late fall/early winter 2009
3 rd Planting	--	March 2011
As-built Analysis Report	--	March 2010
As-built Record Drawings	--	March 2010
Baseline Monitoring Document	June 2010	October 2010
Year 1 (2010) Monitoring Document	November 2010	October 2010
Year 2 (2011) Monitoring Document	November 2011	December 2011
Year 3 (2012) Monitoring Document	November 2012	November 2012

**Table 3. Project Contacts Table
Irwin Creek Restoration Site/EEP Project Number 192**

Designer	HDR Engineering of the Carolinas, Inc. 3733 National Drive Raleigh, NC 27612 919-785-1118
Construction and Seeding and Matting Contractor	Blythe Development Company 1415 E. Westinghouse Charlotte, NC 28273
Planting Contractor	North State Environmental, Inc. 2889 Lowery Street, Suite B Winston Salem, NC 27101 336-725-2010
Monitoring Performer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 919-215-1693

**Table 4. Project Baseline Information and Attributes
Irwin Creek Restoration Site/EEP Project Number 192**

Project Information	
Project Name	Irwin Creek Restoration Site
Project County	Mecklenburg County, North Carolina
Project Area	5.7 acres
Project Coordinates	35.199345°N, 80.900418°W
Project Watershed Summary Information	
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Catawba
USGS 8-digit HUC	03050103
USGS 14-digit HUC	03050103020020
NCDWQ Subbasin	03-08-34
Project Drainage Area	20,000 acres
Project Drainage Area Impervious Surface	>30%
CGIS Land Use Classification	
Reach Summary Information	
Enhanced length	980 linear feet
Drainage Area	31 square miles
NCDWQ Index Number	11-137-1
NCDWQ Classification	C
Dominant Soil Series	Monacan
Drainage Class	Moderately well-somewhat poorly
Soil Hydric Status	Contains 5% hydric Wehadkee soils
Wetland Summary Information	
Size of Wetland	0.5 acres
Wetland Type	Riparian riverine
Mapped Soil Series	Monacan
Drainage Class	Moderately well-somewhat poorly
Soil Hydric Status	Contains 5% hydric Wehadkee soils
Source of Hydrology	Stormwater, stream overbank
Regulatory Considerations	
Regulation	Applicable
Waters of the U.S. –Sections 404 and 401	No
Endangered Species Act	No
Historic Preservation Act	No
CZMA/CAMA	No
FEMA Floodplain Compliance	No
Essential Fisheries Habitat	No

APPENDIX B

VISUAL ASSESSMENT DATA

Figure 2. Current Conditions Plan View

Table 5. Vegetation Condition Assessment Table

Vegetation Monitoring Plot Photos

Legend

- Conservation Easement = ~ 5.7 acres
- ★ Vegetation Plot Origins
- Vegetation Plots**
- Met Success Based on Planted Stems
- Did Not Meet Success Based on Planted Stems Only
- Groundwater Gauges not meeting success
- Photo Points
- Wetland Creation = 0.5 acre
- Planting Zones = ~ 3.2 acres**
- Zone 1: Streamside Assemblage
- Zone 2: Floodplain Bench
- Zone 3: Floodplain Bench/Depression
- Zone 4: Slope
- Structures
- Roads



Prepared for:



Project:

IRWIN CREEK RESTORATION SITE

EEP Project Number 192
Mecklenburg County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by:

CLF

Date:

DEC 2011

Scale:

1:1200

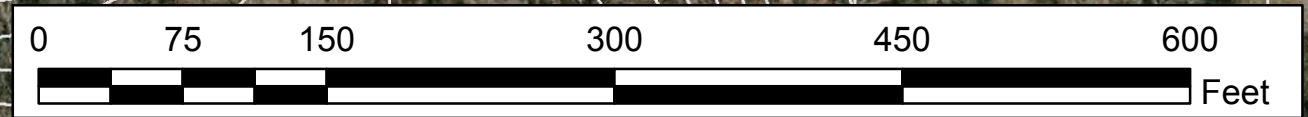
Project No.:

10-009

FIGURE

2

Background Imagery:
2005 Mecklenburg County
aerial photography, NC One Map
LIDAR, 2-foot contours, NCDOT



Monitoring Feature	Latitude	Longitude
Vegetation Plot Corners		
plot 1 origin	35.19894	-80.90159
plot 1	35.19899	-80.90175
plot 1	35.19890	-80.90169
plot 1	35.19902	-80.90164
plot 2 origin	35.19891	-80.90110
plot 2	35.19887	-80.90120
plot 2	35.19896	-80.90124
plot 2	35.19899	-80.90114
plot 3 origin	35.19936	-80.90031
plot 3	35.19943	-80.90044
plot 3	35.19935	-80.90042
plot 3	35.19945	-80.90033
plot 4 origin	35.19934	-80.89967
plot 4	35.19938	-80.89981
plot 4	35.19930	-80.89976
plot 4	35.19942	-80.89972
plot 5 origin	35.19995	-80.89916
plot 5	35.19990	-80.89928
plot 5	35.19997	-80.89927
plot 5	35.19988	-80.89918
Photo Point Locations		
photo 1	35.19890	-80.90195
photo 2	35.19879	-80.90108
photo 3	35.19934	-80.90059
photo 4	35.19921	-80.90045
photo 5	35.19984	-80.89953
Groundwater Monitoring Gauges		
gauge 1	35.19962	-80.89983
gauge 2	35.19885	-80.90156

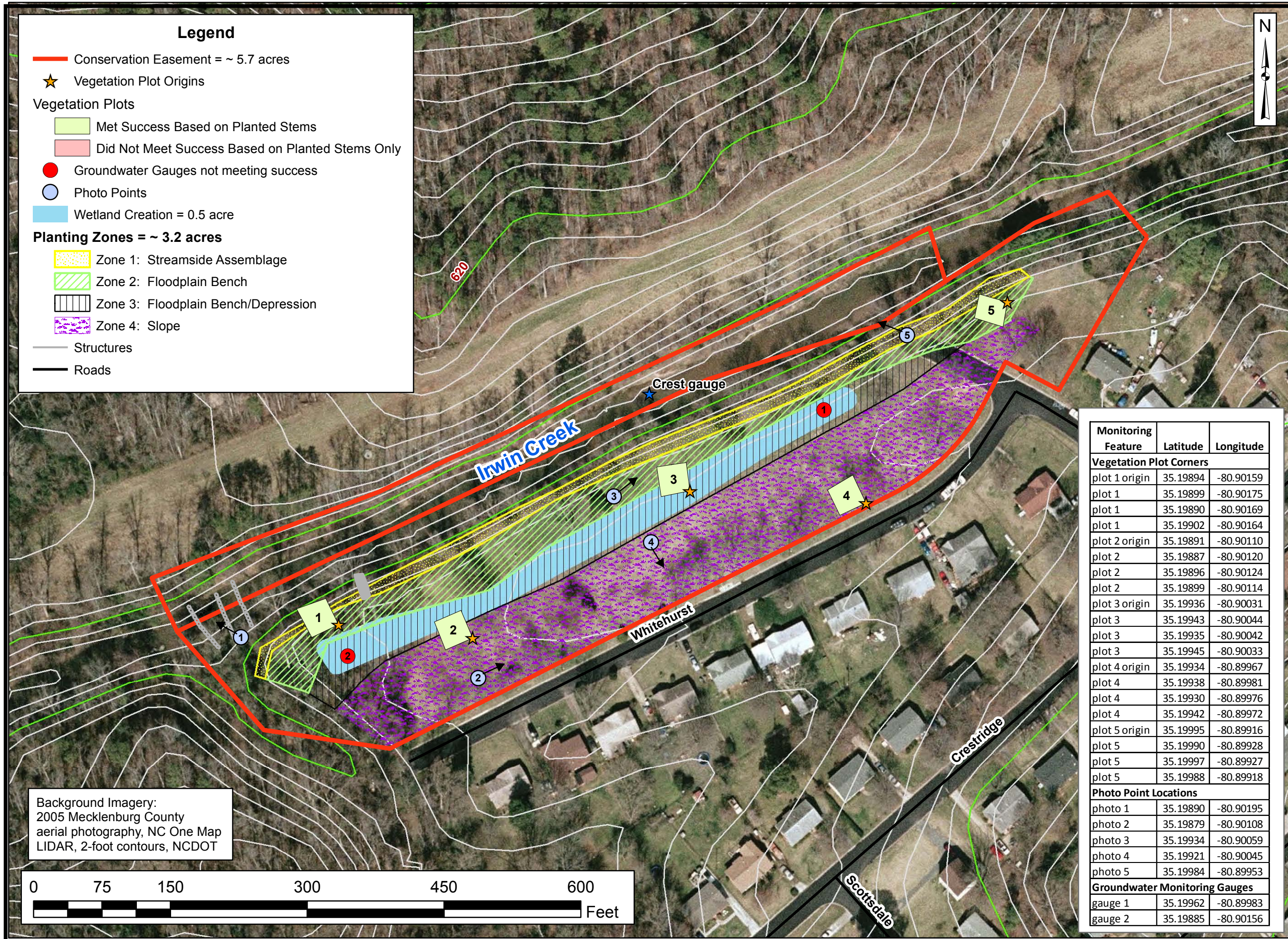


Table 5 **Vegetation Condition Assessment**
Irwin Creek Restoration Site/EEP Project Number 192

Planted Acreage¹ **3.2**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	NA	NA	NA	NA	NA	NA
2. Low Stem Density Areas	NA	NA	NA	NA	NA	NA
				Total	0	0.00
3. Areas of Poor Growth Rates or Vigor	In general herbaceous vegetation within the Site has been slow to establish; however, herbaceous vegetation has filled in most areas that were previously bare. Ball and burlap trees planted immediately after Site construction were in poor health with many dying over the summer of 2010 as the result of dry conditions. This is difficult to quantify or depict on mapping since these observations were made scattered throughout the entire Site. Supplemental planting occurred in March 2011 with 5 ball and burlap trees and 1000 bare root seedlings. Currently, newly planted and surviving ball and burlap trees are thriving.	NA	NA	NA	2.25	70.3%
				Cumulative Total	0	2.25

Easement Acreage² **14**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern ⁴	NA	NA	NA	NA	NA	NA
5. Easement Encroachment Areas ³	NA	NA	NA	NA	NA	NA

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.

**Vegetation Monitoring Photographs
Taken June 2012**



APPENDIX C

VEGETATION PLOT DATA

Table 6. Vegetation Plot Criteria Attainment

Table 7. CVS Vegetation Plot Metadata

Table 8. Total and Planted Stems by Plot and Species

**Table 6. Vegetation Plot Criteria Attainment
 Irwin Creek Restoration Site (EEP Project Number 192)**

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	

**Table 7. CVS Vegetation Plot Metadata
Irwin Creek Restoration Site (EEP Project Number 192)**

Report Prepared By	Corri Faquin
Date Prepared	7/18/2012 9:55
database name	Axiom-EEP-2012-A.mdb
database location	C:\Axiom\Business\CVS
computer name	CORRI-PC
file size	49704960
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT -----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
ALL Stems by Plot and spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY -----	
Project Code	192
project Name	Irwin Creek Whitehurst Road
Description	Stream and Wetland Restoration
River Basin	Catawba
length(ft)	980
stream-to-edge width (ft)	150
area (sq m)	13650
Required Plots (calculated)	NA
Sampled Plots	5

EEP Project Code 192. Project Name: Irwin Creek Whitehurst Road

Scientific Name	Common Name	Species Type	Current Plot Data (MY3 2012)															Annual Means											
			E192-AXE-0001			E192-AXE-0002			E192-AXE-0003			E192-AXE-0004			E192-AXE-0005			MY3 (2012)			MY2 (2011)			MY1 (2010)			MY0 (2010)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																				11	1	1	34	1	1	368	
Acer rubrum	red maple	Tree			15			7			13				1	1	1	1	1	36	1	1	99	4	4	4	6	6	81
Alnus serrulata	hazel alder	Shrub	2	2	2				1	1	1							3	3	3	3	3	3	5	5	5	6	6	6
Aronia arbutifolia	Red Chokeberry	Shrub	2	2	2				3	3	3				4	4	4	9	9	9	9	9	9	9	9	9	9	9	9
Baccharis halimifolia	eastern baccharis	Shrub																				3							
Betula nigra	river birch	Tree	12	12	12	2	2	2	1	1	1	1	1	1	1	1	1	17	17	17	19	19	19	7	7	7	6	6	21
Callicarpa americana	American beautyberry	Shrub							1	1	1				2	2	2	3	3	3	4	4	4	5	5	5	8	8	9
Cephalanthus occidentalis	common buttonbush	Shrub	1	1	1				1	1	1							2	2	2	4	4	4	3	3	3	6	6	6
Cornus amomum	silky dogwood	Shrub	4	6	6	4	4	4	1	1	1	4	4	4	1	1	1	14	16	16	15	17	17	2	4	4	2	4	4
Diospyros virginiana	common persimmon	Tree	1	1	1													1	1	1									
Fraxinus americana	white ash	Tree	1	1	1													1	1	1	1	1	1	1	1	1	1	1	1
Fraxinus pennsylvanica	green ash	Tree	6	6	12	3	3	3	8	8	31	4	4	4	5	5	5	26	26	55	29	29	75	9	9	31	8	8	32
Itea virginica	Virginia sweetspire	Shrub																					1	1	1	2	2	2	
Liquidambar styraciflua	sweetgum	Tree				1	1	2									1	1	2	1	1	1	1	1	2	1	1	4	
Liriodendron tulipifera	tuliptree	Tree				4	4	5									4	4	5	7	7	7	5	5	5	8	8	8	
Pinus taeda	loblolly pine	Tree			2															2									
Platanus occidentalis	American sycamore	Tree	4	4	4	3	3	3	2	2	2	3	3	3				12	12	12	17	17	17	5	5	5	7	7	7
Populus deltoides	eastern cottonwood	Tree				7	7	7			14							7	7	21	7	7	42	2	2	32	2	2	59
Quercus nigra	water oak	Tree																									1	1	1
Quercus phellos	willow oak	Tree																									1	1	1
Rhus glabra	smooth sumac	shrub																											1
Salix nigra	black willow	Tree																			4	4		4	4	2	7	7	
Salix sericea	silky willow	Shrub			1	1														1	1		1	1		4	4	4	
Sambucus canadensis	Common Elderberry	Shrub																			1	1	1	1	1	1	2	2	2
Unknown		Shrub or Tree																			2	2	2	1	1	1			
Stem count			33	36	59	24	24	33	18	18	68	12	12	12	14	14	14	101	104	186	120	127	321	62	71	157	79	90	633
size (ares)			1			1			1			1			1			5			5			5			5		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.12			0.12			0.12			0.12		
Species count			9	10	12	7	7	8	8	8	10	4	4	4	6	6	6	14	15	16	15	17	20	17	19	19	19	20	21
Stems per ACRE			1335	1457	2388	971.2	971.2	1335	728.4	728.4	2752	485.6	485.6	485.6	566.6	566.6	566.6	817.5	841.7	1505	971.2	1028	2598	501.8	574.7	1271	639.4	728.4	5123

Color for Density

- Exceeds requirements by 10%
- Exceeds requirements, but by less than 10%
- Fails to meet requirements, by less than 10%
- Fails to meet requirements by more than 10%

- PnoLS = Planted stems excluding livestock
- P-all = Planted stems including livestock
- T = Planted stems and natural recruits
- Total includes stems of natural recruits

APPENDIX D
STREAM SURVEY DATA
Fixed-Station Photos

**Irwin Creek
Taken May and June 2012**



Photo Point 1: Downstream structure left in place to avoid disturbance to wetlands and stream banks in addition to provide potential aquatic habitat and channel grade control



Photo Point 2:
Levee Area



Photo Point 3:
Excavated bench area

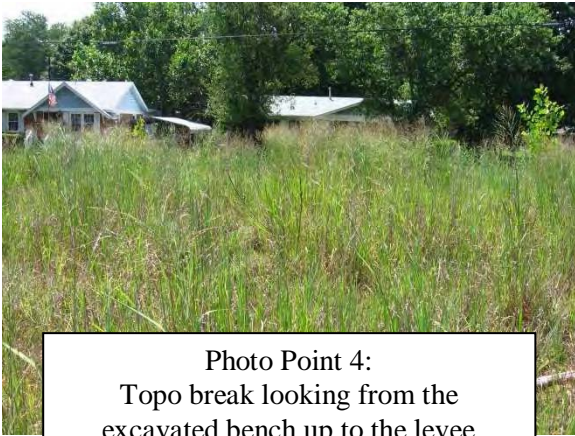


Photo Point 4:
Topo break looking from the excavated bench up to the levee



Photo Point 5:
Stream-side assemblage

APPENDIX E
HYDROLOGY DATA

Table 9. Verification of Bankfull Events

Figure 3. Annual Climatic Data vs. 30-year Historic Data

2012 (Year 3) Groundwater Gauge Graphs

Table 10. Wetland Hydrology Criteria Attainment

Table 9. Verification of Bankfull Events**Irwin Creek Restoration Site (EEP Project Number 192)**

Date of Data Collection	Date of Occurrence	Method	Photo (if available)
September 23, 2010	July 12, 2010	Total of 2.14 inches* of rain reported to fall over 2 days (July 11-12, 2010) as well as a brief spike in groundwater at groundwater gauge 2	--
September 23, 2010	August 19, 2010	Total of 1.1 inches* of rain reported to fall over 2 days (August 18-19, 2010) after a total of 4.43 inches* of rain the preceding 4 weeks as well as brief spike in groundwater at groundwater gauges 1 and 2	--
October 18, 2010	September 29, 2010	Total of 4.04 inches* of rain reported to fall over 6 days (September 25-30, 2010) as well as a brief spike in groundwater at groundwater gauge 2	--
October 21, 2011	August 5, 2011	Total of 2.50 inches* of rain reported to fall on August 5, 2011 as well as a brief spike in groundwater at groundwater gauge 2	--
August 6, 2012	May 8, 2012	Total of 2.77 inches* of rain reported to fall on May 8-9, 2012.	--
August 6, 2012	May 16, 2012	Total of 2.71 inches* of rain reported to fall on May 13-16, 2012.	--

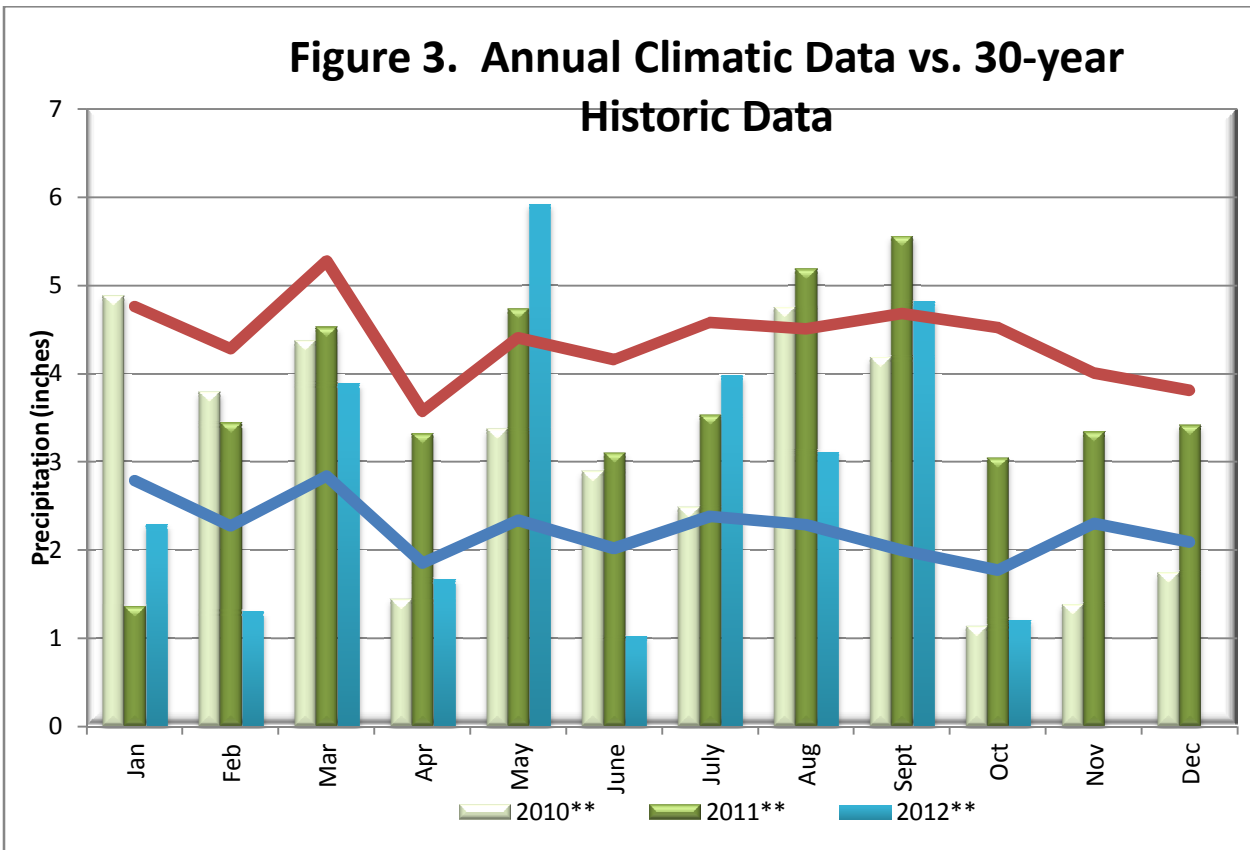
* Reported at KCLT Weather Station at the Charlotte Airport (Weatherunderground 2012).

Month	30th %*	70th %*	2010**	2011**	2012**
Jan	2.79	4.76	4.88	1.36	2.29
Feb	2.27	4.28	3.79	3.44	1.30
Mar	2.84	5.28	4.37	4.52	3.89
Apr	1.85	3.57	1.44	3.32	1.67
May	2.34	4.41	3.37	4.73	5.92
June	2.02	4.16	2.89	3.10	1.02
July	2.38	4.58	2.48	3.53	3.98
Aug	2.29	4.51	4.75	5.18	3.11
Sept	2	4.68	4.18	5.55	4.82
Oct	1.77	4.52	1.13	3.04	1.21
Nov	2.3	4.01	1.38	3.34	
Dec	2.09	3.81	1.74	3.41	

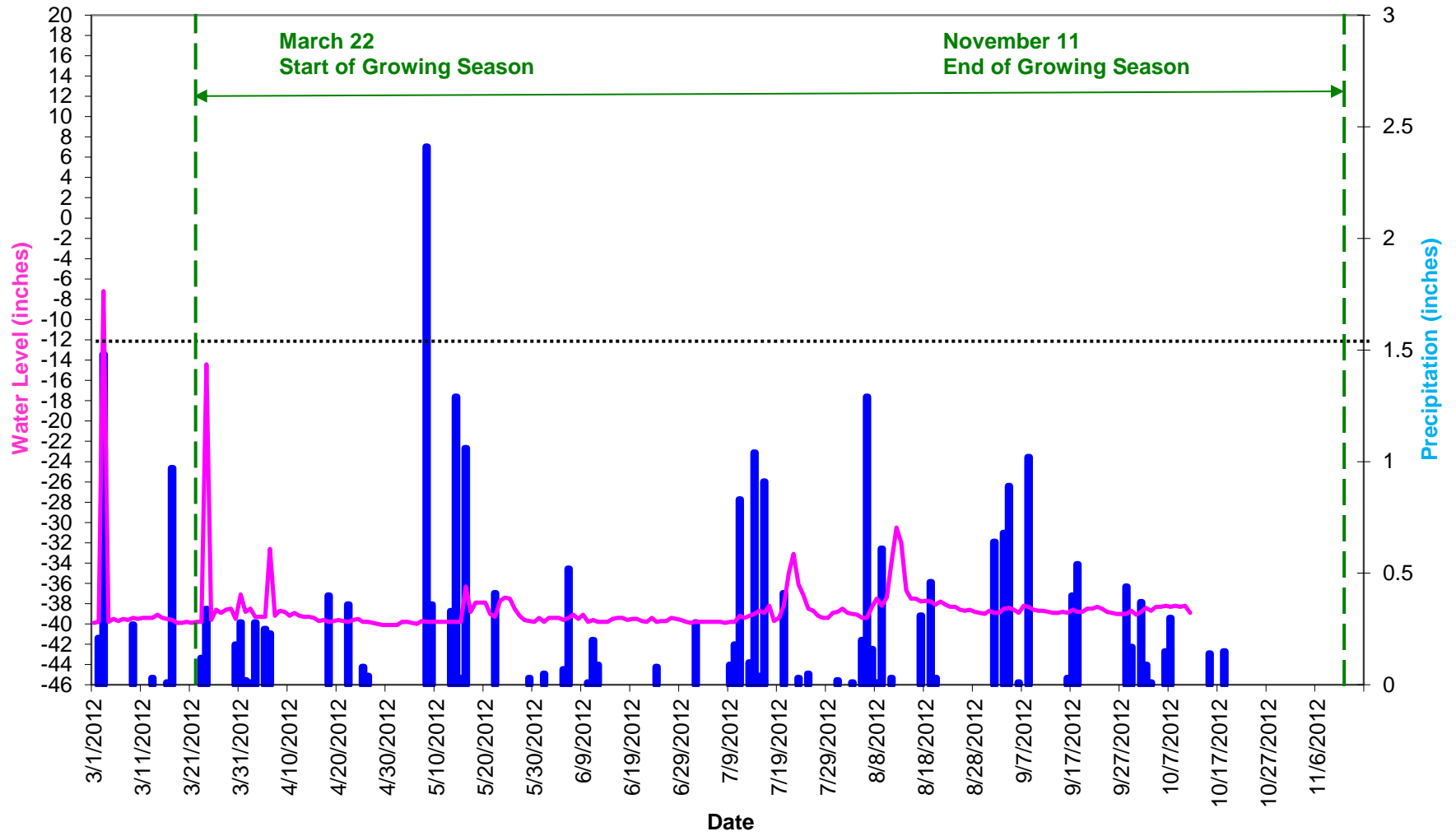
*Charlotte Douglas International Airport 30-year historic data (NOAA 2004)

**Charlotte Douglas International Airport rainfall data (Weatherunderground 2012)

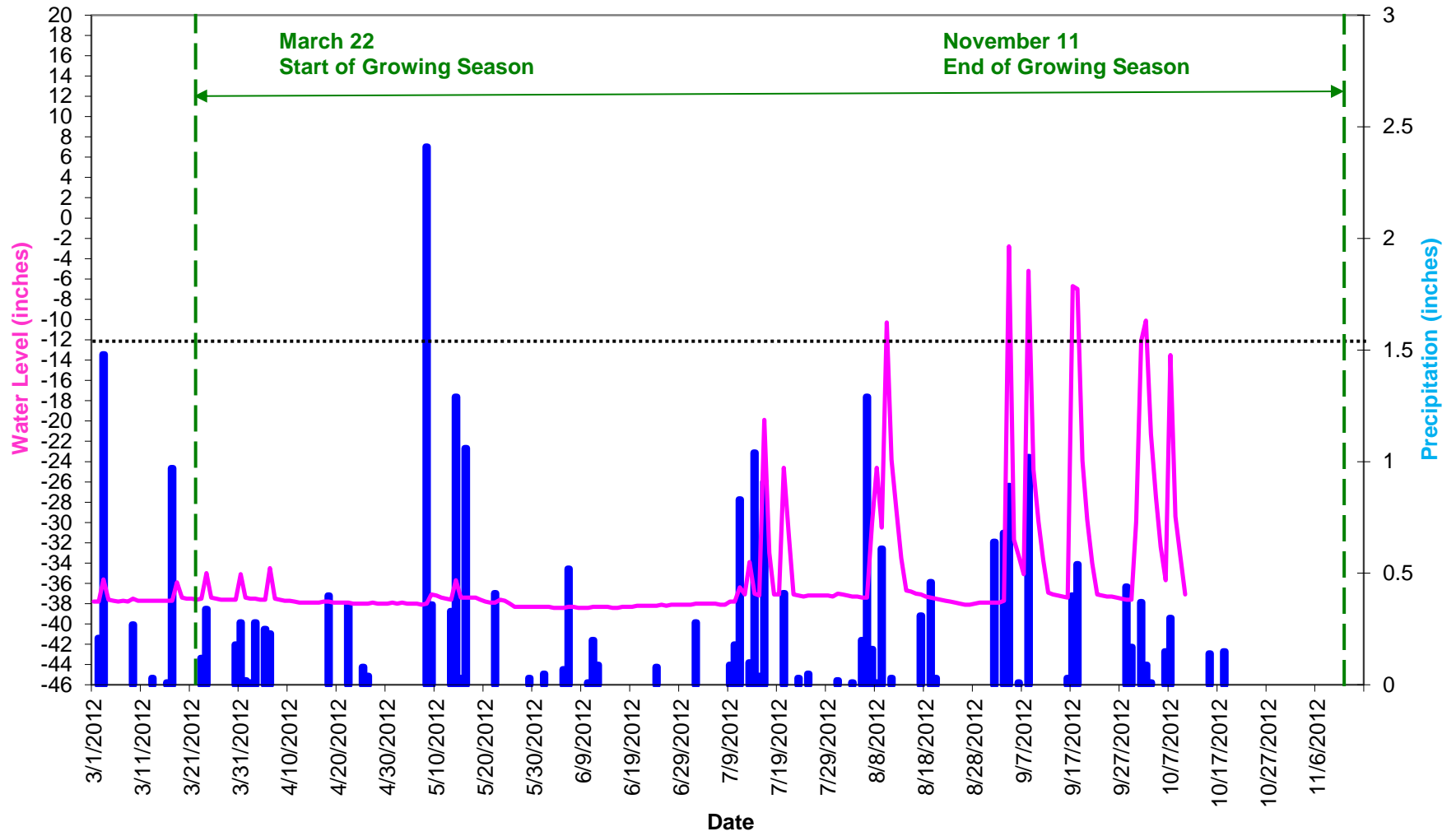
***October rain data through the 23rd.



Irwin Gauge 1 Year 3 (2012 Data)



Irwin Gauge 2 Year 3 (2012 Data)



**Table 10. Wetland Hydrology Criteria Attainment Summary
Irwin Creek Restoration Site (EEP Project Number 192)**

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1	No/1 day (0.004 %)	No/1 day (0.004 %)	No/0 day (0.00 %)		
2	No/3 days (0.01 %)	No/1 day (0.004 %)	No/2 days (0.009 %)		