

Indian and Howard's Creek Local Watershed Plan

Technical Memorandum 3



July 31, 2009

Project Number : 12119010.00

Prepared by

Prepared for



INDIAN AND HOWARD'S CREEKS LOCAL WATERSHED PLAN

TECHNICAL MEMORANDUM 3: SUMMARY OF FIELD ASSESSMENTS

This Technical Memorandum (TM) outlines field data collection methods and results for Phase II of the Indian Creek and Howard's Creek Local Watershed Plan (LWP). During Phase I, the North Carolina Ecosystem Enhancement Program (EEP) and ENTRIX used geographical information systems (GIS) to review data on streams and wetlands in the LWP area and select sites to conduct the field assessments outlined in this Technical Memorandum. Information on the data and methods that were used to select these sites can be found in ENTRIX's Technical Memorandum #2.

During the months of February, March and April, 2009, ENTRIX conducted riparian corridor assessments on forty (40) EEP prioritized stream restoration sites, riparian corridor assessments on ten (10) EEP prioritized stream preservation sites, wetland assessments on thirty (30) EEP prioritized wetland sites, and stormwater best management practice (BMP) assessments at nine (9) sites in the LWP project area. This TM outlines the methods utilized during field assessments; summarizes fieldwork results; identifies assessed stream and wetland sites to include in the subsequent Technical Memorandum #4 (i.e., the project Atlas); provides a summary view of subwatershed conditions based on overall instream, riparian and wetland conditions; and summarizes wetland assessments conducted by the North Carolina Division of Water Quality (DWQ) Watershed Assessment Team (WAT).

Riparian Corridor Assessments

Riparian corridor assessments were conducted on 40 restoration reaches (Appendix A - Table 1) and 10 preservation reaches (Table 2 - Appendix A). Assessment reaches were prioritized during Phase I of the LWP in coordination with EEP (EEP 2008). The field assessments included three major components: an evaluation of instream and riparian habitat using the DWQ Habitat Assessment for Piedmont and Mountain Streams (DWQ 2006), a stream bank stability assessment using Hydrologic Engineering Circular (HEC)-20 (Johnson 2006), and an evaluation of channel hydraulic capacity. To thoroughly evaluate each reach, the entire reach (up to 3000 feet) was walked. Digital images and notes were recorded for each site. The top 25 restoration and 10 preservation opportunities were prioritized and rank using scores for each assessment component in conjunction with the presence or absence of adjacent potential wetland restoration and project feasibility. Project feasibility includes issues such as the presence of utilities, livestock, and/or invasive plants; conservation easement potential; and construction access. Results from prioritization efforts along with stakeholder input will be assessed for pollutant load reduction potential with a spreadsheet model called STEP L (EPA 2008a). The field data and STEP L modeling results will be analyzed with a multi-criteria decision analysis (MCDA) model to further prioritize mitigation projects for the LWP considering the interests of stakeholders. Results from the MCDA model will be presented in the final project atlas. The following sections describe methodologies for each component of the riparian corridor

assessments. Summary results are provided in Appendix A (Tables 1 & 2). Restoration and preservation site locations are presented in Figures 1.

DWQ Habitat Assessment for Mountain/Piedmont Streams

The DWQ Stream Habitat Assessment Worksheet for Mountain/Piedmont Streams was utilized to evaluate instream and riparian habitat conditions at each reach. Typically, this assessment is used to evaluate 200 meters of a given stream reach when assessing instream biological integrity via sampling benthic macroinvertebrate or fish communities. The scale of assessments used for this LWP included the entire length of stream that was walked by ENTRIX staff. ENTRIX recognizes that habitat conditions are variable across large scales: therefore, these assessments are intended to provide a sense of the prevailing habitat conditions along the entire assessment reach and may not be representative of all individual portions of a given reach.

The DWQ habitat assessment worksheet is designed to evaluate eight (8) riparian and stream habitat metrics. These include evidence of channel modification, instream epifaunal habitat, instream bottom substrates, pool variety, riffle habitats, bank stability and vegetation, canopy coverage, and riparian zone width. Each metric is scored based on field observations resulting in a total score between 0 and 100, with 100 representing the best possible habitat conditions. Total scores for each assessment reach are provided in Appendix A (Tables 1 & 2).

HEC-20 Channel Stability Assessment

ENTRIX utilized a modified version of the Rapid Assessment of Channel Stability developed by Legasse et al. (2001) and modified by Johnson (2006) as described in Hydrologic Engineering Circular (HEC)-20. The original method is semi-quantitative and incorporates thirteen stability indicators that are evaluated in the field. The U.S. Department of Transportation updated the method for HEC-20 by modifying the metrics included in the assessment and incorporating a stream type determination based on Montgomery and Buffington's (1993) stream classification protocol. The result is an assessment method that can be rapidly applied on a variety of stream types in different physiographic settings with a range of bed and bank materials.

The Channel Stability Assessment (CSA) Worksheet is designed to evaluate 13 parameters: watershed land use, status of flow, channel pattern, entrenchment/channel confinement, bed substrate material, bar development, presence of obstructions and debris jams, bank soil texture and coherence, average bank angle, bank vegetation, bank cutting, mass wasting/bank failure, and upstream distance to bridge. As the CSA Worksheet was designed to assess stream channel stability near bridges, two minor adjustments were made to the worksheet to make it more applicable to project specific conditions. Parameter 13 (upstream distance to bridge) was not included in field assessments since bridge crossings account for an insignificant portion of the project reaches. Calculations of ratings thus only apply to 12 parameters as opposed to the original 13. The channel pattern parameter was also adjusted to better assess streams not influenced by bridges. Adjustments included scoring naturally meandering streams lower (better stability) than straight and/or engineered channels. Because straight, engineered channels are hydraulically efficient and necessary for bridge protection, they normally score low (excellent to good rating) with this methodology. Total scores and stability ratings are provided in Appendix A - Table 1.

Channel Hydraulic Capacity Analysis

A cross-section was measured at a representative riffle along each priority restoration reach. Cross-sectional data collected during the riparian corridor assessment was used to determine channel

capacity ratios given in Appendix A - Table 1. The channel capacity ratio is the cross-sectional area at the top-of-bank for a measured cross section divided by the flow area of an estimated discharge of specific recurrence interval. This information is extremely useful, along with the channel stability assessment, to determine if channel adjustment (down-cutting or widening) has occurred. This information may also be important for determining the frequency of flooding events at a given reach and the implications of these events for affecting adjacent floodplain wetland hydrology. ENTRIX analyzed the channel capacity in terms of the 2- and 10-year recurrence interval discharges (Q2 and Q10). The Q2 is a surrogate for dominant discharge. Q10 was also analyzed to assess the magnitude of departure from stable conditions.

ENTRIX used USGS regional stream-flow regression (RR) equations (Pope et al., 2001) for the North Carolina Piedmont to estimate the Q2 and Q10 for each cross section. Top of bank flows (channel flowing full) were then estimated using Manning's equation given roughness, slope, cross-sectional geometry, and hydraulic radius. Channel roughness was estimated in the field, and slopes were calculated using GIS contour data. A channel capacity ratio for the Q2 and Q10 was determined for each cross-section by dividing the cross-sectional area associated with top of bank flows by areas associated with the Q2 and Q10 flows as generated by the RR equations. Any ratio greater than 1.0 for any given recurrence interval would mean that the given recurrence interval flow is confined within the banks of the stream (Appendix A - Table 1). This analysis therefore provides a perspective on the level of channel confinement or entrenchment without relying on field bankfull determinations that can be very subjective in incised Piedmont streams and impossible to calibrate without a streamflow gage.

Initial Stream Prioritization

Restoration and preservation reaches were prioritized using weighted scores of results from field assessments. This prioritization was needed to help identify sites to be included in the final Atlas of project sites for the LWP. For this initial prioritization, a total of 35 restoration reaches out of 40 assessed reaches, were prioritized from highest (1) to lowest (35) priority. Five reaches were eliminated from the prioritization because each reach was determined to be a ditch, exhibiting characteristics of either an ephemeral channel or linear wetland. Ditched reaches may still provide opportunities for wetland restoration or enhancement, and possibly stream restoration if historical records show that these are indeed jurisdictional streams according to regulatory guidelines. Ten preservation reaches were prioritized in ascending order from highest (1) to lowest (10) priority. Prioritization ranks, metrics and weights are provided in Appendix A (Tables 1 & 2).

EEP reviewed the list of sites prioritized by ENTRIX for STEP-L modeling. EEP adjusted the ranking of 4 stream restoration sites (R-132, R-50, R-118, and R-102) so that they are included in modeling of stream restoration benefits. These sites replaced sites that had characteristics making them less feasible for EEP to implement (i.e., short, large numbers of landowners, or a large drainage area).

Wetland Assessments

The majority of the Indian and Howard's Creek LWP priority wetland sites selected by EEP contain the soil series of Chewacla, Riverview and Worsham. All of the previously mentioned soils are listed as hydric in the 2009 Natural Resources Conservation Service (NRCS) National Hydric Soils List (NRCS 2009). Historically, these soils were ditched and drained for agricultural practices. Erosion

control practices in agricultural areas were uncommon until the mid 1900's in the United States (Bennet 1959). As a result, soils located adjoining and adjacent to stream floodplains became buried underneath soils eroded from uplands. Any buried hydric soils, also called relict soils, that were encountered during field assessments were noted.

Wetland assessments were conducted on thirty (30) potential wetland restoration areas within the LWP. ENTRIX staff was assisted by staff from SEPI engineering in order to assess potential wetland restoration areas where soils were mapped as Chewacla Series. ENTRIX used methods for evaluating the presence of wetlands or relict wetland soils based on data typically collected on the standard United States Army Corps of Engineers (USACE) wetland data point form (USACE 1987). Up to three soil borings to a depth of 20 inches were analyzed at each site. At very large sites, additional soil borings may have been analyzed. Primary and secondary indicators of wetland hydrology were noted along with evidence of man-made drainage such as ditches, swales, or tiles. Vegetation data was also recorded, however vegetation at most sites included only cover crops or pasture grasses. Twenty (20) wetlands were numerically ranked for wetland restoration, enhancement, or creation potential based on the extent of hydric soil indicators at each site, the percentage of soil samples at each site that contained redoximorphic features, and other site characteristics including potential available hydrology and the existence of hydrophytic vegetation. The ten lowest ranking wetlands were not included in the final soils analysis. Summary data and soils analysis of the twenty highest ranked sites is provided under the subwatershed summaries

Initial Wetland Prioritization

As described above, twenty sites were selected from the original 30 EEP pre-selected sites. Sites are numerically ranked by mitigation potential with preference given to potential restoration and enhancement sites (Appendix A - Table 3). Sites eligible for creation, and sites not recommended for any type of restoration, are depicted in Appendix A - Table 4. Site rankings are depicted in Tables 3 and 4 Appendix A in descending total acreage order by mitigation type. Mitigation potential is based on the extent of hydric soil indicators at each site and percentage of soil samples at each site that contained redoximorphic features. Other site characteristics used for consideration include site hydrology, potentially available hydrology, and the existence of hydrophytic vegetation.

Sites excluded from further consideration typically contained the following parameters:

- Lack of hydric soils (12-20 inches), occurring on site;
- no available hydrology via connectivity to the floodplain;
- no available hydrology via ditches, and,
- lack of hydrophytic vegetation on site.

Potential restoration sites typically contained the following parameters:

- Hydric soils (12-20 inches), occurring on site;
- available hydrology via connectivity to the floodplain;
- available hydrology via ditches, and,
- partial or lack of hydrophytic vegetation on site.

Potential enhancement sites typically contained the following parameters:

- Hydric soils (0-6 inches), typically in > 50% of cores;
- site hydrology, such as inundation or ponding;
- available hydrology via connectivity to the floodplain;

- available hydrology via ditches, and,
- partial hydrophytic vegetation on site.

Potential creation sites typically contained the following parameters:

- Lack of hydric soils (0-20 inches), occurring on site;
- available hydrology via connectivity to the floodplain;
- available hydrology via ditches, and,
- lack of hydrophytic vegetation on site.

Best Management Practice (BMP) Assessments

BMP assessments were performed on nine (9) potential sites as identified previously through GIS analyses (Appendix A - Table 5). Assessments were performed by ENTRIX staff and included cursory field observations of topography, land use, drainage patterns, available space for potential stormwater treatment, and general feasibility. During field assessments, numerous photographs and site characteristics were recorded along with rough sketches of possible BMP layouts. Sites were then ranked low, medium, or high based on treatment potential and constructability. BMP site locations are presented in Figure 1.

Subwatershed Summaries

The following describes general conditions of each subwatershed that was evaluated by ENTRIX or the DWQ WAT. These summaries are based on summary information provided in Appendix A (Tables 1 & 2) and intended to present a general view of the prevailing conditions within each subwatershed. See Figure 1 for subwatershed locations.

Little Indian Creek Subwatershed

The Little Indian Creek Subwatershed (12.1-mi² drainage area) is located in the northwest corner of the LWP study area within the northwestern portion of the Indian Creek watershed. Land use within the subwatershed is predominantly agriculture and pasture. However, much of the riparian zones in the subwatershed are intact mature forests. Four restoration reaches (R-5, R-12, R-13, Alt R-137) and two preservation reaches (P-21, P-23) were evaluated in the subwatershed. Restoration reaches within the subwatershed scored relatively high on habitat assessments compared with other subwatershed restoration reaches. Higher habitat scores can be attributed to the natural condition of channel form, mature riparian buffer, and the abundance of coarser substrates resulting in ample riffle habitat and good riffle-run-pool sequences. Preservation Reach P-21, on Little Indian Creek proper, exhibited large depositional point bars (primarily sand) and opposite cut banks along meander bends, indicating heavy sediment loads. All streams scored well for stability in large part due to bedrock controls and bed armoring as well as intact bank and riparian vegetation. Most streams within the Little Indian Creek subwatershed appear to be incised and confined based on the channel capacity ratios presented in Appendix A - Table 1. Future incision is not likely as many of these streams are incised to bedrock; however, stream widening may continue to take place.

Little Indian Creek Subwatershed contains one potential wetland enhancement site. Appendix A - Table 3 summarizes this site and the other sites reviewed as part of the study. Site W-3 showed low-chroma hydric soil indicators within six inches of the soil surface and contains standing water. NRCS maps indicate that the site contains a Chewacla soil map unit, but field assessment of the soil profile revealed that color, hue, value and chroma assessed in the field did not correlate with the

NRCS soil description properties. Therefore, it could not be ascertained that the soil examined in the field was indeed from the Chewacla series. The site is situated in the floodplain of Little Indian Creek. The site still appears to receive substantial input from the perennial stream. Additionally, hydrophytic vegetation was encountered on the entire site. It is recommended that a more in-depth site soil classification be performed to rule out the existence of Chewacla soils onsite. If site soils are determined to be another hydric soil series, then it is assumed that less monitoring will be required to gain restoration mitigation credits from the USACE.

The DWQ-WAT assessed Wetland Site 002 in the subwatershed. Wetland 002 is approximately 0.04 acres in size and appears to be an old series of ponds that used to be fed by an adjacent stream that was moved. This wetland was identified for possible enhancement opportunities including rerouting the stream back through the wetland area, fencing out livestock, and replanting. Detailed discussions of the DWQ WAT wetland assessments are covered in DWQ (2008).

Indian Creek Upper Subwatershed

The Indian Creek Upper Subwatershed (9.5-mi² drainage area) is located in the northern portion of the LWP in the northeast corner of the Indian Creek Watershed. Land use within the subwatershed is predominantly agriculture and pasture. However, much of the riparian zones along streams in the subwatershed are intact mature forests, including large sections of intact riparian forests adjacent to Indian Creek proper. Two restoration reaches (R-33, R-35) and four preservation reaches (P-6, P-15, P-31, P-33) were evaluated in the subwatershed. Potential restoration reaches scored average on the habitat assessment in large part due to sedimentation, channel modification, poor bank stability and vegetation, and thin riparian buffer zones at these reaches. The majority of preservation reaches scored above the average among preservation reaches except for P-33. This reach along Indian Creek proper scored low on all parameters of the habitat assessment except for the riparian vegetation metrics. Indian Creek proper is full of sediment with large sand bars on meander bends, and large incised and actively eroding banks. A notable preservation reach in the subwatershed is Reach P-31, which exhibited natural channel pattern, mature riparian vegetation, and excellent instream habitat. Overall the stability of restoration reaches in the subwatershed were ranked Fair in large part due to bank erosion and lack of bank vegetation, watershed land use including abundant pasture and agriculture, and bar development. Preservation reaches received a rating of Good. Based on the channel capacity ratios, restoration reaches in the subwatershed are not as confined as those in Little Indian Creek and likely have a higher frequency of overbank flows and better floodplain connectivity.

During field assessments, EEP requested that ENTRIX staff evaluate alternate restoration reach R-24. This reach is a small ephemeral stormwater drainage ditch adjacent to West Lincoln High School. While stream restoration did not appear feasible, this site did present an excellent opportunity for BMP retrofits. This site is labeled BMP-9 in Figure 1. The site contains a large open unused field west and downstream of an approximately 6-acre highly impervious catchment that drains to R-24. The impervious catchment includes a small portion of Cat Square Road, high school parking lots, and portions of West Lincoln High School buildings. Potential BMP structures include grassed and/or engineered swales, stormwater wetlands, and bioretention.

Indian Creek Upper Subwatershed contains two potential wetland restoration sites (Appendix A - Table 3): W-55 and W-69. Table 3 summarizes these sites and other sites reviewed as part of the study. Site W-55 showed low-chroma hydric soil indicators within 12 inches of the soil surface and the northern portion of the site contained areas of inundation at a depth of 2 inches standing water.

Hydrophytic vegetation in non-cultivated areas was encountered in W-55 along with areas containing cultivated areas without hydrophytic vegetation. NRCS maps indicate that site W-55 contains Chewacla and Riverview soil map units. Field assessment of the soil profiles does correlate with the NRCS map units. Site W-69 showed low-chroma hydric soil indicators within 12 inches of the soil surface and contained standing water originating from a seep, approximately 0.3 acres, in the southern portion of the site. NRCS maps indicate that site W-69 contains a Chewacla soil map unit; field assessment of the soil profiles does correlate with the NRCS map units. Site W-69 contains a ditch running roughly parallel to a disturbed emergent wetland system intergrading to cultivated crops and a bottomland hardwood forest.

The DWQ-WAT assessed several potential wetland sites within the Upper Indian Creek subwatershed. Of these, three were determined to be jurisdictional wetlands (Wetland Sites 015, 017, and 051). Of the three, only Wetland 015 was identified for possible enhancement opportunities due to recent logging activity, impaired hydrology, and soil compaction. The other two were preservation sites not needing enhancement or restoration. The DWQ WAT determined that this one acre site could easily be enhanced from a low to a high-functioning wetland. Further discussions of these wetlands are covered in DWQ (2008).

Indian Creek Middle Subwatershed

The Indian Creek Middle Subwatershed (10.9-mi² drainage area) is located in the southeast portion of the LWP directly east of the Mill Creek Subwatershed. The predominant land use within the subwatershed is agriculture and pasture, however the southern portion of the subwatershed boundary is urban and low-density residential within the Town of Cherryville. Three restoration reaches were evaluated in the subwatershed including sites R-27, R-104a, and R-104b. Streams in the southern portion including R-104a and R-104b are affected by urban land uses and flow through an active cattle farm. Reach R-104 was split into two reaches, for assessment purposes, based on the major differences encountered at these reaches. Reach 104a is a smaller stream that is heavily impacted by an adjacent cattle operation with many areas of hoof shear and cut banks along the reach. Restoration Reach R-104b drains commercial areas including a large impervious catchment in the Town of Cherryville, and this reach exhibits many of the features associated with changes in hydrology resulting from urban land uses such as mass wasting and extreme sedimentation. Cattle have been recently fenced out of Reach 104a and 104b but the fence is right at the top of bank throughout most portions of 104b and continued cattle access is evident. For prioritization ranking, Reaches 104a and 104b are listed as one project, R-104, in Appendix 1 – Table 1. Since assessment scores for Reach 104a were slightly higher than those for Reach 104b, Reach 104a scores were used to rank project R-104. Other reaches in the subwatershed scored well on the habitat assessments due to excellent instream habitat. All streams have relatively good riffle-run-pool habitats with abundant cobble and gravel substrates. Riparian vegetation along banks in the subwatershed reaches are impacted by adjacent agricultural land uses and most of the riparian buffers are narrow. All of the restoration reaches received a Fair rating on the stability assessment due to watershed land uses including heavy agriculture and pasture as well as urban land uses, instream bar development, mass wasting and bank slumping, and a general lack of stream bank vegetation. According to the channel capacity ratio, these streams are relatively confined, with channel capacities ratios greater than 1.0 for the Q10 discharge; therefore, there is little floodplain connectivity at these restoration sites.

Indian Creek Middle Subwatershed contains two sites for potential wetland enhancement: site W-47 and W-58. Appendix A - Table 3 summarizes these sites and other sites reviewed as part of the study. Site W-47 exhibited low-chroma hydric soil indicators within six inches of the soil surface

and contained inundated site hydrology. The site is partially covered with hydrophytic vegetation, and there is an emergent wetland present here. NRCS maps indicate that the site contains a Chewacla soil map unit, and field assessment of the soil profiles does correlate with the NRCS map units. Site W-47 contains one ditch that originates from the western edge of the site and flows perpendicularly through the site before losing its slight bed and bank. Site W-58 exhibited low-chroma hydric soil indicators within six inches of the soil surface and contained inundated site hydrology. The site is partially covered with hydrophytic vegetation, and there is an emergent wetland present here. NRCS maps indicate that the site contains a Chewacla soil map unit, and field assessment of the soil profiles does correlate with the NRCS map units. Site W-58 contains one ditch located on the eastern edge of the map unit.

The DWQ-WAT assessed several potential wetland sites within the Indian Creek Middle Subwatershed. Of those wetlands assessed by the DWQ WAT, three were determined to be jurisdictional wetlands (Wetland Sites 100, 102, and 108). All of these wetlands were determined to be of high quality and no enhancement was recommended. Further discussions of these wetlands are covered in DWQ (2008).

Two BMP opportunities were evaluated within this subwatershed. These include BMP-6 and BMP-7. BMP-6 lies at the lowest point of a large impervious catchment within the old Carolina Freight Company facility in the Town of Cherryville. The drainage area to this site is approximately 23 acres and potential BMP opportunities would include larger structures such as a wet pond or a stormwater wetland. BMP-7 is located behind a wood chipping facility at the upstream end of Reach 104a. Opportunities for stormwater attenuation and treatment include bioretention, swales, and stormwater wetlands.

Indian Creek Lower Subwatershed

The Indian Creek Lower Subwatershed (12.1-mi² drainage area) is located in the southern portion of the LWP. Agriculture, pasture, as well as scattered low-density residential and industrial development are the predominant land uses in the subwatershed. Three potential restoration reaches were evaluated in the subwatershed; sites R-115, R-118, and R-124. Potential restoration reaches in the subwatershed scored above average on habitat assessments in large part due to coarser and more diverse substrate materials, channel meanders, and good riparian and bank vegetation. In general the subwatershed has abundant cattle activity, and many streams are impacted by hoof shear and bank erosion from cattle access. Reach R-115 is a drainage ditch or swale that drains potential wetland restoration site W-50. This reach was channelized between the years of 1938 and 1951 as determined through historical aerial comparisons. This ditch was not evaluated for channel capacity because it lacks continuous bed and bank features and other typical stream characters such as substrate sorting or flow in the channel. Restoration reaches in the subwatershed received a rating of Good for bank stability due to the presence of bank vegetation and bedrock controls and armoring. According to the channel capacity analysis, reach R-118 appears to be a confined channel supported by field observations of higher and steeper than normal banks. Reach R-124 has channel capacity ratios below 1.0 for both the Q2 and Q10 flows, indicating frequent overbank flows and excellent floodplain connectivity.

Indian Creek Lower Subwatershed contains three potential wetland restoration and/or enhancement sites: sites W-50, W-61, W-62 and W-73. Appendix A - Table 3 summarizes these sites and other sites reviewed as part of the study. W-50 showed low-chroma hydric soil indicators within six inches of the soil surface. Hydrophytic vegetation was encountered at the site, though it was not

dominant. Sites W-50 exhibited site hydrology in the form of scattered standing water. NRCS maps indicate that the site contained both Chewacla and Pacolet soil map units. Field assessment of the soil profiles at the site correlates with the NRCS map units. Site W-50 contains two ditches that originate from the eastern corner of the site and flow west and northwest, respectively, off the site. The potential exists to plug the ditch to create wetlands hydrology. The site contains both emergent wetlands and cultivated areas. W-61 showed low-chroma hydric soil indicators within twelve inches of the soil surface. Hydrophytic vegetation was encountered at the site, though it was not dominant. W-61 exhibited site hydrology in the form of partial soil saturation. NRCS maps indicate that the site contained a Chewacla soil map unit. Field assessment of the soil profiles at the site correlates with the NRCS map unit. Ditches located on the northern and southern ends of site could potentially provide increased hydrological function if plugged. Plugging the ditch to create wetlands hydrology is recommended. Site W-61 contains an intergrading wetland system of emergent wetlands and a bottomland hardwood forest wetland. W-62 showed low-chroma hydric soil indicators within six inches of the soil surface. Hydrophytic vegetation was encountered at the site, though it was not dominant. W-62 exhibited site hydrology in the form of scattered standing water. NRCS maps indicate that the site contained both Chewacla and Pacolet soil map units. Field assessment of the soil profiles at the site correlates with the NRCS map units. Ditches located on site W-62 include a ditch that bisects the site. Plugging the ditch to make the site 'wet' is recommended. Site W-62 contains an intergrading wetland system of emergent wetlands and a bottomland hardwood forest wetland. W-73 showed low-chroma hydric soil indicators within six inches of the soil surface. Hydrophytic vegetation was encountered at the site, though it was not dominant. Site W-73 showed no significant hydrology indicators. NRCS maps indicate that W-73 contains Worsham soil map units; however, it could not be confirmed that site W-73 contains Worsham soils. Site W-73 contains multiple ditches spanning the site; modifying and plugging the ditches located on the site could potentially improve site hydrology for wetlands. W-73 contains both emergent wetlands and cultivated areas

The DWQ-WAT assessed several potential wetland sites within the Indian Creek Lower Subwatershed. Of those wetlands assessed by the DWQ WAT, ten were determined to be jurisdictional wetlands (Wetland Sites 118, 119, 120, 124a, 124b, 124c1, 124c2, 125a, 125b1, 125b2). Although several of the wetlands rated poorly on the WAM assessment, 119 was the only one recommended for enhancement. A drainage ditch along the wetland is affecting wetland hydrology and recommendations include plugging the ditch. Further discussions of these wetlands are covered in DWQ (2008).

UT-1 to Indian Creek Lower Subwatershed

The UT-1 to Indian Creek Lower Subwatershed (2.7-mi² drainage area) is one of the smaller subwatersheds in the LWP and is located in the southern portion of the Indian Creek Watershed. The subwatershed contains first and second order streams that flow into Indian Creek. Both restoration reaches (R-131, R-132) evaluated in the subwatershed are heavily impacted by cattle. The assessed reaches scored lower than average on the habitat assessments due to previous and on-going channel modification, sedimentation, low bank stability, and limited riparian vegetation. The streams were rated Fair and Good respectively on the stability assessments due to sparse bank vegetation, mass wasting and bank slumping, and poor substrate materials. Based on low channel capacity ratios, both streams appear to have frequent overbank flow events.

UT-1 to Lower Indian Creek Subwatershed contains two potential wetland enhancement sites: sites W-52 and W-53. Table 3 Appendix A summarizes these sites and other sites reviewed as part of the

study. W-52 showed low-chroma hydric soil indicators within six inches of the soil surface and showed saturation below 12 inches. There is a channelized drainage that bisects the site. NRCS maps indicate that the site contains a Chewacla soil map unit, and field assessment of the soil profile does correlate with the NRCS map units. Vegetation existing on the site consisted of common pasture grasses and scant areas of hydrophytic vegetation bordering the floodplain of the ditch. W-53 showed low-chroma hydric soil indicators within six inches of the soil surface and showed saturation below 12 inches. There is a channelized drainage that bisects the site. NRCS maps indicate that the site contains a Chewacla soil map unit, and field assessment of the soil profile does correlate with the NRCS map units. Vegetation existing on the site consisted of common pasture grasses and scant areas of hydrophytic vegetation bordering the floodplain of the ditch.

The DWQ WAT assessed two contiguous wetland sites (058a and 058b) within the subwatershed. These wetlands represented two different wetland types. Wetland 058a is a riverine swamp forest and 058b is a non-tidal freshwater marsh. No enhancements were suggested for these sites. Further discussions of these wetlands are covered in DWQ (2008).

Little Creek Subwatershed

The Little Creek Subwatershed (5.2-mi² drainage area) lies on the eastern edge of the LWP within the Indian Creek Watershed. Land use in the subwatershed is predominantly agriculture, pasture and animal operations. Riparian buffers are relatively intact and mature where assessments were conducted. Preservation reach P-35 was evaluated in the subwatershed. This reach should have been divided into two reaches as the upper 5,000 linear foot section is a first order tributary to the lower 3,850 linear foot section of Little Creek proper. The upper section of Reach P-35 scored high on the habitat assessment and received a rating of Good on the stability assessment due to mature riparian buffer, good bank vegetation, and excellent instream habitat. The lower section was not assessed separately, but this section of Little Creek appears to be incised and has more sedimentation in the channel than the upper section. Reach P-35 flows into a large complex of preservation reaches in the Indian Creek Upper Subwatershed.

No EEP prioritized wetland restoration sites were evaluated in the subwatershed. The DWQ WAT evaluated two wetlands (049 and 050) in the southwestern portion of the subwatershed. Wetland 049 is a small high quality 0.2-acre seep. No enhancements were recommended; however, an infestation of *Microstegium* was noted for wetland 049. Wetland 050 is a 0.5-acre high quality seep. Habitat and vegetation rated lower for this seep due to apparent previous grazing. No enhancements were recommended for wetland 050.

Mill Creek Subwatershed

The Mill Creek Subwatershed (7.1-mi² drainage area) lies on the southwestern edge of the LWP within the Indian Creek Watershed. Land use in the subwatershed is predominantly agriculture and animal operations; however, stream riparian forests appear to be relatively intact, including riparian buffers adjacent to Mill Creek. Streams in the Mill Creek Subwatershed resemble Mountain type streams with drop-pool sequences over bedrock features, riffle-pool sequences over boulder/cobble, and abundant mountain laurel (*Kalmia latifolia*) along the banks. One preservation reach (P-43) was fully evaluated along with a cursory assessment of reach P-44. Reach P-43 received a relatively low score on the habitat assessment as compared to other preservation reaches in the LWP. This can be attributed to the sedimentation and apparent historical channel modification observed along P-43. However, reach P-44 appears to be in good condition and based on field judgments, would be a good candidate for preservation.

Two restoration reaches were evaluated in the subwatershed (Alt-R-31 and R-32). Both restoration reaches are heavily impacted by cattle operations. The upper section of R-32 is in excellent condition and may provide opportunities for preservation. Reach R-32 flows into a large dairy operation at the downstream end and because impacts in this section are substantial, habitat and stability assessments conducted on R-32 apply only to the downstream impacted areas. Where cattle are present on both restoration reaches, the riparian zone has been reduced to scattered standing trees and stream banks have abundant hoof shear with sediment filling the channel. Both reaches scored low on the habitat assessment and received a Fair rating on the stability assessment due to a severe lack of bank vegetation, abundant cut-banks and hoof shear, and sedimentation in the channel. The Q2 capacity ratio for R-32 is relatively low and the Q10 capacity ratio is less than 1.0 suggesting this reach experiences frequent overbank flows. The Q2 and Q10 capacity ratios for Alt-R-31 were both above 1.0, suggesting less frequent overbank flows in this reach.

No EEP prioritized wetland restoration sites within the subwatershed were evaluated. The DWQ WAT evaluated an existing 1.3 acre wetland (084) along Mill Creek in the southeastern portion of the subwatershed. Wetland 084 received an overall rating of High and no enhancements were recommended. The DWQ WAT did make note of a small ephemeral channel draining the wetland that had a substantial headcut and suggested that if the headcut continues to migrate upstream, it could affect wetland hydrology.

Lick Fork Subwatershed

Lick Fork Subwatershed (5.3-mi² drainage area) lies in the extreme southwestern portion of the LWP within the Indian Creek Watershed. The southern portion of the subwatershed encompasses part of the Town of Cherryville where urban land use is predominant. The majority of the subwatershed is dominated by agriculture and pasture land uses.

Stormwater BMP sites 1, 2, 3, 4, 5, and 8 were field assessed for potential implementation within the Lick Fork subwatershed. BMP-1 is located at the Carolina Care Center of Cherryville. There is open space available along the front of the property to potentially treat runoff from an existing parking lot and associated buildings using swales or bioretention. BMPs -2a and -2b are located on adjacent properties, Cherryville High School and First Wesleyan Church respectively. There is a small area available for bioretention at the end of the high school bus/car parking lot to treat up to 0.7 acres of impervious area. Additional stormwater treatment could be provided by installing a swale leading down to a drainage way along the north side of the parcel. Retrofit opportunities for BMP-2b at the church include bioretention and/or a swale. There is an existing curb cut that diverts runoff from up to 2.1 acres of the property to a vegetated ephemeral ditch, which could easily be enhanced to provide further treatment. BMP-3 is located on an industrial lot where there appears to be no practical BMP opportunities. BMP-4 lies within an open, grassy area next to the First Baptist Church, where a small bioretention cell could be constructed. Runoff from 0.2 acres of parking lot could be diverted to the cell along with adjacent roof drainage. BMP-5 provides space for an engineered or grass swale along the parking lot at the back of Aaron Moss Park. Runoff from up to 0.6 acres of impervious area could be diverted to the swale and further conveyed to an existing stream along the north edge of the city property. There is very little space available to install a treatment practice at BMP-8. An existing storm drainage system at this industrial site discharges along a steep slope along the south edge of the property. Treatment could potentially be provided at the base of the slope; however, this area is located on a different parcel.

No EEP prioritized wetland restoration sites were evaluated by ENTRIX in the subwatershed. The DWQ WAT evaluated wetland site 109 in the northeast portion of the subwatershed. Wetland site 109 is a 6.7 acre bottomland hardwood forest that rated as high quality on the WAM. The only point of concern for this site was privet infestation. No enhancements were recommended.

Leonard Creek Subwatershed

The Leonard Creek Subwatershed (5.7-mi² drainage area) lies in the south-central portion of the LWP within the Indian Creek Watershed. Land use is dominated by low-density residential development and forest in the southern portion of the subwatershed, with agriculture, pasture, and forest in the northern portion of the subwatershed. Only one stream, Leonard Fork (R-147), was evaluated in the subwatershed. Leonard Fork scored Poor on the habitat assessment due to heavy sedimentation, channel modification, and very few riffle pool sequences due to historic channelization. However, the stream received a rating of Good on the stability assessment in large part due to abundant bank vegetation and little evidence of bank erosion. The Q2 flow is confined within the channel but larger flows likely over top the banks. No wetlands were evaluated by ENTRIX or the DWQ WAT.

Howard's Creek Middle Subwatershed

The Howard's Creek Middle Subwatershed (7.4-mi² drainage area) lies in the center of the LWP on the eastern edge of the Howard's Creek Watershed. Land use in the subwatershed is predominantly agriculture and pasture. Four restoration reaches (R-50, R-61, R-63, and R-90) were evaluated in the subwatershed. All restoration reaches in the subwatershed are affected by cattle access or agricultural practices along the banks of the stream. Habitat scores were low overall due to a lack of bank vegetation, little-to-no riparian buffer, streambed incision, mass wasting along the banks, and sedimentation. Most streams were incised to bedrock which created fairly good riffle habitats downstream of bedrock features where cobbles had broken off from bedrock. All reaches received a rating of Fair on the stability assessment due to many of the same impacts that resulted in the low habitat assessment scores. The Q2 flow is contained within the channel of reach R-50; however, the ratio is low and overbank flows likely occur often at this reach. Both the Q2 and Q10 flows are contained within reaches R-61, R-63, and R-90, and overbank flows are likely limited at these reaches.

Although sites wetland sites were assessed in the subwatershed, none were prioritized for enhancement or restoration. The DWQ WAT assessed one wetland site in the subwatershed. Wetland site 011 keyed out as a riverine swamp wetland even though this wetland appears to be fed by groundwater. No enhancements for this site were recommended.

Howard's Creek Subwatershed

The Howard's Creek Subwatershed (8.8-mi² drainage area) is in the eastern portion of the LWP just west of the South Fork Catawba River Subwatershed. Six restoration reaches (R-75, R-76, R-77, R-79, R-80, and R-81) and one preservation reach (P-10) were evaluated in the subwatershed. Two restoration reaches (R-79, and R-80) were determined to be maintained; therefore, these reaches were not evaluated for hydraulic capacity. Reach R-80 is a channelized stream as it does appear on the USGS topographic map. The time period in which R-80 was modified was indeterminable from the historical aerial analysis. Reach R-79 is likely a channelized ditch that drains wetlands as it does not appear on the USGS topographic map. This reach may have been ditched prior to 1938, the earliest year for which historical aeriels were obtained. Both of these reaches scored extremely low on the habitat assessment because of the ongoing ditch maintenance and the lack of instream habitat

features that result from ditching and dredging. Reach R-76 and R-77 are reaches of Howard's Creek proper. Both reaches of Howard's Creek scored low on the habitat assessment due to heavy sedimentation, evidence of channel modification, and limited riparian buffer. Because R-76 and R-77 are contiguous reaches, a channel capacity analysis was conducted on R-77 only. Both the Q2 and Q10 ratios were below 1.0 suggesting frequent overbank flows. Evidence of overbank flows such as wrack lines and sediment deposits in the floodplain were witnessed along these reaches. Reaches R-75 and R-81 scored Good and Fair respectively on the habitat assessments due to fairly good instream habitat, abundant bank vegetation, lack of recent channel modification, and recovering riparian vegetation from historic grazing. Channel capacity ratios for R-75 and R-81 were higher than 1.0 for both the Q2 and Q10 flows indicating that these streams are incised. Overall, streams in the subwatershed are heavily impacted by cattle and agricultural practices.

The close proximity of several wetland restoration opportunities in this subwatershed may make them more attractive to EEP as project opportunities. Sites concluded to be potential wetland restoration or enhancement sites in the Howard's Creek Subwatershed include sites W-30, W-31, W-34, W-38, and W-80. Table 3 Appendix A summarizes these sites and other sites reviewed as part of the study. Site W-30 showed low-chroma hydric soil indicators within six inches of the soil surface. The site contained areas of adequate site hydrology in the form of ponding water. NRCS maps indicate that site W-30 contained Chewacla and Riverview soil map units; however, the field assessment of the soil profile revealed that color, hue, value and chroma assessed in the field did not correlate with the NRCS soil description properties. Therefore, it could not be concluded that the soil examined in the field was indeed from the Chewacla and Riverview series. Site W-31 showed low-chroma hydric soil indicators within six inches of the soil surface. The site contained areas of adequate site hydrology in the form of ponding water. Site W-31 contained two ditches that bisect the site. This site appears to be an emergent wetland system intergrading to a bottomland hardwood forest system. NRCS maps indicate that the site contained Chewacla and Riverview soil map units; however, the field assessment of the soil profile revealed that color, hue, value and chroma assessed in the field did not correlate with the NRCS soil description properties. Therefore, it could not be concluded that the soil examined in the field was indeed from the Chewacla and Riverview series. Site W-34 showed low-chroma hydric soil indicators within six inches of the soil surface. Site W-34 showed no significant site hydrology indicators. NRCS maps indicate that the site contained Chewacla and Riverview soil map units, and the field assessment indicated that that color, hue, value and chroma assessed in the field could be correlated with this soils series. Site W-80 showed low-chroma hydric soil indicators within six inches of the soil surface. The site contained areas of adequate site hydrology in the form of ponding water. NRCS maps indicate that the site contained Chewacla and Riverview soil map units; however, the field assessment of the soil profile revealed that color, hue, value and chroma assessed in the field did not correlate with the NRCS soil description properties. Therefore, it could not be concluded that the soil examined in the field was indeed from the Chewacla and Riverview series. Site W-38 showed hydric soil indicators from 12-20 inches. Site W-38 exhibited low-chroma indicators at depths greater than twelve inches and contained marginal site hydrology. Site W-80 contained one abutting ditch. This site appears to be an emergent wetland system intergrading to bottomland hardwood forest system. NRCS maps indicate that the site contained Chewacla and Riverview soil map units, and the field assessment indicated that that color, hue, value and chroma assessed in the field could be correlated with this soils series. The site is currently in cultivation. Additionally, non-dominating hydrophytic vegetation was encountered in each of the sites. It is recommended that a more in-depth site soil classification be performed to rule out the existence of Chewacla soils on site. If site soils are

determined to be another hydric soil series, then it is assumed that less monitoring will be required to gain restoration mitigation credits from the USACE.

The DWQ WAT assessed four wetland sites in the subwatershed including sites birthday-1, birthday-2, 063, and 056. Sites birthday-1 and birthday-2 are both high quality wetland sites that were not part of the random sample to characterize the watershed. No enhancements were recommended for these sites. Site 056 is 0.5 acres of bottomland hardwood forest. Enhancements recommended for this site include re-routing a previously moved stream or plugging the existing ditch to bring the overall function to a rating of high. Site 063 is 1.5 acres of bottomland hardwood forest that rated medium for overall functioning. However, this rating was downgraded to "low functioning" based on best professional judgment. Suggested enhancements included fencing out cattle and replanting.

Howard's Creek Upper Subwatershed

The Howard's Creek Upper Subwatershed (2.9-mi² drainage area) lies in the north central portion of the LWP. Land use is predominantly pasture and agriculture and the riparian forests throughout the subwatershed appear to be heavily impacted. Three restoration reaches were evaluated including R-41, R-45, and R-46. Reaches R-45 and R-46 scored low on habitat assessments and are impacted by cattle access. These reaches exhibit such characteristics as hoof shear and bank cutting, large sediment bars, thin riparian buffers, and limited bank vegetation. Reach R-41 flows through a residential area and scored relatively high on the habitat assessment due to good instream habitat, riffle habitats and pool variety. Reach R-41 scored lower on substrate materials, channel modification, and riparian zone width. All reaches received a rating of Fair on the stability assessment due to the lack of bank vegetation, cut-banks, sedimentation, and channel modification. The channel capacity ratio for the Q2 flows were greater than 1.0 for all reaches indicating slight incision. The Q10 flow ratios were less than 1.0 suggesting that these reaches do receive overbank flows at moderate frequencies.

Howard's Creek Upper Subwatershed contains one potential site for wetland enhancement. Appendix A - Table 3 summarizes this site and the other sites reviewed as part of the study. Site W-9 showed low-chroma hydric soil indicators in the 6 to 12 inch range of the soil surface and contained areas of standing water. Hydrophytic vegetation was encountered in non-cultivated areas of site W-9. NRCS maps indicate that the site contains a Chewacla soil map unit, and the field assessment of the soil profile correlates with this finding. Site W-9 contains one ditch running perpendicular roughly through the middle of the site. Ditch plugging could potentially improve site hydrology. Site W-9 appears to be a disturbed emergent wetland system intergrading to cultivated crops and a bottomland hardwood forest. The DWQ WAT did not evaluate wetlands in the Howard's Creek Upper Subwatershed.

UT to Howard's Creek Upper Subwatershed

The UT to Howard's Creek Upper Subwatershed (4.0-mi² drainage area) is located in the northeastern portion of the LWP. Land use within the subwatershed is predominantly pasture and agriculture. Three priority restoration reaches were evaluated in the subwatershed including R-51, R-53, and R-55. Reach R-53 scored higher on the habitat assessments due to better instream habitat, substrate materials and slightly wider riparian zone widths. All reaches are heavily impacted by cattle resulting in channels incised to bedrock. Reach R-53 also received a Good rating on the stability assessment while reaches R-51 and R-55 received Fair ratings due to lack of bank

vegetation, bank erosion, and sedimentation. For all assessed reaches the Q2 and Q10 capacity ratios are above 1.0 indicating that these streams are incised and overbank flows are infrequent.

The DWQ WAT evaluated two wetland sites in the subwatershed; sites 006a and 006b. These wetlands received ratings of medium and low respectively due to current grazing practices at the site. The DWQ WAT suggested enhancements that include fencing out the cattle and replanting. The WAT also suggested restoring the floodplain connectivity of an adjacent incised stream to enhance wetland hydrology at these sites.

Tanyard Creek Subwatershed

The Tanyard Creek Subwatershed (4.4-mi² drainage area) is located in the eastern portion of the LWP within the Howard's Creek Watershed. Land use within the subwatershed is predominantly agriculture and pasture. Four EEP priority stream restoration reaches were evaluated in the subwatershed including R-68, R-69, R-74, and R-102. Restoration reaches received average scores on the habitat assessments when compared with other restoration reaches in the LWP. Several of the streams scored High for instream habitat and riffle habitat in large part due to abundant cobble and gravel riffle areas. Sediment infilling was observed in pools and within the interstices of cobble/gravel riffle features. Bank vegetation was marginal at all sites assessed and riparian buffers were typically impacted by adjacent agricultural land uses. Three out of four reaches received a rating of Fair on the stability assessments due to sedimentation, watershed land-uses, and thin riparian buffers. Capacity ratios were either low or below 1.0 for the Q2 flow in reaches R-68, R-69, and R-102. Reach R-74 had a channel capacity ratio greater than 1.0 for the Q10 flow indicating that this reach is confined and overbank flows are infrequent.

Tanyard Creek Subwatershed contains one potential wetland enhancement site. Appendix A - Table 3 summarizes this site and the other sites reviewed as part of the study. Site W-25 showed low-chroma hydric soil indicators within six inches of the soil surface and also showed evidence of inundation. NRCS maps indicate that site W-25 contains Chewacla, Riverview and Madison soil map units, and the field assessment of the soil profiles does correlate with the NRCS map unit. The site is situated in the center of a cattle grazing pasture. Vegetation existing on the site consisted of a mixture of hydrophytic vegetation and common pasture grasses.

The DWQ WAT evaluated one wetland in the subwatershed. Wetland Site 019 appeared to be a ditch with hydrology driven by overland flow from precipitation and flooding from Tanyard Creek. This wetland rated High on the WAM assessment and no enhancements were recommended.

UT to Tanyard Creek Subwatershed

The UT to Tanyard Creek Subwatershed (2.4-mi² drainage area) lies just east of the Tanyard Creek Subwatershed in the Howards Creek Watershed. Land use in the subwatershed is predominantly agriculture and pasture with some low-density residential in the southern portion. Restoration reach R-70 and preservation reach P-93 were evaluated. Both reaches received low scores on the habitat assessment. Reach R-70 scored low due to a lack of bank vegetation, thin riparian buffer, light penetration, evidence of channel modification, and abundant sediment in the channel. Reach P-93 scored low among other preservation reaches due to heavy sedimentation and impacts to instream habitat. However, P-93 has a unique bedrock cascade that extends for approximately 250 feet down the length of the stream and has a vertical drop of about 125 feet. Reach R-70 received a Fair rating on the stability assessment due to channelization, watershed land use, bar development, and evidence of bank failure. Reach P-93 received a Fair rating on the stability assessment due to watershed land

use and bar development. Channel capacity ratios for R-70 were above 1.0 for the Q2 and Q10 flows indicating that this stream is confined within the channel even at higher flows. Overall, streams in the subwatershed have been heavily impacted by agricultural and animal operation practices. There were no wetlands evaluated by the DWQ WAT or ENTRIX in the subwatershed.

Middle South Fork Upper Subwatershed

The Middle South Fork Upper Subwatershed (4.1-mi² drainage area) is located in the far eastern portion of the LWP. Land use in the subwatershed is predominantly agriculture and pasture with some low-density residential neighborhoods located in the eastern portion. Two restoration reaches were evaluated in the subwatershed including R-92 and R-93. Both reaches scored very low on habitat assessments due to channelization, limited instream habitat, sedimentation, and a lack of bank vegetation. Reach R-92 is heavily impacted by cattle access resulting in mass wasting and incision. Reach R-93 appears to have been channelized and moved away from the natural drainage way for agricultural purposes prior to 1938. Reaches R-92 and R-93 received Fair and Good ratings respectively on the stability assessments. The R-93 rating of Good was in large part due to channel maintenance that results in better scoring for parameters such as bar development, bank slope, bank cutting, and erosion. Reach R-92 received a Fair rating due to channelization, bank slope, mass wasting and erosion, limited bank vegetation, and bar development. Channel capacity ratio for R-92 was low for the Q2 and below 1.0 for the Q10, indicating that the dominant flow is confined within the channel but that overbank flows do occur at higher flows. Overall, streams in the subwatershed are heavily impacted by agriculture and cattle resulting in heavy sedimentation and bank erosion.

Middle South Fork Creek Subwatershed contains two potential wetland restoration sites: Site W-44 and W-39. Appendix A - Table 3 summarizes these sites and other sites reviewed as part of the study. Site W-44 showed low-chroma hydric soil indicators within six inches of the soil surface. The site does not appear to have significant hydrology indicators, but both contain potential hydrology via ditches and perennial stream floodplains. Site W-44 is situated in the floodplain of UT to Middle South Fork Creek. Vegetation existing on the site consists of common pasture grasses and scant areas of hydrophytic vegetation within the floodplain of the perennial stream. NRCS maps indicate that site W-44 contains Chewacla, Riverview and Madison soil map units, and field assessment of the soil profiles does correlate with the NRCS map units. Site W-39 exhibited low-chroma indicators from 12-20 inches. The site does not appear to have significant hydrology indicators, but both contain potential hydrology via ditches and perennial stream floodplains. The NRCS map depicts site W-39 as containing a Chewacla map unit, and field soil samples appeared to verify the NRCS map unit type. Site W-39 is located along the floodplain of the South Fork of the Catawba River separated by a large earthen berm on the east bank of the river, west of the site. Numerous ditches bisect site W-39.

Middle South Fork Lower Subwatershed

The Middle South Fork Lower Subwatershed (1.3-mi² drainage area) lies just north of the South Fork Lower Subwatershed in the southeastern portion of the LWP. Restoration reach R-96 was evaluated for restoration potential. Upon evaluation, R-96 was determined to be a ditch that was likely dug prior to 1938 as observed through the historical aerial analysis to drain adjacent wetlands and increase pasture lands. The reach scored low on the habitat assessment because it doesn't function as a stream but rather a linear pond and bank vegetation was dominated by blackberry (*Rubus* sp.) and multiflora rose (*Rosa multiflora*). The reach received a Fair rating due in large part to cattle access resulting in eroded banks and extreme hoof shear. Channel capacity ratios were not calculated. Although wetland evaluations were not conducted at this site by ENTRIX, this site may

still provide opportunities for wetland restoration or enhancement. Wetland hydrology and vegetation were present at the site. No wetlands were evaluated by the DWQ WAT or ENTRIX in the subwatershed.

Rockdam Creek Subwatershed

Rockdam Creek is a relatively small subwatershed (4.0-mi² drainage area) that lies south of the Howard's Creek Subwatershed in the east-central portion of the LWP area. Land use in the subwatershed is predominantly agriculture and pasture with some low-density residential. No prioritized stream, wetland, or BMPs were evaluated by ENTRIX in the subwatershed, nor were any wetland sites evaluated by the DWQ WAT.

South Fork Lower Subwatershed

The South Fork Lower Subwatershed (5.2-mi² drainage area) is located in the far southeastern portion of the LWP. Part of the subwatershed encompasses the eastern portion of the Town of Lincolnton. Land uses include urban, low-density residential, industrial, agricultural and pasture. No prioritized stream, wetland, or BMP were evaluated by ENTRIX in the subwatershed nor were any wetland sites evaluated by the DWQ WAT.

Conclusions

Based on field assessments in the LWP area, there appear to be abundant opportunities for stream restoration and enhancement, stream preservation, and wetland restoration and enhancement. Opportunities for successful BMP implementation are less common and may require further field reconnaissance to identify additional locations. Several potential stream restoration sites have adjacent priority wetland sites that were determined to be good candidate sites for wetland restoration. Both the wetland and stream sites at these locations will receive a higher priority since dual mitigation opportunities exist. The prioritization of field-assessed sites will be provided to the stakeholders for final prioritization using an MCDA model. The number of sites that will be presented will include the top 25 stream restoration sites, 20 wetland restoration sites, 10 preservation sites, and up to three BMP sites deemed feasible for implementation. Specific project opportunities will then be presented in the project atlas.

The results of the soil assessment for the priority wetland restoration site assessment of the Indian and Howard's Creek LWP have concluded that there appear to be 5 sites containing soils suitable for wetland restoration and 15 sites suitable for wetland enhancement (Appendix A - Table 3). Additionally, 7 sites were found to be potentially suitable for wetland creation (Appendix A - Table 4). All of the restoration and enhancement sites contain redoximorphic indicators at ranges from 6 to 20 inches deep. The determination of whether the Chewacla soils are hydric will be dependent upon the flooding on the site, and the post construction monitoring results for inundation for consecutive days (correlating to 5-12.5% of the growing season) and in 5 out of 10 years per USACE guidance. It is recommended that a more in-depth site soil classification be performed to rule out the existence of Chewacla soils on the following sites: W-3, W-30, W-31, W-47, W-73, and W-80. NRCS maps indicate that these sites contain a Chewacla soil map unit, but field assessment of the soil profile revealed that color, hue, value and chroma did not correlate with the NRCS soil description properties. Therefore, it could not be ascertained that the soil examined in the field was indeed from the Chewacla series. If the site soils mentioned above are determined to be another hydric soil series, then it is assumed that the time period required for monitoring will be less to gain restoration mitigation credits from the USACE because the requirement of inundation for

consecutive days (correlating to 5-12.5% of the growing season) and in 5 out of 10 years would not be needed. All of the potential restoration or enhancement sites have either adequate or available site hydrology to restore or enhance wetlands. At many of these sites, the site hydrology may be restored or enhanced by the plugging of existing ditches. It is recommended that the extent of this wetland restoration or enhancement be studied to determine the extent of the new wetlands and to prevent hydrologic trespass onto adjacent properties. Vegetation existing on potential restoration or enhancement sites ranges from cultivated crops to partial emergent and/or forested hydrophytic vegetation. Revegetation on sites either lacking a hydrophytic seed source or denuded of wetland vegetation may be enhanced by plantings. Post-restoration site monitoring via wetland monitoring wells will determine final mitigation credit through the USACE.

References

- Bennet HH. 1959. The Hugh Bennet Lectures. The Agricultural Foundation Inc., North Carolina State College. Raleigh, North Carolina: 1959, 23.
- Johnson PA. 2006. Assessing stream channel stability at bridges in physiographic regions. U.S. Department of Transportation. Federal Highway Administration. Report Number FHWA-HRT-05-072.
- Legasse PF, Schall JD, and Richardson EV. 2001. Stream stability at highway structures; Third addition. U.S. Department of Transportation. Federal Highway Administration. Report Number FHWA NHI 01-002 Hydraulic Engineering Circular No. 20.
- Montgomery DR, and Buffington JM. 1993. Channel classification, prediction of channel response, and assessment of channel condition. Washington State Timber/Fish/Wildlife Agreement. TFW-SH10_93-002.
- Natural Resources Conservation Service (NRCS). 2009. National Hydric Soils List North Carolina. ftp://ftp-fc.sc.egov.usda.gov/NSSC/Hydric_Soils/Lists/nc.xls
- North Carolina Division of Water Quality (DWQ). 2006. North Carolina Division of Water Quality Standard Operating Procedures – Biological Monitoring. Biological Assessment Unit.
- North Carolina Division of Water Quality Wetland Assessment Team (DWQ WAT). 2008. Indian and Howard's Creek Local Watershed Planning Area Wetland Assessment Summary Addendum Site Descriptions. October 15, 2008
- North Carolina Ecosystem Enhancement Program (EEP). 2008. Indian and Howard's Creek Local Watershed Plan Preliminary Findings Report. pp. 97. Online at http://www.nceep.net/services/lwps/Indian_Howards_Creek/PhaseI_Report_Final20081219.pdf.
- Pope BF, Tasker GD, and Robbins JC. 2001. Estimating the magnitude and frequency of floods in rural basins of North Carolina – Revised. U.S. Geological Survey. Water-Resources Investigations Report 01-4207.
- U.S. Army Corps of Engineers (USACOE) 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. Environmental Laboratory. Vicksburg, Miss.
- U.S. Environmental Protection Agency (EPA), 2008a. STEPL - Spreadsheet Tool for Estimating Pollutant Load. Accessed May 12, 2008 at: <http://it.tetrattech-ffx.com/stepl/>
- U.S. Environmental Protection Agency (EPA), 2008b. BMP Descriptions for STEPL and Region 5 model. Accessed May 12, 2008 at: http://it.tetrattech-ffx.com/stepl/STEPLmain_files/BestManagementPracticesDefinitions.pdf

Appendix A

Tables

Table 1. Ranked priority restoration reaches for the Indian and Howards Creek LWP

Rank	Sub-Watershed	Priority Restoration Reaches	Habitat Assessment Total Score		Stability Assessment Total Score		Channel Capacity Ratios			Length of Stream (ft)	Drainage Area (SqMi)	Adjacent Priority Wetland	Wetland ID	Flow Status	Easement Potential	Construction Access	Utility	Livestock Access	Score
							CSA Q _{TOB} / CSA Q ₂	CSA Q _{TOB} / CSA Q ₁₀	CCR Value										
1	Howard's Cr. Middle	R-90*	38	Poor	95	Fair	3.69	1.83	Poor	2584	0.33	N		P	Excellent	Good	Y	Persistent	16
2	Howard's Cr. Middle	R-61*	51	Fair	92	Fair	4.88	2.51	Poor	1846	0.37	N		P	Good	Good	N	Persistent	15
3	Howard's Cr.	R-77*	29	Poor	92	Fair	Over TOB	Over TOB	Excellent	4371	26.9	Y	30, 34	P	Good	Good	N	Persistent	14
4	Mill Creek	R-31*	69	Good	77	Fair	3.28	1.72	Poor	1285	0.30	N		P	Good	Good	N	Persistent	14
5	UT to Howard's Cr. Upper	R-51*	57	Fair	82	Fair	2.56	1.35	Fair	2321	0.62	N		P	Good	Good	N	Persistent	14
6	UT to Tanyard Cr.	R-70*	43	Fair	90	Fair	2.17	1.14	Fair	3471	0.52	N		P	Good	Excellent	Y	Persistent	14
7	Indian Cr. Middle	R-27*	70	Good	75	Fair	2.5	1.26	Fair	2253	0.65	Y	58	P	Poor	Good	N	Occasional	13
8	Tanyard Cr.	R-69*	51	Fair	96	Fair	1.52	Over TOB	Good	2775	0.30	Y	25	P	Good	Good	Y	Persistent	13
9	Mill Creek	R-32*	39	Poor	91	Fair	1.09	Over TOB	Excellent	4402	6.48	N		P	Good	Good	N	Persistent	13
10	UT to Howard's Cr. Upper	R-55*	41	Fair	90	fair	2.18	1.12	Fair	2299	2.17	N		P	Good	Good	Y	Persistent	13
11	Howard's Cr. Middle	R-63*	68	Good	92	Fair	2.53	1.36	Fair	4444	0.64	N		P	Good	Excellent	Y	Persistent	13
12	Middle South Fork	R-92*	31	Poor	91	Fair	1.77	Over TOB	Good	3984	0.21	N		P	Good	Good	N	Occasional	13
13	Indian Cr. Lower	R-124*	64	Good	71	Good	Over TOB	Over TOB	Excellent	1277	0.26	Y	62	P	Excellent	Good	N	Persistent	12
14	UT-1 to Indian Cr. Lower	R-131*	28	Poor	87	Fair	1.32	Over TOB	Good	3418	0.97	Y	52	P	Good	Good	N	None	12
15	Little Indian Cr.	R-12*	78	Good	70	Good	4.65	2.22	Poor	2709	0.16	N		P	Good	Fair	N	Persistent	12
16	Indian Cr. Upper	R-33*	52	Fair	82	Fair	1.5	Over TOB	Good	2453	1.21	N		P	Good	Good	Y	Persistent	12
17	Howard's Cr. Upper	R-45*	46	Fair	83	Fair	1.69	Over TOB	Good	1471	0.13	N		P	Good	Good	N	Occasional	12
18	Little Indian Cr.	R-137	59	Fair	92	Fair	2.44	1.17	Fair	734	0.36	N		P	Good	Good	N	Historic	12
19	Leonard Creek	R-147	40	Poor	81	Fair	1.75	Over TOB	Good	1204	5.53	N		P	Excellent	Good	N	None	12
20	Indian Cr. Middle	R-104*	63	Good	82	Fair	2.16	1.18	Fair	1326	1.49	N		P	Good	Good	N	Occasional	12
21	Howard's Cr.	R-76	45	Fair	69	Good	no XS	no XS		1763	26.0	Y	80	P	Good	Good	N	Occasional	11
22	Little Indian Cr.	R-13*	56	Fair	78	Fair	3.53	1.65	Poor	1971	0.25	N		P	Fair	Fair	N	Historic	11
23	Howard's Cr. Upper	R-46	45	Fair	80	Fair	1.47	Over TOB	Good	1579	2.20	N		I/P	Good	Good	Y	Occasional	11
24	Tanyard Cr.	R-74*	46	Fair	99	Fair	2.6	1.29	Fair	1392	0.45	N		P	Good	Good	N	None	11
25	Tanyard Cr.	R-102*	56	Fair	88	fair	Over TOB	Over TOB	Excellent	4416	2.90	N		P	Good	Good	Y	Persistent	11
26	Howard's Cr.	R-75*	65	Good	64	Good	2.07	1.02	Fair	4405	0.51	N		P	Excellent	Excellent	Y	Historic	11
27	Indian Cr. Lower	R-118*	72	Good	69	Good	3.08	1.57	Poor	2319	1.67	N		P	Excellent	Excellent	Y	None	11
28	Indian Cr. Upper	R-35	48	Fair	75	Fair	1.19	Over TOB	Excellent	2236	18.5	N		P	Good	Excellent	N	None	10
29	Howard's Cr. Middle	R-50*	56	Fair	86	Fair	1.53	Over TOB	Good	3192	7.11	N		P	Good	Excellent	Y	None	10
30	UT to Howard's Cr. Upper	R-53	71	Good	65	Good	3.61	1.89	Poor	1878	1.00	N		P	Good	Good	N	None	10
31	Tanyard Cr.	R-68	55	Fair	67	Good	Over TOB	Over TOB	Excellent	1473	6.13	Y	25	P	Good	Good	N	None	9
32	UT-1 to Indian Cr. Lower	R-132*	45	Fair	70	Good	Over TOB	Over TOB	Excellent	3418	1.08	Y	53	P	Fair	Fair	Y	Persistent	9
33	Howard's Cr. Upper	R-41	61	Good	83	Fair	1.65	Over TOB	Good	1343	1.40	Y	9	P	Poor	Fair	Y	None	8
34	Little Indian Cr.	R-5	85	Excellent	57	Good	1.69	Over TOB*	Good	1864	1.49	Y	3	P	Fair	Fair	N	None	6

* indicates reaches to be modeled

Howard's Cr.	R-79	14	Bad	73	Fair	Ditch	Ditch		893	0.04	Y	31	I/P	Good	Good	N	Persistent
Howard's Cr.	R-80	1	Bad	90	Fair	Ditch	Ditch		1450	0.37	N		E	Good	Good	N	Persistent
Middle South Fork	R-93	18	Bad	68	Good	Ditch	Ditch		2163	0.11	N		P	Excellent	Excellent	N	None
Middle South Fork	R-96	22	Poor	79	Fair	Ditch	Ditch		2026	0.06	N		E	Good	Good	N	Persistent
Indian Cr. Lower	R-115	7	Bad	12	Excellent	Ditch	Ditch		2175	N/A	Y	50	E	Good	Good	N	Persistent
Howard's Cr.	R-81	57	Fair	85	Fair	2.56	1.34	Fair	2626	0.51	N		P	Poor	Good	N	None

Prioritization metrics and weights

	Stability Assessment Ranking				Habitat Assessment Ranking				Adj. Wetland Potential		Construction Access			Conservation Easement Potential			
Value1	144-108	108-72	72-36	36-0	0-20	20-40	40-60	60-80	80-100	Y	N	Excellent	Good	Fair	Excellent	Good	Fair
Value2	Poor	Fair	Good	Excellent	Bad	Poor	Fair	Good	Excellent								
Score	3	2	1	0	4	3	2	1	0	3	0	3	2	1	3	2	1
	Livestock access				Channel Capacity Ratio				Utilities								
Value1	Persistent	Occasional	Historic	None	CCR>3	3>CCR>2	2>CCR>1.2	1.2>CCR	N	Y							
Value2					Poor	Fair	Good	Excellent									
Score	3	2	1	0	3	2	1	0	1	0							

Table 2. Ranked priority preservation reaches for the Indian and Howards Creek LWP

Rank	Sub-Watershed	Priority Preservation Reaches	Habitat Assessment Total Score		Stability Assessment Total Score		Channel Capacity Ratios			Length of Stream (ft)		Drainage Area (SqMi)	Adjacent Priority Wetland	Flow Status	Easement Potential	Utility	Livestock Access	Score
							CSA Q _{TOB} / CSA Q ₂	CSA Q _{TOB} / CSA Q ₁₀	CCR Value									
1	Howard's Cr.	P-10	90	Excellent	47	Good	2.05	1.00	Fair	7158	Excellent	0.426	No	Perennial	Excellent	Y	None	13
2	Indian Cr. Upper	P-6	80	Good	61	Good	1.79	Over TOB	Good	7031	Excellent	0.228	No	Perennial	Good	N	None	13
3	Indian Cr. Upper	P-31	95	Excellent	41	Good	2.97	1.54	Fair	5717	Good	0.314	No	Perennial	Excellent	N	None	13
4	Mill Creek	P-43	77	Good	72	Good	1.307		Good	5791	Good	1.971	No	Perennial	Good	N	None	12
5	Indian Cr. Upper	P-15	83	Excellent	65	Good	4.06	2.04	Poor	2526	Fair	0.171	No	Perennial	Excellent	N	None	11
6	Little Indian Cr.	P-23	90	Excellent	50	Good				4138	Good	11.883	No	Perennial	Good	N	None	11
7	Little Creek	P-35	88	Excellent	51	Good	3.68	1.86	Poor	8781	Excellent	0.194	No	Perennial	Fair	N	None	11
8	Little Indian Cr.	P-21	57	Fair	70	Good	2.08	1.21	Fair	3051	Good	8.371	No	Perennial	Good	N	None	10
9	UT to Tanyard Cr.	P-93	59	Fair	80	Fair	1.198		Excellent	2958	Fair	2.003	No	Perennial	Good	Y	None	9
10	Indian Cr. Upper	P-33	43	Fair	83	Fair				5016	Good	21.67	No	Perennial	Fair	N	None	7

Prioritization metrics and weights

	Stability Assessment Ranking				Habitat Assessment Ranking					Conservation Easement Potential			Channel Capacity Ratio			
Value1	0-36	36-72	72-108	108-144	80-100	60-80	40-60	20-40	0-20	Excellent	Good	Fair	CCR>3	3>CCR>2	2>CCR>1.2	1.2>CCR
Value2	Excellent	Good	Fair	Poor	Excellent	Good	Fair	Poor	Bad	Excellent	Good	Fair	Poor	Fair	Good	Excellent
Score	3	2	1	0	4	3	2	1	0	3	2	1	3	2	1	0
	Stream Length			Utilities												
Value1	>6000	6000>L>3000	<3000	N	Y											
Value2	Excellent	Good	Fair	N	Y											
Score	3	2	1	1	0											

Table 3. Summary of Prioritized Wetland Sites

EEP SITE	SITE RANKING ¹	SQUARE	ACREAGE	SUB WATERSHED*	NRCS MAPPED SOIL TYPE**	FIELD VERIFIED SOIL TYPE	RELICT SOILS***	HYDRIC SOILS DEPTH (INCHES)	SITE HYDROLOGY INDICATORS	HYDROPHYTIC VEGETATION	POTENTIAL AVAILABLE SITE HYDROLOGY	POTENTIAL MITIGATION TYPE	EXISTING LANDCOVER
W-39	1	332521.0	82.17	MSF- Upper	Ch	Ch	Yes	12 TO 20	No	Partial	Stream	Restoration	Cultivated crops
W-44	2	94850.5	23.44	MSF- Upper	Ch, Rv, Ms	Ch, Rv, Ms	No	0 TO 6	No	Yes	Ditch	Restoration	Cultivated crops
W-38	3	49503.4	12.23	HC	Ch	Ch	Yes	12 to 20	No	Partial	Ditch	Restoration	Emergent wetland/cultivated crop
W-73	4	39442.7	9.75	IC - Lower	Wo	Unknown	No	0 TO 6	No	Partial	Ditch	Restoration	Degraded emergent wetland
W-34	5	17552.7	4.34	HC	Ch, Rv	Ch, Rv	No	0 TO 6	No	Yes	Ditch	Restoration	Cultivated crops
W-30	1	51124.0	12.63	HC	Ch, Wo	Unknown	No	0 TO 6	Yes	No	Ditch	Enhancement	Cultivated crops
W-52	2	36903.5	9.12	UT1 to IC - Lower	Ch	Ch	Yes	12 TO 20	Yes	Partial	Ditch	Enhancement	Emergent wetland/cultivated crops
W-25	3	35222.6	8.70	Tanyard Creek	Ch	Ch	No	0 TO 6	Yes	Yes	Stream	Enhancement	Emergent wetland
W-61	4	17014.1	6.80	IC - Lower	Ch	Ch	Yes	12 TO 20	Partial	Yes	Ditch	Enhancement	Emergent wetland/cultivated crops
W-53	5	21174.5	5.23	UT1 to IC - Lower	Ch	Ch	No	6 TO 12	Yes	Yes	Ditch	Enhancement	Emergent wetland/cultivated crops
W-31	6	16391.8	4.05	HC	Ch, Rv	Unknown	No	0 TO 6	Yes	Yes	Ditch	Enhancement	Degraded emergent / forested wetland
W-58	7	14627.6	3.61	IC - Middle	Ch	Ch	No	0 TO 6	Yes	Partial	Ditch	Enhancement	Emergent wetland
W-55	8	14574.0	3.60	IC - Upper	Ch, Rv	Ch, Rv	No	6 TO 12	Yes	Yes	Stream	Enhancement	Emergent wetland/cultivated crops
W-50	9	13991.1	3.46	IC - Lower	Ch, Pa	Ch, Pa	No	0 TO 6	Yes	Yes	Ditch	Enhancement	Degraded emergent / forested wetland
W-80	10	12813.6	3.17	HC	Ch, Rv	Unknown	No	0 TO 6	Yes	Yes	Ditch	Enhancement	Emergent / forested wetland
W-9	11	12092.5	2.99	HC - Upper	Ch	Ch	No	6 TO 12	Yes	Yes	Ditch	Enhancement	Degraded emergent / forested wetland
W-47	12	10374.1	2.56	IC - Middle	Ch	Unknown	No	0 TO 6	Yes	Partial	RPW	Enhancement	Emergent wetland
W-69	13	8115.3	2.01	IC - Upper	Ch	Ch	No	6 TO 12	Yes	Yes	Ditch	Enhancement	Emergent wetland/cultivated crops
W-62	14	6998.8	1.73	IC - Lower	Ch, Pe	Ch, Pe	No	0 TO 6	Yes	Yes	Ditch	Enhancement	Emergent wetland/cultivated crops
W-3	15	6948.7	1.72	Little IC	Ch	Unknown	No	0 TO 6	Yes	Yes	Stream	Enhancement	Cultivated crops

*HC' = Howard's Creek Watershed; 'IC' = Indian Creek Watershed; 'MSF' = Middle South Fork Watershed.

** 'Ch' = Chewacla; 'Wo' = Worsham; 'Rv' = Riverview; 'Pa and Pe' = Pacolet; 'Ms' = Madison.

*** Field evidence of relict soils included hydric indicators below 20 inches, the presence of site ditching, and remnant hydrophytic vegetation.

¹ Site rankings are grouped by mitigation type.

Table 4. Summary of Wetland Sites Less Considered

EEP SITE	SITE RANKING ¹	SQUARE	ACREAGE	SUB WATERSHED*	NRCS MAPPED SOIL TYPE**	FIELD VERIFIED SOIL TYPE ²	RELICT SOILS***	HYDRIC SOILS DEPTH (INCHES)	SITE HYDROLOGY INDICATORS	HYDROPHYTIC VEGETATION	POTENTIAL AVAILABLE SITE HYDROLOGY	POTENTIAL MITIGATION TYPE ³	EXISTING LANDCOVER
W-65	1		4.20	HC - Middle	Ch, Rv	Unknown	Unknown	12 to 20 inches	Partial	Partial	Ditch	Creation	Emergent wetland/cultivated crops
W-38	2	17553	12.23	HC	CH, RV, GN	N/A	N/A	None to 24 inch depth.	None	Partial	Ditch	Creation	Disturbed Agriculture
W-23	3	94851	11.78	MSF- Upper	CH	N/A	N/A	None to 24 inch depth.	None	Partial	Ditch	Creation	Disturbed Agriculture
W-32	4	39443	9.66	IC - Lower	CH	N/A	N/A	None to 24 inch depth.	None	None	Ditch	Creation	Cultivation
W-29	5	49503	6.28	HC	CH	N/A	N/A	None to 24 inch depth.	None	None	Ditch	Creation	Cultivation
W-51	6	35223	6.20	Tanyard Creek	CH, HE	N/A	N/A	None to 24 inch depth.	None	None	Ditch	Creation	Cultivation
W-14	7	332521	4.55	MSF- Upper	WO	N/A	N/A	None to 24 inch depth.	None	Partial	Ditch	Creation	Disturbed Agriculture
W-49	8	36903	6.60	UT1 to IC - Lower	WO	N/A	N/A	None to 24 inch depth.	None	Partial	None	None Recommended	Disturbed Agriculture
W-45	9	51124	4.33	HC	CH	N/A	N/A	None to 24 inch depth.	None	Partial	None	None Recommended	Disturbed Agriculture
W-70	10	16392	1.53	HC	CH	N/A	N/A	None to 24 inch depth.	None	None	None	None Recommended	Cultivation

* 'HC' = Howard's Creek Watershed; 'IC' = Indian Creek Watershed; 'MSF' = Middle South Fork Watershed.

** 'Ch' = Chewacla; 'Wo' = Worsham; 'Rv' = Riverview; 'Pa and Pe' = Pacolet; 'Ms' = Madison

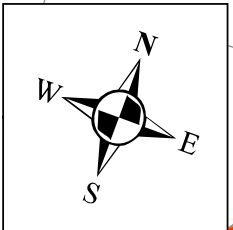
¹ Site rankings are grouped by mitigation type.

² Sites not considered did not receive map unit correlation assessment.

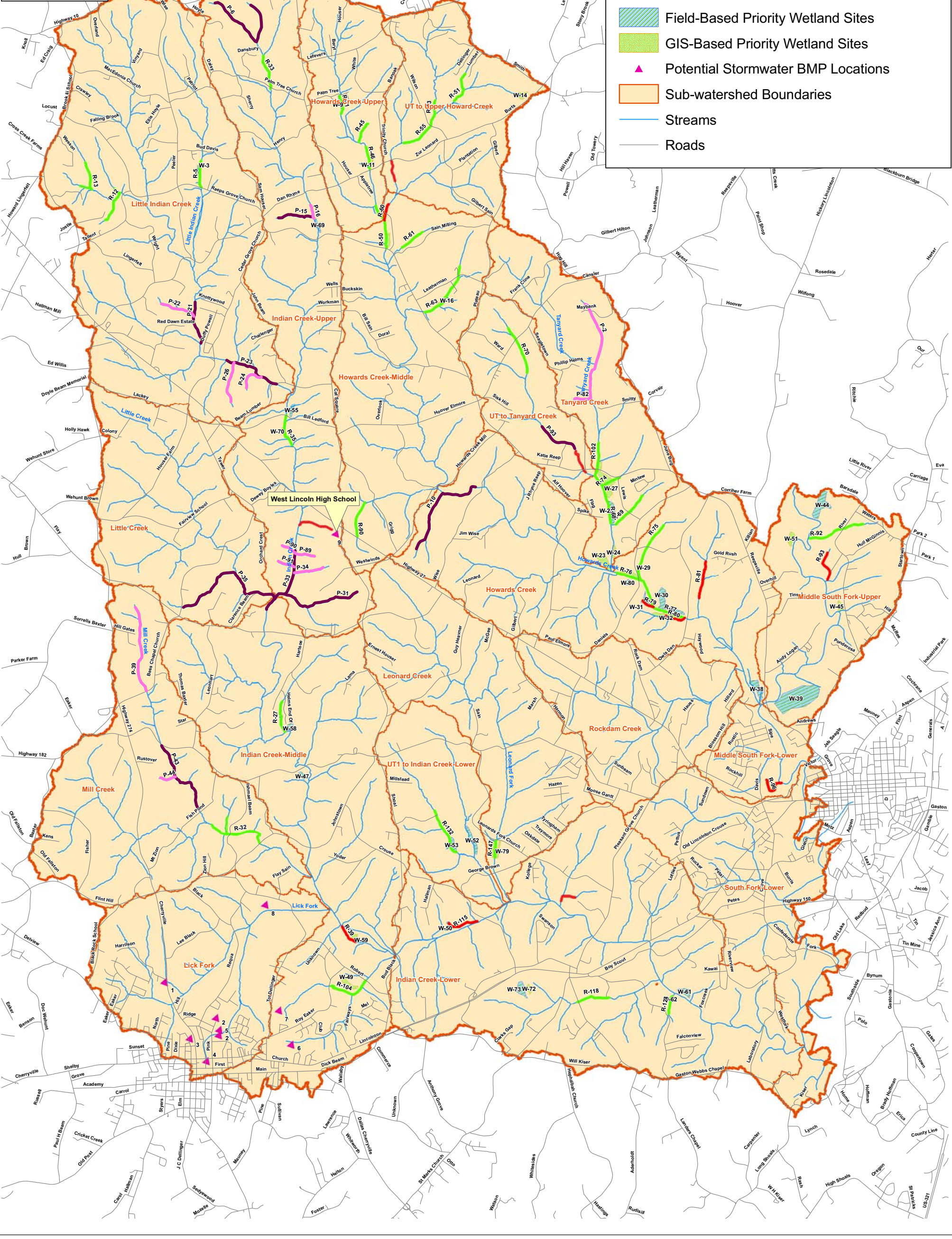
³ Sites not recommended for restoration typically contained no available hydrology or were situated in an upland.

Table 5. BMP sites for the Indian Creek and Howards Creek LWP

Id	Property	Site Quality	Potential BMP Type	Construction Access	Treatment Area	Notes
1	Carolina Care Center of Cherryville (Nursing Home)	Low	Swale, bioretention	Excellent	Parking lot, roof drainage (up to approx. 0.7 acres)	Very little open space available, existing grass swale, very flat slopes - not a good site
2a	Cherryville High School	Medium	Bioretention, swale, and/or wetland	Excellent	Bus and car parking lot (approx. 0.7 acres)	Excellent site at end of bus parking lot, small area for bioretention, steep slope down to floodplain - potential for treatment/swale along slope or in fp
2b	First Wesleyan Church	Medium	Bioretention, swale	Excellent	Parking lot, roof drainage (up to approx. 2.1 acres)	Parking lot already diverting runoff to curbcut and into grass/shrubby area - could easily enhance by installing swale and/or bioretention
3	Industrial Lot					poor site - large parking lot and bldgs - no room for BMP
4	First Baptist Church	Medium	Bioretention	Excellent	Parking lot (up to approx. 0.2 acres)	Small grassed area next to church - good bioretention opp, large, ideal open area at back of property - currently play area - doubtful church would give up
5	City of Cherryville - Park	Medium	Bioretention, swale	Good	Parking lot (up to approx. 0.6 acres)	Steep slope at back of parking lot active erosion (gullies) - room for swale along top of slope, potential for small bioretention at end of parking lot
6	Carolina Freight Area (Large area)	Medium	Pond, wetland	Excellent	Parking lot (23 acres)	Very large industrial lot, paved, very little use. Good site for BMP, but may be too small for drainage area.
7	Industrial Lot	Low	Swale, bioretention	Excellent	Parking lot (up to approx. 1.7 acres)	Ditch on north side and large open area in back that could be used for treatment, employees complained of flooding issues - would need to address quantity issue before treatment
8	Industrial Lot	Low	Engineered swale, bioretention	Good	Parking lot, roof drainage (up to approx. 3.5 acres)	Little area in front for swale, parking lot in back outlets into steep slope above floodplain - possible treatment opportunity in floodplain
9	West Lincoln High School	High	Bioretention, swale, and/or wetland	Excellent	Parking lot (up to approx. 2.3 acres)	Excellent site - runoff from parking lot actively eroding slope - install swale and/or bioretention/wetland, shrubby area at bottom of slope-possible ephemeral/wetland area - potential to enhance and cleanup



- Field-Based Priority Preservation Reaches
- GIS-Based Priority Preservation Reaches
- Field-Based Prioritized Restoration Reaches
- GIS-Based Prioritized Restoration Reaches
- Field-Based Priority Wetland Sites
- GIS-Based Priority Wetland Sites
- ▲ Potential Stormwater BMP Locations
- Sub-watershed Boundaries
- Streams
- Roads



0 1 3 4 Miles

Map Scale: 1:34,714

This map and all data contained within are supplied as is with no warranty. Entrix expressly disclaims responsibility for damages or liability from any claims that may arise out of the use or misuse of this map. It is the sole responsibility of the user to determine if the data on this map meets the user's needs. This map was not created as survey data, nor should it be used as such. It is the user's responsibility to obtain proper survey data, prepared by a licensed surveyor, where required by law.

**Figure 1. Field Assessment Sites
 Technical Memorandum 3
 Indian and Howard's Creek LWP**



ENTRIX
 3141 John Humphries Wynd Suite 265
 Raleigh, NC 27612
 919-239-8900
 www.entrix.com