

RESTORATION PLAN

**FULL DELIVERY PROJECT TO PROVIDE STREAM RESTORATION
CAPE FEAR RIVER BASIN CATALOGING UNIT-03030003**

**DEEP RIVER – CARBONTON DAM
RESTORATION SITE**

PREPARED FOR:



**ECOSYSTEM ENHANCEMENT PROGRAM
RALEIGH, NORTH CAROLINA**

PREPARED BY:



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1.0 INTRODUCTION

Restoration Systems, LLC (RS) proposes to restore a section of the Deep River and certain tributaries, which lie within the impoundment created by the Carbonton Dam, located at the juncture of Chatham, Lee, and Moore Counties, North Carolina (**Figure 1, Appendix A**). In order to successfully accomplish the goals of the project, RS has enlisted the services of several firms, which provide scientific and engineering expertise.

The stream restoration described herein involves the removal of the Carbonton Dam and associated powerhouse, resulting in passive restoration of flowing (lotic) functional attributes to the freed section of the Deep River. The use of the term “lotic” refers to a flowing water regime, which characterizes all non impounded sections of the Deep River. The antonym, “lentic”, refers to still waters of a lake or pond. This restoration plan describes the dam removal and explains the goals, existing conditions, monitoring protocols, and dam removal methods proposed by RS to be utilized for the generation of 90,494 linear feet of stream mitigation units for the N.C. Ecosystem Enhancement Program (EEP).

This project was identified by RS based on the conclusions of the North Carolina Dam Removal Task Force (NCDRTF): consisting of the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), N.C. Division of Water Quality (NCDWQ), N.C. Wildlife Resources Commission (NCWRC), U.S. Environmental Protection Agency (USEPA), National Marine Fisheries Service (NMFS), N.C. Division of Marine Fisheries (NCDMF), N.C. Natural Heritage Program (NCNHP), N.C. Division of Coastal Management (NCDCM), and N.C. Department of Transportation (NCDOT).

The NCDRTF recommends large-scale dam removal as an appropriate and desirable form of compensatory stream mitigation. Task Force participants have prioritized dams in North Carolina to identify the dam removals that would result in the largest ecological benefit (**Table 1, Appendix B**). According to the NCDRTF, the Carbonton Dam is one of four dams in North Carolina that will provide the highest ecological benefit when removed. The other dams are the Lowell Mill Dam on the Little River, Johnston County, and the Cape Fear River Lock and Dams #2 and #3. The Lowell Mill Dam is a privately owned dam that was ranked first due to ongoing dam removal efforts to restore anadromous fish migration within the Neuse River watershed. The Cape Fear River Lock and Dams are publicly owned, and would need an Act of Congress to remove, leaving Carbonton Dam as the second-highest priority privately owned dam in the State of North Carolina.

This project was originally offered in response to an NCDOT Full-Delivery Request for Proposal (RFP) in May, 2003. Following the issuance of that RFP, RS sought additional confirmation from regulatory agencies that this project was both appropriate and applicable as compensatory stream mitigation for NCDOT. Two regulatory field reviews were made, one on March 30, 2003 with the NCDWQ, and the other on April 22, 2003 with the USACE and the USFWS. During the field reviews, the respective agencies confirmed that removal of the Carbonton Dam was both feasible and desirable as compensatory mitigation in the amount and approach described in this proposal.

Though encouraged by the agency's support for the project, NCDOT ultimately decided to await regulatory guidance on the compensatory mitigation method before committing to this project. The USACE subsequently provided the appropriate guidance to facilitate the removal of problem dams for mitigation: *Determining Appropriate Compensatory Mitigation Credit for Dam Removal Projects, March 22, 2004* (USACE Public Notice 3/23/04). The mitigation potential determinations and project considerations in this proposal are based on this guidance. During this period, NCDOT transferred its mitigation responsibilities to EEP, and RS submitted a technical proposal to provide "full-delivery" stream mitigation units associated with this project to the newly formed program. This restoration plan is a contract milestone in the development of this project for EEP.

1.1 Project Description

The Carbonton Dam is located on the Deep River approximately 9 miles west of Sanford, North Carolina within the Cape Fear River Basin (Hydrologic Unit [HU] 03030003) (**Figures 1 and 2, Appendix A**). The Deep River is a 4th order river, and the project reach of the Deep River has a watershed of approximately 1,000 square miles. For the purposes of this document, the 5.5-acre land parcel that supports the dam will be hereafter referred to as the "Site". All proposed construction activities mentioned in this report will occur on-Site, unless specifically mentioned otherwise. The on-Site construction activities will free approximately 126,673 linear feet of the Deep River and associated tributaries from the impounding impact of the dam. These freed reaches will benefit from functional improvement resulting from the restoration of the lotic flow regime. These benefited stream reaches will be hereafter referred to collectively as the "Site impoundment".

For the purposes of this report, the limits of the Site impoundment have been identified as any stream reach of the Deep River or associated tributaries located above the Carbonton Dam with a thalweg elevation less than 227.6 feet above mean sea level (AMSL). The mainstem Site impoundment is wholly contained within the channel of the Deep River resulting in a "run of the river" bank-to-bank system with water depths ranging from 5 feet up to approximately 25 feet and widths ranging from approximately 150 to 260 feet. There is no sustained flooding of impounded water on the floodplain adjacent to the Deep River or the major, named tributaries. The flood level of the Site impoundment fluctuates with the river stage. The river level can go much higher than the dam, and can also be released through the gates within the dam, bypassing the dam crest. The Carbonton Dam is not used for flood storage, as the same level of water entering the impoundment is released from the dam.

Tributary widths range from 5 to 35 feet, with varying depths that are dependent upon the relationship between the channel thalweg and the elevation of the dam crest. The Carbonton Dam is responsible for the loss of a lotic flow regime and has effectively caused functional degradation within approximately 126,673 linear feet of stream ecosystem (63,223 linear feet within the Deep River and 63,450 linear feet of tributaries).

The hydroelectric facility at the Carbonton Dam was the business venture of John R. McQueen and Imlah Fogle Chandler, who together founded Sandhill Power Company in 1911. The dam was built in 1921, and is constructed of reinforced concrete. The dam ranges in height from a high of 27 feet at the river thalweg to a low of 6 feet on the north side of the dam near the river

bank. Investigations into historic documents have led to the discovery that multiple widths have been reported for the dam in the past (1982 FERC assignments and 2005 Feasibility Study). A registered survey of the dam has been acquired by RS, and the length of the dam (including the powerhouse) is 260 feet in length. The designed purpose of the dam was to supply local communities with power for domestic and industrial purposes. The power generated from the Site was interconnected with the Little River plant and provided electric power to the towns of Liberty, Cumnock, and Siler City. Carolina Power and Light (CP&L) acquired the plant in 1927. The Federal Energy Regulatory Commission issued a license for the construction of a new Project in 1982, as FERC Project Number 3155. The Project license was subsequently transferred to the Cox Lake Carbonton Associates. Personal communication with Mr. Mike Allen, the most recent owner and operator of the dam, suggests that the intended method of operating the dam was to fill the pool, then fully open the turbine gates and peak the generation capacity of the plant until the Site impoundment was drained. The gates would then be closed, and the Site impoundment would be allowed to refill. Once full, the process began yet again. The photo provided below was taken in 1921 during dam construction, and demonstrates the holding capacity of the dam. This mode of operation is assumed to have severely disrupted the river ecosystem. Rapidly dynamic river levels would have resulted in substantial stress to aquatic communities as well as unnatural, erosive sediment transport. These stresses were likely greatly detrimental if these techniques were used during the summer, which has low river flow, higher temperatures, and low dissolved oxygen. The dam is still capable of operating in this manner, and is only prevented by regulations that dictate the operation of the hydroelectric facility today, which were not in place in 1921 when the dam was designed and constructed. Currently, the operation of the dam is restricted to engaging the turbines only when the river stage is sufficient to power the turbines without draining the impoundment. These restrictions are the result of both energy-related and environmentally based regulations. Thus, the hydroelectric facility no longer predictably runs at peak capacity.



Sandhill Power Company Dam Construction - 1921
(Source: Chatham County Historical Association, 2005)

Land use adjacent to the Site impoundment is predominantly undisturbed woodland, with areas of agriculture, maintained grass (House in the Horseshoe historic site), and pine plantations occurring less frequently in smaller patches. The entire Site impoundment is bordered by a mature riparian buffer that varies in width from a minimum of 100 feet to large forested tracts of undeveloped land adjacent to the Site impoundment.

1.2 Goals and Objectives

The desired result of this project is to restore the impounded reach of the Deep River and affected tributaries to their natural lotic condition by removing the dam and related facilities in their entirety. Several criteria will be evaluated to demonstrate the reestablishment of conditions representative of a lotic environment, including flow regime, water chemistry, and aquatic community changes. These criteria will be monitored in order to demonstrate the achievement of certain goals of the project.

The specific goals of this project include:

- Reduction of inundated areas and passive restoration of riparian areas.
- Restoration of currently inundated shallow water habitat for the Cape Fear shiner (*Notropis mekistocholas*), a federally endangered species of freshwater fish.
- Reduction or prevention of stratified water temperature profiles typical of deepwater habitats and seasonal declines in water dissolved oxygen levels below levels measured in reference reaches.
- Restoration of appropriate in-stream sediment transport and supply.
- Restoration of upstream and downstream fish passage, and reconnection of currently disjunct populations of rare aquatic species of concern.
- Restoration of a natural flow regime.
- Restoration of lotic mussel habitat.
- Improvement in the abundance and diversity metrics for benthic macro-invertebrate communities.
- Provide compatible legal and public recreational opportunities at the site of the former dam.
- Provide academic grade data and/or peer-reviewed publications regarding the ecological consequences of large dam removal.

The removal of the Carbonton Dam as a large-scale compensatory project is consistent with state and national regulatory support for environmentally beneficial dam removal. Indeed, North Carolina is a leader in removing dams to improve watersheds and the environment. The Quaker Neck and Cherry Hospital dams were removed in 1998, and the Rains Mill dam was removed in 1999. The Quaker Neck dam removal project received the 2001 Governors Conservationist of the Year award and was publicized nationwide for its environmental benefits. The USACE and N.C. Division of Water Resources are planning to remove the Eno River Dam as an environmental restoration Section 206 project. Additionally, the North Carolina Clean Water Trust Fund has partnered with Piedmont Triad Water Authority to remove the Cedar Falls Dam upstream of this project on the Deep River.

Existing guidance and support by resource agencies (**Appendices C and G**) strongly recommend removal of the Carbonton Dam as an attractive, flexible alternative to more traditional stream restoration methodology.

2.0 EXISTING CONDITIONS

2.1 Physical Resources

2.1.1 Regional Characteristics

The Site impoundment is located within the Piedmont physiographic region and the Triassic Basin ecoregion of North Carolina. This ecoregion is characterized by irregular plains with low rounded hills and contains less relief and wider valleys than other areas of the Piedmont. Soils contain more clay than is typical in neighboring ecoregions due to the Lower Mesozoic sedimentary parent material that consists of unmetamorphosed shale, sandstone, mudstone, siltstone and conglomerates (Horton and Zullo 1991). The clay has a high shrink-swell capacity (Griffith *et al.* 2002). Because of the unusual geology and minor relief, streams in this ecoregion are characterized by low base flows.

The Deep River originates in the southeast corner of Forsyth County and the southwest corner of Guilford County and flows southeast through Randolph County before flowing into Moore County. Urban development is high in the headwaters of the Deep River near the communities of the Triad (Greensboro, Winston Salem, and High Point), but generally decreases from the headwaters towards the Carbonton Dam.

2.1.2 Local Physiography and Watershed Characteristics

The Site impoundment is part of Cape Fear local subbasin 03-06-10 (NCDWQ 2005). Land use within the subbasin is characterized by mature upland forest and pine plantations (71 percent), agriculture (17 percent), early successional forest (4 percent), and bottomland forest (4 percent). Elevations adjacent to the Site impoundment range from a low of approximately 228 feet National Geodetic Vertical Datum (NGVD) at the dam to a high of 392 feet NGVD at the top of a ridge on the north side of the river near the upper limits of the Site impoundment

2.1.3 Dam and Impoundment

The Site impoundment occurs within the relict channel of the Deep River, which is characterized by steep banks with occasional to frequent areas of bank failure in locations where mature trees have been toppled by storms or flood flows. The majority of the banks are forested with riparian vegetation typical of the region, such as box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), and sycamore (*Platanus occidentalis*). The lentic flow results in a stratified water column, where velocities are low near the surface, and stagnant at depths below the crest of dam elevation. Water depths range up to 25 feet, and water clarity ranges from 1 to 5 feet. The water quality varies seasonally, with low dissolved oxygen, elevated fecal coliform levels, stratified temperatures, and critically high chlorophyll a levels, resulting in habitat impairment within the Site impoundment during the summer due to warmer temperatures and lower river base flow. Using the classification system described by Cowardin *et al.* (1979), the Site

impoundment is best classified as a lacustrine, limnetic water body with an unconsolidated bottom characterized by mud (L1UB3).

Prior to the existence of custom hi-resolution mapping products, efforts at determining the limits of the impoundment were based upon water surface slope and identified the location average flow resumption of the *water surface*. Through additional investigations, it was learned that water depths, sediment distribution, flow velocities, and available instream habitats at that location were still affected by the dam at the Northern Suffolk railroad bridge. Therefore, RS requested additional investigations and ordered custom hi-resolution mapping products that facilitated extending the limits of the impoundment within the Deep River further upstream than previously reported.

The upstream limits of the impounding effect of the Carbonton Dam have been located in the field based upon interpolation of remote sensing data generated specifically for this project by GeoData Corporation. The GeoData mapping products (hi-resolution mapping) were commissioned by RS, and consist of hi-resolution color-infrared stereoscopic aerial photography (dated January 2005) and 2-foot interval hypsographic contours generated from the aerial photography. The hi-resolution mapping was generated and verified using multiple ground control stations, which were further used to calculate water surface elevations throughout the Site impoundment. Through interpretation of the channel depth from cross-section data, channel bed elevations were tied into the hi-resolution mapping using Trimble Geo-XT sub-meter Global Positioning System (GPS) coordinates, and the upstream limits of waters affected by the dam were determined. The upper limits of selected waters were visited, field verified, and photographed to verify these methods of determining the limits of the impoundment, and then applied to all affected reaches. The limits for individual stream reaches that will be monitored for functional improvement and stream mitigation units during post-removal monitoring activities are provided in **Figure 3 (Appendix A)**, as well as at a larger scale using the hi-resolution mapping products in **Figures 4A-E (Appendix A)**.

2.1.4 Deep River below Carbonton Dam

Downstream of the dam, the reference reach of Deep River channel is incised with steep banks that are well vegetated with riparian vegetation similar to the communities adjacent to the Site impoundment. Bank failures are evident in some reaches, and the bank slope is 3 to 1 along the flowing river. Flow ranges from sluggish in the summer months to velocities that exceed 5 feet/second in riffle areas during higher flows. The lotic river ranges from approximately 120 to 160 feet in width, with water depths up to approximately 5 feet. Water clarity extends to the bed depth except in deeper pool areas. The substrate consists of boulders, cobble, gravel, and sand with the particle distribution skewed towards heavier materials in riffles and the lighter ones in pools. Using the classification system described by Cowardin *et al.* (1979), the Deep River below the dam is best classified as a lower perennial, riverine system with a stream bed of cobble and gravel and sand (R2SB3/4).

2.1.5 Water Resources

The Site impoundment is located within sub-basin 03-06-10 of the Cape Fear River basin (NCDWQ 2005). This area is part of U.S. Geological Survey (USGS) Hydrologic Unit 03030003 of the Southeast Atlantic Region (**Figure 2, Appendix A**). The reach of the Deep River to be restored supports a watershed encompassing approximately 1000 square miles of land area

(NCDWQ 2005). Four large, named perennial streams (Big Governor's Creek, McLendon's Creek, Line Creek, and Lick Creek) and 11 unnamed tributaries contribute to the Site impoundment (**Figure 3, Appendix A**). The watershed sizes of the named tributaries are 40 square-miles, 100 square-miles, 2 square-miles, and 1 square-mile for Big Governor's, McLendon's, Line, and Lick Creek, respectively.

2.1.5.1 Waters of the United States

The Site impoundment and associated tributaries are all subject to jurisdictional consideration under Section 404 of the Clean Water Act as waters of the United States (33 CFR Section 328.3). The Site impoundment may be classified as a lacustrine, limnetic system with an unconsolidated bottom dominated by mud (L1UB3) (Cowardin et al. 1979). Both upstream and downstream of the impoundment, the Deep River may be classified as riverine, upper perennial with a rock bottom dominated by rubble (R3RB2). It is anticipated that the Site impoundment will share the R3RB2 classification once restored. The named tributaries to the Site impoundment may be classified as riverine, upper perennial systems with unconsolidated bottoms dominated by cobble/gravel (R3UB1) upstream of the effect of the Caribton Dam.

Vegetated wetlands are defined by the presence of three primary criteria: hydric soils, hydrophytic vegetation, and evidence of hydrology at or near the surface for a portion (between 5- and 12.5- percent) of the growing season (DOA 1987). The Site impoundment is currently completely covered by open water. No additional wetlands occur within the embankments of the Deep River since the impoundment does not extend into the floodplain. Once the impoundment has been dewatered through dam removal, it is possible that palustrine wetlands will persist on stream terraces within the main channel of the Deep River. These potential wetlands would likely be classified as palustrine, forested, broad-leaved deciduous, temporarily flooded (PFO1A) systems considering the palustrine habitats that occur within the reference reaches of the Deep River both upstream and downstream of the Site impoundment.

2.1.5.2 Impaired Waterbodies

The NCDWQ has assembled a list of impaired water bodies according to the Clean Water Act (Section 303(d)) and 40 CFR 130.7, hereafter referred to as the NC 2004 Section 303(d) list. The list is a comprehensive public accounting of all impaired water bodies. An impaired water body is one that does not meet water quality standards including designated uses, numeric and narrative criteria, and anti-degradation requirements defined in 40 CFR 130.7. Standards violations may be due to an individual pollutant, multiple pollutants, or an unknown cause of impairment. The source of impairment could be from point sources, nonpoint sources, and/or atmospheric deposition. Some sources of impairment exist across state lines. North Carolina's methodology is strongly based on aquatic life use support guidelines available in the Section 305(b) guidelines (EPA-841-B-97-002A and -002B). Those streams attaining Not Supporting (NS) status are listed on the NC 2004 Section 303(d) list. Streams are further categorized into one of six parts within the NC 2004 Section 303(d) list according to source of impairment and degree of rehabilitation required for the stream to adequately support aquatic life.

The Site impoundment is not listed in any section of the NC 2004 Section 303(d) list. However, the draft Cape Fear Basinwide Management Plan (DWQ 2005) indicates that since the year 2000 sampling, the Deep River from the mouth of Big Governor's Creek to NC-42 [Stream Index

17-(32.5)a] has exceeded allowable chlorophyll-a levels and is proposed for listing on the NC 2006 Section 303(d) list. This reach of the Deep River, which occurs in the backwaters of Carbonton Dam, has been listed as impaired for aquatic life because the chlorophyll-a standard was violated in 13 percent of samples. Nutrient loading from upstream land uses has caused increased algal growth behind other dams in the Deep River as well. The Deep River is also impaired in reaches or tributaries that receive direct runoff from Greensboro, Jamestown, High Point, and Asheboro (NCDWQ 2000, NCDWQ 2005).

2.1.5.3 Best Usage Classifications

North Carolina streams have been assigned a best usage classification by the NCDWQ, which reflects water quality conditions and potential resource usage. Unnamed tributaries receive the same classification as the named streams to which they flow. The Site impoundment of the Deep River is currently classified as **WS-V HQW** until reaching a confluence with Big Governor's Creek, at which time the classification of the impoundment changes to **WS-IV**. A classification of **WS-V** indicates waters protected as water supply sources, which are generally upstream and draining to **WS-IV** waters. **WS-V** has no categorical restrictions on watershed development or wastewater discharges. The supplementary classification **HQW** identifies waters for protection that maintain quality higher than state water quality standards. A classification of **WS-IV** indicates waters used as water supply sources for drinking, culinary or food processing purposes for those users where a **WS-I**, **-II**, or **-III** classification is not feasible. **WS-IV** waters are generally in moderately to highly developed watersheds or protected areas. Big Governor's Creek, McLendon's Creek, and Lick Creek are all classified as **C**. A classification of **C** indicates waters that are suitable for aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture.

2.1.5.4 Water Quality

The water quality of the Site impoundment has been measured at regular intervals by the Upper Cape Fear River Basin Association (UCFRBA) and by NCDWQ at an Ambient Monitoring Station (AMS) located near N.C. Highway 42 at the Carbonton Dam. Water quality parameters that are monitored include temperature, specific conductivity, dissolved oxygen, pH, fecal coliform, chlorophyll-a, turbidity, and total suspended solids (TSS). According to these data, fecal coliform, dissolved oxygen, and temperature periodically attain levels that are detrimental to native aquatic communities. The most recent NCDWQ data indicate that the Site impoundment and associated main tributaries are support-threatened or not-supporting their intended uses, and have been proposed for listing on the NC 2006 Section 303(d) list.

2.1.6 Summary of Potential Impacts to Water Resources

Impacts to water resources within the Site impoundment may result from activities associated with dam removal. Impacts that could occur as a result of dam removal are: fill (concrete) entering the Deep River during final removal of the dam; compaction of soils at the dam removal site; uncontrolled release of sediments; and increased potential for release of fuel, oil and hydraulic fluid from construction equipment.

In order to minimize these potential impacts to water resources adjacent to the Site, Best Management Practices (BMPs) intended to protect surface waters will be strictly enforced during the dam removal phase of the project. BMP's will include: minimizing incidental fill as a

result of dam demolition to the greatest extent possible and removing fill material from waters; ripping and scarifying construction staging site soils following construction; eliminating uncontrolled release of sediment by a phased approach to dewatering and demolition; briefing and monitoring equipment operators to ensure fuel and hydraulic lines are properly maintained on high ground to preclude leakage, and ensuring that problems will be addressed immediately. It is important to note that a phased, gradual dewatering will be implemented using the dam gates in order to prevent a stochastic mobilization of sediment throughout the Site impoundment. These sediments will be beneficial for channel geomorphology and available instream habitat once distributed downstream, and it is recognized that that a gradual and controlled release is important to facilitate the assimilation of sediments into starved downstream reaches.

2.2 Biotic Resources

This discussion of biotic resources located within the Site impoundment is limited to aquatic fauna. Although terrestrial organisms such as birds, reptiles, and foraging aquatic mammals use the section of the river and will directly benefit from dam removal, the primary monitoring efforts associated with dam removal will focus on benthic macroinvertebrate, fish, and freshwater mussel communities. This section describes the communities encountered and the potential changes in these communities induced by removal of the Carbonton Dam. The composition and distribution of fauna observed with the Site impoundment is reflective of the bathymetry, flow, light penetration, and substrate within the impoundment.

2.2.1 Aquatic Community

The Site impoundment currently supports communities of benthic macroinvertebrates, fish, and freshwater mussels that are representative of a lentic ecosystem. The absence of lotic-adapted species is well documented within impoundments. Sampling specific to this dam removal project has been designed and is currently underway. This section will describe the typical aquatic communities that are expected to currently exist within the impoundment, and **Section 3.0** will provide details on ongoing and planned reference studies that will provide specific data to verify and revise the descriptions provided herein.

Previous benthic macroinvertebrate sampling efforts by NCDWQ indicate that the Site impoundment supports a bioclassification of Good (criteria for classification is based on the number of taxa present in the intolerant groups and the Biotic Index Value), which indicates a potentially diverse aquatic community of macroinvertebrates and fish present within the Site impoundment (NCDWQ 2000). Bioclassification data have also been collected for the impounded sections of Big Governor's Creek and McLendon's Creek. These streams were both rated Fair, which indicates that the abundance and diversity of intolerant macroinvertebrate and fish species are in decline from previous sampling efforts. In NCDWQ (2005), benthic macroinvertebrate sampling was not undertaken within the Site impoundment nor in its tributaries, but the most recent data from the AMS indicate that the Site impoundment and associated main tributaries are support-threatened or not-supporting their intended uses, and have been proposed for listing on the NC 2006 Section 303(d) list.

Aquatic insects found in a lentic community provide an indication of the aquatic habitats available within the system. Low flow conditions and seasonally low dissolved oxygen will affect

the resident community structure of the Site impoundment. In addition, nutrient rich water that stagnates behind the dam facilitates algal blooms that can further deplete dissolved oxygen levels and contribute to environmental stress on aquatic communities. The most intolerant orders of aquatic insects are the mayflies (Order Ephemeroptera), caddisflies (Order Trichoptera), and stoneflies (Order Plecoptera) (known collectively as “EPT”). Individual genera within each of these orders vary with respect to specific habitat requirements, but organisms can be grouped by feeding guilds. Feeding guilds are functional feeding groups that include grazers, shredders, gatherers, filter-feeders, and predators. The filter-feeder, grazer, and shredder guilds are anticipated to be less dominant or absent in the Site impoundment than in natural reaches of the Deep River due to the lack of consistent flow, seasonal low dissolved oxygen, and decomposing vegetative debris. Once the dam is removed and lotic habitats are restored, EPT diversity should increase.

Dams have been shown to result in declines in fish biodiversity and fisheries (Nehlsen et al. 1991, Martinez et al. 1994, Moyle and Leidy 1995, LaRoe et al. 1995, Quinn and Kwak 2003, and others), and are identified as a major factor in the decline of freshwater mussels (USFWS 1992, Williams et al., 1992, Bogan 1993, Neves 1993). It is anticipated that the existing fish community is characterized by low diversity with increased abundance of species adapted to lentic ecosystems. The restoration of lotic habitats is expected to result in an increase of EPT species. A corresponding increase in fishes feeding on the previously reduced EPT species will likely occur. It is also anticipated that fish species considered to be less tolerant to fluctuations in temperature and dissolved oxygen will be more abundant, such as the federally endangered Cape Fear shiner. The shiner is generally associated with gravel, cobble, and boulder substrates and has been observed to inhabit pools, slow riffles, and slow runs (USFWS 1988). In these habitats, the species is typically associated with schools of other related species, but it is never the numerically dominant species. Juveniles are often found in slackwater, among large rock outcrops in midstream, and in flooded side channels and pools (USFWS 1988).

The Site impoundment is also expected to support less diverse, more lentic adapted mussel populations than the lotic reaches of the Deep River. Species richness and mussel abundance within the impounded portion of the river may increase with greater upstream distance from the dam.

2.2.2 Rare and Protected Species

Some populations of fauna and flora have been in, or are in, the process of decline due to either natural forces or their inability to coexist with human activities. Federal law (under the provisions of the Endangered Species Act of 1973, as amended) requires that any action likely to adversely affect a species classified as federally protected, be subject to review by the USFWS. Other species may receive additional protection under separate state laws. Currently, the agency review of this project has been favorable for development of this project. The USFWS has written correspondence (see **Appendix C**) that supports this project and indicates that the Section 7 consultation has already been completed based on their preliminary understanding of how the project would proceed. Soon after completion and submittal of the restoration plan, RS will again consult with the USFWS on behalf of the Cape Fear shiner, providing greater details of planned dewatering and demolition strategies, and the agency agrees with the biological conclusions provided herein.

Federally Protected Species

Plants and animals with federal classifications of Endangered, Threatened, Proposed Endangered, and Proposed Threatened are protected under provisions of Sections 7 and 9 of the Endangered Species Act of 1973, as amended. For Chatham, Lee, and Moore Counties, the most up to date county lists are February 5, 2003, February 24, 2003, and September 9, 2002, respectively. The USFWS lists six federally protected species for these counties (Table 5).

Table 2. Federally Protected Species listed for Chatham, Lee, and Moore Counties

Common Name	Scientific Name	Status**	County***
Bald eagle	<i>Haliaeetus leucocephalus</i>	T*	C
Cape Fear shiner	<i>Notropis mekistocholes</i>	E	C,L,M
Red-cockaded woodpecker	<i>Picoides borealis</i>	E	C,L,M
Harperella	<i>Ptilimnium nodosum</i>	E	C,L
American chaffseed	<i>Schwalbea americana</i>	E	M
Michaux's sumac	<i>Rhus michauxii</i>	E	M

*Proposed for delisting

**Federal Status: E--Endangered; a taxon "in danger of extinction throughout all or a significant portion of its range;" T--Threatened; a taxon "likely to become endangered within the foreseeable future throughout all or a significant portion of its range;" T (S/A) – Threatened, due to similarity of appearance

***: C-Chatham, L-Lee, M-Moore

***Haliaeetus leucocephalus* (Bald Eagle)**

Threatened (Proposed for delisting)

Family: Accipitridae

Date Listed: March 11, 1967

The bald eagle is a large raptor with a wingspan greater than 6 feet. Adult bald eagles are dark brown with a white head and tail. Immature eagles are brown with whitish mottling on the tail, belly, and wing linings. Bald eagles typically feed on fish but may also take birds and small mammals. In the Carolinas, nesting season extends from December through May (Potter *et al.* 1980). Bald eagles typically nest in tall, living trees in a conspicuous location near open water. Eagles forage over large bodies of water and utilize adjacent trees for perching (Hamel 1992). Disturbance activities within a primary zone extending 750 to 1500 feet from a nest tree are considered to result in unacceptable conditions for eagles (USFWS 1987). The USFWS recommends avoiding activities that may result in a disturbance, including construction and tree-cutting within this primary zone. Within a secondary zone, extending from the primary zone boundary out to a distance of 1.0 mile from a nest tree, construction and land-clearing activities should be restricted to the non-nesting period. The USFWS also recommends avoiding alteration of natural shorelines where bald eagles forage, and avoiding significant land-clearing activities within 1500 feet of known roosting sites.

There are no NCNHP records of the bald eagle occurring within the Site impoundment. Although appropriate nesting and roosting habitat does occur within the mature forest adjacent

to the Site impoundment, these areas will not be impacted by proposed construction activities. The dewatering of the Site impoundment is not likely to adversely affect the bald eagle, since foraging habitat of the eagle will still be available within the restored Deep River. No impacts are anticipated to the bald eagle as a result of the proposed restoration activities.

***Notropis mekistocholas* (Cape Fear Shiner)**

Endangered

Family: Cyprinidae

Date Listed: September 25, 1987

The Cape Fear shiner is a small (up to 2 inches), moderately stocky minnow. It is pale, silvery yellow with a black band along the sides. Moderate-sized eyes are located on the sides of the head (USFWS 1988). This species is distinguished from all other *Notropis* by having a coiled alimentary tract that is visible through the wall of the belly (Rohde *et al.* 1994). Food items probably include bottom detritus, diatoms, and other periphytes (USFWS 1988). Habitat of the Cape Fear shiner is generally slow pools, riffles, and runs over gravel, cobble, and boulders (USFWS 1988). Little is known about the Cape Fear shiner's life history. Present distribution (November 1988) includes portions of Randolph, Chatham, Lee, Moore, and Harnett Counties (USFWS 1988). As of 10 December 1993, the NCWRC has designated Critical Habitat for this species in the Deep River, from its confluence with the Haw River (on the Chatham/Lee County line) upstream to the Carbonton Dam near the NC Route 42 bridge (also on the Chatham/Lee County line).

One of the main benefits anticipated by the restoration of lotic flow to the Site impoundment is to provide additional habitat for the Cape Fear shiner. Once the Carbonton Dam has been removed, it is anticipated that currently disjunct, known populations of the shiner located both upstream and downstream of the Site impoundment will be connected throughout the restored reach of the Deep River. The removal of the Carbonton Dam will allow these disjunct populations to interbreed, and will be an important step to increase the genetic diversity and available habitat required to facilitate the continued survival and recovery of the species. If suitable habitat is found to be successfully restored through habitat monitoring after dam removal, it may be possible to extend the Critical Habitat for the shiner upstream to High Falls Dam in Moore County.

***Picoides borealis* (Red-cockaded Woodpecker)**

Endangered

Family: Picidae

Date Listed: October 13, 1970

This small woodpecker (7 to 8.5 inches long) has a black head, prominent white cheek patches, and a black-and-white barred back. Males often have red markings (cockades) behind the eye, but the cockades may be absent or difficult to see (Potter *et al.* 1980). Primary habitat consists of mature to over-mature southern pine forests dominated by loblolly (*Pinus taeda*), long-leaf (*P. palustris*), slash (*P. elliotii*), and pond (*P. serotina*) pines (Thompson and Baker 1971). Nest cavities are constructed in the heartwood of living pines, generally older than 70 years that have been infected with red-heart disease. Nest cavity trees tend to occur in clusters, which are

referred to as colonies (USFWS 1985). The woodpecker drills holes into the bark around the cavity entrance, resulting in a shiny, resinous buildup around the entrance that allows for easy detection of active nest trees. Pine flatwoods or pine-dominated savannas that have been maintained by frequent natural fires serve as ideal nesting and foraging sites for this woodpecker. Development of a thick understory may result in abandonment of cavity trees.

No suitable habitat for the red-cockaded woodpecker occurs within or adjacent to the Site impoundment. Any areas dominated by pine trees are involved in timber management, and are not left. The proposed project will not affect the red-cockaded woodpecker.

***Ptilimnium nodosum* (Harperella)**

Endangered

Family: Apiaceae

Date Listed: September 28, 1988

This species is a slender, annual herb which grows to 6 to 36 inches in height (Kral 1983). The leaves are reduced to hollow, quill-like structures which are green, ribbed, and purplish-tinged near the base. Flowers occur as umbels consisting of five regular parts and are bisexual or unisexual, each umbel containing both perfect and male florets. Flowering begins in May in populations occurring in ponds, while riverine populations may flower much later, beginning in late June or July and continuing until frost (Kral 1983). In North Carolina, Harperella typically occurs on rocky or gravelly shoals of clear, swift-flowing streams.

Suitable habitat for Harperella currently does not exist in or adjacent to the Site impoundment. The open water extends from bank to bank of the relict Deep River channel, and the banks are steep with little habitat for plants or shrubs to grow. The low average flow regime of the Site impoundment does not provide the habitat conditions required by the species. Once the dam has been removed, the restored Deep River will occur within the original channel and the lotic flow regime will be more consistent with the habitat requirements of Harperella. Reference sections of the Deep River located both upstream and downstream of the Site impoundment do support rocky and gravelly shoals and river islands that are adjacent to flow and can be characterized as appropriate habitat for Harperella. The proposed stream restoration project may result in reestablishment of suitable habitat for Harperella.

Discussions have been held with the North Carolina Botanical Garden about a future attempt to transplant propagules of this plant along the restored reach of the Deep River. A site visit by scientists following dam removal will clarify the potential candidacy of the project for such an undertaking.

***Schwalbea americana* (American Chaffseed)**

Endangered

Family: Scrophulariaceae

Date Listed: September 29, 1992

American chaffseed is a perennial pubescent herb that stands 12 to 24 inches tall. It is semi-parasitic, without host specificity. The alternately-leaved plant is erect and simple, or branched

only at the base. The fleshy leaves are lanceolate, sessile, yellow-green or dull green with red undertones, and become smaller and narrower from the base of the plant to the top (Kral 1983). Flowers are purplish-yellow, tubular, bilaterally symmetrical and showy. They are arranged on a spike-like terminal raceme and bloom from April to June. The fruit is a narrow capsule approximately 0.5 inches long which matures in early summer. Seeds are enclosed in a sac-like structure that provides the common name. American chaffseed occurs in open grass/sedge assemblages with seasonally moist to dry acidic sandy loams or sandy peat loams. These assemblages typically exist in moist pine flatwoods, savannas, bog borders, and open oak woods. In North Carolina, most documented occurrences are at Fort Bragg, in frequently burned impact zones. These areas consist of pine/scrub oak sandhills, pine savannas, and ecotones of streamhead pocosins. Frequent fires maintain a strong dominance and high diversity of herbs in what were historically fire-dominated communities (USFWS 1995). No suitable habitat for American chaffseed occurs in or near the Site impoundment. The proposed project will not affect the American chaffseed.

***Rhus michauxii* (Michaux's Sumac)**

Endangered

Family: Anacardiaceae

Date Listed: September 28, 1989

Michaux's sumac is a densely pubescent, deciduous, rhizomatous shrub, usually less than 2 feet high. The alternate, compound leaves consist of 9 to 13 hairy, round-based, toothed leaflets borne on a hairy rachis that may be slightly winged (Radford *et al.* 1968). Small male and female flowers are produced during June on separate plants; female flowers are produced on terminal, erect clusters followed by small, hairy, red fruits (drupes) in August and September. Michaux's sumac tends to grow in disturbed areas where competition is reduced by periodic fire or other disturbances, and may grow along roadside margins or utility right-of-ways. In the Piedmont, Michaux's sumac appears to prefer clay soil derived from mafic rocks or sandy soil derived from granite; in the Sandhills, it prefers loamy swales (Weakley 1993). Michaux's sumac ranges from south Virginia through Georgia in the inner Coastal Plain and lower Piedmont.

No suitable habitat for Michaux's sumac occurs in or near the Site impoundment. The proposed project will not affect the Michaux's sumac.

Federal Species of Concern

There are eighteen Federal Species of Concern (FSC) listed by the USFWS for Chatham, Lee, and Moore Counties, North Carolina. Federal species of concern are not afforded federal protection under the Endangered Species Act of 1973, as amended, and are not subject to any of its provisions, including Section 7, until they are formally proposed or listed as Threatened or Endangered. An FSC is defined as a species that is under consideration for listing for which there is insufficient information to support listing. In addition, FSCs that are listed as Endangered (E), Threatened (T), or Special Concern (SC) by the NCNHP list of Rare Plant and Animal Species are afforded state protection under the N.C. State Endangered Species Act and the N.C. Plant Protection and Conservation Act of 1979, as amended. Table 3 summarizes

federal species of concern listed for Chatham, Lee, and Moore Counties that are protected by the state.

Table 3. Federal Species of Concern

Common Name	Scientific Name	Potential Habitat	State Status****
Bachman's sparrow	<i>Aimophila aestivalis</i>	No	SC
"Carolina" redhorse	<i>Moxostoma</i> sp. 2	Yes**	SR (PE)
Robust redhorse	<i>Moxostoma robustum</i>	Yes	SR (PE)
Carolina darter	<i>Etheostoma collis</i> pop 2	Yes	SC
Pinewoods darter	<i>Etheostoma mariae</i>	Yes*	SC
Sandhills chub	<i>Semotilus lumbee</i>	Yes*	SC
Northern pinesnake	<i>Pituophis melanoleucus melanoleucus</i>	No	SC
Southern Hognose Snake	<i>Heterodon simus</i>	No	SC
Atlantic pigtoe	<i>Fusconaia masoni</i>	Yes*	E
Brook Floater	<i>Alasmidonta varicose</i>	Yes*	E
Yellow lampmussel	<i>Lampsilis cariosa</i>	Yes*	E
Carolina creekshell	<i>Villosa vaughaniana</i>	Yes*	E
Septima's clubtail dragonfly	<i>Gomphus septima</i>	No	SR
Sandhills clubtail dragonfly	<i>Gomphus parvidens carolinus</i>	No	SR
Arogos skipper	<i>Atrytone arogos arogos</i>	No	SR
Buttercup phacelia	<i>Phacelia covillei</i>	No	SR-T
Virginia quillwort	<i>Isoetes virginica</i>	Yes	SR-L
Bog spicebush	<i>Lindera subcoriacea</i>	No	E
Georgia indigo-bush	<i>Amorpha georgiana</i> var. <i>georgiana</i>	No	E
Sandhills bog lilly	<i>Lilium iridollae</i>	No	SR-L
Alabama beaksedge	<i>Rhynchospora crinipes</i>	No	E
Bog oatgrass	<i>Danthonia epilis</i>	No	SR-T
Conferva pondweed	<i>Potamogeton confervoides</i>	Yes	SR-D
Heller's trefoil	<i>Lotus helleri</i>	No	SR-T
Pickering's dawnflower	<i>Stylisma pickeringii</i> var. <i>pickeringii</i>	No	E
Roughleaf yellow-eyed grass	<i>Xyris scabrifolia</i>	No	SR-T
Sandhills milkvetch	<i>Astragalus michauxii</i>	No	T
Sandhills pyxie-moss	<i>Pyxidantha barbulate</i> var. <i>brevistyla</i>	No	E
Spring-flowering goldenrod	<i>Solidago verna</i>	No	SR-L
Sun-facing coneflower	<i>Rudbeckia heliopsisidis</i>	No	E***
Venus flytrap	<i>Dionea muscipula</i>	No	SR-L, SC***

*Potential Habitat: The Site impoundment does not currently offer habitat, but the restored Deep River and associated terrace may.

** The Carolina redhorse has been collected within the Site impoundment.

*** Historic record – the species has not been observed in one of the counties within the last 20 years

****State Status: E = Endangered; T = Threatened; SR = Significantly Rare; SC = Special Concern; W5A = Watch list, category 5A (rare because of significant decline); -L=limited to North Carolina and adjacent states (endemic or near endemic); D = disjunct population; T = throughout (these species are rare throughout their ranges [fewer than 100 populations total]) (Amoroso 2002; LeGrand and Hall 2001).

2.3 Human Resources

2.3.1 Cultural Resources

The term “cultural resources” refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. “Significant” cultural resources are those that are eligible or potentially eligible for inclusion in the *National Register of Historic Places*. Evaluations of site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO). A file search was conducted at two SHPO offices (the Office of State Archaeology [OSA] and the Survey & Planning Branch) in order to determine whether cultural resources investigations have been conducted within the project vicinity, and to determine whether significant cultural resources have been documented within the Site impoundment.

On January 20, 2004, a review of Survey and Planning records found that the dam and associated power house were identified during a survey of historic structures in Lee County in 1992 (State record LE-106). As a result of the identification, SHPO asked that a National Register eligibility determination be made of the structure by RS. The resulting study (**Appendix D**) determined the facility was eligible for listing in the National Register under Criterion A, and certain mitigation measures were necessary prior to its removal.

Restoration Systems has concurred with a Memorandum of Agreement (MOA) between the SHPO and the USACE. The MOA is also included in (**Appendix D**) Mitigation measures to be performed by RS include a photographic recordation of the dam, and installation of an interpretive display recalling the history of the dam. In addition, in an effort to be sensitive to the need for a permanent record of the structure, RS has generated an architectural survey drawing of the dam and powerhouse.

A commitment to undertake these measures has allowed RS to obtain a letter of concurrence for Section 106 approval from SHPO (**Appendix D**).

2.3.2 Public Recreational Usage

Another valuable human use of the Carbonton Dam is public recreation. Currently, both the Site and the Site impoundment are used for recreational fishing. There is a NCWRC boat ramp on the Site impoundment located 0.3 mile upstream of the NC 42 bridge crossing. The existing depths of the Site impoundment allow for the use of deeper hulled motor boats than will be feasible when the water depths of the Deep River are returned to nominal, lotic levels. The removal of the Carbonton Dam will result in unavoidable, permanent loss to motor boat access from the NCWRC boat ramp.

RS has agreed with the NCWRC to evaluate and fund an additional off-site motor boat access opportunity to mitigate for the loss of this opportunity on-site. The agreed upon budget for this evaluation and mitigation effort is \$20,000.

The banks downstream from the dam are popular for anglers that do not care to use, nor have access to, a motor boat. The area is used almost daily for compatible and ecologically passive

canoe and kayak access to the river. These downstream bank areas are also used for fishing access and clamming within the lotic Deep River. It is important to note that before the involvement of RS and the development of this project, all recreational access to the dam Site was the result of illegal trespassing. RS is proposing a plan for perpetual public access to the dam Site after the dam removal activities. This plan will be discussed in greater detail in **Sections 6.1 and 6.3.**

3.0 MONITORING REFERENCE STUDIES

In order to document the environmental benefits of removing the Carbonton Dam, RS has initiated multiple reference studies as of the timing of this report. These studies are intended to collect information that will improve knowledge about the Site impoundment and its ecosystem. These studies will also provide pre-removal baseline data for comparison to post-removal data that will be collected through future sampling efforts. Through this comparison of pre-removal to post-removal conditions, the planning team will be able to indirectly measure the functional improvement within the Site impoundment by documenting changes to the biota and geomorphology as it they transition to a lotic ecosystem. These monitoring studies can be grouped into several categories that describe the aspect of the Site impoundment that will be sampled. The categories include channel geomorphology, aquatic communities, water quality, and sediment toxicity.

Fifty-three unique locations have been identified and are being visited to sample various data that support the collection of information (**Figure 5, Appendix A**). These locations will hereafter be referred to as “stations”. All pre-removal data collection will be completed prior to any capacity modifications to the Site impoundment.

3.1 Channel Geomorphology

The channel geomorphology at all 53 stations is currently being studied through the sampling of channel cross-sections, sampling of sediment grain size distribution, collection of digital photography and digital videography, and measurement of channel flow velocity relative to a baseline standard. In addition, a complex hydraulic model will be generated for an area that extends from the dam to immediately upstream on NC 42 using HEC-RAS. This will fulfill several predictive needs for the project design engineer responsible for planning the dam removal.

3.1.1 Cross-sections

Personnel from EcoScience Corporation (ESC) began sampling the cross-section stations in May 2005. Permanent channel cross-sections have been established at all 53 sample station locations (**Figure 5, Appendix A**) within the Site impoundment and un-impounded reference areas of the Deep River and its tributaries. All cross-sections are measured from a rebar monument placed outside of the channel and located with GPS technology that has reported sub-meter accuracy. From the rebar monument, a cross-section of the channel is measured using either a “simple” or “complex” method that is selected based upon channel dimensions and station access. A simple cross-section involves extending a level rope or measuring tape across the channel, and then using a pocket rod to measure the distance from the ground (or channel bed) surface to the stationary tape. The rebar bin is also included as a cross-section measurement, so that successive monitoring will still be relative to the pin location. Simple

cross-sections are performed in challenging access areas on small tributary channels where a measuring tape or rope is extended across the entire width of the stream channel without a measurable sag in a bubble level placed on the rope. A complex cross-section is performed on larger stream channels where navigable water access (motor boat or canoe) is possible. The simple cross-section methods were not used for these channels because their width was too great to successfully stretch a tape or rope across the channel without creating a sag in the line. The complex methods involved use of a TopCon Total Station (both vertical and horizontal) or a laser level (vertical measurement) coupled with a Laser Atlanta laser rangefinder (for the horizontal measurement). Regardless of the collection technique, each cross-section station will be measured once before the dam is removed (pre-removal), and then revisited once each successive year of monitoring after the dam has been removed (post-removal). The pre-removal data will be compared to the post-removal data to measure the change of the river channel as the water level recedes into the relict channel and the hydrology returns to a lotic flow regime.



*Collection of cross-section data from two stations for pre-removal sampling
(Source: EcoScience Corporation 2005)*

3.1.2 Sediment Grain Size Distribution

Sediment grain size distribution is being collected from all 53 stations. For depths less than 3 feet (ability to wade to the station), ESC personnel will perform 200 random pebble counts and convert the data into a sediment grain size distribution based upon proportions of each grain



*Sediment sampling within the Site impoundment
(Source: EcoScience Corporation 2005)*

size class. For deeper water, ESC personnel will utilize the bulk material method for sorting the particle classes, and collect the sediment through five ponar dredge collections at each station.

3.1.3 Photography and Videography size class.

Digital photography and digital video is being collected at each station. Four photos will be taken at each station and photograph perspectives will include looking upstream, downstream, and perpendicular to each bank. Additional photographs may be taken to document flow or other potential habitat areas at the discretion of ESC personnel. Video collection will include a narrative by ESC personnel that describes notable features present at the station, and include a panning view of the station from the perspective of the camera.

3.1.4 Video Transect

A video transect will be collected, which will be available for qualitative of pre-/post-removal conditions for any section within the mainstem portion of the Site impoundment. The video transect will be correlated to sub-meter GPS. The intent of these data is to serve as a post-removal resource, so that an area of interest may be photographed and referenced with GPS, and then compared to the same location on the pre-removal video tape. The video transect will be performed from the Site to at least as far as the railroad bridge located 10 miles upstream of the Site. An effort will be made to obtain some video at the complete upper limits of the impoundment, but the availability of these data will be dependent upon the access conditions of the impoundment to motor boats.

3.1.5 Flow Velocity

The flow velocity is being collected at all 53 stations. The flow velocity of the lotic Deep River is variable between riffle and pool habitats, and flow is expected to always be present, even at depth. Within the impoundment, it is expected that the flows will be reduced when compared to the lotic reference stations, and that water near the channel bottom will be stagnant. Flow is very important to the aquatic community, and will be important for making an assessment of restored post-removal habitat. To collect these data, a Swiffer velocity probe is used to measure the velocity in five different locations along the channel cross-section of each station. The probe measurement is made at 1 foot below the water surface. If water depths exceed 4 feet, then two measurements are made at each location, where the first measurement is made



Impounded (lentic)



Lotic reference

(Source: EcoScience Corporation 2005)

at 1 foot below the water surface, and the second measurement is made at 1 foot above the channel bottom. Due to the large number of stations, it is impossible to sample them all at the same river stage. Thus, the data will be compared to a daily standard that is sampled from the Site each day that other stations are being visited. Thus, the fluctuation between sampling dates that occurs on-Site will allow for standardization of the other station data.

3.1.6 Hydraulic Modeling

A HEC-RAS hydraulic model is being constructed of the Deep River by Milone and MicBroom, Inc (MMI) from above the NC 42 bridge to below the Carbonton dam. The model will initially be used to evaluate pre- and post-dam removal river flow and velocity to determine the potential for bridge pier scour. If scour is a concern, rip-rap or other armoring will be included in the demolition plans. Preliminary investigations and professional determinations suggest scour will not occur.

Another use of the hydraulic model will be to evaluate pre- and post-dam-removal 100- and 500-year flood elevations to determine what impact that dam removal will have on the Deep River floodplain. Work in the floodplain requires a certification that construction or demolition will result in no rise in the floodplain elevation. It is reasonable to assume that removing an obstruction from the floodplain will not result in a rise in base flood elevation,

The HEC-RAS model will further evaluate substrate erosion and transport once the impoundment is dewatered and the area above the dam can be evaluated to determine what substrate exists and how it will be handled before the dam is removed (see Section 4.3 for further discussion of substrate management.) If the composition of the channel substrate is such that portions may remain in place after dam removal, the HEC-RAS model will be used to predict erosion potential and whether sediment transport downstream will be a consideration.

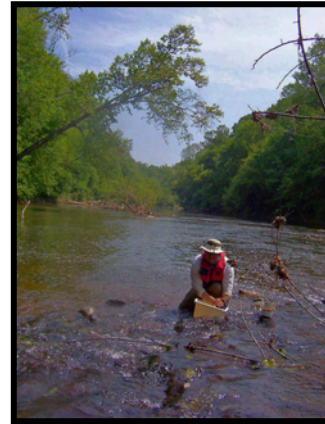
3.2 Aquatic Community Sampling

It is expected that substantial changes will occur to the aquatic ecosystem through the removal of the Carbonton Dam. RS has involved personnel from ESC and the Catena Group (TCG) to perform surveys for benthic macroinvertebrates, fishes, mussels, and aquatic snails. These surveys have been designed to occur at the most appropriate seasonal times relative to the life cycles of targeted taxa, and all surveys have already been completed to satisfy the pre-removal baseline data collection. Surveys for benthic macroinvertebrates were conducted by ESC during April and May, 2005. Surveys for freshwater mussels, fish, and snails were conducted during April through June, 2005. Data from these efforts are not yet fully processed, thus, the data will be presented and interpreted to describe the baseline condition of the aquatic communities in the post-removal restoration report, which will be presented in the Mitigation Plan.

3.2.1 Benthic Macroinvertebrates

There are 17 stations (**Figure 5, Appendix A**) where quantitative benthic macroinvertebrate sampling has been conducted. Sampling locations were established from a sub-set of the 53 stations where channel geomorphology data is being collected. The benthic macroinvertebrate stations occur on the Deep River and its named tributaries, in both the Site impoundment and in reference lotic reaches. The sampling methods utilized the Standard Qualitative Method, with

modifications for deep water sampling within the Site impoundment, as described in NCDWQ (2003). The samples will be sent to a NCDWQ certified laboratory for identification. A completed habitat assessment form was completed from each sampled station.



Sweep net and rock wash sampling for benthic macroinvertebrates at a reference station

(Source: EcoScience Corporation 2005)

3.2.2 Fishes

Fish sampling was conducted by TCG, and the ensuing text in this sub-section has been provided by their personnel. Sampling locations were established from a sub-set of the 53 stations where channel geomorphology data is being collected.

Fish surveys were conducted at each of five lotic stations located outside of the Site impoundment (**Figure 5, Appendix A**). Fish surveys were not conducted within the Site impoundment as it was determined, in conjunction with USFWS, that these lentic areas contain a predictable suite of impoundment-adapted species, and therefore should not require an initial inventory. A three-person team was used for fish surveys with site access provided via canoe or powerboat. The length of each survey reach ranged from 200 to 400 meters in length. The midpoints of each survey site were recorded using a hand-held Garmin etrex Vista GPS unit. Seine netting was the primary method used to sample fish, as it is the most effective survey method for the targeted Cape Fear shiner (the shiner). Seine netting is an effective method in shallow riffles and runs, as well as shallow pools; generally the preferred habitat of the shiner. This method is not as effective in deeper pools or riffles with a very strong current, therefore fish species preferring these habitats were not effectively sampled. Other sample methods included capturing fish in hand held dip nets against shoreline or bottom structure as well as visual census surveys. Visual census survey methods using mask/snorkel were also employed. These methods often provide more accurate estimates on abundance of some species than more traditional methods, such as mark recapture and depletion (Hankin and Reeves 1988, personal observations).

Each habitat type in a given survey reach was sampled at least once. Seine hauls were performed by dragging the net upstream through the riffle/run. Pools were sampled by the team making fast pulls in a downstream direction and herding fish towards the banks, or sand/gravel bars. All captured fish were placed into water buckets until they could be identified to species level and counted. Specimens that did not recover from the sampling methods were preserved

in 95% ethanol. Additionally some shiner species were collected and preserved in 95% ethanol for laboratory identification to confirm field identification. The remaining fish were released. Habitat notes were recorded at each collection site. A relative abundance of abundant, common, uncommon and rare was assigned to each species captured or observed at each site.

3.2.3 Mussels

Mussel sampling was performed by TCG, and the ensuing text in this sub-section has been provided by their personnel. Sampling locations were established from a sub-set of the 53 stations where channel geomorphology data is being collected.

A three-person survey team was used to survey for mussels at each of 11 stations (**Figure 5, Appendix A**). Watercraft (canoes, powerboats) were used to access all of the sites surveyed in the Deep River. The length of each survey site ranged from 200 to 400 meters. The midpoints of each survey site were recorded using a hand-held Garmin etrex Vista GPS unit.

All appropriate habitat types within a given survey site were searched thoroughly via visual surveys using glass bottom buckets (batisopes) and/or mask/snorkel in the shallow water habitats and SCUBA at each of the impounded sites. Tactile methods were also employed when appropriate. Where SCUBA was used, one of the three person survey team members provided surface support to the two divers. All species of freshwater bivalves were recorded and returned to the substrate. Searches were also conducted for relict shells, and the presence of a shell was equated with presence of that species, but not factored into the Catch per Unit Effort (CPUE) by species. CPUE is defined as the number of individuals found per person hour of search time. All species that are monitored by the NC Natural Heritage Program (NCNHP) were measured (total length). Representative photographs were taken of each collected mussel species.

3.2.4 Snails

Snail sampling was performed by TCG, and the ensuing text in this sub-section has been provided by their personnel. Snail surveys were conducted in conjunction with the mussel survey efforts with similar methodology, as described in **Section 3.2.3**. Snails were hand picked from rocks and woody debris. Dip nets were used, where appropriate, to sift through leaf packs. Following each timed search, collected snails were identified to the species level and each species was assigned a relative abundance rating to correspond to the survey site.

3.2.5 Habitat Assessment

At stations where sampling of aquatic organisms was conducted, forms that evaluate the quality and character of the sampled habitat niches were completed to provide a comparable score that describes the habitat available at that station. The same 4-page form will be completed at all 53 stations, so that the quality of habitat can be compared, even though intensive sampling of aquatic taxa was not performed at all stations. An example of the form template can be found at <http://h2o.enr.state.nc.us/ncwetlands/dave.pdf>.

3.3 Water Quality

At all 53 stations, in-situ water quality measurements are being collected using a HydroLab Quanta field sampling probe that measures pH, dissolved oxygen, conductance, and

temperature. Using other field methods, ESC personnel are performing measurements of depth, velocity, and turbidity. Due to the fact that natural variability in flow will affect these measurements, they are being standardized by collecting data for each parameter at the dam Site the same day other collections are being performed.

Aside from the in-situ sampling occurring at each station, physical water quality parameters are currently collected at an Ambient Monitoring Station (AMS) located within the Site impoundment at NC42, immediately upstream of Carbonton Dam. These data have been obtained by ESC from NCDWQ, and data coverage exists on a monthly basis from year 1992 to present. Data collected by the AMS are not standard for all samples, but can include: water temperature (°C), dissolved oxygen (mg/L), pH (field measured), conductance at 25°C (µmhos/cm), turbidity (NTU), fecal coliform bacteria (number of colonies/100 milliliters), suspended residue (total suspended solids) (milligrams/Liter), ammonia as nitrogen (milligrams/Liter), total Kjeldahl nitrogen (milligrams/Liter), nitrite and nitrate as nitrogen (milligrams/Liter), total phosphorus (milligrams/Liter), and assorted metals. The Upper Cape Fear River Basin Association has also collected physical water parameters. A combination of these three sources will provide acceptable coverage of physical water chemistry and parameters throughout restoration and monitoring activities.

3.4 Sediment toxicity

The USFWS agreed to develop sediment sampling protocols and manage sediment sampling in the Deep River. The work is being supervised by Tom Augspurger, an environmental toxicologist. These sediment sampling protocols have been designed and approved by resource agencies to screen for toxic materials that may be hazardous to the river ecosystem if mobilized through dam removal. Sediment sampling is expected to occur in July or August 2005. The number of stations sampled will be determined in the field by examination of the available sediments. The sediments will be sampled and analyzed, and if toxic compounds are identified, then a plan for removal or remediation will be implemented prior to Site impoundment dewatering. The following text in this sub-section has been provided by Mr. Augspurger.

Sediment sampling will target depositional areas where any contamination would be highest as a worst case scenario. These quiescent areas are where fine-grained sediments (which have the greatest potential to accumulate contaminants) are most likely to settle. Samples will be collected using a stainless-steel petit Ponar dredge. The dredge will collect the top 5 to 10 centimeters of sediment; multiple grabs will be collected and made into a single composite sample at each site. The composite of the grab samples will be homogenized by stirring with a stainless-steel spoon in a stainless-steel bucket. Debris (e.g., sticks, leaves, rocks bigger than ~0.1 cm³) will be removed during homogenization. Collection will be thoroughly cleaned (ambient water rinse, detergent and water scrub, distilled / demineralized water rinse, 10% nitric acid rinse, distilled / demineralized water rinse, hexanes rinse, and a final rinse with distilled / demineralized water) before sampling each site. Aliquots of the homogenate were put into jars provided by the analytical lab. An aliquot was also put into a 4-L container in the event that additional testing (tier 3) is conducted. Samples were stored in a cooler on ice (~ 4 °C) in the field and upon reaching the Service lab in Raleigh until delivered to the analytical lab.

Sediment chemistry results will be obtained within 2 to 4 weeks of sampling so that a decision on any additional testing (e.g., tier 3 toxicity testing) can be made within the holding times for the archived sample.

Sediment Chemical Analyses

The sediment samples will be analyzed for elemental contaminants by inductively coupled plasma mass spectrometry (ICP-MS), inductively coupled plasma atomic emission spectrometry (ICP-AES) and cold vapor atomic absorption (CVAA) and for polycyclic aromatic hydrocarbons by gas chromatography and high performance liquid chromatography. These analyses will address the components of highway run-off. Sediment particle sizes will be determined by sieve series, and percent organic carbon (volatile organic solids) determined by loss on ignition. Particle size and organic carbon help with interpretation of the other chemistry data. Analyses will be accompanied by batch-specific quality control / quality assurance samples (blanks, duplicates, standard reference material). Tritest, Inc. of Raleigh, NC is performing the analyses. They have the NC Laboratory Certification for all of the analyses.

4.0 DAM REMOVAL

The removal of the Carbonton Dam is proposed to occur through a staged approach. The stages will be designed to carefully evaluate and remediate potential disturbances to water quality or aquatic life within the Deep River. The stages of dam removal are: pre-removal species surveys, dewatering the impoundment, sediment management, and complete removal of the dam.

RS has retained Milone & MacBroom, Inc. (MMI), an engineering firm with expertise in dam removal who has engineered and managed the removal of approximately 30 dams in seven states. MMI is widely considered an expert in dam removal by regulatory agencies in the northeastern U.S. Subsections 4.2 through 4.5 incorporate guidance and text from MMI, and summarize the plan of action for dam removal based on information available at this time.

4.1 Pre-Removal Species Surveys

Surveys for rare aquatic species, including fish and mussels will be performed within the river bed for a distance of 800 feet below the dam site prior to demolition activities. Surveys will focus on the potential presence of the Cape Fear shiner, Carolina redhorse, robust redhorse, Carolina darter, pinewoods darter, sandhills chub, Atlantic pigtoe, brook floater, yellow lampmussel, and Carolina creekshell. Populations will be identified and habitat areas delineated in the field using GPS. Additional monitoring that will occur prior to irreversible dewatering activities include sediment toxicity sampling and a scour analysis of the NC 42 bridge using a HEC-RAS hydraulic model.

4.2 Dewatering

Controlled dewatering is necessary to prepare final construction plans and to manage excess substrate that may exist in the Deep River channel immediately above the Carbonton dam. It is believed that partial components of a previous earth and timber dam possibly remain in place between the current dam spillway and the NC 42 bridge. Historic photos indicate that, in 1921, rock and timber cribbing existed in the river channel during construction of the current dam, and it is unknown whether this was removed before the impoundment was flooded. Dewatering will

allow investigation and evaluation of the channel substrate to determine whether any material must be removed before dam demolition. If so, a plan will be prepared to either remove and dispose of it, or reuse rock or other material for fill and grading during construction of the future public park at the dam site.

The impoundment will be lowered by directing flow through the existing "mud gates" located in the south water room of the powerhouse structure, and once the turbines have been removed, through the turbine draft tubes in either or both of the water rooms. To accomplish this, the mud gates will be rebuilt, the head gates may need refurbishing, and the turbines and shafts will be removed. The mud gates and possibly the head gates will allow dewatering to occur in a controlled manner, which is anticipated to begin in early-mid fall 2005. The precise date, however, will be based on coordination with the USFWS and other agencies in order to minimize impacts on dissolved oxygen and aquatic species downstream. Section 404 and Section 401 permits are not required to dewater the impoundment.

Once the impoundment is lowered to its maximum extent, the dam spillway, and powerhouse head works and structure (and to the extent possible tail works) can be inspected to determine appropriate demolition techniques and sequences.

4.3 Substrate Management

The channel substrate above the Carbonton Dam will be investigated when the site impoundment is lowered in fall 2005. Historic construction photos of the current dam, field investigations, and personal communication with a fisherman at the dam site indicate that portions of an earth & timber crib dam may remain between the current dam and the NC Highway 42 bridge (see photo).

Lowering the impoundment will occur in fall 2005 to avoid impacting downstream species and water quality, and in the interim substrate will be investigated using remote-sensing techniques such as side-scan sonar, and bottom-penetrating radar (see **Figure 6, Appendix A**). A diver will also be retained to inspect the channel bottom to gather as much information as possible.

Hand soundings, probing, fathometer readings in March 2005, and a more-recent bathymetric survey show that ridges and valleys exist behind the dam that could be the reported crib dam, as well as sediment, trees, timbers, and other material that was deposited since 1921 when the dam was constructed. It is also possible that a bedrock ridge exists behind the dam, because bedrock outcrops exist at both the north abutment and below the spillway. It was historically commonplace to situate dams where bedrock foundations could be utilized in river channels.

If the channel substrate is indeed rock and earth as suspected, it will be evaluated whether to mechanically dredge to the natural channel or to remove timbers and leave other portions in place. Depending on the character and volume of material dredged, it may be used at the proposed park at the dam site (see Section 6.3) as fill where the grade must be raised and leveled. The park site has steep grades and to develop parking requires cut and fills and leveling, and concrete rubble from the dam demolition will be used as structural fill in those areas. Possibly, channel substrate can also be used to augment the concrete fill.



*Sandhill Power Company Dam Construction - 1921
(Source: Chatham County Historical Association, 2005)*

4.4 Dam Removal and Restoration Methods

It is anticipated that the dam demolition will begin in mid to late fall when cooler weather is present. Once the impoundment is dewatered and the channel substrate is evaluated and a plan prepared to handle it, the substrate management plan will be implemented. It is anticipated that some portion of the channel substrate will need to be removed by mechanical dredging, cabling or other methods. **Figure 6 (Appendix A)**, *Substrate Investigation*, shows what is believed to be the maximum extent of any area from which substrate would be removed.

After the substrate management plan has been fully implemented, dam demolition will proceed, while continuing to discharge normal river flow through the powerhouse mud gates and turbine draft tubes. **Figure 7 (Appendix A)**, *Construction Access*, shows that the primary access to the Deep River will be from the south (Lee County) side for substrate removal, and spillway and powerhouse demolition. RS has obtained an agreement for a temporary construction easement on the north side so necessary equipment can be staged there to remove channel substrate, or portions of the dam spillway itself.

The Carbonton Dam is an Abursen-style, flat-slab buttress dam with a reinforced-concrete upstream face on an approximate 2:1 slope, a powerhouse at the south end, and a mass-concrete ogee spillway at the northernmost end. The downstream side consists of reinforced concrete, vertical supports, and horizontal reinforced concrete stiffening members. Together they form approximately square, hollow "rooms" behind the downstream face (see photo.)



*Carbonton Dam Showing Buttresses
On Downstream Face
(Source: NCDENR-DWR; Instream Flow Web page)*

The dissimilar ogee spillway that is continuous to the buttressed spillway, is an interesting feature, and along with the north abutment, appears to be the final segment built in the original 1921 construction sequence. The designers likely intended for the powerhouse to be the primary outlet works, and it would follow that the ogee portion was provided as an emergency spillway. However, the crest of the ogee segment is higher than the buttressed portion, so the intent of that spillway is puzzling. It may have been a repair or an "afterthought" added to the original design to provide an abutment against bedrock, instead of an original abutment associated with the buttress portion. The ogee spillway is absent from the historic construction photographs so the intended function remains unknown. Nevertheless, it was likely that the impoundment stage was intended to be managed below the crest of the buttressed spillway for most river flows.

It is anticipated that the ogee spillway will be the first segment removed when dam demolition begins. River flow will continue to be discharged through the powerhouse during this phase, and one or more temporary water dams may be employed to direct flow away from the immediate demolition area. The ogee spillway may lend itself to low-level blasting in order to weaken its structure so it can be more-easily removed by hydraulic hammers. An inspection and blast survey by a licensed blasting firm will be scheduled when the impoundment is dewatered, and the results used to decide whether to employ explosives in this phase. The buttressed-portion of the spillway is less suited to blasting as a demolition method, but that alternative will also be considered and evaluated during the inspection.



*The ogee spillway on the north side of the dam
(Source: Restoration Systems 2005)*

When the ogee spillway and north abutment is demolished, the next phase will be to demolish the buttressed spillway, beginning from the north end. If river flow discharging at the powerhouse becomes troublesome, flow will be diverted to the north side of the channel using temporary water dams or other means. As the buttressed spillway is sequentially removed, concrete will be transported to, and used as fill for, the proposed public park on the south river bank.

Lastly, the powerhouse will be demolished and that material, too, will be used to fill the park area as needed to create level grades for the driveway, parking areas, and other features. The final stage of demolition will be removing any temporary fill or water dams from the channel in order to establish free flow through the dam site.

4.5 Dam Site Stabilization

The property along the south side of the Deep River will become a legally accessible park. (see Section 6.3.) Slopes from the proposed park to the river will be filled, graded and stabilized using concrete rubble and possibly channel substrate from the dam spillway and powerhouse demolition. Land areas in the park proper will be graded using local soil and vegetated for stabilization.

There are mainly bedrock outcroppings along the north side of the river that will limit access and utilization of this portion of the park parcel. Any disturbance on the north side of the river that results from construction equipment access will be restored as closely as possible to pre-existing conditions and stabilized to prevent erosion and silt discharges to the Deep River.

The channel substrate will be characterized and evaluated whether it will be partially or totally removed, and its fate evaluated in terms of future erosion potential due to increased velocity through the dam site. Once the substrate character and volume of material is known, hydraulic

modeling will be used to predict its fate if left in place, versus being mechanically dredged and removed. Since the volume and composition of the material at channel bottom within the construction footprint of the dam project is unknown at this time, the final disposition and treatment of the material will be finalized into a management plan once the impoundment is dewatered. That plan will provide for minimizing downstream impacts due to the substrate reentering the flow stream.

5.0 RESTORATION SUCCESS AND MONITORING

To monitor the benefits of the Carbonton Dam removal on the ecology of the Deep River and its adjacent tributaries, the project will be evaluated for improvement to three out of four criteria listed as measures for success in *Determining Appropriate Compensatory Mitigation Credit for Dam Removal Projects, March 22, 2004* (USACE Public Notice 3/23/04) (**Appendix E**). The monitoring reference studies described in **Section 3.0** will provide all necessary data for evaluating the success of this project.

5.1 Success Criteria

For this project, improvements in desirable water quality parameters, restoration of habitat for the federally endangered Cape Fear shiner, or a measurable improvement in lotic adapted aquatic species will be used to evaluate the success of this project. The remaining monitoring data will not be used a success criteria by themselves, but will supplement other collected data to evaluate the success of the water quality, endangered species, or aquatic habitat criteria. **Table 4 (Appendix B)** provides a list of measured parameters from the various reference studies that will be applicable to measuring functional benefit and success.

5.1.1 Channel Cross-Sections

Channel geomorphology will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. Channel cross-sections are being performed at all 53 stations. Data will be used to evaluate the restoration of riffle habitat that is required by the Cape Fear shiner, as well as serve as a representative indicator of microhabitats for lotic adapted aquatic species. Additionally, these data may be useful post-removal to monitor channel adjustments in reaches that were previously controlled by the Site impoundment.

5.1.2 Sediment Grain Size Distribution

Sediment grain size distribution will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. This metric is being sampled at all 53 stations. Data will be used to demonstrate an increase in substrate heterogeneity, which will increase microhabitats available for benthic macroinvertebrates. An increase in substrate heterogeneity with an overall increase in sediment grain size will also potentially allow for the restoration of habitat for lotic fish species and freshwater mussels. The Cape Fear shiner requires gravel, cobble, and boulder substrate, which is less prevalent within the Site impoundment than in reference lotic reaches.

5.1.3 Photography and Videography

Photography and videography data will be used to support success evaluation for the Aquatic Community criterion. Additionally, they will likely be important for station relocation during the post-removal sampling efforts. The data will provide a qualitative evaluation of developing habitat niches, and may be useful post-removal to monitor channel adjustments in reaches that were previously controlled by the Site impoundment.

5.1.4 Video Transect

A video transect will be used to support success evaluation for the Aquatic Community criterion. This resource was collected in June 2005, and extends from the dam Site to the railroad bridge located approximately 10 miles upstream. Data will provide a record of river condition to assist with identification and monitoring of riffles, as well as monitor for detrimental channel readjustment.

5.1.5 Flow Velocity

Flow velocity will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. This metric is being sampled at all 53 stations. Data will be used to demonstrate the restoration of lotic conditions within the reaches previously controlled by the Site impoundment. The flow velocity is expected to have microvariability, and be lower in pools than in riffles and slow runs. Restoration of lotic conditions will support an increase in substrate heterogeneity, which will increase microhabitats available for benthic macroinvertebrates. The microhabitat created in eddies and sheltered areas will also potentially allow for the restoration of habitat for lotic fish species and freshwater mussels. The Cape Fear shiner requires lotic flow, and TCG found the most Cape Fear shiner individuals at the reference station with the highest flow.

5.1.6 Benthic Macroinvertebrates

Benthic macroinvertebrate data will be used to support success evaluation for the Aquatic Community criterion. The samples from the 17 sampled stations will be compared by their biotic index assigned values (BIAV) for a quantitative change. Additionally, the data will be evaluated for a quantitative difference in abundance and diversity between lotic and lentic stations. As lentic stations transition to lotic, success will be evaluated based upon values of the community and BIAV data. These indices will be evaluated to identify that the Site impoundment is in transition towards more closely representing the values of the lotic, reference stations than the pre-removal data for that station.

5.1.7 Fishes

Fish sampling data will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. The samples from the 11 post-removal sampled stations will be compared by catch per unit effort for a qualitative change. Additionally, the data will be evaluated for a quantitative difference in abundance and diversity between lotic and lentic stations. As lentic stations transition to lotic, success will be evaluated based upon values of the community data more closely representing the values of the lotic, reference stations than the pre-removal data for that station. For the Endangered Aquatic Species criteria, the discovery of the Cape Fear shiner in areas previously characterized as the Site impoundment will be used to evaluate success. If no individuals of the shiner are discovered within the post-removal monitoring period, habitat analyses will be used as a surrogate.

5.1.8 Mussels

Mussel sampling data will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. The samples from the 11 sampled stations will be compared by catch per unit effort for a qualitative change. Additionally, the data will be evaluated for a quantitative difference in abundance and diversity between lotic and lentic stations. As lentic stations transition to lotic, success will be evaluated based upon values of the community data more closely representing the values of the lotic, reference stations than the pre-removal data for that station. For the Endangered Aquatic Species criteria, the discovery of rare mussel fauna in areas previously characterized as the Site impoundment will be used to evaluate success. If no individuals of these rare taxa are discovered within the post-removal monitoring period, habitat analyses will be used as a surrogate.

5.1.9 Snails

Mussel sampling data will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. The samples from the 11 sampled stations will be compared by catch per unit effort for a qualitative change. Additionally, the data will be evaluated for a quantitative difference in abundance and diversity between lotic and lentic stations. As lentic stations transition to lotic, success will be evaluated based upon values of the community data more closely representing the values of the lotic, reference stations than the pre-removal data for that station. For the Endangered Aquatic Species criteria, the discovery of rare snail fauna in areas previously characterized as the Site impoundment will be used to evaluate success. If no individuals of these rare taxa are discovered within the post-removal monitoring period, habitat analyses will be used as a surrogate.

5.1.10 Habitat Assessment

Habitat assessment data will be used to support success evaluation for the Aquatic Community and Threatened and Endangered Aquatic Species criteria. Data will be used to support improvement in aquatic community populations as well as demonstrate the presence of habitat for the Cape Fear shiner. As the physical parameters of the Site impoundment become more indicative of a lotic flow regime, the habitat assessment score will quantitatively increase. As lentic stations transition to lotic, success will be evaluated based upon the quantitative habitat values more closely representing the values of the lotic reference stations than the pre-removal data for that station.

5.1.11 Water Quality

Water quality data will be used to support success evaluation for all three criteria. Monitoring by NCDWQ and the Upper Cape Fear River Basin Association will allow constant, monthly monitoring that was initiated prior to removal of the dam. The success of the project for improvement in water quality will be dependent on these data successfully not indicating impairment in any of the monitored parameters. Particularly, special attention will be paid to fecal coliform, dissolved oxygen, and chlorophyll a levels, to ensure that they do not exceed the allowable thresholds for the best usage classification of each classified waterbody. For the in situ measurements at the Site impoundment stations to be considered successful, the data shall not demonstrate thermal stratification, nor exhibit low dissolved oxygen below 4 mg/L when reference lotic stations demonstrate higher level of dissolved oxygen.

6.0 PROJECT DETAILS

6.1 Determination of Stream Mitigation Units (SMU's)

Using Geographical Information Systems (GIS), an analysis of available stream mitigation units was performed with hi-resolution mapping products purchased in January 2005. The process for determining the limits of the Site impoundment was described in detail in **Section 2.1.3**. It has been determined that a total 126,673 linear feet of impounded waters of the U.S. exist within the Site impoundment and adjacent tributaries (**Figure 8, Appendix A**)

According to the interagency guidance, *Determining Appropriate Compensatory Mitigation Credit for Dam Removal Projects, March 22, 2004* (USACE Public Notice 3/23/04), the linear length of the Site impoundment has been evaluated against the four general criteria (water quality, protected species habitat, improved aquatic community, or anadromous fish passage) and two bonus factors (human recreational or scientific value) for stream mitigation unit determination to assess the available units. This project is designed to restore three of four general criteria, as well as accomplish both bonus activities. Through re-establishment of habitat for federally endangered Cape Fear shiner, a general improvement to the aquatic community, and improvement to the water quality within the previous Site impoundment, the monitored project will satisfy requirements to be eligible for 70-percent of the total Site impoundment length.

In addition, RS and the Triangle Land Conservancy (TLC) have joined in an agreement to protect the dam site and develop it as a natural park that provides the public with a legal canoe and kayak launching grounds, a fishing access point, and an opportunity for general river recreation at the site.

According to the agreement, RS will provide site grading and the establish an improved parking lot, as well as design and place narrative signs that describe the cultural and natural history of the Site and area. These displays will depict the dam and its relevance to local history in order to educate the public on the historic value of the Site, as well as the innovative environmental benefits that have occurred as a result of the dam removal.

Aside from public recreating and education, the Site impoundment is subject to a study by UNC Chapel Hill PhD Candidate Adam Riggsbee. RS has provided UNC with unrestricted funding for any research project the University deems necessary. These two bonus factors demonstrate that the project should be considered for an additional proportion of the potential stream mitigation units associated with this project.

6.2 Total Potential Stream Mitigation Units

As discussed in **Sections 2.1.3** and **6.1**, 126,673 linear feet of impounded stream and river are within the Site impoundment. The project is eligible for a stream mitigation unit ratio that ranges between a minimum of 75-and maximum of 90-percent of the total impounded length. Using these percentages, the project will receive between 95,005 and 114,005 SMU's based on determinations by the Program Assessment and Consistency Group (PACG). The current contract between RS and EEP currently has reserved 90,494, so any stream mitigation units

that are in excess of this amount will be considered reserve to compensate for units potentially lost during post-removal functional evaluations.

6.3 Perpetual maintenance and Protection of the Site

The current easement, held by the North Carolina Wildlife Habitat Foundation (and previously invoiced as a payment milestone) prevents the construction of another dam in the future, allows the removal action and restorative modifications, and safeguards the modifications from alteration inconsistent with the project. This legal condition is a fundamental requirement of the Dam Removal Guidance, and conforms to the requirements of the EEP.

However, in order to make the project eligible for the “human values” credits offered by the Dam Removal Guidance, RS and Triangle Land Conservancy (TLC) have signed a letter of mutual intent agreeing to conditions which will allow the site to be actively managed for public access by the Conservancy. The conditions of the agreement are as follows:

- The property be fully restored and in the monitoring phase before closing.
- Cash payment of \$140,000 at closing for the perpetual stewardship of the property.
- Payment to TLC to contract for an independent Phase 1 environmental audit of the property and associated river location to TLC’s scope and satisfaction. Given its findings, more extensive examinations may be necessary.
- TLC’s involvement in Site planning to ensure that the design fits with other TLC properties managed for recreation. TLC reserves sole discretion to accept conveyance of the property after approval of site design.
- Site design meets, at a minimum, the following considerations:
 - Elimination of the dam and powerhouse.
 - Access to and from the site designed and constructed with long-term maintenance and safety as chief design considerations.
 - Adequate and safe parking.
 - Site design accommodates regular flood events and long-term maintenance.
 - Safe canoe portage and access to the river.
- A reasonable number of replacement site amenities, including reproductions of signage and other potential targets for vandalism, accompany transfer of the property.

When these conditions are fulfilled, TLC will receive the property fee-simple and provide permanent deeded public access to the Site for perpetuity. The Site is an appropriate compliment to other TLC managed properties in the area and in keeping with the Conservancy’s long-term commitment to recreation and public appreciation of the Deep River.

Complimentary properties managed by TLC on the river include, immediately upstream of the dam, the Knight Forest and Coffey properties (35 and 257 acres respectively), and downstream, the LaGrange Riparian Preserve (308 acres), McIver Landing (5 acres and the likely “pull-out” point for boats entering the river from Carabonton), Endor Iron Furnace (426 acres), Chalett Tract (37 acres), White Pines Preserve (275 acres), 2nd Island (8 acres) and Justice Tract (760 acres).

RS has retained a landscape architect who is developing a basic park concept in coordination with the TLC. The proposed park boundary protects approximately 1.6 acres of river floodplain and contains approximately 370 linear feet of public-access frontage on the Deep River. The intention is that the Site be a passive recreation area consisting of vehicle parking, picnicking

sites, an improved path to river edge where car-top kayaks, canoes, and small boats can be hand-launched, and fishing access. The TLC desires that all park amenities be passive and as "zero-maintenance" insofar as practical. **Figure 9 (Appendix A)**, *Park Concept Plan*, depicts a preliminary footprint of the park and the facilities that RS would provide before turning the land over to the TLC. The scheme is tentative based on how much fill is available to raise and level the grade for entrance driveways and the parking area.

Additionally, RS will place two interpretive signs at the park to memorialize the Carbonton Dam, and describe the cultural and natural history of the area. RS has received interest from N.C. Department of Cultural Resources to place identical signs at the nearby House in the Horseshoe State Historic Site which is on the impoundment Historic construction photographs, schematics of the dam, and modern pictures of the dam removal will likely be incorporated into the interpretive message.

6.4 Dam Ownership

The Carbonton Dam is currently owned by Michael R. Allen and Carbonton Hydroelectric, LLC. RS has an executed contract to purchase the 5.5 acres on which the dam is sited and the facility itself. . Prior to the exercise of the contract, RS has acquired an easement and produced deed of assignment (**Appendix F**), to the North Carolina Wildlife Habitat Foundation (NCWHF). The deed easement prohibits any development of the property in perpetuity that is inconsistent with the ecological restoration and conservation of the Site. Once Mr. Allen has successfully surrendered his FERC license, RS will complete the purchase of the Site. After the completion of the dam removal and preparation of the Site for the TLC park, the deed will be transferred to TLC with an endowment as described previously in this sub-section. Further coordination with TLC and the NCWHF will determine whether the deed easement will continue to be held by NCWHF or be transferred to TLC or another party. In any case, the easement prevents future reconstruction of a dam, and contains additional provisions that conform to standards designated by the EEP and the Dam Removal Guidelines. Construction of a canoe access point on the footprint of the facility will be provided by TLC to help fulfill the commitment to provide public recreational access.

6.5 Agency Review

Due to the innovative approach to stream restoration that defines this project, RS encouraged regulatory agency personnel to visit the Site impoundment prior to original submission of the project to NCDOT in 2003. Two separate boat trips were undertaken to provide representatives of NCDWQ, USACE, and USFWS an opportunity to see the dam and review the entire Site impoundment. Representatives John Dorney, David Penrose, and Steven Mitchell of NCDWQ attended the March 26, 2003 visit, while John Thomas, USACE, and Mike Wicker, USFWS, attended the April 29, 2003 visit. All agency personnel expressed openness to the innovative approach utilized for this project, and Mr. John Dorney (NCDWQ) and Mr. Mike Wicker (USFWS) have provided a written evaluation of the possibilities that this project provides (available on request). At this time, no red-flag issues that would prevent further development of this project have been raised as concerns by the resource agencies.



USACE and USFWS Site Impoundment Review



NCDWQ Site Impoundment Review

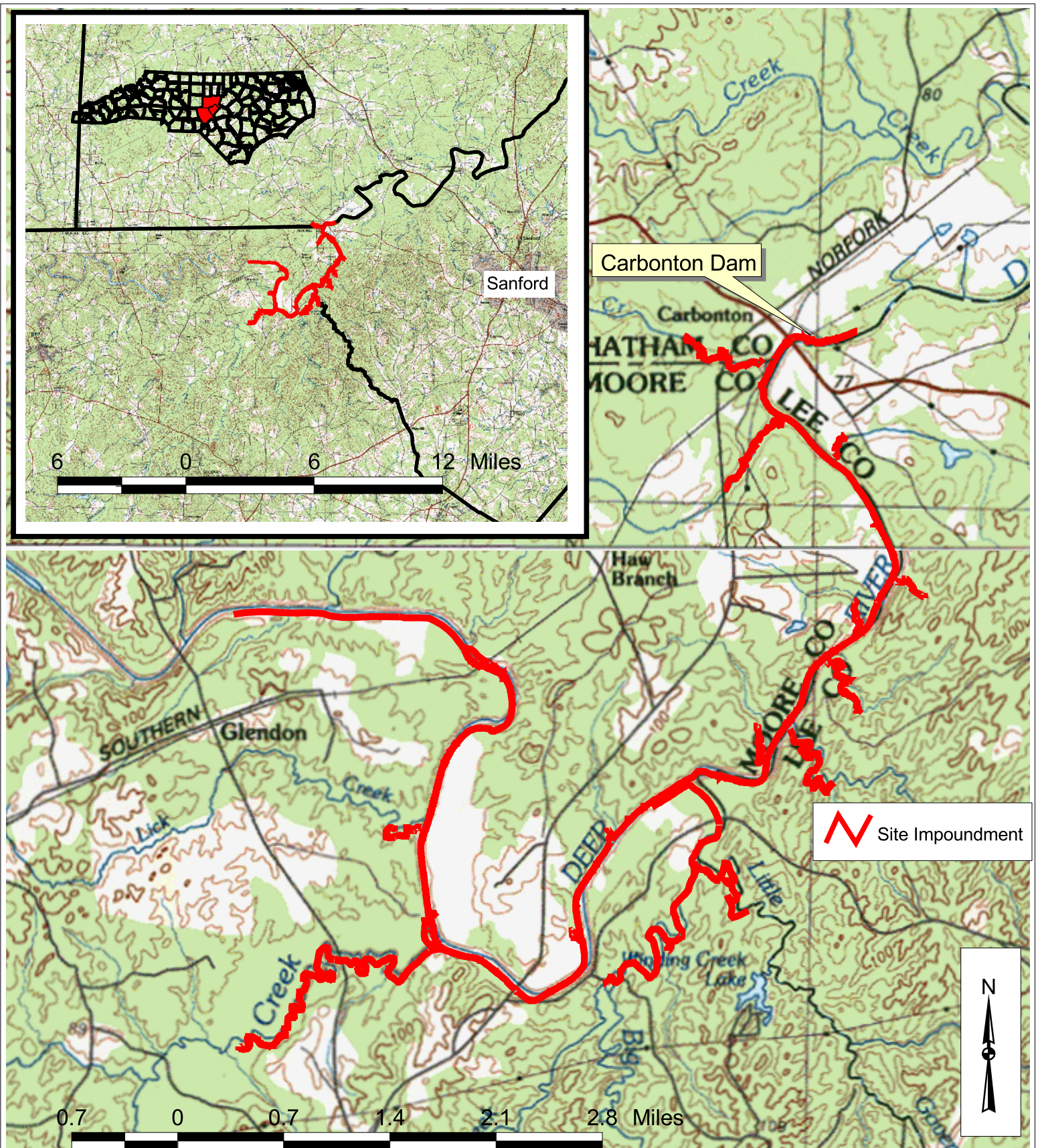
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APPENDIX A
FIGURES



Site Location

Deep River- Carbonton Dam
Restoration Site

Lee, Chatham, and Moore
Counties, North Carolina

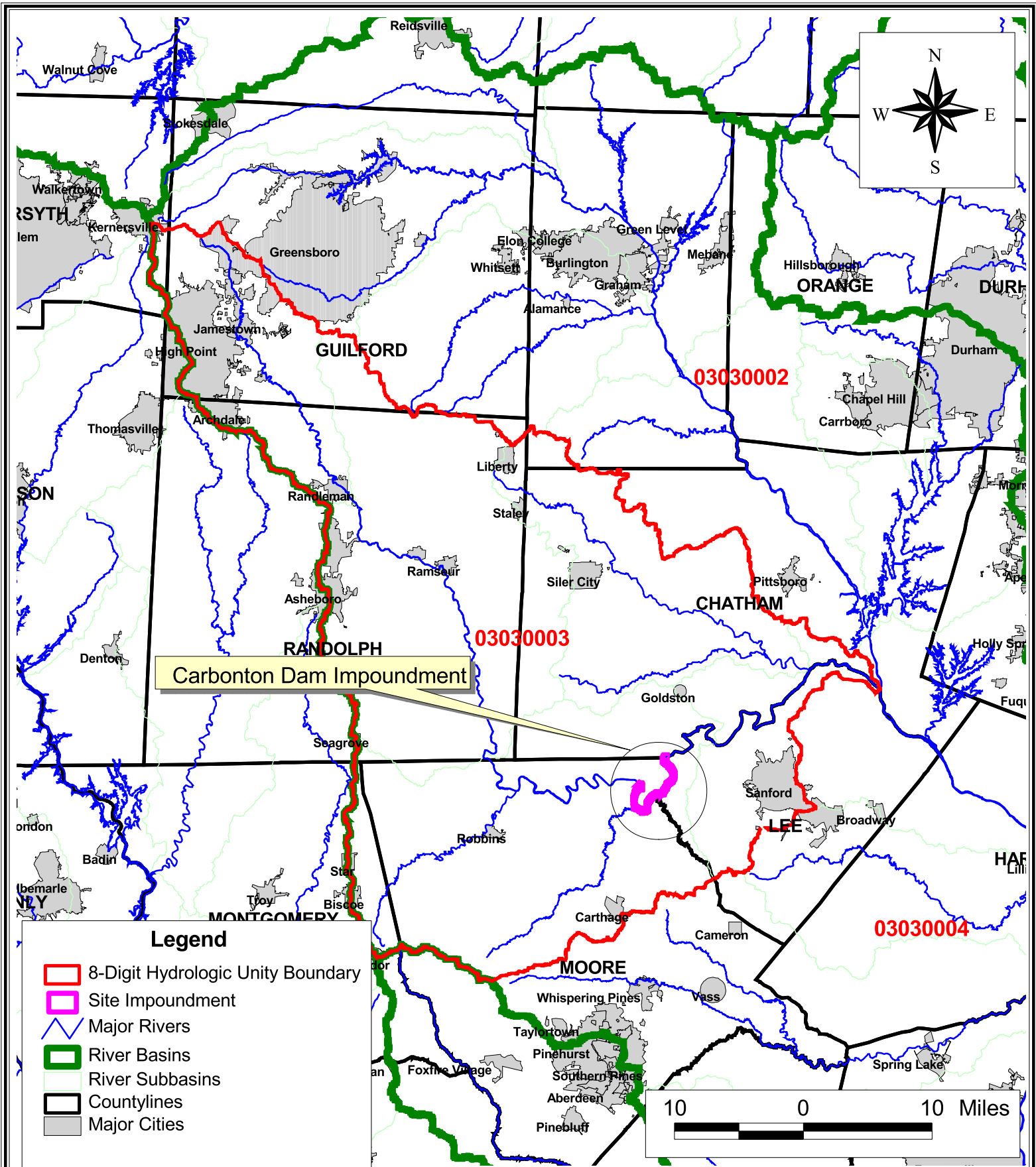
FIGURE

1

Drawn By: MTC	Date: July 2005
Chkd By: APS	Project No: 05-235.03
SCALE: AS SHOWN	



EcoScience



Legend

- 8-Digit Hydrologic Unit Boundary
- Site Impoundment
- ~ Major Rivers
- River Basins
- River Subbasins
- County Lines
- Major Cities

Hydrologic Units

Deep River-Carbonton Dam Restoration Site

Chatham, Lee, and Moore Counties, North Carolina

Drawn By: MTC

Chkd By: GRM

Date: July 2005

Project: 05-235

FIGURE

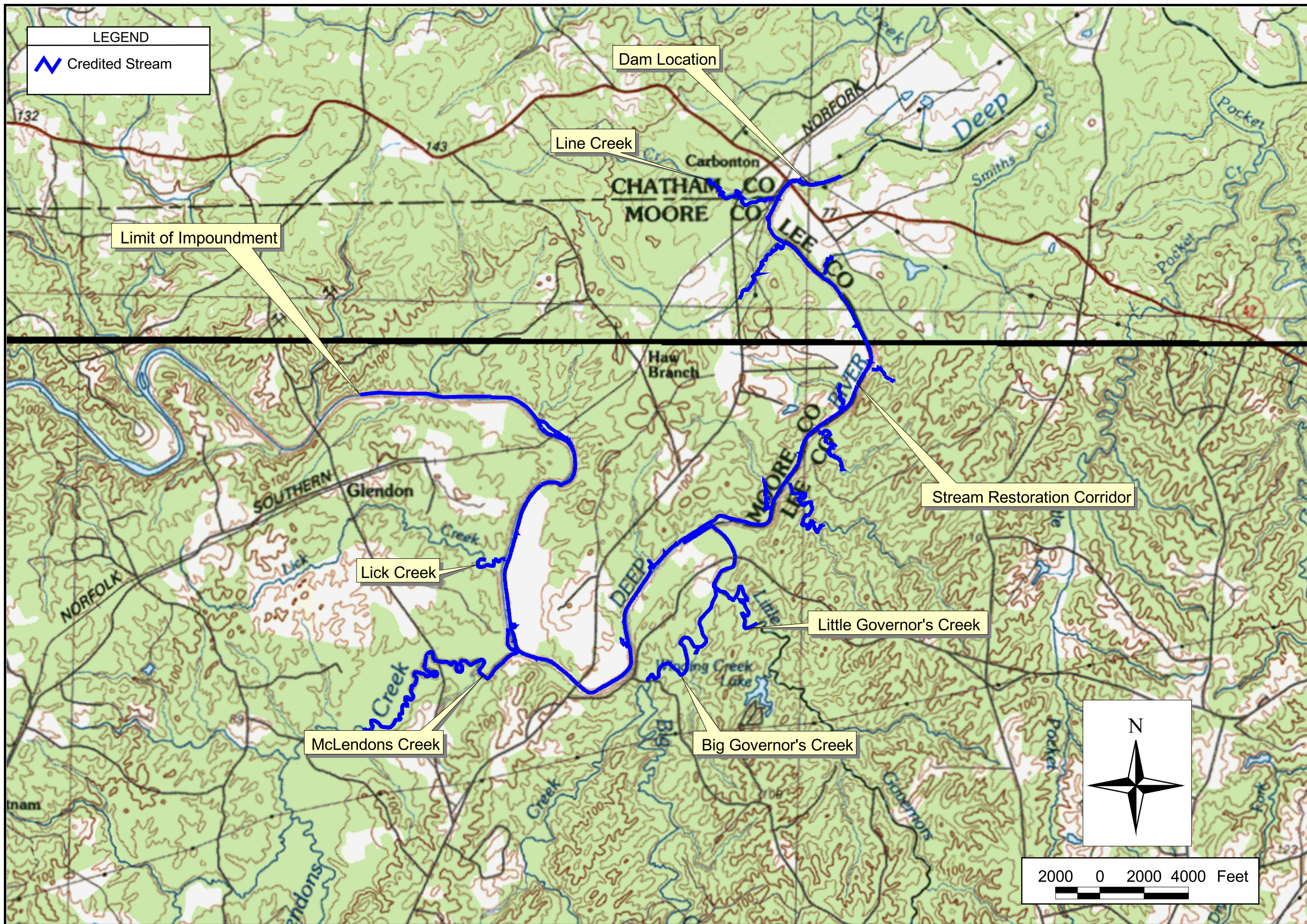
2



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Raleigh, North Carolina

EcoScience



LEGEND

 Credited Stream



EcoScience Corporation
Raleigh, North Carolina



Natural Resources
Restoration & Conservation



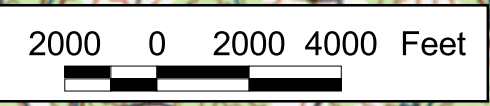
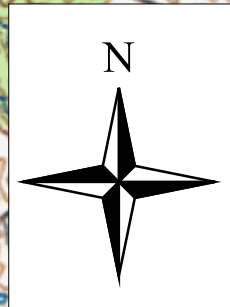
PROJECT:
Deep River-Carbonton Dam Restoration Site
Chatham, Lee, and Moore Counties, North Carolina

TITLE:
Stream Restoration Corridor

Dwn By: JDG	Ckd By: MTC
Date: JUL 2005	Scale: AS SHOWN

ESC Project No.:
05-235.03

FIGURE
3





EcoScience Corporation
Raleigh, North Carolina

PROJECT:

**Deep River-
Carbonton
Dam Restoration
Site**

Aerial View of Credited Reaches

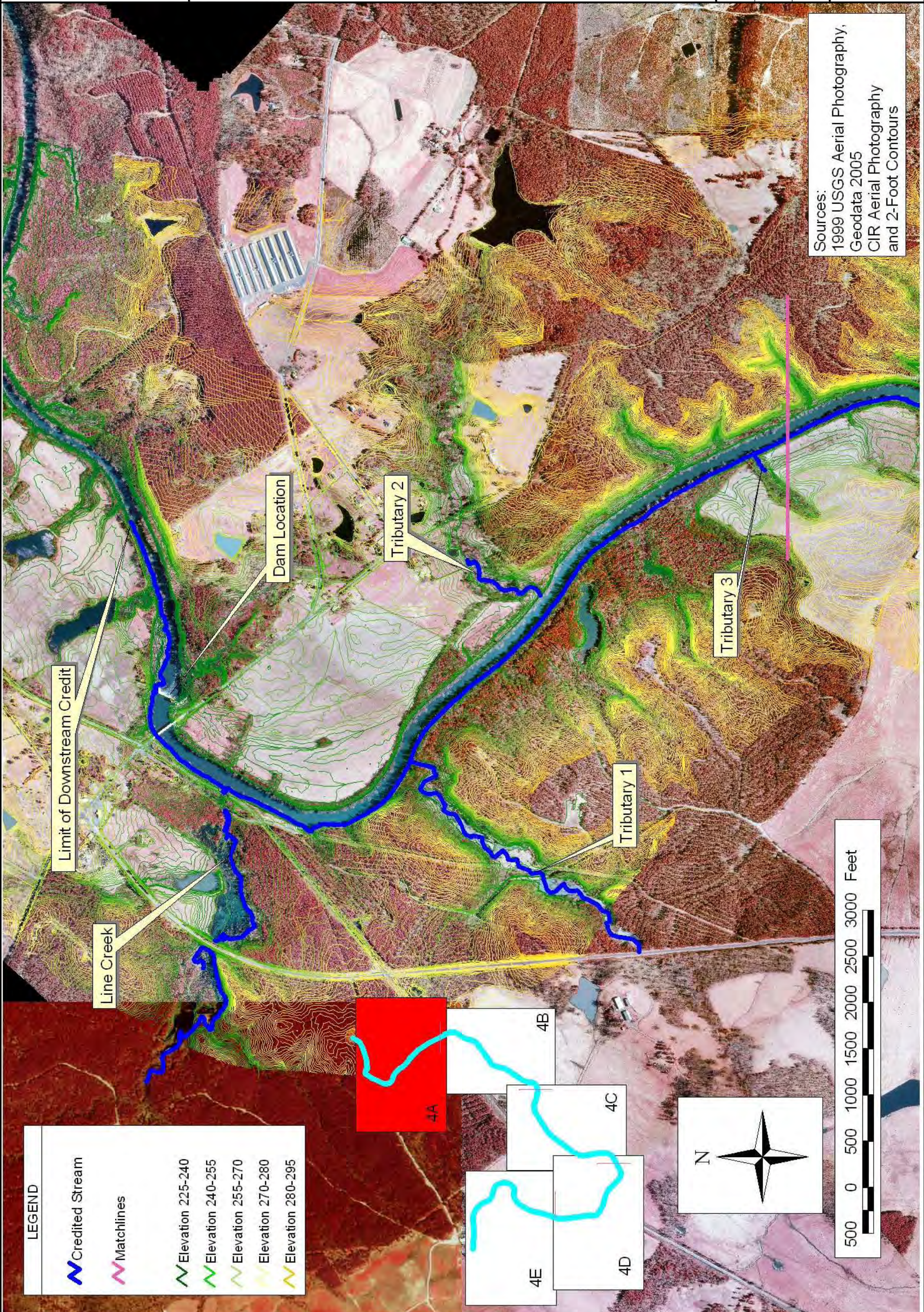
Chatham, Lee
and Moore Counties,
North Carolina

Dwn By:	JDG	Ckd By:	MTC
Date:	JUL 2005	Scale:	AS SHOWN
ESC Project No.:		05-235.03	

FIGURE

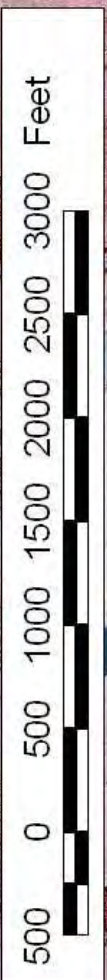
4A

Sources:
1999 USGS Aerial Photography,
Geodata 2005
CIR Aerial Photography
and 2-Foot Contours




LEGEND


- Credited Stream
- Matchlines
- Elevation 225-240
- Elevation 240-255
- Elevation 255-270
- Elevation 270-280
- Elevation 280-295





LEGEND


 Credited Stream


 Matchlines

 Elevation 225-240

 Elevation 240-255

 Elevation 255-270

 Elevation 270-280

 Elevation 280-295

Tributary 4

Tributary 5

Tributary 6

Tributary 8

4A

4E

4B

4D

4C

Tributary 7

Sources:
1999 USGS Aerial Photography,
Geodata 2005
CIR Aerial Photography
and 2-Foot Contours



EcoScience Corporation
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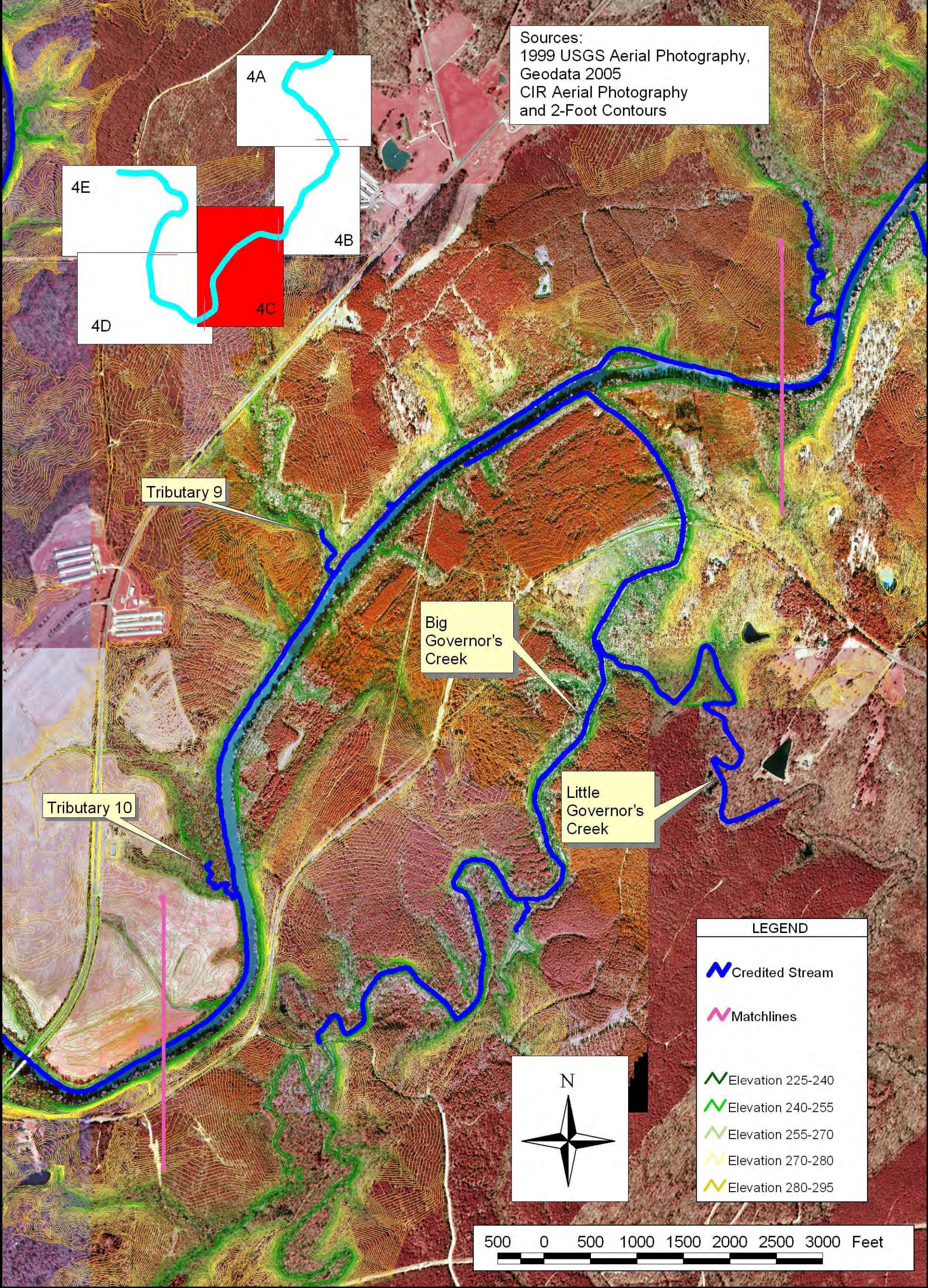
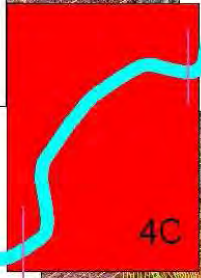
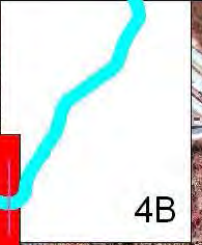
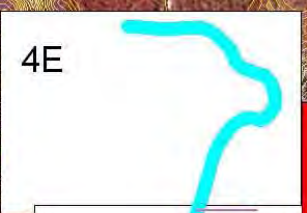
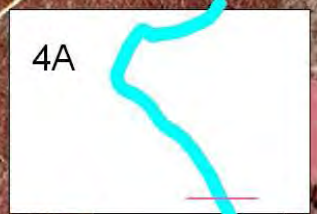
Aerial View of Credited Reaches

Deep River- Carbonton Dam Restoration Site
Chatham, Lee and Moore Counties, North Carolina

Dwn By:	Ckd By:	FIGURE
JDG	MTC	
Date:	JUL 2005	
Scale:	AS SHOWN	
ESC Project No.:	05-235.03	

4B

Sources:
 1999 USGS Aerial Photography,
 Geodata 2005
 CIR Aerial Photography
 and 2-Foot Contours



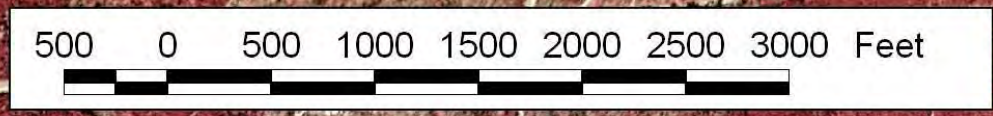
Tributary 9

Big Governor's Creek

Little Governor's Creek

Tributary 10

LEGEND	
	Credited Stream
	Matchlines
	Elevation 225-240
	Elevation 240-255
	Elevation 255-270
	Elevation 270-280
	Elevation 280-295



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 Raleigh, North Carolina

Aerial View of Credited Reaches

Deep River- Carbonton Dam Restoration Site
 Chatham, Lee and Moore Counties, North Carolina

Dwn By:	Ckd By:
JDG	MTC
Date:	JUL 2005
Scale:	AS SHOWN
ESC Project No.:	05-235.03

FIGURE

4C

LEGEND

-  Credited Stream
-  Matchlines
-  Elevation 225-240
-  Elevation 240-255
-  Elevation 255-270
-  Elevation 270-280
-  Elevation 280-295

Sources:
 1999 USGS Aerial Photography,
 Geodata 2005
 CIR Aerial Photography
 and 2-Foot Contours

Lick Creek

MCLendon's Creek

Tributary 11

Tributary 10

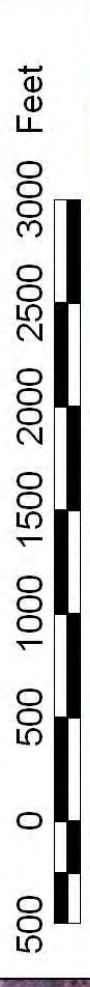
4A

4E

4C

4B

4D



PROJECT:

**Deep River-
 Carabnton
 Dam Restoration
 Site**

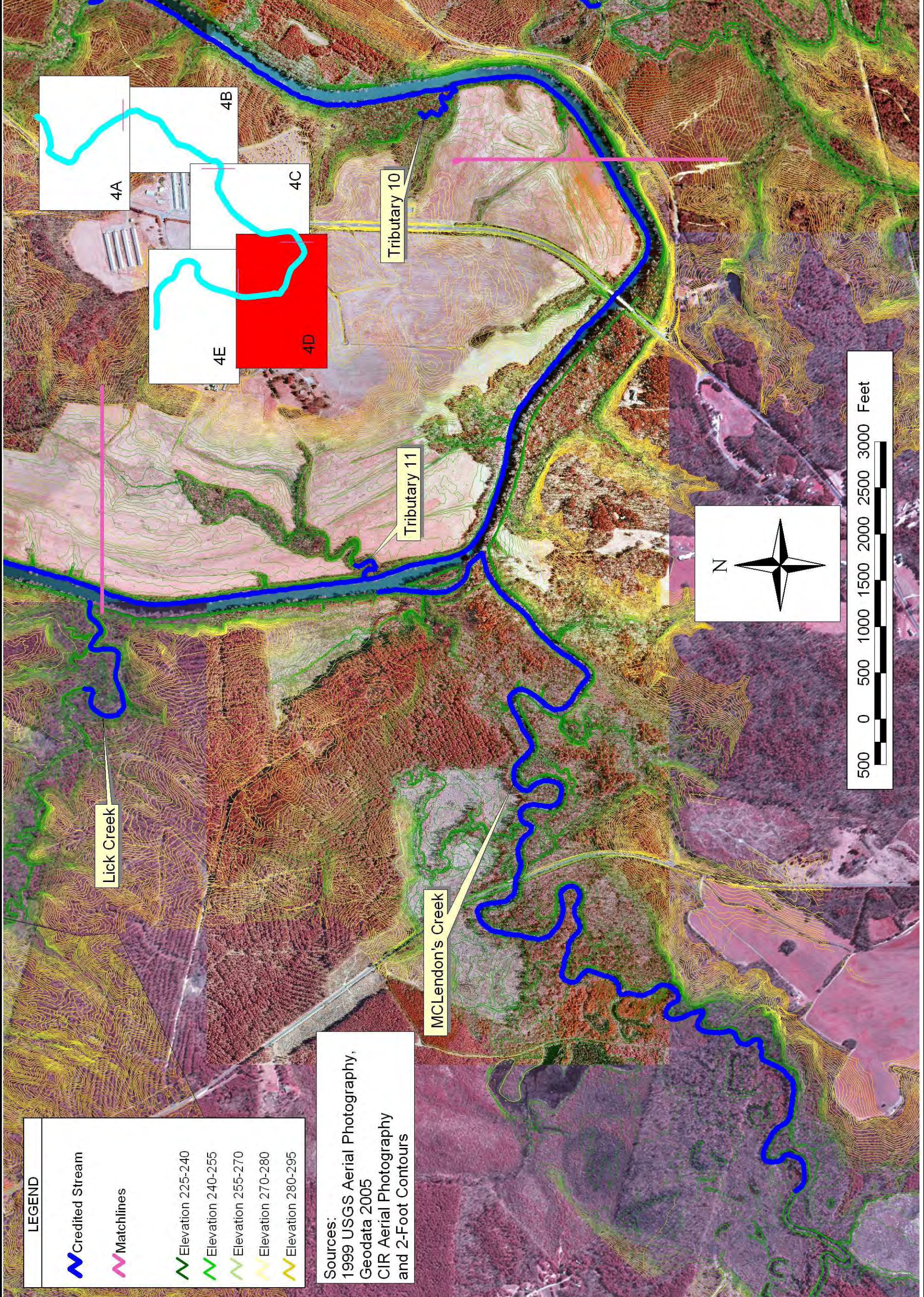
**Aerial View
 of Credited
 Reaches**

Chatham, Lee
 and Moore Counties,
 North Carolina

Drawn By:	JDG	Checked By:	MTC
Date:	JUL 2005	Scale:	AS SHOWN
ESC Project No.:	05-235.03		

FIGURE

4D





EcoScience Corporation
Raleigh, North Carolina

PROJECT:

Deep River-Carabonton Dam Restoration Site

Aerial View of Credited Reaches

Chatham, Lee and Moore Counties, North Carolina

Dwn By:	JDG	Ckd By:	MTC
Date:	JUL 2005	Scale:	AS SHOWN
ESC Project No.:		05-235.03	

FIGURE

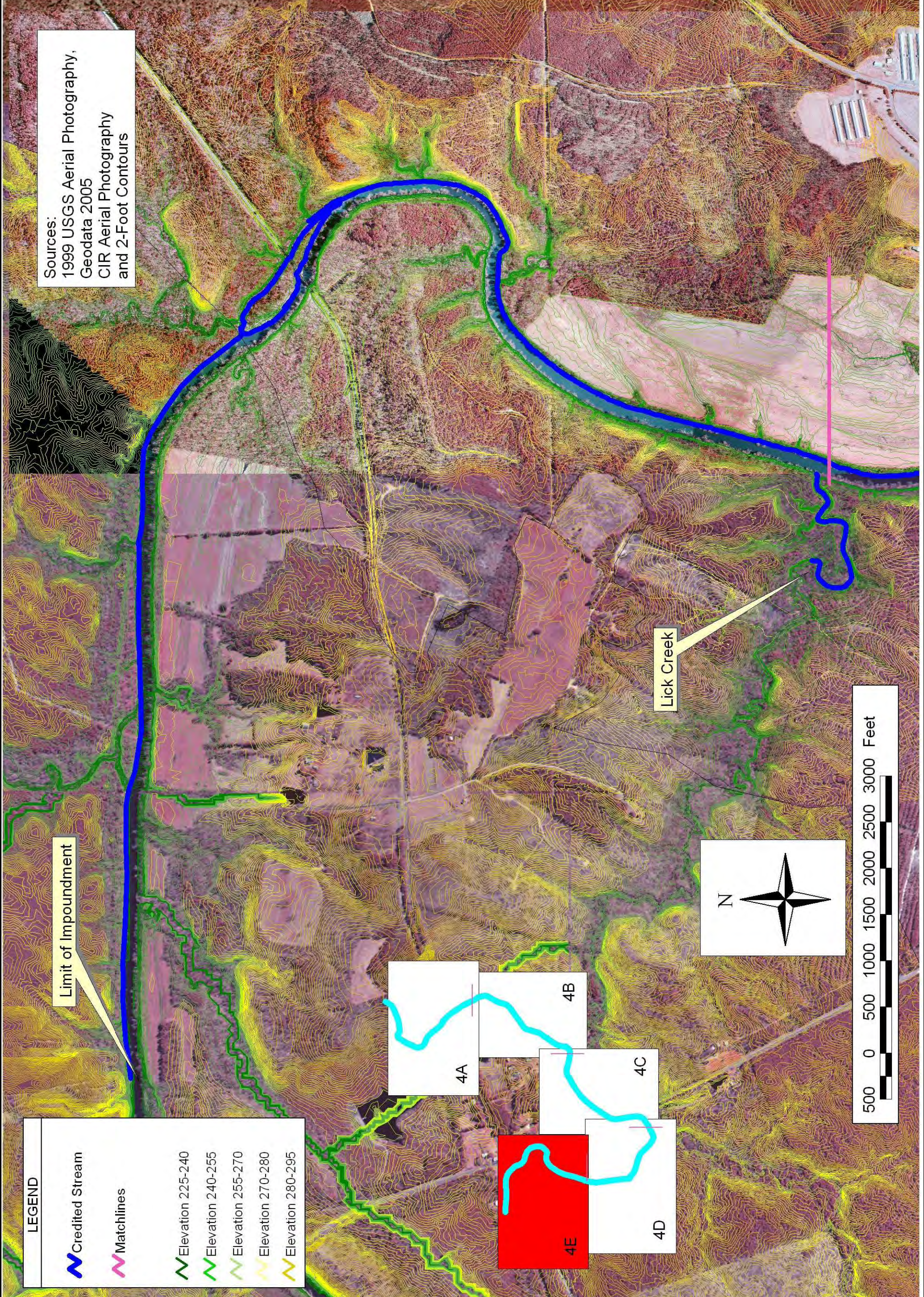
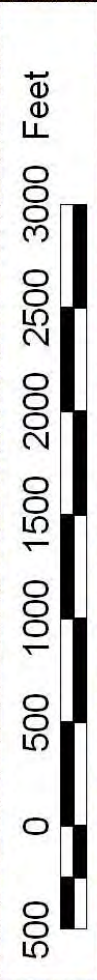
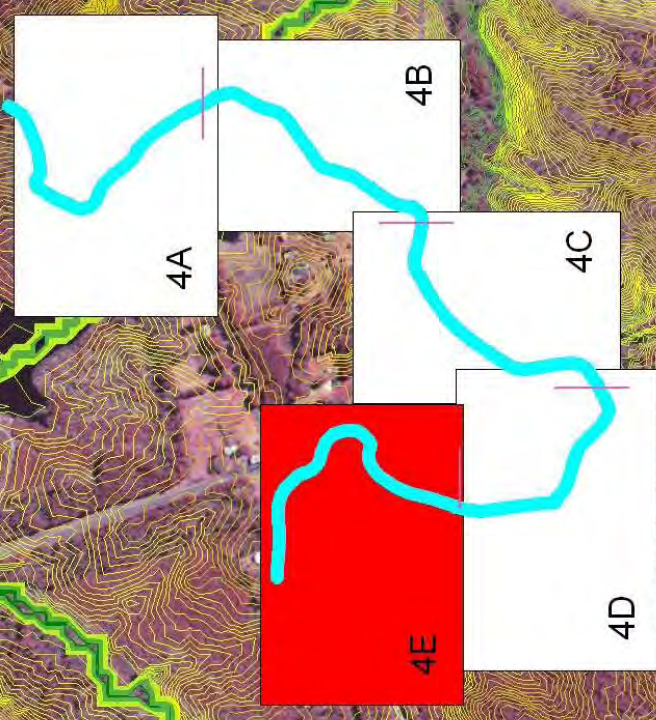
4E

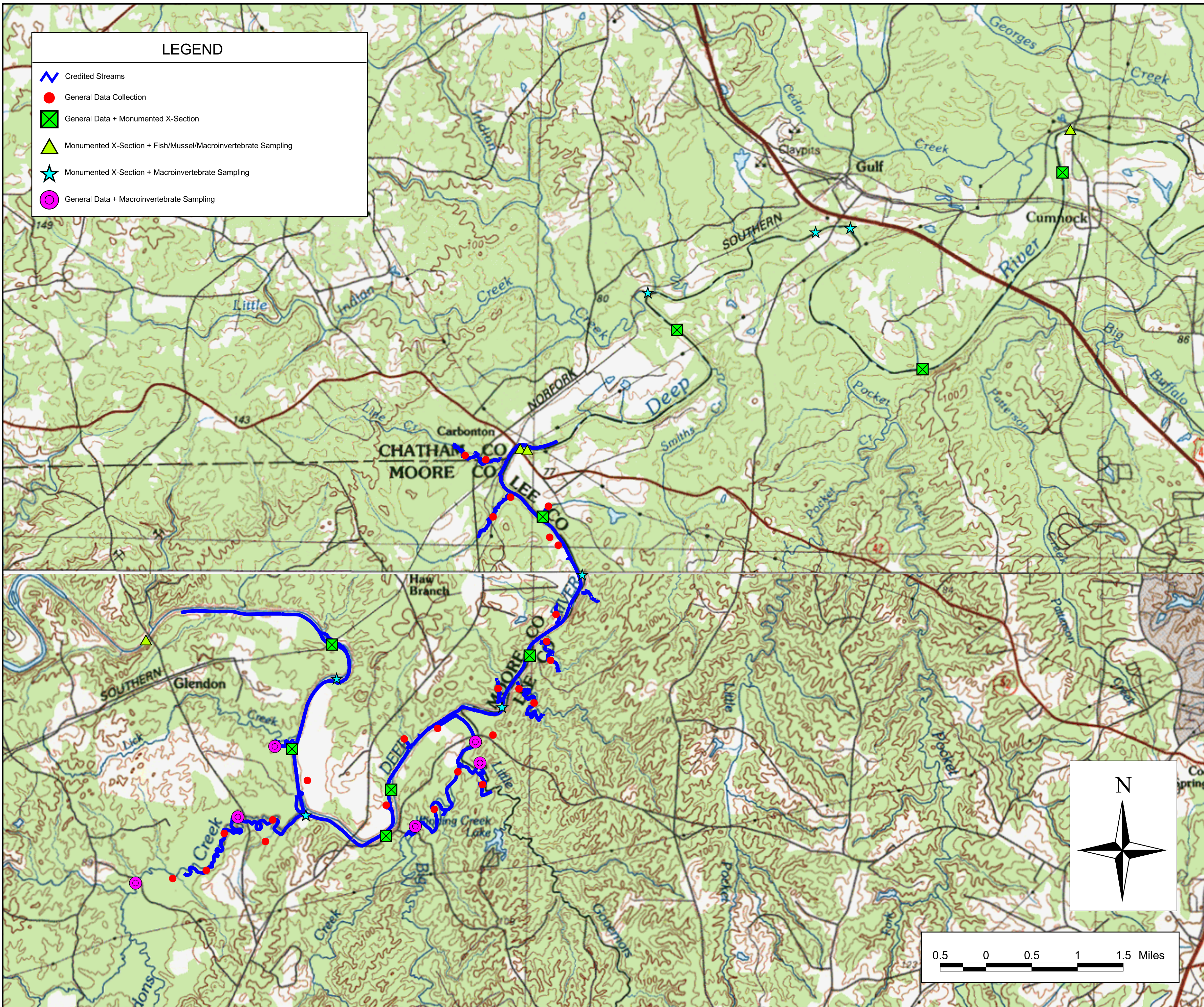
Sources:
1999 USGS Aerial Photography, Geodata 2005
CIR Aerial Photography and 2-Foot Contours

Limit of Impoundment







Lick Creek

LEGEND	
	Credited Stream
	Matchlines
	Elevation 225-240
	Elevation 240-255
	Elevation 255-270
	Elevation 270-280
	Elevation 280-295





LEGEND

-  Credited Streams
-  General Data Collection
-  General Data + Monumented X-Section
-  Monumented X-Section + Fish/Mussel/Macroinvertebrate Sampling
-  Monumented X-Section + Macroinvertebrate Sampling
-  General Data + Macroinvertebrate Sampling



EcoScience Corporation
Raleigh, North Carolina

CLIENT:



Natural Resources
Restoration & Conservation



PROJECT:

**Deep River-
Carbonton
Dam
Restoration
Site**

Chatham, Lee
and Moore Counties,
North Carolina

TITLE:

**Monitoring
Station
Locations**

Dwn By:

Ckd By:

JDG

MTC

Date:

Scale:

JUL 2005

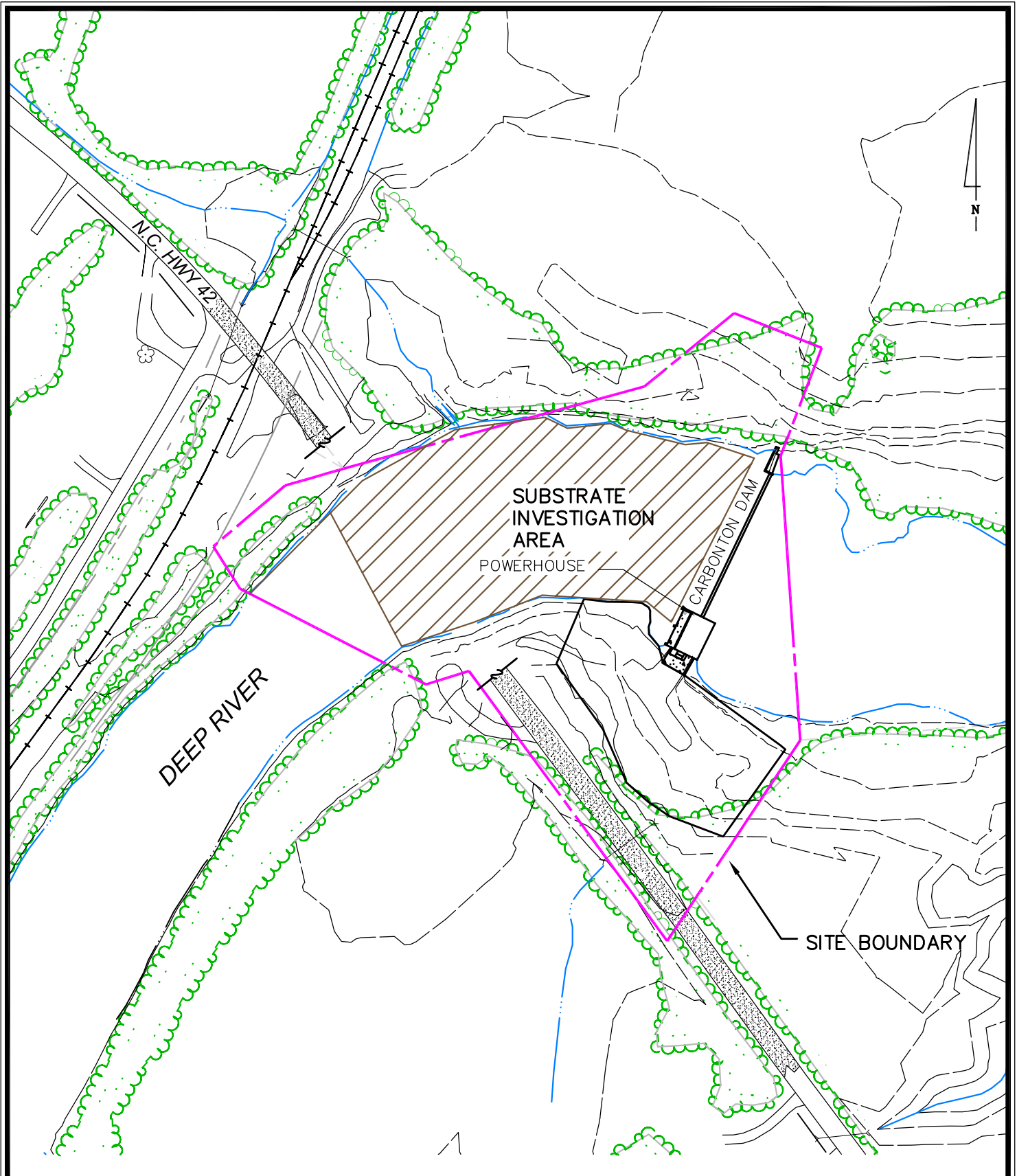
AS SHOWN

ESC Project No.:

05-235.03

FIGURE

5

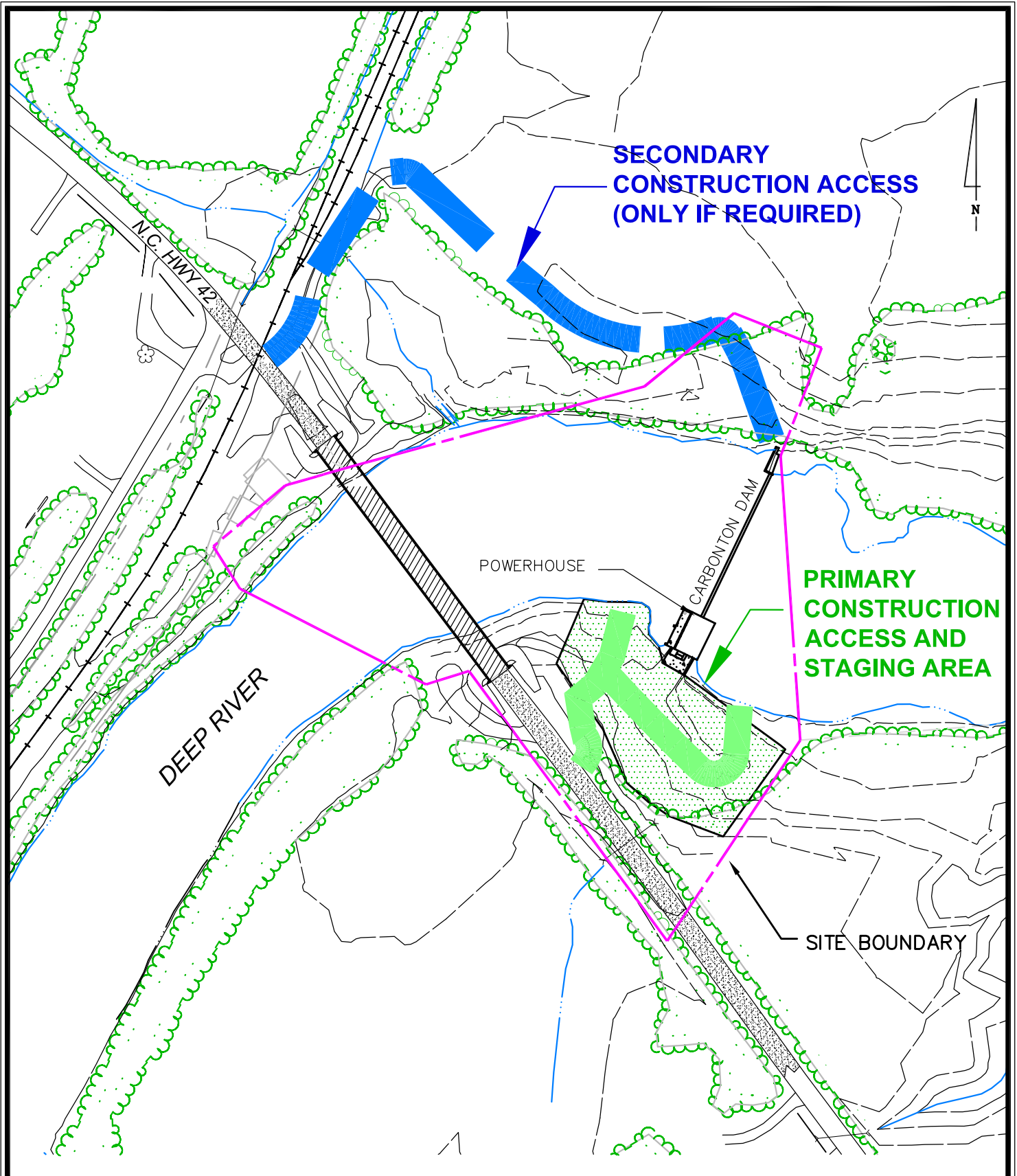


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SUBSTRATE INVESTIGATION
 DEEP RIVER
 CARBON DAM RESTORATION SITE
 CARBONTON, NORTH CAROLINA

DATE: 8/01/05
 SCALE: N.T.S.

FIGURE:
6



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CONSTRUCTION ACCESS

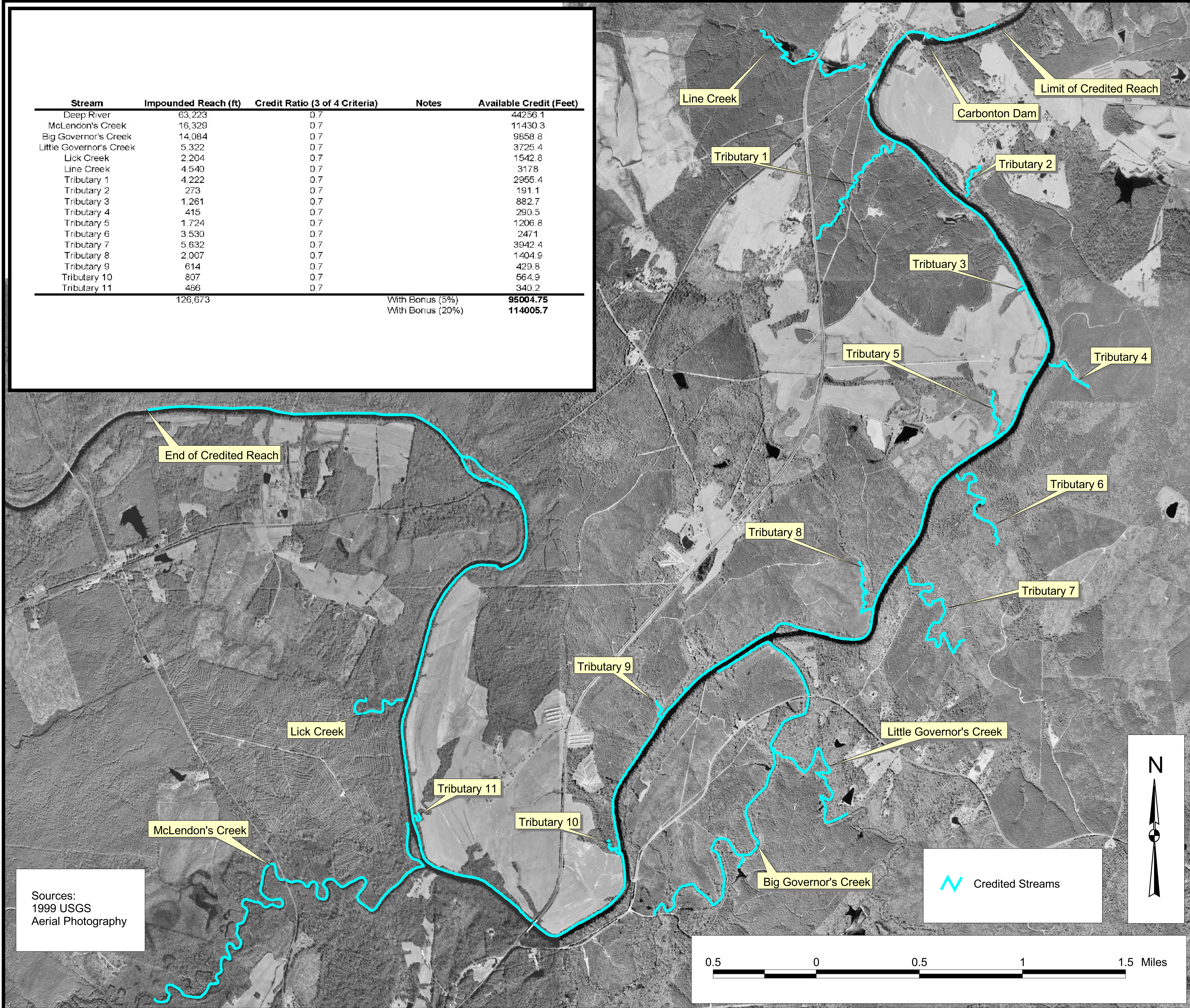
DEEP RIVER
CARBON DAM RESTORATION SITE
CARBONTON, NORTH CAROLINA

DATE: 8/1/05

SCALE: N.T.S.

FIGURE:
7

Stream	Impounded Reach (ft)	Credit Ratio (3 of 4 Criteria)	Notes	Available Credit (Feet)
Deep River	63,223	0.7		44256.1
McLendon's Creek	16,329	0.7		11430.3
Big Governor's Creek	14,084	0.7		9858.8
Little Governor's Creek	5,322	0.7		3725.4
Lick Creek	2,204	0.7		1542.8
Line Creek	4,540	0.7		3178
Tributary 1	4,222	0.7		2955.4
Tributary 2	273	0.7		191.1
Tributary 3	1,261	0.7		882.7
Tributary 4	415	0.7		290.5
Tributary 5	1,724	0.7		1206.8
Tributary 6	3,530	0.7		2471
Tributary 7	5,632	0.7		3942.4
Tributary 8	2,007	0.7		1404.9
Tributary 9	614	0.7		429.8
Tributary 10	807	0.7		564.9
Tributary 11	486	0.7		340.2
	126,673		With Bonus (5%)	95004.75
			With Bonus (20%)	114005.7



Sources:
1999 USGS
Aerial Photography



Raleigh, North Carolina

CLIENT:



Natural Resources
Restoration & Conservation



PROJECT:

Deep River-Carbonton Dam Restoration Site

Chatham, Lee and Moore Counties, North Carolina

TITLE:

Restoration Credit Determination

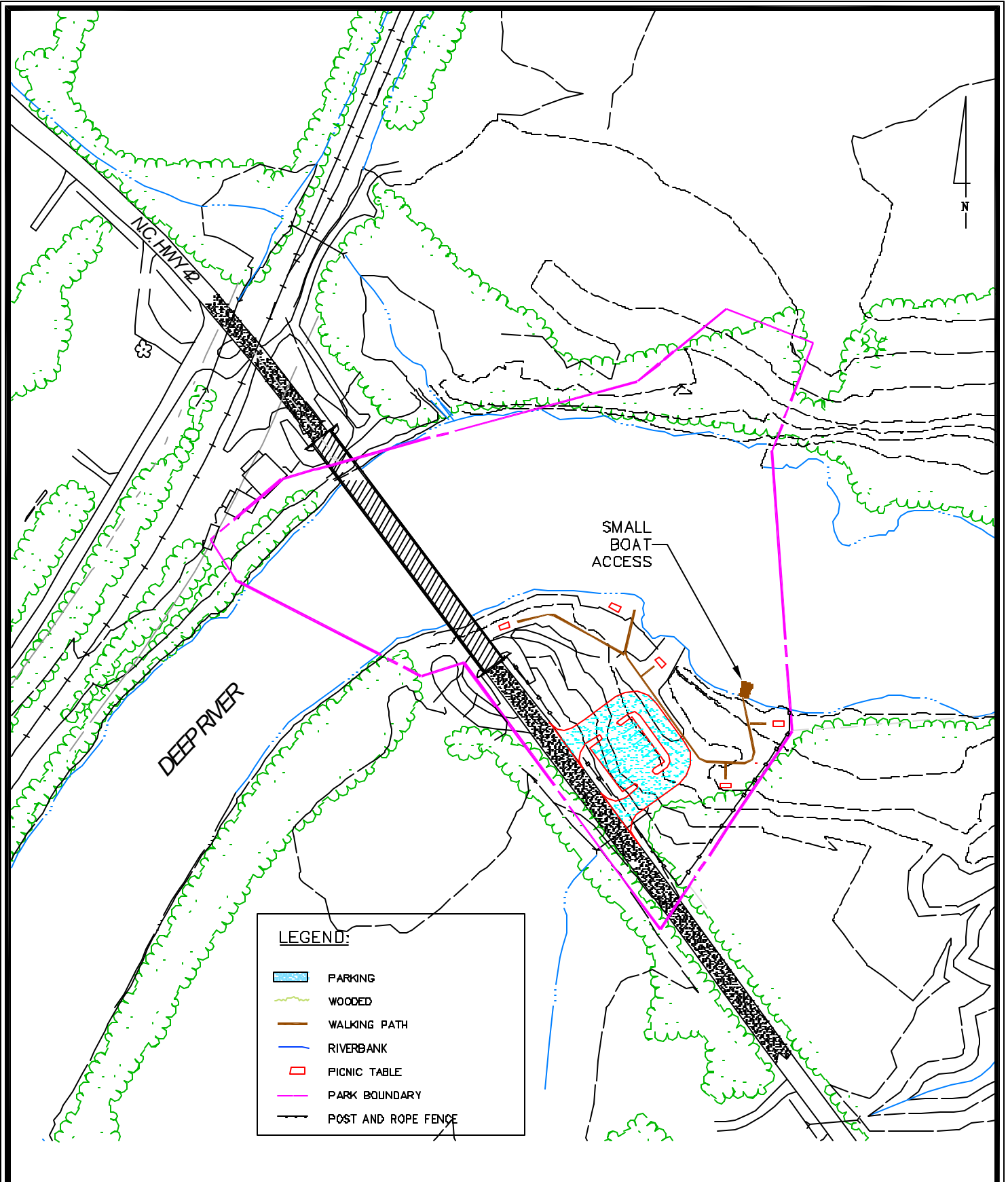
Dwn By: JDG Ckd By: MTC

Date: JUL 2005 Scale: AS SHOWN








ESC Project No.: 05-235.03

FIGURE

8



LEGEND:

-  PARKING
-  WOODED
-  WALKING PATH
-  RIVERBANK
-  PICNIC TABLE
-  PARK BOUNDARY
-  POST AND ROPE FENCE



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PARK CONCEPT PLAN

DEEP RIVER
 CARBON DAM RESTORATION SITE
 CARBONTON, NORTH CAROLINA

DATE: 8/1/05
 SCALE: N.T.S.

FIGURE:
9

APPENDIX B
TABLES

Table 1. Preliminary Dam Prioritization through Rankings of Environmental Advantages of Dam Removal. These ratings have been performed by agency representatives involved in the Dam Removal Task Force of North Carolina.

Dam	Threatened & Endangered Species Value				Water Quality Value			Anadromous Fish Value					
	NCWRC	NHP	USFWS	Mean	DWQ-Pen	EPA	Mean	NCMFS	NCWRC	NMFS	USFWS	Mean	Mean of Means
Lowell	4.0	4.0	4.0	4.0	4.0	3.5	3.8	3.0	5.0	3.0	3.0	3.5	3.75
Lock & Dam #2	3.0	3.0	4.0	3.3	1.0	4.0	2.5	4.0	4.0	5.0	5.0	4.5	3.44
Lock & Dam #3	3.0	3.0	3.0	3.0	1.0	4.0	2.5	4.0	3.0	5.0	5.0	4.3	3.25
Carbonton Dam	5.0	5.0	5.0	5.0	4.0	4.0	4.0	0.0	0.0	1.0	1.0	0.5	3.17
Atkinson's Millpond	4.0	4.0	4.0	4.0	3.0	4.0	3.5	2.0	4.0	1.0	1.0	2.0	3.17
Fishing Creek Millpond	4.0	4.0	5.0	4.3	3.0	3.5	3.3	3.0	0.0	2.0	2.0	1.8	3.11
Buckhorn	3.0	3.0	4.0	3.3	2.0	3.5	2.8	2.0	2.0	4.0	4.0	3.0	3.03
Rocky Mount Millpond	3.0	3.0	1.0	2.3	4.0	4.5	4.3	2.0	1.0	2.0	2.0	1.8	2.78
Milburnie	1.0	1.0	2.0	1.3	0.0	4.6	2.3	2.0	5.0	5.0	5.0	4.3	2.63
Wiggins Millpond	1.0	1.0	1.0	1.0	3.0	4.5	3.8	2.0	3.0	2.0	2.0	2.3	2.33
Hoggards Mill	0.0	0.0	0.0	0.0	3.0	3.5	3.3	4.0	5.0	2.0	2.0	3.3	2.17

DRTF agencies include U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), N.C. Division of Water Quality (NCDWQ), N.C. Wildlife Resources Commission (NCWRC), N.C. Division of Marine Fisheries (NCDMF), N.C. Division of Coastal Management (NCDCM), and the N.C. Natural Heritage Program (NCNHP)

Source: Meeting minutes from February 21, 2002 meeting; Taken from memo written by David Schiller, NCDOT

Table 4. Pre-removal monitoring activities that contribute to success criteria for the Deep River-Carbonton Dam Restoration Site in Chatham, Lee, and Moore Counties, North Carolina. These reference monitoring studies will all be complete by dewatering. It is proposed that post-removal sampling occur on an annual basis, and that sampling occur for the same parameters at the same stations detailed in this report. Thus, pre- and post-removal data will be comparable to identify and evaluate the success of the project for restoration of lotic functional attributes.

Monitoring Component	Success Criterion	Date Performed	Tasks Performed	Use for Demonstrating Success
Channel Cross-Section	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • December 2003 through August 2005 • Post Removal 	Channel cross-section performed at 53 stations both within the Site impoundment and within lotic reference reaches	Data will be used as supporting data to evaluate the restoration of riffle habitat that is currently absent in the Site impoundment. Additionally, these data will be used to monitor for any channel readjustments that occur post-removal.
Sediment Grain Size Distribution	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • August 2003 to August 2005 • Post removal 	Pebble count- wadeable stream Bulk material method- deep water	Data will be useful for habitat restoration success for the Cape Fear shiner, as well as a factor in quantitative improvement in the habitat assessment score
Video Transect	<ul style="list-style-type: none"> • Aquatic Community 	<ul style="list-style-type: none"> • June 2005 	GPS correlated video transect	Data will provide a record of river condition to assist with identification and monitoring of riffles, as well as monitor for detrimental channel readjustment
Flow Velocity	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • April 2005 to August 2005 • Post removal 	Flow measurements with Swiffer velocity meter at five intervals across the channel cross-section. If water depth is greater than 4 feet, then two measurements are made at each location along the cross-section	Data will be used to identify an improved flow regime that will help in verifying slow moving riffle areas, which may indicate successful restoration of habitat requirements for Cape Fear shiner, benthic macroinvertebrates, and reference fish community
Fish Community Changes	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • April 2005 to June 2005 	Sampled at 5 stations for pre-removal data. Will be sampled at same 11 stations as mussels and snail post-removal. All pre-removal sampling performed by The Catena Group.	Improvement by one category of catch per unit effort. Discovery of Cape Fear shine within previous Site impoundment, or concurrence from USFWS that appropriate habitat for the shiner has been restored
Benthic Macro-Invertebrate Community Changes	<ul style="list-style-type: none"> • Aquatic Community 	<ul style="list-style-type: none"> • April 2005 and May 2005 • Post removal 	Standard Qualitative collection method with modifications for deep water habitats. Performed at 17 stations	Quantitative improvement in species diversity or feeding guild diversity indices. May be modified based upon opportunities in pre-removal data, once available.
Freshwater Mussel Community Changes	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • April 2005 to June 2005 	Visual and tactile surveys	Recolonization of mussel species adapted to lotic habitat. Discovery of rare mussel species may be used for demonstrating benefit in Endangered Species criterion.
Freshwater Snail Community Changes	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • April 2005 to June 2005 	Visual surveys	Recolonization of mussel species adapted to lotic habitat. Discovery of rare mussel species may be used for demonstrating benefit in Endangered Species criterion.
Habitat Assessment	<ul style="list-style-type: none"> • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • April 2005 to August 2005 	Completion of the 4-page habitat assessment form described in Section 3.2.5	Data will be used to support improvement in aquatic community populations and to characterize discovery of potential habitat for the Cape Fear shiner.
Physical Water Quality	<ul style="list-style-type: none"> • Water Quality • Aquatic Community • Endangered Species 	<ul style="list-style-type: none"> • 1992 through post-removal monitoring 	Performed by DWQ as part of ambient monitoring network; and supplemented by in situ measurements at each station. Post removal data collection will also occur	Lack of impairment in fecal coliform, dissolved oxygen, and Chlorophyll a. Individual station data will not demonstrate thermal stratification, nor exhibit low dissolved oxygen that is below 4 mg/L when lotic stations are above.

APPENDIX C
USFWS SECTION 7 COORDINATION
FEDERALLY PROTECTED SPECIES



United States Department of the Interior

 ORIGINAL

FISH AND WILDLIFE SERVICE
Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

February 9, 2005

David Schiller
Restoration Systems, LLC
1101 Haynes Street, Suite 107
Raleigh, NC 27604

RECEIVED
FEB 15 2015
BY: DAS

Dear Mr. Schiller:

Thank you for your February 8, 2005 letter and attached Feasibility Study for the proposed removal of Carbondon Dam located on the Deep River in Lee, Chatham and Moore counties in central North Carolina. This letter provides the U.S. Fish and Wildlife Service's (Service) response pursuant to section 7 of the Endangered Species Act, as amended (16 U.S.C. 1531 *et seq.*) (Act).

Based on the information provided and other information available, it appears that your project site does not contain any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act. We concur that this project will not affect the red cockaded woodpecker (*Picoides borealis*), Harperella (*Ptilimnium nodosum*) and Michaux's sumac (*Rhus michauxii*) and the project is not likely to adversely affect the bald eagle (*Haliaeetus leucocephalus*) and Cape Fear Shiner (*Notropis mekistocholas*). We believe that the requirements of section 7(a)(2) of the Act have been satisfied. We remind you that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

Thank you for the opportunity to review this project. If you have any questions or comments regarding our response, please contact Mr. Dale W. Suiter of this office at (919) 856-4520, Ext. 18 or Dale_Suiter@fws.gov.

Sincerely,


for Pete Benjamin

Ecological Services Supervisor

APPENDIX D
HISTORIC AND CULTURAL RESOURCES

- SHPO SECTION 106 COORDINATION
 - MEMORANDUM OF AGREEMENT
- NATIONAL REGISTER EVALUATION BY URS CORPORATION



North Carolina Department of Cultural Resources
State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

September 1, 2004

Todd J. Tugwell
Raleigh Regulatory Field Office
US Army Corps of Engineers
6508 Falls of the Neuse Road, Suite 120
Raleigh, NC 27615

Re: Removal of Carbondon Dam and Powerhouse, Deep River Mitigation Bank
USACE Action ID # 200421183, Multi-County, ER 04-2232

Dear Mr. Tugwell:

Thank you for including our staff in the review team for this project. We have reviewed the prospectus and participated in an on-site meeting, which included a tour of the dam, powerhouse and impoundment. Based on this information, we offer the following comments.

Development of the Deep River Mitigation Bank will require the removal of the Carbondon Dam and Powerhouse, which dates to the early 1900s. It is our understanding that Restoration Systems intends to have architectural drawings made of the dam and powerhouse prior to their removal. We recommend that two copies of the drawings be made available to our office and documentary photographs of both the dam and powerhouse be taken and provided to us. Research should be undertaken to determine the age and history of the facilities, as well as their eligibility for inclusion in the National Register of Historic Places.

The resulting materials would be suitable for use in an interpretive exhibit that could be placed on-site for the public benefit. It might also be appropriate to provide copies of the research report, drawings and photographs to the local libraries or historical societies.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

	Location	Mailing Address	Telephone/Fax
ADMINISTRATION	507 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-4763/733-8653
RESTORATION	515 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6543/715-4801
SURVEY & PLANNING	515 N. Blount Street, Raleigh, NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6543/715-4801

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck
Deputy State Historic Preservation Officer

PS:w

cc:

George Howard
Restoration Systems, LLC
1101 Haynes Street, Suite 107
Raleigh, NC 27604



North Carolina Department of Cultural Resources
State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evarra, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

February 1, 2005

David H. Schiller,
Manager Contracts and Regulatory Affairs
Restoration Systems
Pilot Mill
1101 Haynes St., Suite 107
Raleigh, NC 27604

Re: Removal of Carbondon Dam and Powerhouse, Deep River Mitigation Bank,
USACE Action ID # 200421183, Chatham and Lee Counties, ER 04-2232

Dear Mr. Schiller:

Thank you for your letter of December 16, 2004, transmitting the Sandhill (Carbondon) Power Company Dam and Powerhouse National Register of Historic Places Evaluation, prepared by Marvin Brown of URS.

For purposes of compliance with Section 106 of the National Historic Preservation Act, we concur that the Sandhill Power Company Dam and Powerhouse are eligible for listing in the National Register of Historic Places under the following criteria.

Criterion A for Industry and Criterion C for Architecture and Engineering

In addition to the recognition of significance by surveyors, the photo documentation and map of the area, reveal a great deal of integrity. While a number of changes have been made, in terms of *materials*, demolition of the Sandhill Power Company Dam and Powerhouse, will result in an adverse effect on these National Register-eligible resources. Therefore, any planned activities are subject to Section 106 of the National Historic Preservation Act and the regulations of the Advisory Council on Historic Preservation.

We have reviewed the mitigation proposed to address this adverse effect, and find this documentation will address our requirements with a few additional elements. We believe that the necessary recordation measures can be incorporated into a Memorandum of Agreement (MOA) between the United States Army Corps of Engineers (ACOE) and us for the undertaking. A draft MOA will be provided under separate cover for consideration by you and the ACOE.

	Location	Mailing Address	Telephone/Fax
ADMINISTRATION	507 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-4763/733-8653
RESTORATION	513 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6547/715-4801
SURVEY & PLANNING	515 N. Blount Street, Raleigh, NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-4545/715-4801

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning this comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above tracking number.

Sincerely,



Peter Sandbeck

cc: ACOE Raleigh Office



DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS

P.O. BOX 1890
WILMINGTON, NORTH CAROLINA 28402-1890
February 17, 2005

IN REPLY REFER TO

Regulatory Division

Action ID 200421183

Ms. Martha Catlin
Advisory Council on Historic Properties
Office of Federal Agency Programs, Eastern Office
1100 Pennsylvania Avenue NW, Suite 803
Washington, DC 20004

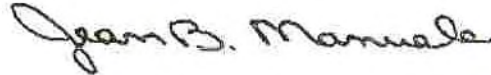
Dear Ms. Catlin:

Mr. George Howard with Restoration Systems, L.L.C., has been coordinating with our office and proposes to apply for a Department of the Army (DA) permit pursuant to Section 404 of the Clean Water Act to discharge fill material in the waters of the Deep River associated with the removal of the Carbonton Dam and Powerhouse (also known as the Sandhills Power Company). The purpose of the removal of the dam and powerhouse is to restore approximately 10 miles of impounded river to a naturally free-flowing system. Specifically, the project is located immediately upstream of N.C. Highway 42 on the Deep River, approximately 10 miles west of Sanford, in Lee, Chatham and Moore Counties.

Having applied the criteria of effect, we have determined that the proposed undertaking will adversely affect the Carbonton Dam, a property eligible for listing on the National Register of Historic Places. While we are presently considering issuance of the DA permit to the applicant for the proposed project, we have begun consultation with the North Carolina State Historic Preservation Office (SHPO) and the applicant to develop a Memorandum of Agreement (MOA) to address the adverse effect. Attached is a draft copy of the MOA for your review and comment. Accordingly, we would like to know whether or not the Advisory Council wishes to participate in the consultation process under Section 106 of the National Historic Preservation Act.

If you have any questions or need additional information, please contact me or Mr. Todd Tugwell Wade, Raleigh Regulatory Field Office, telephone (919) 876-8441, Ext. 24 and 26, respectively.

Sincerely,



Jean B. Manuele
Chief, Raleigh Field Office

Enclosure/as

Copy Furnished (without enclosure):

Mr. George Howard
Restoration Systems, L.L.C.
Pilot Mill
1101 Haynes Street, Suite 107
Raleigh, North Carolina 27604

Ms. Renee Gledhill-Earley
North Carolina Department of
Cultural Resources
State Historic Preservation Office
4617 Mail Service Center
Raleigh, North Carolina 27699-4617

MEMORANDUM OF AGREEMENT
BETWEEN
THE UNITED STATES ARMY CORPS OF ENGINEERS
AND
THE NORTH CAROLINA STATE HISTORIC PRESERVATION OFFICER
FOR
REMOVAL OF THE CARBONTON DAM, AND POWERHOUSE
ON THE DEEP RIVER
CHATHAM AND LEE COUNTIES, NORTH CAROLINA

WHEREAS, the US Army Corps of Engineers (USACE) is considering issuance of a permit to Restoration Systems, LLC for the demolition of the Carbonton Dam and Powerhouse (also known as the Sandhill Power Company); and

WHEREAS, the USACE has determined that the Undertaking will adversely affect the Carbonton Dam and Powerhouse, properties determined eligible for listing in the National Register of Historic Places; and

WHEREAS, the USACE has consulted with the North Carolina State Historic Preservation Officer (SHPO) pursuant to 36 CFR 800, regulations implementing Section 106 of the National Historic Preservation Act (16 U.S.C. 470f); and

WHEREAS, Restoration Systems, LLC was invited to participate in the consultation and concur in this Agreement;

NOW, THEREFORE, the USACE, and the North Carolina SHPO agree that the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the Undertaking on historic properties.

STIPULATIONS

The USACE will include the following conditions in any permit issued for the Undertaking:

I. Photographic Recordation

Prior to the demolition of the Carbonton Dam and Powerhouse, Restoration Systems, LLC shall carry out the Recordation Plan attached to this Memorandum of Agreement as Appendix A. The documentation shall be submitted to the North Carolina SHPO for integration onto the permanent statewide inventory of historic properties.

II. Public Education/ Interpretive Display

Restoration Systems, LLC, in consultation with the North Carolina SHPO, will develop and install an interpretive display at the site of the Carbonton Dam and Powerhouse to provide for the public's education about the historical and architectural significance of the site and the environmental benefits of the removal of the dam and powerhouse.

**NATIONAL REGISTER EVALUATION OF THE
SANDHILL POWER COMPANY
DAM AND POWERHOUSE
ON THE DEEP RIVER NORTHEAST OF NC 42,
CARBONTON, LEE AND CHATHAM COUNTIES,
NORTH CAROLINA**

**USACE Action ID #200421183
ER #04-2232**

Prepared For:

**Restoration Systems, LLC
1101 Haynes Street, Suite 107
Raleigh, NC 27604**

Prepared By:

**URS Corporation – North Carolina
1600 Perimeter Park Drive
Morrisville, NC 27560**

December 2004

**NATIONAL REGISTER EVALUATION OF THE
SANDHILL POWER COMPANY
DAM AND POWERHOUSE
ON THE DEEP RIVER NORTHEAST OF NC 42,
CARBONTON, LEE AND CHATHAM COUNTIES,
NORTH CAROLINA**

**USACE Action ID #200421183
ER #04-2232**

Prepared For:

**Restoration Systems, LLC
1101 Haynes Street, Suite 107
Raleigh, NC 27604**

Prepared By:

**URS Corporation – North Carolina
1600 Perimeter Park Drive
Morrisville, NC 27560**

December 2004

Marvin A. Brown

12-14-04

**Marvin A. Brown, Principal Investigator
URS Corporation-North Carolina**

Date

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I. INTRODUCTION AND SUMMARY OF FINDINGS

Restoration Systems, LLC is currently developing restoration plans for a stretch of the Deep River located in Chatham, Lee, and Moore counties, North Carolina (USACE Action ID #200421183, ER #04-2232) (Figures 1 and 2). The restoration site consists of removing the Carbonton Dam and hydroelectric facility (hereinafter referred to by its historic name, the Sandhill Power Company Dam and Powerhouse), along with the associated impoundment located approximately nine miles west of Sanford within the Cape Fear River Basin (Hydrological Unit 03030003) (Figure 3). The dam at Carbonton has effectively eliminated stream characteristics within a 49,000-foot reach of the river. Adverse environmental effects caused by the impoundment of the river include: inundation and loss of riparian and wetland areas; inundation, fragmentation, and loss of shallow water habitat for the Cape Fear Shiner, a federal endangered species; alteration of water temperatures and seasonal fluctuations in water oxygen levels; interruption of in-stream sediment supply; blocking upstream and inhibiting downstream fish passage; reduced downstream flow; inundation and loss of mussel habitat; and down-cutting and channel erosion below the dam. The restoration plan utilizes dam removal as an effective approach to environmental mitigation and stream restoration in North Carolina (U.S. Army Corps of Engineers et al 2004). The dam at Carbonton is ranked fourth in the state in the combined agency listing of dams identified for beneficial removal (Table 1).

Table 1. Preliminary Rankings of Environmental Advantages of Dam Removal Based on "Mean of Means" (source: DRTF February, 25, 2002, and Restoration Systems, LLC).

Dam	Mean of Means Score
Lowell	3.75
Lock & Dam #2	3.44
Lock & Dam #3	3.25
Carbonton Dam	3.17
Atkinson's Millpond	3.17
Fishing Creek Millpond	3.11
Buckhorn	3.03
Rocky Mount Millpond	2.78
Milburnie	2.63
Wiggins Millpond	2.33
Hoggards Mill	2.17

The Raleigh Regulatory Field Office of the US Army Corps of Engineers (USACE) and Restorations Systems entered into formal consultation with the Office of State Archaeology and the Survey and Planning Branch of the North Carolina State Historic Preservation Office (SHPO) regarding the Sandhill Power Company Dam and Powerhouse in 2004. In a letter of September 1, 2004, from the SHPO to the USACE (included as Appendix A), the SHPO noted that Restoration Systems intends to make architectural drawings of the dam and powerhouse prior removal, and recommended that two copies of the drawings, as well as current documentary photographs of the dam and powerhouse, be provided to the SHPO. The SHPO further stated: "Research should be undertaken to determine the age

and history of the facilities, as well as their eligibility for inclusion in the National Register of Historic Places." This report provides the results of that research.

In November 2004 Senior Architectural Historian Marvin A. Brown of URS Corporation-North Carolina (URS) evaluated the eligibility of the dam and powerhouse for listing in the National Register. He conducted fieldwork at the site and research at the Lee County courthouse and public library in Sanford, the Chatham county courthouse and public library in Pittsboro, and the SHPO and North Carolina State Archives and Library in Raleigh. He also drafted this report. Mr. Brown conducted the assessment in accordance with the basic requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106, codified at 36 CFR Part 800.

As a result of the fieldwork and evaluation, URS recommends that the Sandhill Power Company Dam and Powerhouse, as an individual resource, is eligible for listing in the National Register under Criterion A as a significant, early twentieth-century example of a power-generating facility in North Carolina.



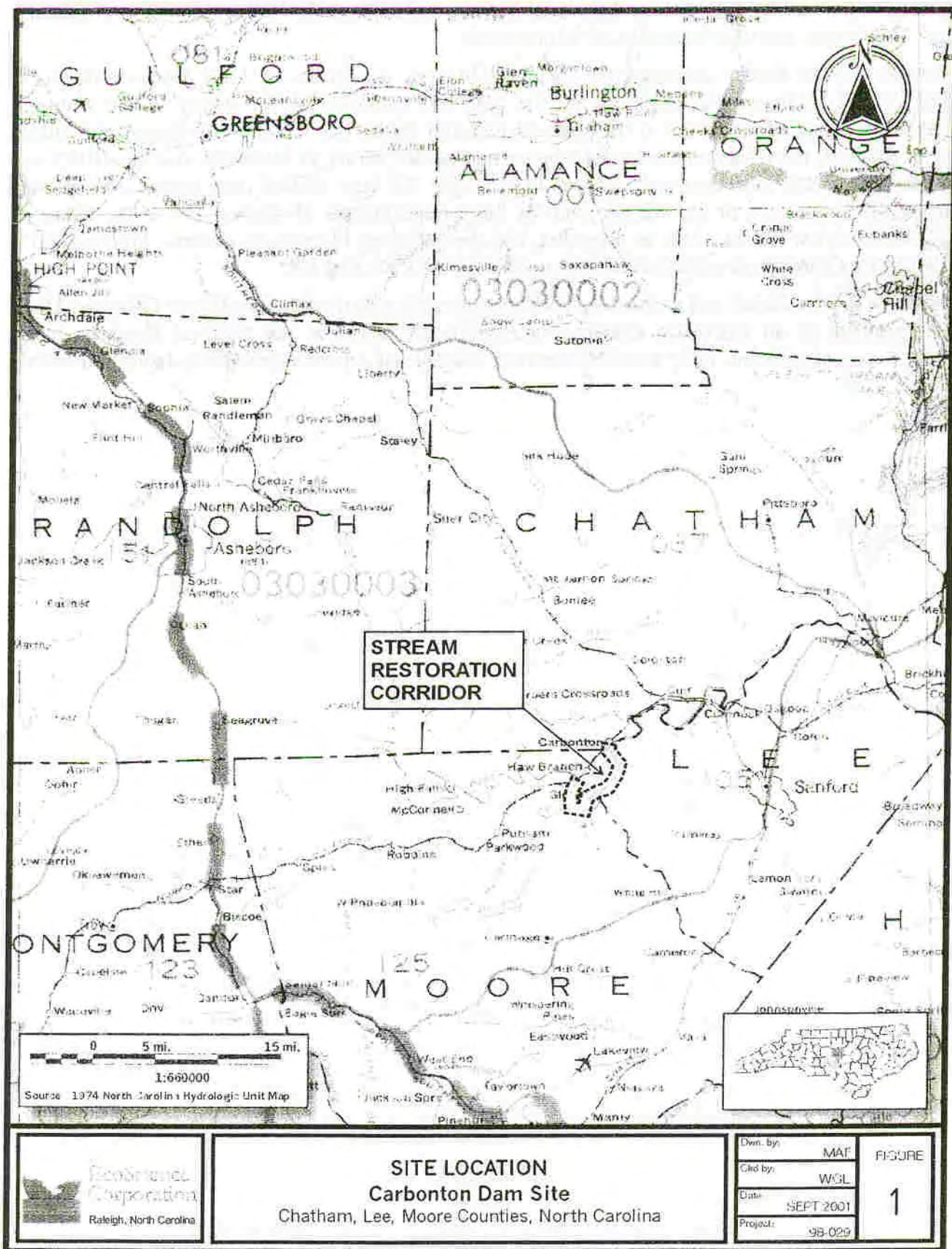


Figure 1: Site Location Map (Source: Restoration Systems, LLC and EcoScience).

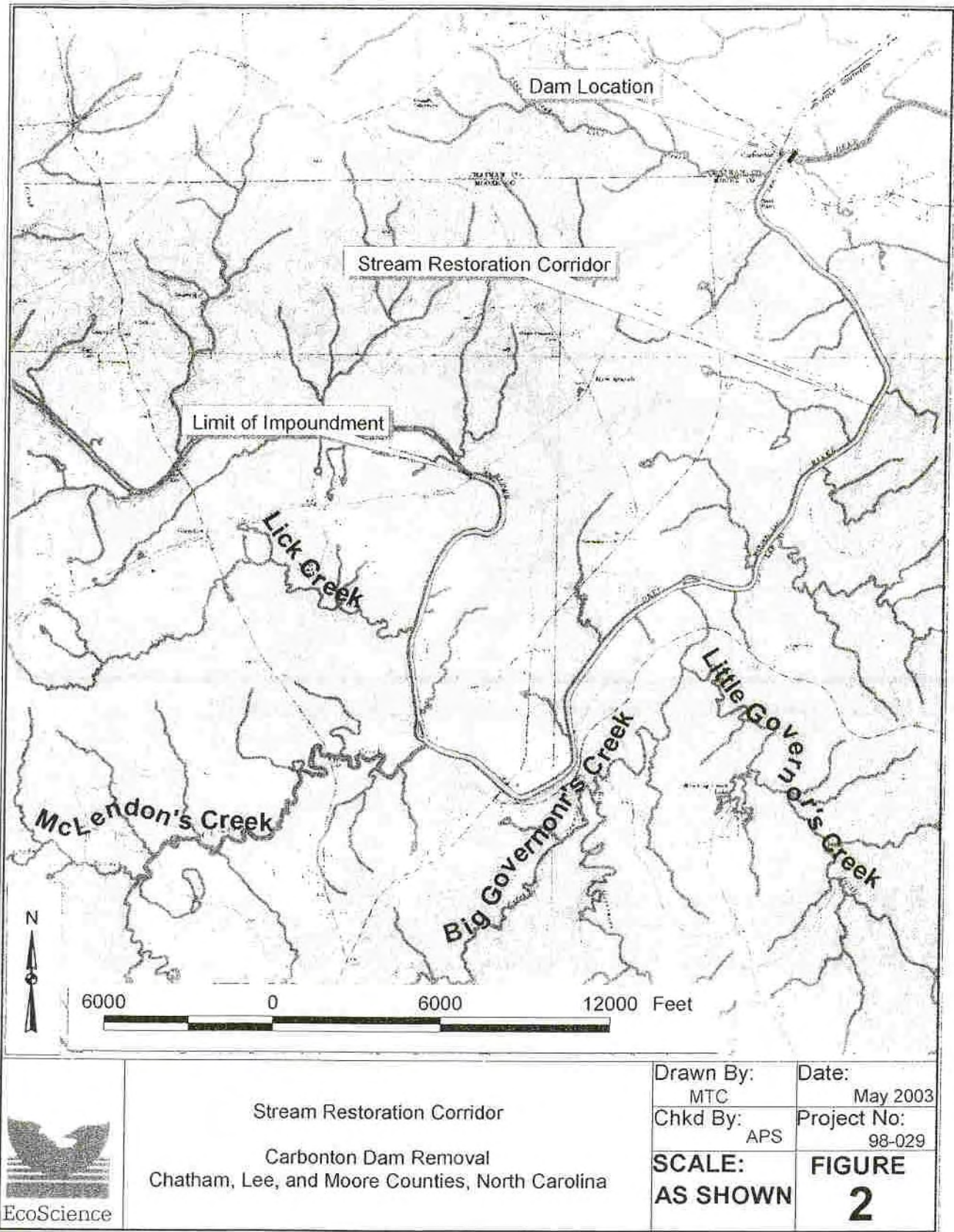


Figure 2: Stream Restoration Corridor (Source: Restoration Systems, LLC and EcoScience).

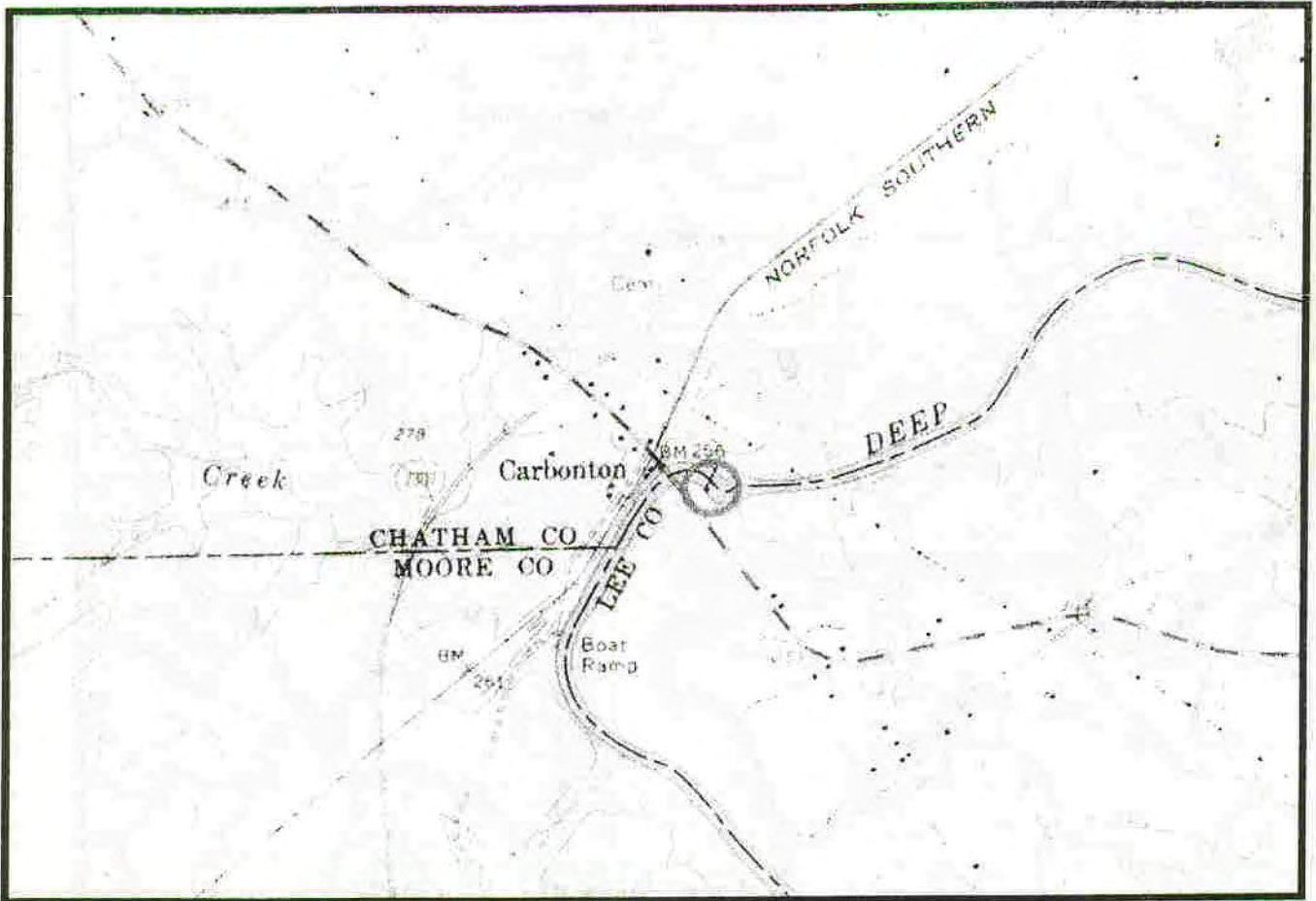


Figure 3: Resource Location Map (Source: Goldston NC USGS Quadrangle Map)

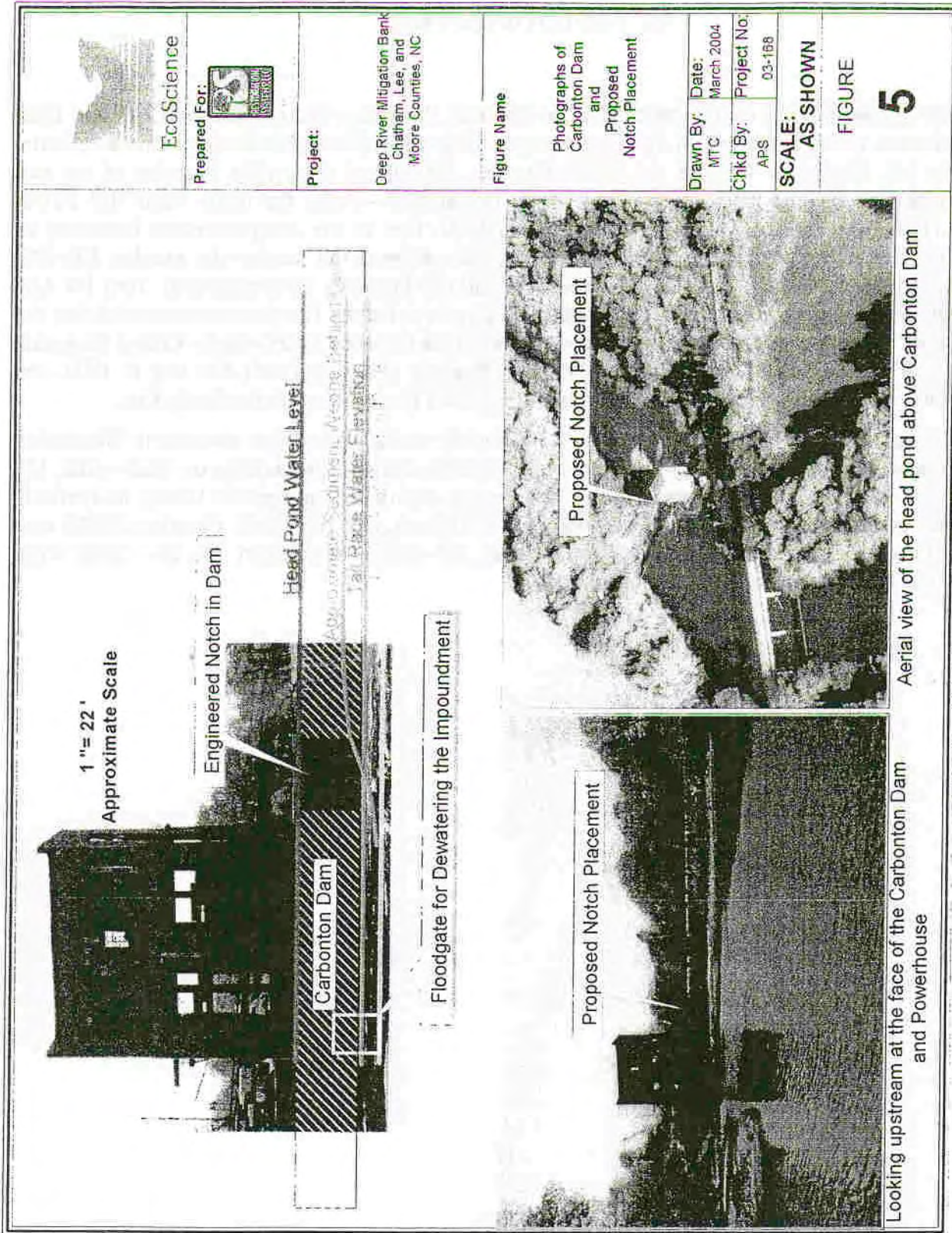


Figure 4: Sandhill Power Company Dam and Powerhouse and Proposed Notch Replacement (Source: Restoration Systems, LLC and EcoScience).

II. METHODOLOGY

This project consisted of the evaluation of a single resource, the former Sandhill Power Company Dam and Powerhouse, which is located on the Deep River at the border of Lee and Chatham counties. Initial research by Mr. Brown of URS at the North Carolina SHPO and the public libraries of the two counties indicated that the resource was previously inventoried—under the name Sand Hill Power Company Hydroelectric Plant—by Daniel Pezzoni in 1991. Part of the comprehensive inventory of Lee County resources conducted by Mr. Pezzoni, it was assigned the survey site number LE-106. Following the inventory, Mr. Pezzoni completed a Multiple Property Documentation form for Lee County, which was never submitted to the National Register for listing. He also recommended that the resource, with others in Lee County, be included on the North Carolina SHPO Study List of resources that are potentially eligible for listing in the National Register (Pezzoni 1992). On July 8, 1992, the North Carolina State Professional Review Commission placed the resource on the Study List.

After his initial research, Mr. Brown made two field visits to the site of the resource in November 2004. He mapped, photographed, and evaluated the resource and its surroundings on these visits. He subsequently conducted further research at the Lee County courthouse and public library in Sanford, the Chatham county courthouse and public library in Pittsboro, and the North Carolina SHPO and North Carolina State Archives and Library in Raleigh, and drafted this report. He also spoke with Michael Allen, the current owner of the resource.

III. INVENTORY AND EVALUATION

SANDHILL POWER COMPANY DAM AND POWERHOUSE (LE-106)

On the Deep River northeast of NC 42,
Carbonton, Lee and Chatham Counties

A. History

Early History of Carbonton Community and Power Facility

The Sandhill Power Company Dam and Powerhouse is located in the Carbonton community in current Lee and Chatham counties. In the mid nineteenth century, the Cape Fear and Deep River Navigation Company platted the town and laid plans to make the Deep River navigable as far upriver as the border of Randolph County. The company hoped to take advantage of the resources of the surrounding Deep River Coal Field and the path of the Deep River, which flows through the field on its way to the Cape Fear River and the Atlantic Ocean. The name Carbonton arose from the company's vision of a prosperous coal shipping port (Hadley, Horton, and Strowd 1971:191; Pezzoni 1985:26-27; Hadley 1980).

Although the town of Carbonton never blossomed as envisioned, it did become home to a few enterprises and dwellings. Four stores were opened and, in the mid-1850s, Cyrus Harrington established his Carbonton Academy in the community. A gristmill and cotton gin rose at the river, powered by waters held in check by a wooden dam. Only two resources, both located more than half a mile distant and invisible from the river, continue to stand from the community's earliest years, the eighteenth- and nineteenth-century Carbonton Cemetery (LE-235) and the Carbonton Academy (LE-109) (Hadley, Horton, and Strowd 1971:191; Pezzoni 1985:29-32; Riley 1958:117-127; Carbonton Academy survey form; Carbonton Cemetery survey form).

On the heels of three developments, limited growth finally came to the Carbonton community and its surroundings in the early twentieth century. At the opening of the twentieth century, the Durham and Charlotte Railroad, soon to become part of the Norfolk and Southern system, built a rail line just west of the dam and powerhouse along the Deep River (<http://users.inna.net/~jaydeet/timeline.htm>; Hadley, Horton, and Strowd 1971:191). Also early in the century, small hydroelectric plants began to spring up along the Deep and other Piedmont rivers (Osborn and Selden-Sturgill 1991:276-277; Hadley, Horton, and Strowd 1971:195-196, 380-381; Riley 1958). And in 1907, population growth in the area was sufficient (along with other political considerations) to lead to the creation of Lee County from portions of Chatham and Moore (Corbitt 1987:136).

The ultimate force behind the construction of the dam and the powerhouse was local entrepreneur Imlah Fogle (I.F.) Chandler. In 1920 I.F. and his wife L.B. Chandler transferred approximately five acres of land in Lee and Chatham counties to an entity known as the Electric Light and Power Company (Lee County Deed Book 20, Page 489). In 1921 that company's successor, the Sandhill Power Company, removed the earlier wooden dam and erected the current concrete dam and concrete and brick powerhouse (Riley 1958:117-127).

The Sandhill Power Company had its origins in the Pigeon River Power Company at the opening of the twentieth century. I.F. Chandler's concern, the Pigeon River operated small power facilities from

the Smokey Mountains in western North Carolina to the Sand Hills in the eastern Piedmont. In 1921 Chandler merged the Pigeon River with the holdings of another local entrepreneur, John R. McQueen of Moore County. That same year their newly formed Sandhill Power Company erected the new dam and powerhouse on the Deep River in Carbondon (Riley 1958:117-127).

In 1924 the Sandhill Power Company sold its numerous holdings to Frank A. Reid of New York City, who purchased them on behalf of the Electric Bond and Share Company (Lee County Deed Book 20, Page 672). Through acquisitions, Electric Bond and Share backed the creation and growth of Carolina Power & Light Company (CP&L), which it had formed in 1908. In 1926 CP&L officially absorbed Sandhill Power into its burgeoning empire (Riley 1958:56-57, 117-127).

The Carbondon facility provided power for communities throughout Lee, Chatham, and Moore counties. In 1924 transmission lines extended out from it as far northwest as Siler City and as far southeast as Southern Pines. Secondary lines extending off of these principal lines served smaller and more distant communities in the region, such as Goldston, Vass, and Pinehurst (Figure 5).

Hydroelectric Power in North Carolina in the Early Twentieth Century

The Carbondon facility was part of a broad shift to hydroelectric power in North Carolina during the first third of the twentieth century. In 1898 the state's first hydroelectric facility—the no-longer-extant Idols (Fries) Hydroelectric Power Plant—was erected on the Yadkin River near Clemmons in Forsyth County. As the new century progressed, industry began to harness the enormous potential of the Piedmont's watercourses. Initially, small operators raised a number of these facilities, but they were soon joined by future major utilities such as Southern (later Duke) Power Company in 1905 and CP&L three years later. By the 1920s long-distance transmission of electricity had radically affected industrial production in the state. Indeed, the success of the hydro facilities led to their displacement by coal-fired facilities as the century progressed. Not dependent on the vagaries of water levels, coal-fired plants provided industry with solidly dependable power (Bishir and Southern 2003:55-57, 400).

In 1924 North Carolina had about 19 hydroelectric facilities that provided power to communities at large rather than just to dedicated industrial enterprises. Those owned by the conglomerates—Southern, CP&L, and the Tallassee Power Company—were the largest, generating tens of thousands of horsepower each. The Sandhill Power Company facility at Carbondon, which produced 1,350 horsepower, was one of the smallest (Thorndike 1924a). (Plants built solely to supply adjacent textile mills were smaller yet, generating horsepower measured in the hundreds rather than the thousands (Thorndike 1924b).)

Five of the 19 power generating facilities standing in 1924 in piedmont North Carolina, including the one in Carbondon, are known to have survived to the present. CP&L's Blewitt Falls Dam and Power Station (1912 and later), a large multi-story facility that generated 32,150 horsepower in 1924, continues to operate on the Pee Dee River in Anson County. Also still operating are the Southern (later Duke) Power Company's Lookout Shoals Dam and Power Plant (1915) on the Catawba River in Iredell County and Mountain Island Dam and Power Plant (1922-1923) on the Catawba near Mount Holly in Catawba County. Both of these were built as much larger facilities than Carbondon. In 1924 Lookout Shoals generated 30,000 horsepower and Mountain Island, the state's second largest hydroelectric plant, 80,000 horsepower. Only the Lockville Power Plant on the Deep River in Chatham County, erected by the Deep River Power Company in 1922 and now largely a shell, was a small plant comparable in size to Carbondon. In 1924 it could generate 1,100 horsepower (Thorndike 1924a; Bishir and Southern 2003:259, 301,453, 483; Lockville survey form). (A small powerhouse erected in

Franklinton in Randolph County about 1935, probably directly linked to textile production, stood in the town in 1979 and may yet be extant (Franklinton survey form). The status of other small hydroelectric facilities erected to serve dedicated industries has not been determined.) No early small hydroelectric facilities are known to survive in western North Carolina and perhaps none were built; the size and fall of the rivers in the mountains seem to have promoted the construction of large dams and hydro facilities from the beginnings of the industry (Bishir, Southern, and Martin 1999).

Recent History of Sandhill Power Company Dam and Powerhouse

The Carbonton facility was a dependable source of power for the Lee-Chatham-Moore County area into the late twentieth century, when its operating history became spotty. In the 1960s CP&L decommissioned it due to lack of need. At that time the company removed all of the facility's original equipment (Allen 2004). By 1971 it had ceased operations and it remained moribund in 1974 (Hadley, Horton, and Strowd 1971:191; Railroad House Historical Association 1974:79). In 1983 CP&L sold the facility to Carolina Hydro, Inc. (Lee County Deed Book 345, Page 993), which that same year transferred it to Cox Lake-Carbonton Associates of New York (Lee County Deed Book 347, Page 848; see also Lee County Deed Book 603, Page 136 (1997)). The new owners installed entirely new equipment—from the turbines and wicket gates beneath the water to the shafts, the generators, and the control board above—and brought the facility back on line (Allen 2004). In 1993 Cox Lake-Carbonton Associates leased the facility to Carbonton Hydroelectric, Inc. (Lee County Deed Book 516, Page 598). According to records of the North Carolina Utilities Commission, in the late 1990s the Carbonton Hydroelectric facility was selling power back to its former owner, CP&L (<http://ncuc.commerce.state.nc.us/regcomp.html>). The facility continued to operate into the new century. A logbook of handwritten notes on notebook paper, affixed to a clipboard hanging in the facility, indicates that it last operated in May 2004. The Sandhill Company Dam and Powerhouse, along with five associated acres in Lee and Chatham counties, is currently privately owned by Michael R. Allen of Burlington, North Carolina, who acquired it in March 2003 (Lee County Deed Book 839, Page 36). Mr. Allen had previously been associated with Carbonton Hydroelectric.

B. Description

The Sandhill Company Dam and Powerhouse has two components, a gravity dam and a powerhouse, both of which were built in 1921 (Figure 6; Plate 4). The dam extends across the Deep River, placing it in both Lee and Chatham counties. The powerhouse stands on a concrete pad at the dam's southern edge, wholly within Lee County. Just upstream from the two is a state-owned bridge erected in 1961 to carry NC 42 over the river. A few twentieth-century frame and concrete-block buildings stand near the bridge in Chatham County. Along the river near the facility, also in Chatham County, runs an active set of Norfolk-Southern tracks (Plate 1).

The gravity dam, much of which is hidden by the falling waters of the Deep River, is a functional, unadorned, concrete structure. It stretches from the powerhouse on the south, across the river, to a recessed, tapered, concrete shelf or spillway and a roughly stepped table of exposed rock (Plates 2, 3, and 4).

On the Lee County side of the river, the concrete-and-brick powerhouse rises from a concrete pad set over six concrete sluices (Plate 5). Water flows through steel trash racks at the upstream side of the pad

into the sluices. Six long, heavy, rectangular, wooden sluice gates once rode up and down between the concrete piers that form the powerhouse's tall base (Plate 6). The three gates at the south have been severed from their pulleys and slipped into the water, cutting off the flow of water through those sluices. The three gates at the north have been cut from their pulleys as well, but they remain suspended on steel cables above the water, allowing the river to continue to flow through their sluices. A pair of turbines connected to shafts, each served by three of the sluices, are hidden beneath the river on the downstream side of the sluices. The shaft at the south no longer turns, but the one at the north, the turbine of which continues to be spun by the water passing through the permanently open sluice gates, still slowly rotates (Plate 7). Two smaller shafts, which are connected to wicket gates beneath the water and power packs above, are also at rest. Due to the sluice gates, the base of the powerhouse appears relatively open at its upstream face. Its substantial nature is apparent, however, at its downstream elevation, where a massive footing of concrete still bearing the imprints of the boards into which it was poured looms over the river (Plate 8). The foundation is further supported by exposed I-beams. Because of the wide fluctuations in the height of the river and the possibility of floodwaters reaching the generators, the foundation is not only substantial, but raised high in the air as well.

The powerhouse lacks an internal stairwell. Rather, an exterior set of stairs akin to a fire escape winds up its southeast side elevation. They open onto a concrete-floored deck edged by metal handrails that extends across the southwest upstream elevation. Now permanently affixed to the deck's floor are the cables, minus their pulleys, that hold the three northern sluice gates in place (Plate 9).

Brick walls, laid in four-over-one common bond and crowned by a parapet roof, enclose the upper level of the powerhouse, in which the power-generation equipment is housed. Three large, metal casement windows with almost all of their lights broken out pierce the downstream elevation of the upper level. A single metal casement window, also largely without glazing, is set into the northwest side elevation. The southeast side elevation also has a single opening, which is served not by a window but by a later-added overhead steel door. An I-beam projecting above this opening likely held a pulley that lifted the turbines and other equipment into the building. With the stairs climbing the wall immediately beneath this opening, it is not clear how this was done. The upper level's upstream elevation, facing the deck, has two plywood-covered metal casement windows and a single offset doorway. All of the bays terminate at exposed I-beam lintels.

I-beams topped by plywood sheets and an undetermined roofing material support the roof of the upper level (Plate 10). Within the cavernous space rise two circular concrete pads framed by tubular railings, which once each supported a generator. Only one generator remains in place, on the northern pad; the other was struck by lightning and has been removed (Plate 11). Two subsidiary pieces of hydraulic equipment—power packs to operate the wicket gates—stand next to the pads. They are connected to shafts that extend down to the river and the wicket gates that protect the turbines. A wide metal control board is set against the wall and central boarded-up window of the room's upstream elevation (Plate 12). None of the equipment is original to the structure; rather it was all added in the early 1980s (Allen 2004). The generator was manufactured by the Falk Corporation of Milwaukee, "A Good Name In Industry" according to its nameplate. The control board carries the name "Toshiba Houston International Corporation". The roll-up metal door is an "Overhead Door".

The environs of the Sandhill Power Company Dam and Powerhouse include the Deep River, surrounding farmland and woodland, and a small number of resources erected during the twentieth century. A small piece of scrub-covered property—upon which stand the rusting hulks of two Bucyrus-Erie cranes holding clamshell dredges that were once used to remove woody debris, flood trash, and other materials upstream of the dam—separates the resource from the bridge that carries NC 42 over the Deep River (Plate 13). A plaque on the bridge carries the legend "Lee County Project 8.26123,

Federal Aid, 1961". Beyond (northwest of) the bridge, on the Chatham County side of the river, two abandoned, deteriorated, one-story, frame buildings still stand (Plate 14). Beyond them is the track of the Norfolk-Southern line. On the farther side of the line is a long, concrete-block residence that appears to date from the mid twentieth-century (Plate 15). To its southeast, down an unpaved road paralleling the rail line, stand a few small, modern, manufactured houses.

C. Evaluation of Significance and National Register Eligibility

As noted above, following his comprehensive inventory of Lee County in 1991, principal investigator Daniel Pezzoni completed a Multiple Property Documentation form for Lee County. Although this form was never submitted to the National Register for listing, it includes a detailed discussion of the nature and significance of the county's industrial resources and a list of the requirements that such resources should meet to be eligible for National Register listing. In his descriptive discussion of these resources, he notes that the Carbondon plant is the "principal historic power generating facility in Lee County". In general he posits significance for the county's industrial resources in two areas: under Criterion A in the area of industry and under Criterion C in the area of architecture and engineering "for the quality of workmanship exhibited in the construction of the buildings or the rarity of the construction techniques." He further sets out four registration requirements:

- (1) the resource must have been constructed before 1942 [now 1954];
- (2) the resource should have good integrity, it should retain its original form without major alterations and additions, and it should stand on its original site;
- (3) since few industrial resources retain their original machinery, the retention of such machinery "should not be an issue of paramount importance" and
- (4) "Unless they are of exceptional significance and are the best surviving examples of a certain functional type...deteriorated resources would not ordinarily be considered eligible under the criteria and areas of significance discussed here. An exception to this would be sites such as the tar kilns...; although they have been abandoned for many years, they retain their defining characteristics of form and could even conceivably be placed back into operation."

Although these registration requirements remain suggestions, they provide a sensible set of standards for assessing the National Register eligibility of industrial resources in Lee County, including the Carbondon facility.

URS recommends that the Sandhill Power Company Dam and Powerhouse is eligible, as an individual resource, for National Register listing under Criterion A as a significant, early twentieth-century example of a power-generating facility in North Carolina. It is more than 50 years old. It is without major alterations and additions and stands on its original site, thereby retaining good integrity. Its loss of original equipment is common and expected, rather than of paramount importance. And it is the best surviving example of its type in the county, and perhaps the state, and of exceptional significance. URS recommends that the resource's period of significance is 1921, its date of construction. Due to the rarity of the resource, which may have only one surviving contemporary at Lockville, and the part it played in a significant trend in early twentieth-century North Carolina history—the development of hydroelectric energy to serve the state's industries and rapidly growing population—the Sandhill Power Company Dam and Powerhouse is believed to be of statewide, rather than just local, significance.

D. Proposed National Register Boundary and Justification

The proposed National Register boundary of the Sandhill Power Company Dam and Powerhouse is the boundary of its current tax parcel Lee County PIN no. 8494-64-5136-00 (Figure 7). This 5.5-acre parcel of property has been associated with the resource since 1920, just prior to the construction of the powerhouse and dam, when I.F. Chandler transferred it the Electric Light and Power Company, the immediate predecessor of Sandhill Power. It is located within both Lee and Chatham counties. The boundary is subject to two exceptions that are spelled out in the 2003 deed (Lee County Deed Book 839, Page 36) to its current owner, Michael R. Allen. It does not include (1) the portion of the parcel located within the bounds of North Carolina Highway No. 42 and (2) the portion of the parcel that lies below the high water mark of the Deep River.

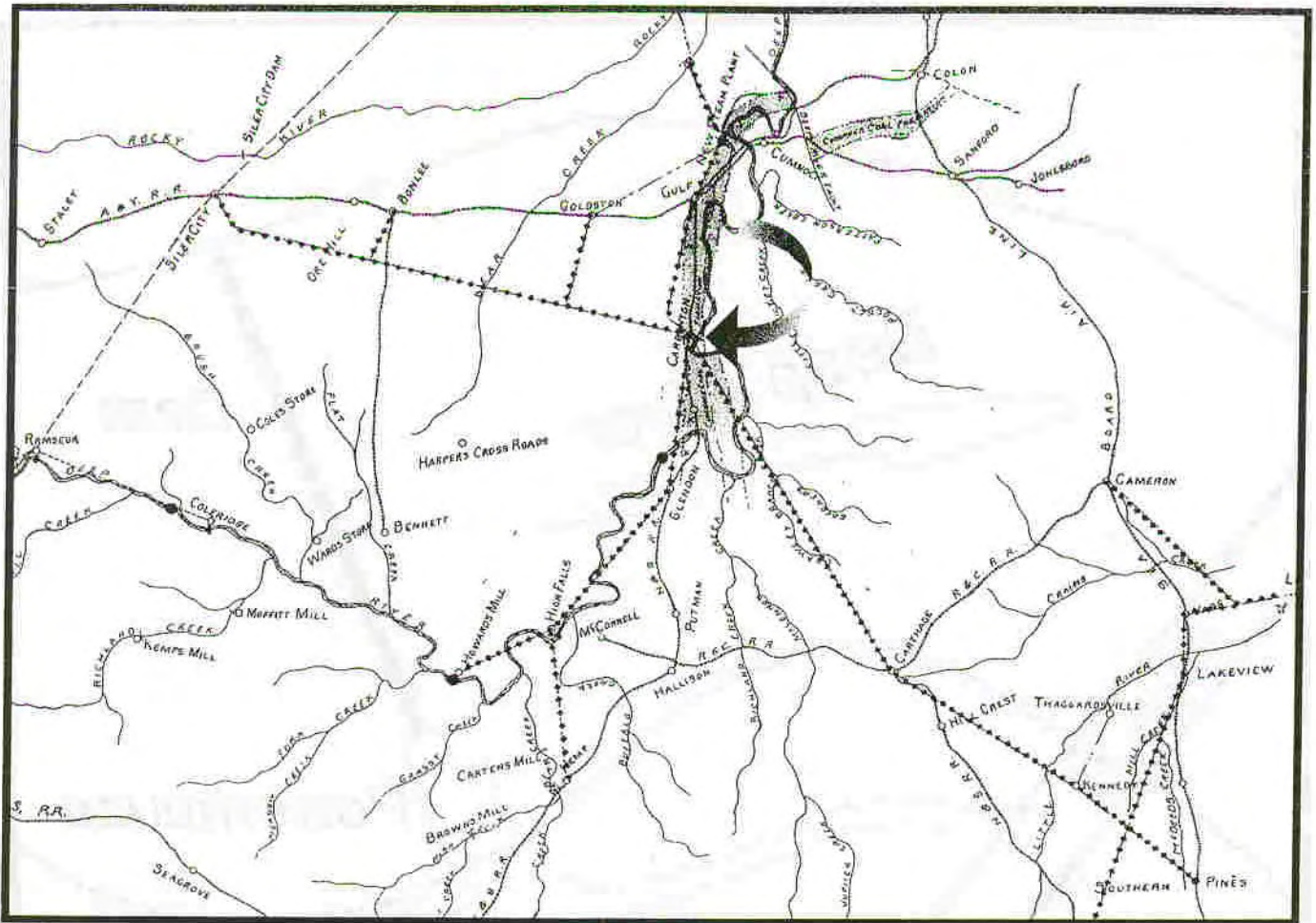


Figure 5: Sandhill Power Company Transmission Lines in 1924 (“General Map Showing Deep River Region” in Saville, *Water-Power Investigation of Deep River*)

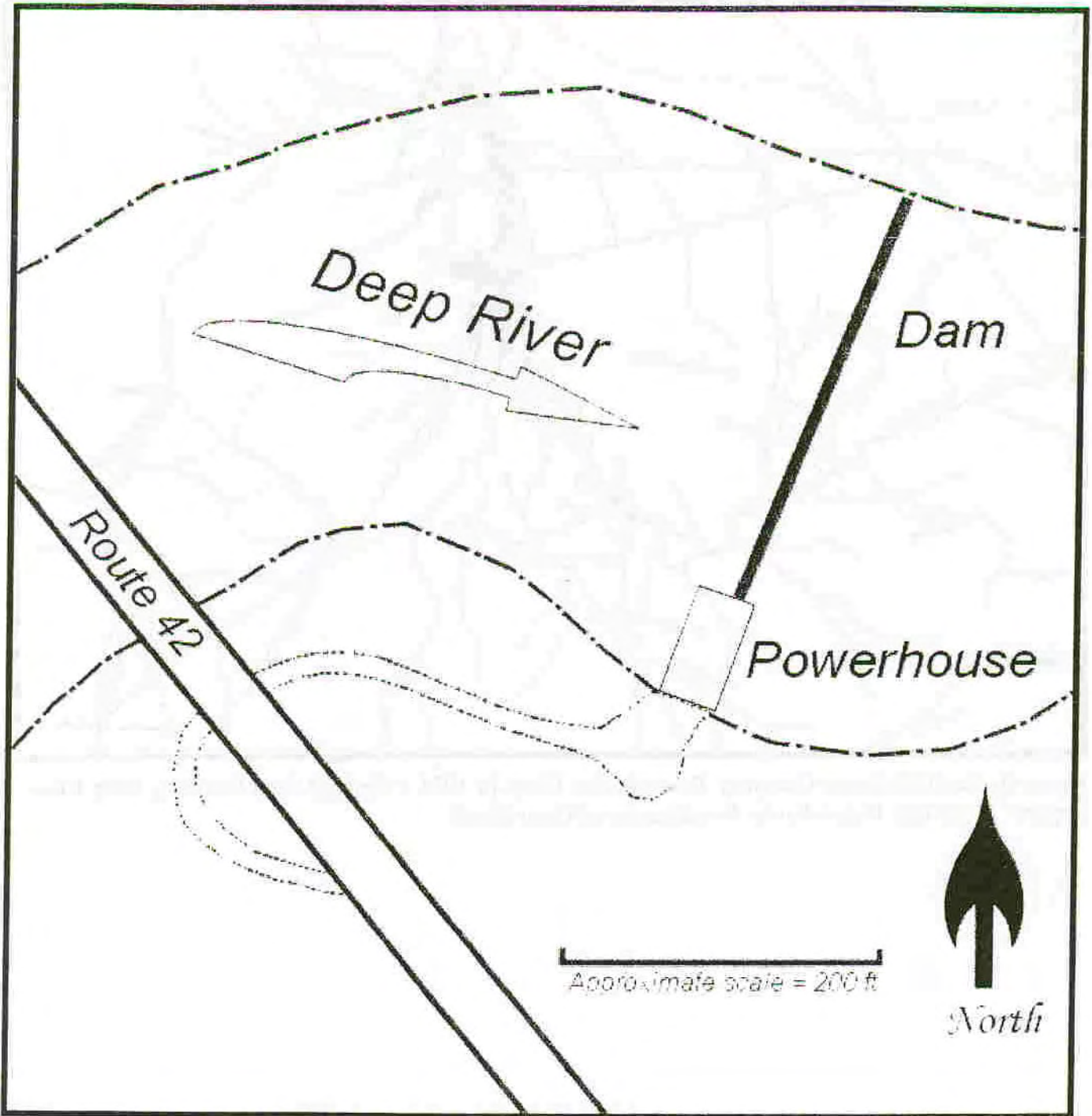


Figure 6: Sketch map of Sandhill Power Company Dam and Powerhouse

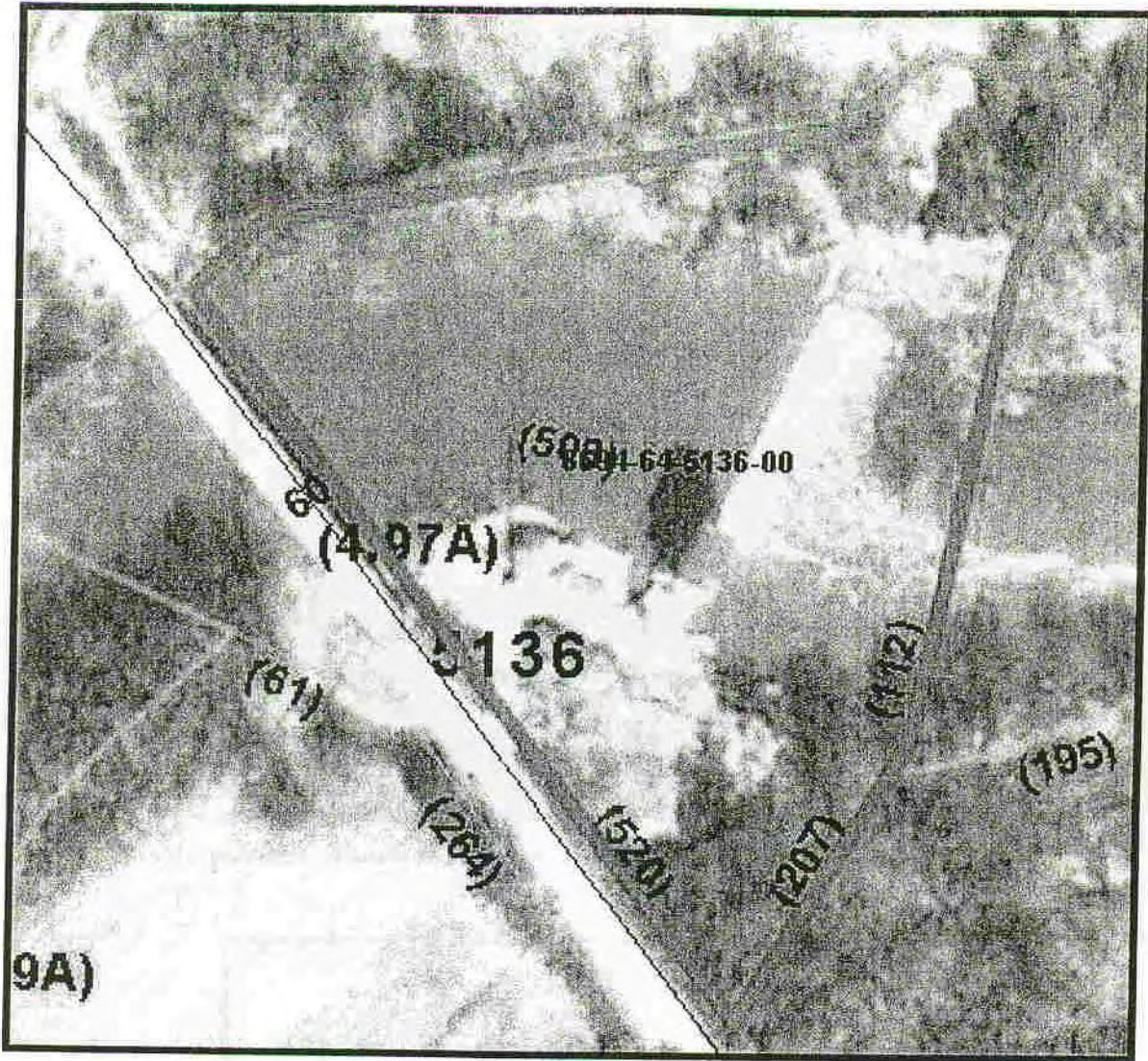


Figure 7: Proposed National Register Boundary Map of Sandhill Power Company Dam and Powerhouse (Source: Lee County Tax Maps, PIN no. 8494-64-5136-00)



Plate 1: Aerial view of Sandhill Power Company Dam and Powerhouse and vicinity (Source: Restoration Systems, LLC).



Plate 2: Looking north toward dam at right and powerhouse at left

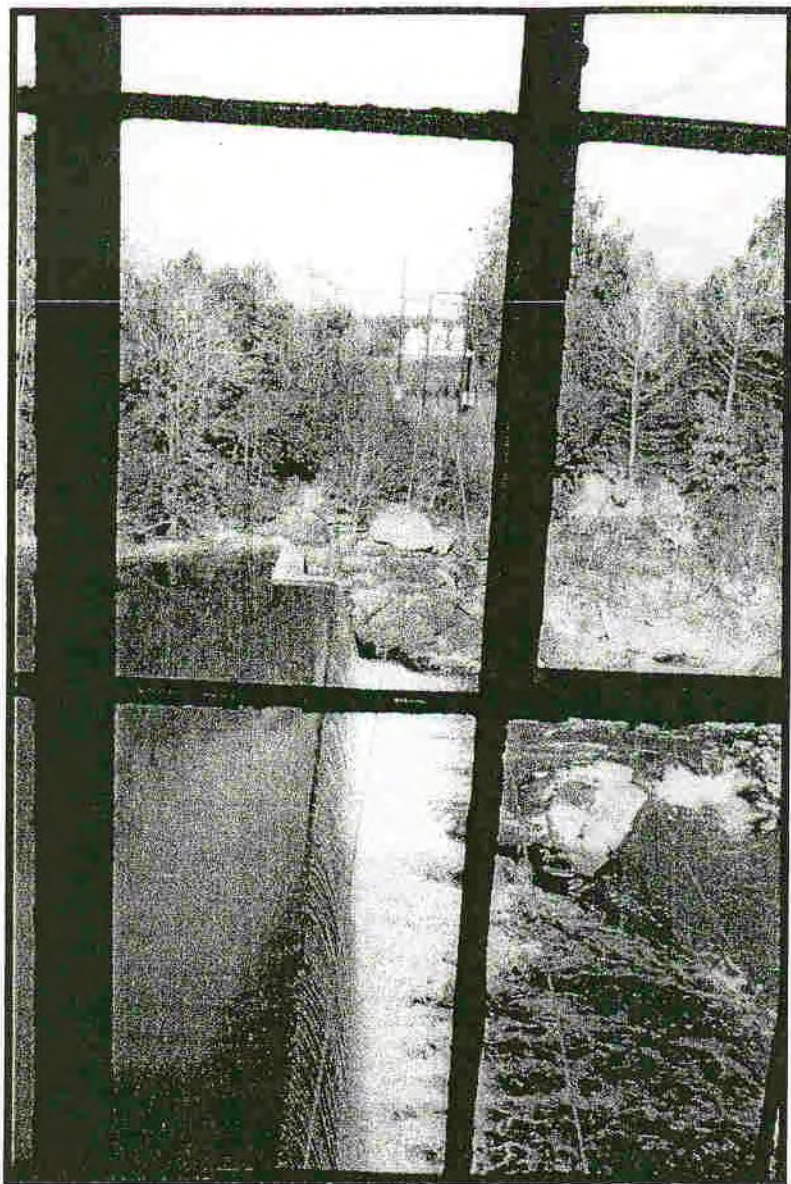


Plate 3: Looking northeast from powerhouse down toward dam and Deep River

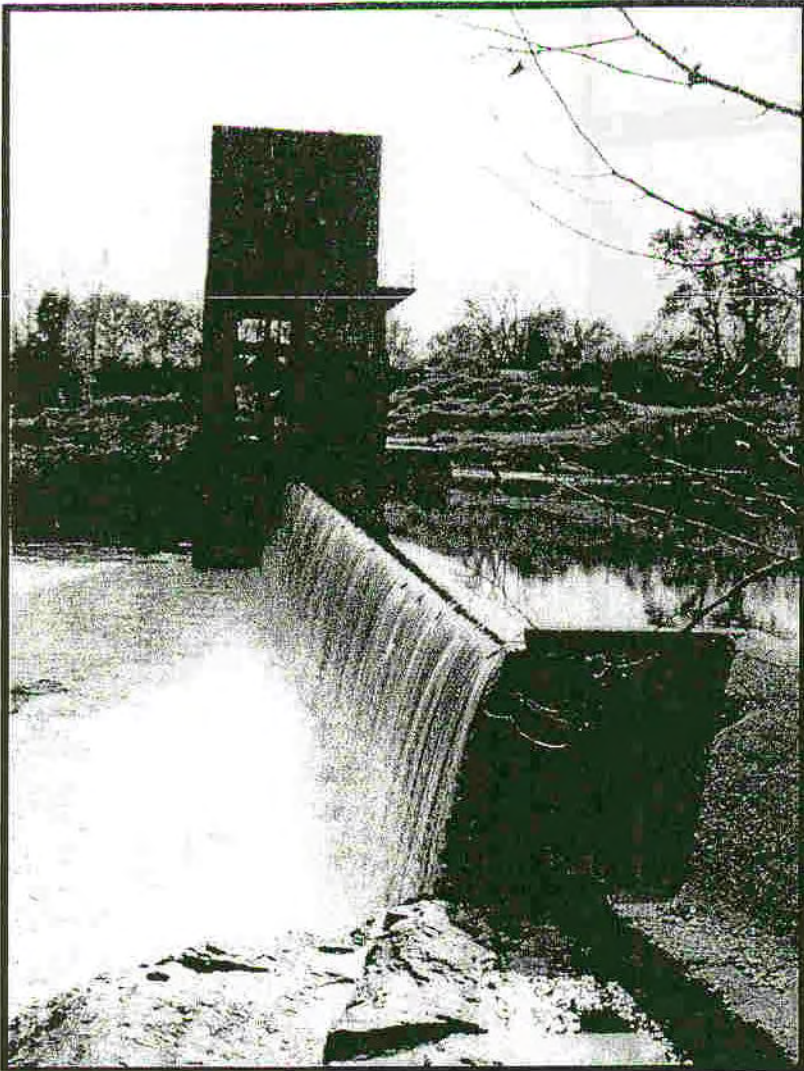


Plate 4: Looking southwest from Chatham County bank of the Deep River toward dam and powerhouse

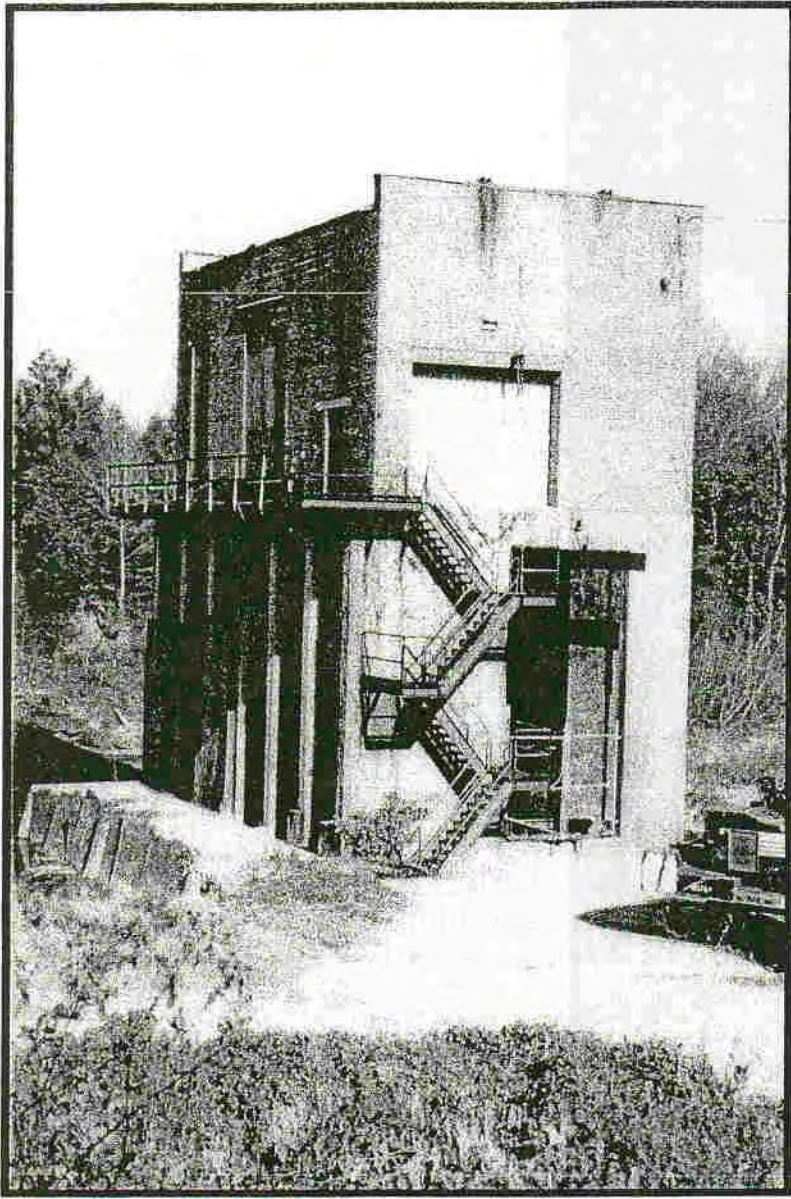


Plate 5: Looking northeast toward upstream and southwest sides of powerhouse

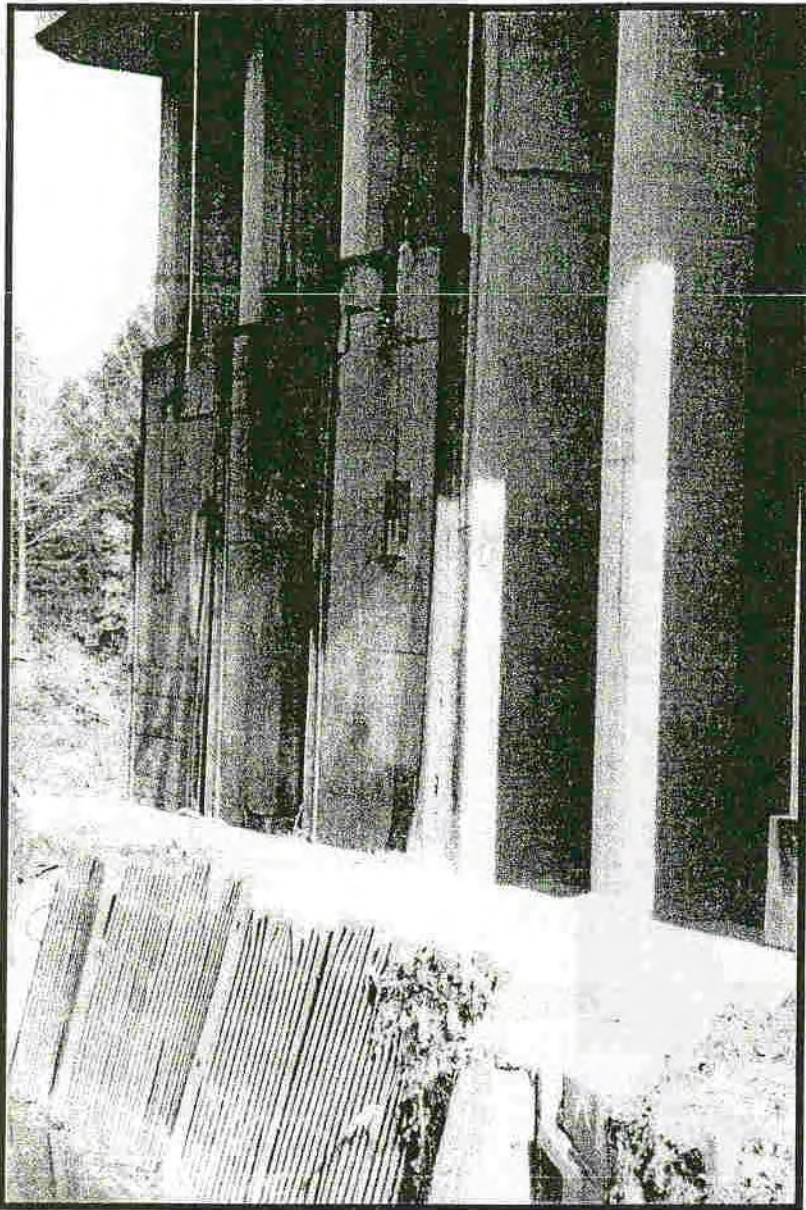


Plate 6: Looking northeast toward trash racks and sluice gates at upstream side of powerhouse

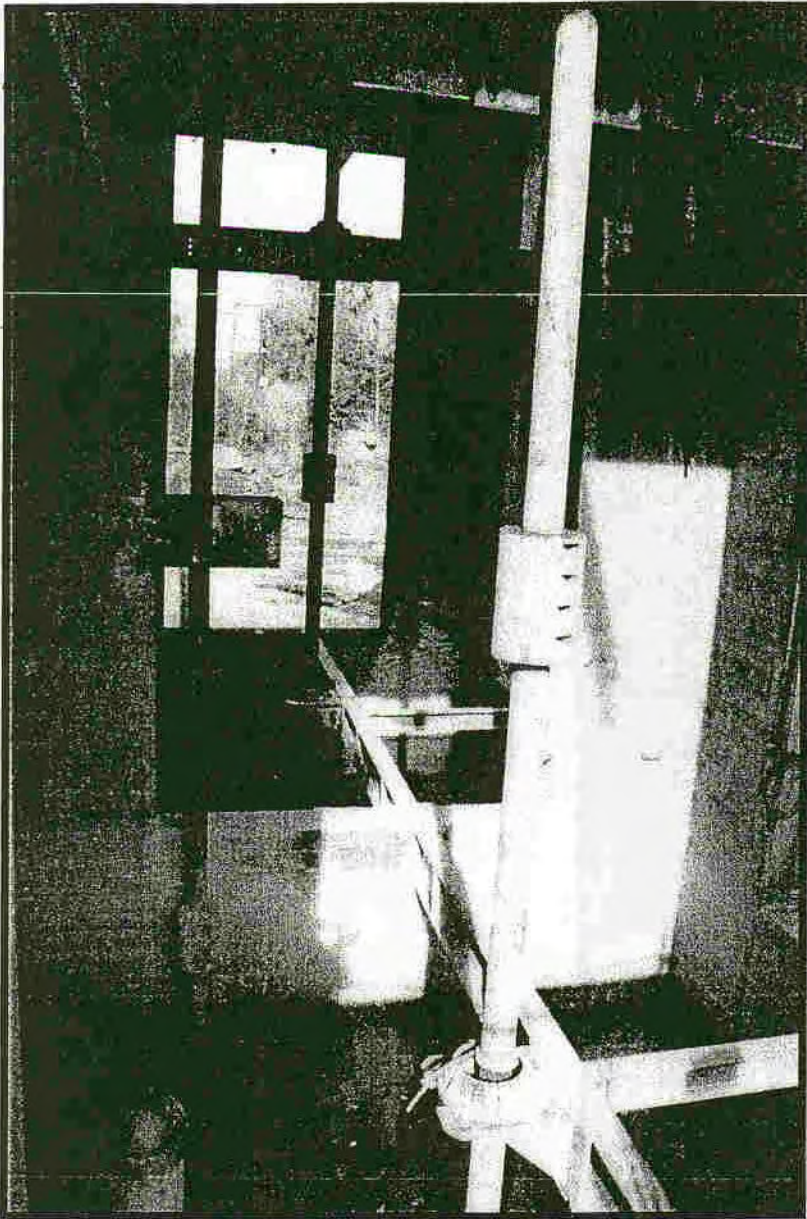


Plate 7: Looking northeast toward turbine shafts beneath powerhouse

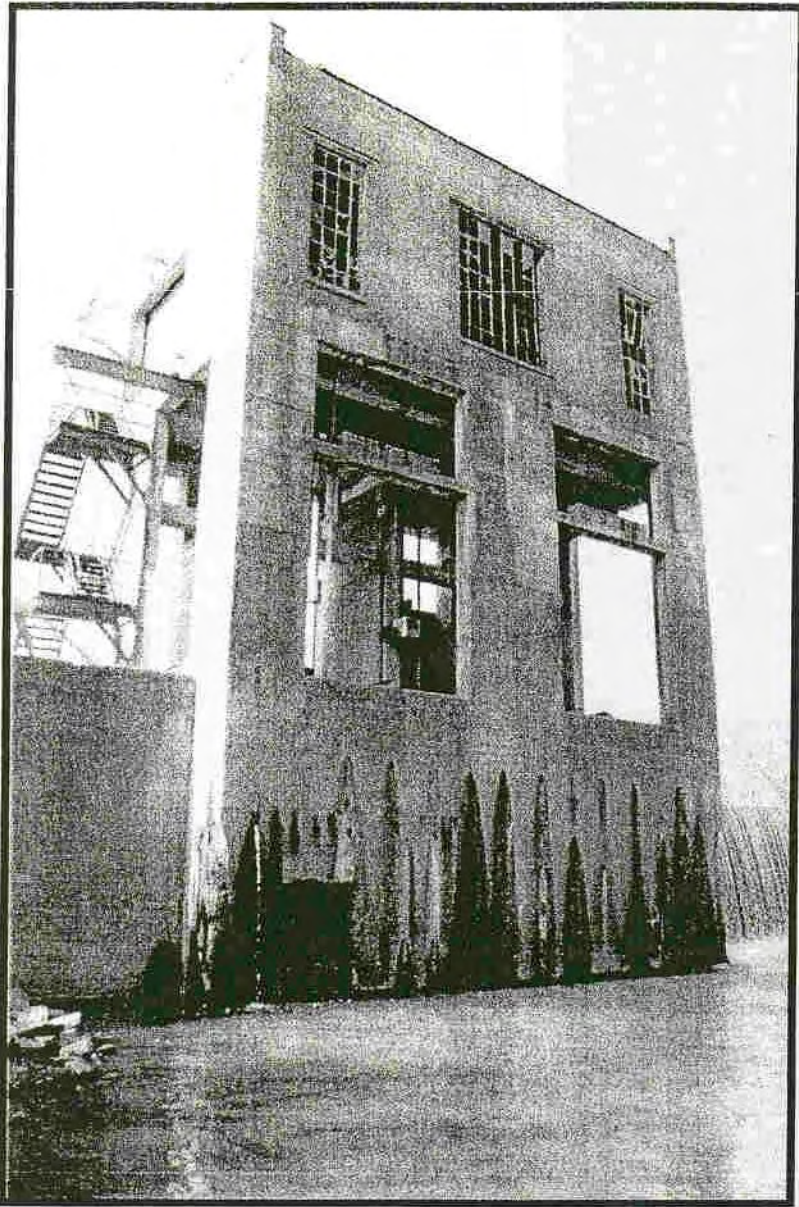


Plate 8: Looking northwest toward downstream side of powerhouse

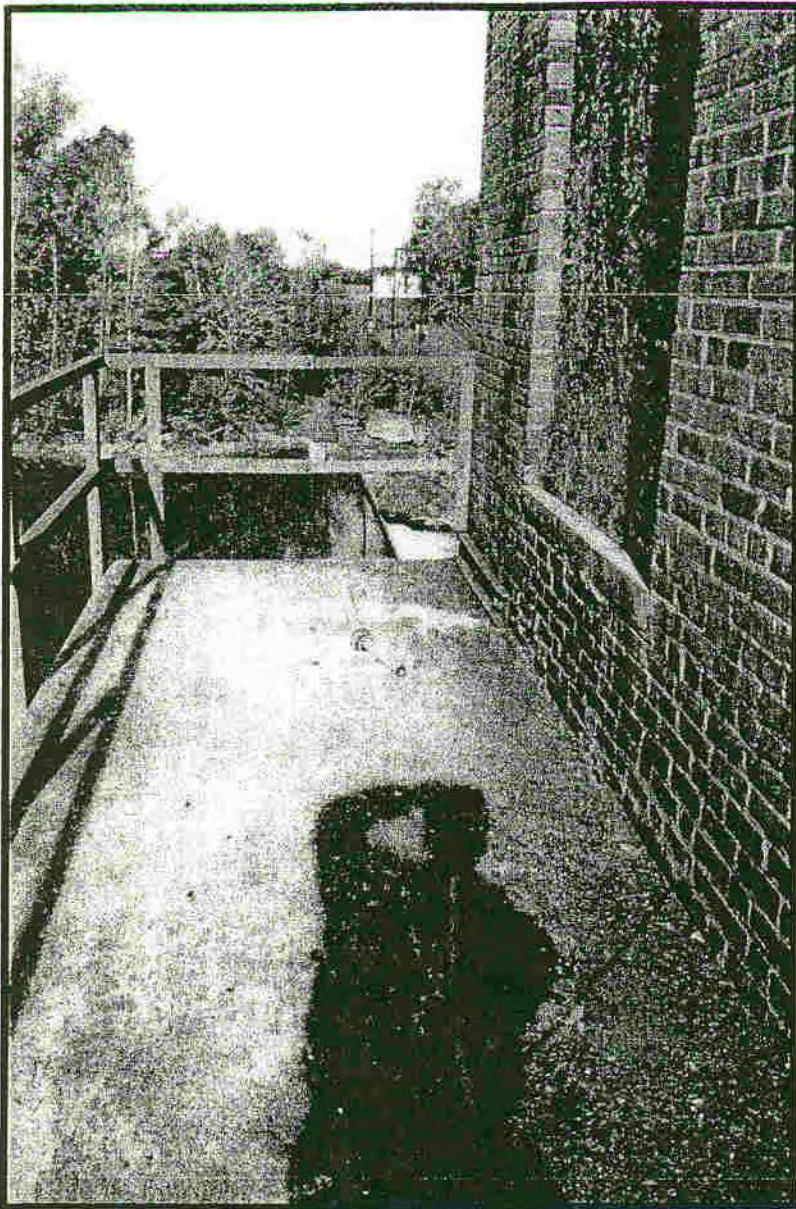


Plate 9: Looking northeast across deck at upstream side of powerhouse

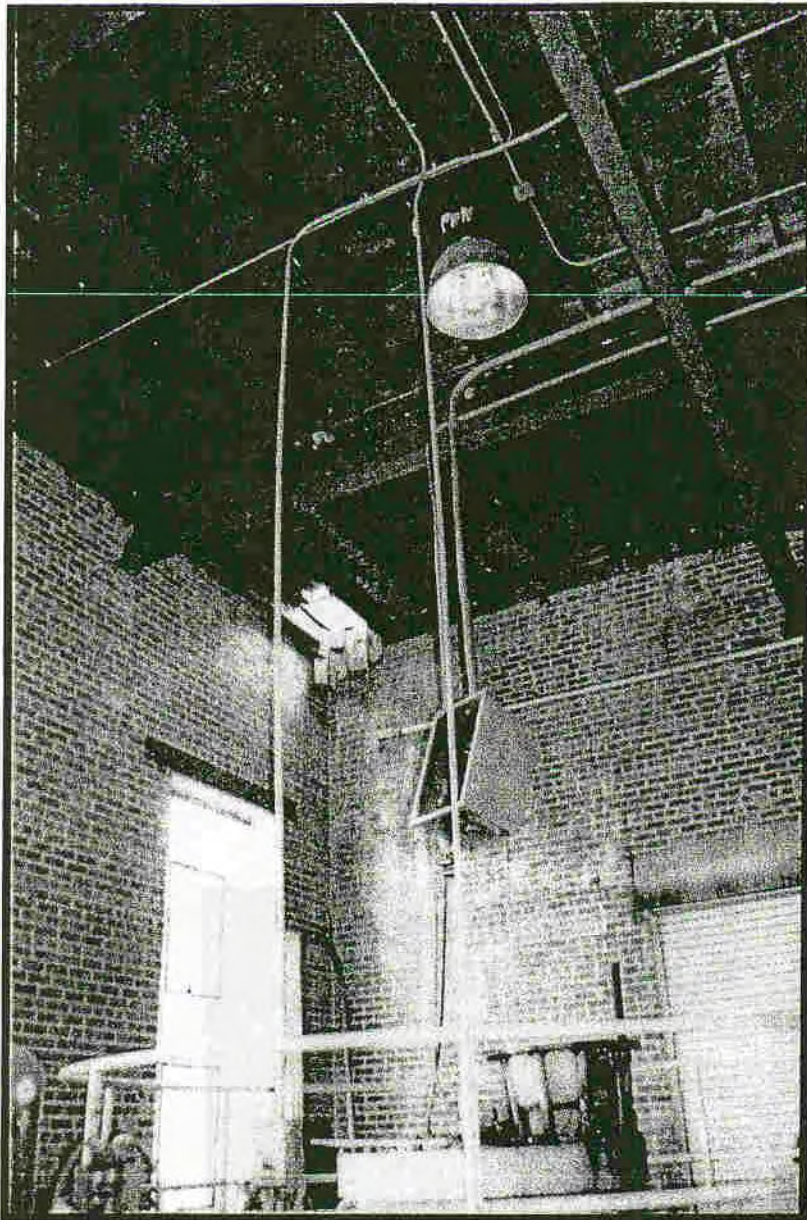


Plate 10: Upper level of powerhouse with downstream window at left, empty generator pad at center, roll-up metal door at right, and roof framing at top

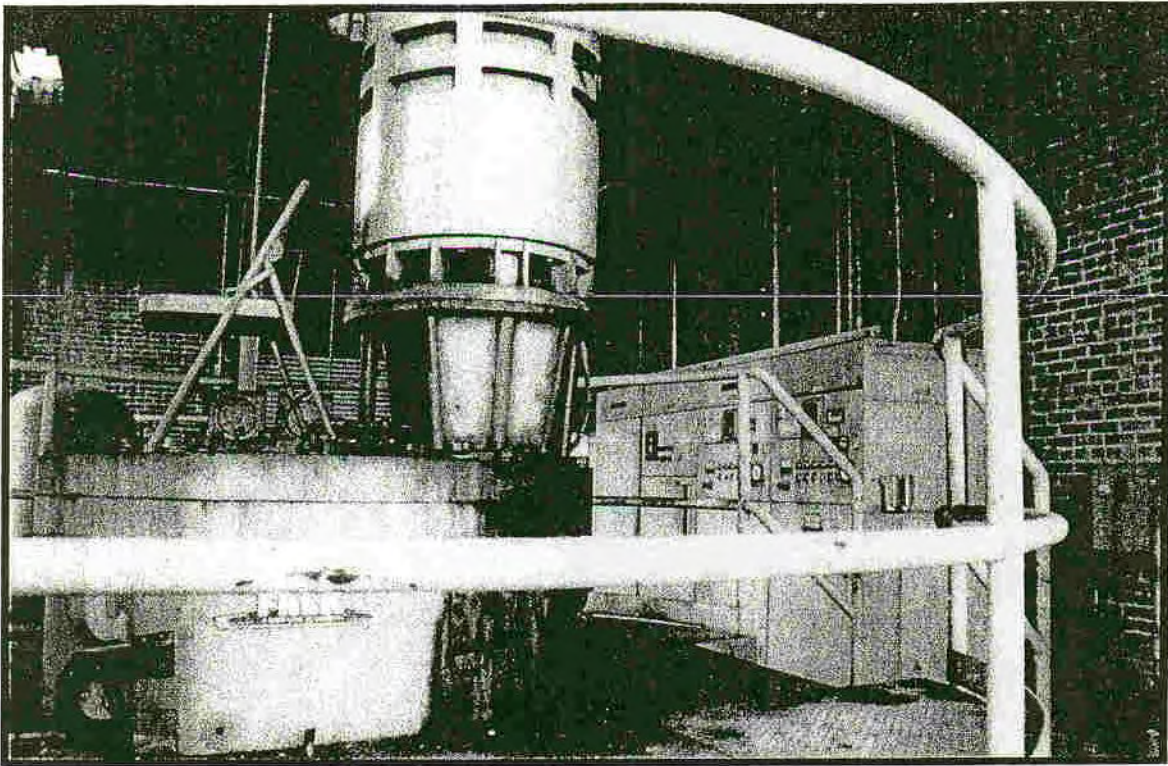


Plate 11: Upper level of powerhouse with generator at left and control board at right

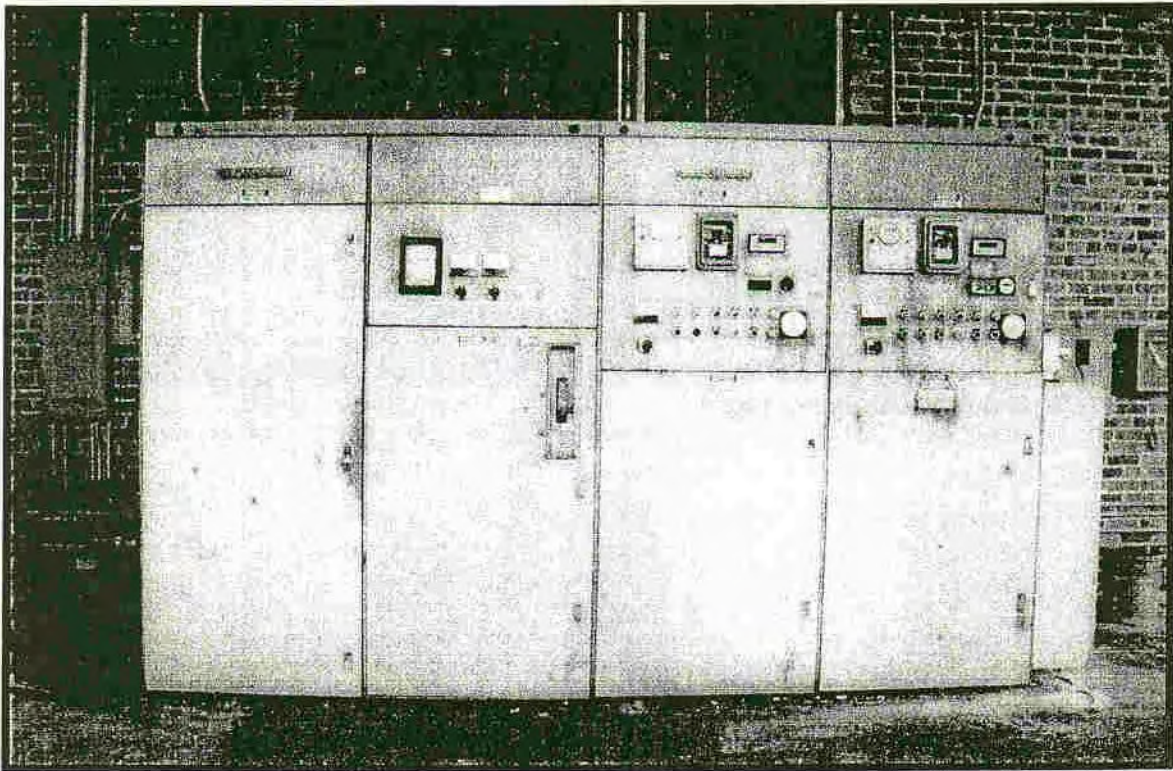


Plate 12: Upper level of powerhouse with control board against upstream window and wall

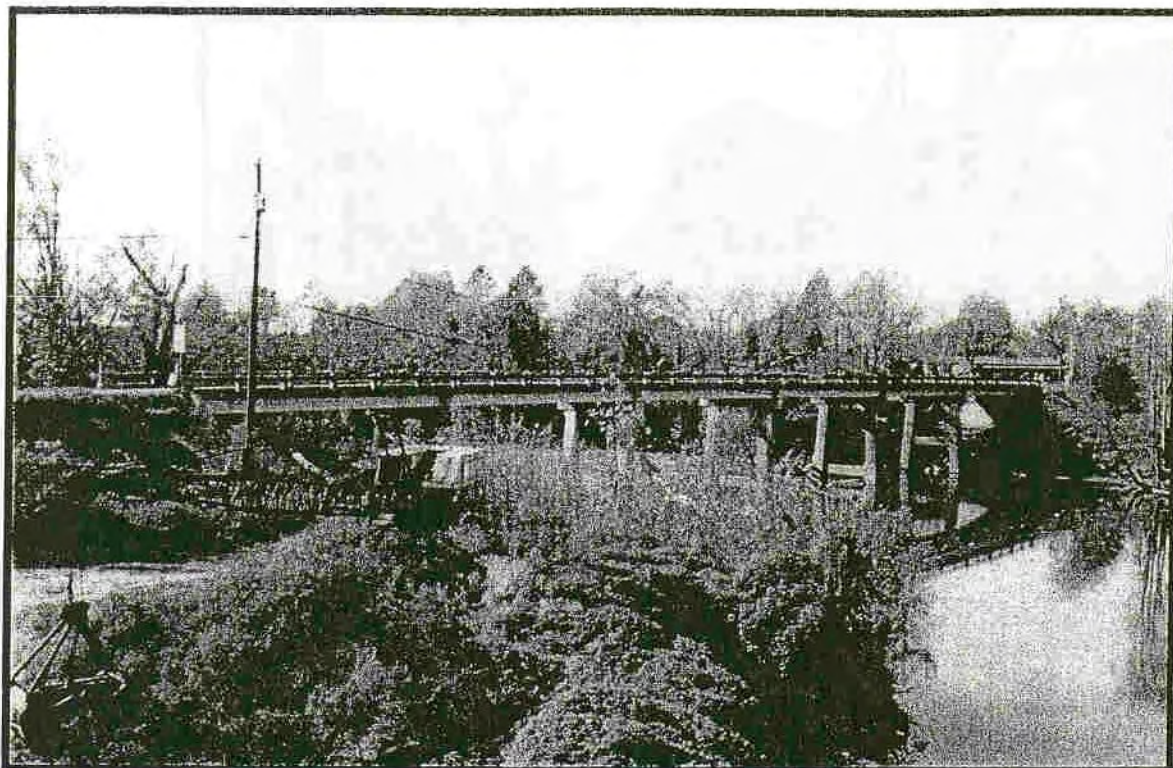


Plate 13: Looking northwest from powerhouse toward dredging crane in foreground and NC 42 bridge



Plate 14: Looking east at two frame buildings on Chatham County side of Deep River; powerhouse and NC 42 bridge at far right distance

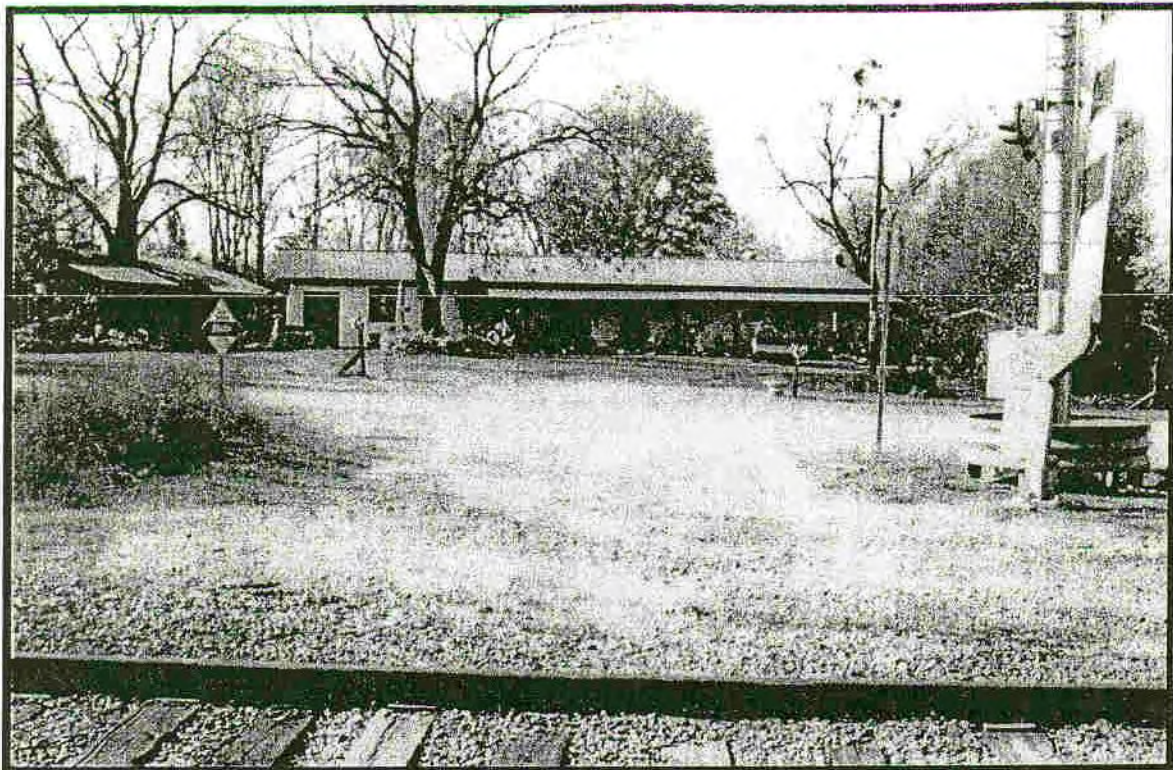


Plate 15: Looking west across Norfolk-Southern line toward mid twentieth-century, concrete-block residence

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US Department of Agriculture

1933 "Soil Map, Lee County, North Carolina." Copy hanging on wall at Lee County Register of Deeds Office, Sanford NC.

VII. APPENDIX

North Carolina State Historic Preservation Office Review Letter of September 1, 2004



North Carolina Department of Cultural Resources

State Historic Preservation Office

Peter B. Sandbeck, Administrator

Michael F. Easley, Governor
Lisbeth C. Evans, Secretary
Jeffrey J. Crow, Deputy Secretary

Office of Archives and History
Division of Historical Resources
David Brook, Director

September 1, 2004

Todd J. Tugwell
Raleigh Regulatory Field Office
US Army Corps of Engineers
6508 Falls of the Neuse Road, Suite 120
Raleigh, NC 27615

Re: Removal of Carbonton Dam and Powerhouse, Deep River Mitigation Bank
USACE Action ID # 200421183, Multi-County, ER 04-2232

Dear Mr. Tugwell:

Thank you for including our staff in the review team for this project. We have reviewed the prospectus and participated in an on-site meeting, which included a tour of the dam, powerhouse and impoundment. Based on this information, we offer the following comments.

Development of the Deep River Mitigation Bank will require the removal of the Carbonton Dam and Powerhouse, which dates to the early 1900s. It is our understanding that Restoration Systems intends to have architectural drawings made of the dam and powerhouse prior to their removal. We recommend that two copies of the drawings be made available to our office and documentary photographs of both the dam and powerhouse be taken and provided to us. Research should be undertaken to determine the age and history of the facilities, as well as their eligibility for inclusion in the National Register of Historic Places.

The resulting materials would be suitable for use in an interpretive exhibit that could be placed on-site for the public benefit. It might also be appropriate to provide copies of the research report, drawings and photographs to the local libraries or historical societies.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

	Location	Mailing Address	Telephone/Fax
ADMINISTRATION	507 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-4763/733-8653
RESTORATION	515 N. Blount Street, Raleigh NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6547/715-4801
SURVEY & PLANNING	515 N. Blount Street, Raleigh, NC	4617 Mail Service Center, Raleigh NC 27699-4617	(919)733-6545/715-4801

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

Peter Sandbeck
Deputy State Historic Preservation Officer

PS:w

cc:

George Howard
Restoration Systems, LLC
1101 Haynes Street, Suite 107
Raleigh, NC 27604

APPENDIX E
AGENCY GUIDANCE
COMPENSATORY MITIGATION RATIOS FOR DAM REMOVAL PROJECTS

Determining Appropriate Compensatory Mitigation Credit for Dam Removal Projects

Developed cooperatively by US Army Corps of Engineers (COE), Wilmington District, US Fish and Wildlife Service (Service), US Environmental Protection Agency (EPA), Region IV, NC Division of Water Quality (DWQ), and NC Wildlife Resources Commission (WRC)

Version-4.0

March 22, 2004

Although dam removal projects would be expected to result in the restoration of natural stream systems that had been previously impacted, there is no established procedure to identify when and how dam removal can be utilized as compensatory mitigation for loss of streams and stream functions due to permitted development projects. The following guidance has been prepared to address these issues and is intended to provide the regulated community of North Carolina with joint and consistent District and DWQ Guidance.

The intent of this guidance is to provide a consistent method to determine mitigation credit derived from appropriate dam removal projects across the state.

This guidance is intended to apply to the removal of larger dams. Removal of smaller dams (generally involving impoundments of 10 acres of surface area or less) may provide project specific compensatory mitigation opportunities, utilizing channel restoration that follows the typical natural channel design methods. The DWQ will use this guidance as a working policy. The Wilmington District also intends to use this guidance, but will do so only after the Corps follows its normal public interest review process, which provides for opportunity for public notice and comment. These guidelines should not be construed as affecting the applicability of the Clean Water Act (CWA) 404 (b) (1) Guidelines, found at 40 CFR Part 230, the Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army (DA) concerning the Determination of Mitigation Under the Clean Water Act Section 404(b) (1) Guidelines, or the review process outlined in DWQ's rules (15A NCAC 2H.0506).

Although the agencies believe that there is benefit in dam removal projects, use of dam removal projects as

compensatory mitigation should be used cautiously and on a limited basis until a better understanding of the benefits and consequences of dam removal projects is gained. It is anticipated that this guidance will be subject to periodic review and revision based on the review and monitoring of these projects. This guidance relates to dam removal projects only and is not intended to address other types of potential compensatory stream mitigation projects.

Debit/Credit Process

All considerations for compensatory mitigation credit for dam removal should be evaluated through the mitigation bank process involving a Mitigation Bank Review Team (MBRT) and subsequent execution of a Mitigation Banking Instrument (MBI). For proposals by the Ecosystem Enhancement Program (EEP), evaluation will be done by the EEP Program Assessment and Consistency Group (PACG) in accordance with the EEP Memorandum of Agreement (MOA). It is expected that all proposals will be adequately described in a planning document that is subject to review and approval by the appropriate agencies. Once it has been determined that a project may proceed under these guidelines, specific DA permit requirements for removal of the dam and any associated structures will be determined by the U.S. Army Corps of Engineers.

I. General criteria that will be considered when determining mitigation credit.

A. Water quality issues: Documented impairments to water quality in the impoundment that would be alleviated by removal of the dam. These include low dissolved oxygen levels, elevated temperatures (especially for trout or cool water ecosystems), elevated chlorophyll a, nutrient or toxicant levels or downstream flow interruptions. Other considerations include listing of the waterbody on the state's 303(d) list, or known, repeated violations of water quality standards, or High Quality Water (HQW) or Outstanding Resource Water (ORW) classification above or below the dam.

B. Rare, endangered and threatened aquatic species: State or Federally listed rare, endangered or threatened aquatic species that are

likely to colonize the restored stream reach. Long-term monitoring (beyond 5 years) may be needed in order to demonstrate that this criterion has been met. If monitoring fails to demonstrate suitable habitat improvements or the presence of appropriate species, as described in the approved mitigation plan, then credit amount and/or release of future credits may be adjusted. In some instances, reintroduction of species by the appropriate agencies may be done in conjunction with the project.

- C. Establishment of an appropriate aquatic community:** Removal of the dam may result in the restoration of the appropriate aquatic community. Success criteria for this category may be based upon a demonstrated improvement of water quality from "good" to "Very Good" within the monitoring period. Use of DWQ's Benthic Macroinvertebrate stream rating system or similar metrics may be used to measure this criterion. Finally, restoration of non-anadromous fish use (such as Darters) may also receive mitigation credit on a case-by-case basis. The credit would be based upon documentation of restoration of the fragmented aquatic habitat.
- D. Anadromous fish passage:** Documented re-establishment of anadromous fish use of streams upstream of the removed dam. If monitoring fails to demonstrate the presence of anadromous species, as described in the approved mitigation plan, then credit amount and/or release of future credits may be adjusted accordingly. In some, but not all cases, the applicant may be credited at a ratio of 5:1 for this criterion. However, the final decision will be determined as outlined in the Debit/Credit Process.

When reviewing projects pertaining to either endangered/threatened species and/or anadromous fish criteria, the MBRT and/or PACG will solicit the expertise of the appropriate Federal agency (USFWS) and/or the National Marine Fisheries Service (NMFS) for federally listed species and the NCWRC and/or the North Carolina Division of Marine Fisheries (NCDMF) for state listed species

to determine the viability of the restoration of endangered or threatened species and/or their habitat or anadromous fish of the project and will provide feedback with regard to the monitoring and the success criteria established by the project proponent.

II. Additional site-specific factors that may be considered during the review of dam removal projects for mitigation credits

A. Wooded buffers: Although wooded buffers are less critical for temperature control, aquatic food chain support and physical stability on larger rivers, this guidance recognizes the benefits that wooded buffers provide and encourages their establishment, where possible. More favorable mitigation credits will be supported where fully protected, wooded buffers (planted or otherwise protected) are established on both sides of the waterbody. Buffers of at least 50 feet (30 feet in the mountains) are needed for water quality benefits while buffers up to 300 feet wide are often cited as valuable for wildlife habitat and corridors or where threatened or endangered species are present. The provision of wooded buffers will be treated as a significant factor for the amount of credit available from the site as described in Table 1.

B. Human values: If the project is designed to provide direct human benefits including recreational benefits (such as parks, trails, marked canoe trails, boat access, and signage for environmental education) or scientific research conducted beyond the required monitoring of the project, then additional credit may be generated as follows:

An additional 20% bonus (with no more than 10% for each category and up to no more than the maximum credit) could be available.

The purpose of this provision is to encourage dam removal applicants to provide these additional benefits to the public from the dam removal. These activities offered by the

applicant may offset any negative local public perception associated with the dam's removal, if any. The provision of new recreational opportunities may also help offset any change in existing recreational uses such as traditional hunting or boating.

C. Calculation of compensatory mitigation for dam removal.

1. Selection of projects: Not all dam removal projects will be suitable for compensatory mitigation. If the dam removal does not meet any of the four general criteria listed above (e.g., water quality issues in the lake, endangered and threatened aquatic species, reestablishment of improved aquatic life and/or anadromous fish passage), then it is unlikely that the Federal and State agencies will support removal of the dam as compensatory mitigation.

2. Maximum Potential Credit:

With the exception of III, below, the maximum potential credit (in linear feet) that may be generated by a single project will be the length of stream restored to flowing condition measured from the dam to the upstream edge of the normal pool as indicated by the elevation of the crest of the dam for run-of-river dams or the outfall, whichever is lower in elevation. Restoration of flow in any perennial tributaries to the impoundment may also be counted. Any intermittent streams that would no longer be flooded may be credited at one-half of their length. Alternatively, a functional habitat-based calculation may be used on a case-by-case basis when the either the MBRT or the PACG agree that such a calculation is appropriate. Regulatory agencies agree that such a calculation is appropriate.

3. Credit for demonstrated downstream benefits:

A length of river immediately downstream of the dam may exhibit aquatic life and stream bank stability benefits due to the restoration of natural flows. Credit may be available for this reach on a case-by-case basis based on monitoring

and evaluation by the appropriate agency review. The pool removal credit and the downstream benefit credit combine to establish the maximum potential credit. The amount of available credit associated from removal of the impoundment and the downstream benefit credit will be determined by either the MBRT or the PACG.

4. Baseline Mitigation Credit calculations:

To establish the baseline mitigation credit, the maximum potential credit (as calculated above) will be adjusted based on the number of general criteria met and the length and width of any buffer that is protected (via conservation easement, etc.) adjacent to the restored stream.

If one criterion is met, 50% of the maximum credit will be available. In the event that 2 or 3 of the criteria are met, then the maximum credit will be 70%. Should all 4 criteria be present, then 100% of the maximum credit will be available. Furthermore, additional credit beyond 100% for buffer establishment and/or preservation will be determined on a case-by-case basis.

Table 1. Adjustment of Baseline Mitigation Credit based on the extent of protected buffers

Percent of Corridor Protected	Average Width ¹	Divide baseline credit by
100 ² to 75%	50 to 150 feet	0.75
	150 to 300 feet	0.70
74 to 50%	50 to 150 feet	0.85
	150 to 300 feet	0.80
49 to 25%	50 to 150 feet	0.95
	150 to 300 feet	0.90
24 to 0%	50 to 150 feet	1.0
	150 to 300 feet	1.0

¹ A minimum width of 30 feet can be substituted for the 50-foot threshold for projects in the mountains.

² Note that to facilitate calculation of buffer credits, the extent of the pre-project perimeter of the impoundment is equivalent to 100% of the buffer.

Only in exceptional cases, where sufficient documentation exists, will the baseline credit be increased to an amount that exceeds the maximum credit as above referenced Section C II.

It is acknowledged that it may be difficult to obtain easements (or other protective mechanisms) from all landowners along a channel. In addition, the acquisition and legal protection of buffers may take several years. Project sponsors are encouraged to propose what is likely to be obtained when the plan is submitted for review. Additional credit would be made available during the monitoring period as additional buffer is protected.

If these categories of buffer protection are not available, adjustments may be made on a case-by-case basis. These adjustments could be modified if the protection efforts target areas with special ecological functions and/or values that are identified by conservation groups such as the NC Natural Heritage Program. Areas that are already protected by conservation easements or public purchase can be utilized toward the protected buffer percentages. Additional credit may be provided on a case-by-case basis, if it is determined that the buffers need to be planted. Similarly, in river basins where DWQ administers riparian buffer protection rules that protect the wooded buffer, these credit multipliers would likely be recalculated on a buffer width after subtracting the area of the protected buffer.

5. Case-by-case process for unique situations:

The agencies acknowledge that there may be unusual and unique dam removal scenarios (such as provision of a buffer substantially larger than suggested herein or removal of an urban dam with on-site, watershed based stormwater management), which will require additional flexibility and extensive inter-agency coordination. In these cases, a special Mitigation Banking Review Team may need to be established to address these scenarios.

D. **Other factors to consider on a case-by-case basis in the Debit/Credit Process:**

1. **Wetlands:** Removal of some dams will result in a net gain of wetland acreage while others will result in a net decrease in wetland acreage. A careful evaluation of the effect that the removal of a dam would have on wetlands should be made. This would involve considering wetland functions, values, and eco-region context, as well as possible restoration of these functions prior to dam removal. Protection of any drained wetland areas through conservation easements would be helpful. Any net increase of wetland acreage may be counted as wetland mitigation credit while any net decrease could result in the need for compensatory mitigation to offset those impacts.

2. **Sediment:** The dam should be removed gradually to lessen the downstream impact of any accumulated sediment on downstream biota. Preferably the site should be dewatered and the dam gradually notched over a large portion of the monitoring period. Other methods of gradually lowering the water level will also be considered. Fish and other aquatic moratoria may provide useful guidance for the timing of dam removal. Monitoring of sediment stability in newly exposed stream banks will be necessary to determine if temporary planting will be needed to control erosion. If the sediments are believed to contain toxicants such as heavy metals and toxic organic chemicals, then testing will be needed prior to removal of the dam. If levels of toxicants are problematic, then management of these sediments (including removal and appropriate disposal) will be needed before dam removal. However, if it is determined that the release of those toxicants would be detrimental to the aquatic environment, the MBRT or PACG may exclude the project from further consideration.

3. **Monitoring:** The purpose of monitoring is to document the projected benefits of the dam removal, identify any problems encountered and propose solutions, as well as, justify the amount

of credit and the credit release schedule for the project. Monitoring of the biological, chemical and physical effects of dam removal will be required before, during, and after dam removal. Annual reports to the relevant agencies are also required. Action plans should then be developed, approved by the permitting agencies and implemented to address any problems found during the monitoring period. Monitoring should be done for five (5) years after the initiation of dam removal with one year of pre-dam removal monitoring to document baseline conditions. Monitoring should consider fish and macrobenthos monitoring, limited water chemistry monitoring, as well as stream bank stability and reestablishment of a stable channel within the now-drained impoundment. Finally, the monitoring plan must document how the project has resulted in an improvement to any of the criteria upon which the project was based. Existing data may be useful in this regard. If monitoring doesn't support the expected credits based on the criteria listed above, then the number of credits should be adjusted, as appropriate.

4. Remedial action: If problems are identified before, during or after dam removal, a remedial action plan must be developed which adequately addresses these issues. For instance, if the newly exposed stream banks are experiencing erosion, then a temporary seeding of a non-invasive annual plant may be needed until the native vegetation can stabilize these sites. Similarly, if downcutting occurs in the tributaries to the dam, measures to stabilize these streams may be necessary. Monitoring programs must be designed to identify these (and other) potential problems so they can be addressed adequately. If active measures are needed, then the use of natural channel design is recommended.

5. Long-term protection of the dam site: The dam site will need to be protected with a conservation easement to ensure that construction of a new dam will not occur. The extent of long-term protection of the remainder of the restored

stream corridor will determine, in part, the mitigation credits as outlined in the buffer protection portions of this guidance.

6. Rare, threatened and endangered species:

Dam removal in habitat known to support state or Federally listed rare, threatened or endangered species must be coordinated with the appropriate state and Federal agencies to ensure that upstream and downstream habitat is not adversely affected.

7. Exotic species: The upstream habitat should be thoroughly surveyed to ensure that exotic flora and fauna are not released downstream and that exotic fauna do not invade the area of the drained impoundment.

8. Downstream flow alteration: Following the removal of a dam, possible downstream flow alterations should be examined. Possible alterations could include changes in the regulated floodplain, alterations in the downstream channel morphology and low flow implications for wastewater dischargers.

9. Existing physical constraints: Existing features such as roads parallel to the channel, utilities or structures need to be considered with respect to the practical amount of buffer that can be restored or protected. If some of these features cannot be moved, then the maximum of possible buffer credit should be adjusted accordingly.

10. Downstream flooding: In most situations, it is likely that dam removal will have a negligible effect on downstream flooding. However, if this factor is of concern to the public or the agencies, then a modeling effort may be needed to evaluate this factor.

11. Water Supply protection: It is unlikely that dams will be approved for removal as compensatory mitigation if they are being actively used as water supplies. In any event, project proponents should check the

classification of the water to be certain that it is not being used as a water supply.

E. Credit Release Schedule:

For dam removal projects when credit release schedules are appropriate (i.e., mitigation banks), the agencies propose to follow the recently agreed upon, joint federal and state credit release schedule for stream mitigation as outlined below. This schedule has been modified slightly to reflect the definitional differences between more typical stream mitigation and dam removal since some provisions for stream mitigation do not apply to dam removal projects.

Initial crediting: 15%

Execution of MBI (where appropriate)
Approval of final mitigation plan
Delivery of financial assurances
Recordation of preservation mechanism

Construction release (initiation of gradual dewatering of the lake): 10%

Upon initiation of initial physical and biological monitoring (25% cumulative)

After year 1: 10% if a bankfull event has not occurred; 20% if bankfull event has occurred, if channel is stable and other success criteria (if any) are met (cumulative 35% and 45%). This assumes that the project is satisfying the criteria upon which it was based.

After year 2: 10% if first bankfull event occurred in previous year or a bankfull event does not occur in this year; 20% if bankfull event has occurred and if the restored stream channel is stable and other success criteria (if any) are met (cumulative 45% and 55%). This assumes that the project continues to satisfy the criteria upon which it was based.

After year 3: 10% or 20% (same as year 2) (cumulative 55% to 65%). This assumes that the project continues to satisfy the criteria upon which it was based.

After year 4: 10% or 20% (same as year 2 and year 3), (cumulative 65% to 75%). This assumes that the project continues to satisfy the criteria upon which it was based.

After year 5: 25% if at least one bankfull event has occurred in the previous year(s). 35% if the first bankfull event occurs in year 5 and the agencies make a determination of success as defined in the mitigation plan. This assumes that the project continues to satisfy the criteria upon which it was based.

The above release schedule is to be utilized as a guideline, but can be modified by either the MBRT in the event that monitoring reveals that identified success criteria are being met prior to the outlined release schedule.

APPENDIX F

- **DEED OF ASSIGNMENT**
- **LETTER OF INTENT FROM TRIANGLE LAND CONSERVANCY**

COPY

FILED
CHATHAM COUNTY
REBA G. THOMAS
REGISTER OF DEEDS

The foregoing certificate(s) of
BRENDA H. COBB

notary/notaries public
is/are certified to be correct.

Caci Langley
Assistant - Register of Deeds

FILED Apr 29, 2005
AT 11:19:59 am
BOOK 01174
START PAGE 1098
END PAGE 1104
INSTRUMENT # 05460

BOOK 1174 PAGE 1098

STATE OF NORTH CAROLINA

CONSERVATION EASEMENT

CHATHAM AND LEE COUNTIES

Prepared by and return to: William P. Aycock, II, Esquire
P. O. Box 21847, Greensboro, NC 27420

THIS CONSERVATION EASEMENT DEED, made this 28th day of April, 2005, by and between MICHAEL R. ALLEN and spouse, PATRICIA R. ALLEN, Grantor, and RESTORATION SYSTEMS, LLC, a North Carolina limited liability company, Grantee, whose mailing address is 1101 Haynes Street, Suite 107, Raleigh, North Carolina, 27604. The designations Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Ecosystem Enhancement Program within the Department of Environment and Natural Resources for the purposes of funding, acquiring, maintaining, restoring, enhancing, and creating riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District have entered into a Memorandum of Agreement, (MOA) duly executed by all parties on July 22, 2003. This MOA recognizes that the Ecosystem Enhancement Program is to provide for compensatory mitigation by effective protection of the land and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Gulf Township, Chatham County, and Pocket Township, Lee County, North Carolina (the "Grantor's Property"), and being more particularly described in Deed Book 1005 at Page 727 of the Chatham County Registry, and Deed Book 839 at Page 036 of the Lee County Registry, North Carolina; and

WHEREAS, the restoration, enhancement, creation, and preservation of Grantor's Property is a condition of the funding provided by the N.C. Ecosystem Enhancement Program. Grantor and Grantee agree that third-party rights of access, monitoring, enforcement and completion of any project encumbered by this conservation easement shall be held by the N.C. Ecosystem Enhancement Program (to include any

successor State agencies), and that these rights are in addition to, and do not limit, the rights of enforcement under this conservation easement; and

WHEREAS, upon receipt of the appropriate permits, Grantor intends to remove the Carbondon Dam which is located across the portion of the Deep River on the Grantor's Property; and

WHEREAS, Grantor is willing to grant a Conservation Easement over the herein described areas of the Grantor's Property, thereby restricting and limiting the use of the included and described areas of the Grantor's Property to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept such easement. This Conservation Easement shall be for the protection, restoration and benefit of the waters of the Deep River and certain of its tributaries.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement of the nature and character and to the extent hereinafter set forth, over a described area of the Grantor's Property, referred to hereafter as the "**Easement Area**," for the perpetual protection of the Easement Area, and being more particularly described as follows:

SEE EXHIBIT 'A' ATTACHED HERETO AND INCORPORATED HEREIN BY REFERENCE.

Grantor and Grantee acknowledge the restoration, enhancement, creation, and preservation of the Easement Area is a condition of any funding as provided by the Ecosystem Enhancement Program. Grantor and Grantee further agree that third-party rights of access, monitoring, enforcement and completion of any Easement Area encumbered by this Conservation Easement shall be held by the Ecosystem Enhancement Program (to include any successor State agencies), and that these rights are in addition to, and do not limit, the rights of enforcement under this Conservation Easement.

The purposes of this Conservation Easement are to maintain, restore, enhance, create and preserve riparian resources in the Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Easement Area a condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

This Conservation Easement shall be perpetual. It is an easement in gross, runs with the land, and is enforceable by Grantee against Grantor, their personal representatives, heirs, successors, and assigns, lessees, agents, and licensees.

II. RESTRICTED ACTIVITIES

The Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. The following specific uses are prohibited or restricted, as indicated:

No dam or similar structure of any type shall be constructed over, on or across the portion of the Deep River located within the Easement Area nor shall there be any alteration, modification or removal of any in-stream structures or other improvements that may be placed or located in, on or adjacent to the portion of the Deep River within the Easement Area in connection with the restoration, enhancement, creation and/or preservation of stream and riparian mitigation within the Easement Area.

The Grantee, and authorized representatives of the Grantee, shall have the right to enter the Easement Area and shall have the right of reasonable ingress and egress to the Easement Area over the Grantor's Property, at all reasonable times to undertake any activities to restore, manage, maintain, enhance, and monitor the riparian resources of the Easement Area. These activities include utilization of heavy equipment to remove any dam or in-stream structures installed in violation of the above-described restriction and to direct in-stream, above ground, and subterranean water flow. In addition, the Grantee, and authorized representatives of the Grantee, shall have the right to enter the Easement Area and shall have the right of reasonable ingress and egress to the Easement Area over the Grantor's Property, at all reasonable times for the purpose of inspecting said property to determine if the Grantor is complying with the terms, conditions, restrictions, and purposes of this Conservation Easement.

III. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Easement Area that is inconsistent with the purposes of this Easement and to require the restoration of such areas or features of the Easement Area that may have been damaged by such activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, their successors or assigns, that comes to the attention of the Grantee, the Grantee shall, except as provided below, notify the Grantor, their successors or assigns in writing of such breach. The Grantor shall have ninety (90) days after receipt of such notice to correct the conditions constituting such breach. If the breach remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by appropriate legal proceedings including damages, injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Easement Area; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief if the breach of the term of this Conservation Easement is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement. The Grantor and Grantee acknowledge that under such circumstances damage to the Grantee would be irreparable and remedies at law will be inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Easement Area over the Grantor's Property at reasonable times for the purpose of inspection to determine whether the Grantor, their successors or assigns are complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor, their successors or assigns, for any injury or change in the Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life, damage to property or harm to the Easement Area resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, their successors or assigns, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be deemed or construed to be a waiver by Grantee. No delay or omission by Grantee in exercise of any right or remedy shall impair such right or remedy or be construed as a waiver.

IV. MISCELLANEOUS

A. This Conservation Easement shall be construed to promote the purposes of N.C. Gen Stat. § 143-214.8 et seq., the Ecosystem Enhancement Program.

B. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown above or to other address(es) as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Grantor's Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees to make any subsequent lease, deed, or other legal instrument by which any interest in the Grantor's Property is conveyed subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall be binding upon the Grantee, its successors and assigns and shall survive any merger of the fee and easement interests in the Easement Area or any portion thereof.

F. This Conservation Easement may be amended, but only in a writing signed by all parties hereto, and provided such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement.

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

V. QUIET ENJOYMENT

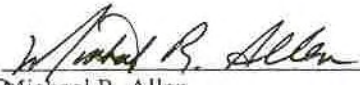
Except as expressly set forth herein, Grantor reserves all remaining rights accruing from ownership of the Grantor's Property, including the right to engage in or permit or invite others to engage in only those uses of the Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Easement Area, and the right of quiet enjoyment of the Easement Area.

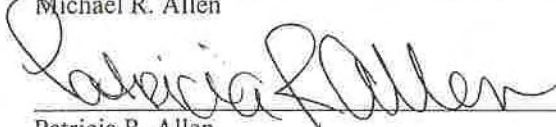
TO HAVE AND TO HOLD the said rights and easements perpetually unto Grantee for the aforesaid purposes.

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same are free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

TO HAVE AND TO HOLD the said rights and easements perpetually unto Grantee for the aforesaid purposes.

IN TESTIMONY WHEREOF, the Grantor has caused this Deed of Conservation Easement to be duly executed, the day and year first above written.


_____(SEAL)
Michael R. Allen


_____(SEAL)
Patricia R. Allen

STATE OF NORTH CAROLINA

COUNTY OF Alamance

I, Brenda H Cobb, a Notary Public, do hereby certify that Michael R. Allen personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

WITNESS my hand and official seal this the 28th day of April, 2005

Brenda H Cobb
Notary Public

My commission expires:

September 5, 2009



STATE OF NORTH CAROLINA

COUNTY OF Alamance

I, Brenda H Cobb, a Notary Public, do hereby certify that Patricia R. Allen personally appeared before me this day and acknowledged the due execution of the foregoing instrument.

WITNESS my hand and official seal this the 28th day of April, 2005

Brenda H Cobb
Notary Public

My commission expires:

September 5, 2009



EXHIBIT "A"

All that property located in Pocket Township, Lee County, and Gulf Township, Chatham County, North Carolina, and more particularly described as follows:

BEGINNING at an existing iron pin in the northeast right-of-way of N.C. Hwy. 42, a corner with Kelly (see Deed Book 459, Page 538, Lee County Registry), which iron pin is located the following three calls from NCGS Marker "Junk" (N=645,169.7923'; E=1,910,651.0704'): South 85° 26' 49" West 13884.12 feet to a pump pipe set (NC Grid Coordinate N=644,067.6403'; E=1,896,810.7652'); South 33° 30' 04" West 42.26 feet to a pump pipe set; South 33° 30' 04" West 170.73 feet to the POINT AND PLACE OF BEGINNING; thence from said Beginning Point across N.C. Hwy. 42 to an iron stake set inside the southwestern right-of-way of N.C. Hwy. 42, South 33° 30' 04" West 61.01 feet; thence parallel, but inside the right-of-way of N.C. Hwy. 42, North 36° 19' 56" West 381.00 feet to a mag nail set in a concrete bridge abutment, a corner with Blankley (see Deed Book 745, Page 501, Lee County Registry); thence with Blankley's line, South 72° 30' 04" West 51.01 feet to a non monumented corner; thence continuing with Blankley's line, North 62° 49' 56" West 40.88 feet to a pump pipe set; thence North 62° 49' 56" West 12.53 feet to a non monumented corner on the southeastern bank of the Deep River; thence crossing the Deep River, North 62° 49' 56" West 184.59 feet to a non monumented corner on the northwest bank of the Deep River; thence North 32° 19' 56" West 10.66 feet to an iron stake set; thence North 32° 19' 56" West 46.34 feet to a non monumented corner which lies 2.13 feet± within the Norfolk Southern Railroad Right-Of-Way; thence North 49° 40' 04" East 28.71 feet to an iron stake set; thence North 49° 40' 04" East 78.29 feet to a non monumented corner; thence North 73° 51' 52" East 37.17 feet to an iron stake set; thence North 73° 51' 52" East 32.29 feet to an existing iron pin bent located under the N.C. Hwy. 42 bridge approximately in the center line of N.C. Hwy. 42; thence North 74° 40' 57" East 354.79 feet to an existing iron pipe in Kelly's line (see Deed book 393, Page 610, Chatham County Registry); thence North 50° 41' 42" East 131.55 feet to an iron stake set; thence South 68° 29' 54" East 107.13 feet to an existing concrete monument in the line of Carolina Power & Light Company (see Deed Book 519, Page 199, Chatham County Registry); thence South 20° 44' 00" West 131.87 feet to a 3/8" bolt set in a rock outcrop adjacent to an existing concrete dam; thence crossing the Deep River, South 03° 59' 58" East 323.75 feet to a pump pipe set; thence South 33° 30' 04" West 42.26 feet to a pump pipe set; thence continuing South 33° 30' 04" West 170.73 feet to an existing iron pipe in the northeastern right-of-way of N.C. Hwy. 42, the POINT AND PLACE OF BEGINNING and containing 5.50 acres, including the right-of-way of N.C. Hwy. 42 and as shown on a survey for Restoration Systems, LLC, "Carbonton Hydroelectric Dam," recorded in P. C. 2005, Slide 3, Lee County Registry, and P.C. 2005, Slide 10, Chatham County Registry.



February 1, 2005

George Howard
Restoration Systems, Inc.
1101 Haynes Street, Suite 107
Raleigh, NC 27604

RE: Carbonton Dam Donation-Letter of Intent

Dear George,

The intent of this letter is to declare the desire of Triangle Land Conservancy (TLC) to accept fee simple donation of 5.5 acres that Restoration Systems has under option at the Carbonton Dam on the Deep River as shown on Exhibit A pending final approval by TLC's Board of Directors in February 2005.

TLC agrees that it would maintain this property as a public access to the Deep River and understands that the property would be conveyed subject to a deed restriction prohibiting dam reconstruction or impoundment of the Deep River in perpetuity.

I respectfully submit for consideration the following conditions that TLC would require Restoration Systems to meet as part of this fee simple donation:

- The property be fully restored and in the monitoring phase before closing.
- Cash payment of \$140,000 at closing for the perpetual stewardship of the property.
- Payment to TLC to contract for an independent Phase 1 environmental audit of the property and associated river location to TLC's scope and satisfaction. Given its findings, more extensive examinations may be necessary.
- TLC's involvement in site planning to ensure that the design fits with other TLC properties managed for recreation. TLC reserves sole discretion to accept conveyance of the property after approval of site design.
- Site design addresses at a minimum the following considerations:
 - Elimination of the dam and powerhouse.
 - Access to and from the site designed and constructed with long-term maintenance and safety as chief design considerations.
 - Adequate and safe parking.
 - Site design accommodates regular flood events and long-term maintenance.
 - Safe canoe portage and access to the river.
- A reasonable number of replacement site amenities, including reproductions of signage and other potential targets for vandalism, accompany transfer of the property.

In consideration of the foregoing, we covenant and agree that this letter expresses our intent and creates a non-binding obligation by and between Triangle Land Conservancy and Restoration Systems, Inc. for a period not to exceed twelve (12) months from the date set out below.

Signature Kevin Brice Date February 1 2005
Kevin Brice, Executive Director

Printed Name _____

Signature George Howard Date Feb 1 2005
George Howard, Restoration Systems, Inc.

Printed Name _____

COPY

FILED
LEE COUNTY
MOLLIE A. MCINNIS
REGISTER OF DEEDS

FILED Apr 29, 2005
AT 12:02:38 pm
BOOK 00969
START PAGE 0734
END PAGE 0735
INSTRUMENT # 04007

BK:00969 PG:0734

Prepared by and return to: William P. Aycock II, Esquire
Schell Bray Aycock Abel & Livingston P.L.L.C.
P. O. Box 21847
Greensboro, North Carolina 27420

STATE OF NORTH CAROLINA

ASSIGNMENT

COUNTY OF LEE

THIS DEED OF ASSIGNMENT, made this 28th day of April, 2005, by and between **RESTORATION SYSTEMS, LLC**, a North Carolina limited liability company, whose mailing address is 1101 Haynes Street, Suite 107, Raleigh, North Carolina 27604, ("RS") and **NORTH CAROLINA WILDLIFE HABITAT FOUNDATION**, a North Carolina non-profit corporation, whose mailing address is P. O. Box 29187, Greensboro, North Carolina 27429-9187, ("NCWHF").

WITNESSETH:

THAT WHEREAS, Michael R. Allen and wife, Patricia R. Allen, heretofore executed and delivered to RS a Conservation Easement upon certain lands therein described, dated April 28, 2005, and recorded in Book 969, Page 727, in the office of the Register of Deeds of Lee County, North Carolina; and

WHEREAS, RS has agreed to transfer and assign said Conservation Easement to NCWHF.

NOW, THEREFORE, RS, as aforesaid, in consideration of One Dollar (\$1.00), has assigned, bargained and sold and does hereby assign, bargain, sell and convey unto NCWHF, its successors and assigns, all right, title and interest of RS in and to said Conservation Easement and in and to the lands therein described and conveyed, together with all rights and powers therein given to RS. Said Conservation Easement is incorporated herein by reference as if set out herein in full.

TO HAVE AND TO HOLD the same to it, NCWHF, its successors and assigns, in the same manner and to the same extent as RS now holds the same.

IN TESTIMONY WHEREOF, RS has caused this instrument to be executed on its behalf by its Manager, who has hereunto set his hand and seal the day and year first above written.

RESTORATION SYSTEMS, LLC,
a North Carolina limited liability company

By: GA Howard (SEAL)
Name: George A. Howard
Title: Manager

STATE OF NORTH CAROLINA

COUNTY OF WAKE

I, Charlotte Robinson, a Notary Public, do hereby certify that George A. Howard, a Manager of RESTORATION SYSTEMS, LLC, a North Carolina limited liability company, personally appeared before me this day and acknowledged the due execution and sealing of the foregoing instrument as Manager on behalf of and as the act of the company referred to in this acknowledgment.

WITNESS my hand and official seal this the 28th day of April, 2005.

Charlotte Robinson
Notary Public

My commission expires:

5-17-09



NORTH CAROLINA - LEE COUNTY

The foregoing certificate(s) of

CHARLOTTE ROBINSON

Notary Public is (are) certified to be correct.
Duly registered this date and hour shown
on the first page hereof.

MOLLIE A. MCINNIS
Register of Deeds

By: Jenny D. Meadows
Agent / Deputy

APPENDIX G
WRITTEN EVALUATION OF CARBONTON DAM REMOVAL FOR COMPENSATORY
MITIGATION
NCDWQ AND USFWS



Michael F. Easley, Governor

William G. Ross Jr., Secretary
North Carolina Department of Environment and Natural Resources

Alan W. Klimek, P.E., Director
Division of Water Quality

April 15, 2003

George A. Howard
Restoration Systems L.L.C.
1101 Haynes Street
Suite 203
Raleigh, North Carolina 27604

Dear Mr. Howard:

RE: Carbonton dam removal as compensatory stream mitigation
Moore County

Based on our field visit on March 26 and subsequent discussions with John Thomas with the Corps of Engineers, DWQ supports the removal of the Carbonton dam and believes that this project can provide suitable compensatory stream mitigation for a variety of projects in the area. Our position assumes that the US Fish and Wildlife Service have no objections to the dam's removal in relation to the Cape Fear Shiner population downstream and pending the planned visit with the Corps of Engineers and US Fish and Wildlife Service staff at the end of this month.

We do have the following concerns that we believe can be addressed through monitoring before and after dam removal and will be glad to work with you on a detailed monitoring plan if the project moves forward:

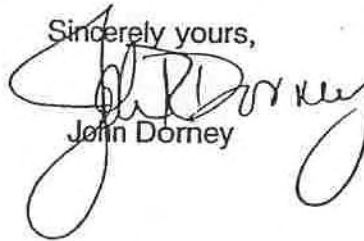
1. Seasonal issues with respect to the Cape Fear Shiner – We believe that removal of the dam would be best in the fall with respect to possible downstream impacts on the species and other aquatic life but will be glad to discuss the timing of the removal with you and other agencies.
2. Sediment – There are several issues with respect to sediment that will need to be addressed as outlined below.
 - a. Sampling for contaminants – The sediment in the lake will need to be sampled for contaminants (especially heavy metals). If levels of metals are problematic, then some sediment removal from the lake may be needed before the dam is removed to prevent the flushing of these metals downstream.
 - b. Management of sediment release on downstream aquatic life at dam removal – It will be necessary to get some idea of the amount of sediment that will be released during dam removal and whether it will need to be removed (perhaps with a temporary instream structure immediately downstream of the dam with associated sediment pumping and removal) before the dam is breached.
3. Aquatic life recovery – Monitoring of the aquatic life (fish and macrobenthos) above and below the present dam before dam removal as well as the recovery of these organisms in the reestablished river channel will be needed to demonstrate the effectiveness of the dam removal as well as identify any adverse impacts that will need to be addressed.
4. Stream stability – We are concerned that some of the tributaries above the dam may experience excessive headcutting and therefore introduce excessive sediment into the river. A proposed monitoring plan for these tributaries and their streambank stability will be needed. Any headcutting will likely be fairly rapid so monitoring should be designed accordingly. We are also concerned about river bank stability once the dam is removed and before vegetation gets established to stabilize these banks. The timing of dam removal may also influence this concern as would plans for temporary cover on exposed banks.



5. Water Quality effects of the dam – As we discussed, please contact Ms. Dianne Reid in DWQ's Environmental Sciences Branch for background data on the water quality of the Deep River behind the dam. We believe that these data will provide strong support for removal of the dam.
6. Mitigation credits – As we discussed briefly, the Corps of Engineers and DWQ will need to work with you to develop a credit schedule. Two pertinent factors in those credits will probably be the protection of buffers along the Deep River and whether the Cape Fear Shiner reoccupies the Deep River once the dam is removed.

Again, DWQ supports the concept of the removal of the Carbonton dam and believes that it will provided compensatory stream mitigation credits in accordance with our flexible stream mitigation policy dated May 2000. We look forward to working with you on this important project. I can be reached at 919-733-9646 if you have any questions.

Sincerely yours,



John Dorney

Cc: Steve Mitchell
Dave Penrose
Dianne Reid
Bryn Tracy
John Thomas, Raleigh Field Office US Army Corps of Engineers
Mike Wicker, US Fish and Wildlife Service
File copy
Central Files



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Raleigh Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

May 8, 2003

George A. Howard
Restoration Systems L.L.C.
1101 Haynes Street
Suite 203
Raleigh, North Carolina 27604

Dear Mr. Howard:

The removal of Carbonton Dam on the Deep River near Carbonton, North Carolina would restore natural hydrology to the Deep River for approximately ten and one quarter miles and consequently make this habitat suitable for the native flowing stream aquatic community including the federally-listed endangered Cape Fear shiner *Notropis mekistocholas*. The removal of the dam would also remove a barrier that prevents upstream and downstream populations of Cape Fear shiner from being connected. The Cape Fear shiner is known from four small populations in the Cape Fear drainage in Randolph, Moore, Lee, Harnett and Chatham Counties. Dam construction in the Cape Fear system has probably had the most serious impact on the species by inundating the species' rocky riverine habitat. Changes in flow regulation at existing hydroelectric facilities could further threaten the species. The removal of Carbonton Dam will restore a very significant amount of inundated habitat and will also remove Carbonton Dam's role in modifying stream flow. The removal of Carbonton Dam would be very beneficial for the natural stream aquatic community including the Cape Fear shiner. I look forward to the removal of this dam and would like to work closely with the dam removal effort to insure the dam is removed in a manner that provides the greatest environmental benefit.

Sincerely,

Mike Wicker

APPENDIX H

**SELECTED PHOTOGRAPHS OF THE
DEEP RIVER- CARBONTON DAM RESTORATION SITE**



View across ogee and buttressed spillways of the Carbonton Dam. Perspective is from north bank looking south.



Aerial view of Site impoundment



Aerial view of Carbonton Dam



Bridge crossing over lotic reference reach of the Deep River



Aerial view of lotic reference reach of the Deep River



View of Site impoundment from a bridge crossing



Debris pile accumulated within the Site impoundment that has accumulated against bridge pilings