COMPENSATORY WETLAND MITIGATION PLAN

FOR

MARTIN LUTHER KING, JR. PARKWAY

EXTENSION BETWEEN COOK ROAD AND HOPE VALLEY ROAD

DURHAM COUNTY, NORTH CAROLINA

Prepared for:

City of Durham
Durham County, North Carolina

To fulfill requirements associated with:

DWQ Project No. 991177
Action ID Nos. 200020073 and 200020074

Prepared by:

CZR Incorporated
4709 College Acres Drive, Suite 2
Wilmington, North Carolina 28403
910-392-9253
czrwilm@aol.com

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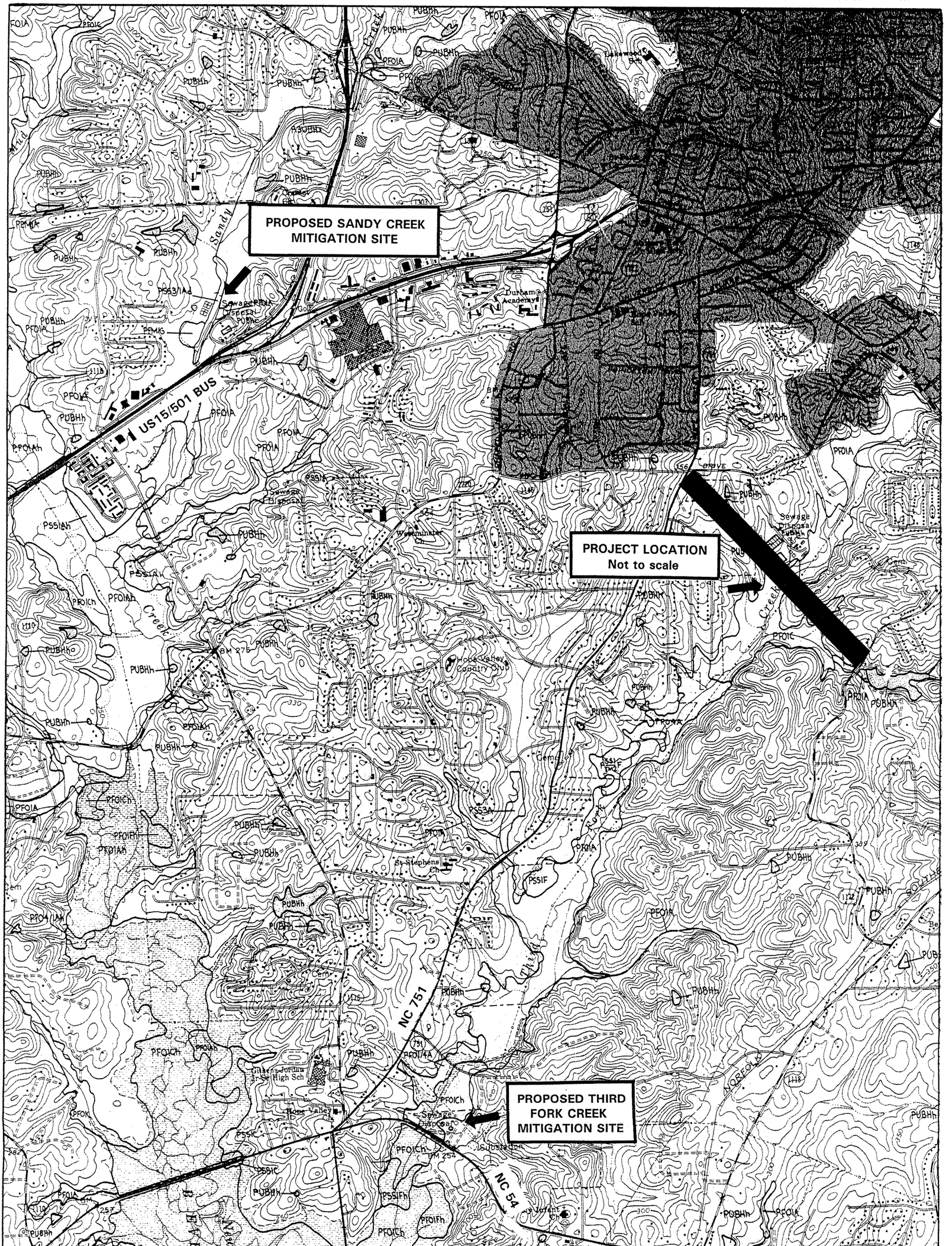
I. INTRODUCTION

Two mitigation sites are proposed to serve as compensatory in-kind, on-site, up-front, and concurrent mitigation to offset impacts to Section 404 jurisdictional areas associated with the extension of the Martin Luther King, Jr. (MLK) Parkway between Cook Road and Hope Valley Road, Durham County, North Carolina (Figure 1). Impacts from the MLK Parkway project will include fill of 1.65 acres of jurisdictional wetland and 0.08 acre of non-wetland jurisdictional waters, totaling 1.73 acres near Third Fork Creek. Seasonally inundated, palustrine deciduous broad leaved forest comprises 1.11 of the impacted acreage and man-dominated shrub/scrub comprises the remaining 0.62 acre. The channel and much of the adjacent floodplain of Third Fork Creek will be bridged. The bridge over Third Fork Creek will shade 0.10-acre of non-wetland jurisdictional waters and 0.28 acre of a beaver impoundment. Jurisdictional areas avoided within the corridor total 1.48 acres. This plan fulfills part of the requirements of the Section 404 Nationwide Permits 14 and 26 (Action ID Nos. 200020073 and 200020074, respectively) and the Section 401 certification (DWQ Project No. 991177). This mitigation plan was generated in accordance with the US Army Corps of Engineers (USACOE) Compensatory Mitigation Planning checklist dated 6 June 1999.

Development of two proposed mitigation sites will result in at least 3.46 acres of wetland restoration (2:1 ratio). One of the two sites is located at an abandoned wastewater facility tract on Third Fork Creek owned by the City of Durham (City). Approximately 1.74 acres are available for wetland restoration and 0.41 acres for wetland creation at this 12.5-acre site (Figure 2). The remaining 10.5 acres of the Third Fork site will also be set aside in perpetuity as preservation acreage and managed accordingly. Negotiations have begun with the USACOE to manage this area as preservation and their decision is pending. The Third Fork Creek mitigation site property is adjacent to USACOE-owned flowage easements and North Carolina State Game Lands in the floodplain of Third Fork Creek. The second proposed site is property owned by the the City at the abandoned wastewater facility on Sandy Creek. It is expected to provide approximately 2.07 additional acres of wetland restoration and 2.29 acres for wetland creation (Figure 3).

Any successful restoration or creation acreage above the required acreage could be set aside as a mitigation bank for the City of Durham. Should there be a deficit of successfully restored wetland acreage at the end of the monitoring period, this deficit will be made up either by 1) remediation of the unsuccessful portion of the site if feasible, 2) participation in the North Carolina Wetland Restoration Program (WRP) if acreage is available, 3) development of an alternative restoration site agreed upon by all reviewing agencies, and/or 4) enhancement and preservation of the beaver meadow on the east side of the Sandy Creek property.



MARTIN LUTHER KING, JR. PARKWAY EXTENSION
LOCATIONS OF PROJECT AND MITIGATION SITES

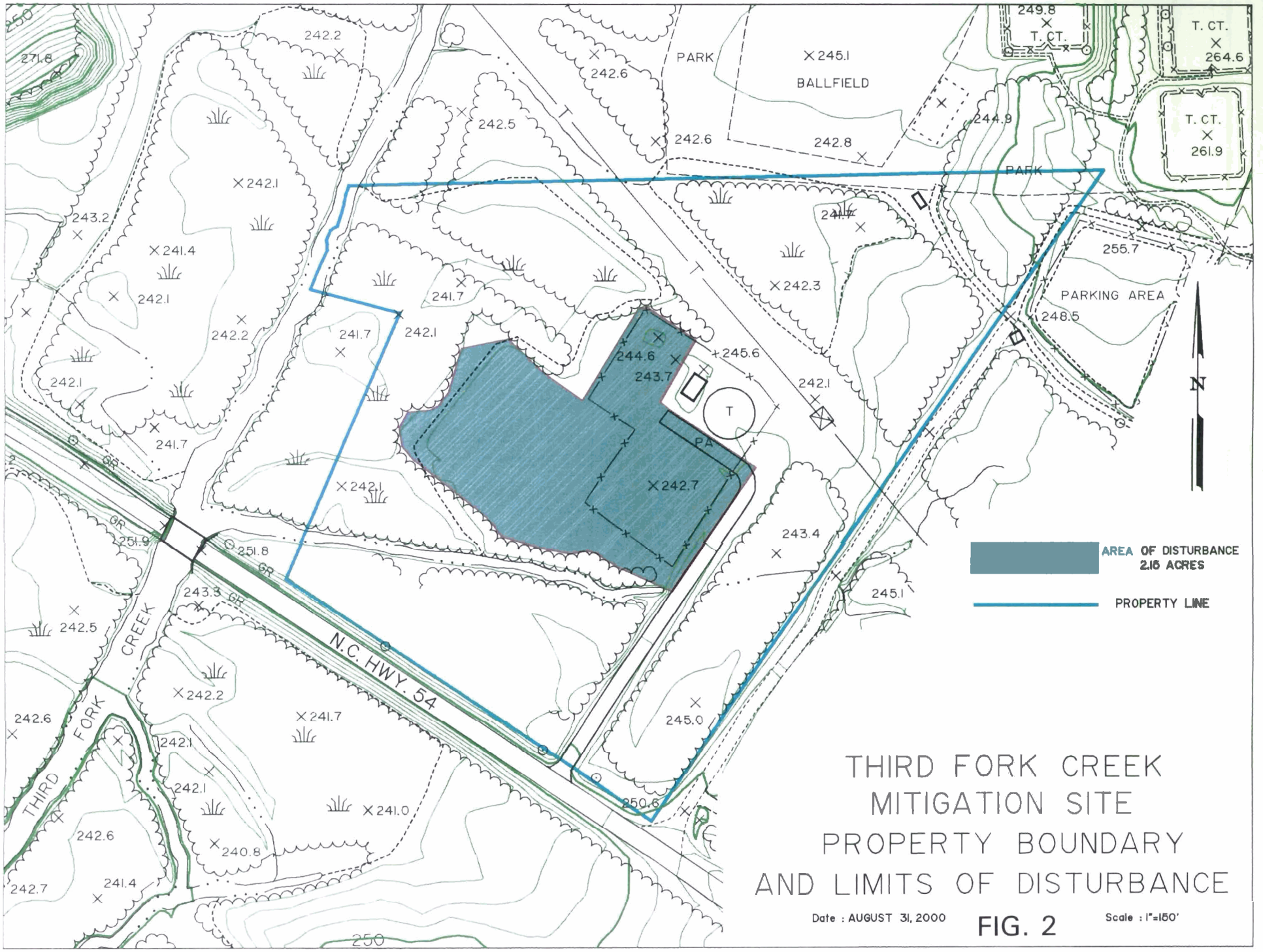
Client: City of Durham-Engineering	SOURCE: National Wetlands Inventory-USGS Quadrangle Southwest Durham, NC	Scale: 1:24,000
DATE: 08/29/00		DRAWN BY: jkb

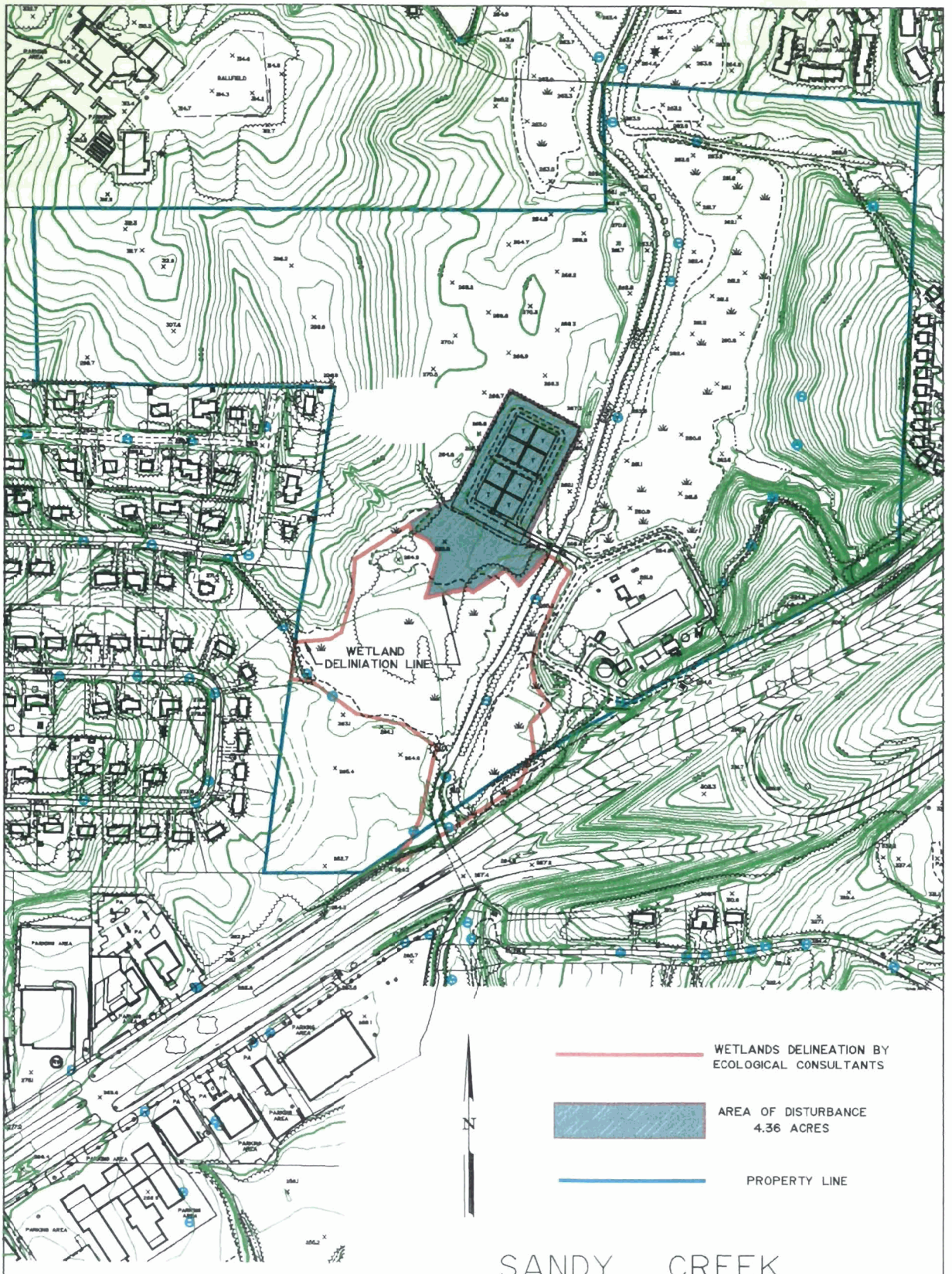
CZR INCORPORATED
ENVIRONMENTAL CONSULTANTS

4709 COLLEGE ACRES DRIVE, SUITE 2
WILMINGTON, NORTH CAROLINA 28403
TEL 910/392-9253
FAX 910/392-9139
czrwilm@aol.com

CP# 1753

FIGURE 1


PARK
BALLFIELD
PARK
PARKING AREA
AREA OF DISTURBANCE
2.16 ACRES
PROPERTY LINE
N
N.C. HWY. 54
THIRD FORK CREEK
THIRD FORK CREEK
MITIGATION SITE
PROPERTY BOUNDARY
AND LIMITS OF DISTURBANCE
Date : AUGUST 31, 2000
FIG. 2
Scale : 1"=150'



SANDY CREEK MITIGATION SITE PROPERTY BOUNDARY AND LIMITS OF DISTURBANCE

FIG. 3

Date : AUGUST 31, 2000

SCALE 1" = 450'

II. SELECTION OF MITIGATION SITES

A search for potential mitigation sites was conducted by CZR and involved looking for disturbed or former wetland sites in close proximity and within a similar topographic setting to the impacted project area. Potential mitigation sites were evaluated with regard to landscape position, level of disturbance, area available for wetland restoration, likelihood and ease of successful restoration, potential of the site to provide important wetland functions, ease of acquisition, and construction costs.

Five other candidate sites were visited and investigated as potential mitigation areas. These sites included portions of University Park, an old sewage disposal area on Little Lick Creek, property in the vicinity of the New Hope substation, an abandoned disposal area south of the proposed MLK Parkway crossing of Third Fork Creek, and property north of the City of Durham's Maintenance Facilities Complex. These sites were not chosen primarily due to the expected difficulty in restoration of successful wetland hydrology. Mitigation potential for some of these sites was discussed on-site with USACOE and NCDWQ personnel and it was agreed that the Third Fork Creek site was a suitable candidate for proposed restoration.

Agency personnel also indicated that restoration deficiencies, should they occur, could be fulfilled through participation in the WRP. In July 2000, when it became known that WRP had no available acreage to include in the mitigation plan, additional sites were investigated for potential preservation at the suggestion of the USACOE. These sites included City owned floodplain acreage that contained minor drains and/or wetland. This search for preservation acreage revealed the Sandy Creek site. Further discussion with USACOE and NCDWQ personnel resulted in the inclusion of restoration of portions of the Sandy Creek site as additional proposed 2:1 mitigation acreage.

III. DESCRIPTION OF PROPOSED MITIGATION SITES

A. THIRD FORK CREEK SITE

This proposed mitigation site is located in Durham County, N.C. approximately 2,500 feet east of the intersection of N.C. 54 and N.C. 751. The site is approximately 400 feet northeast of the N.C. 54 bridge crossing of Third Fork Creek. A sewer line and transmission tower line corridor occur just north of the mitigation area. The area is located on the USGS Southwest Durham 7.5 minute topographic quadrangle and the Southwest Durham National Wetlands Inventory Map (NWI) at latitude 35°55'10" North and longitude 78°57'12" West (Figure 1). The soils are identified in the Durham County Soil Survey as Chewacla and Wehadkee (Sheet No. 34). The NWI map identifies the section of Third Fork Creek at the mitigation site as PFO1Ch, which in the Cowardin classification system is palustrine, forested wetland with deciduous broad-leaved trees, seasonally flooded, and subject to controlled inundation. The area proposed for wetland restoration/creation is shown on the NWI map as upland.

The proposed mitigation site is within the same drainage basin of the project area, the Cape Fear River, approximately 2.5 miles downstream of the impacted wetlands along Third Fork Creek and approximately one-half mile upstream from where Third Fork Creek joins New Hope Creek. The site is within the USGS Hydrologic Unit 03030002 (NCDWQ Cape Fear Subbasin 030605). Third Fork Creek and its unnamed tributaries in this vicinity are classified as WS-IV, NSW and suitable for all Class C uses. Land bordering a portion of the proposed mitigation site has USACOE flowage easements and is registered as North Carolina State Game Lands.

The site formerly supported a wastewater treatment plant until the 1980s. Two impounded "sludge" ponds formerly occupied approximately 0.78 acre of the site as depicted on the 1980 City of Durham topographic map. The two sludge ponds and associated berms were removed in accordance with North Carolina Department of Environment, Health, and Natural Resources (DEHNR) guidelines. A brick building, tank, and some miscellaneous debris still exist on the site. A chain-link fence surrounds these hard structures and some adjacent land that appears to have contained a gravel parking area in the past (Figure 2). Selected photographs of the site are included in Appendix A.

B. SANDY CREEK SITE

The second proposed mitigation site is located in Durham County approximately 1,000 feet north of the intersection of Chapel Hill Boulevard (US Business 15/501) and Sandy Creek. This site is also an abandoned wastewater treatment facility (New Hope Treatment Plant) owned by the City of Durham. The area is located on the USGS Southwest Durham 7.5 minute topographic quadrangle and the Southwest Durham National Wetlands Inventory Map (NWI) at latitude 35°58'00" North and longitude 78°57'45" West (Figure 1). The soils are identified in the Durham County Soil Survey as Chewacla and Wehadkee (Sheet No.25). The NWI map identifies the section of Sandy Creek at the mitigation site as PSS3/1Ad, which in the Cowardin classification system is a palustrine, shrub/scrub wetland with deciduous broad-leaved vegetation, temporarily/seasonally flooded, and partially drained and ditched. An area south of and adjacent to the restoration area is shown on the NWI map as PEM1G, which is classified as palustrine, emergent, persistent, and intermittently exposed wetland. The area proposed for wetland restoration/creation is shown on the NWI map as upland.

The proposed mitigation site is approximately 2.25 miles northwest of the impacted wetlands along Third Fork Creek. Sandy Creek is a tributary to New Hope Creek and is the next upstream drain above the mouth of Third Fork Creek. The site is within the USGS Hydrologic Map Accounting Unit 030300 (Cape Fear Subbasin 030605), which is within the same drainage basin of the project area, the Cape Fear River. Sandy Creek is classified by the state as C-NSW.

This property was originally developed only on the east side of the creek in 1928. The proposed mitigation site was filled in and developed in 1954 and was a functional wastewater treatment plant until it was abandoned in 1984. A bridge across Sandy Creek provides access to the western portion of the property that is proposed for mitigation. The 106-acre property still contains some abandoned structures and various paved access roads in stages of disrepair. Beavers currently can be found using a well-developed pond on the west side of the creek south of the proposed wetland development area. Beavers have occupied the east side of the creek at times in the past, but this portion of the property has returned to a marshy meadow since the beavers moved to the west side of the creek. There is a sewer line easement between the beaver meadow and the east side of the creek.

The portion of the site proposed for mitigation is an approximate 2.4-acre complex of eight old sludge ponds separated by concrete berms/walls and surrounded by a fence. Approximately 1.96 acres of additional filled and disturbed area occurs south of the sludge ponds, outside of the fence, and is included in the proposed restoration area (Figure 3). There are numerous piles of vegetative debris from Hurricane Fran within the fenced area. Selected photographs of the site are included in Appendix B.

The Parks and Recreation Department of the City of Durham has plans to develop portions of the Sandy Creek property as a science center and nature trail. Restoration of the proposed mitigation site will not interfere with plans for the center as described in the Master Plan (City of Durham Parks and Recreation 2000). Restoration of the sludge ponds to wetlands will complement the center, as it will provide educational and scientific opportunities of value to the planned center and provide additional habitat for numerous wildlife species within a heavily urbanized area of the City.

IV. WETLAND GOALS AND OBJECTIVES FOR ESTABLISHMENT

The topographic position of the sites, within the floodplain of Third Fork and Sandy Creeks, makes both sites good candidates for successful wetland restoration. Naturally low elevations of the sites, in combination with the presence of invading wetland species in the vicinity of the proposed target elevations of the constructed sites, indicate that the removal of the approximate 0.5 to 3 feet of fill material at the Third Fork site and 0.5 to 4 feet of fill material at the Sandy Creek site will facilitate establishment of the areas as functional wetlands. The planting of trees will enlarge the hardwood buffer zone adjacent to both creeks. Restoration of the wetlands in the vicinity of the abandoned wastewater treatment plants will contribute to overall improvement of the water quality of Third Fork Creek and Sandy Creek, as well as that of New Hope Creek, into which they both drain. Restoration and preservation of these two sites in perpetuity through conservation easements will contribute to the environmental value of adjacent and surrounding areas.

The restored sites will perform such wetland functions as increase water storage, filter runoff and pollutants, trap sediment, increase habitat diversity for area wildlife, and serve as a buffer to the waters of Third Fork and Sandy Creeks. Topographic modifications at the Third Fork site will be designed to capture some of the water from an adjacent drainage basin of approximately 450 acres and will help restore a more natural hydrology regime to the site. Similar modifications at the Sandy Creek site will capture overland drainage from approximately 35.6 acres uphill. Capture of stormwater from these drainage basins will attenuate the erosive velocity of input to Third Fork Creek and Sandy Creek. Topographic modifications will also prolong the floodwater storage capacity of both sites by increasing the amount of available floodplain, thereby reducing the sediment load during the higher stages of flow on both creeks. The planting of suitable wetland tree seedlings will help diversify the vegetative community and provide new areas of habitat and food sources for wildlife.

Both proposed mitigation sites are underlain by rocks typical of the Triassic Basin portion of the piedmont. These rocks have low porosity and low permeability and therefore support a lower potential for sustained base flows in area streams. Rainfall in the Triassic Basin most typically will flow overland to a stream rather than infiltrate through the groundwater to the stream (North Carolina Department of Natural Resources 1999). This overland flow (runoff) serves as a source of potential pollutants from surrounding urbanized areas. Restoration of wetlands to capture and filter the overland runoff will enhance the quality of downstream receiving waters.

V. EXISTING CONDITIONS OF THE SITES

A. THIRD FORK CREEK MITIGATION SITE

1. VEGETATION OF THIRD FORK CREEK SITE

The site supports a variety of upland and wetland plant species characteristic of disturbed and/or early successional stage vegetation. Although the site was bushhogged in August 1998, herbaceous vegetation is well established and is being invaded by hardwood saplings. Vegetation in drier areas throughout most of the site is dominated by fescue grass (*Festuca pratensis*), lespedezas (*Lespedeza cuneata* and *L. violacea*), blackberry (*Rubus argutus*), goldenrod (*Solidago canadensis*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), Japanese honeysuckle (*Lonicera japonica*), trumpet creeper (*Campsis radicans*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), American sycamore (*Platanus occidentalis*),and river birch (*Betula nigra*). Wetter areas are dominated by rushes (*Juncus effusus, J. diffusissimus, J. marginatus*), barnyard grasses (*Echinochloa crusgalli* and *E. muricata*), panic grasses (*Panicum dichotomiflorum* and *P. rigidulum*), smartweeds (*Polygonum cespitosum* and *P. pennsylvanicum*), marsh dayflower (*Murdannia keisak*), green ash (*Fraxinus pennsylvanica*), and black willow (*Salix nigra*).

2. HYDROLOGY OF THIRD FORK CREEK SITE

Elevations of the site range from 242 to 245 feet. Small pools of water were observed during visits to the site on 7 May 1998, 9 September 1998, and 13 January 1999. These scattered pools support wetland vegetation, but exist on highly disturbed and/or compacted soils. Several pools have formed over an old paved road covered with a thin layer of soil. An unnamed channelized 8-foot wide tributary to Third Fork Creek is located at the southern edge of the site. This drain passes through a 5-foot culvert under the access road from NC 54. The USGS quadrangle map for Southwest Durham shows this drain and Third Fork Creek to be subject to periods of controlled inundation (the 240 foot contour and below is within the B. Everett Jordan Lake project area). However, lake level control is not expected to be the source of any water for this mitigation site as the spillway invert is at 240 feet and the historic lake maximum (during Hurricane Fran in 1996) was 233 feet.

The closest USGS stream gage data is located on New Hope Creek near Blands, about two miles downstream from the mouth of Third Fork Creek and approximately 5.7 miles from the Sandy Creek site. Application of New Hope's Creek's behavior history to either of the other creeks will be of little to no value in calculating the likelihood or duration of overflow (Personal communication Mr. Eric Farr, Hydrology Section, USACOE, Wilmington).

The main sources of water to the site are precipitation, direct run-off from an approximate 7.0-acre drainage basin, some overflow from the unnamed tributary which has an approximate 450-acre drainage basin, and some seasonal and/or irregular overflow from Third Fork Creek. No monitoring wells have been installed on the site.

3. SOILS OF THIRD FORK CREEK SITE

Soils of the site are highly disturbed and somewhat compacted. Soil samples were collected at six locations at the site and submitted for analysis by the North Carolina Department of Agriculture, Agronomic Division in 1998. The results of the analysis are found in Appendix C. Holes were augered to depths of approximately 14 inches. Matrix soil colors at 10 inches below the surface were generally 10YR 4/4 to 10YR 5/3 with some mottling. A layer of small gravel was found at various locations, especially within the fenced area, between 4 and 6 inches below the surface. Hydric soils were observed along the western edge of the site near a linear depression and at a few scattered depressions on the site.

Mr. Richard Brooks, a regional soil scientist with the North Carolina Division of Soil and Water Resources, met City of Durham and CZR representatives at the site on 26 January 1999 to examine the subsoils of the proposed restoration area. The City of Durham arranged for a backhoe to dig observation pits for evaluation of the subsoils. The purpose of the excavation was to verify the presence and amount of

Wehadkee soils beneath existing fill. Four pits were dug with the backhoe and four holes were hand augered by Mr. Brooks. While the Durham County soil survey references a general 60 percent Chewacla and 35 percent Wehadkee association of this floodplain soil association, Mr. Brooks estimated that this site was originally underlain by approximately 70 percent Wehadkee soil and 30 percent Chewacla soil (Appendix C). Fill material overlying these floodplain soils ranged from 6 to 36 inches in thickness. The proposed restoration/creation proportions of this site are based on the results of this investigation.

4. REFERENCE ECOSYSTEM FOR THIRD FORK CREEK SITE

Alluvial forested wetlands occur adjacent to the proposed mitigation site and demonstrate that the area is capable of supporting wetlands. Portions of the restoration area are bordered by undisturbed, naturally vegetated bottomland hardwoods that will serve as a buffer and reference ecosystem in close proximity to the mitigation site. This natural forest varies in width from 200 to 375 feet between Third Fork Creek and the restoration area.

The canopy in this forest is comprised of American elm (*Ulmus americana*), green ash, red maple, and black gum (*Nyssa sylvatica*). The shrub layer close to the creek is dominated by Chinese privet (*Ligustrum sinese*), but this layer is less prevalent further from the creek. The herbaceous layer is sparse and contains trumpet creeper, poison ivy, and greenbrier (*Smilax* spp.). Other herbs in the reference forest, but in fewer numbers include Virginia bugleweed (*Lycopus virginicus*) and sedges (*Carex* spp.). Evidence of wetland hydrology that was observed during a site visit in September 1998 included drainage patterns, water marks on trees, and saturation within the top twelve inches of soil. Agency personnel agreed during a site visit in 1999 that this area, while not entirely wetland, will be suitable for use as a reference ecosystem. Monitoring wells will be installed and monitored in the reference ecosystem in conjunction with wells at the mitigation site to assist with determination of hydrological success.

B. SANDY CREEK SITE

1. VEGETATION OF SANDY CREEK SITE

This site supports a variety of slightly mesophytic and wetland vegetation typical of piedmont floodplains, disturbed successional areas, and man-dominated areas. The site proposed for mitigation is surrounded by open alluvial forest on three sides with small sloughs occurring to the west and small sloughs and levees found on the creekside. The eastern side of the mitigation area near the creek is dominated by species more tolerant of periods of flooding such as American sycamore, red maple, green ash, river birch, box elder (*Acer negundo*), Chinese privet, Nepal microstegium (*Microstegium vimineum*), and various knotweeds. Scattered specimens of tulip poplar

(*Liriodendron tulipfera*) are also found. The slightly higher elevations on the more mesic portions of the floodplain to the northwest and north of the mitigation area contain white oak (*Quercus alba*), loblolly pine (*Pinus taeda*), red maple and a sparse herb layer containing Japanese honeysuckle, Virginia creeper, and poison ivy. The southwest edge of the mitigation site adjoins the upper fringe of a beaver impoundment and contains several small sloughs and depressions. The canopy is predominantly red maple and green ash with a few scattered sweetgum (*Liquidambar styraciflua*). The open herbaceous community south of the site is comprised of a collection of wetland and upland species common to disturbed areas. Plants found in this vicinity are red cedar (*Juniperus virginiana*), black willow, various bushclovers (*Lespedeza* spp.), rushes (*Juncus* spp.), grasses (*Panicum* spp.), Nepal microstegium, and sedges (*Carex* spp.). The wettest areas in the adjacent floodplain contain false stinging nettle (*Bohemeria cylindrica*), Jack in the Pulpit (*Arisaema triphyllum*), arrow arum (*Peltandra virginica*), cypress witchgrass (*Dichanthelium dichotomum*), and slender spike grass (*Chasmanthium laxum*) among others.

2. HYDROLOGY OF SANDY CREEK SITE

Current elevations of the floodplain portion of the entire property range from 260 to 270 feet while elevations in the vicinity of the proposed mitigation area vary between 262 and 265 feet. Standing water does collect at times in the bottom of the existing contained sludge ponds, which presently support areas of wetland vegetation. Like the Third Fork Creek site, existing wetter areas are the result of water perched on disturbed and compacted soils. Drainage from an approximate 36.4-acre basin uphill of the mitigation area will serve as one source of hydrology input to the site.

Like numerous streams in the state, Sandy Creek appears to have been channelized in the past with steep creekbanks of about four feet in height. Low stream flows in North Carolina typically occur at the conclusion of the growing season in late summer and early autumn, so the hydrology suggested by the estimated water budget for this site is typical. No monitoring wells have been installed on the site.

3. SOILS OF SANDY CREEK SITE

Soils of the Sandy Creek mitigation site are mapped as Chewacla and Wehadkee, which are soils typical of a North Carolina piedmont floodplain. Because so much of the man-dominated area of the site was filled during construction of the west side component of the wastewater facility, the soil profile of the mitigation site is disturbed. Since the bridge across the creek was constructed, the area south of the fence has been used by the City as an occasional dumping ground for excess soil, gravels, and vegetative debris.

Removal of the sludge pond structures at the Third Fork Creek site allowed for a more extensive investigation of the existing soil profile, an approximation of the how much fill was actually present on the site, and an assessment of the proportion of the site underlain by Wehadkee soil. Because the concrete sludge pond structures still remain at the Sandy Creek site, only the areas beyond the perimeter of the fence can be probed. Investigations of soils in these areas indicate disturbed fill in the southern portion of the site and at least 25 inches of levee deposited material in areas east of the fence. Soils probed in the abandoned beaver meadow area on the opposite side of the creek were characteristic of Wehadkee. Using the Durham County soil survey as a guide, it may be expected that at least 35 percent of the soil on the property is hydric (Wehadkee). However, the Third Fork Creek soil investigation indicates that it is possible that the Wehadkee component at the Sandy Creek site could be higher. In floodplains, the Wehadkee component is likely to be found away from the levees of the creek and near the upland toe of slope at the edge of the floodplain and in the areas of historic swamp or marsh (Personal communication, August 2000. Mr. Richard Brooks, NC Division of Soil and Water Resources).

4. REFERENCE ECOSYSTEM FOR SANDY CREEK SITE

Reconnaissance of the site occurred on 15 August 2000 and an investigation of the surrounding area of natural alluvial forest indicated that suitable reference areas exist on the City property adjacent to the proposed mitigation site both upstream and downstream on the east side of the creek. The upstream end of the abandoned beaver meadow appears to have been unaffected by the longstanding water of the beaver impoundment. This forest community was delineated as wetland in December of 1997 by Ecological Consultants and is shown on the signed USACOE wetland plat for the property. The forest is comprised of mature and immature specimens of green ash, red maple, black gum, ironwood (*Carpinus caroliniana*), American elm, box elder, sweet gum, tulip poplar, and hackberry (*Celtis laevigata*). Downstream of the access road to the property, close to where Sandy Creek flows beneath US Business 15/501, is a smaller forested wetland suitable for reference purposes. Both of these alluvial forests contain a more extensive herbaceous layer of wetland plants than what is found on the lowest areas of the fill just south of the fenced in area. This herbaceous layer is composed of species such as false nettle, knotweeds, spotted touch-me-not (*Impatiens capensis*), and Carolina lily (*Lilium michauxii*). Photographs of both of these reference areas are included in Appendix B. No hydrology data exists for either reference area, but wetland hydrology indicators present in August 2000 include water stained leaves, drift lines, water marks on trees, drainage patterns, and soil saturation within12 inches of the soil surface.

VI. SITE PREPARATION AND PLANTING PLANS

A. THIRD FORK CREEK SITE

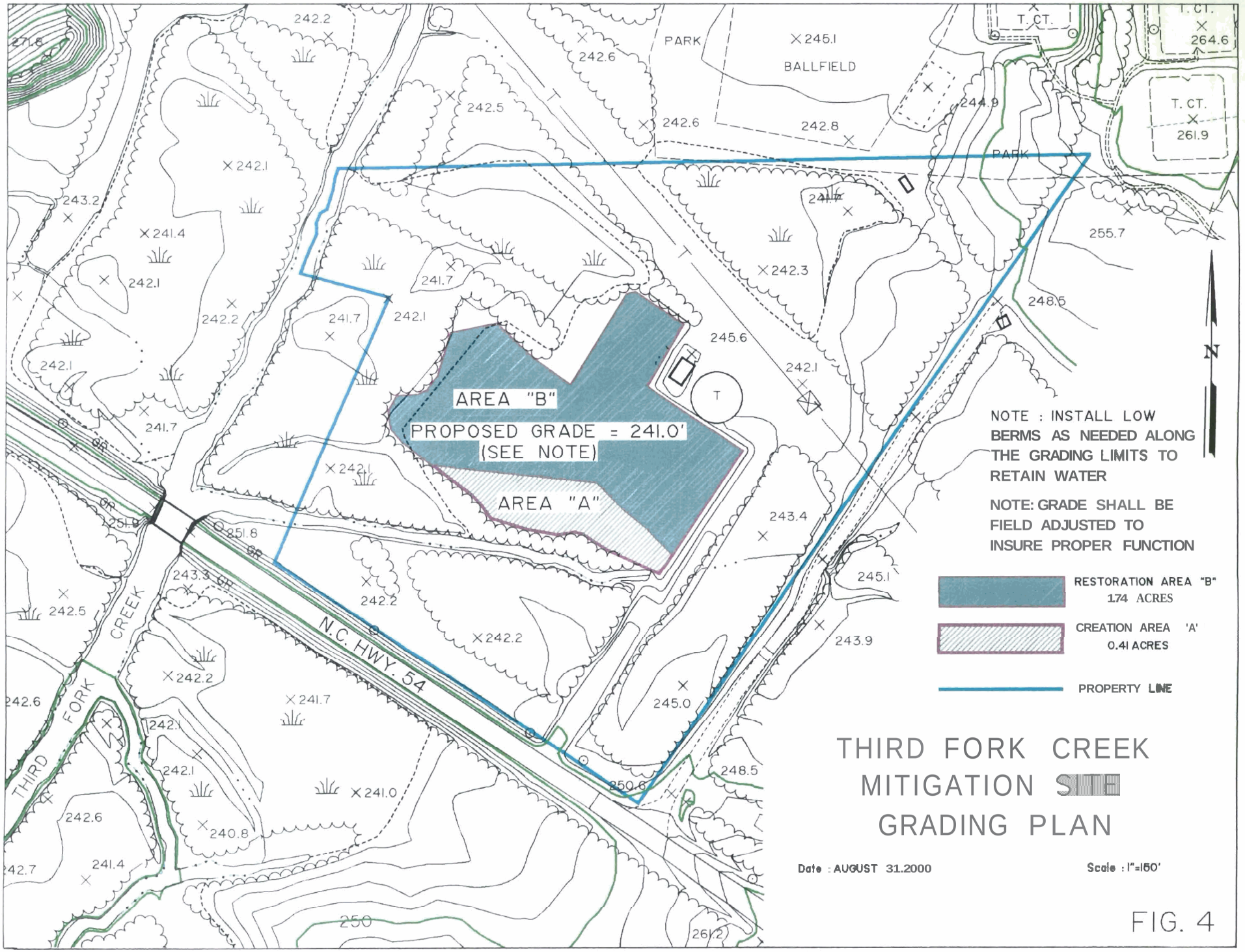
1. HYDROLOGY RESTORATION PLAN FOR THIRD FORK CREEK SITE

Excavation of disturbed soils and pavement, removal of existing hard structures (as necessary), and contouring and disking of the site will lower elevations and return the topography to near pre-disturbance conditions. Survey information has been incorporated into a grading plan that depicts proposed elevations (Figure 4). An approved NCDENR Division of Land Quality sedimentation and erosion control plan will be strictly followed to avoid impacts to water quality during preparation of the site.

Hydrologic inputs to the restoration area are direct runoff from approximately seven acres uphill, overflow from an unnamed tributary to Third Fork Creek, precipitation, and overflow from Third Fork Creek. The channelized unnamed tributary at the southern boundary of the site drains a 450-acre basin, as depicted on the USGS 5cfs map. The site does receive overbank flood waters as reported by City personnel and is subject to seasonal saturation. Removal of the some of the levees placed during channelization of the stream, in conjunction with lowering the elevation of the site to six inches below the invert of the streambank, will capture some overflow from this stream. Low berms may also be installed at certain locations to help store water that collects on the site.

Some of the runoff from the 450-acre basin will be diverted onto the site from the channelized tributary through an existing low swale. The invert of this swale is six inches higher than the average target elevation of the mitigation site. There is no stream gage data available to help characterize the incidence of bank overflow for Third Fork Creek or the unnamed tributary. However, low flows in North Carolina typically occur at the conclusion of the growing season in late summer and early autumn, so hydrology at the mitigation sites will likely be met in the early part of the growing season.

Historic climate data (1970-1999) from the Durham County weather station located at the water treatment facility at Hillandale Drive and Hillsborough Street in west Durham were used to calculate a water budget for the Third Fork site (Appendix D). Climate data from the Raleigh Durham Airport weather station over the same period were used for any gaps in the Durham data. Because of uncertainty in the frequency and duration of overbank flooding, this water budget did not include any overbank flooding from either the adjacent tributary or Third Fork Creek. Potential evapotranspiration (PET) was calculated using the Thornthwaite method (Thornthwaite and Mather 1957).



THIRD FORK CREEK MITIGATION SITE GRADING PLAN

Date : AUGUST 31.2000

Scale : 1"=150'

FIG. 4

In the budget calculations, PET and infiltration are the major sources of output at this site with precipitation and uphill runoff the sources of input. Infiltration rate was based on the mid-point of the range of values for a Natural Resources Conservation Service (NRCS) Group D soil. However, using the mid-point infiltration value, the budget indicates that the site will require overbank flooding in order to have a surplus of water in the growing season. It is possible that the soils beneath the fill at the Third Fork Creek site have become compacted from construction and operation of the wastewater facility and may become even more compacted following the mitigation alterations. Therefore, the true infiltration rate may likely be lower than the numbers used in the budget. The budget used is a conservative estimate of hydrology input.

2. PLANTING PLAN FOR THIRD FORK CREEK

The spreading of approximately 6 inches of suitable topsoil will provide a medium for the establishment of the planted seedlings. Lower elevation areas will be planted with a species mix of green ash and swamp black gum (*Nyssa sylvatica* var. *biflora)*, while the other areas will be planted with a mix of black gum, swamp chestnut oak (*Quercus michauxii)*, willow oak (*Q. phellos*), water oak (*Q. nigra*), overcup oak (*Q. lyrata*), and cherrybark oak (*Q. pagoda*). Hackberry and American elm may also be planted if seedlings are available. A total of seven to nine species of bare root seedlings will be planted on the site, depending on availability. The proposed source for seedlings is the N.C. Division of Forest Resources. The exact species mix available will be determined in fall 2000. Planting is proposed for the site during the winter of 2000/2001 prior to mid-March 2001.

Tree seedlings will be planted on nine-foot spacings. Approximately 1,200 trees will be planted on the 2.15 acres and will give a baseline tree density of 538 trees per acre. With the presence of beavers upstream and possibly downstream, it may be a prudent measure to protect the planted trees with tree collars. These have been used with success to discourage beaver damage and reduce the need to replant the site should beavers move into the vicinity. If tree collars are not used, the baseline density of trees will be increased.

B. SANDY CREEK SITE

1. HYDROLOGY RESTORATION PLAN FOR SANDY CREEK SITE

Excavation of disturbed soils and pavement and removal of existing hard structures (as necessary) will lower elevations. The spreading of at least 6 inches of suitable topsoil and contouring and disking of the site will return the topography to near pre-disturbance conditions. Survey information has been incorporated into a site plan that depicts proposed elevations (Figure 5). The site will be lowered to six inches below the invert of a creekside slough at the northeast corner of the existing sludge ponds. Low berms may be placed at the southern end of the mitigation site to hold the

WETLANDS DELINEATION BY ECOLOGICAL CONSULTANTS

RESTORATION AREA "B" 2.07 ACRES

CREATION AREA "A" 2.29 ACRES

PROPERTY LINE

FIG. 5

SANDY CREEK MITIGATION SITE GRADING **PLAN**

Date : **AUGUST 31, 2000**

SCALE 1" = 200'

water on- site. Removal of fill material and demolition of the sludge ponds or piping infrastructure will be done in accordance with all necessary permits and guidelines governing demolition and disposal of such materials. An approved NCDENR Division of Land Quality sedimentation and erosion control plan will be strictly followed to avoid impacts to water quality during preparation of the site.

Historic climate data (1970-1999) from the Durham County weather station located at the water treatment facility at Hillandale Drive and Hillsborough Street in west Durham were used to calculate a water budget for the Sandy Creek site (Appendix D). Climate data from the Raleigh Durham Airport weather station over the same period were used for any gaps in the Durham data. Because of uncertainty in the frequency and duration of overbank flooding of Sandy Creek, this water budget did not include any overbank flooding. Potential evapotranspiration (PET) was calculated using the Thornthwaite method.

In the budget calculations, PET and infiltration are the major sources of output at this site with precipitation and upstream runoff the sources of input. The budget indicates that the site will likely have a surplus of water very early in the growing season and possibly again in the very late growing season, without any overbank flooding. Like the Third Fork Creek site, the infiltration rate was based on the mid-point of the range for a NRCS hydrologic Group D soil. It is likely that the site may actually have an infiltration rate somewhat lower than the mid-point used in the budget because of compaction of the native soils. Therefore, the budget probably represents a conservative estimate of hydrology input.

2. PLANTING PLAN FOR SANDY CREEK SITE

Lower elevation areas will be planted with a species mix of green ash and swamp black gum, while the other areas will be planted with a mix of black gum, swamp chestnut oak, willow oak, water oak, overcup oak, and cherrybark oak. Hackberry and American elm may also be planted if seedlings are available. A total of seven to nine species of bare root seedlings will be planted on the site, depending on availability. The proposed source for seedlings is the N.C. Division of Forest Resources. The exact species mix available will be determined in fall 2000. Planting is proposed for the site during the winter of 2000/2001 prior to mid-March 2001.

VII. MONITORING PLAN

Shallow monitoring wells will be used document successful restoration of wetland hydrology at both sites. One or two semi-continuous recorders and several manual wells will be used at each mitigation site and reference ecosystem to characterize the hydrology of the site. Since the sites are located within floodplains, electronic semi-continuous wells will be installed with the calibration point above the ground surface to also record durations of standing water. The growing season for

Durham County extends from 30 March through 11 November (226 days), which is based on the average periods when air temperatures are continuously above 28°F. Wells will be checked weekly during the early growing season (31 March -31 May) and monthly for the remainder of the year. Analysis of hydrology data will be included in the annual reports.

Tree plots will be established in the vicinity of monitoring wells on each site and will be of sufficient area to characterize the site as described in the USACOE Compensatory Hardwood Mitigation Guidelines. Annual sampling of the tagged, planted tree seedlings will occur late in each growing season of the monitoring period and will be used to monitor survival.

As set forth in the Mitigation Guidelines, vegetative success will be achieved if at the end of the 5-year monitoring period tree density is at least 320 trees per acre. Hydrological success will be achieved if the sites match or exceed the wetland hydroperiods of their respective reference ecosystem. Hydrological success willalso be achieved if the sites exceed a hydroperiod of 12.5 percent of the growing season under normal rainfall conditions, regardless of the hydroperiods recorded at the reference ecosystems. Partial restoration success of portions of the sites will be considered should the entire sites not meet all required success criteria. Should portions of the restoration sites not exhibit wetland hydrology or the vegetation survival not be acceptable, a remediation proposal will be coordinated with regulatory agencies prior to any modification of the sites.

Analysis of tree or hydrological data will be separate for each site but included in one report. Baseline data collected after planting will be included in an as-built report. Annual reports will be generated for each year of the monitoring period.

REFERENCES

City of Durham. 2000. Master Plan. City of Durham Parks and Recreation Department.

Kirby, Robert M. 1971. Durham County Soil Survey. US Department of Agriculture, Soil Conservation Service.

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Radford, A. E., H. E. Ahles, and C.R. Bell. 1968. Manual of the vascular flora of the Carolinas. The University of NC Press. Chapel Hill, NC.

Thornthwaite, C. W. and J. R. Mather. 1957. Instructions and tables for computing potential evapotranspiration and the water balance. Laboratory of Climatology Publication No. 10, Centerton, N.J.

U.S. Department of Agriculture. 1986. Urban hydrology for small watersheds (210-V1-TR-55), Second Edition.

APPENDIX A
Selected Photographs of the Third Fork Creek Site

Photo 1. View from within the fenced areas looking northeast toward the abandoned wastewater. treatment plant. September 1998

Photo 2. View from fence looking west across the area formerly occupied by the sludge ponds. Fescue grasses dominate the area. September 1998

Photo 3. Soil observation pit within fenced area of abandoned wastewater treatment plant. Area was determined to contain several feet of fill over Wehadkee soils. January 1999

Photo 4. View of former sludge ponds site (cleared area in the background) showing lower elevation, naturally forested areas adjacent to the proposed mitigation site. Sign of high water (water mark on tree) from recent flooding is noted by biologist. January 1999

Photo 5. View of adjacent floodpain forested wetland north of the proposed mitigation site. September 1998

Photo 6. Natural forested wetland area just north and adjacent to the abandoned wastewater treatment plant. Surface water, sediment deposits, and water marks on trees are present. January 1999

APPENDIX B
Selected Photographs of the Sandy Creek Site

Photo 1. View to north of existing sludge pond cells at Sandy Creek mitigation site. 15 August *2000.*

Photo 2. View to south from fence around sludge pond cells at the Sandy Creek mitigation site. 15 August *2000.*

Photo 3. Beaver pond south of the Sandy Creek mitigation site. 15 August *2000.*

Photo 4. Typical floodplain between sludge ponds cells and Sandy Creek. 15 August *2000.*

Photo 5. Reference ecosystem on east side of Sandy Creek upstream of mitigation site. 15 August *2000.*

Photo 6. Reference ecosystem east of Sandy Creek downstream of mitigation site. 15 August *2000.*

APPENDIX C
Correspondence

NCDA Agronomic Division 4300 Reedy Creek Road Raleigh, NC 27607-6465 (919) 733-2655

Grower: CZR Incorporated
Attn:Sam Cooper
4709 College Acres Dr. Suite 2
Wilmington, NC 28403

Copies to: County Extension Director

RECEIVED
SEP 29 1998
CZR Incorporated
Wilmington, NC

CP# 1451 incoming

Soil Test Report

9/28/98 SERVING N.C. CITIZENS FOR OVER 50 YEARS

Farm: Wake County

1 -- 11

Agronomist Comments:

Field Information		Applied Lime			Recommendations										
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P_2O_5	K_2O	Mg	Cu	Zn	B	Mn	See Note
M01	Hardwood,E				1st Crop: Hardwood,E	0	0.0	20-40	20-40	0	0	0			11
					2nd Crop: Hardwood,Seed	0	120-160	40-60	20-40	0	0	0			11

Test Results																		
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI (1)	Mn-AI (2)	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO_3-N	NH_4-N	Na
MIN	0.12	1.20	17.8	97.0	0.5	6.8	26	54	73.0	23.0	723			94	94	162	59				0.3

Field Information		Applied Lime			Recommendations										
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P_2O_5	K_2O	Mg	Cu	Zn	B	Mn	See Note
M02	Hardwood,E				1st Crop: Hardwood,E	1.4T	0.0	0	30-50	0	0	0			11
					2nd Crop: Hardwood,Seed	0	120-160	0	30-50	0	0	0			11

Test Results																		
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI (1)	Mn-AI (2)	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO_3-N	NH_4-N	Na
MIN	0.27	1.15	14.1	84.0	2.3	5.1	111	40	64.0	18.0	747			853	853	294	35				0.1

Field Information		Applied Lime			Recommendations										
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P_2O_5	K_2O	Mg	Cu	Zn	B	Mn	See Note
M03	Hardwood,E				1st Crop: Hardwood,E	.7T	0.0	0	0-20	0	0	0			11
					2nd Crop: Hardwood,Seed	0	120-160	0	0-20	0	0	0			11

Test Results																		
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI (1)	Mn-AI (2)	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO_3-N	NH_4-N	Na
MIN	0.09	1.18	24.1	93.0	1.8	5.6	99	74	64.0	27.0	452			230	230	189	41				0.3

Field Information		Applied Lime			Recommendations										
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P_2O_5	K_2O	Mg	Cu	Zn	B	Mn	See Note
M04	Hardwood,E				1st Crop: Hardwood,E	1.7T	0.0	10-30	0	0	0	0			11
					2nd Crop: Hardwood,Seed	0	120-160	30-50	0	0	0	0			11

Test Results																		
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI (1)	Mn-AI (2)	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO_3-N	NH_4-N	Na
MIN	0.13	1.14	20.8	88.0	2.5	4.8	32	84	59.0	27.0	467			139	139	162	51				0.2

Field Information		Applied Lime			Recommendations										
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P_2O_5	K_2O	Mg	Cu	Zn	B	Mn	See Note
M05	Hardwood,E				1st Crop: Hardwood,E	1.4T	0.0	30-50	0-20	0	0	0			11
					2nd Crop: Hardwood,Seed	0	120-160	60-80	0-20	0	0	0			11

Test Results																		
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI (1)	Mn-AI (2)	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO_3-N	NH_4-N	Na
MIN	0.27	1.04	20.1	89.0	2.2	5.0	18	66	63.0	25.0	1204			303	303	219	85				0.2

Field Information		Applied Lime			Recommendations										
Sample No.	Last Crop	Mo	Yr	T/A	Crop or Year	Lime	N	P_2O_5	K_2O	Mg	Cu	Zn	B	Mn	See Note
M06	Hardwood,E				1st Crop: Hardwood,E	1.5T	0.0	20-40	0-20	0	0	0			11
					2nd Crop: Hardwood,Seed	0	120-160	40-60	0-20	0	0	0			11

Test Results																		
Soil Class	HM%	W/V	CEC	BS%	Ac	pH	P-I	K-I	Ca%	Mg%	Mn-I	Mn-AI (1)	Mn-AI (2)	Zn-I	Zn-AI	Cu-I	S-I	SS-I	NO_3-N	NH_4-N	Na
MIN	0.32	0.97	20.9	89.0	2.4	5.0	24	75	65.0	22.0	685			553	553	207	73				0.2

NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
RALEIGH REGIONAL OFFICE

NCDENR

JAMES B. HUNT JR.
GOVERNOR

WAYNE MCDEVITT
SECRETARY

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES- DIVISION OF SOIL AND WATER CONSERVATION:
REGIONAL SOIL SCIENTIST

TO: MR. LEE MURPHY, ASSISTANT CITY ENGINEER
CITY OF DURHAM

FROM: RICHARD BROOKS, RALEIGH REGIONAL SOIL SCIENTIST, DSWC

DATE: JANUARY 28, 1999

REFERENCE: PROPOSED WETLAND MITIGATION SITE

Cc: DANNY SMITH, DWQ; KEN JOLLY, COE; JULIA BERGER, CZR

At your request, I have performed an investigation to try to determine whether or not hydric soil conditions existed prior to the construction of the now abandoned waste water treatment plant along Third Fork Creek and if so, to what extent. As I understand, the determination will provide information to answer a restoration vs. creation issue as it relates to credit toward mitigation.

My investigation consisted of both hand auger holes (1A, 2A, and 7A) and backhoe pits (3BH, 4BH, 5BH, and 6BH). These investigation sites are indicated on the attached map. This site is highly disturbed and in today's terminology would be Udorthents- manmade, cut and fill, highly disturbed, etc. One issue to overcome was how much fill was present and to identify where the "old" or buried surface began.

It was not too difficult to determine the amount of fill at investigation sites, but it appeared that the site was disturbed enough during construction that the old surface material was not very evident. My recommendation is based on locating the bottom of the fill and measuring down to where a dominance of redoximorphic (hydric indicators) exists. Based on this, I extrapulated a line through the site that shows the boundary between the areas that had a dominance of hydric indicators within 12 inches of the base of the fill material and the areas where they occurred deeper in the profile.

3800 BARRETT DRIVE, SUITE 101, RALEIGH, NORTH CAROLINA 27609
PHONE 919-571-4700 FAX 919-571-4718

(It should be noted that redoximorphic features were beginning to form in the fill
material.)

Detailed descriptions were not performed due to the wet conditions and highly disturbed profiles. Julia Berger recorded specific notes at each investigation site in respect to depth of fill material and depth to redox features. The map indicates which parts I felt hydric conditions (Wehadkee- hydric) existed prior to construction of the treatment plant and the area where I felt redox features were not strong enough to indicate hydric conditions (Chewacla- "non-hydric"). Data that indicates the history of flooding in the latter area could allow this area to be considered hydric if it meets the required number of consecutive days of inundation.

If you have any questions, please feel free to contact me at 919-571-4700, ext. 239 or E-mail richard_brooks@rro.enr.state.nc.us. Have a great day!

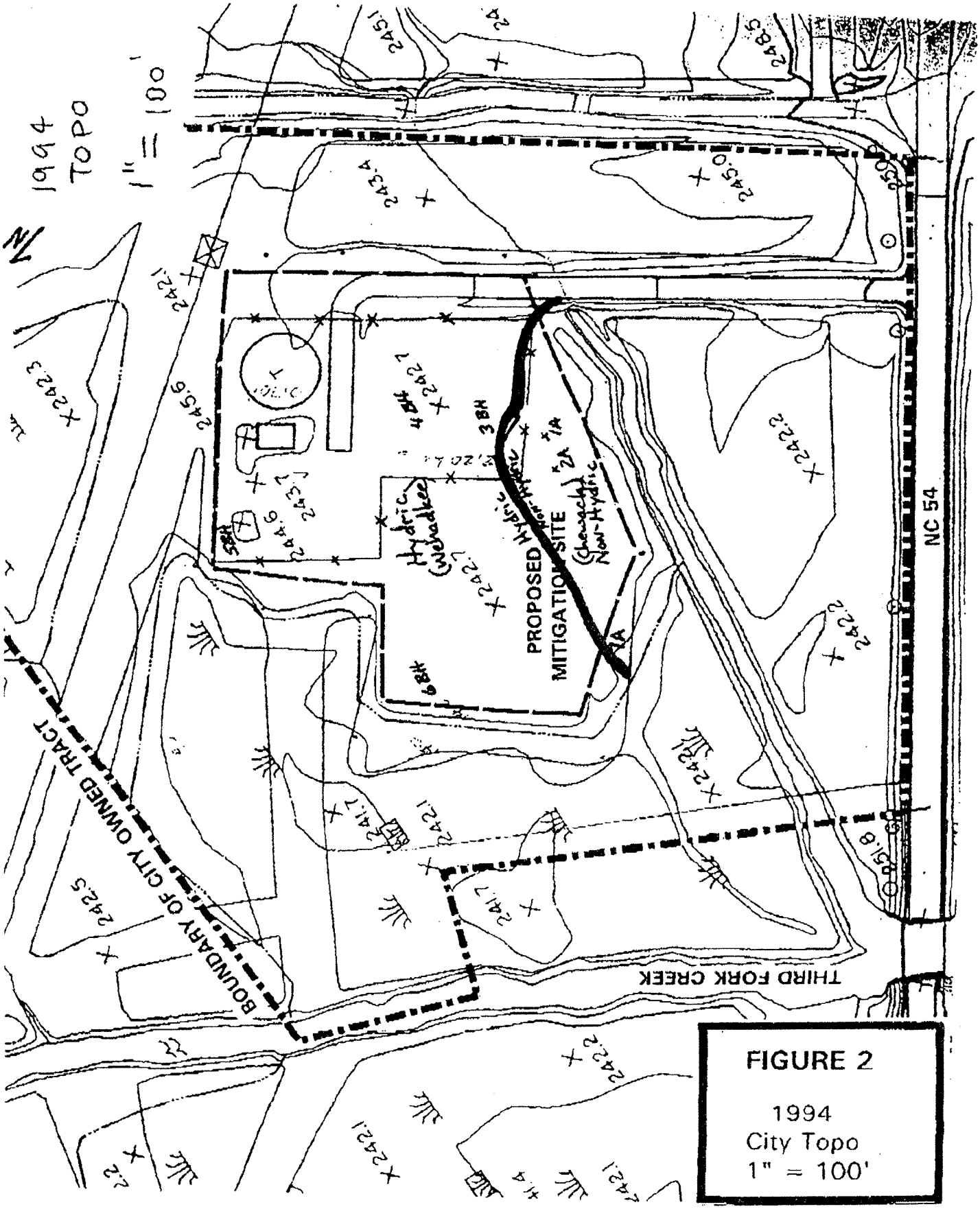

FIGURE 2

1994
City Topo
1" = 100'

APPENDIX D
Water Budgets

Table D-1. Third Fork Creek mitigation site input water budget for average conditions without overbank flooding on a 2.15 acre site.

7.0 ACRE DRAINAGE BASIN INPUT				
	RAINFALL[a] (1970-1999)	PET[b]	NET (rainfall-PET)	TOTAL (basin factor x net)
January	4.39	0.24	4.15	13.3
February	3.74	0.4	3.34	10.7
March	4.76	1.1	3.66	11.7
April	3.3	2.29	1.01	3.2
May	4.85	3.64	1.21	3.9
June	3.87	5.22	-1.44	0
July	4.02	6.55	-2.53	0
August	4.34	5.9	-1.56	0
September	4.31	4.29	0.02	0.1
October	3.86	2.26	1.6	5.1
November	3.44	1.12	2.32	7.4
December	3.47	0.45	3.02	9.7

[a] Rainfall data was provided by the State Climate Office of NC State University and collected at the Durham County weather station and/or Raleigh-Durham Airport.

[b] Potential evapotranspiration (PET) was calculated using the Thornthwaite method.

Table D-2. Third Fork Creek output water budget for average conditions without overbank flooding on a 2.15-acre site.

	TOTAL INPUT (Rainfall and basin)	OUTPUT		NET
		PET[a]	Infiltration[b]	
January	17.7	0.24	18.6	−1.1
February	14.4	0.4	16.8	-2.8
March	16.5	1.1	18.6	-3.2
April	6.5	2.3	18.0	-13.8
May	8.8	3.6	18.6	-13.4
June	3.9	5.22	18.0	-19.3
July	4.0	6.55	18.6	-21.2
August	4.3	5.9	18.6	−20.2
September	4.4	4.29	18.0	−17.9
October	9.0	2.26	18.6	-11.9
November	10.8	1.12	18.0	-8.3
December	13.2	0.45	18.6	-5.85

[a] Potential evapotranspiration (PET) was calculated using the Thornthwaite method.

[b] Infiltration rate used was the mid-point for Natural Resources Conservation Service hydrologic Group D soil.

Table D-3. Sandy Creek mitigation site input water budget for average conditions without overbank flooding on a 4.36-acre site.

35.6-ACRE DRAINAGE BASIN INPUT				
	RAINFALL[a] (1970-1999)	PET[b]	NET (rainfall-PET)	TOTAL (basin factor x net)
January	4.39	0.24	4.15	33.9
February	3.74	0.4	3.34	27.3
March	4.76	1.1	3.66	29.9
April	3.3	2.29	1.01	8.3
May	4.85	3.64	1.21	9.9
June	3.87	5.22	-1.35	0
July	4.02	6.55	-2.53	0
August	4.34	5.9	-1.56	0
September	4.31	4.29	0.02	0.2
October	3.86	2.26	1.6	13.1
November	3.44	1.12	2.32	19.0
December	3.47	0.45	3.02	24.7

[a] Rainfall data was provided by the State Climate Office of NC State University and collected at the Durham County weather station and/or Raleigh-Durham Airport.

[b] Potential evapotranspiration (PET) was calculated using the Thornthwaite method.

Table D-4. Sandy Creek mitigation site output water budget for average conditions without overbank flooding on a 4.36-acre site.

	TOTAL INPUT (Rainfall and basin)	OUTPUT		NET
		PET[a]	Infiltration[b]	
January	38.3	0.24	18.6	19.5
February	31.0	0.4	16.8	13.8
March	34.7	1.1	18.6	15.0
April	11.6	2.29	18.0	-8.7
May	14.8	3.64	18.6	-7.5
June	3.9	5.22	18.0	-19.3
July	4.0	6.55	18.6	-21.1
August	4.3	5.9	18.6	-20.2
September	4.5	4.29	18.0	-17.8
October	17.0	2.26	18.6	-3.9
November	22.4	1.12	18.0	3.3
December	28.2	0.45	18.6	9.1

[a] Potential evapotranspiration (PET) was calculated using the Thornthwaite method.

[b] Infiltration rate used was the mid-point for Natural Resources Conservation Service hydrologic Group D soil.