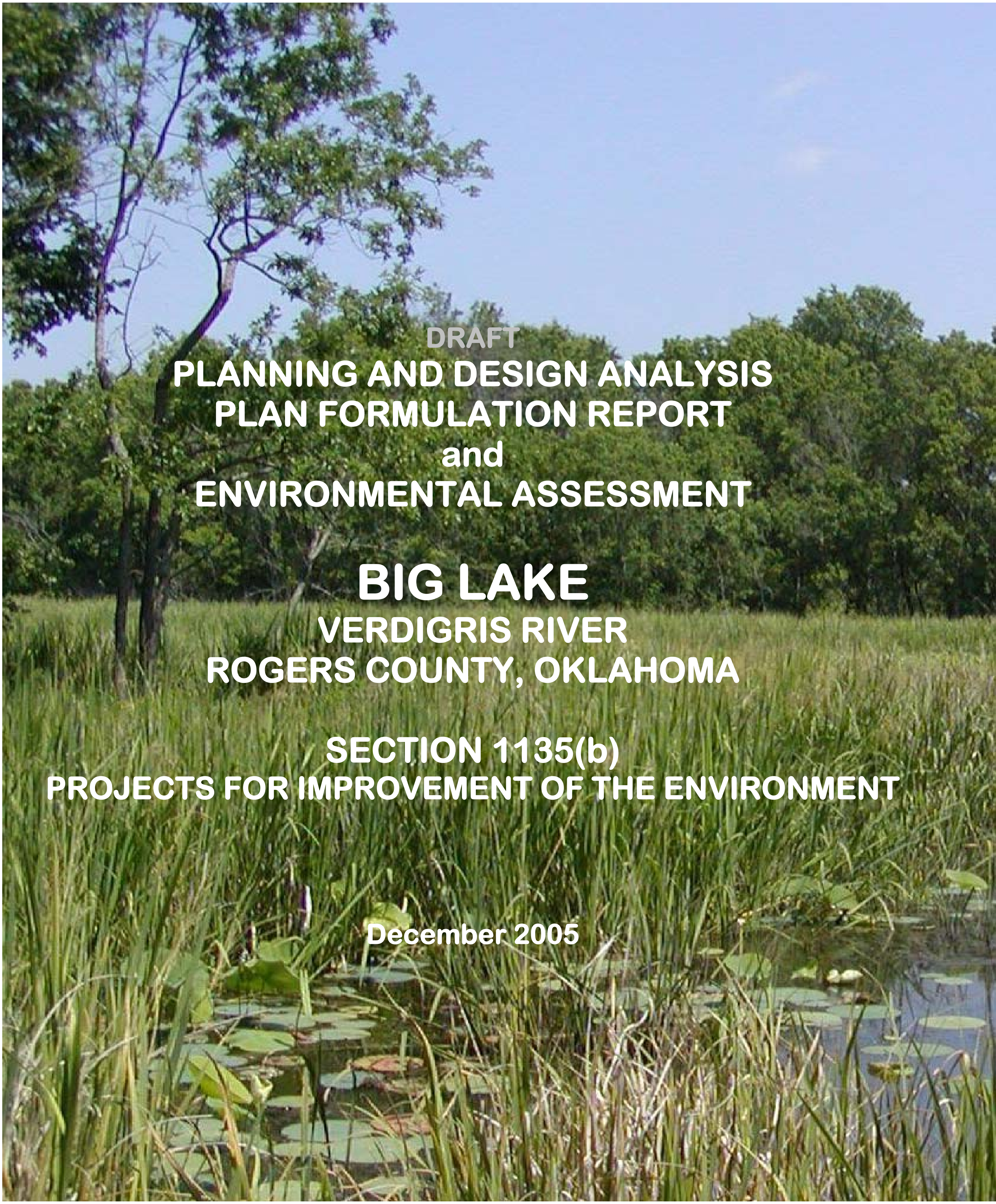

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PLANNING AND DESIGN ANALYSIS
PLAN FORMULATION REPORT
and
ENVIRONMENTAL ASSESSMENT

BIG LAKE

VERDIGRIS RIVER
ROGERS COUNTY, OKLAHOMA

SECTION 1135(b)
PROJECTS FOR IMPROVEMENT OF THE ENVIRONMENT

December 2005

Finding of No Significant Impact

In accordance with the National Environmental Policy Act of 1969, including guidelines in 33 Code of Federal Regulations, Part 230, the U.S. Army Corps of Engineers, Tulsa District has assessed the environmental impacts associated with restoring and improving the flooding regime of the riparian habitat for the Big Lake Ecosystem Restoration Project, Rogers County, Verdigris, Oklahoma. The recommended plan includes increasing the water pump capacity to 10,000 gallons per minute, widening and extending the water conveyance system to flood 77 additional acres of bottomland hardwoods and planting 50 acres with native bottomland hardwood trees. The plan also involves implementing a management regime that includes resting individual green-tree cells on a rotating basis to maximize habitat benefits.

Based on the enclosed environmental assessment, it is my determination that construction of the proposed project would not have significant adverse effects on the natural or human environment to warrant the preparation of an Environmental Impact Statement (EIS).

____________________	Miroslav P. Kurka
Date	Colonel, U.S. Army
	District Engineer

Enclosure
Environmental Assessment

DRAFT

PLAN FORMULATION REPORT
and
ENVIRONMENTAL ASSESSMENT

VERDIGRIS RIVER
BIG LAKE, ROGERS COUNTY, OKLAHOMA
SECTION 1135(b)
PROJECT FOR IMPROVEMENT OF THE ENVIRONMENT

PLANNING AND DESIGN ANALYSIS

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ROGERS COUNTY, OKLAHOMA

PLANNING AND DESIGN ANALYSIS
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STUDY AREA

Location

Big Lake is located in Rogers County, about 10 miles northeast of Tulsa, Oklahoma. Big Lake is a natural oxbow lake located along the Verdigris River, approximately 15 miles downstream of Oologah Lake and Dam. A location map is shown in Figure 1.

Related Federal Projects

The Newt Graham lock and dam on the McClellan-Kerr Navigation System is located on the Verdigris River at McClellan-Kerr navigation mile 421.7, about 8 miles southwest of Inola in Wagoner County, Oklahoma. Construction began in October 1966 and the project became operational on December 26, 1970. Project purposes are navigation, recreation and fish and wildlife. The operation of the navigation project changed the normal hydrologic conditions for Big Lake. The subject project will not affect operation of the Newt Graham lock and dam

Oologah Lake, the nearest federal project, is located on the Verdigris River at river mile 90.2, about 2 miles southeast of Oologah in Rogers County, Oklahoma. The project was authorized by Congress in the Flood Control Act of June 28, 1938. Construction began in July 1950 and was completed in May 1963. Construction for ultimate development was initiated in July 1967 and all structures were completed in 1974. Project purposes are flood control, water supply, navigation, recreation, and fish and wildlife. The subject project will not affect operation of Oologah Lake and Dam.

PROBLEM DESCRIPTION

The Big Lake ecosystem complex is approximately 1,041 acres and includes over 700 acres of various types of wetland habitat. Other areas of comparable habitat have been lost to agricultural uses or operation of the navigation channel. The development of the navigation system greatly curtailed over bank flooding and made clearing for farming more feasible.

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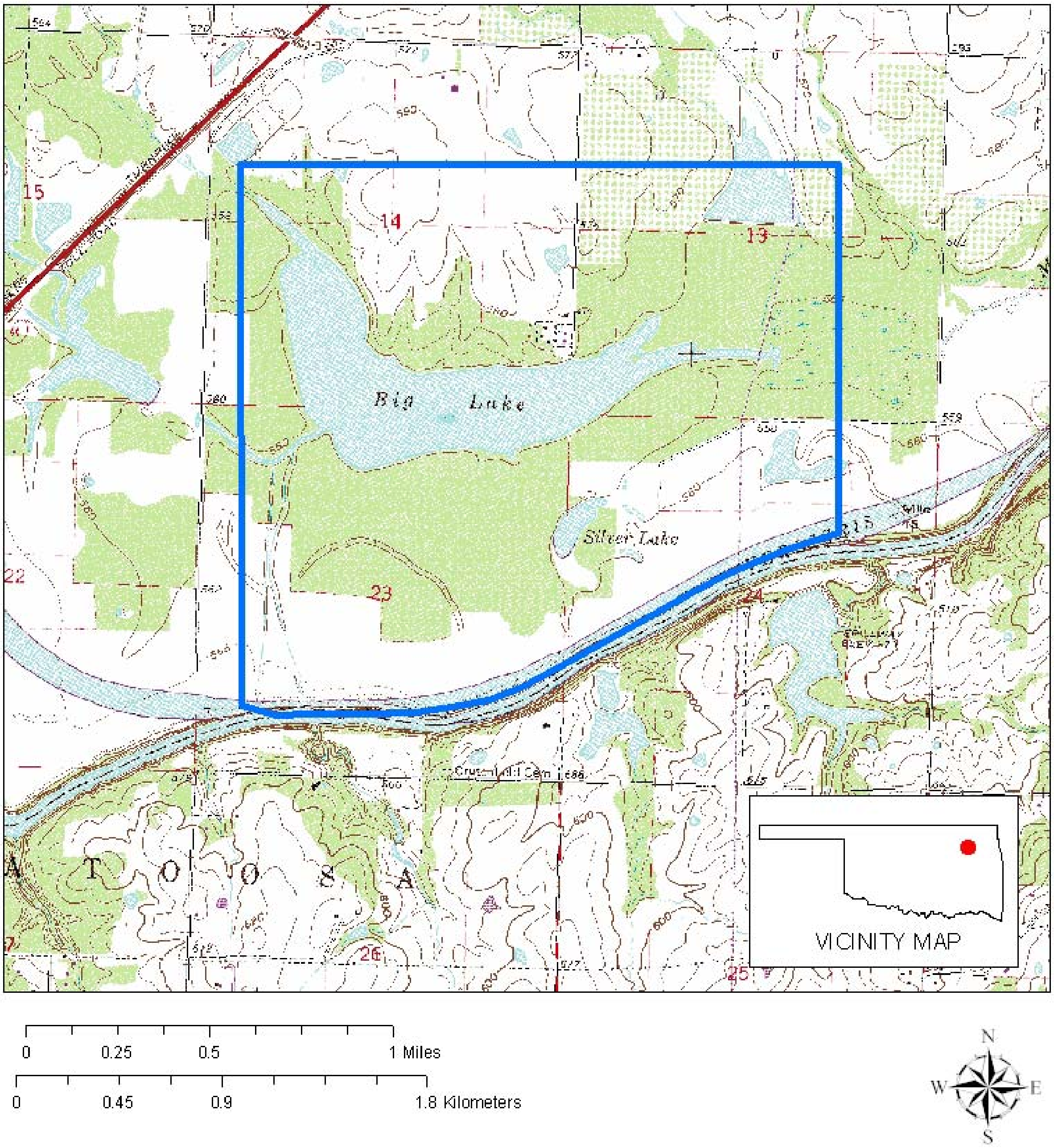

Figure 1
Study Area

Prior to the construction of Oologah Lake and the navigation system, this ecosystem was flooded seasonally from the Verdigris River. The naturally occurring floods sustained and recharged the oxbow lake and riparian forested wetlands associated with the floodplain. Subsequent to the change in river flows, part of the Big Lake complex was converted to green tree reservoirs, which are seasonally flooded by pumping from the river. Construction of Oologah Lake and the navigation system has altered the natural cycles of flooding along the Verdigris River and without pumping water into the site; the values and functions of the Big Lake riparian ecosystem complex would be severely degraded.

The Big Lake area is one of the few remaining large contiguous bottomland hardwood forests remaining in northeastern Oklahoma. Wetlands in the project area are classified as lacustrine open water, palustrine forested, palustrine scrub-shrub, palustrine aquatic bed and palustrine emergent. The area is home to a wide diversity of wildlife, including amphibians, reptiles, mammals, Neotropical birds, wading birds, shorebirds, wintering and migrating waterfowl. Bottomland hardwood habitat area has severely decreased in Rogers County. Prior to construction of the navigation system, it is estimated that 38,400 acres of bottomland hardwood habitat existed in Rogers County. In 1982, only 10,800 acres remained which is a reduction of 72 percent (Bottomland Hardwoods of Eastern Oklahoma; Brabander, Masters, Short, December 1985).

The Big Lake bottomland hardwood wetlands and other bottomland hardwood habitat in eastern Oklahoma have been identified as having national importance for migrating and wintering waterfowl in the Central Flyway. These areas are within the Lower Mississippi Valley Joint Venture boundary of the North American Waterfowl Management Plan. This area has also been identified in several state and federal studies ("Bottomland Hardwoods of Eastern Oklahoma", "North American Waterfowl Plan for Northeastern Oklahoma"), which reaffirmed the importance of bottomland hardwood habitat for fish and wildlife purposes.

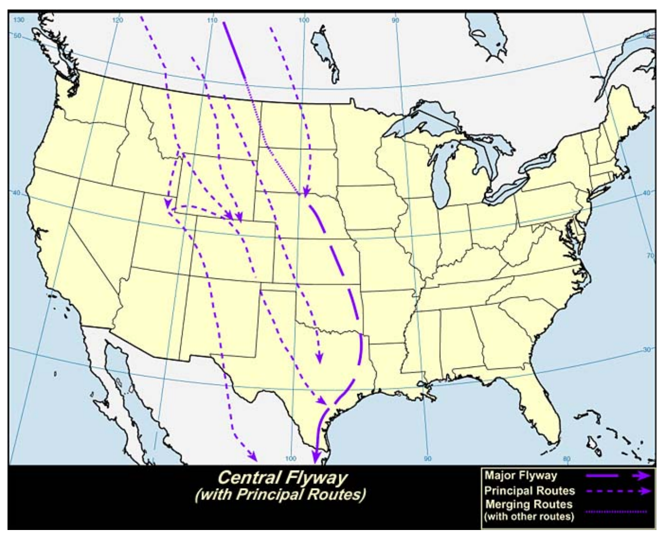

Figure 2
Central Flyway

The Big Lake Club is a non-profit organization established in 1916. They own and manage 1,041 acres of wetlands, bottomland hardwoods, and crop fields. Approximately 713 acres of this area are wetlands comprised of a 166-acre oxbow lake and 547 acres of riparian forested wetlands. The remaining acreage is comprised of flooded crop fields, seasonal hunting cabins and non-flooded bottomland hardwoods. The area is used by Club members to hunt ducks and geese during established hunting seasons. The Club manages hunting in accordance with state and federal guidelines as well as adding restrictions to insure that populations are not adversely impacted. Hunting is limited to members and guests. A copy of the Big Lake Club hunting rules is included in Appendix 2. Population surveys were conducted, using established standards, by Big Lake Club members from the late 1980's to late 1990's. These surveys indicate a significant waterfowl population of 30,000 to 35,000 using Big Lake, often exceeding counts at state and federal managed facilities in Oklahoma. A copy of the population survey data is included in Appendix 2.

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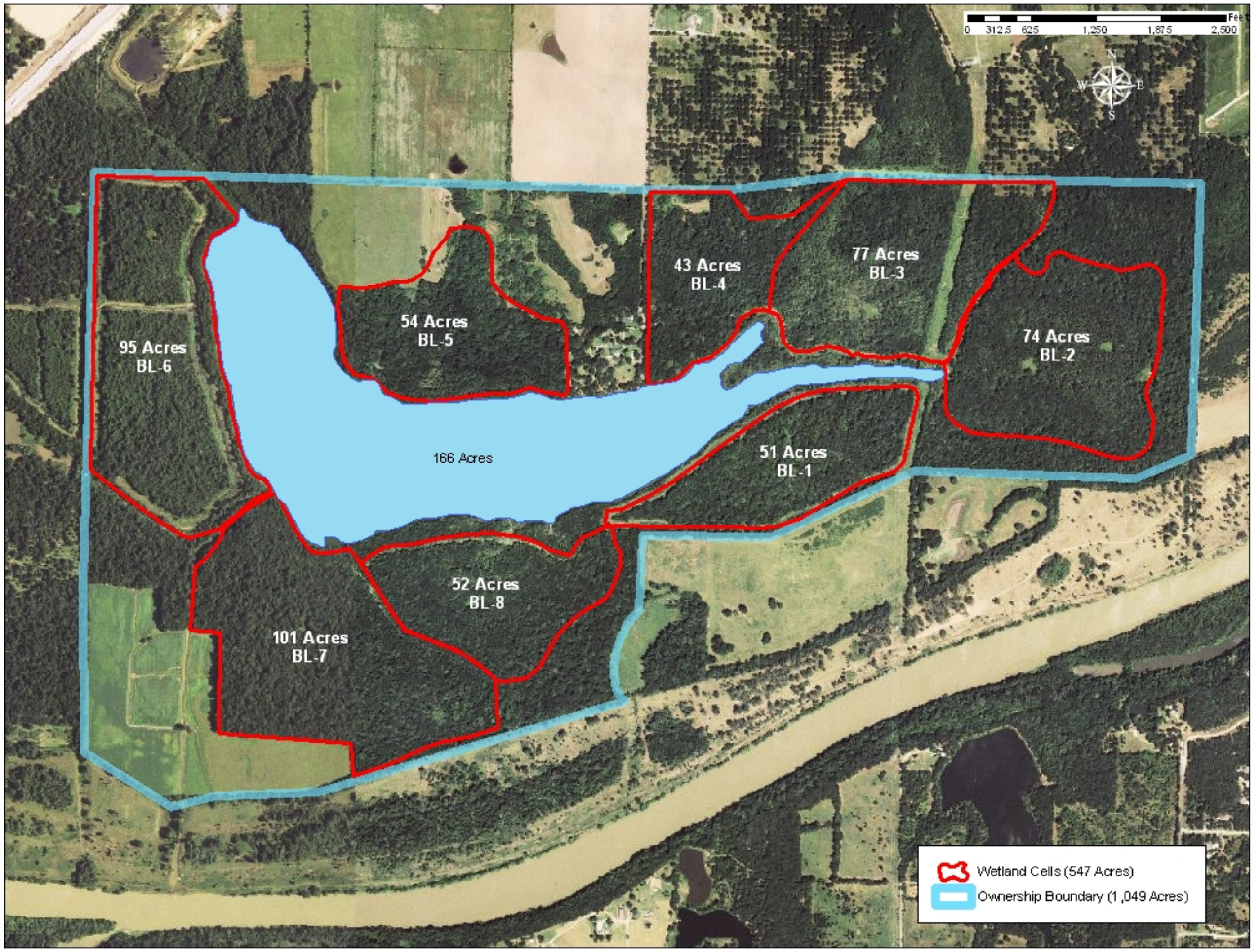

Figure 3
Big Lake Map

A levee system divides the forest into eight wetland cells or green tree reservoirs. These cells are labeled BL1 through BL8 (see map at figure 3). Each fall the bottomland hardwoods are flooded to provide habitat for migrating and wintering waterfowl, wading birds, shorebirds and other wetland wildlife species. The green tree reservoirs are flooded from November through January. Pumping is halted in February allowing water to drain off in time for the early growth period. The trees are routinely inspected to ensure all standing water is gone before the growing season starts.

The wetland habitat is maintained by pumping water from the Verdigris River to a high point on the property and allowing it to gravity flow through a conveyance system into the managed areas. The existing system does not allow for selective filling of green tree reservoirs. Water fills the first cell (BL7), and then moves east into the next cell and so on. Cells on the north side of the lake (BL2, BL3, BL4, and BL5) are not connected to the conveyance system and depend on overland flow or overflow from water pumped into the lake. The system was originally designed to flood only about 140 acres (BL7 and BL8). The sponsor has been attempting to flood 400-500 acres (including the lake) but the pump has failed due to over use. Without federal assistance, the sponsor will likely fall back to only managing 140 acres. The remainder of the forested wetlands will be dependant on rainfall and runoff events.

EXISTING CONDITIONS

Social and Economic Conditions

The study area is located at Big Lake in Rogers County, northeast Oklahoma, about 7 miles northeast of Catoosa, Oklahoma and 15 miles northeast of Tulsa, Oklahoma. Big Lake is a natural oxbow lake located along the Verdigris River, approximately 15 miles downstream of Oologah Lake and Dam. This area is considered the social area within which the primary impacts of the proposed project would occur. The proposed project would have a direct impact on persons living and recreating on the premises of the Big Lake Club along the Verdigris River.

The U.S. Census Bureau estimated that Rogers County had a population of 70,641 in 2000, which is a 22 percent increase over the 1990 population of 55,170. The State of Oklahoma posted a population increase of 9.7 percent during the same period. The largest minority population in the county is Native American, which represent about 11 percent of the population. Twenty-five percent of the county population is under the age of 16. As for the study area, Big Lake Club is owned by a private nonprofit organization whose members frequent during hunting season. The membership count for Big Lake Club is nine as of 2005. Each member is limited to three guests on the premises at one time. The green tree reservoir areas are hunted in rotation with hunting on consecutive days banned. As well as being a hunting area for members of the club, Big Lake is also used for research by schools, universities, and resource agencies.

In 2000, 64.3 percent of the residents of the town of Catoosa were in the labor force, of which 3.4 percent were unemployed. The State of Oklahoma unemployment rate was 3.3 percent during the same year. The majority of the area’s employees worked in manufacturing, retail trade, educational, health, and social services sectors. Manufacturing sectors provided 15.3 percent of the employment for Catoosa.

The rural area in the vicinity of Big Lake Club is primarily undeveloped, with an additional mix of commercial and agricultural operations. The area impacted by the project mainly consists of wetlands and bottomland hardwoods, which serve as habitat for migratory waterfowl and other wetland wildlife. Members of Big Lake Club pay annual dues totaling $64,800. The 2000 per capita income (PCI) for residents in Catoosa was $16,061. This compared with $17,646 PCI for the State of Oklahoma and $21,587 for the entire United States.

Natural Resources

Terrestrial Resources

The project is located in the central lowlands of the Prairie Parkland province (Bailey, 1995). Vegetation in this province is forest-steppe, characterized by intermingled prairie, groves, and strips of deciduous trees. Historically, the flood plain habitat consisted of a vegetative composition typical of bottomland hardwood forest, comprised primarily of oak, hickory, pecan, hackberry, black walnut, cottonwood, elm, and sycamore. Bottomland hardwood systems serve as catchments and water retention areas in times of flooding, help control erosion, contribute to the nutrient cycle, and play a vital role in maintaining water quality by serving as a depository for sediments, wastes and pollutants from runoff. Despite these important functions, bottomland hardwoods ecosystems are one of the most endangered ecosystems in the United States (MacDonald et al. 1979).

Construction of the navigation system through channelization and cutting off meandering bends on the Verdigris River has dramatically altered the flooding regime of the floodplain forest. High spoil banks along the river have prevented floodwaters from overtopping its banks to nourish and recharge wetlands and riparian vegetation. The land between the Verdigris river and adjacent to the Big Lake area has been severely altered by the existence of the spoil banks. This area is a narrow strip of land that is owned and managed by the U.S. Army Corps of Engineers. Dredge spoil material was deposited along the banks during construction of the navigation system. The area consists of grasses and scrub-shrub vegetation. There is also an old dredge disposal pit located in this area adjacent to the Big Lake property that is no longer actively used. The dredge spoil pit has been abandoned and now contains mature vegetation such as cottonwoods, sycamore and willows along with an understory of Virginia creeper, poison ivy, redbud, dogwood, persimmon and other common plants.

Vegetation of the Big Lake area consists of an overstory of burr oak, pin oak, red oak, black oak, chinkapin oak, shumard oak, pecan, black walnut, hackberry, sugarberry, American elm, silver maple, sycamore, winged elm, green ash, red ash and an understory of woodland oats, goldenrod, box elder, red bud, dogwood, wild rye grass, munro grass, beadgrass, sedge, and Virginia creeper.

Wetlands

There are numerous wetlands in the project area. In the center of the project area is an old oxbow lake that is used to help supply water to some of the green-tree areas, it is classified as lacustrine open water. The green-tree areas fall within the classification of palustrine forested, palustrine scrub-shrub, palustrine aquatic bed and palustrine emergent.

The oxbow lake is basically shallow with depths ranging from no more than 8-ft to less than 1 foot. Vegetation around the perimeter of the lake and the eastern quarter of the lake consist of buttonbush, burhead, rice cutgrass, river bulrush, soft rush, spike rush, smartweed, cardinal flower, arrowhead, cattails, cowlily, flat sedge, hopsedge, lake sedge, winged loosestrife, spatterdock, purple primrose willow, beggartick . Other wetland vegetation seen in the area consist of indigo bush, deciduous holly, curly dock, hairy beadgrass, false nettle, water hemp, frog fruit and numerous species of rushes and sedges.

Figure 4
Big Lake

Wildlife

Most riparian habitats contain a rich diversity of wildlife species because of the abundance of food, vegetative cover, and water found there. Brabander et al. (1985) describe the importance of bottomland hardwoods in eastern Oklahoma and estimates that a significant number of species of fish, amphibians, reptiles, birds, and mammals may use bottomland hardwoods in a 28 county study area in eastern Oklahoma. Among the Central Plains states, Oklahoma ranks first in surface area of reservoirs and second, behind North Dakota, in the percentage of that area that is considered valuable habitat for migrating and wintering waterfowl.
The following paragraphs provide a listing of wildlife species that could occur in the Big Lake project area.

Mammals most likely to occur in the area include white-tailed deer; eastern fox and gray squirrel; thirteen-lined ground squirrel, fox squirrel, plains pocket gopher; eastern cottontail and swamp rabbit; common muskrat; eastern chipmunk; American beaver; bobcat; common gray fox; coyote; nine banded armadillo; common raccoon; striped and eastern spotted skunk; Virginia opossum Eastern Pipistrelle and numerous bats and rodents.

Fish occurring in the oxbow lake include catfishes, sunfishes, gar, common carp, smallmouth and largemouth bass.

Amphibians and reptiles that have been found in Rogers County and typically could be present in the Big Lake area include: water snake, cottonmouth, copperhead, common garter snake, ribbon snake, racer, ring-necked snake, worm snake, black-rat snake, milk snake, speckled king snake, diamond back water snake, flat-headed snake, ground snake, slender glass lizard, fence lizard, collared lizard, Texas horned lizard, Mississippi mud turtle, alligator snapping turtle, eastern and ornate box turtle, western narrow mouthed toad, American toad, cricket frog, and bull frog.

Birds most likely to be found utilizing the area include: black crowned night heron, snowy and cattle egret, blackbird, red-shouldered hawk, indigo and painted bunting, wood thrush, barred owl, great horned owl, scarlet tanager, summer tanager, downy woodpecker, red-headed woodpecker, ruby-throated hummingbird, flycatchers, native sparrow, lark sparrow, red-winged blackbird, cardinal, blue jays, and mourning dove. Neotropical migrants utilize the bottomland forests along the river during spring migration.

Waterfowl common to the area include: Canada, snow and blue geese, wood ducks, mallards, northern pintail, blue-winged and green-winged teal, gadwall, coots, grebes, common and hooded merganser, northern shoveler, American black ducks, cormorant, little blue and great blue heron and egrets. Other species viewed in the area but not as common are red-breasted merganser, pelicans, gulls and avocets.

Soils

Lands proximal and adjacent to Big Lake consist of Verdigris clay loam and a strip of Osage Clay immediately south of Big Lake.

The Verdigris series formed under trees and tall grasses in recent alluvium along the major streams. Verdigris clay loam is a nearly level soil located on bottom lands that are flooded during wet seasons. Slopes range from 0 to 1 percent.

Like the Verdigris series, the Osage series formed under trees and tall grasses in recent alluvium along major streams. Osage clay is a nearly level, imperfectly drained soil in the bottom lands. Slopes range from 0 to 1 percent.

Prime and Unique Farmland

According to the U.S. Department of Agriculture (USDA), the definition of "prime farmland" is soil that is best suited for producing food, feed, forage, fiber and oilseed crops. Rogers County has 20 soils classified as prime farmland (USDA, 1983). The Verdigris clay soils are considered prime farmland and the Osage Clay series if the area is drained; however, the majority of Big Lake Area (where the work is proposed) is covered with bottomland hardwoods and is not cultivated.

Wild and Scenic Rivers

Pursuant to the Wild and Scenic River act, Wild River Areas are defined as those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. Scenic river areas are defined as those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads. Neither the Verdigris River nor Big Lake is listed as a wild and scenic river.

Threatened and Endangered Species

According to the U.S. Fish and Wildlife Service, the following federally-listed threatened and endangered species may be found in Rogers County, Oklahoma. The species likely to occur in the project area include: American burying beetle (Nicrophorus americanus), and bald eagle (Haliaeetus leucocephalus).

The American burying beetle (ABB) is federally listed as Endangered. In Oklahoma the ABB is currently known to occur in 22 counties, including Rogers County. The beetle has been found in various types of habitat including oak-pine woodlands, open fields, oak-hickory forest, open grasslands, and edge habitat. Research indicates that American burying beetles are feeding habitat generalists. ABBs are nocturnal and have a life span of about one year. ABBs enter an inactive period underground when the nighttime low temperatures are 60^0F or below. This typically occurs from mid-September through late-May in Oklahoma. Once the nighttime low temperatures are consistently (at least 5 consecutive days) above 60^0F, ABBs become active (USFWS 2005).

The bald eagle is federally listed as Threatened and has been proposed for delisting. The bald eagle's preferred habitat is coastal areas, rivers or lakeshores with large, tall trees. The bald eagle is a winter resident that is frequently seen in the vicinity of Big Lake. Bald eagle nesting activity has increased dramatically in Oklahoma in recent years; however, no nesting pairs have been reported in the Big Lake area.

Cultural Resources

Archaeological sites representative of the Early Archaic Period through the Middle and Late Archaic, Woodland, Plains Village, and Historic Periods are known from the generalized vicinity of Big Lake and northeastern Oklahoma. This culture-historical sequence falls generally within the overall sequence that has been established for eastern Oklahoma. Some sites in this area have undisturbed, deeply-buried deposits; many are comprised of multi-component prehistoric and/or historic occupations. There have been no large or systematic archaeological surveys south of Oologah Reservoir on the Verdigris River. Recorded archaeological sites within the immediate vicinity of Big Lake are few in number, and none have been extensively investigated.

Air Quality

The U.S. Environmental Protection Agency published a Conformity Rule on November 30, 1993, requiring all federal actions to conform to appropriate State Implementation Plans established to improve ambient air quality. At this time, the Conformity Rule only applies to Federal actions in non-attainment areas. This geographical region is in attainment and meets National Ambient Air Quality Standards for the criteria pollutants designated in the Clean Air Act. Consequently, a conformity determination is not required

The study area is located in a predominately rural area. There is no air quality monitoring station located in Verdigris, Oklahoma. The nearest State and Local Air Monitoring Station (SLAMS) is located in downtown Tulsa, which is over 10 miles southwest of the project site, in Tulsa County. The Oklahoma Department of Environmental Quality (ODEQ) monitors the air quality stations in Tulsa and the surrounding area for both criteria pollutants and air toxins. National Ambient Air Quality Standards exist for six pollutants: carbon monoxide, ozone, particulate matter smaller than 10µm, sulfur dioxide, nitrogen oxides, and lead. These "criteria pollutants" are the only ones for which standards have been established. The EPA assigns designations, based on an area's meeting, or "attaining" these standards. The Tulsa County area is designated "In Attainment" for criteria pollutants and air toxins.

Water Quality

Under section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. Impaired waters are those that do not meet water quality standards that have been set for them by states, territories, and authorized tribes, even after point sources of pollution have been controlled by the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDL) for these waters. A TMDL specifies the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and allocates pollutant loadings among point and nonpoint pollutant sources. By law, EPA must approve or disapprove lists and TMDLs established by states, territories, and authorized tribes.

The Verdigris River, which provides water to flood the green-tree reservoirs at Big Lake, is listed by the Oklahoma Department of Environmental Quality (ODEQ) on EPA's 303(d) list as being impaired for Lead. Total maximum daily loads for this parameter have not been determined yet, but are expected by December 31, 2005. The source of the contamination is listed as unknown.

Mossy Creek which flows through Big Lake is fed by Dog Creek which is listed on the 303(d) list as impaired for Dissolved Oxygen and pathogens. The source is also listed as unknown.

Hazardous, Toxic and Radiological Waste

Potential for discovery of hazardous material at Big Lake was evaluated through examination of historic and current land use, review of environmental data bases, interviews with local regulatory personnel, and visual observations. Based on the findings of this survey, the potential for discovery and significant problems related to HTRW during project construction is believed to be low.

Lands adjacent to the project area are primarily composed of agricultural land. As such, these lands have not been subject to industrial development or other land use activities with associated potential for significant contamination.

However, a major interstate is located within 1/8 of a mile from the project area and could be a potential source for HTRW contamination resulting from a major accident on the interstate. In addition, approximately 3 miles upstream of the project site on the Verdigris River is the Port of Catoosa. The Port of Catoosa is a 2,000 acre industrial park. Various commodities are shipped to and from the facility. There are 50 companies located within the port involved in manufacturing, distribution, and processing of products ranging from agricultural commodities to manufactured consumer goods. Many types of bulk liquids, including chemicals, asphalt, refined petroleum products, and molasses are transferred and stored at the Port.

At this time, there is no reason to believe that environmental media in the project area have been significantly contaminated by past or current land practices or by releases from adjoining properties. No hazardous, toxic, or radiological waste was observed, and potential for encountering these materials appears unlikely.

MOST PROBABLE FUTURE WITHOUT A PROJECT (No Action Plan)

The current failed pump was designed to flood approximately 140 acres of riparian forested wetlands. To replace the hydrologic conditions that existed prior to the impoundment of Oologah Lake and the development of the navigation channel, the sponsor has attempted to directly flood approximately 400 to 500 acres of bottomland hardwoods and oxbow lake annually. This has overburdened the water conveyance system resulting in high maintenance and repair costs and ultimate failure of the system. The pump would eventually be replaced with a similar capacity model, which would be used only to its rated capacity. Without the ability to pump water into the extended riparian forested wetland cells, management of this valuable ecosystem would be more difficult and valuable waterfowl and wildlife habitat would be degraded. Flooding the green tree reservoir cells with a single 5,000 gallons per minute (gpm) pump would mean that flooding of the cells would start earlier than optimal in order to flood all areas in time to support the waterfowl migration. Some trees would be flooded before they are dormant with probable negative effects over time.

PLAN FORMULATION

Planning Objectives

There were two planning objectives developed for this study:

1. Provide a replacement for seasonal flooding of the Big Lake area lost due to the navigation channel.
2. Improve opportunities for managing the green tree reservoirs in the Big Lake area.

Development of Alternatives

During the plan formulation process, several alternatives were considered. The following alternatives were dropped during the early evaluation process.

a. Place a pump station on the north east end of the lake to pump water from the lake to the three green tree reservoirs located at the east end of the lake. This alternative would eliminate the need for extending the conveyance system. Further investigation revealed that this alternative would not be feasible. The lake is very shallow at the north east end (about 18 inches). A large volume of water would have to be pumped into the lake in order to use it to fill the three green tree reservoirs. Electricity is not readily available at the site.

b. Relocation of the pump station to another site along the navigation channel was briefly considered. This plan was rejected because additional clearing to install a pipe or conveyance ditch would be needed and additional cost to bring in utilities would be incurred.

c. Changing the operation of the navigation channel to allow flooding during the required time period was rejected. There would be too many damages from induced flooding and impacts to barge traffic.

d. Installing control structures between the lake and each green tree reservoir to allow the reservoirs to fill from the lake by gravity flow was considered. Water would be pumped into the lake, starting early in the fall. This plan was discarded because several of the green tree reservoirs are at higher elevation than the lake.

The following alternatives were carried forward to more detailed evaluation.

1. Improve Conveyance System. The existing water conveyance system is a series of irrigation ditches, pipes, and stop log structures. The green tree reservoirs (see map at figure 3) are filled in a cascade fashion, with BL7 filling and then spilling over into BL8, etc. This alternative would increase the size of the system to contain flow from pumping at a rate of 5,000 gpm. It would include constructing an earthen berm adjacent to the current conveyance ditch to selectively control which green-tree reservoirs (BL7, BL8 BL1) would be flooded and which would be rested in a given year instead of flooding the areas in a cascading fashion. This alternative also includes installing stop logs or other water control structures for each green tree reservoir. The irrigation system would be extended to flood BL3. This alternative would improve management opportunities for the whole wetland complex. Fifty acres of native bottomland hardwood trees would be planted.

2. Increase Pump Capacity. This alternative involves increasing the existing pumping capacity from 5,000 gpm to 10,000 gpm. The plan would include adding new pumps with 5,000 gpm total capacity along with a building and utility housing. The irrigation ditch would be widened to accommodate the increased pumping capacity. Minor modifications to some of the 'choke points' along the irrigation ditches would be required and the irrigation system would be extended to reach BL3. Flooding of the green tree reservoirs would continue to be done in a cascade fashion; however, management changes would include resting the greentree areas on a rotating cycle. The additional capacity of the pump would allow overfill from the lake to flood BL2. Fifty acres of native bottomland hardwood trees would be planted.

3. Improve Conveyance and Increase Pump Capacity. This alternative consists of measures to increase the conveyance capacity and the pumping capacity. The conveyance system would be enlarged to contain the flow delivered by a pump capacity of 10,000 gpm. The plan would include adding a new pump with 5,000 gpm capacity along with a building and utility housing. It would include constructing an earthen berm adjacent to the current conveyance ditch to selectively control which green-tree reservoirs (BL7, BL8, BL1) would be flooded and which would be rested in a given year instead of flooding the areas in a cascading fashion. Management changes for the other greentree reservoirs would include resting them on a rotating cycle. Fifty acres of native bottomland hardwood trees would be planted.

Comparison of Alternatives

Terrestrial Habitat Evaluation Procedures

The Habitat Evaluation Procedure (HEP) methodology was used to assess the quality of the habitat in the Big Lake Area. HEP is an environmental accounting process developed to appraise habitat suitability for fish and wildlife species in the face of potential change (USFWS, 1980a-c). Designed to predict the response of habitat parameters in a quantifiable fashion, HEP is an objective, reliable, and well-documented process used nationwide to generate environmental outputs for all levels of proposed projects and monitoring operations in the natural resources arena. When applied correctly, HEP provides an impartial look at environmental effects, and delivers measurable products to the user for comparative analysis. In HEP, a Suitability Index (SI) is a mathematical relationship that reflects a species' or community's sensitivity to a change in a limiting factor (i.e., variable) within the habitat type. The SI values range from 0.0 to 1.0, where an SI = 0.0 represents a variable that is extremely limiting, and an SI = 1.0 represents a variable in abundance (not limiting) for the species or community. In HEP, a Habitat Suitability Index (HSI) model is a quantitative estimate of habitat conditions for an evaluation species or community. HSI models combine the HSIs of measurable variables into a formula depicting the limiting characteristics of the site for the species/community on a scale of 0.0 (unsuitable) to 1.0 (optimal). The HEP was designed to evaluate the future changes in quantity (acres) and quality (habitat suitability and functional capacity) of terrestrial ecosystems. Outputs were calculated in terms of annualized changes anticipated over the life of the project [i.e., Average Annual Habitat Units (AAHUs)] in the HEP analyses.

Big Lake is located within the study area of the McClellan-Kerr Arkansas River Navigation System (MKARNS) study and was used as a "reference site" in that study for development of terrestrial habitat community models. The Forest Community model developed for the MKARNS study and the Baseline data obtained was used for this study. A complete copy of the Habitat Evaluation Procedures report prepared for the MKARNS study and EIS is included as an appendix to this report (Appendix 1).

The primary community within the project area is Bottomland Hardwood Forest. This community type was used to gauge the impacts of the proposed alternatives. Specifically, the impact measures focused on the quantity (measured in acres) and quality (measured in HSI) of habitat lost or created throughout the life of the project. The restoration criteria focused on the recovery of a specific habitat, defined on the basis of quantity recovered, and obtainable habitat quality. HEP combines both the habitat quality (HSI) and quantity of a site (measured in acres) to generate habitat units (HU). Once the HSI and habitat quantities have been determined, the HU values can be mathematically derived with the following equation: HU = HSI x Area (acres). Under the HEP methodology, one HU is equivalent to one acre of optimal habitat for a given species or community (ERDC-EL, 2004a).

Site Data Collection. In the spring of 2004, members of the MKARNS multi-agency team completed intensive baseline habitat sampling at 22 sites across the Arkansas River ecosystem. The Big Lake area was among the sites sampled.

A total of 5 HSI variables were measured during the field sampling of Big Lake in an attempt to develop a description of the baseline (Spring 2004) conditions. Variables ranged from measurements of vegetative cover to the counting of the number of species. These variables are described in detail in the Big Lake HEP report in Appendix 1. The sampling effort was completed efficiently on 100-meter (m) transects. Six HSI variables were obtained from Geographic Information System (GIS) resources and spreadsheet calculations. These variables are also described in detail in the attached HEP report.

Field Sampling Protocol. Three 100-m transects were laid down within the boundaries of the indicated cover type at each site, and variables were measured at 10 meter intervals (i.e., 10 sampling stops or stations per transect were made). Data collected on the cover type transects were averaged to generate a cover type score for the site. This strategy reduced the coefficients of variance (i.e., standard deviations of the field data). Figure 5 shows field collection of diameter breast height data along transects in BL1.

Figure 5
Obtaining DBH Data

Baseline Conditions. Once the baseline data inventory was conducted, and both the variable and cover type acreages were determined, the baseline conditions in terms of HUs were generated by multiplication. The baseline analysis results for the Big Lake Area are shown in Table 1 below.

TABLE 1
Baseline Habitat Assessment

SITE NAME	MODEL NAME	HABITAT SUITABILITY INDEX (HSI)	APPLICABLE ACRES	BASELINE HABITAT UNITS (HUS)
BL1	Forest Community Model	0.83	51	42.33
BL2	Forest Community Model	0.65	74	48.10
BL3	Forest Community Model	0.55	77	42.35
BL4	Forest Community Model	0.55	43	23.65
BL5	Forest Community Model	0.55	54	29.70
BL6	Forest Community Model	0.55	95	52.25
BL7	Forest Community Model	0.65	101	65.65
BL8	Forest Community Model	0.83	52	43.16
Lake	Best Professional Judgment	0.50	166	83
Total			**713**	**430**

Generating Without Project Conditions and Calculating Outputs

Future impacts were projected as change from these baseline conditions over the 20-year project life in the HEP assessments. NEPA regulations require consideration of the No Action Alternative during the formulation of plans. The Without Project descriptions should adequately describe the future. Without Project conditions are not "before-and-after" comparisons, they are future oriented. In developing acreage projections for the Future without Project the following assumptions were made:

- Ownership and/or function of land within the project area would not change.
- Forest would likely continue to develop into a more mature forest.

Calculating Annualized Units for the Without Project Condition.

Most Federal agencies use annualization as a means to display benefits and costs. Federal projects are evaluated over a period of time referred to as the "period of analysis". This is defined as that period between the time that the project becomes operational and the projected end of the project life. In HEP, HUs are annualized by summing HUs across all years in the period of analysis and dividing the total (cumulative HU) by the number of years in the life of the project. In this manner, pre-start changes can be considered in the analysis. The results of this calculation are referred to as Average Annual Habitat Units (AAHUs). The total acres of each habitat projected to be gained plus the AAHUs for each terrestrial site under the without project or no action alternative is shown in Table 2 below.

Table 2
Future Without Federal Action

BASELINE (TARGET YEAR 0)				**TY 1**		**TY 11**		**TY 21**		**CUMULATIVE HUS**	**W/OUT PROJ HUS**
Area	**Acres**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**		
BL1	51	0.83	42.33	0.83	42.33	0.83	42.33	0.88	44.88	171.87	8.59
BL2	74	0.65	48.10	0.65	48.10	0.65	48.10	0.70	51.80	196.10	9.81
BL3	77	0.55	42.35	0.55	42.35	0.55	42.35	0.60	46.20	173.25	8.66
BL4	43	0.55	23.65	0.55	23.65	0.55	23.65	0.60	25.80	96.75	4.84
BL5	54	0.55	29.70	0.55	29.70	0.55	29.70	0.60	32.40	121.50	6.08
BL6	95	0.55	52.25	0.55	52.25	0.60	57.00	0.60	57.00	218.50	10.93
BL7	101	0.65	65.65	0.65	65.65	0.70	70.70	0.70	70.70	272.70	13.64
BL8	52	0.83	43.16	0.83	43.16	0.83	43.16	0.88	45.76	175.24	8.76
Lake	166	0.50	83.00	0.50	83.00	0.50	83.00	0.45	74.70	323.70	16.19
Total	713		430		430		440		449	1750	
								Without Project AAHUs			**87.48**

<u>Generating With Project Conditions and Calculating the Outputs.</u>

Anticipated impacts resulting from each of the alternatives proposed were determined and calculated. Assumptions were made that the lands directly impacted by widening of the water conveyance or construction of additional levees would be maintained for it's constructed purpose and would not develop into mature bottomland hardwood forest. The acres of habitat impacted were deducted from the total acreage of the greentree reservoirs to determine the total acres that would benefit from the project. For example: Alternative 2 consists of widening the existing water conveyance ditch impacting approximately 0.5 acres. It was determined that this was a permanent impact. The 0.5 acres was subtracted from the total acreage of BL1, BL7, and BL8 to determine the remaining acreage that would be restored resulting from this project. The anticipated impacts and benefits were calculated and projected through the period of analysis for each of the alternatives

Alternative 1 - Approximately 7 acres would be adversely impacted by constructing an earthen berm the entire length of the levee south of the lake as proposed in alternative 1. This would result in a loss of 5 habitat units in areas BL1, BL7 and BL8. The pumping capacity would remain at the 5,000 gpm rate. This would mean the flooding regime would start earlier in the season and possibly before the trees were dormant in order to have water in all the areas in time for the waterfowl migration. Flooding the trees prior to dormancy would be detrimental to the habitat and could result in tree mortality. The management regime for the greentree areas would change from the No Action plan to include resting the flooding of the areas on a rotating cycle, varying flooding and dewatering dates and watering depths. See Appendix 3 for the recommended Greentree Reservoir Management Plan. Areas BL1, BL7 and BL8 are expected to benefit the most from a management change since they are currently flooded annually and under this alternative one or more of these areas could be flooded while the other two were rested. BL2 is dependant on water flow from the oxbow lake and under this alternative it is anticipated that most years the area would not be flooded and therefore benefits were reduced. BL3 would be added to the flooding regime and would be flooded on a three-year rotating cycle with the other areas. It is expected during drought years that there would not be enough water to flood the area and that this area may experience more dry years than wet. Approximately 50 acres of native oaks would be planted in this area where trees have died in the past from water remaining in the area too long. The benefits from the planting of these trees would not be fully realized within the 20 year period of analysis but would be expected to materialize around 30-40 years after project implementation. Area BL4 and BL6 would continue to mature into a viable bottomland hardwood area and would benefit from the proposed flooding/resting regime. Area BL5 BLH would continue to mature but would only experience flooding during rain events that occurred during the dormant periods and expected to reflect the same conditions as without the project. The oxbow lake habitat was expected to decline over the years due to sedimentation. Total anticipated AAHUs with this alternative would be 89.46.

Alternative 2 – Impacts resulting from implementing this alternative would result in the loss of approximately 0.5 acres due to the widening of the existing water conveyance ditch. This would result in a minuscule loss of 0.2 HU to areas BL1, BL7 and BL8. The pumping capacity would be increased from 5,000 gpm to 10,000 gpm. All areas are expected to benefit from the increased pumping capacity. Flooding of the areas wouldn't occur until the trees were dormant and with the increased capacity the areas would be flooded in time for the waterfowl migration. The greentree reservoirs would be managed on a rotating cycle. However, because some areas are flooded in a cascading fashion they would have to be grouped together in the rotating cycle. The lake is expected to benefit from the sustained water supply and could potentially be raised slightly to offset any impacts from sedimentation. Total anticipated AAHUs with this alternative would be 93.79

Alternative 3 – Impacts are the same as Alternative 1 with the construction of a levee to allow selective flooding of the greentree areas BL1, BL7, and BL8. Benefits resulting from the increased pumping capacity would be the same as in Alternative 2. Total anticipated AAHU would be 92.95

Table 3 lists the costs and outputs for the action alternatives that were evaluated.

TABLE 3
Summary of Benefits and Costs
Action Alternatives

	PLAN 1	**PLAN 2**	**PLAN 3**
Construction Cost	605,761	776,120	913,500
LERRD*	254,000	254,000	254,000
Total Implementation Cost	859,761	1,030,120	1,167,500
Annual Interest Rate	5-3/8%	5-3/8%	5-3/8%
Project Life	20 years	20 years	20 years
Interest and Amortization	71,199	85,307	96,684
Operation & Maintenance	5,000	8,900	12,000
Total Annual Cost	$76,199	$94,207	$108,684
Benefits	89.46 AAHU	93.79 AAHU	92.95 AAHU
* Lands, Easements, Rights-of-Way, Relocations, and Disposal areas.			

COST EFFECTIVENESS/ INCREMENTAL COST ANALYSIS

The alternatives described above were evaluated for effectiveness using the professional judgment of the study team. Costs and benefits were developed for the three action alternatives. Cost effectiveness and incremental cost analysis was done with the IWR-PLAN software, version 3.33. IWR-PLAN provides two processing functions. It can assist in developing alternatives by combining management measures and comparing these alternatives through cost effectiveness and incremental cost analyses. The software also compares the formulated alternative plans and identifies which alternatives are not cost effective, cost effective, and the most efficient of the cost effective (called "best buys"). For this study, the software was used to compare complete alternatives, not to develop alternatives from management measures. The naming conventions of the alternatives are shown below.

Plan 0 No Action
Plan 1 Improve Conveyance System
Plan 2. Increase Pump Capacity
Plan 3. Improve Conveyance and Increase Pump Capacity

The cost and benefit information shown in Table 3 was used as input for the IWR-PLAN software. Figure 6 below shows all the alternatives, including the no action plan plotted with the output in average annual habitat units (AAHU) on the abscissa and the average annual cost in dollars on the ordinate. IWR-PLAN classifies a plan as cost effective if no other plan provides the same level of output for less cost and if no other plan provides more output for the same or less cost. As illustrated on Figure 6, Plan 3 is not cost effective and was dropped from further discussion. The remaining plans are cost effective and Plan 0 and Plan 2 are also 'best buy plans'. Best buys are a subset of cost effective plans that are superior financial investments. Best buys are the most efficient plans at producing the output variable - they provide the greatest increase in the value of the output parameter variable for the least increase in cost. The first best buy is the most efficient plan, producing output at the lowest incremental cost per unit. If a higher level of output is desired than that provided by the first best-buy, the second best buy is the most efficient plan for producing additional output, and so on.

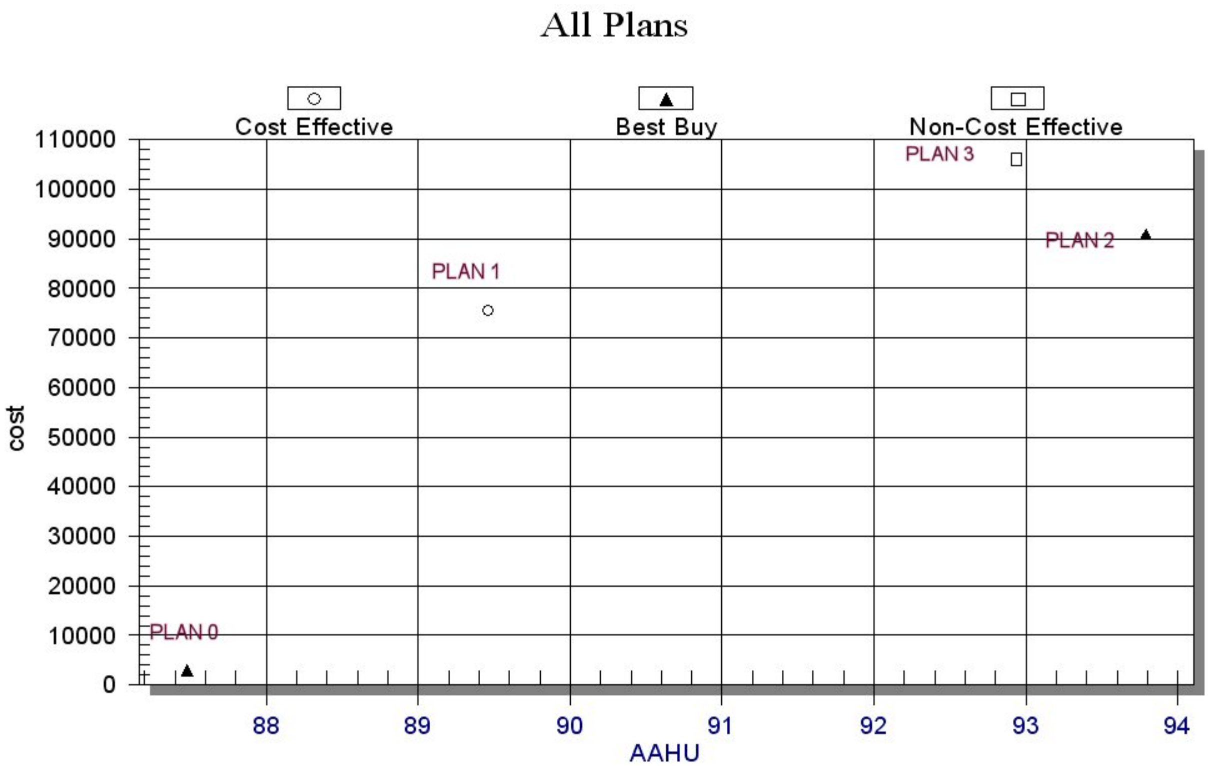

Figure 6
Outputs vs. Costs – All Plans

Figure 7 below shows the comparison of the best buy plans. The output in AAHU is plotted on the abscissa and the incremental cost per unit of output in dollars is plotted on the ordinate. Plan 2 is the only action plan that falls within the best buy category. Plan 1 is cost effective but not as efficient at increasing AAHU.

Best Buy Plans

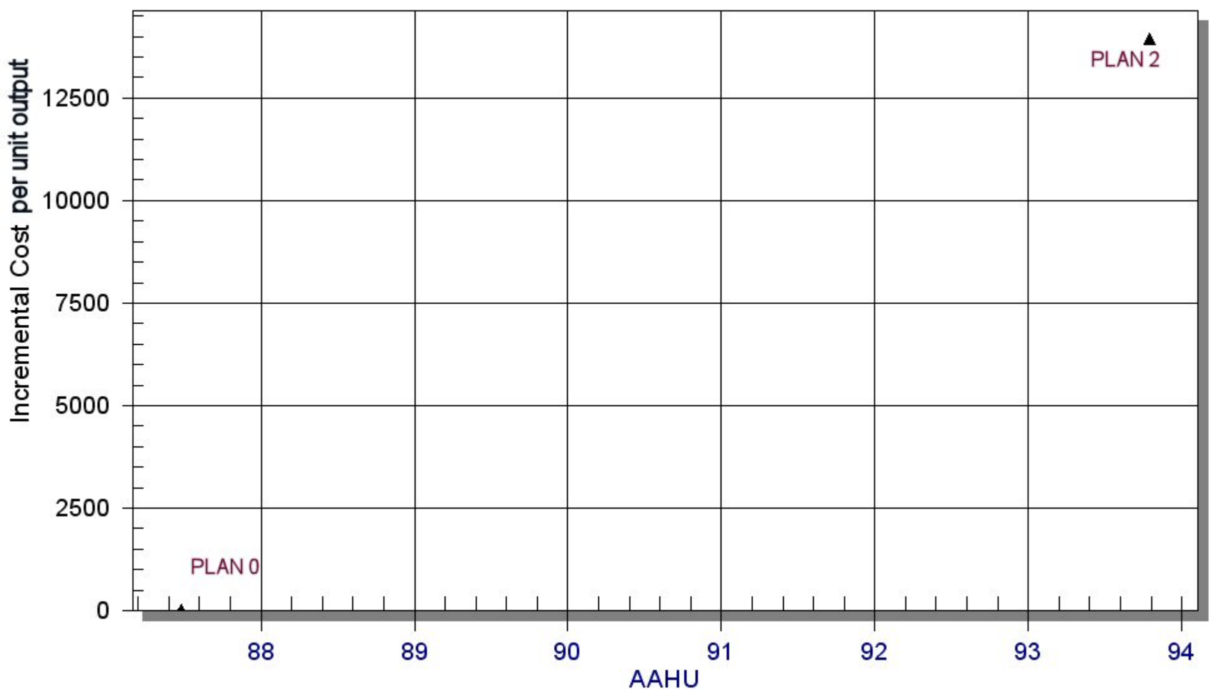

Figure 7
Incremental Cost Analysis Point Graph
Best Buy Plans

Figure 8 below also shows plan 0 and plan 2. The bar graph height shows incremental cost and the bar width shows increase in AAHU from one plan to the next. Due to the small ordinate value for plan 0, it does not show on the bar graph.

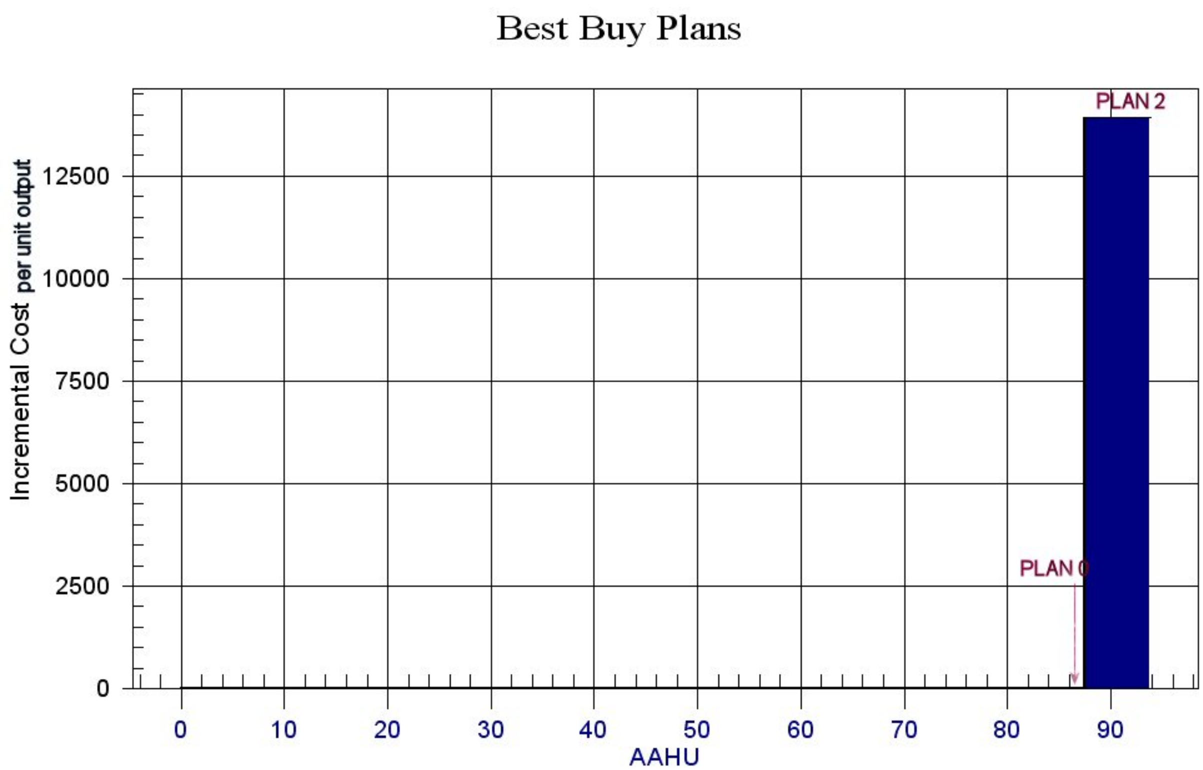

Figure 8
Bar Graph Best Buy Plans

RECOMMENDED PLAN

The three action alternatives were analyzed using the IWR-PLAN decision software. The incremental cost analysis indicated that plan 3 was not cost effective. Plan 1 was cost effective but less efficient than plan 2. Plan 2, as well as the no action plan is more efficient plans called “best buys”. The best buy plans are those cost effective plans which are most efficient at producing the output. The best buy plans produce the output at the least incremental cost per unit. In this case, implementing plan 2 would result in the average annual habitat unit at the lowest incremental cost above the no action plan. Plan 2 is supported by the sponsor for the recommended plan.

Description of Recommended Plan

The recommended plan is plan 2 (see Figure 9) This plan satisfies the two planning objectives by increasing the existing pumping capacity from 5,000 gpm to 10,000 gpm and allowing better management of the green tree reservoirs. The plan would include adding new pumps with 5,000 gpm total capacity along with a building and utility housing. The water conveyance channel would be extended and widened in some sections to accommodate the extra water from increasing the pumping capacity. Minor modifications to some of the 'choke points' of the existing irrigation ditches would be required and the irrigation system would be extended to reach BL3. Flooding of the green tree reservoirs would continue to be done in a cascade fashion for BL1, BL7, and BL8. The additional capacity of the pump would allow overfill from the lake to flood BL2. Fifty acres of native bottomland hardwood trees would be planted in BL3. The additional pump capacity would allow flooding to be delayed until all trees were dormant. A management regime that includes resting individual green-tree cells on a rotating basis would be implemented to maximize habitat benefits. With the 10,000 gpm capacity, the flooding of all the green tree reservoirs could be accomplished in 40 to 60 days. This would ensure the areas were flooded in time for the migration of waterfowl and ensure water remained in the areas sufficiently long enough to benefit the habitat.

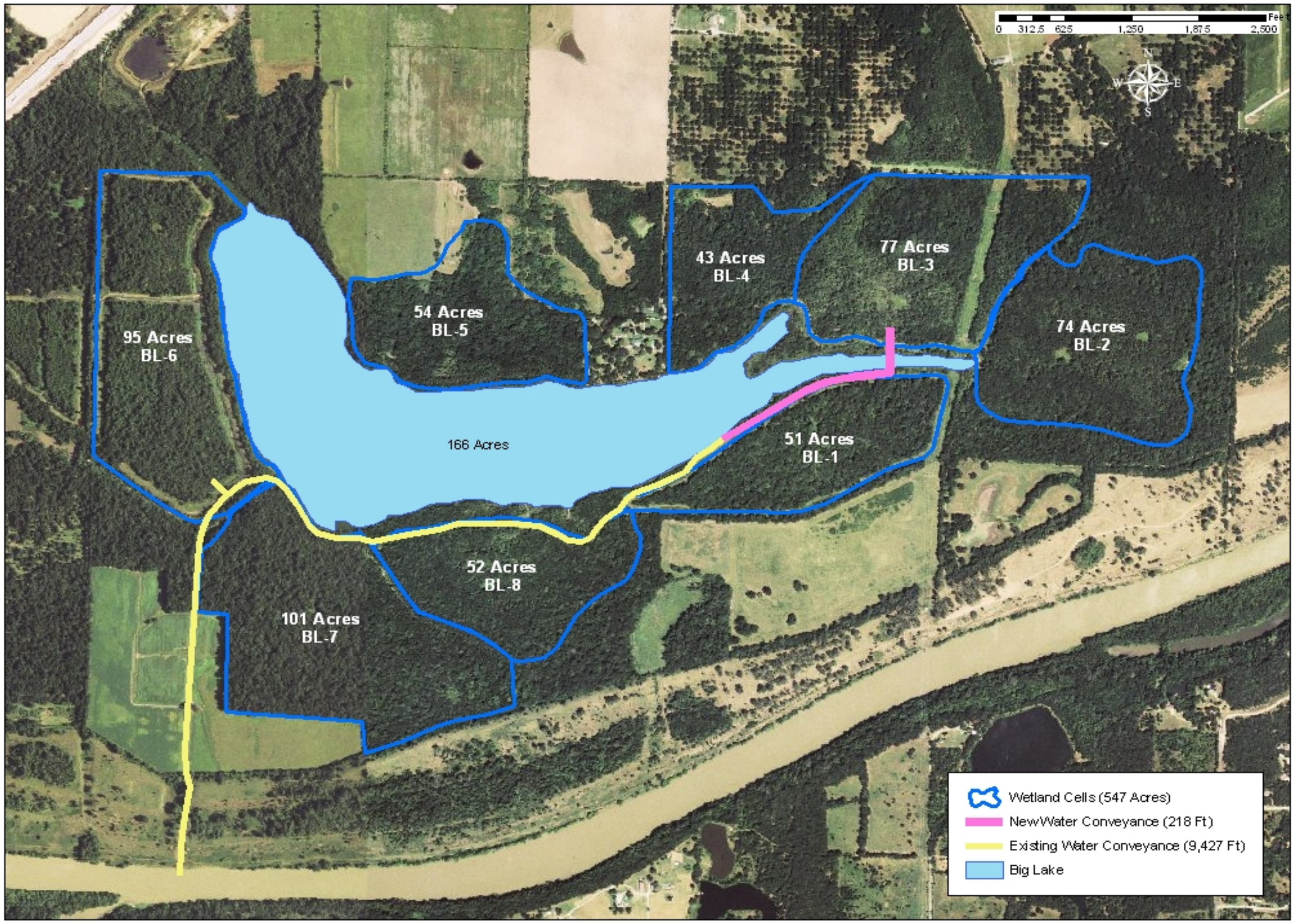

Figure 9
Recommended Plan

The future with project (plan 2) AAHUs for each area within Big Lake is shown in Table 4 below.

Table 4
Future Outputs with the Recommended Plan

BASELINE (TARGET YEAR 0)				**TY 1**			**TY 11**		**TY 21**		**CUMULATIVE HUS**	**W/PROJ HUS**
Area	**Acres**	**HSI**	**HU**	**Acres**	**HSI**	**HU**	**HSI**	**HU**	**HSI**	**HU**		
BL1	51	0.83	42.33	50.75	0.83	42.12	0.88	44.66	0.98	49.74	178.85	8.94
BL2	74	0.65	48.10	74.00	0.65	48.10	0.70	51.80	0.80	59.20	207.20	10.36
BL3	77	0.55	42.35	77.00	0.55	42.35	0.60	46.20	0.75	57.75	188.65	9.43
BL4	43	0.55	23.65	43.00	0.55	23.65	0.60	25.80	0.70	30.10	103.20	5.16
BL5	54	0.55	29.70	54.00	0.55	29.70	0.60	32.40	0.70	37.80	129.60	6.48
BL6	95	0.55	52.25	95.00	0.55	52.25	0.60	57.00	0.75	71.25	232.75	11.64
BL7	101	0.65	65.65	100.88	0.65	65.57	0.75	75.66	0.80	80.70	287.58	14.38
BL8	52	0.83	43.16	51.88	0.83	43.06	0.88	45.65	0.98	50.84	182.70	9.14
Lake	166	0.50	83.00	166	0.50	83.00	0.55	91.30	0.65	107.90	365.20	18.26
Total	713		430	712.50		429.80		470		545	1876	
									Recommended Plan AAHUs			**93.79**

Real Estate Considerations

The project sponsor, Big Lake Club, owns in fee or has access through all lands needed for the project. The land needed for the federal project includes 50 acres for new tree planting, 0.5 acres for clearing and extending the water supply system, 0.5 acres for construction staging, and 0.25 acres for the new pumps and associated structures. The area required for clearing and staging is on land that was used in a cooperative project with the US Fish and Wildlife Service and is not credited to this project. The location for the pump is on land owned by the Corps of Engineers. The sponsor was granted an easement from the Corps for use of the land for purposes of water conveyance.

Recent sales of land in the vicinity of Big Lake were used to determine value and credit for land. There were five sales of land located within two miles of Big Lake within the last four years. A weighted average of the median 3 sales was used to estimate the value for land at Big Lake. The estimated value is $5,077 per acre. The new pump house would be located on an easement on land owned by the Corps of Engineers. Therefore, the total real estate value for the lands required (50 acres) for the federal project is estimated to be $254,000.

Cost Apportionment

The total cost of the recommended plan would be shared between the Government and Big Lake Club on a 75/25 percent proportion, respectively. The 25 percent apportionment to the sponsor is comprised of credit for the value of any lands, easements, rights-of-way, relocations, and disposal areas (LERRD) required for the project and in-kind services. Tree planting and associated tasks would comprise the in-kind services. Table 5 displays the cost apportionment.

Table 5
Cost Apportionment

TOTAL PROJECT COST	$1,130,120
Big Lake Club Share	
LERRD Credit	($254,000)
In-Kind Credit	($28,530)
Big Lake Club (25%)	$282,530
Federal Share (75%)	$847,590

Operation, Maintenance, Repair, and Rehabilitation and Replacement (OMRR&R)

Annual OMRR&R costs associated with this project are estimated at $8,900 and will be a non-Federal responsibility. The sponsor has agreed to follow the OMRR&R requirements as shown in the final operation and maintenance manual. OMRR&R required for the project would consist of implementing most of the management activities currently employed such as keeping the irrigation ditches clear and flooding at the proper time, replacement of dead or damaged trees, and periodic inspection of the irrigation system operation. Additionally, the pump should be maintained according to the manufacturer's specifications. A draft operation and maintenance manual with guidelines for managing the green tree reservoirs is included in Appendix 3. The manual will be finalized after construction is complete.

ENVIRONMENTAL EFFECTS OF THE RECOMMENDED PLAN

A summary of environmental impacts is presented in Table 6, Impact Assessment Matrix.

Social and Economic

Future Without-Project Conditions.

Under the without-project conditions, population trends of the past decade would likely continue with an annual rate of population growth of about 1 percent over the next twenty years. Job opportunities around the Big Lake Club will remain unaffected, and the demand for residential lands will be linked to future population dynamics in the area. The sponsor will face high operations and maintenance costs if they try to manage the Big Lake system with inadequate capacity in the pump system. Damages will consist mainly of financial expenditures foregone in order to maintain the pumping system. Eventually, without federal assistance, the sponsor will fall back to only managing 140 acres.

The unemployment rate will not be affected by the failure of the pumping system at the Big Lake Club. As for the rural communities surrounding Big Lake Club, manufacturing, retail trade, education, health, and social services would remain an important part of the industrial segment of the economy. The failed pumping system would continue to pose a threat to the members of Big Lake Club and to the flora and fauna that are present along Big Lake. Given that the members of Big Lake Club do not reside on the property, and the town of Catoosa is 7 miles away from the affected area, other residents living in town will be unaffected by the presence of the failed pumping system.

Income of persons living near Big Lake has not deviated since the pump has failed. However, the additional costs incurred by the members of Big Lake Club would result in reduced disposable income, as well as the degradation to the habitat area. As employment opportunities remain lower in the affected area than in the town of Catoosa, the income of members of the Club would not likely be tied to employment in the affected area. As well, property values would not stabilize at lower levels if damage to the bottomland hardwoods from lack of flooding does occur.

Land use for the affected area along Big Lake would continue to be a mixture of contiguous bottomland hardwoods and wetlands, where land use near Big Lake will remain low to middle-high income residential properties, commercial development, and light industrial lands. The median house value in the Catoosa area in 2000 was $77,200.

Future With-Project Conditions.

Improving the conveyance and increasing the pump capacity at Big Lake would have a positive impact on the number of people who use the study area, as well as the flora and fauna. The project would not impact future population trends.

Improvements to the pumping system would decrease the risk of loss to the bottomland hardwoods, and to the migratory waterfowl that frequent the Big Lake area seasonally. Long-term impacts would include an enhanced bottomland hardwood area. The overall aggregate employment rate of the Big Lake area would not be significantly affected. Improving the conveyance and increasing the pump capacity could positively affect short-term employment minimally; however long-term related employment would not be affected.

Although land use for the Big Lake area would continue to be a mixture of contiguous bottomland hardwoods and wetlands, the quality of sustainability of these areas would be much greater if the project were pursued. The safety of area residents residing near Big Lake would not be harmed by any of the alternatives presented in this report.

Executive Order 12898 on Environmental Justice requires Federal agencies to address impacts to minority and low-income population. Executive Order 13045 requires that health risks and safety risks to children be addressed. The impacts are significant if action substantially impacts the health and well being of minority and low-income populations to a greater degree than other populations. Actions that substantially affect the health risks and safety risks to children are considered significant. The health and well being of minority and low-income populations will follow historic trends. The age distribution of children (those under 14 years of age) also will follow historic trends. Under with-out project conditions, the health and well being of minority and low-income populations will follow historic trends. The age distribution of children (those under 14 years of age) also will follow historic trends.

Table 6.0 Impact Assessment Matrix

Name of Parameter	Magnitude of Probable Impact						
	Increasing Beneficial Impact			No Appreciable Effect	Increasing Adverse Impact		
	Significant	Substantial	Minor		Minor	Substantial	Significant
A. Social Effects							
1. Noise Levels				x			
2. Aesthetic Values				x			
3. Recreational Opportunities				x			
4. Transportation				x			
5. Public Health and Safety				x			
6. Community Cohesion (Sense of Unity)				x			
7. Community Growth and Development				x			
8. Business and Home Relocations				x			
9. Existing/Potential Land Use				x			
10. Controversy				x			
B. Economic Effects							
1. Property Values				x			
2. Tax Revenues				x			
3. Public Facilities and Services				x			
4. Regional Growth				x			
5. Employment				x			
6. Business Activity				x			
7. Farmland/Food Supply				x			
8. Flooding Effects				x			
C. Natural Resource Effects							
1. Air Quality				x			
2. Terrestrial Habitat				x			
3. Wetlands		x					
4. Aquatic Habitat		x					
5. Habitat Diversity and Interspersion			x				
6. Biological Productivity		x					
7. Surface Water Quality				x			
8. Water Supply				x			
9. Groundwater			x				
10. Soils				x			
11. Threatened and Endangered Species			x				
D. Cultural Resources							
1. Historic Architectural Values				x			
2. Pre-Historic & Historic Archeological Values				x			

Natural Resources

Terrestrial

Increasing the water capacity of the current conveyance ditch would result in minor adverse impacts to the trees in the immediate vicinity of the ditch. Approximately half an acre of clearing along the irrigation ditch will be required. A majority of the trees impacted are adjacent to greentree reservoir BL1 and are growing along the slope of the previously constructed levees and within the shallow areas of the current water conveyance ditch. Diameter at breast height (dbh) for a majority of the impacted trees is less than 6-inches. The predominant species impacted are willows, dogwood, ash, box elder and a few oaks. The benefits gained by implementing the proposed plan would far outweigh the impacts of removing these immature trees.

Implementing a management plan that includes varying flooding and dewatering dates, varying flooding depths and rate of dewatering as well as resting areas periodically would improve the availability of nutrients associated with leaf litter decomposition that promote invertebrates and good timber vigor. Partial draw-downs that produce “puddling” of water tend to concentrate invertebrates in the leaf litter and provide an important food source. Studies have shown that flooding these units the same time and depths year after year results in reduced acorn production and tree vigor, as well as timber mortality (Missouri Conservation Commission); therefore, long-term benefits are anticipated from implementing the management plan proposed with the recommended plan.

Figure 10
Existing Conveyance Ditch

Prime and Unique Farmland

Two soil types are transected by the project. These are Verdigris clay soils and the Osage Clay series both of which are listed as prime farmland soil. Widening of the water conveyance system and extending the delivery system would occur along areas that have already been highly disturbed in the original creation of the greentree reservoirs, construction of the low water dam and electric transmission line right of way. The area is heavily vegetated and has not been used for cultivation of crops. This project would not adversely impact prime farmland.

Aquatic and Wetlands

There would be minor impacts resulting from extending the water conveyance system to flood area BL3. This would involve trenching and placement of pipe in the wetland area between the existing levee and the lake. A narrow strip of wetland vegetation would be trampled or uprooted. Impacts would be temporary and aquatic plants are expected to rebound and recolonize during the next growing season. The current water conveyance ditch would be widened by heavy equipment displacing reptiles, amphibians and fish to adjacent areas. This would be temporary and once construction was complete the aquatic wildlife would be expected to return.

Wildlife

The current water conveyance ditch would be widened by heavy equipment displacing any mammals, reptiles, amphibians and fish to adjacent areas. This would be temporary and once construction was complete the wildlife would be expected to return. There would be minor impacts resulting from extending the water conveyance system to flood area BL3. This would involve trenching and placement of pipe in the wetland area between the existing levee and the lake. Construction activities would deter wildlife from utilizing the area; however, impacts/disturbance is considered temporary and minor. Wildlife would return to the area once construction was completed.

Threatened and Endangered Species

The recommended plan would have no adverse impacts to the Bald Eagle resulting from construction and could have minor beneficial impacts by providing a mechanism to keep the oxbow lake recharged with water ensuring a good food source.

The recommended plan would not adversely affect the American Burying Beetle (ABB). The water conveyance ditch and the location for extending the irrigation line is wet throughout the year and not considered suitable habitat for the ABB.

Cultural Resources

In addition to planting new bottomland hardwood trees, structural elements of the proposed project include the installation of new pumps and minor modifications to the irrigation system. Specifically, two new 300-foot long ditches (2-3 feet deep) are planned in order to connect existing drainages, and one 24-inch flow pipe will be placed below normal lake level on the lake’s east end.

The Big Lake system of dikes, channels, and pipes has resulted in significant disturbance within these narrow, localized corridors. While surrounding bottomland hardwood forest has remained protected, the construction of these elements has resulted in significant movement of the top several feet of soil. In fact, both new 300-foot long ditches will be placed immediately adjacent to an existing low-relief dike, so that adjacent hardwood forest is not impacted. Additionally, the 24-inch pipe planned for placement on the east end of Big Lake will be located in a portion of the lake that has been extensively modified in the past with a flow/gate structure, culverts, and a power line right-of-way.

In short, all structural elements will be placed in areas where significant earth movement was involved in constructing other elements of the water flow and retention system. Therefore, the proposed project should not adversely affect historic properties. Coordination to this effect has been initiated with the Oklahoma State Historic Preservation Office (SHPO) and Oklahoma Archeological Survey (OAS) (see Appendix 4). However, if archaeological sites or historic standing structures are identified in the course of the project, they will be evaluated for historical significance consistent with the procedures outlined in 36 CFR 800, implementing regulations for Section 106 of the National Historic Preservation Act of 1966 (as amended). Sites or structures that are determined eligible for the National Register, and that will be adversely impacted, may be mitigated. Plans for resolving adverse effects will be determined through consultation with the SHPO, OAS, Advisory Council on Historic Preservation (ACHP), and appropriate and interested Native American tribes and other interested parties.

Air Quality

The recommended plan would have no adverse impacts on air quality. There would be minor temporary air emissions during the widening of the water conveyance ditch; however this would not adversely impact the air quality. This area is currently in attainment with the Clean Air Act Amendments of 1990.

Water Quality Permits

The project is located in the Verdigris River flood plain and involves placement of a water intake pipe in the river below the ordinary high water mark. The U.S. Army Corps of Engineers, Tulsa District has determined that the Nationwide Permit for minor discharges (NWP 18) pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act is required for the recommended plan. The application process has been started and the permit will be issued before the EA is finalized (Appendix B).

Noise

Noise levels are anticipated to increase slightly during construction but will return to baseline levels once construction is complete. There would be no anticipated permanent increase in noise as a result of this project.

Cumulative Effects

No cumulative negative impacts are anticipated as a result of the proposed project.

PROJECT IMPLEMENTATION

Once a letter of intent is received from Big Lake Club, efforts would continue on the development of plans and specifications for the recommended plan. When the plans and specifications are sufficiently complete, construction approval and a commitment of Federal funds for construction would be requested. Once received, the Project Cooperation Agreement (PCA) will be executed, followed by advertisement of a construction contract. Table 7 displays the major project milestones and their expected completion date.

Table 7
Major Project Milestones and Completion Dates

MILESTONE	COMPLETION DATE
Initiate Plans and Specifications	March 2006
Receive Construction Approval	April 2006
Execute PCA	April 2006
Verify Real Estate	May 2006
Advertise Construction Contract	July 2006
Award Contract	August 2006

DRAFT

APPLICABLE ENVIRONMENTAL LAWS AND REGULATIONS

TABLE 8.0

RELATIONSHIP OF PLANS TO ENVIRONMENTAL PROTECTION STATUTES
AND OTHER ENVIRONMENTAL REQUIREMENT

Policies	Compliance of Alternatives
Federal	
Archeological and Historic Preservation Act, 1974, as amended, 16 U.S.C. 469, et seq	All plans in full compliance
Clean Air Act, as amended, 42 U.S.C. 7609, et seq	All plans in full compliance
Clean Water Act, 1977, as amended (Federal Water Pollution Control Act), 33 U.S.C. 1251, et seq	All plans in partial compliance(1)
Endangered Species Act, 1973, as amended, 16 U.S.C. 1531, et seq	All plans in full compliance
Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1-12, et seq	All plans in full compliance
Fish and Wildlife Coordination Act, as amended, 16 U.S.C. 661, et seq	All plans in full compliance
Land and Water Conservation Fund Act, 1965, as amended, 16 U.S.C. 4601, et seq	All plans in full compliance
National Historic Preservation Act, 1966, as amended, 16 U.S.C. 470a, et seq	All plans in full compliance
National Environmental Policy Act, as amended, 42 U.S.C. 4321, et seq	All plans in full compliance(2)
Native American Graves Protection and Repatriation Act, 1990, 25 U.S.C. 3001-13, et seq	All plans in full compliance
Rivers and Harbors Act, 33 U.S.C. 401, et seq	All plans in full compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq	All plans in full compliance
Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq	All plans in full compliance
Water Resources Planning Act, 1965	All plans in full compliance
Floodplain Management (E.O. 11988)	All plans in full compliance
Protection of Wetlands (E.O. 11990)	All plans in full compliance
Environmental Justice (E.O. 12898)	All plans in full compliance
Protection of Children (E.O. 13045)	All plans in full compliance
Migratory Bird Treaty Act , 16 U.S.C. 703-711, et seq (E.O. 13186)	All plans in full compliance
Farmland Protection Policy Act, 7 U.S.C. 4201, et seq	All plans in full compliance

Note: Full Compliance - Having met all requirements of the statutes, Executive Orders, or other environmental requirements for the current stage of planning.
(1) Section 404 of the Clean Water Act – application for a nationwide permit has been submitted for water intake for pump. Awaiting final approval letter
(2)National Environmental Policy Act of 1969 requires an environmental review prior to a Federal agency making an irretrievable commitment of Federal resources
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Federal, State, and Local Agency Coordination

The draft environmental assessment (EA) was coordinated with the following agencies having legislative and administrative responsibilities for environmental protection. A copy of the correspondence from those agencies that provided comments and planning assistance for preparation of the draft EA are in the appendices. The mailing list for the 30-day public review period for this EA is in Appendix 4.

U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Geological Survey
Natural Resources Conservation Service
Oklahoma Archeological Survey
Oklahoma State Historic Preservation Officer
Oklahoma Department of Environmental Quality
Oklahoma Water Resources Board
Oklahoma Department of Wildlife Conservation
Muscogee (Creek) Nation of Oklahoma
Caddo Tribe of Oklahoma
Wichita and Affiliated Tribes

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