DRAFT MASTER PLAN

MASTER PLAN REVISION
ADDICKS AND BARKER RESERVOIRS
BUFFALO BAYOU AND TRIBUTARIES
FORT BEND AND HARRIS COUNTIES, TEXAS

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U.S. Army Corps of Engineers
Galveston District

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ACRONYMS AND ABREVIATIONS

CBC	Christmas Bird Count
CEE	Council of Environmental Education
cfs	Cubic Feet per Second
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	U.S. Corps of Engineers Manual
EP	U.S. Corps of Engineers Pamphlet
ER	U.S. Corps of Engineers Regulation
ES	Environmentally Sensitive
FBC	Fort Bend County
FEMA	Federal Emergency Management Agency
FFA	Future Farmers of America
FONSI	Finding of No Significant Impact
HCFCD	Harris County Flood Control District
HIRec	High Impact Recreation
IPM	Integrated Pest Management
LTA	Local Training Area
MRM	Multiple Resource Management
MSL	Mean Sea Level
NAWMP	North American Waterfowl Management Plan
NGDV	National Geodetic Vertical Datum
NEPA	National Environmental Policy Act
NLCD	National Land Cover Database
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
Ops	Operations
PHIRec	Proposed High Impact Recreation
SHPO	State Historic Preservation Officer
TDHS	Texas Department of Health Services
TFS	Texas Forest Service

ACRONYMS AND ABREVIATIONS (continued)

TPWD	Texas Parks and Wildlife Department
TSDC	Texas State Data Center
TWDB	Texas Water Development Board
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey

SECTION 1.- INTRODUCTION

In December of 1935, a thunderstorm recorded 16.5 inches of rainfall and resulted in major flooding along Buffalo Bayou through the City of Houston causing eight deaths and an estimated $2.6 million in property damages. Power to all Houston Ship Channel industries was cut off as Buffalo Bayou rose 10 inches every hour for 24 hours, reaching 52 feet above sea level at Capitol Street Bridge, where normally the bayou ran at six feet above sea level.

In response to this catastrophe and to provide a measure of flood risk management for future events, Congress authorized the U.S. Army Corps of Engineers (USACE) to construct Addicks and Barker Reservoirs. Completed in 1948, the reservoirs are located in Harris and Fort Bend Counties west of the City of Houston. The reservoirs are normally "dry" in the sense that they impound water during rainfall or flood events, and do not store water year-round as is typical of lake-forming reservoirs. This "dry" condition of the reservoirs has presented the USACE with several management opportunities, primarily the sustainable management of natural resources of Corps of Engineers administered land and water in accordance with ecosystem management principles, and the opportunity to provide quality public outdoor recreational experiences for present and future generations.

To reflect current resource management values and principles, and in accordance with Corps of Engineers regulations, this 2008 Addicks and Barker Reservoirs Master Plan Revision describes proposed changes to land use classifications, the need for undertaking these reclassifications, and the laws, regulations, values, standards, principles and guidance used in developing this Draft Master Plan Revision. The proposed land use classifications detailed in this revision replace land use classifications identified under the current Addicks and Barker Reservoirs Master Plan Update (1986). The following sections provide an overview of the factors influencing the operation and management of the Federal project and lands, and establish new land use classifications in-line with current USACE management objectives and principles.

1.01 AUTHORIZATION

The Buffalo Bayou, Texas, Project, which includes the Addicks and Barker Dams and Reservoirs, was authorized for flood control by the Rivers and Harbors Act, approved June 30, 1938, and modified by the Flood Control Acts of August 11, 1939, and September 3, 1954, and provides for improvements to Buffalo Bayou and its principal tributaries, White Oak Bayou and Brays Bayou. The project was authorized for the purpose of protecting urban development in the downstream floodplain of Buffalo Bayou through the City of Houston. Federal laws state that land and water areas of U.S. Army Corps of Engineers (USACE) water resource projects, constructed for the primary purposes of flood risk management, navigation, and/or power, shall be administered to encourage and develop collateral uses, such as conservation of fish and wildlife resources, recreation, and other purposes in the public interest.

Development and use of flood-control reservoir areas for recreational and related purposes were authorized by Section 4 of the Flood Control Act, approved December 22, 1944, and amended by Section 209 of the Flood Control Act of 1954, approved December 3, 1954. The Fish and Wildlife Coordination Act, enacted March 10, 1934, as amended, provides authority for making project lands of value for wildlife purposes available for management by interested Federal and state wildlife agencies. This Master Plan has been prepared in accordance with guidance contained in the following:

1) ER 1165-2-400: *Water Resource Policies and Authorities, Recreation Planning, Development and Management Policies* (1985).

2) ER 1110-2-400: *Design of Recreation Sites, Areas, and Facilities* (1988).

3) ER 1130-2-540: *Environmental Stewardship Operations and Maintenance Policies* (1996).

4) EP 1130-2-540: *Environmental Stewardship Operations and Maintenance Guidance and Procedures* (1996).

5) EM 1110-1-400: *Recreation Planning and Design Criteria* (1987).

6) ER 1130-2-550: *Recreation Operations and Maintenance Policies* (1996).

7) EP 1130-2-550: *Recreation Operations and Maintenance Guidance and Procedures* (1996).

8) ER 405-1-12: *Real Estate Handbook* (1985)

1.02 AUTHORIZED PROJECT PURPOSE

The only authorized purpose of the Addicks and Barker floodwater detention structures (dams and reservoirs) is to reduce potential flood damages within the downstream floodplain of Buffalo Bayou and its tributaries, through the City of Houston. All other use of reservoir lands is subordinate to this purpose.

Addicks and Barker Reservoirs are an integral part of the Buffalo Bayou Project, Texas. The Buffalo Bayou Project reduces potential flood damages through a combination of reservoirs, channel improvements, and detention basins. The two reservoirs serve as detention basins and are designed and located to collect excessive amounts of rainfall, and then release that rainfall down Buffalo Bayou at a controlled rate. Although the primary purpose of the reservoirs is flood risk management, they also constitute major natural resources and recreational opportunities. Project lands have been developed to meet varied recreational needs of the surrounding region in accordance with Section 4 of the Flood Control Act of 1944.

1.03 NATURAL RESOURCE MANAGEMENT MISSION STATEMENT

Of the 26,000 acres within Addicks and Barker Reservoirs, approximately 21,000 acres are undeveloped in contrast to the surrounding urban setting of the Houston metropolitan area. As part of its sustainable management program objectives (published after release of the current Master Plan) it is the policy of the Corps of Engineers that programs and activities related to environmental stewardship and management of natural resources use the following U.S. Army Corps of Engineers mission statement published in ER 1130-2-550 and EP 1130 as their design base:

> "The Army Corps of Engineers is the steward of lands and waters at Corps water resources projects. Its Natural Resources Management Mission is to manage and conserve those natural resources, consistent with ecosystem management principles, while providing quality public outdoor recreation experiences to serve the needs of present and future generations.
>
> In all aspects of natural and cultural resources management, the Corps promotes awareness of environmental values and adheres to sound environmental stewardship, protection, compliance, and restoration practices.
>
> The Corps manages for long-term public access to, and use of, the natural resources in cooperation with other federal, state, and local agencies as well as the private sector.
>
> The Corps integrates the management of diverse natural resource components such as fish, wildlife, forest, wetlands, grasslands, soils, air and water with the provision of public recreation opportunities. The Corps conserves natural resources and provides public recreation opportunities that contribute to the quality of American life."

1.04 NEED AND PURPOSE OF THE MASTER PLAN

The original Master Plan (1963) served as a guide for the orderly and coordinated development and management of all land and water resources in the Addicks and Barker Reservoirs. In the original document, data on the scope of development considered adequate for initial public use and an estimate of future requirements were presented. This revised Master Plan presents an inventory and assessment of the land and water resources as well as recreational resources, an analysis of resource use, and a reevaluation of existing and future needs required to protect and improve the values of the natural and recreational resource base.

This major revision of the Addicks and Barker Reservoirs Master Plan reflects current conditions, a reclassification of project land use, as well as formulation of resource use objectives, existing facilities, and proposed facilities and actions. This revision was accomplished for the purposes of incorporating current data concerning the reservoirs and the rapidly expanding West Houston areas, revising outdated material, reflecting the current status of the reservoirs, outlining future plans, and revising land classifications.

The Master Plan will be reviewed on an annual basis to incorporate minor changes and additions and periodically (e.g. approximately every 5 years) reevaluated by an interdisciplinary team to assess the extent to which the document serves its intended purpose.

1.05 PRIOR MASTER PLANS AND SUPPLEMENTS

The original Master Plan was approved in 1963 and updated in 1973 and 1977. The most recent update was completed in June 1986 (USACE 1986).

1.06 GUIDING PRINCIPLES FOR DEVELOPMENT, ADDICKS AND BARKER RESERVOIRS, HARRIS AND FORT BEND COUNTIES, TEXAS

The following principles and introductory statement were developed by the Galveston District on December 5, 2006 to provide guidance to the public and governmental entities interested in submitting requests for proposed development projects within the reservoirs.

The USACE is committed to the environmental sustainability of its projects across the nation and around the world. The Galveston District recognizes that Addicks and Barker Reservoirs are important and valuable natural resources located in an area of ever-increasing population and development. Managed properly, the reservoirs will continue to provide opportunities for diverse public use without compromising their primary purpose of flood risk management, their long-term environmental sustainability, or the USACE Natural Resource Management Mission. With this in mind, the District has established the following Guiding Principles for Development in Addicks and Barker Reservoirs.

Guiding Principles for Development

Mission essential considerations:

- The primary function of the reservoirs is flood risk management. No development will be approved that impacts this function of the reservoirs.

- Proposed development must reflect broad-based community needs and not special or limited interests.

- The long-term environmental sustainability of the reservoirs will be maintained. Environmentally sensitive areas and resources are excluded from development. These areas include: riparian bottomland hardwoods, prairies, wetlands, endangered species habitats, and cultural resource sites.

- Proposed development must preserve or enhance the aesthetic integrity of the reservoirs. All proposed projects must address environmental sustainability and provide buffers between the proposed project and external residential or commercial development.

- The naming of park facilities or features will be approved by the Galveston District. Names should reflect regional or national historical figures or events, or unique environmental features, and will not be named in honor of a living person.

Given these considerations, the following kinds of projects may be considered for approval:

- Environmental restoration and habitat enhancement projects are encouraged.
- Maintenance or modification of an existing facility or feature that does not increase the footprint of the facility or feature. This includes maintenance or minor modification of existing roadways, drainage features, and utilities to ensure public safety and health.
- Projects of low or minimal environmental impact including:
    - Trails and trailhead facilities;
    - Picnic areas and related facilities; and
    - Educational facilities related to the environment and local history.
- Minimal new construction of limited impact may be considered on a case-by-case basis.

1.07 APPLICATION OF OTHER PUBLIC LAWS

Development and management of Federal reservoirs for various purposes is regulated under several statutes. These laws cover development of recreation facilities, licensing of project lands for fish and wildlife purposes, protection of natural resources, and leasing of public lands for incidental uses other than recreation.

A. Fish and Wildlife

Fish and wildlife resources are maintained and protected in compliance with the following public laws:

1) The Fish and Wildlife Coordination Act, enacted March 10, 1934, as amended, August 14, 1946 (PL 79-732), 1958 (PL 85-624), provides authority for making project lands of value for wildlife purposes available for management by interested Federal and State wildlife agencies. It further provides for more effective integration of a fish and wildlife conservation program with Federal water resources developments.

2) The National Environmental Policy Act of 1969, as amended (42 USC 4321 et seq.), declares a national environmental policy and requires that all Federal agencies shall, to the fullest extent possible, use a systematic, interdisciplinary

approach which integrates natural and social sciences and environmental design arts in planning and decision making.

3) The Endangered Species Act of 1973 as amended (16 USC 1531 and 1536) requires that Federal agencies shall, in consultation with the U.S. Fish and Wildlife Service (USFWS) (or the National Marine Fisheries Service), use their authorities in furtherance of conserving endangered and threatened species and take such action as necessary to assure that their actions are not likely to jeopardize such species or destroy or modify their critical habitat.

4) The Water Resource Development Act of 1986, Section 1135, provides for modifications in the structures or operations of a project, consistent with authorized project purposes to improve the quality of the environment, i.e. restoration of fish and wildlife habitat.

B. Cultural Resources Considerations

The term "cultural resource" includes both prehistoric and historic archeological sites, e.g. buildings, structures, sites, objects, and/or districts. Cultural Resources are managed by the U.S. Army Corps of Engineers, Galveston District (USACE) in compliance with ER 1130-2-540. This regulation establishes land management policy for USACE administered project lands. ER 1130-2-540 incorporates the following laws:

1) The American Antiquities Act of 1906 established that the President of the United States is authorized to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon the lands owned or controlled by the Government of the United States to be national monuments. That permits for the examination of ruins, the excavation of archeological sites, and the gathering of objects of antiquity upon the lands under their respective jurisdictions may be granted by the Secretaries of the Interior, Agriculture, and War. That the Secretaries of the Departments aforesaid shall make and publish from time to time uniform rules and regulation for the purpose of carrying out the provisions of this Act.

2) The National Historic Preservation Act of 1966 as amended (PL 96-515). This act establishes the basis for historic preservation in the U.S. The most relevant sections include: 106, which states that the head of any Federal agency must take into account the effect of an undertaking on any site that is included in or eligible for inclusion in the National Register; and 110, which states that all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by said agency.

3) The Archaeological and Historic Preservation Act as amended (PL 86-523). This act provides for the preservation of historic sites, buildings, objects, and antiquities of national significance by providing for the preservation of historical and archeological data which might otherwise be irreparably lost or

destroyed as the result of any alteration of the terrain caused as a result of any Federal construction project or federally licensed activity or program.

4) The Archeological Resources Protection Act of 1979 as amended (PL 69-95). This act prohibits unauthorized excavation on Federal and Indian lands, establishes standards for permissible excavation, and prescribes civil and criminal penalties for unlawful excavation or destruction of historic properties.

5) The Native American Graves Protection and Repatriation Act as amended (PL101-601). This act requires that Native Americans cultural items be returned to their respective peoples if and when they have been excavated, and allows archeological teams a short time for analysis before the remains must be returned. “Cultural items” include human remains, funerary objects, sacred objects, and objects of cultural patrimony.

6) 36 CFR 800 initiates the Section 106 process of the National Historic Preservation Act. It also provides methods to be used for the identification of historic properties, assessment of adverse effects, resolution of adverse effects, failure to resolve adverse effects, coordination with NEPA, Council review of Section 106 compliance, documentation standards, and post-review discoveries.

C. Recreation

Development and management of recreation facilities by the USACE, other governmental agencies, local groups, or individuals is authorized under the following public laws:

1) Section 4 of the Flood Control Act, approved December 22, 1944 (PL 534, 78th Congress), authorizes providing facilities for public use, including recreation, and conservation of fish and wildlife.

2) The River and Harbors Act, approved March 2, 1945 (PL 14, 79th Congress), specifies the rights and interests of the states in watershed development and water utilization and control, and the requirements for cooperation with state agencies in planning for flood control and navigation improvements.

3) Section 209 of the Flood Control Act of 1954 (PL 83-780), approved September 3, 1954, amended the Flood Control Act of 1944. It authorized the Secretary of the Army to grant leases to federal, state or governmental agencies without monetary considerations for use and occupation of land and water areas under the jurisdiction of the Department of the Army for park and recreation purposes when in the public interest.

4) The Land and Water Conservation Fund Act of 1965, approved September 1, 1964 (PL 578, 88th Congress, 78 Stat. 897), contains provisions by which the USACE may charge for admission and use of its recreation areas under prescribed conditions.

5) The Federal Water Project Recreation Act, approved July 9, 1965 (PL 72, 89th Congress, 79 Stat. 213) contains cost sharing provisions for acquisition of lands and development of recreation facilities for water resources projects authorized after 1965. It also provides for cost sharing development of new areas that were not part of initial project construction.

6) The Architectural Barriers Act of 1968 (PL 90-480), together with the acts and amendments listed in 7, 8, and 9 below, provides information and guidance regarding universal accessibility for persons with disabilities to the USACE recreation facilities and programs.

7) The Rehabilitation Act of 1973 (PL 93-112) and the Rehabilitation Act Amendments of 1974 (PL 93-516) (see Architectural Barriers Act above).

8) The Rehabilitation, Comprehensive Services, and Developmental Disabilities Amendments of 1978 (PL 95-602) (see Architectural Barriers Act above).

9) The Americans with Disabilities Act of 1990 (PL 101-336) (See Architectural Barriers Act above).

10) The Omnibus Budget Act - Day Use Fees, approved August 10, 1993 (PL 103-66), contains provisions by which the USACE may collect fees for the use of developed recreation sites and facilities.

D. Other Incidental Uses.

1) Title 10, United States Code, Section 2667, authorizes the lease of land at water resource projects for any commercial or private purpose not inconsistent with other authorized purposes, subject to specific restrictions thereupon, as set out in regulations, policy, and Delegations of Authority.

2) Title 16, United States Code, Section 460d, authorizes use of public lands for any public purpose, including fish and wildlife, if it is in the public interest. Such uses are also subject to regulations, policy and Delegations of Authority. The use of project lands for easements and licenses is authorized in various Congressional Acts and codified in Titles 10, 16, 30, 32 and 43 of the United States Code.

3) If needed, lands and rights-of-way will be acquired pursuant to provisions of the Uniform Real Property Acquisition and Relocation Assistance Act of 1970, P.L. 91-646, as amended.

1.08 ENVIRONMENTAL ASSESSMENT

The National Environmental Policy Act (NEPA) of 1969 requires that decision making should proceed with full awareness of the environmental consequences that follow from a major Federal action. As part of the NEPA compliance process, the Corps of Engineers is conducting an environmental assessment (EA) to judge the physical effects of changes

on the natural environment as outlined in this revised master plan. The EA is being conducted parallel to the preparation of the revised master plan and will be available, upon completion, through the Corps of Engineers - Galveston District offices.

SECTION 2. PROJECT DESCRIPTION

2.01 LOCATION

Addicks and Barker Reservoirs are located in southeast Texas in the San Jacinto River basin approximately 17 miles west of downtown Houston (Figure 2-2). They are strategically located above the confluence of Buffalo Bayou and South Mayde Creek. Beyond this confluence, Buffalo Bayou continues east through downtown Houston, where it joins with White Oak Bayou, and eventually becomes the Houston Shipping Channel, which flows into the San Jacinto Bay approximately nine miles north of Galveston Bay. The majority of both Addicks and Barker Reservoirs fall within Harris County, with a small portion of Barker Reservoir contained within Fort Bend County. Addicks Reservoir is situated on the north side of Interstate Highway 10 with State Highway 6 bisecting the reservoir north to south. Barker Reservoir is situated on the south side of Interstate 10, west of State Highway 6.

2.02 RESERVOIR HISTORY AND DATA SUMMARY

Constructed in the 1940's, Addicks and Barker Reservoirs are rolled, earthen dams, each with five gated conduits serving as the outlet works (Figure 2-1). The original design concept for both dams provided for four of the five outlet conduits to be uncontrolled, permitting a combined uncontrolled discharge of approximately 15,700 cubic feet per second (cfs) into Buffalo Bayou. In 1948, two of the four uncontrolled conduits were gated at each dam resulting in a reduced combined uncontrolled discharge of approximately 7,900 cfs, which was considered to be the channel capacity at that time.

Figure 2-1. Barker Reservoir outlet works showing outfall conduits.

The threat of flooding in the areas below the dams continued to rise with the increase in urban development throughout the 1940's and 50's. In 1960, a study was prepared to consider the feasibility of gating the remaining uncontrolled conduits. As a result of that study, the remaining uncontrolled conduits on both reservoirs were gated by 1963. Normal regulating procedures specify that releases from the two reservoirs, in addition to the uncontrolled runoff downstream, should not exceed 2,000 cfs as measured at the Piney Point Road gauging station, located 10.7 channel miles below Barker Dam (Figure 2-2).

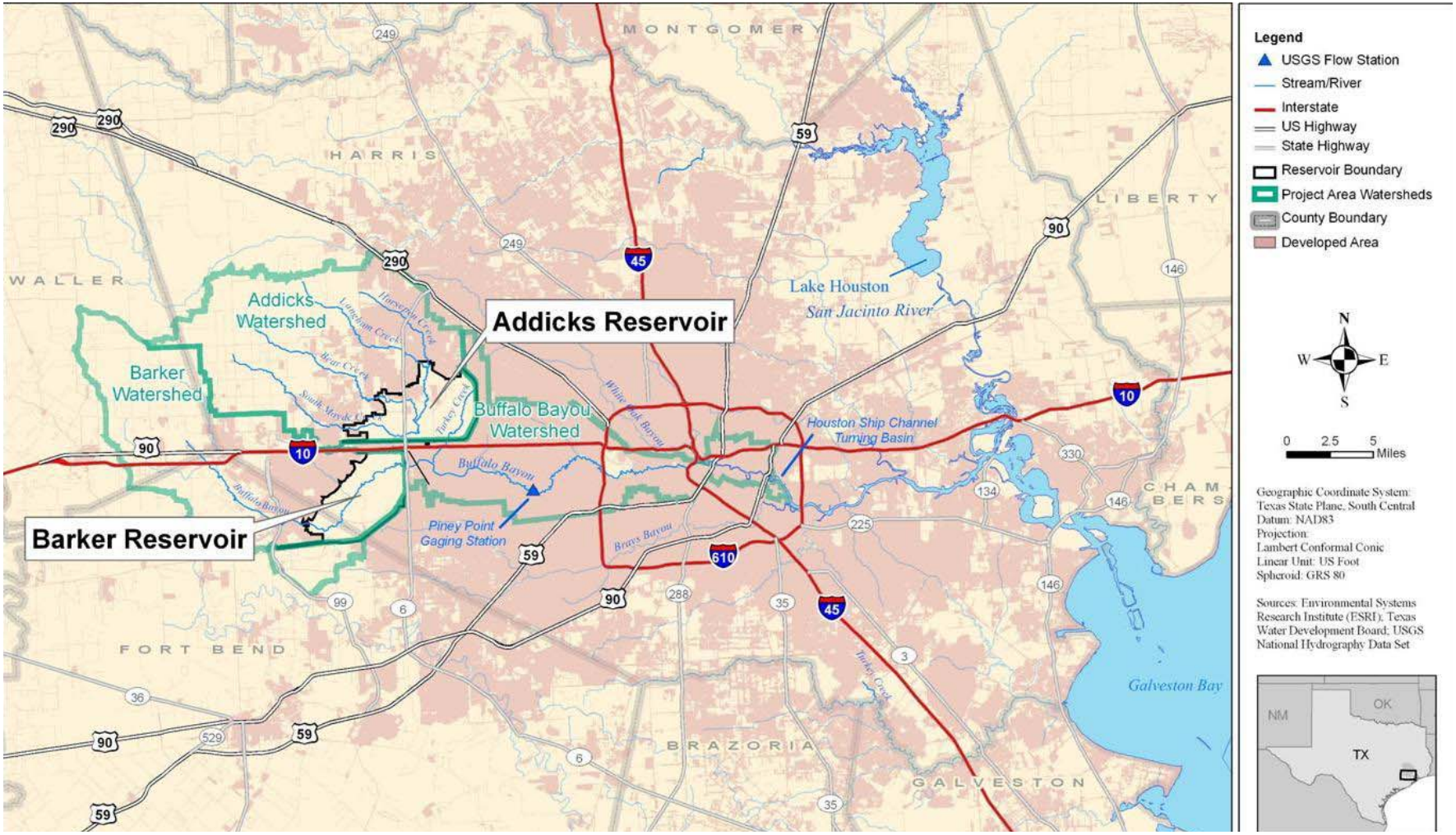

Figure 2-2. Location of the Addicks and Barker Reservoirs

A. Addicks Reservoir

Construction of the Addicks Dam began in May 1946 and was completed in December 1948. Acquisition of all land in Addicks Reservoir was completed in 1948. Addicks Reservoir has an earthen embankment dam that is 61,166 feet long and stands 51.6 feet above the streambed at the highest point. The maximum reservoir capacity is 233,700 acre-feet, and discharges are made through five-gated conduits with a discharge capacity of 7,852 cfs. Table 2-1 presents pertinent data for Addicks Reservoir.

Table 2-1. Pertinent Data Summary for Addicks Reservoir

Feature	Elevation Feet (M.S.L.)[1]	Storage Capacity (Acre-Feet)
Top of dam	122.7	---
Maximum design water surface	114.0	233,700
Natural ground at end of dam	112.0	200,800
Standard Project Flood max. water surface	110.6	178,556
Government-owned real estate limit	106.1	116,263
100 yr flood event	104.1	92,572
50 yr flood event	102.4	74,591
10 yr flood event	97.7	36,473
Conduit invert/Streambed elevation	71.1	0
1. Elevations are mean sea level datum of 1929, 1973 adjusted.		

B. Barker Reservoir

Construction of the Barker Dam began in February 1942 and was completed in February 1945. Acquisition of all lands in the current Barker Reservoir was completed in 1951. Barker Reservoir has an earthen embankment dam that is 71,900 feet long and stands 41.5 feet tall above the stream bed at the highest point. The maximum reservoir capacity is 192,500 acre-feet. Discharges are made through five-gated conduits with a maximum discharge capacity of 8,734 cfs. Table 2-2 presents pertinent data for Barker Reservoir.

Table 2-2. Pertinent Data Summary for Barker Reservoir

Feature	Elevation Feet (M.S.L.)[1]	Storage Capacity (Acre-Feet)
Top of dam	114.7	---
Maximum design water surface	105.4	192,500
Natural ground at end of dam	106.0	209,000
Standard Project Flood max. water surface	100.4	123,653
Government-owned real estate limit	97.3	83,410
100 yr flood event	97.8	89,498
50 yr flood event	96.6	75,087
10 yr flood event	93.1	37,176
Conduit invert/Streambed elevation	73.2	0
1. Elevations are mean sea level datum of 1929, 1973 adjusted.		

C. Basin Hydrologic and Climate Summary

1) Basin Hydrology - The Addicks and Barker Reservoirs are located in the San Jacinto River Basin (3,953 square miles) directly upstream of the Buffalo Bayou Watershed (103 square miles). The area is generally flat, characterized by a gentle slope generally from west to east. The area is underlain by the Gulf Coast aquifer, which stretches northeast across Texas from the Rio Grande to the Louisiana-Texas border. Significant declines in water levels have been observed in this aquifer in the southern and eastern portions of the watershed as a result of years of heavy municipal and industrial water use (TWDB, 2006). Consequently, these declines in aquifer levels have resulted in surface subsidence. Developed land use is prevalent in the area surrounding the reservoirs, resulting in a variety of altered hydrologic characteristics, most notably increased storm water runoff volumes and flashy flood flows. Impervious surface areas inhibit water infiltration, thereby increasing the volume and velocity of storm water runoff in developed areas. This rapid conversion of rainfall to runoff results in flashy flow conditions in area streams (i.e. rapid rise and fall of stream flow volume) and more frequent localized flooding.

   The watershed of Addicks Reservoir covers approximately 130 square miles and includes four primary streams: Bear Creek, Horsepen Creek, Langham Creek and South Mayde Creek. The Barker Reservoir watershed covers approximately 126 square miles and includes two primary streams: Mason Creek and Upper Buffalo Bayou (HCFCD, 2007). Runoff collected by both reservoirs eventually flows into Buffalo Bayou which continues east through the Houston metropolitan area. After combining with White Oak Bayou and passing through downtown Houston, Buffalo Bayou becomes the Houston Ship Channel (at the Turning Basin). The Houston Ship Channel eventually connects with the San Jacinto River and Galveston Bay.

2) Climate - The climate of southeastern Texas in the area surrounding Houston is generally classified as subtropical, where prevailing southeastern winds from the Gulf of Mexico result in high temperatures and humidity. Severe weather occurs as tropical storms and hurricanes, which are associated with strong winds and heavy rainfall, winter northern frontal passages, and occasional tornadoes. Summers are hot and humid and characterized by afternoon thunderstorms. The average high temperature for July and August is about 93°F. Winters are cool and temperate, with some rain and the rare snowfall. The coolest month is January with an average temperature of 51.8° F. Annually, the Houston area averages 99 days over 90° F and 18 days under 32° F (National Weather Service Forecast Office 2004). Climatic averages are presented in Table 2-3.

Table 2-3. Regional Average Temperatures (°F) from 1971 to 2000			
Month	**Average Temperature**	**Average High Temp.**	**Average Low Temp.**
January	51.8	62.3	41.2
February	55.4	66.5	44.3
March	62.3	73.3	51.3
April	68.5	79.1	57.9
May	75.8	85.5	66.1
June	81.2	90.7	71.8
July	83.6	93.6	73.5
August	83.3	93.5	73.0
September	78.7	88.9	68.4
October	70.4	82.0	58.8
November	60.9	72.0	49.8
December	53.7	64.6	42.8

3) Precipitation - Harris County receives an average of 47.8 inches of precipitation each year as measured at Bush International Airport. Normal monthly rainfall in the Houston area varies from about three inches to over five inches with the heaviest rainfall occurring during May and June (Table 2-4).

4) The highest annual total precipitation measured was 72.86 inches and occurred in 1900, which corresponds to the year of the Great Hurricane in Galveston, Texas. This Category 4 hurricane produced 130 mph winds (National Weather Service Forecast Office, 2004), 15 foot storm surges, and killed more than 8,000 people. It remains the deadliest natural disaster in U.S. history. The lowest annual rainfall total occurred in 1917 when only 17.66 inches of rain was recorded1. Although snow and ice storms have been recorded in the region, such occurrences are rare.

Table 2-4. Regional Average Rainfall from 1971 to 2002	
Month	**Mean Rainfall (inches)**
January	3.7
February	3.0
March	3.4
April	3.6
May	5.2
June	5.4
July	3.2
August	3.8
September	4.3
October	4.5
November	4.2
December	3.7

5) Effects of Global Climate Change – Global climate change has the potential to impact the operation and management of Addicks and Barker Reservoirs. Although the magnitude and spatial distributions of impacts is speculative, the scale of the predicted changes is sufficient to expect some level of impact to the Texas coastal system. Table 2-8 shows some of the predicted possible outcome parameters for Texas.

6) Past Flooding Events – The reservoirs were built in response to the Houston area being subject to periodic flooding throughout its history. Harris County

has been the storm center of at least 12 major storms since 1853 (USGS, 2003). The following is a list of major storms and their associated damages:

Table 2-5. Summary of predicted changes in precipitation, temperature, and streamflow for Texas		
Winter	Precipitation	5 – 30 % decrease
Spring	Precipitation	10 % increase
Summer	Precipitation	10 % increase
Fall	Precipitation	10 % increase
Winter	Temperature	4 ° Increase
Spring	Temperature	3 ° Increase
Summer	Temperature	4 ° Increase
Fall	Temperature	4 ° Increase
Winter	Streamflow	35 % decrease
Spring	Streamflow	35 % decrease
Summer	Streamflow	35 % decrease
Fall	Streamflow	35 % decrease

- 1929 – Major flooding resulted from a Gulf storm causing 14 hours of rain and at least 10 inches of rainfall throughout the county resulting in seven deaths and over one million dollars in damages. All bayous were over their banks.

- 1935 - Major flooding following 16.5 inches of rainfall caused eight deaths and over $2.5 million in property damages.

- 1973 - A catastrophic storm produced 15 inches of rain and caused an estimated $50 million in damages.

- 1979 – Tropical Storm Claudette produced the highest record rainfall event recorded in U.S history in a 24 hour period, dropping 43 inches of rain on Alvin, Texas, located 50 miles southeast of the reservoirs. If this event had occurred over the Addicks and Barker watersheds, their reservoir capacities may have been exceeded.

- 1981 - A tropical depression caused about two to 10 inches of rain to fall in the Houston area.

- 1983 – Hurricane Alicia dumped 15 inches of rain in eastern Harris County over a four day period. The death toll from Alicia was 11, with nearly $500 million in damages. Due to its passage through Galveston and not Freeport, the impacts to Addicks and Barker Reservoirs were less pronounced.

- 1992 – A rain event caused the flooding of Interstate 10 and one death. The upper Buffalo Bayou watershed accumulated nine inches of rain in six

hours. This event, along with considerable rainfall over the previous three months, resulted in record pools to date at both Addicks and Barker Reservoirs.

- 1994 – As a result of the combination of residual atmospheric moisture from Hurricane Rosa and low-level moisture from the Gulf of Mexico, heavy rainfall caused severe flooding over a 38-county area – an area including Harris and Fort Bend counties. This event caused 22 flood-related deaths and damaged 15,775 homes. FEMA declared 29 of the 28 counties to be disaster areas and approved $54 million in disaster assistance.

- 1998 – In September, Tropical Storm Frances produced over 10 inches of rain that fell on Harris County. The total damage caused by Frances to Harris, Galveston, Brazoria, and Matagorda counties totaled $286 million. Two months later, in November, another heavy rain event produced about eight inches of rain over the Houston area.

- 2001 - Tropical Storm Allison hit the southeastern coast of Texas in early June and dumped almost 36 inches of rain over a five day period resulting in 22 deaths and $5 billion in damages. The center of this event was 50 miles northeast of Addicks and Barker watersheds and could have potentially exceeded reservoir capacity had the storm event occurred directly over the reservoir watersheds.

- 2002 – In late October, strong thunderstorms caused five to eight inches of rain to fall in a short time in areas west and north of Houston.

- 2005 - Hurricane Rita caused $159.5 million in property and crop damage in southeastern Texas in September. In Harris County, sustained wind gusts of 60 mph caused widespread power outages.

Despite numerous major flood events in the Metropolitan Houston area since 1963 when the remaining two conduits at each dam were gated, Addicks and Barker Reservoirs have not exceeded the limits of government owned land in any flood event (Tables 2-5 and 2-6). However, had some of these events been centered over Addicks and Barker Reservoirs or the Upper Buffalo Bayou Watershed, the combined rainfall and runoff could have resulted in flood pools exceeding the limits of government owned land and possibly exceeding the capacity of Addicks and Barker Dams.

7) Flood Risk Management - Addicks and Barker Reservoirs fulfill their mission by reducing the damage to property downstream of the dams caused by flooding. The USACE is responsible for estimating the value of the reservoirs, and one way to do so is by estimating the monetary amount of flood damage avoided by the presence and operation of the reservoirs. Table 2-7 shows

estimated flood damage prevented by operation of Addicks and Barker Reservoirs.

Table 2-6. Top-Ten Recorded Flood Pools* with Reference Pools - Addicks Reservoir

Event	Elevation[1]	Surface Area (Acres)	Capacity in Acre-feet[2]	% Capacity Max. Pool[3]	% Capacity GOL[4]
Max. Pool[5]	112.00	16,423	200,800	100.0	172.7
GOL[6]	106.10	12,460	116,263	57.9	100.0
100yr Flood[7]	104.10	11,213	92,572	46.1	79.6
March 6 1992	100.58	8,446	57,956	28.9	49.8
November 7, 2002	99.57	7,730	49,797	24.8	42.8
St Hwy 6 (edge)	99.10	7,424	46,236	23.0	40.0
November 17, 1998	98.82	7,242	44,183	22.0	38.0
October 23, 1994	98.75	7,196	43,678	21.7	37.6
May 15, 1968	98.28[8]	***	***	***	***
November 25, 2004	98.00	6,718	38,461	19.2	33.1
July 8, 2007	97.94	6,682	38,059	19.0	32.7
September 4, 1981	97.37	6,337	34,349	17.1	29.5
September 17, 1998	97.07	6,159	32,474	16.2	27.9
April 20, 1991	96.78	5,971	30,715	15.3	26.4
Conduit invert	71.10	0	0	0	0

*As of September 2007
1. Elevation of water surface is in feet-NGDV (1973).
2. One acre-foot of water is one acre of water, one foot deep.
3. Percent of capacity of maximum possible pool before water spills around end of dam.
4. Percent of capacity of maximum possible pool contained within the government owned land (GOL).
5. Maximum possible pool before water spills around the end of the dam.
6. Maximum possible pool contained within the government owned land.
7. Pool that would result from a 100 year storm event over the entire watershed.
8. Original elevations of 100.03 MSL adjusted to reflect the 1973 adjustment.

2.03 RESERVOIR REGULATION

The operational objective of Addicks and Barker Reservoirs is to provide flood damages to downstream interests along Buffalo Bayou resulting from storm events and above normal flows. Except for periods of heavy rainfall, these dams do not normally impound water.

Under normal conditions, both dams have two conduits set to pass the normal flow of water. When the reservoirs are empty and one inch of rain falls below the dams, the gates are closed until it is safe to make releases. If releases are being made, the gates will be closed if 0.5 inch of rain falls below the reservoirs or flooding is predicted. Normal reservoir operations will resume when it is safe to make releases. The maximum allowable release from both reservoirs, combined with the uncontrolled runoff downstream, is 2,000 cfs at the Piney Point Road gauging station (Figure 2-2), which is

located 10.7 channel miles below Barker Dam. If downstream flows are already at or above 2,000 cfs, water is not released from the reservoirs.

Table 2-9 gives the minimum time, in days, needed to discharge flood waters derived from four different flood frequencies. This estimate assumes there is no additional rainfall and resultant runoff during the period of regulation and emptying the reservoirs. These values are hypothetical and represent only a preliminary estimate of the time required to empty the reservoirs under standard operating procedures.

Table 2-7. Top-Ten Recorded Flood Pools* with Reference Pools - Barker Reservoir

Event	Elevation[1]	Surface Area (Acres)	Capacity in Acre-feet[2]	% Capacity Max. Pool[3]	% Capacity GOL[4]
Max. Pool[5]	106.00	16,739	209,000	100.0	250.6
GOL[6]	97.30	12,060	83,410	39.9	100.0
100yr Flood[7]	97.80	12,293	89,498	42.8	107.3
March 6, 1992	95.89	11,338	66,910	32.0	80.2
November 7, 2002	95.53	11,184	62,856	30.1	75.4
W. Pkwy (edge)	95.50	11,171	62,521	30.0	75.0
November 18, 1998	94.60	10,753	52,646	25.2	63.1
July 9, 2007	94.14	10,519	47,754	22.8	57.3
November 28, 2004	93.98	10,434	46,077	22.0	55.2
April 20, 1991	93.63	10,179	42,470	20.3	50.9
May 15, 1968	92.56[8]	***	***	***	***
May 31, 1997	92.87	9,502	34,950	16.7	41.9
October 22, 1994	92.83	9,432	34,571	16.5	41.4
September 17, 1998	92.65	9,123	32,901	15.7	39.4
Conduit invert	73.20	0	0	0	0

*As of September 2007
1. Elevation of water surface is in feet-NGVD (1973).
2. One acre-foot of water is one acre of water, one foot deep.
3. Percent of capacity of maximum possible pool before water spills around end of dam.
4. Percent of capacity of maximum possible pool contained within the government owned land (GOL).
5. Maximum possible pool before water spills around the end of the dam.
6. Maximum possible pool contained within the government owned land.
7. Pool that would result from a 100 year storm event over the entire watershed.
8. Original elevations of 94.60 MSL adjusted to reflect the 1973 adjustment.

Table 2-8. Estimated Flood Damage Prevented

Fiscal Year	Annual Flood Damages Prevented	Cumulative Total	Notes/Storm Event
47-'78		$31,428,000	1973 Storm/other events
1979	$5,300,000	$36,728,000	Tropical Storm Claudette
1980	$501,000	$37,229,000	
1981	$17,733,000	$54,962,000	Tropical Depression
1982	$11,700,000	$66,662,000	
1983	$16,000,000	$82,662,000	Hurricane Alicia
1984	$0	$82,662,000	
1985	$18,800,000	$101,462,000	
1986	$25,500,000	$126,962,000	
1987	$34,792,000	$161,754,000	
1988	$0	$161,754,000	
1989	$60,434,000	$222,188,000	
1990	$27,960,000	$250,148,000	
1991	$22,420,000	$278,108,000	
1992	$397,600,000	$675,708,000	March 1992 Flood
1993	$306,100,000	$981,808,000	Tropical Storm Arlene
1994	$289,700,000	$1,271,508,000	
1995	$340,000,000	$1,611,508,000	October 1994 Flood
1996	$260,000	$1,611,768,000	
1997	$285,000	$1,612,053,000	
1998	$478,000	$1,612,531,000	
1999	$445,000	$1,612,976,000	
2000	$415,000	$1,613,391,000	
2001	$24,000,000	$1,637,391,000	Tropical Storm Allison
2002	$23,300,000	$1,660,691,000	
2003	$385,000,000	$2,045,691,000	November 2002 Flood
2004	$194,060,000	$2,239,751,000	
2005	$371,953,000	$2,611,704,000	Hurricane Rita
2006	$387,200,000	$2,998,904,000	
2007	$801,000,000	$3,799,904,000	

Table 2-9. Flood Durations for Addicks and Barker Reservoirs

Frequency	Addicks Reservoir (days)	Barker Reservoir (days)
10-year	26	29
20-year	37	40
50-year	49	54
100-year	58	65

SECTION 3. OPERATING PROJECTS: STATUS

3.01 EXPENDITURES FOR RECREATIONAL, MULTI-USE, AND NATURAL RESOURCE DEVELOPMENT

A. Federal Government

Increased development in the areas around Addicks and Barker Reservoirs has increased the recreational and multi-use value of the lands within the reservoirs. The USACE has made more than 20,000 acres of the projects' 26,000 acres available to local government agencies for recreational and multi-use development (Figures 3-1 and 3-2).

Recreational development in the reservoirs is managed to minimize potential impacts to natural resources, and lease agreements require the lessee to set aside lands for the protection and enhancement of valuable natural resources. Through a careful review process within the Galveston District Office and with other local, state, and Federal agencies having an interest in the reservoirs, the USACE has approved construction of a variety of recreational and multi-use facilities while protecting and preserving thousands of acres of natural habitat. This conservation effort is crucial to providing quality wildlife habitat and multifaceted recreational opportunities for future generations.

A portion of the reservoir lands (1,371 acres) is also used for military training purposes. The Army's 90th Reserve Command holds a permit for lands within Barker Reservoir for training purposes consistent with the unit's mission (Figure 3-2).

Federal Operation and Maintenance Cost - Total Federal operations and maintenance baseline cost for the last five fiscal years (FY) are listed in Table 3-1.

Table 3-1. Federal Expenditures for Addicks and Barker Reservoirs

FY 2003	$ 3,500,000.00
FY 2004	$ 2,000,000.00
FY 2005	$ 1,600,000.00
FY 2006	$ 2,000,000.00
FY 2007	$ 2,300,000.00

B. Non-Federal Public Agencies

Land at both Addicks and Barker Reservoirs has been leased for recreation and educational purposes to Harris County Precinct Three, Fort Bend County, and the City of Houston. Use of ball fields (soccer and baseball) within the reservoirs is limited to league play only with the exception of a few areas designated as public ball fields.

1) Harris County Precinct 3

Bear Creek Pioneers Park is a 3,085-acre lease in Addicks Reservoir issued to Harris County, of which about 1,280-acres are developed. Development at the county park includes organized picnic shelters, soccer, baseball fields, tennis courts, horseshoe pits, an equestrian trail, a wildlife area, three public golf courses, trails, a dog park, the Houston Farm and Ranch Club, a community center, and mowed open spaces (Figure 3-1). Sports fields within the park are generally reserved for league play.

George Bush Park is an 8,000-acre lease in Barker Reservoir issued to Harris County. Development at the county park includes hiking and biking trails, a shooting range, model airplane facilities, baseball fields, soccer fields, a dog park, a fishing area, and an equestrian area with parking for trailers. Sports fields within the park are generally reserved for league play. Figure 3-2 shows a site plan of this park.

2) Fort Bend County

Cinco Ranch Park is a 1,980 acre lease in Barker Reservoir issued to Fort Bend County, of which 200 acres are subleased to the YMCA as a day camp (Figure 3-2). Development within the lease-held area is limited to passive hike and bike trails.

3) City of Houston

Cullen Park is a 9,270 acre lease in Addicks Reservoir issued to the City of Houston. Development at the city park includes organized picnic shelters, multi-sport play fields, baseball fields, hiking and biking trails, picnic areas, and a velodrome (Figure 3-2).

C. Private Recreational Investment

1) Concession leases. The USACE does not have concession leases within the reservoirs. Third-party concession leases between recreational lease holders (Harris County, Fort Bend County, and the City of Houston) are permitted and are bound by the agreements between the USACE and the recreational lease holders. Third-party concession leases are discussed in more detail in Section 6.04.

2) Recreational Development by Organizations. Bayou Rifles Shooting Range in Addicks Reservoir is the only development by an organization that is outside the current recreational leases. Bayou Rifles Shooting Range is a membership-only shooting club with membership applications open to the general public. It was established in 1936 and maintained its location as part of a grandfather clause when the reservoir project was first developed in the mid- 1940s. Development consists of facilities for staging various shooting activities including outdoor pistol (7, 15, 25, 50-yd, 40, 50, 75, 100m) and outdoor rifle (40, 60, 77, 100m) ranges, as well as facilities for silhouette shooting, muzzle-loading, and airgun activities.

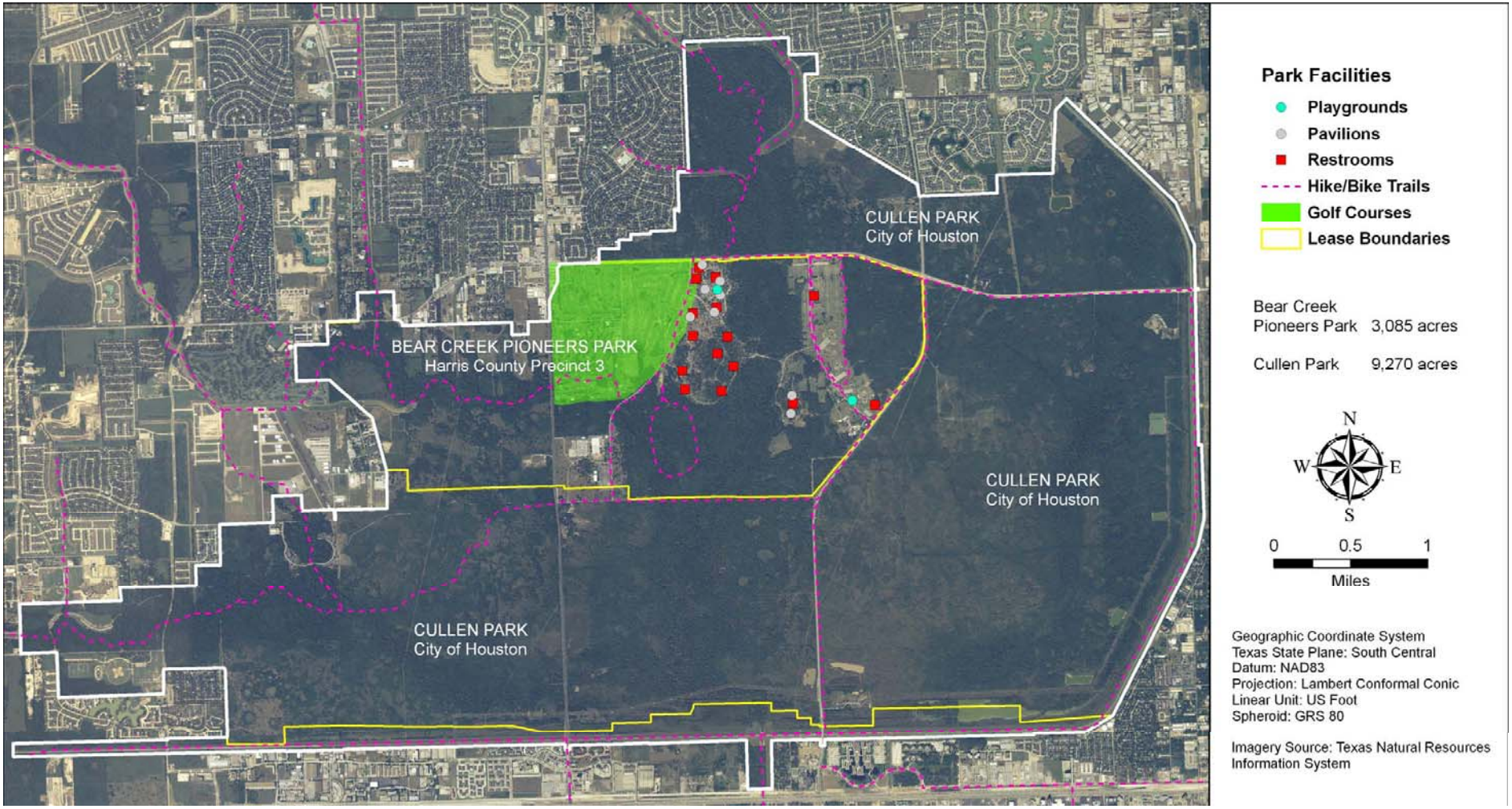

Figure 3-1 Leases and Facilities – Addicks Reservoir

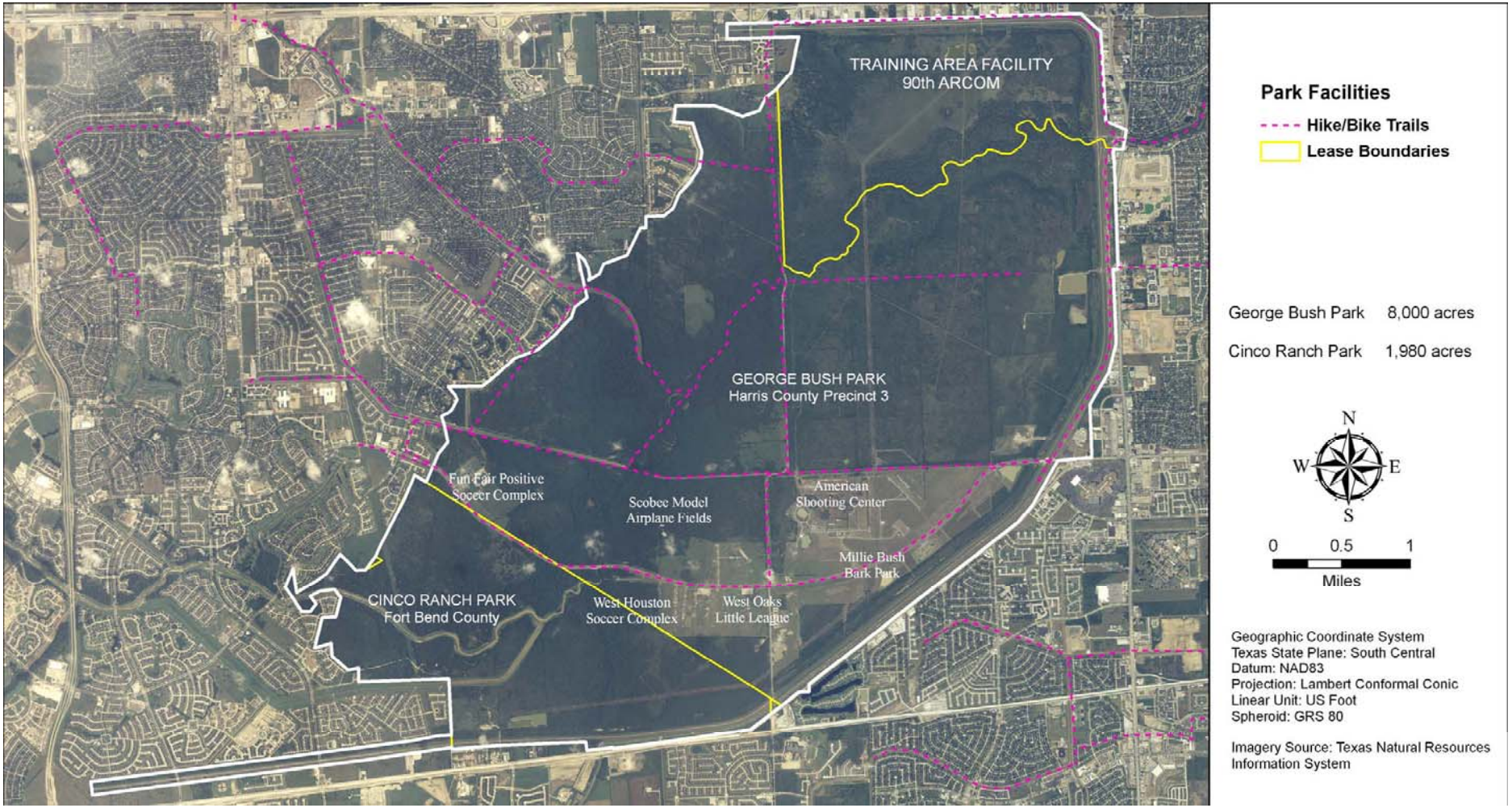

Figure 3-2. Leases and Facilities – Barker Reservoir

SECTION 4. EXISTING ENVIRONMENTAL AND RECREATIONAL RESOURCES

4.01 PHYSIOGRAPHIC

Addicks and Barker Reservoirs are in the Gulf Coast Prairies and Marshes ecoregion (Gould, 1975), which is a nearly level plain in a narrow band about 60 miles wide along the Texas coast bordering the Gulf of Mexico from the Sabine River to the Rio Grande (Figure 4-1). The region is flat and gradually slopes coastward from an elevation of approximately 245 ft (Diamond and Smeins, 1984). It is comprised of shallow bays, estuaries, salt marshes, dunes, and tidal flats as well as tallgrass prairie, forested riparian corridors, mottes and coastal woodlots, and dense brush habitats. Soils in the marshy areas include acid sands, sandy loams, and clay, while the prairies contain more clay and are very rich in nutrients (TPWD, 2007). Prairie within the ecoregion are further divided into the Upper and Lower Coastal Prairie (north and south of the San Antonio River) based on climate and soil variations (Diamond and Smeins, 1984). The reservoirs are located close to two other ecoregions, the Post Oak Savannah (north and west), and the Piney Woods (north and east) (Gould, 1975).

Figure 4-1. Gould (1975) Ecoregions

4.02 GEOLOGY AND SOILS

The geology and general soils in the area of the reservoirs are of Quaternary Age and are of the Houston Group. The Houston Group is divided into two formations, the Lissie Formation at the base, and the Beaumont Formation at the top (Wheeler, 1976).

The soils on which Addicks and Barker Reservoirs lie are of the Lissie Formation and consist of thick beds of sand, containing lentils of gravel, interbedded with clay and silt (Smeins et al., 1991). Beds of marine clays occur between thick strata of fine sand as a result of the advance and retreat of the Gulf of Mexico. The formation is generally composed of about 60 percent sands or silty sands, 20 percent sandy clay, 10 percent gravel and 10 percent clay. Both the Lissie Formation and Beaumont Formation soils found at Addicks and Barker Reservoirs generally drain poorly due to their low relief and

dense subsoils (Smeins et al., 1991). The soils are nearly level and clayey, suggesting the majority of this area supported a native prairie plant community (Wheeler, 1976) outside of the forested riparian corridors. Table 4-1 provides a breakdown and short description of the soils occurring in the reservoirs and Figure 4-2 shows approximate locations of the different soil types within the reservoirs.

Table 4-1. Soil Types in Addicks and Barker Reservoirs

Soil Series	Short Description
Addicks	Loamy, slightly acid through moderately alkaline, poorly drained, moderately permeable, nearly level, upland prairie soil
Aris	Loamy, strongly acid through neutral, poorly drained, very slowly permeable, nearly level, upland prairie soils
Aris-Urban	same as Aris, but extensive built-up area where works, structures, and soil disturbance comprise 75 to 100 percent of the area
Beaumont	Clayey, very strongly acid through mildly alkaline, poorly drained, very slowly permeable, nearly level, upland prairie soils
Bernard	Loamy, slightly acid through moderately alkaline, somewhat poorly drained, very slowly permeable, nearly level through gently sloping, upland prairie soils
Bernard-Urban	same as Bernard, but extensive built-up area where works, structures, and soil disturbance comprise 75 to 100 percent of the area
Clodine	Loamy, slightly acid through moderately alkaline, poorly drained, moderately permeable, nearly level, upland prairie soils
Clodine-Urban	same as Charles, but extensive built-up area where works, structures, and soil disturbance comprise 75 to 100 percent of the area
Edna	Loamy, medium acid through moderately alkaline, poorly drained, very slowly permeable, nearly level through gently sloping, upland prairie soils
Gessner	Loamy, slightly acid through moderately alkaline, poorly drained, moderately permeable, nearly level, upland prairie soils
Katy	Loamy, strongly acid through mildly acid, somewhat poorly drained, very slowly permeable, nearly level, upland prairie soils
Lake Charles	Clayey, slightly acid through moderately alkaline, somewhat poorly drained, very slowly permeable, nearly level to gently sloping, upland prairie soils
Midland	Loamy, strongly acid through moderately alkaline, poorly drained, very slowly permeable, nearly level, upland prairie soils
Nahatche	Loamy, strongly acid through mildly alkaline, somewhat poorly drained moderately permeable, nearly level, forested bottomland soils

As the topography of the reservoirs is nearly flat with little relief, remnant microtopographic features play an important role in plant diversity. Where remaining, these features consist of floodplain mounds, pimple mounds, and series of microridges and microdepressions called gilgai (Fields, R.C. et al, 1986). Pimple mounds are small (usually 18 to 60 feet in diameter) low (usually less than 12 inches high) mounds of sandier soil than the surrounding flat areas (Carty et al., 1988). The origin of these

pimple mounds is unclear, but some theories put forth include: products of past coastal environments and associated drainage patterns, wind and wave action (Smeins et al., 1991); wind driven accumulation of sediments around clumps of vegetation; and the actions of burrowing animals (Aronow, 1992; Cox, 1984; Price, 1949). The mounds also have an influence on patterns of plant distribution and abundance and are associated with the federally listed endangered Texas prairie dawn-flower (See Section 4.04 E). The introduction of agricultural practices such as leveling for rice farming and disking for row cropping, leveled many of the microtopographic features historically prevalent in both reservoirs, more so in Barker than Addicks. However, both reservoirs still exhibit many instances of microtopographic features.

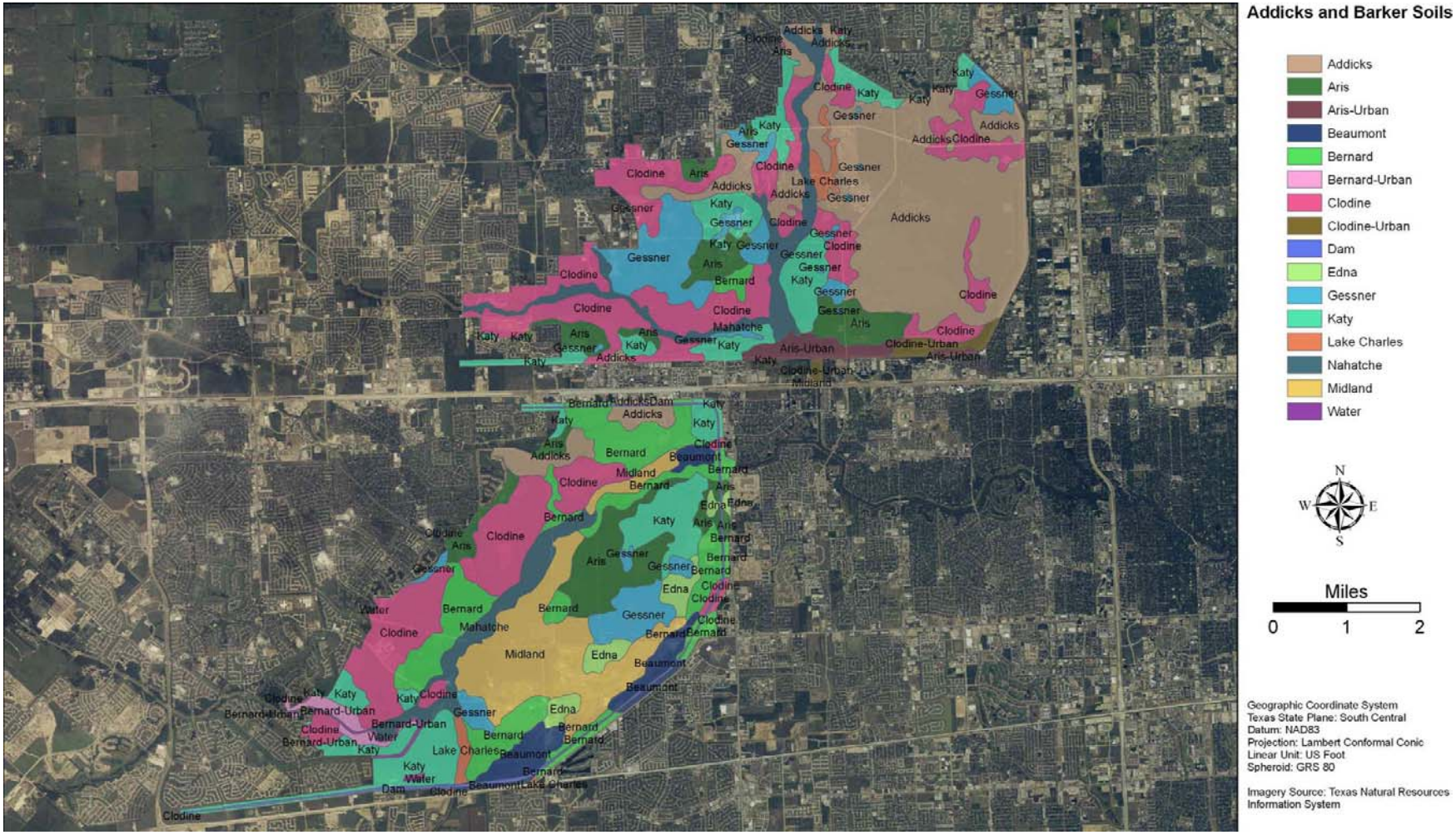

Figure 4-2. Soil Types – Addicks and Barker Reservoirs

4.03 ECOLOGICAL RESOURCES

A. Ecological Background and Trends

Addicks and Barker Reservoirs are located in the Upper Texas Coastal Prairie which contains an assemblage of grasslands, wooded stream bottoms and upland wooded areas (Diamond and Smeins, 1984). Prior to European settlement and twentieth-century development, the region included woodlands of sugarberry, pecan, elms, and live oaks, interspersed with open prairies with native grasses dominated by little bluestem and other typical prairie species (Gould, 1975; Diamond and Smeins, 1984) Of the approximately 8 million acres of the native Coastal Prairie grasslands once found in Texas, it is estimated that less than one percent remains in a relatively pristine state following its conversion to cropland, rangeland, pasture, or urban land uses (Diamond and Smeins, 1984; Grafe et al, 1999).

Coastal forests of the Upper Texas Coast region typically occur along river and bayou drainages and on ridges, barrier islands, and delta splays (Barrow et al, 2005). Long-term historical data for losses of bottomland hardwoods in eastern Texas are not well documented (USFWS, 1985). Recent collaborative studies (USFWS, TPWD, DOI) examining the status and trends of Texas coastal wetlands, mid-1950s to early 1990s, identify the net loss of 96,477 acres of palustrine forested wetlands (swamps, bottomland hardwoods, etc.) from 886,285 acres in 1955 to 789,808 acres, a loss of 11% (USFWS, 1997) Between 1992 and 2000, forest declined by approximately 17% percent within the Houston region, primarily from urban expansion (Forest Service, 2005).

Land-use prior to construction of the dams and reservoirs was primarily ranching and rice farming (Barker) and dairy herds (Addicks) which resulted in the alteration of the native prairie and woodland habitats. Woody vegetation became established with the decline of agricultural and ranching practices and with the continued suppression of a natural fire regime. Returning vegetation often includes the exotic invasive species Chinese tallow (*Triadica sebifera* syn. *Sapium sebiferum*), and more recently, deep-rooted sedge (*Cyperus enrerianus*) among others (USACE, 1987). Examples of this conversion occur throughout the reservoirs. Outside the reservoirs, urban development in the surrounding area and region has also increased with the decline of rice farming and the resulting conversion of extensive open space to urban land-use marking westward expansion of the City of Houston (Katy Prairie Conservancy, 2007). Minimal grazing (under grazing leases) still takes place within the reservoirs and farming has stopped altogether since acquisition of the reservoir lands by the USACE. Despite the extensive impacts, native vegetation assemblages are identifiable in Addicks and Barker (Fields, R.C. et al 1983; Fields, R.C. et al 1986).

Existing land cover classifications within the reservoirs are divided into three general categories: Degraded Prairie; Riparian/Bottomland Hardwood Forest; and Developed Land (Table 4-2; Figure 4-3). Degraded Prairie, the most prevalent land cover, includes areas that were historically coastal prairie but now consist mostly of a mix of prairie and old field habitat (mix of non-native and native plants). Riparian/Bottomland Hardwood Forest includes areas along the streams and bayous of remnant forest that were not

cleared for agricultural use and areas of regenerating forest. The Developed Land land cover classification includes areas of recreational and multi-use development. As more detailed vegetation surveys become available, land classifications will be further defined and documented in subsequent updates to the Master Plan.

Table 4-2. 2008 Land Cover Acres - Addicks and Barker Reservoirs

Land Cover Classification	Addicks	Barker
Riparian/Bottomland Hardwood	2,300	1,700
Degraded Prairie	8,912	8,200
Developed Lands	2,100	2,600

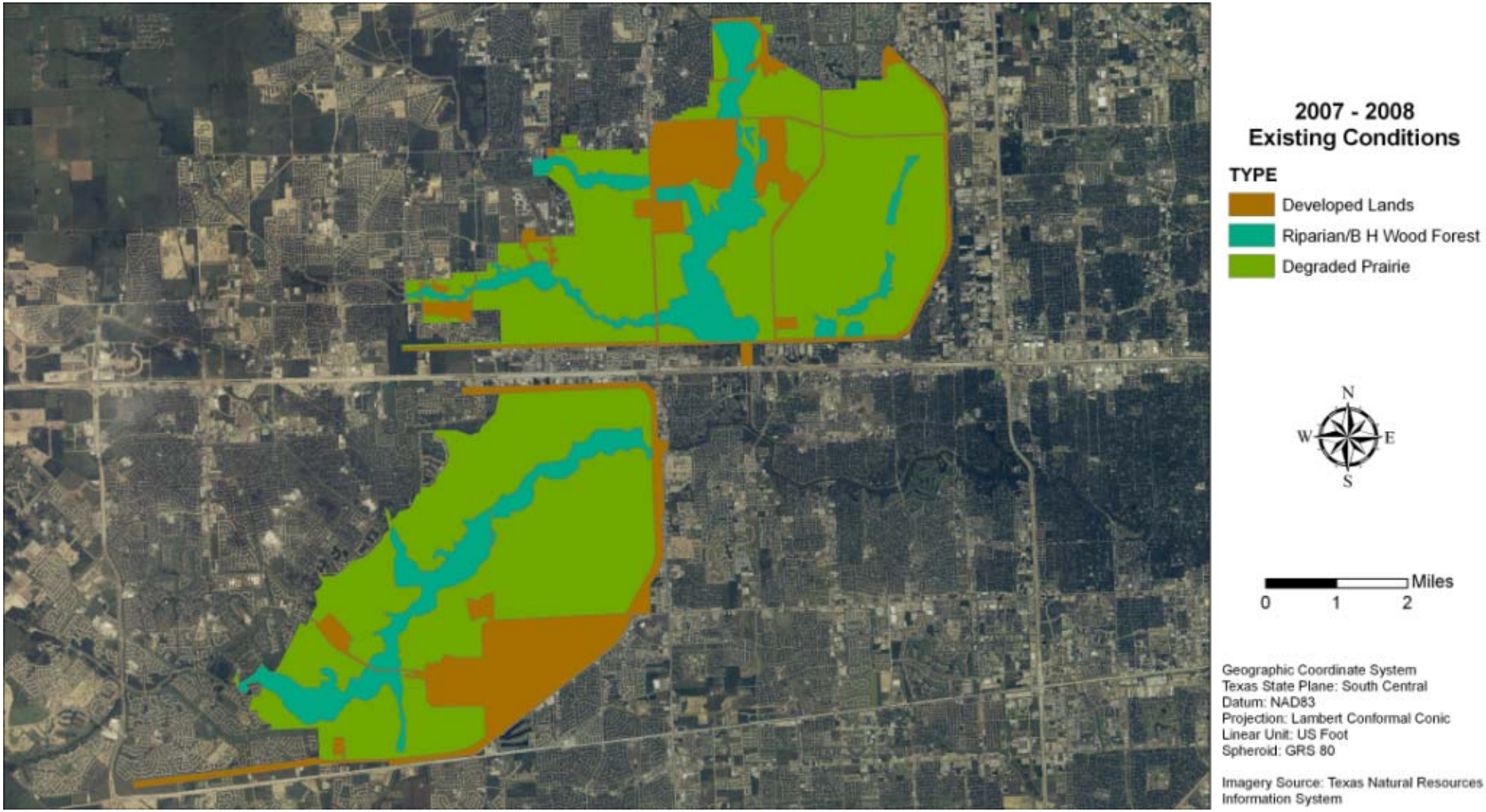

Figure 4-3. Existing Land Cover – Addicks and Barker Reservoirs

B. Vegetation

1) Prairie – For remanant prairie sites of the Upper Coastal Prairie, the dominant prairie community is characterized as littlebluestem-brownseed paspalum-indiangrass (*Schizachyrium scoparium-Paspalum plicatulum-Sorghastrurn nutans*) (Figure 4-5) (Diamond, and Smeins, 1985; TPWD, 2008). Commonly associated plants are: bushy bluestem, slender bluestem, little bluestem, silver bluestem, three-awn, buffalograss, bermudagrass, brownseed paspalum, single-spike paspalum, smutgrass, sacahuista, windmillgrass, southern dewberry, live oak, mesquite, huisache, baccharis, and Macartney rose. Representative plant species are listed in Table 4-2.

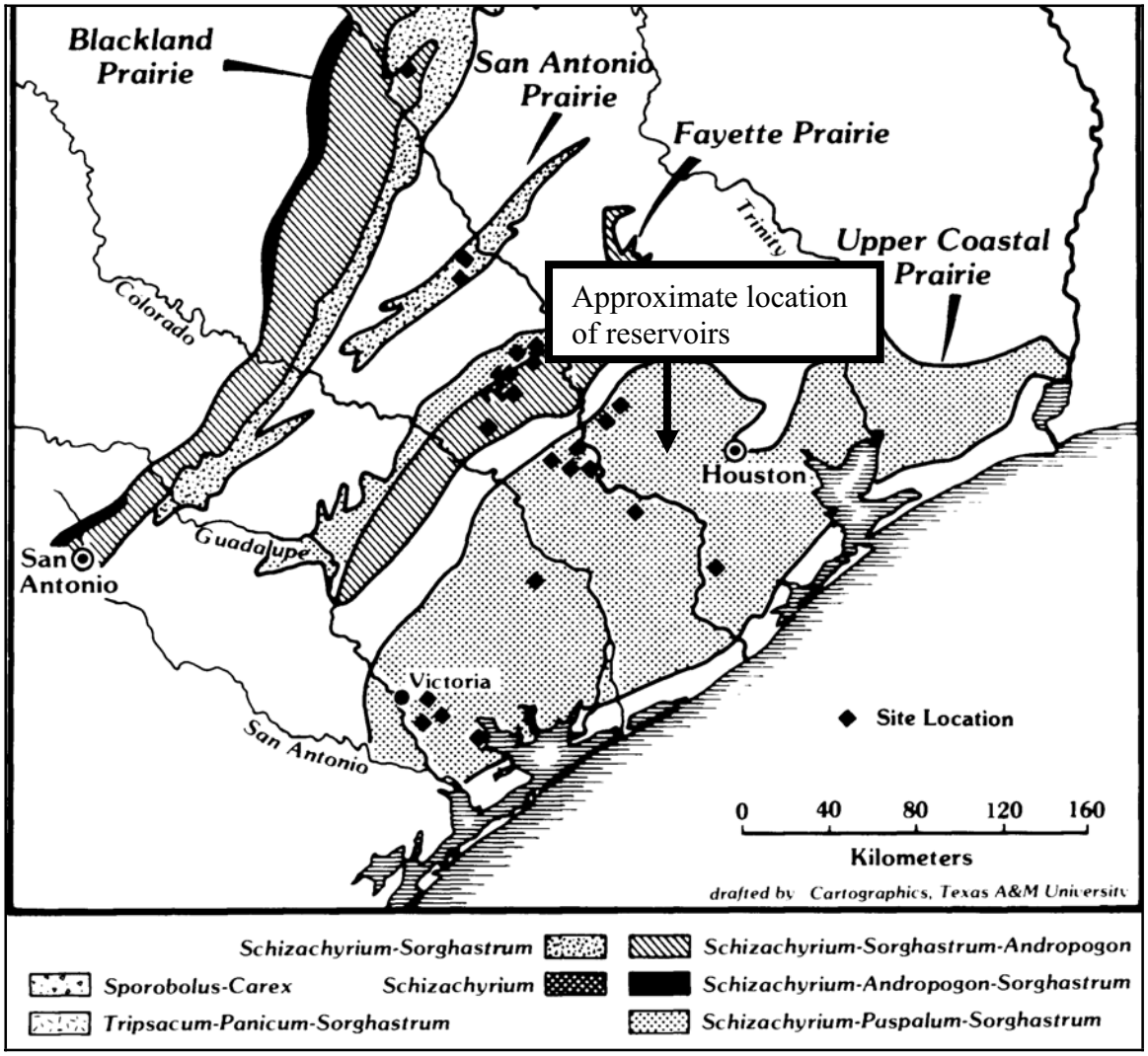

Figure 4-4. Grassland community types of east-central Texas adapted from *Composition, Classification and Species Response Patterns of Remnant Tallgrass Prairies in Texas* (Diamond and Smeins, 1985).

Table 4-3. Characteristic Prairie Community and Species List - Upper Texas Coastal Prairie. (Adapted from Diamond and Smeins, 1985)

Upper Texas Coastal Prairie Community *Schizachyrium scopariumPaspalum plicatulum-Sorghastrurn nutans* (littlebluestem-brownseed paspalum-indiangrass)		
Graminoids (herbaceous flowering grasses, sedges and rushes)		
	Andropogon gerardii	big bluestem
	Bouteloua curtipendula	sideoats grama
	Carex microdonta	small-toothed caric sedge
	Coelorachis cylindrica	cylinder jointtail grass
	Dichanthelium oligosanthes	rosette grass
	Fimbristylis puberula	hairy fimbry
	Panicum virgatum	switchgrass
	Paspalum floridanum	Florida paspalum
	Paspalum plicatulum	brownseed paspalum
	Paspalum setaceum	thin paspalum
	Rhynchospora spp.	beakrush
	Schizachyrium scoparium	little bluestem
	Scleria ciliata	fringed nutrush
	Sorghastrum nutans,	Indiangrass
	Sporobolus asper	scratchgrass
	Stipa leucotricha, Nassella leucotricha	Texas wintergrass, Texas tussockgrass
Forbs (herbaceous flowering plants that are not grasses, sedges, or rushes)		
	Acacia hirta	prairie acacia
	Aster ericoides	white aster
	A. pratensis	aster
	Bifora americana	prairie bishop
	Gnaphalium spp.	cudweed
	Hedyotis nigricans	diamondflowers
	Hymenopappus scabiosaeus	Carolina woollywhite
	Liatris spp.	blazing stars
	Linum medium	stiff yellow flax
	Neptunia lutea	puff
	Physostegia intermedia	slender false dragonhead
	Ratibida columnaris	upright prairie coneflower
	Rudbeckia hirta	blackeyed Susan
	R. nudiflora	violet wild petunia
	Schrankia uncinata	little leaf sensitive-briar
	Sisyrinchium pruinosum	roadside blue-eyed grass

In addition to the general plant community descriptions for the Upper Coastal Prairie, vegetation characteristic of the Houston Coastal Prairie community, *Muhlenbergia capillaries* Herbaceous Vegetation (Natureserve, 2007), is representative of prairie found at Addicks and Barker Reservoirs (Rosen, D. USFWS per comm.). The dominant species of this association is Gulf coast muhly (*Muhlenbergia capillaris*) with Gulf cordgrass (*Spartina spartinae*) prevalent. Eastern baccharis (*Baccharis halimifolia*) occurs as scattered individuals up to moderately dense patches as an invader of disturbed or overgrazed sites. Other potential species include the federally endangered Texas prairie dawn-flower (*Hymenoxys texana*) and the rare endemic species

Houston camphor daisy (*Rayjacksonia aurea*), Texas windmill grass (*Chloris texensis*), and three-flower snakeweed (*Thurovia triflora*), all of which may occur in small grass-free openings in the community. Very few occurrences of this community are known, with nearly all degraded by grazing, fire exclusion, or hydrologic alteration. The few remaining examples are known from private lands and Addicks and Barker Reservoirs, in Harris and Fort Bend counties (Natureserve, 2007).

Typical invasive plants commonly found in old field and pasture land are vasey grass (*Paspalum urvillei*), deep-rooted sedge (*Cyperus enrerianus*), little barley (*Hordeum pusillum*), Johnson grass (*Sorghum halepense*), wax myrtle (*Morella cerifera*) and Roosevelt weed (*Baccharis neglecta*). Native prairie plant species can also be found among the mix of plants commonly found in abandoned agricultural fields throughout the reservoirs. Native and non-native encroaching woody vegetation typically found in these sites include sensitive briar (*Mimosa nuttallii*), rattle bush (*Sesbania drummondii*), McCartney rose (*Rosa bracteata*), yaupon (*Ilex vomitoria*), and Chinese tallow (USACE, 1986). Historically, prairie fires occurred frequently throughout the Gulf Prairies Region, preventing woody plants from establishing, stimulating seed germination, replenishing nutrients, and allowing light to reach herbaceous growth. Fire suppression in remnant prairies allows both native shrubs and invasive species to become established (Grafe et al, 1999). Prior to, and continuing after extensive European settlement, human-induced fires were an integral part of the coastal prairie landscape, suggesting that the most dramatic change to the region's fire regime was the suppression of fire associated with the introduction of heavy grazing (Grace, J.B. et al, 2005).

2) Riparian/Bottomland Hardwood Forest - Bottomland hardwoods perform numerous ecological functions including acting as sources of aquifer recharge, capturing and dispersing sedimentation, filtering runoff and providing important bird habitat (Guilfoyle, 2001). This is of particular importance at Addicks and Barker Reservoirs, as urbanization and agriculture have reduced the amount and quality of riparian and bottomland forests in the region. The reservoirs are situated just east of the Columbia Bottomlands (Austin's Woods) which, at the beginning of the last century, once covered approximately 700,000 acres among the flood plains of the Brazos, San Bernard, and Colorado Rivers, but now exists only as scattered patches totaling approximately 175,000 acres (USFWS, 2008).

Typical species found within riparian forests of the Upper Texas Coast include oaks (*Quercus* spp.), hickories (*Carya* spp.), American elm (*Ulmus americana*), winged elm (*Ulmus alata*), cedar elm (*Ulmus crassifolia*), green ash (*Fraxinus pennsylvanica*), yaupon (*Ilex vomitoria*), deciduous holly (*Ilex decidua*), box elder (*Acer negundo*), dwarf palmetto (*Sabal minor*), hackberry (*Celtis laevigata*), red maple (*Acer rubrum*), soapberry (*Sapindus drummondi*)

(Barrow et al. 2005) and in wetter areas water tupelo (*Nyssa aquatica*) and bald cypress (*Taxodium distichum*).

3) Other Forests / Woodland Areas - Forested or wooded areas outside of the riparian corridors and floodplains grade to a mix of evergreen-deciduous communities including Live Oak Woodland and Coastal Live Oak-Pecan. Typical species found in the Live Oak Woodland community include live oak (*Quercus virginiana*), water oak (*Quercus nigra*), loblolly pine (*Pinus taeda*), American elm (*Ulmus americana*), hackberry (*Celtis laevigata*), yaupon (*Ilex vomitoria*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and dwarf palmetto (*Sabal minor*) (Barrow et al. 2005). Typical species found in the Coastal Live Oak-Pecan (*Quercus virginiana-Carya illinoensis*) community include: post oak, black jack oak, water oak, yaupon, hawthorn (*Crataegus* spp.). These communities grade to or are intermixed with Live Oak-Post Oak communities or prairies (TOES, 1998). Other hardwood species include slippery elm (*Ulmus rubra*), white ash (*Fraxinus americana*), mulberry (*Morus*), and American sycamore (*Platanus occidentalis*). The shrub layer is composed chiefly of yaupon and loblolly pine saplings, southern arrow-wood (*Viburnum dentatum*), rattlebush, baccharis, American beautyberry, vines, rattan-vine (*Alabama supplejack*), grape, greenbriar, dewberry (*Rubus* sp.), honeysuckle (*Lonicera* sp.), peppervine, and McCartney rose.

C. Wetlands

Based on the U.S Fish and Wildlife National Wetland Inventory (NWI) data (Figures 4-4 and 4-5), Addicks and Barker Reservoirs contain approximately 3,400 acres and 4,100 acres of wetlands (Table 4-3), the majority of which are riparian (riverine) and depressional wetlands (e.g. prairie potholes). Wetlands are subject to periodic and constant inundation of water which saturates the soil and supports vegetation which can tolerate these soils. Wetlands like those found within the reservoirs and nearby Katy Prairie provide habitat for aquatic species and are vital for the wildlife directly supported by wetlands. In the water cycle, wetlands are crucial in restoring ground-water levels, by collecting runoff and precipitation and allowing it to infiltrate slowly into the soil. This characteristic of water collection also serves to buffer floods, reducing storm surges and river flows (Tacha, 1994). Wetlands assist with filtering suspended sediment, capturing bed load, aiding in floodplain development, and stabilizing banks against erosion.

Forested wetlands are perhaps the most rapidly disappearing wetland type in the United States. Most swamp and riparian forests underwent severe deforestation and over-harvesting in the early part of this century. Construction of dams and reservoirs along the rivers that supply water to these wetlands, agriculture and silviculture represent the major continuing threats. In addition to the clearing or drowning of forested wetlands within reservoir floodpools, there is a long-term threat that results from the flood-control function of most dams. Once annual flooding is removed, the wetlands begin to dry out and become more susceptible to development pressures and invasion by exotic species. Since the mid-1950s, forested wetlands on the Texas coast have decreased in area by about 11 percent, a net loss of more than 96,000 acres (Moulton and Jacob, 2000).

Prairie pothole and marsh wetlands are inundated by direct precipitation and by runoff and are remnants of the rivers that laid down the great floodplain and delta sediment deposits that make up most of the coastal plain, and where the original morphology has been greatly modified by wind and other agents. The Katy Prairie west of the project is one of the more well known prairies with abundant pothole wetlands. Prairie potholes once covered vast expanses of prairie before urbanization. Historically, agriculture was the greatest cause of the loss of prairie potholes and marshes. Urbanization is probably the greatest cause of loss today. Over the course of American history, more than 115 million acres of wetlands have disappeared, down from an original total of 221 million acres. Over 30 million acres of the remaining acreage are considered too contaminated to be ecologically useable. In Texas, 600,000 acres of coastal wetlands and 52 percent of the total wetland acreage has been lost, with ongoing loss of prairie wetlands and coastal marshes (Tacha, 1994). On the Texas Gulf Coastal plain, freshwater marshes have decreased by almost 30 percent since the mid-1950s, a net loss of more than 235,000 acres (Moulton and Jacob, 2000).

Prairie potholes occur throughout the reservoirs and are important to wildlife, particularly birds that migrate across the western Gulf of Mexico. Frequently, these habitats are the first source of freshwater encountered by migrants and are heavily used by songbirds, shorebirds and waterfowl, and others. Typical vegetation found within marsh wetlands and the more permanent prairie potholes may include floating and submerged plants like water lilies, pondweeds (*Potamogeton* sp.), southern naiad (*Najas guadalupensis*), and duckweed (*Lemna* sp.) in the open water zone. The emergent zone might include cattails (*Typha* sp.), bulrushes, burheads (*Echinodorus* sp.), arrowheads (*Sagittaria* sp.), and common reed (*Phragmites australis*). A higher woody zone may include trees and shrubs like black willow, buttonbush (*Cephalanthus* sp.), rattlebush and coffee bean, baccharis, and Chinese tallow. Edges of less permanently flooded potholes and marshes might have bushy bluestem (*Andropogon glomeratus*) and various other grasses, spikerushes (*Eleocharis* sp.), rushes (*Juncus* sp.), and sedges as well as the shrubs and trees mentioned above (Moulton and Jacob, 2000). As these Federal lands are protected from urban development, they represent conservation and restoration vegetative and wildlife management opportunities.

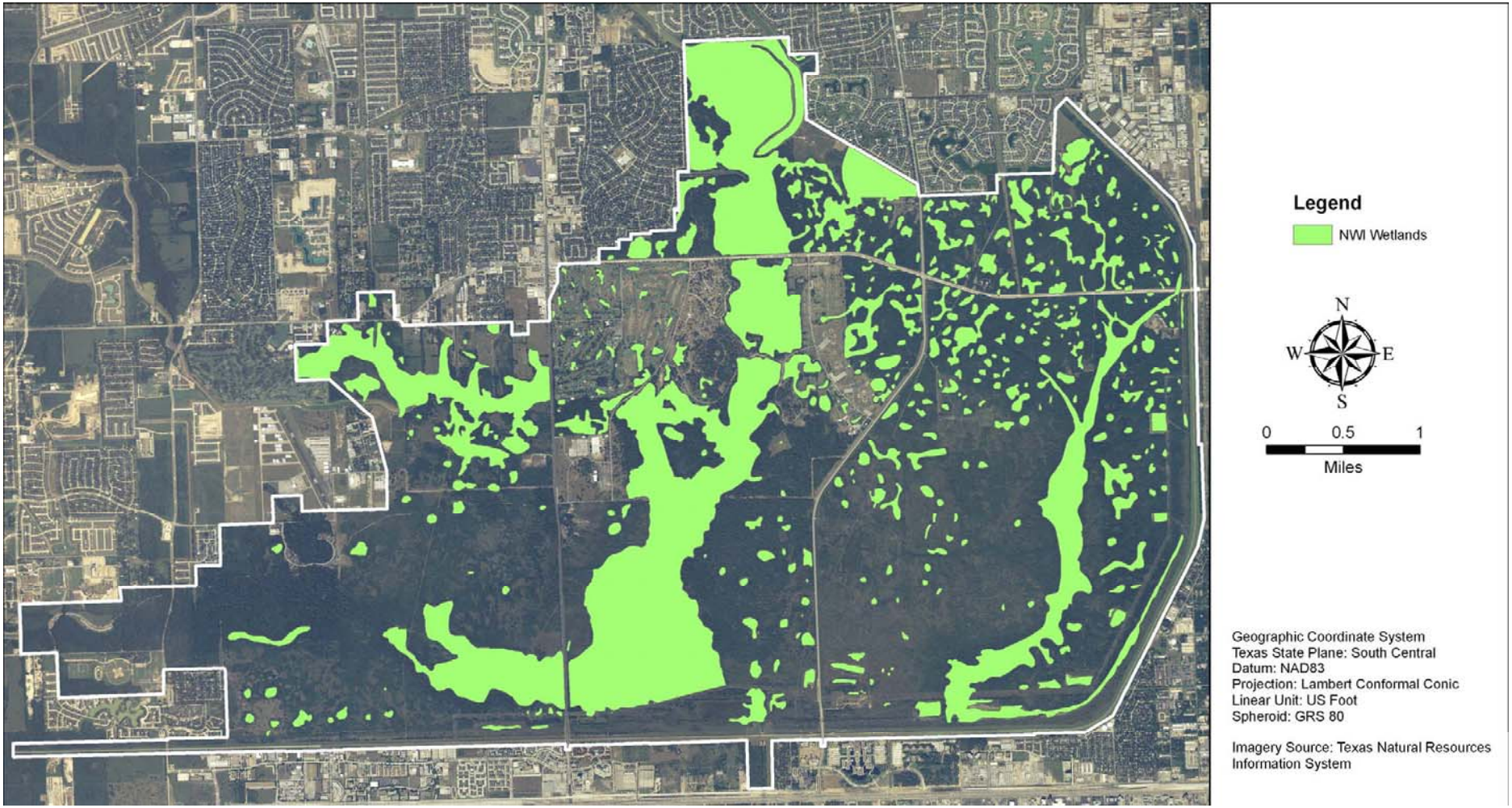

Figure 4-5. Addicks Reservoir NWI Wetlands

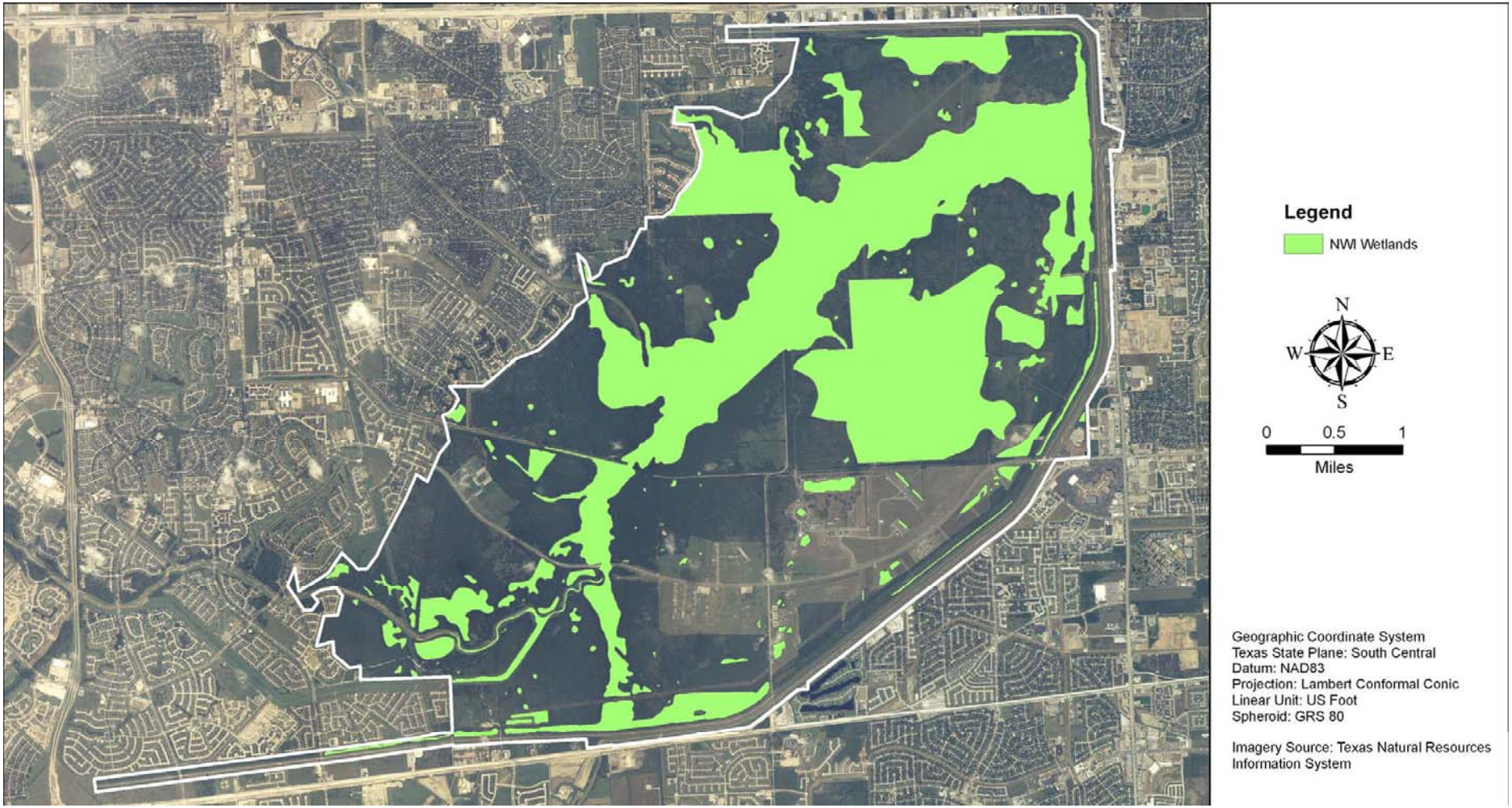

Figure 4-6. Barker Reservoir NWI Wetlands

Table 4-4. Wetlands by Land Use Classification and Reservoir (approx. acres)

Land Use Classification	NWI Wetlands Addicks	NWI Wetlands Barker
Operations	250	600
Existing Recreation	200	100
Proposed High Density Recreation Area	75	<5
Environmentally Sensitive Areas	2,250	1,800
Multiple Resource Management Area	650	1,600
Total	3,400	4,100

D. Wildlife

Coastal prairies and forests provide important wildlife habitat to a wide variety of species. Remnant Gulf Coast Prairies still contain one of the highest numbers of red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), white ibis (*Eudocimus albus*), and white-faced ibis (*Plegadis chihi*) than any other region in the United States (Grafe et al, 1999). Coastal bottomland forests, such as those found within the reservoirs, provide important stopover habitat for migrating birds within the Gulf of Mexico (Barrow et al, 2005). As coastal prairie and bottomland hardwood forests have been lost or degraded from agricultural practices, development, and vegetation management, the importance of the remaining patches of habitat for wildlife increases.

Small to medium-sized mammals potentially in the area are the raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), eastern fox squirrel (*Sciurus niger*), striped skunk (*Mephitis mephitis*), nine-banded armadillo (*Dasypus nobemcinctus*), and rodents including hispid cotton rat (*Sigmodon hispidus*), whitefooted mouse (*Peromyscus leucopus*), deer mouse (*Peromyscus* sp.), and the house mouse (*Mus musculus*). Typical large mammals include striped skunk (*Mephitis mephitis*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), beaver (*Castor canadensis*), feral hog (*Sus scrofa*), and may also include river otter (*Lontra Canadensis*).

The prairie habitat type within the reservoirs provides a mix of marshland, prairie potholes, with adjacent upland grassland that provides habitat for waterfowl, raptors, wading birds, and a variety of other avian species. The wetlands within the prairie area are most often used by waterfowl such as black-bellied whistling-duck (*Dendrocygna autumnalis*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), blue-winged teal (*Anas discors*), gadwall (*Anas strepera*), wigeon (*Anas americana*), and mottled duck (*Anas fulvigula*). Quails (*Coturnix* sp.), doves, roseate spoonbills (*Platalea ajaja*), cardinals (*Cardinalis cardinalis*), bluebirds (*Sialia sialis*) and a large variety of songbirds can be seen throughout the year throughout the prairie habitat using the adjacent mixed pine-deciduous forest areas for cover (National Audubon Society, 2002, 2007).

Bottomland hardwood forests within the reservoirs provide habitat for migrating neotropical songbirds, wintering birds, and year-round residents. Within the neighboring Columbia Bottomlands (Austin's Woods), surveys have detected over 237 species of birds (Barrow et al, 2005). During spring and fall migration, neotropical migrants such as American redstarts (*Setophaga ruticilla*), Baltimore orioles (*Icterus galbula*), and black-throated green warblers (*Dendroica virens*) are likely to use the reservoirs. During winter, typical migrant species include ruby-crowned kinglet (*Regulus calendula*), yellow-rumped warbler (*Dendroica coronata*), white-throated sparrow (*Zonotrichia albicollis*), and yellow-bellied sapsucker (*Sphyrapicus varius*) and wintering waterfowl include wood duck (*Aix sponsa*) and mallard (Guilfoyle, 2001). During migration seasons, nearly all the migratory landbirds of the eastern United States use the coastal plains of the western gulf. In the spring, birds use wooded vegetation along the Gulf as stopover habitat, while in the fall, migrating birds use these woodlands to store energy for continued migration (Barrow et al, 2005).

Year round residents of bottomland hardwood forest within the reservoirs include tufted titmouse (*Baeolophus bicolor*), Carolina wren (*Thryothorus ludovicianus*), Carolina chickadee (*Poecile carolinensis*), downy woodpecker (*Picoides pubescens*), and red-bellied woodpecker (*Melanerpes carolinus*) (Guilfoyle, 2001; National Audubon Society, 2002). Wading birds such as the great egret (*Ardea alba*), great blue heron (*Ardea herodias*), and little blue heron (*Egretta caerula*) also use the bottomland hardwood forests within the reservoirs (Guilfoyle, 2001; National Audubon Society, 2002).

The reservoirs afford extensive bird viewing opportunities and are included within the Great Texas Coastal Birding Trail. The Addicks and Barker Reservoirs are located in the Central Flyway and provide habitat for a number of rare birds. Of the 48 species of Birds of Conservation Concern identified by USFWS as occurring within the Gulf Coastal Prairie region (USFWS, 2002), and the 16 species of rare birds identified by TPWD as occurring within Harris and Fort Bend counties (TPWD, 2007b), 15 have been observed within the vicinity of Addicks and Barker Reservoirs in the past ten years (Table 4-4). The Buffalo Bayou Christmas Bird Count (National Audubon Society, 2002), includes most of the two reservoirs (Figure 11-1) and has recorded winter bird populations for several decades. Additional bird surveys have occurred throughout the year at the Audubon Society's Edith Moore Nature Sanctuary (National Audubon Society, 2007), which is located approximately five miles to the east of Barker Reservoir. Many of the species listed in Table 4-4 require prairie and/or bottomland hardwood habitat found at Addicks and Barker Reservoirs, including white ibis, sedge wren, Henslow's sparrow, and LeConte's sparrow.

Amphibians typical of those found in the reservoirs are green tree frogs (*Hyla cinerea*), leopard frogs (*Rana sphenocephala*), bullfrogs (*Lithobates catesbeianus*), and Gulf Coast toad (*Bufo valliceps*). Typical reptiles include snapping turtle (*Chelydra serpentina*), red-eared turtle (*Trachemys scripta*), three-toed box turtle (*Terrapene carolina*), ornate box turtle (*Terrapene ornata*), green anole lizard (*Anolis carolinensis*), five-lined skink (*Eumeces fasciatus*), and slender glass lizard (*Ophisaurus attenuatus*). The reservoirs also support a number of snake species such as racer, prairie king snake (*Lampropeltis*

calligaster), cottonmouth (*Agkistrodon piscivorus*), and a number of water snakes (University of Texas, 2000).

Although development surrounding the reservoirs is likely to isolate the habitat within Addicks and Barker Reservoirs for many larger mammals, species that are more adapted to human presence occur, such as coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), and bobcat (*Lynx rufus*). Small to medium-sized mammals potentially in the area are the raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), beaver (*Castor canadensis*), otter (*Lutra canadensis*), eastern fox squirrel (*Sciurus niger*), eastern gray squirrel (*Sciurus carolinensis*), cottontail rabbit (*Sylvilagus* sp.), striped skunk (*Mephitis mephitis*), nine-banded armadillo (*Dasypus novemcinctus*), and rodents including hispid cotton rat (*Sigmodon hispidus*), whitefooted mouse (*Peromyscus leucopus*), deer mouse (*Peromyscus* sp.), and the house mouse (*Mus musculus*) (HCFCD, 2001).

Table 4-5. Rare Birds and Birds of Conservation Concern Observed in the Vicinity of Addicks and Barker Reservoirs

Common Name[1] / Scientific Name	Christmas Bird Count (1997-2007)	Edith Moore Nature Sanctuary (2004-2007)
American bittern *(Botaurus lentiginosus)*	X	
White ibis (*Eudocimus albus*),	X	X
Northern harrier (*Circus cyaneus*)	X	
Peregrine falcon (Falco peregrinus)	X	
Red-headed woodpecker *(Melanerpes erythrocephalus*	X	X
Loggerhead shrike *(Lanius ludovicianus)*	X	
Bewick's wren *(Thryomanes bewickii)*	X	
Sedge wren *(Cistothorus platensis*	X	
Tropical parula *(Parula pitiayumi)*	X	
Swainson's warbler (*Limnothlypis swainsonii)*		X
Kentucky warbler (*Oporornis formosus)*		X
Grasshopper sparrow *(Ammodramus savannarum)*	X	
Henslow's sparrow (Ammodramus henslowii)	X	
LeConte's sparrow *(Ammodramus leconteii)*	X	
Painted bunting (*Passerina ciris)*		X

1. Italicized species are listed on the TPWD's Rare Species List
Source: National Audubon Society, 2002, 2007

E. Threatened and Endangered Species

According to the USFWS (2007a), the federally listed endangered plant or wildlife species potentially occurring within Harris or Fort Bend Counties are the Texas prairie dawn-flower (*Hymenoxys texana*, Figure 4-6) and whooping crane (*Haliaeetus leucocephalus*). The TPWD also maintains county lists of state-listed and rare plant and wildlife species (TPWD, 2007b). Appendix D shows the full list of rare species potentially found in Harris and Fort Bend Counties. As shown in Table 4-4, the state-

threatened peregrine falcon and white-faced ibis, as well as the state rare Henslow's sparrow have been sighted in close proximity to Addicks and Barker Reservoir.

The bald eagle (*Haliaeetus leucocephalus*), which was delisted from the Federal endangered species list is known to occur on the eastern side of Lake Houston, at Warren Lake west of Houston, and also nests in Fort Bend and Brazoria Counties. Although rarely recorded in the vicinity of the reservoirs, a sighting of a bald eagle was recorded during the December 29th 2007 Buffalo Bayou Christmas Bird Count.

The Texas prairie dawn-flower, Federally listed on March 1985, is known to occur within the reservoirs (TPWD, 2007c, Figures 4-7 and 4-8). Preferred habitat for this species is on small sparsely vegetated areas of fine-sandy compacted soils where the prairie dawn-flower has a competitive advantage, probably due to its ability to tolerate soils high in salts (USFWS, 1989). A typical prairie dawn-flower location is often the edge of or on the flats in between naturally occurring pimple mounds on what used to be native prairie west and south of Houston. These pimple mounds are naturally occurring small raised areas having slightly better drainage than the surrounding prairie which is seasonally/annually classified as a wetland. Bare spots other than pimple mounds occupied by this species occur where soils have been severely disturbed in the past such as abandoned rice fields, vacant lots, and pastures where pimple mounds have been leveled (USFWS, 1989). The bare spots are usually moist during the winter and spring but dry out during summer (USFWS, 1989). The Texas prairie dawn-flower's principal flowering and seed maturation period is from mid-March to mid-April (USFWS, 1989).

Figure 4-7. Texas Prairie Dawn-flower (TPWD

The Galveston District prepared a biological assessment in 1987 that examined threatened and endangered species in the Addicks and Barker Reservoirs area. According to this biological assessment, Barker Reservoir had one Texas Prairie Dawn-flower population of about 900 individual plants and Addicks Reservoir had 15 populations ranging in size from a few hundred to a thousand or more individual plants. Since this initial biological assessment, annual surveys and data collected by the USACE within the Addicks and Barker Reservoirs have documented populations at 114 sites totaling approximately 67,000 individual plants in 2001. As shown in Figures 4-7 and 4-8, Texas Prairie Dawn-flower is now located throughout much of the northern and western portions of Addicks Reservoir. Fewer locations occur within Barker Reservoir.

The biggest threat to this species is habitat destruction associated with development and road construction, expansion, and maintenance. Although this species is likely tolerant of some disturbance, any activities that would alter the soil such as plowing or blading would likely destroy the habitat (USFWS, 1989). Because Texas prairie dawn-flower occurs in sparsely vegetated areas, infestation of woody species or altering this habitat to create improved pasture could result in a loss of habitat (USFWS, 2007b). Some of the largest known populations of Texas prairie dawn-flower occur within Addicks and Barker Reservoirs, therefore protecting these populations is important to the continued existence of the species.

F. Aquatic Resources

The Addicks and Barker Reservoirs are located directly upstream of the Buffalo Bayou watershed in west-central Harris County and the northern portion of Ford Bend County. Buffalo Bayou is approximately 75 miles long (USACE, 1940) with its headwaters located west of the project area in Waller County. The Bayou generally flows from west to east as it meanders through the northern part of Fort Bend and Harris counties before it merges with the San Jacinto River about nine miles above Galveston Bay.

Water quality for the general project area is under continual study by the Buffalo & White Oak Bayous Indicator Bacteria Total Maximum Daily Load (TMDL) Stakeholders Group. Currently, all main segments and tributaries of Buffalo Bayou that run through either Addicks or Barker Reservoir have been identified as impaired, which is typical for all of the segments for both Buffalo and White Oak Bayous. The sources for the contamination are located upstream and off Federal lands. Where feasible, the Corps will work with Federal, state, and local partners to develop and implement management plans for the restoration of streams and other water bodies within the reservoirs to improve existing water quality and wildlife habitat.

George Bush Park in Barker Reservoir features small ponds for wildlife viewing and bird watching opportunities. Apart from shallow water impounded along the levees, no other appreciable open water habitat exists within the project areas. Prairie pothole wetlands are discussed in greater detail in Section 4.03 C. Wetlands, above.

Due to the vastly fluctuating water levels in the reservoirs, limited water quality, shallow water depths, and high water temperatures, the streams do not support a significant sport fishery. Although species diversity and abundance of game fish are low, Buffalo Bayou and South Mayde Creek downstream of the reservoirs contain probably the only significant sport fishing in the area. Common fish species most likely found in these generally turbid streams are gar, carp, catfish, sunfish, crappie, mosquito fish, and sheepshead minnow. Invertebrates such as gastropods, insect larvae, and several species of crayfish also can tolerate the fluctuating water levels and nutrient loads (USACE, 1986).

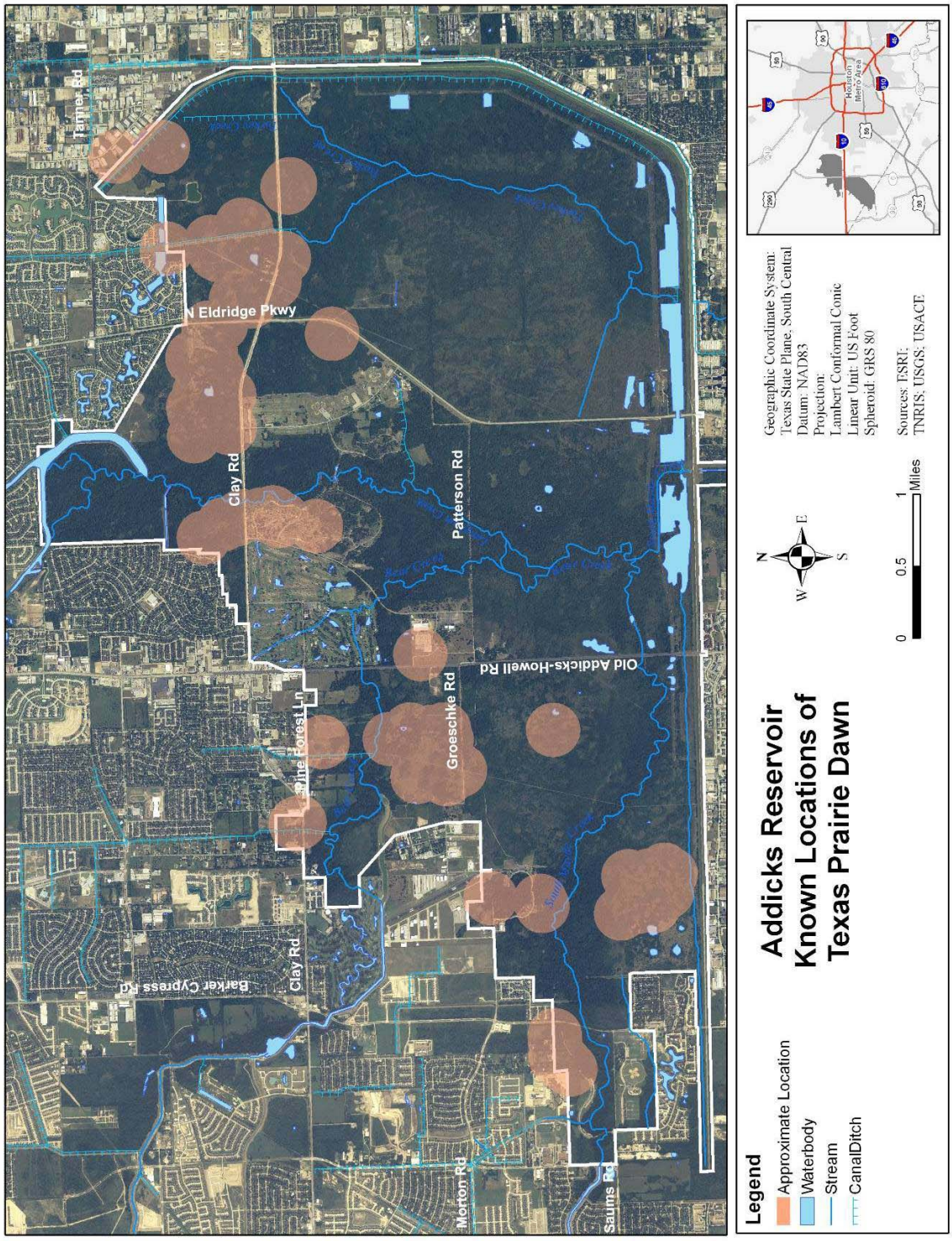

Figure 4-8. Addicks Reservoir - Known Locations of Texas Prairie Dawn-flower

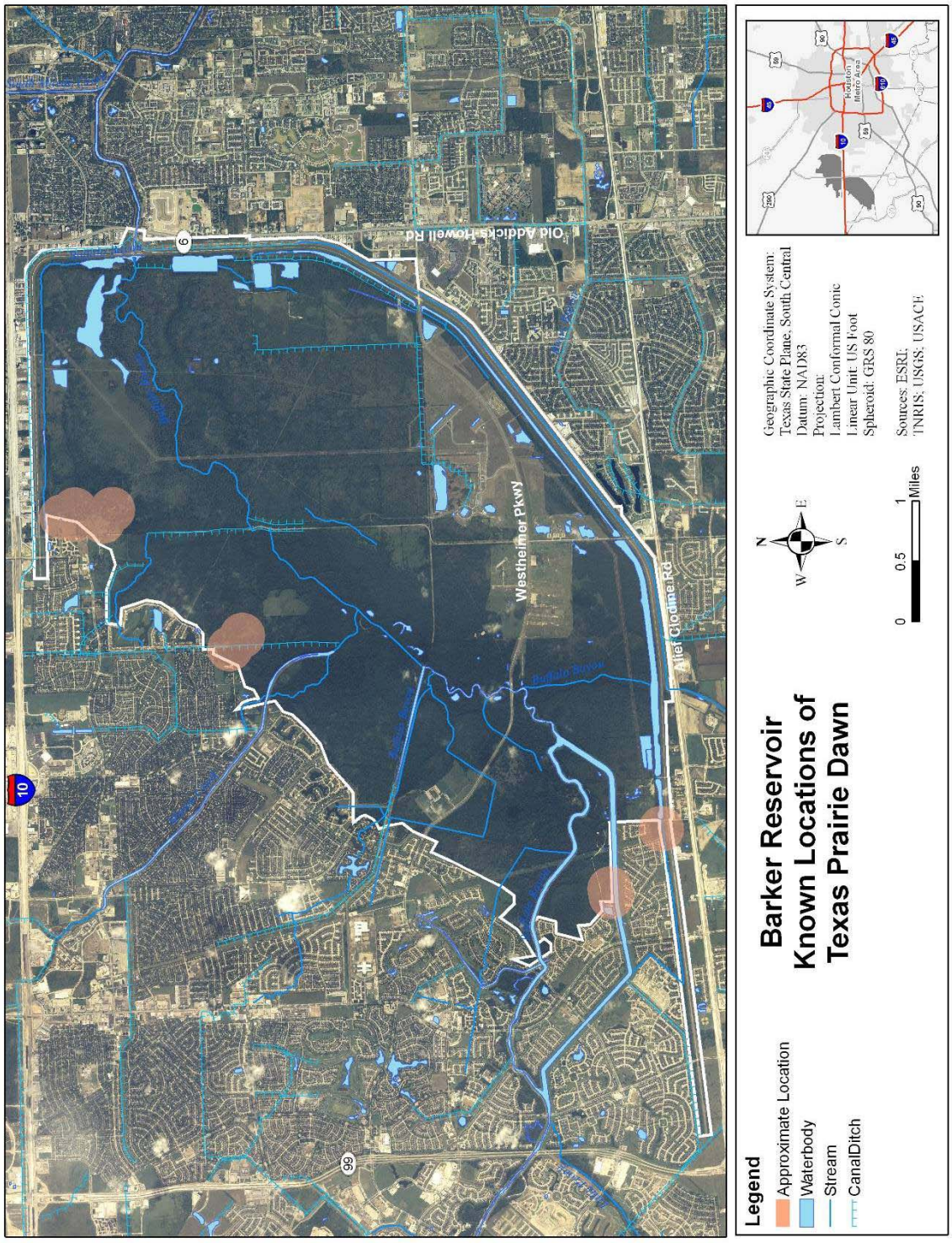

Figure 4-9. Barker Reservoir - Known Locations of Texas Prairie Dawn-flower

4.04 CULTURAL RESOURCES

This section provides a brief overview of the current status of management practices, inventories, cultural resources, and development policy for both Addicks and Barker Reservoirs in Harris County, Texas.

A. Management

The USACE developed regulation ER 1130-2-540, as amended November 2002, to establish land management policy for Corps administered project lands. Chapter 6 – Cultural Resources Management provides guidance on artifact collection use and management, historic preservation, inventory and site evaluation priorities at Operations Projects, and enforcement actions. ER 1130-2-540 incorporates the following Federal laws governing cultural resource management: the National Historic Preservation Act, the Archeological and Historic Preservation Act, Archeological Resources Protection Act, and the Native American Grave Protection and Repatriation Act. Refer to Section 1.05 E Cultural and Historical Considerations for a brief description of these laws.

B. Cultural Resource Inventories

As of the preparation of this document, approximately 11,900 acres (45%) of Addicks and Barker Reservoirs have been inventoried for cultural resources. Approximately 5,750 acres (40%) of Addicks Reservoir has been inventoried and 6,150 acres (47%) of Barker Reservoir has been inventoried. Overall, these inventories provide a strong representative sampling of the distribution, component, and type of cultural resources located on both reservoirs.

C. Resources

A total of 179 cultural resources have been recorded in the reservoirs, 96 in Addicks and 83 in Barker. One hundred twenty-six of the cultural resources are prehistoric and 53 of are historic. Currently there are no identified Traditional Cultural Properties on either reservoir.

Ninety-nine of the prehistoric resources are identified as pimple mounds. The other 27 prehistoric resources appear to be primarily small lithic scatters with some tools present. Lithics, the most common artifact type, occur on most (111) of the prehistoric resources and ceramic sherds, the second most common artifact type, occur on only 39 of the prehistoric resources.

The historic resources primarily date between 1900 and 1930. The majority (23) of the resources are related to early 20th century home sites. There are also 12 historic trash dumps/artifact scatters, 9 resources related to ranching and agriculture, 4 cemeteries, 2 historic bridges, 1 historic recreational facility, and 1 historic rail road feature.

D. Development

Cultural Resources are both a rare and nonrenewable resource. It is the goal of the USACE to manage, protect, and preserve the resources on both the Addicks and Barker Reservoirs. All lessees are expected to aid the USACE in meeting this goal by complying with ER 1130-2-540. Accordingly, all lessees are expected to adhere to the following:

- Prior to the implementation of any project work, the USACE Staff Archeologist shall determine if an archeological inventory or mitigation work needs to be conducted, the lessee shall ensure that all work is conducted.

- If, during project implementation, a lessee should encounter cultural materials, they shall stop all work in the area and contact the USACE Staff Archeologist.

- If, during project implementation, a lessee should encounter human remains, they shall stop all work in the area and contact the appropriate law enforcement officials, the County Coroner, and the USACE Staff Archeologist immediately.

4.05 AESTHETICS

Natural and cultural features that give the project area landscape its character include topographic features, existing structures, and vegetation. The topography within Addicks and Barker Reservoirs is generally flat with a slight decrease in elevation (about 30 feet) from west to east. The landscape within the dry reservoirs of Addicks and Barker is not typical of the surrounding area, which is primarily residential and commercial development. The aesthetic natural quality of the Addicks and Barker reservoirs serves as contrast to the visual character of the adjacent developed areas. The development is connected by a complex highway system associated with suburban sprawl radiating out from the City of Houston, Texas. Within the reservoirs, and especially along roads, the view of mixed forested and grassland areas is periodically interrupted by buildings, recreational developments, and ball fields.

Figure 4-10. Looking west along Barker Reservoir

Addicks Reservoir's northern boundary abuts densely populated residential neighborhoods (Figure 4-9). There is a mixture of residential and commercial development adjacent to the eastern boundary. The West Houston Lakeside Airport, closely populated residential properties, and commercial development abut the western boundary of the reservoir. The southern boundary of Addicks Reservoir is in close

proximity to the northern boundary of Barker Reservoir. Separating the two reservoirs is Interstate Highway 10 and mixed commercial and residential development.

The immediate area surrounding the Barker Reservoir consists of primarily commercial development and Interstate Highway 10 stretching along the entire northern border. Commercial development and State Highway 6 stretch along the entire eastern boundary while the Westpark Tollway and residential developments stretch along the southern border. Abutting the western boundary are densely populated residential neighborhoods. The reservoirs provide an aesthetic relief relative to the surrounding residential, commercial, and roadway development by providing a green space oasis among dense suburban sprawl (see Figure 4-10).

Addicks Reservoir's earthen embankment dam visually dominates the eastern and southern boundaries of Addicks Reservoir. Barker Reservoir's earthen embankment dam visually dominates the northern, eastern, and southern boundaries of Barker Reservoir. There are also six smaller earthen barriers found within the shooting range on the southeastern side of the Barker Reservoir off Westheimer Parkway across from the Dog Park. These six earthen barriers are visually prominent due to the openness of the surrounding area.

Currently, visual resources near the streams include mature trees and an established under story of dense brush along the riparian corridor areas. Upland areas are generally dominated by patchworks of open views across prairie-type grasses (areas with the longest views) and views obstructed by woody vegetation.

The aesthetic value of the forested and open grasslands within the reservoirs is evident when considering the surrounding residential and commercial land development. Without the Federal project, the majority of this land most assuredly would have been lost to suburban sprawl. Prairie wildflowers bloom during the spring and in the summer, between the forested areas. More manicured developed recreational areas (soccer fields, baseball diamonds, tennis courts, shooting ranges, golf courses, model airplane area, dog parks, and picnic areas) are visible along roadways bisecting the reservoirs (Figure 4-11).

Figure 4-11. Barker Reservoir Soccer Complex off Westheimer Parkway

Both reservoirs have several old borrow areas within their boundaries. The borrow areas are generally along the inside of the dam parallel to the dam's length as artifacts of dam construction. These areas are a few feet deep and about 20 to 50 feet wide and anywhere from tens to hundreds of feet long. Many of the borrow areas remain filled with water year round with a few providing some level of habitat for migrating waterfowl and other wildlife such as beaver.

Pipelines, electrical utility lines (both major and minor), phone lines, cell towers, relay stations, roadways (both major and minor), waterlines, and pipeline-related stations (e.g., meter stations, valve stations) are located throughout both Addicks and Barker Reservoirs. The larger electrical transmission lines and associated vegetative clearing are visible from aerial photographs.

4.06 RECREATIONAL RESOURCES

A. Recreational Development

The recreational developments at Addicks and Barker Reservoirs are varied and designed to accommodate local needs through day use facilities. Park and recreation areas within the reservoirs include: sports fields, shooting ranges, model airplane fields, paved trails, playgrounds, community centers, golf courses, community zoo, a war memorial, exercise circuits, numerous picnic facilities and pavilions, a farm and ranch club rodeo arena, equestrian trails, two dog parks, ponds, and a velodrome (Figure 4-12). A summary of developed recreational facilities is presented below in Table 4-5. Youth sports leagues (e.g., Westside Soccer, Bear Creek Soccer Club, Cy-Fair Sports Association, Bear Creek Little League, etc.) lease fields from Harris County, Precinct 3 to promote their leagues, and as such, priority use of the fields is given to the league while the public may be able to use it on a reservation basis depending on the season.

Figure 4-12. Velodrome in Cullen Park

Table 4-6. Summary of Public and Quasi-Public Recreational Development

Recreation Area	Picnic Shelters/Pavilions	Picnic Sites	Visitor Center	Group Camp	Playground Areas	Baseball/Little League Fields	Soccer Fields	Jog, Hike, Bike, Trails (Miles)	Equestrian Trails (Miles)	Horseshoe Pits	Restrooms	Community Center	Golf Courses	Tennis Courts	Pond	Dog Park	Animal Exhibits
Addicks Reservoir																	
Bear Ck. Pioneers Park	8	729	1	1	2	19	36	2.0	3.5	16	18	1	3	4		1	22
Cullen Park	7	390			7		8	3.5			12						
Subtotal	15	1,119	1	1	9	19	42	5.5	3.5	16	30	1	3	4		1	22
Barker Reservoir																	
George Bush Park	3	30			2	6	47	10.8	1		5				3	1	
Subtotal	3	30			2	6	47	10.8	1		5				3	1	
TOTALS	**18**	**1,149**	**1**	**1**	**11**	**25**	**89**	**16.2**	**4.5**	**16**	**35**	**1**	**3**	**4**	**3**	**2**	**22**

B. Visitation

Visitation estimates for this Master Plan update were obtained from the Galveston District's estimates and various county and municipal officials. Table 4-6 provides the total yearly reservoir visitation numbers and hours between 1988 and 2007 Estimates for visitation in 2006 from Harris County were derived from traffic counts at the park entrances and a group size multiplier of 1.5 (email correspondence from J. Langford, Precinct 3, Harris County Parks Administration to J. Splenda, The Louis Berger Group Inc., January 25, 2007) (Table 4-7). Use is fairly consistent throughout the year with every month accounting for between six and 10 percent of the annual use, with May and October receiving the highest amounts of use. Fort Bend County does not have any developed recreational facilities within Barker Reservoir, and as such, does not have a use estimate for the passive activities that may be occurring on their lands. Table 4-8 shows the City of Houston park permit program monitoring numbers for facilities in Cullen Park.

Table 4-7. Addicks and Barker Reservoirs Recreation Totals		
Year	**Park Visits**	**Park Visitor Hours**
1988	3,112,106	8,586,300
1989	3,137,767	8,657,100
1990	4,371,983	12,062,300
1991	unavailable	unavailable
1992	2,377,238	6,558,800
1993	2,651,323	7,315,000
1994	2,764,625	7,627,600
1995	1,368,902	3,776,800
1996	3,390,047	9,353,140
1997	2,791,970	7,703,045
1998	2,861,600	7,895,400
1999	2,369,900	6,538,600
2000	4,568,310	12,603,967
2001	3,516,025	9,700,713
2002	3,024,828	8,345,500
2003	2,659,482	7,337,511
2004	3,081,439	8,501,690
2005	4,388,685	12,108,382
2006	4,702,981	12,975,525
2007	4,163,789	11,487,894
Average	3,226,474	8,901,856

Table 4-8. Monthly Visitation Estimates[1] for Harris County Parks			
2006	**Bear Creek Pioneers**	**George Bush**	**Monthly Totals**
January	196,035	95,562	291,597
February	157,472	51,899	209,371
March	198,498	79,053	277,551
April	195,483	86,405	281,888
May	228,807	92,681	321,488
June	224,108	81,719	305,817
July	137,451	72,906	210,357
August	202,823	75,471	278,294
September	204,068	70,680	274,748
October	243,444	76,946	320,390
November	183,134	70,044	253,178
December	164,118	74,532	238,650
Total	2,335,441	927,898	3,263,339
1. Estimates based on traffic count readings multiplied by a 1.5 group size			

Table 4-9.. Cullen Park – City of Houston Visitation Estimate 2006		
Area	Visitors	Percent
Sports fields	170,000	86%
Picnic pavilions	22,000	11%
Velodrome[2]	5,751	3%
Total	197,751	100%
1. Elliot Reuban, City of Houston park department, permits office. 2. Operated by a City approved concessionaire.		

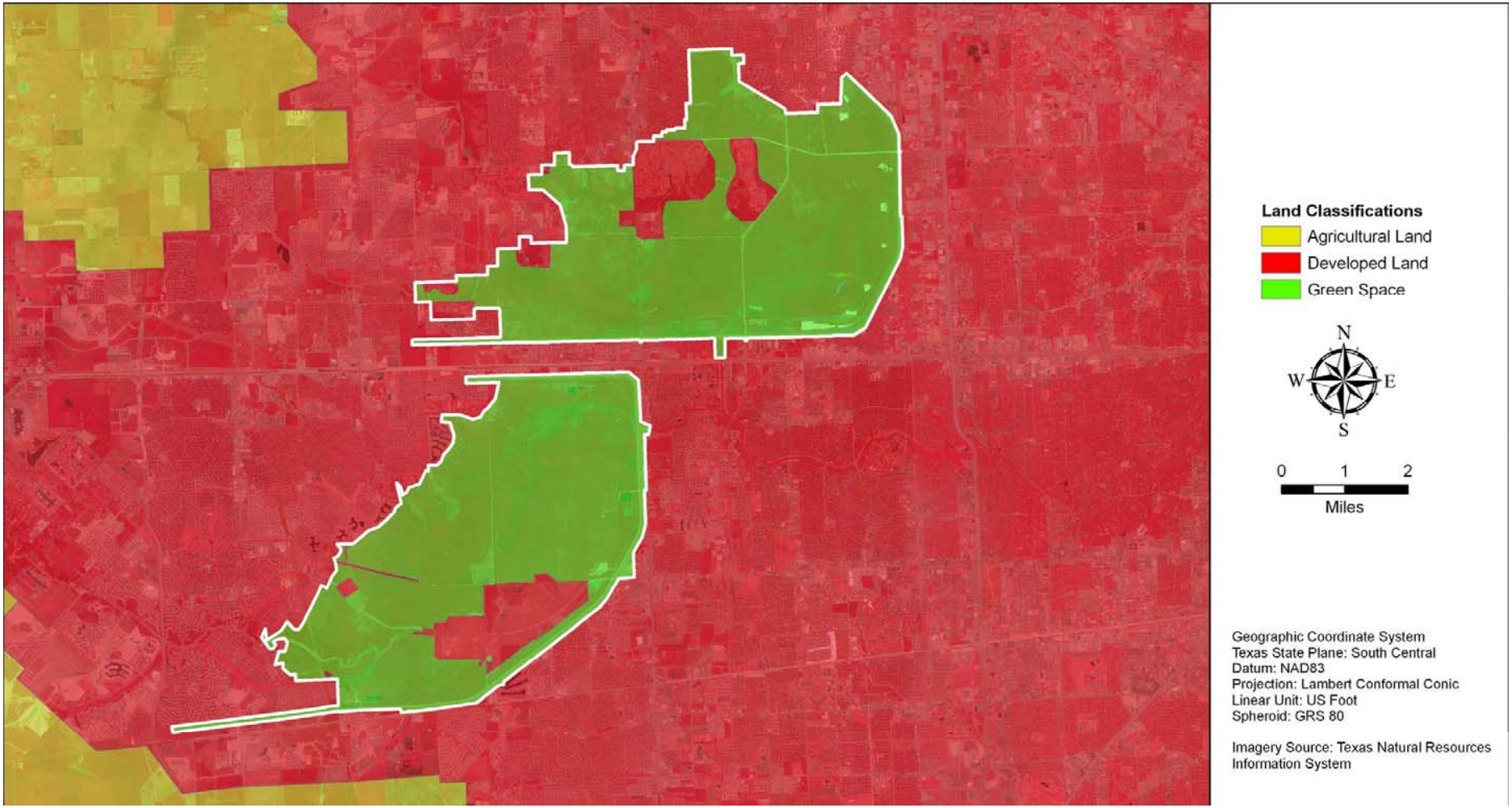

Figure 4-13. Land Use Surrounding the Addicks and Barker Reservoirs (NLCD, 2001)

SECTION 5. FACTORS INFLUENCING AND CONSTRAINING DEVELOPMENT AND MANAGEMENT OF NATURAL RESOURCES

5.01 GENERAL

The Natural Resources Management Mission of the USACE is to manage and conserve the reservoirs' natural resources consistent with the authorized purpose of flood risk management and the Corps' ecosystem management principles while providing quality public outdoor recreation experiences to serve the needs of present and future generations. The Corps integrates the management of diverse natural resource components such as fish, wildlife, forest, wetlands, grasslands, soils, air and water with the provision of public recreation opportunities.

The management of natural resources at Addicks and Barker Reservoirs is influenced by both physical and social factors. Several factors, such as the geology, archeology, history, ecology, environmental and scenic qualities, as well as existing recreational development were introduced and discussed in Section 4. The purpose of this section is to examine factors having the potential to influence natural resource management and operational activities.

5.02 ENVIRONMENTAL AND ECOLOGICAL CONCERNS

Preserving and restoring the remaining coastal prairies and forests/woodlands of the Gulf Coast Prairie and Marshes ecoregion is of primary concern as these ecosystems have been identified by state and Federal agencies as imperiled and declining resources. TPWD lists the ecoregion as Tier I – High Priority for conservation efforts and states that it is among the most threatened of the ten ecoregions of Texas with continued high growth and increasing fragmentation projected for the region.

Management decisions within the reservoirs consider the preservation, protection, and restoration of natural resources. The approval of any actions or operations and maintenance plans will include an assessment of the action's effects on forests, prairie, and rare, threatened, and endangered species and cultural resources within the reservoirs. The approval process may require the relocation or rerouting of a proposed project and/or adoption of other potential recommendations.

Prior to approval of proposed operation and maintenance plans, expansion of existing facilities and infrastructure, or development of new facilities in the reservoirs, the amount and type of impacts to natural resources shall be assessed. Surveys to determine the presence or absence of special status species and habitats shall be conducted prior to approval of any proposed action with said determination potentially necessitating the redesign or relocation of the proposed action. If endangered or threatened species are confirmed on project lands, the USACE, FWS, and TPWD will be notified. Where appropriate, and in accordance with ER 1130-2-540, Environmental Stewardship Operations and Maintenance Policies, recovery plans will be developed and incorporated for protection of those species. Although the only known federally-listed species within Addicks and Barker Reservoirs is the Texas prairie dawn-flower, several state-listed

species could also potentially occur. Surveys for the prairie dawn-flower and its habitat are required prior to any proposed activities within the reservoir to avoid activities that would adversely impact this species or its habitat. Surveys for *Hymenoxys texana* are conducted during the March-April flowering period as the plants are absent during most of the year and are difficult to locate without their flowers. Surveys should also include appropriate state-listed species and other rare and endemic species.

5.03 CULTURAL RESOURCES

Several significant cultural resources have been identified within the boundaries of the Addicks and Barker Reservoirs. In managing these irreplaceable resources, four special considerations have been identified and must be taken into account. The considerations are: Intermittent Flooding; Erosion; Vandalism; and Looting.

While the Addicks and Barker Reservoirs are generally dry, they were designed and built to hold flood waters which results in intermittent flooding. The repeated inundation of archeological sites can have a detrimental affect on artifacts. The process of decay is increased through repeated soaking and drying of several artifact classes.

Erosion is a common problem for cultural resources located along streams and in flood plains. Many of the cultural resources located in the Addicks and Barker Reservoirs are located in these areas and are subject to erosion.

Vandalism occurs when a cultural resource is damaged by human activity, either deliberate or unintentional. Acts of vandalism can include, but are not limited to: the unintentional removal of artifacts from cultural resources, the deliberate or unintentional destruction of a cultural resource, or the deliberate or unintentional defacing of a cultural resource. Past acts of vandalism have been reported on the Addicks and Barker Reservoirs.

Looting is the deliberate act of removing artifacts from a cultural resource. Looting can occur for many reasons; however, it always results in damaging or destroying resources. There is a long history of looting in the United States and the cultural resources located in the Addicks and Barker Reservoirs have not escaped this “activity”.

The Historic Properties Management Plan under development by the Galveston District will provide a discussion of these four special considerations and identify management practices that will aid in protecting and preserving the significant cultural resources located on the Addicks and Barker Reservoirs.

5.04 TOPOGRAPHY, HYDROLOGY, AND SOILS

As part of the Gulf Coast Prairies and Marshes, the project area is relatively flat and devoid of topographic features with moderate to slow surface drainage. The alluvial soils in the region are dense and poorly drained, and excess rainfall tends to run off or pond rather than percolate down through the soil. Soils and topography should be considered during design of proposed projects and management activities. As the reservoirs exhibit very little relief, microtopographic features (pimple mounds, gilgai, prairie potholes) play

and important role in ecologic diversity. Many of these features were leveled as a result of agricultural practices, especially in Barker Reservoir, making the planning and placement of projects and management activities a concern when developing resource management plans.

5.05 FLOODING

The geography of the area, urban development, increases in the amount of impervious land cover, and high average annual rainfall combine to make the region prone to damaging floods. The cumulative effect of excessive rainfall events can contribute to rapid rates of erosion within Buffalo Bayou (TC&B, 2002) and other waterways within the project area. This is exacerbated by continued development in the Buffalo Bayou watershed and may encourage erosion and deposition of the soils.

As upstream development increases, storm waters reach the reservoirs at an increased volume and more rapid rate. Downstream development has restricted reservoir releases into Buffalo Bayou. These two factors have increased detention and water levels, which can in turn adversely affect access, recreation, and traffic thoroughfares within the reservoirs. Areas within the reservoirs are vulnerable to flooding at variable flood frequencies, as depicted in Figures 5-1 and 5-2.

The maximum pool elevation for both reservoirs extends beyond each Project boundary and as such, there is the potential for streets and possibly homes in the surrounding developed areas to be flooded. Before reaching these homes, flood waters would back up the storm drain system spilling out onto streets filling roads in subdivisions upstream of the reservoirs. This would potentially isolate homes and entire subdivisions in areas behind both Addicks and Barker reservoirs.

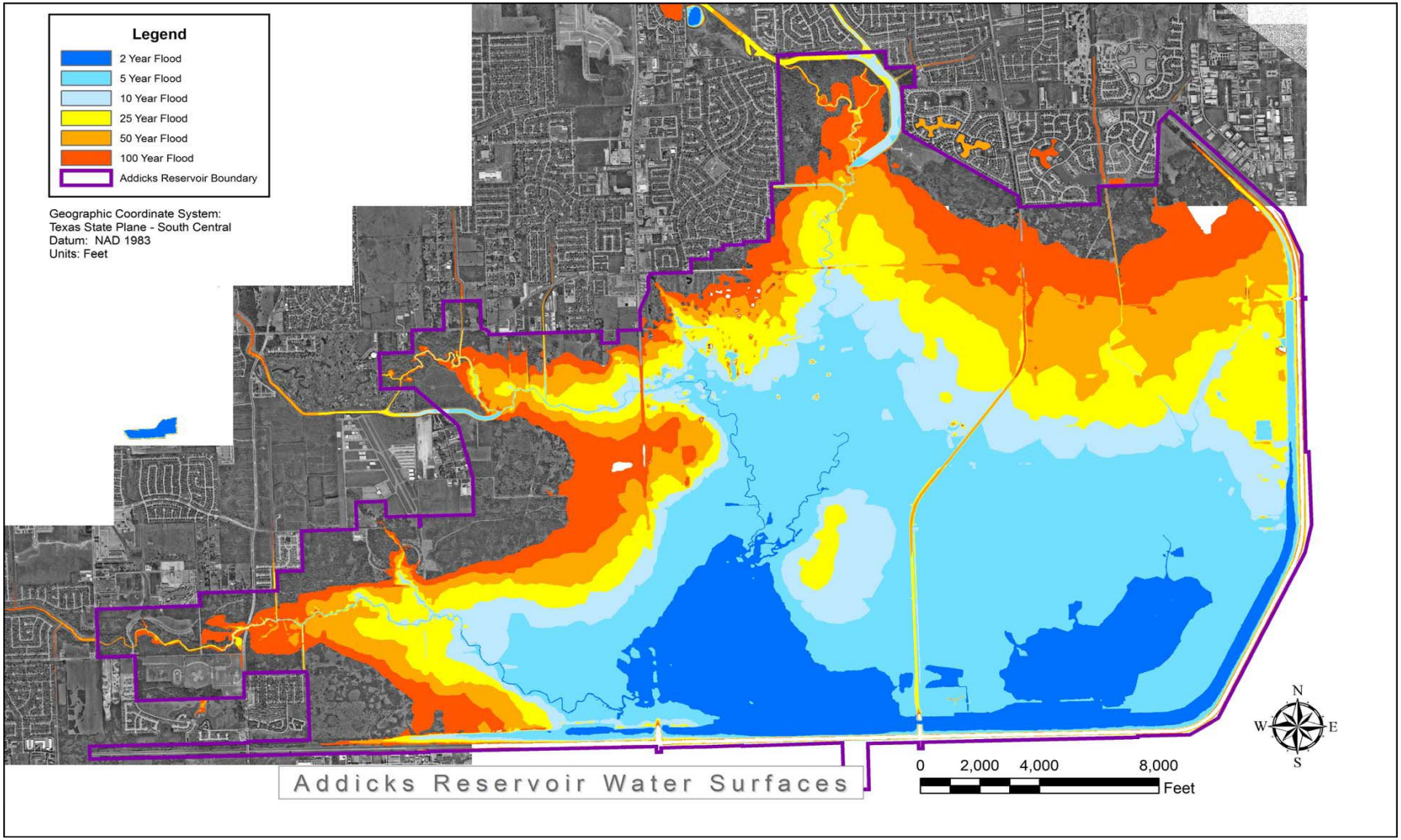

Figure 5-1. Addicks Reservoir Flood Frequencies

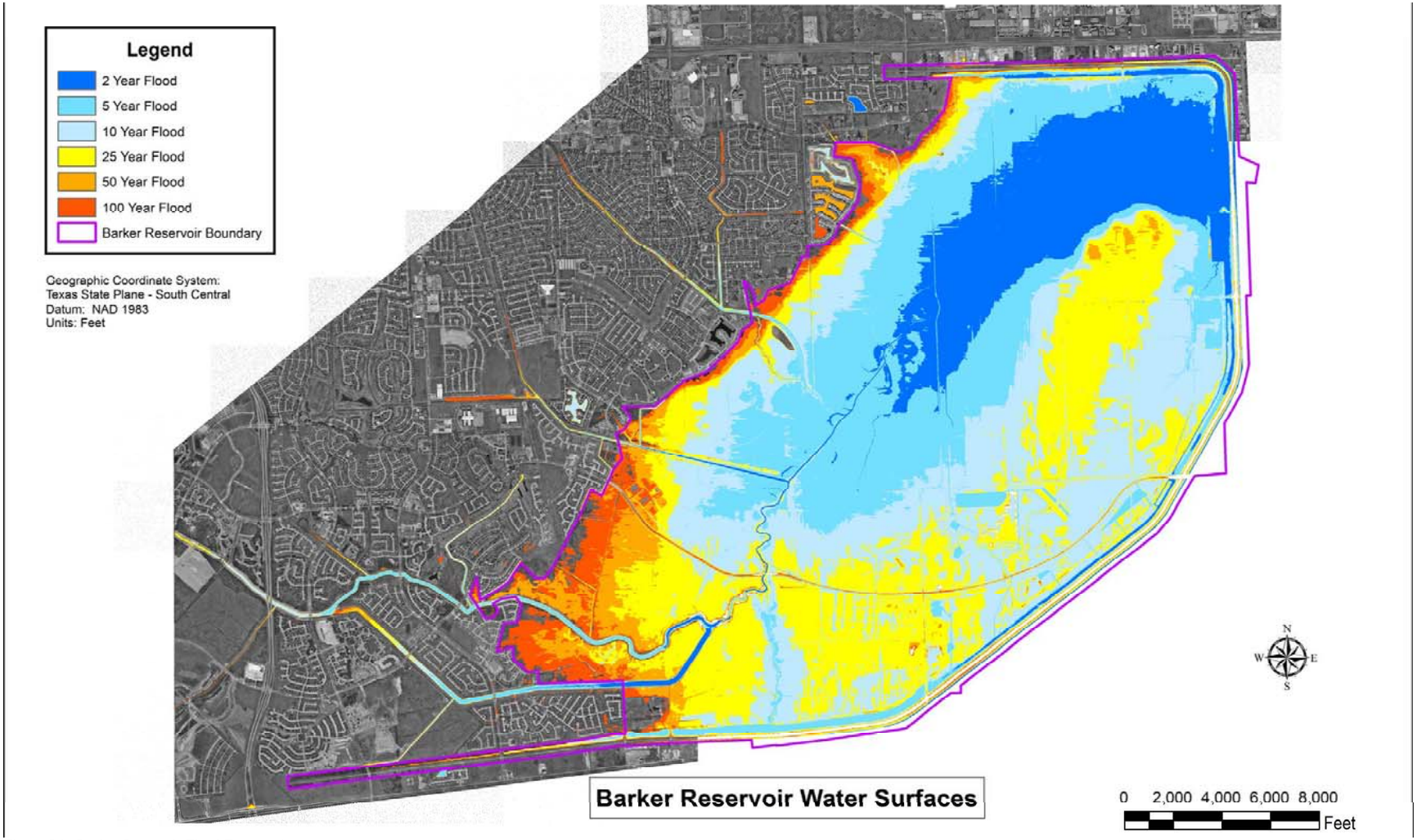

Figure 5-2. Barker Reservoir Flood Frequencies

5.06 ACCESSIBILITY

Accessibility has a major impact on management decision making. Roads are the primary means of access to the reservoirs, and their development, management and maintenance have a major role in promoting recreational use, ensuring public safety, and limiting natural resource degradation.

Addicks and Barker Reservoirs can be accessed through the use of many roadways, which include Interstate Highway 10 and State Highway 6. There are also a variety of secondary, county and access roads that allow entry to the Addicks and Barker Reservoirs. All roadways located within the reservoirs are subject to inundation (see Figure 5-2).

A. Major Highways

Both Addicks and Barker Reservoirs are served by a well developed network of Federal, State and county highways. The major transportation route to the area is Interstate Highway 10, which separates the two reservoirs. State Highway 6 crosses through Addicks Reservoir in a north-south direction.

B. Secondary Roads

1) Addicks Reservoir - Addicks Reservoir can be accessed by a few secondary and county roads. Aside from State Highway 6 mentioned above, North Eldridge Parkway is another primary north-south road providing access to the reservoir. Primary east-west roads within the reservoir include Clay Road, Patterson Road, Groeschke Road, and Saums Road. In addition, there are numerous minor roads the provide access within the developed parks.

2) Barker Reservoir - Westheimer Parkway is the primary east-west route through Barker Reservoir which, outside the reservoir, connects to Highway 6 on the east and Highway 99 on the west. Westheimer Parkway is used both for traffic through the reservoirs, as well as accessing the developed recreation facilities within the reservoir. South Barker-Cypress Road, another road of importance in Barker runs north-south providing access into the reservoir from the south connecting Alief Clodine Road outside the reservoir to Westheimer Parkway in George Bush Park. South Barker-Cypress Road continues all the way through Barker Reservoir; however the road is restricted to non-vehicular traffic between the northern project boundary and the equestrian trail parking area behind the shooting range in Barker Reservoir.

Figure 5-3. Addicks and Barker Road Network

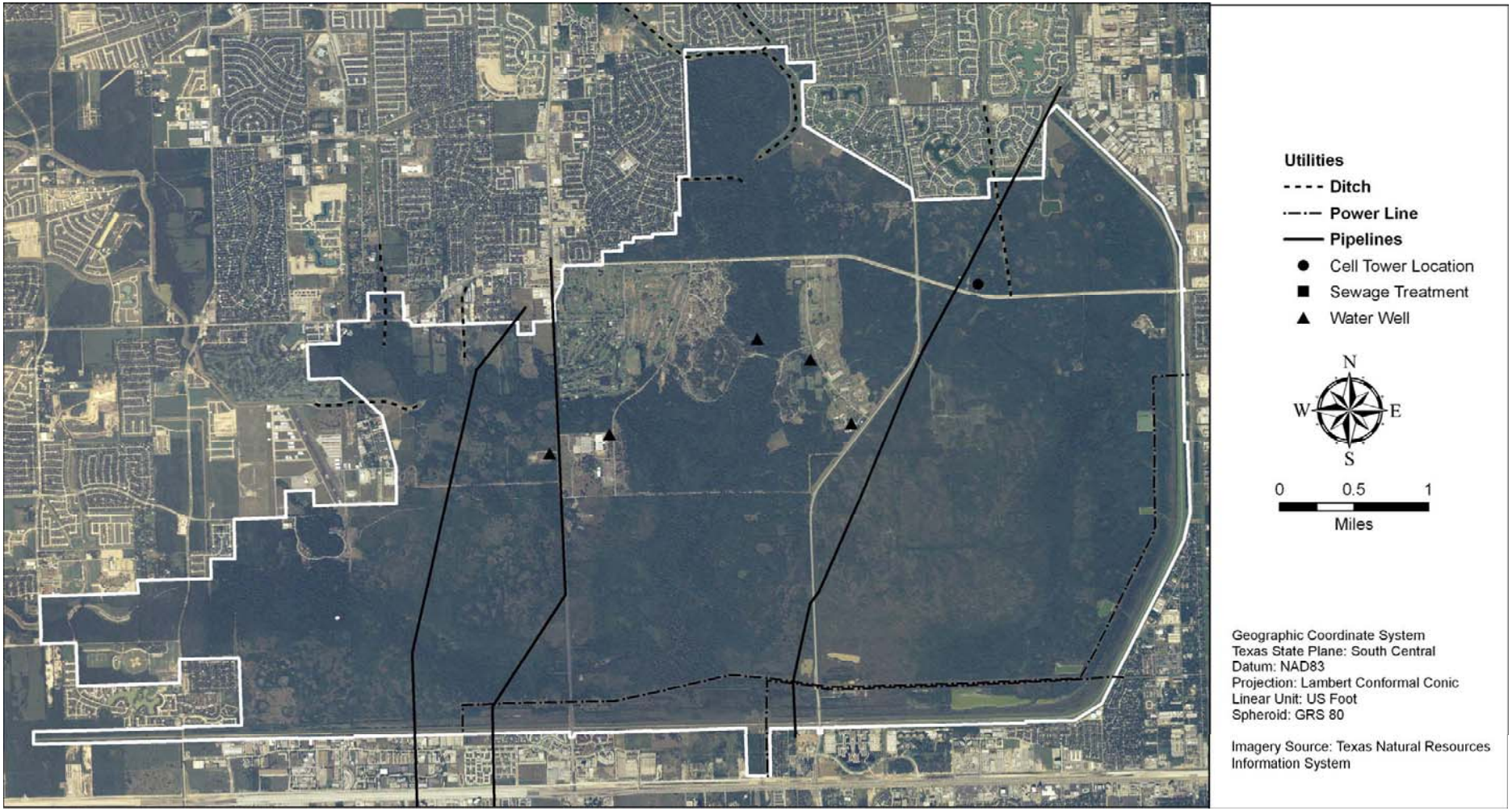

Figure 5-4. Utilities infrastructure – Addicks Reservoir

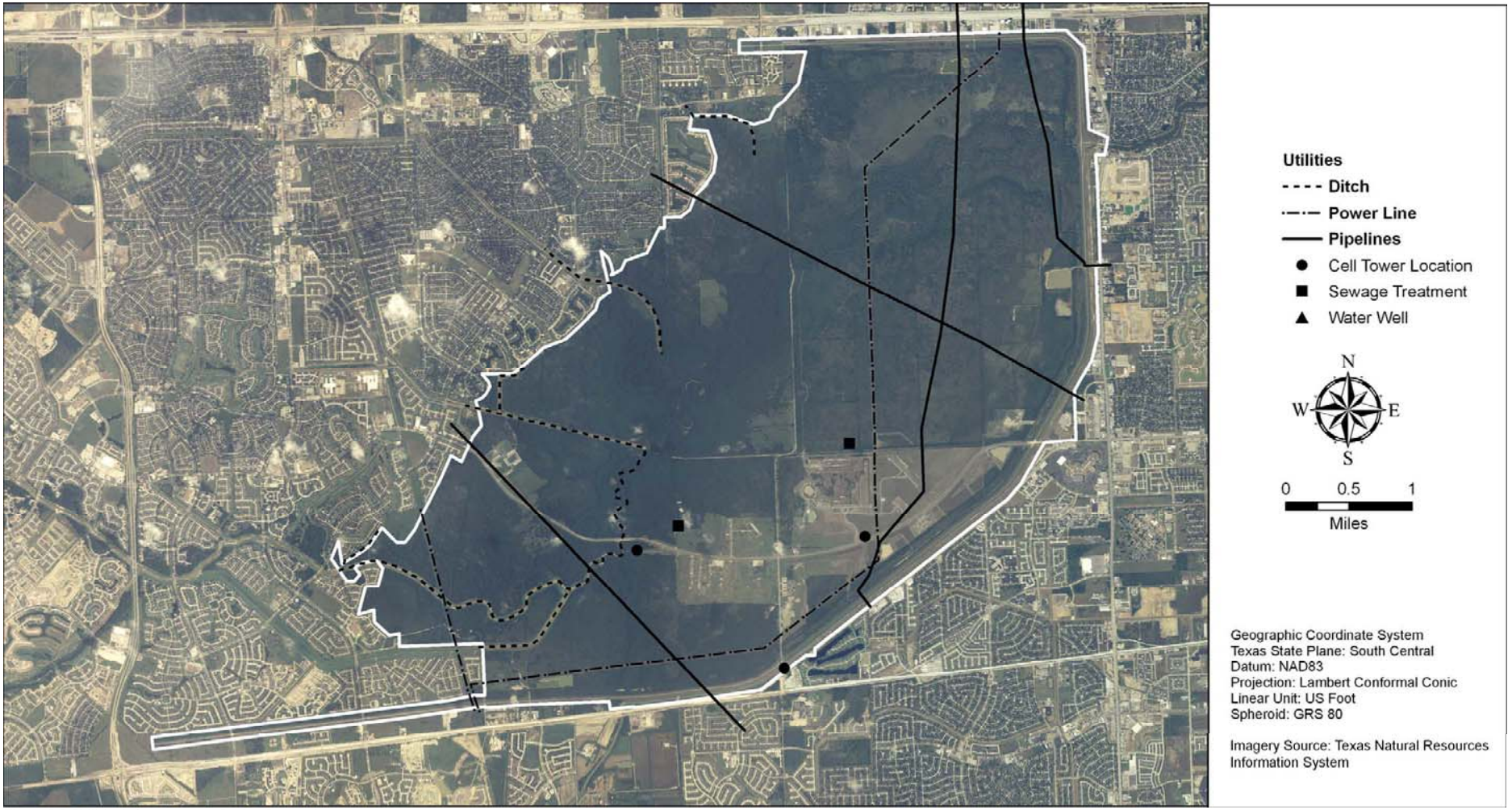

Figure 5-5. Utilities infrastructure – Barker Reservoir

C. Road access/closures during flood events

All roads within the Addicks and Barker Reservoirs are subject to inundation depending on the level of flooding and operating procedures. As the reservoirs fill, flooding typically affects secondary roads first and then the major roads such as State Highway 6. All roads within the reservoirs are owned and operated by various groups such as Texas Department of Transportation, Counties, or others. Public safety associated with these roads is the responsibility of the owner and operator of the road not the USACE. The USACE shares water level information with the various road managers, however, the USACE has no authority or any responsibility toward road closures during such events or managing upkeep after such events.

According to the USACE Emergency Action Plan for the Reservoirs (USACE, 2005), Patterson Road is impacted at three percent capacity (elevation 90.68 feet), where as Bear Creek Drive (within Bear Creek Pioneers Park) is impacted at five percent (elevation 91.93 feet). The low point of State Highway 6 is impacted at 23 percent capacity (elevation 99.1 feet) and the low point on Eldridge Parkway (and the high point on State Highway 6) is impacted at 25 percent (elevation 99.5 feet) capacity. In Barker Reservoir, the low point on South Barker-Cypress Road is impacted when the reservoir is at one percent capacity (elevation 85.0 feet), which is within the two year flood frequency (three percent capacity), while the low point on Westheimer Parkway is impacted at 31 percent capacity (elevation 95.7 feet).

5.07 INFRASTRUCTURE – OUTGRANTS AND FACILITIES

Pipelines, electrical utility lines (both major and minor), phone lines, cell towers, relay stations, roadways (both major and minor), waterlines, and pipeline related stations (e.g., meter stations, valve stations) are located throughout both Addicks and Barker Reservoirs (Figure 5-4). The larger electrical transmission lines and associated vegetative clearing are visible from aerial photographs while most of the pipelines are subsurface. Proposals for future infrastructure projects are to follow existing infrastructure corridors. All utility infrastructure is managed through consents, easements, leases, licenses, or permits, summarized in Table 5-8. A detailed discussion of park leases and third-party concessions can be found in Section 6 – Coordination and Partnerships.

5.08 BOUNDARY MONUMENTATION

The last boundary surveys encompassing the entire reservoir sites were completed between 1942 and 1945. Increased development of the lands around Addicks and Barker Reservoirs has been a significant problem in completion and maintenance of boundary monumentation. Boundary monumentation is necessary to maintain clear limits to keep increasing encroachment and pressures from adjacent neighborhoods at bay. As development pressures continue around the boarders of the reservoirs, property owners expand their property maintenance activities which can encroach into the project area, potentially compromising project purposes. Examples of such encroachment can include, expanding yards, disposing of yard wastes, animal grazing, storage, and/or training. An updated boundary survey is planned, pending funding, to enforce established government

boundary lines and to prevent encroachments. This effort is separate from the signage that exists at all recognized access points into the reservoirs.

Table 5-1. Outgrants Summary

Type	Number		Total	Comments
	Addicks	Barker		
Communication Outgrant	13	6	29	Phone lines, cell towers, relay stations, etc.
Electrical, distribution, Major	4	3	7	Major distribution lines crossing the projects
Electrical distribution, minor	1	5	6	Minor service lines to facilities within the project
Grazing leases	19	5	24	
Pipeline easements and consents	6	7	13	Pipelines range in size from 6” to 40” and carry a variety of products.
Pipeline related facilities	1	4	5	Meter stations, valve stations, pig stations, etc.
Recreational leases	4	4	8	Four major parks and 3 minor outgrants
Roadway easements, major	7	10	17	Public roadway over the dams or through the reservoirs
Roadway easements, minor	4	4	8	Minor roadways and support facilities including driveways, traffic lights, curving, straight, etc.
Sanitary Control outgrants	1	7	8	Sanitary control easements around water wells and waste water discharge pipes.
Stormwater drainage, major	7	14	21	Major drainage ditches discharging water into the reservoirs with ROW widths of up to 310’ wide
Stormwater drainage, minor	12	32	44	Stormwater discharge pipes primarily located along Barker Ditch and ditch ROWs of less than 50’ in width.
Waterline easements	3	2	5	Waterlines
Misc. Real Estate	5	9	14	Gas well, military training areas, water well, monitoring well, etc.

5.09 RESERVOIR PLAN OF OPERATION

Basic operational concepts and plan of operation for Addicks and Barker Reservoirs are explained in Sections 2.02 - 2.03. The reservoirs are regulated by the USACE Hydrology Manual, dated 1977 and Reservoir Regulation Manual, dated 1962. Updates to the Reservoir Regulation Manual are currently in progress.

5.10 DEMOGRAPHICS

A. Population

The following discussion highlights the present and potential future pressures placed on remaining natural habitats and open green spaces within the region as well as the need for park resource and community planning. The Texas State Data Center and Population Estimates and Projections Programs (TDC/OSD) at the University of Texas at San Antonio (2006) predicts the Houston-Sugar Land-Baytown Metropolitan Statistical Area (MSA) population will increase from 4.7 million residents in 2000 to somewhere between 8.4 and 11.1 million by 2040 depending on the growth scenario. This future population will be much larger, older, and more diverse. The State Data Center estimates that the percentage of Anglos in the Houston-Sugar Land-Baytown MSA will decrease from 49 percent in 2000 to 30 percent by 2030, while the percentage of Hispanics will increase from 29 percent in 2000 to 47 percent in 2030 (TDC/OSD 2007). The TDC/OSD also predicts that the overall age of the population will increase from a median age of 32 to 37.6 years between 2000 and 2030.

Table 5-2. Population Data for Fort Bend and Harris Counties, 1940-2030[1]

Year	Fort Bend	Harris
1940	32,963	528,961
1950	31,056	806,701
1960	40,527	1,243,158
1970	52,314	1,741,912
1980	130,846	2,409,547
1990	225,421	2,818,199
2000	354,452	3,400,578
2006	493,187	3,886,207
2010	452,097	3,946,353
2020	563,873	4,530,220
2030	682,296	5,160,953

1. Sources: USCB 2007a (a and b); TWDB, 2006; TDHS, 2005; FBC, 200X; TSDC, 2006

Similar to the Houston-Sugar Land-Baytown MSA, TDC/OSD estimates strong population growth for Harris and Fort Bend Counties through 2030 (TDC/OSD 2007). Population data for Fort Bend and Harris Counties is shown in Table 5-1. The population of Fort Bend County declined six percent between 1940 and 1950. Following that period, the population increased, and by 2006 the population had risen by over 1,000 percent. By 2030 the population is expected to rise an additional 38 percent over 2006 levels. Harris County has experienced consistent growth since 1940 from just over half a million people to almost 3.9 million residents in 2006. The population of Harris County is expected to grow by an additional 33 percent by 2030.

B. Zone of Influence

As stated in Section 2.01, most of the Project is situated in Harris County and a small portion of the Barker Reservoir is within Fort Bend County. Other counties with portions of their boundaries inside this Zone of Influence include Austin, Brazoria, Fort Bend, Harris, Montgomery, and Waller. Approximately 3.5 million people lived within the 25-mile radius of the two reservoirs in 2004. Table 5-2 presents the breakdown of the population by County. The Zone of Influence includes most of Harris and Fort Bend counties and their population while also including a small percentage of Austin, Brazoria, Montgomery, and Waller (Figure 5-1).

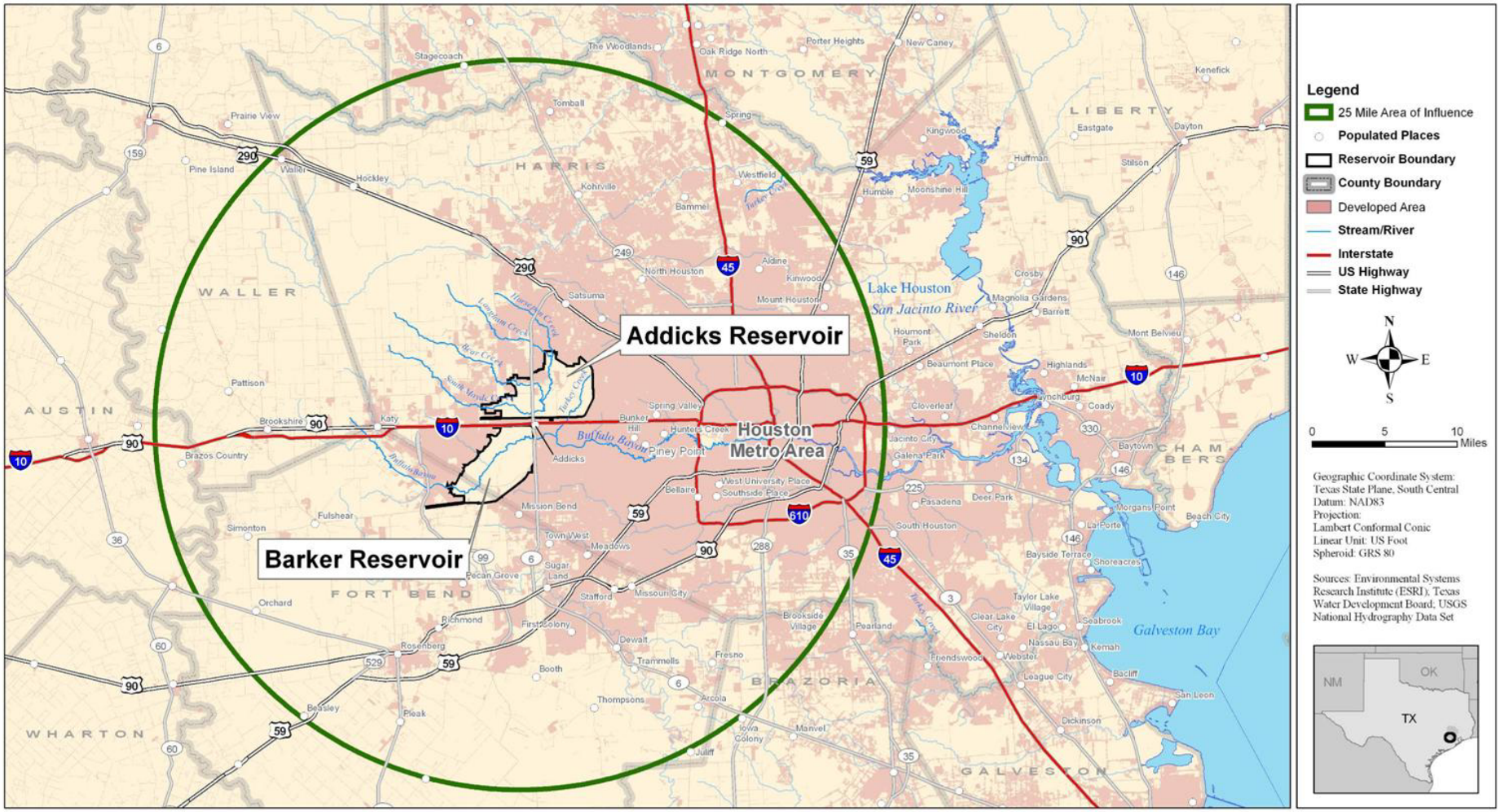

Figure 5-6. Addicks and Barker Reservoirs 25-Mile Zone of Influence.

Table 5-3. 2006 County Population Information			
County	**County Population Estimate[1]**	**Population In Zone of Influence Estimate**	**Percent of Population**
Austin	26,407	2,009	8%
Brazoria	287,898	36,987	13%
Fort Bend	493,187	477,509	97%
Harris	3,886,207	2,931,407	75%
Montgomery	398,290	14,854	4%
Waller	35,185	13,249	38%
Total	5,127,174	3,468,167	68%
1. Source: USCB, 2007a (a-f)			

C. Age Distribution

The U.S. Census Bureau maintains information on age classes based on model estimates from the decennial population census. Table 5-4 shows the U.S. Census estimates for 2006 for the counties identified with portions within the Zone of Influence. Harris County population is slightly younger than the state with higher percentages in the under 5 and under 18 age classes and a lower percentage in the over 65 age class. In comparison, Fort Bend County has a noticeably smaller percentage of the population under 5 and over 65 years old compared to Harris County and the state average. Age classes in Austin, Brazoria, Montgomery, and Waller should be discounted compared to Harris and Fort Bend counties considering the small percentage of the populations of these counties within the Zone of Influence.

Table 5-4. Age Distribution (2006)							
Age Class	**Austin**	**Brazoria**	**Fort Bend**	**Harris**	**Montgomery**	**Waller**	**Texas**
Less than 5	6.5	7.8	6.6	8.8	7.0	7.2	8.2
Less than 18	24.8	27.5	27.6	28.9	27.0	24.9	27.7
More than 65	50.3	8.9	6.2	7.7	8.9	9.6	9.9
Source: USCB 2007a (a-f)							

D. Housing

The US Census reports (2007 a-f) that there are more than 1.1 million owner occupied dwellings within the counties that make up the zone of influence. Generally, the trend in residential building permits (new, privately owned units) issued by the counties within the zone of influence has been stable and positive since 2000 (Table 5-4). Because the Zone of Influence centers on Harris and Fort Bend counties, housing in these counties will have a stronger influence on demand around the reservoirs than the small portions of the counties rounding out the Zone of Influence. Based on recent building permit trends, demand for private residential housing should remain strong in the near future and, when combined with population predictions, building permits and residential growth in Harris and Fort Bend counties can be expected to continue into 2030. Examination of historic

land use cover maps shows a trend of growth and development extending in all directions from Houston center with rapid development occurring to the west along Interstate 10 corridor in the vicinity of the reservoirs.

Table 5-5. Building Permits issued by County (2000 to 2006)

County	2000	2001	2002	2003	2004	2005	2006
Austin	114	38	51	45	28	44	49
Brazoria	2,085	2,405	3,081	3,191	4,367	3,589	4,688
Fort Bend	1,313	1,348	1,130	1,950	4,152	8,796	4,097
Harris	24,565	26,419	34,339	40,983	36,395	41,506	46,455
Montgomery	4,197	4,117	5,033	6,313	6,977	8,885	7,441
Waller	287	188	214	206	213	245	219

Source: USCB 2007b (a-f)

E. Medical Facilities

Medical facilities are abundant throughout Harris County, Fort Bend County, and especially in metro Houston. Within 25 miles of Addicks and Barker Reservoirs there are more than 2,100 various types of medical centers, hospitals, emergency care facilities, clinics, wellness centers, community clinics, shelters, and other related health care related facilities that provide diagnostic, medical, and surgical opportunities. The closest full care emergency room is the West Houston Medical Center.

The following are some of the largest medical centers within the Zone of Influence:

- Ben Taub General Hospital
- Bayou Medical Center
- Cypress Fairbanks Hospital
- Houston North West Medical Center
- IntraCare Medical Center
- Methodist Willowbrook Hospital
- Park Plaza Hospital
- Saint Luke's Minor Emergency Center
- Texas Childrens Hospital
- Memorial Herman Hospital System (6 Hospitals: Memorial Herman Katy, Surgarland, Memorial City, Southwest, Texas Medical Center, and Northwest)

F. Income and Employment

All of the Counties in the Zone of Influence have median household income higher than the rest of the state save for Waller County. Table 5-6 details the median household income by county estimated by the U.S. Census Bureau. The median income of Fort Bend County is noticeably higher than the rest of the state while that of Harris County is relatively equal to that of the rest of the state.

Table 5-6. Per Capita Income by County, in 2004 Dollars	
Austin County	$42,898
Brazoria County	$52,483
Fort Bend County	$65,488
Harris County	$41,922
Montgomery County	$55,452
Waller County	$40,480
State of Texas	$41,645
Source: USCB2007a (a-f) Note: Final release date for these estimates December 2006.	

The educational, health, and social service industries provide the most (15.6 percent) jobs in Austin, Brazoria, Fort Bend, Harris, Montgomery, and Waller Counties. Table 5-7 summarizes employment numbers by industry and county as calculated by the U.S. Census Bureau using 2000 data, the most complete information available for this metric.

G. Demographic Constraints on Resource Development and Management

As indicated in the preceding demographics summary, the population within the Zone of Influence is expected to increase by 32 percent by the year 2030. This population increase will likely be accompanied by continuing residential and commercial development, which will further decrease the amount of open space found within the greater Houston metropolitan area. As testament to this likely change, a study on Houston's regional forest areas found that from 1992 to 2000 built urban areas increased by 55 percent, while forested areas declined by over 17 percent (Forest Service, 2005). This ongoing transition will have a significant effect on the ability for the citizens of this area to connect with their natural environment.

Currently, there are approximately 17,500 acres of open space managed by local county and state agencies for public access and recreation in the area. Each county and state agency operates under a different management mission, and in general, they do not offer the same experience on the same scale as provided by the lands available for outdoor recreation at Addicks and Barker Reservoirs.

In order to both respond to the recreational demands of a rapidly growing population and ensure that future generations have the ability to connect with the open space natural environment of the Project Area, it is necessary to promote recreational infrastructure that allows for, and focuses on, the connection of humans with their natural environment. Unmanaged expansion of areas for outdoor recreation requiring intensive infrastructure (playing fields and accompanying access roads/parking lots) would likely have the opposite effect and limit the ability of future generations to readily connect with their natural environment in an otherwise urbanized area. Examples of infrastructure that would promote a connection between humans and their environment would include low impact recreational uses such as hiking trails, nature centers, and wildlife viewing areas.

Development focused on these passive outdoor recreational activities would ensure an opportunity for future generations to connect with their environment, be consistent with the USACE natural resource stewardship mission, and easily integrate into the overall flood risk management function of the reservoirs.

Table 5-7. Percent of Employed Persons (16 or over) by Industry and County (based on 2000 survey)

Industry	Austin	Brazoria	Fort Bend	Harris	Montgo-mery	Waller
Agriculture, forestry, fishing and hunting, and mining	7.1	7.1	3.9	2.2	3.5	5.7
Construction	8.6	8.6	6.6	8.7	10.1	11.4
Manufacturing	15.2	15.2	10.6	11.8	11.5	12.6
Wholesale trade	4.3	4.3	4.7	4.9	4.7	3
Retail trade	14.1	14.1	11.5	11	12.9	12.6
Transportation and warehousing, and utilities	6.5	6.5	5.6	6.8	7.9	5.8
Information	1.9	1.9	2.9	2.3	2.3	1.4
Finance, insurance, real estate, and rental and leasing	5.8	5.8	7.6	7	6.1	4.8
Professional, scientific, management, administrative, and waste management services	5	5	12.4	12.5	10.7	6.1
Educational, health and social services	19.3	19.3	20.8	17	15.6	21
Arts, entertainment, recreation, accommodation and food services	4.1	4.1	5.4	7.2	5.9	6.3
Other services (except public administration)	4.3	4.3	4.4	5.5	5.2	4.8
Public administration	3.7	3.7	3.7	2.9	3.6	4.6
Source: USCB 2007a (a-f)						

5.11PROJECTED USER DEMAND

As the gulf coast of Texas continues to experience strong growth, the demand for outdoor recreation increases. At the same time, conversion of open space to residential development reduces the amount of open space available. Increased demand for recreational facilities combined with a decreased availability of open space for recreation puts stress on the natural environment and associated natural resource conservation efforts.

In February 2000, TPWD, in coordination with Texas Tech University, conducted a study looking at conservation and outdoor recreation issues in Texas that could be used in the state's future planning efforts. As part of this study, a survey of Texas residents was conducted asking their opinion of the importance of natural areas in Texas to enjoy and experience nature to which the vast majority of those polled (79 percent) stated that it was very important (TPWD, 2005). After reviewing the data accumulated by researchers and the solutions and strategies called for by experts, the authors of the Texas Tech study compiled a list of key conservation and recreation recommendations for Texas. One of

their recommendations emphasized the need for access to natural areas for outdoor recreation. Harris County (2000) reported that based on county resident survey responses, visitors are attracted by a park location and the presence of nature trails (17%). In Precinct 3 (the precinct that includes Addicks and Barker Reservoirs), the most frequently used park features are running tracks/nature trails followed by children's play areas and picnic areas (Harris County 2000).

Both short-term and long-term trends point to continued growth in outdoor recreation across all segments of the population with growth particularly strong in both viewing and learning activities. Participation in outdoor, land based recreation in Harris and Fort Bend Counties totaled over 89 participants per square mile, which is in the top 25 percent for counties in the nation (Cordell 1999). Nationally, participation in non-consumptive wildlife activities is expected to increase 61 percent through 2040 and should increase more rapidly than the population. The largest relative increase is expected to come in the southern region, including Texas (Cordell, 1999). In addition to non-consumptive wildlife viewing, biking, horseback riding, and picnicking participation rates will experience the greatest increase throughout the southern US, outpacing population growth. In anticipation of the growing demand, Harris County Precinct 3 administrators listed trails (natural and hardened surface) as the number one priority for new facilities in Precinct 3 (Harris County 2003).

Along with the increased demand for access to natural areas, demand for recreation associated with developed recreational areas such as multi-sport athletic fields (baseball, little league, soccer, etc.) has also increased. The demand for these recreational facilities is not typically captured in national or state recreation surveys, since the level of demand is usually dependent on the membership drives of sports leagues using the facilities and the management and maintenance of the facilities is usually the responsibility of local governments. Harris County, Precinct 3 (2003) lists Trails, Playgrounds, Soccer fields, and Ball fields as the top 4 priorities for new parks within the Precinct. Eleven municipalities within Harris County have developed their own park master plans, and hike/bike trails were cited in the top two responses of every user survey asking for new amenities (Harris County 2003).

Another metric of measuring demand can be found in Harris County's ability to provide park space for the population. The Harris County Parks Master Plan (Phase Two) recognizes an existing shortage of park space to satisfy the population (Harris County 2003). Harris County (2003) reports that based on year 2000 population data for the Houston-Galveston Area Council, there are about 15 acres of park land for every 1,000 people, which is below the County objective to maintain 20 acres for every 1,000 people and well below the Urban Land Institute standard of 25.5 acres per 1,000 population. This illustrates a local need to acquire large tracts of land to be developed as parks or maintained as open space and/or conservation areas to achieve the County's park acreage goal (Harris County 2003).

5.12 RELATED RECREATIONAL RESOURCES

Within the Zone of Influence (includes portions of Harris, Ft. Bend, Waller, Brazoria, Austin and Montgomery Counties), recreational opportunities exist that are similar to those offered within the reservoirs. A number of these have dedicated ball fields, picnic area complexes, and paved trails. Lands administered by these government agencies are summarized in Table 5-7 and show how many acres each entity manages within and outside the Addicks and Barker Reservoirs. The City of Houston operates over 307 parks varying from Regional parks to metro (including Cullen Park), community parks and natural areas. Harris County manages 39 parks in Precinct 3 while Fort Bend County manages eight parks; not including those park lands within Addicks and Barker Reservoirs. Amenities within these parks ranges from sports complexes with multiple ball fields to picnic pavilions to dedicated tree parks and trail corridor parks, all of which are also present within Addicks and Barker Reservoirs.

Table 5-8. Reservoir Park Acres and Park Acres Outside Reservoir Boundaries Within the Zone of Influence

Addicks and Barker Park Acres	
Entity	**Reservoir Park Acres**
City of Houston	9,270[1]
Precinct 3 (Harris County)	11,085[1]
Fort Bend County	1,980
Total	22,335
Parks Outside of Reservoir Boundaries within the 25-mile radius Zone of Influence	
Entity	**Non-Reservoir Park Acres**
City of Houston[2]	3,595
Precinct 3 (Harris County)[2]	1,374
Fort Bend County[2]	484
Total	5,453

1. Combined 20,355 acres is approximately 41% of Harris County total park acres of 49,705 (includes reservoir parks)
2. Sources: City of Houston 2007, Harris County 2003; Fort Bend, 2007

One third of Harris County residents surveyed as part of a county park awareness study (Harris County 2000) indicated location and convenience as reasons to visit a park followed by nature trails. Throughout the Harris County Precincts, children's areas, picnic areas, and nature/jogging trails were the most frequently used facilities (Harris County 2000). This data suggest county residents like to use parks and open spaces in close proximity to their homes. As for usage, 39 percent of survey respondents indicated using one of Harris County parks within the last three months (Harris County 2000). Herman Park and Memorial Park (Houston City Parks) received the highest amount of responses concerning which park was visited most recently, while within Precinct 3, Bear Creek Park received the most responses (Harris County 2000). In 2003 the 9,970 acres of park acres leased in Addicks and Barker Reservoirs leased to Harris County Precinct 3 by the USACE, represented 88% of the total park acres listed for the Precinct 3. The 9,970 acres also represented approximately 20% of the total park acres listed for all of Harris County (Harris County, 2003). Fort Bend County webpage lists a total of 2,460 park acres for the county, of which 1,980 acres (80%) are located in Barker Reservoir (Fort Bend County, 2008).

Outside the Zone of Influence (within a 2-hour drive of the reservoirs), the types of recreation facilities become more diverse and include 9 lakes, 6 state parks, and over 90 miles of Gulf coast shoreline (Figure 5-3). In addition, there are 6 national wildlife refuges within the region. Five of these refuges are adjacent to Galveston Bay or the

Gulf of Mexico protecting inter-coastal habitats. Of the refuges within the region, characteristics of Addicks and Barker Reservoirs are most similar to the Attwater Prairie Chicken National Wildlife Refuge. Attwater Prairie Chicken National Wildlife Refuge (NWR), located approximately 60 miles west of Houston, is 10,582 acres and has one of the largest remnants of coastal prairie habitat remaining in southeast Texas (USFWS, 2007). The refuge offers a visitor center, a 5 mile auto tour, and 2 hiking trails totaling 3.5 miles in length.

5.13 BORROW AREAS

Both reservoirs have several old borrow areas within their boundaries. The borrow areas are generally found along the inside of the dam parallel to the dams length as artifacts of dam construction. These areas are commonly a few feet deep, about 20 to 50 feet wide, and stretch hundreds of feet. Given the precipitation patterns and hydrologic conditions of the reservoirs (see Section 2.02), many of the borrow areas remain filled with water year round providing some level of habitat for migrating birds or opportunistic vegetation. When the borrow areas dry out they become susceptible to colonization of invasive species tolerant of the changing conditions; often out-competing less tolerant native residents.

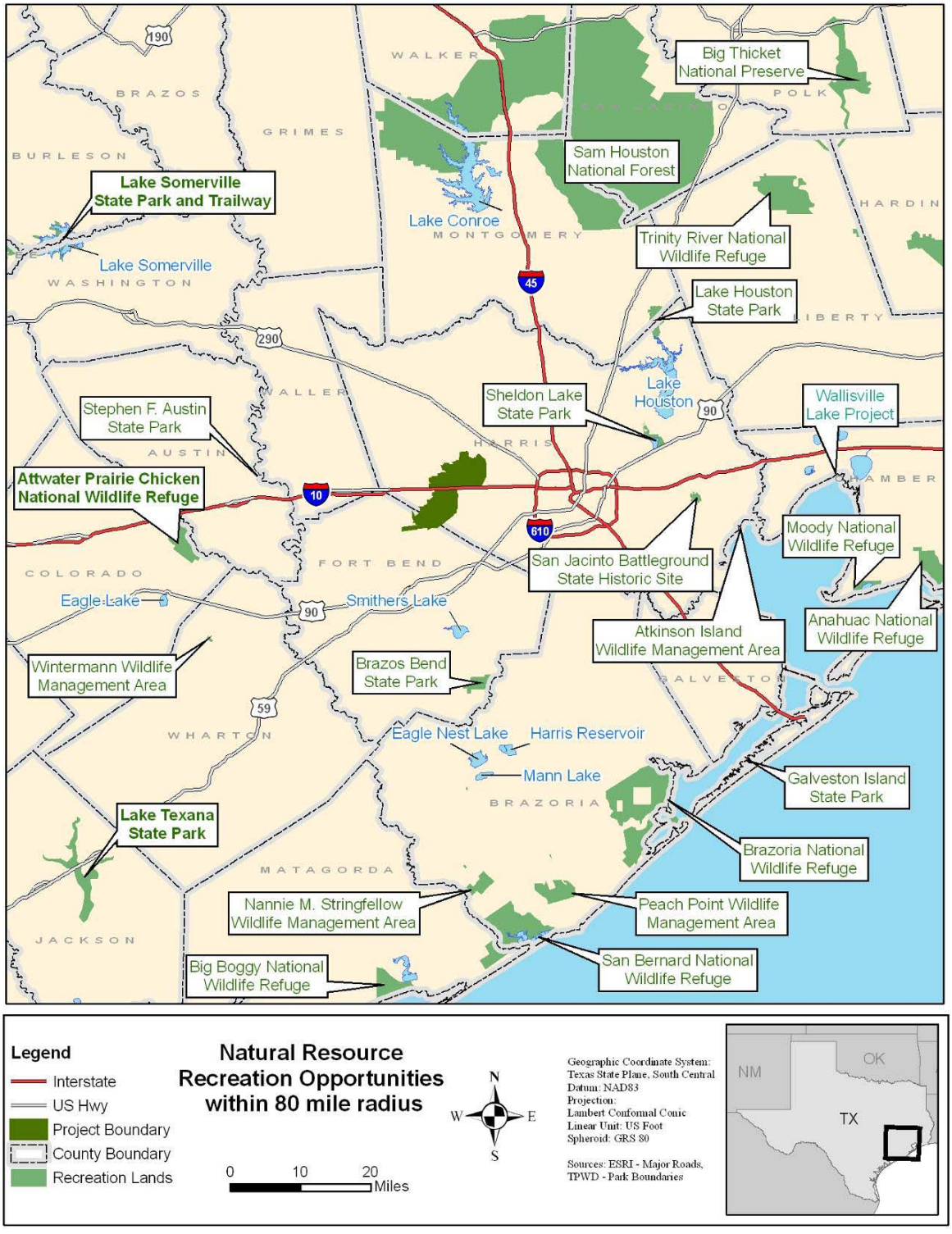

Figure 5-7. Natural Resource Recreational Opportunities within an 80-Mile radius of Addicks and Barker Reservoirs

SECTION 6. COORDINATION AND PARTNERSHIPS

6.01 GENERAL

The USACE has maintained coordination with Federal and State agencies and other organizations since the planning stages of the Buffalo Bayou project and during the development of the original master plan document and subsequent updates. This section identifies these efforts. A brief summary of the coordination and partnering process, both present and historical, is contained in the following paragraphs.

6.02 FEDERAL AGENCIES

A. U.S. Fish and Wildlife Service (USFWS)

This agency is responsible for the operation, maintenance, and removal of a water control structure to impound water for waterfowl habitat in a parcel of land containing approximately 70 acres in Barker Reservoir (Tract BR-54).

The USFWS assists in evaluating endangered/threatened species status on project lands. The USACE will cooperate with this agency to assure optimal habitat management and conservation of natural resources, consistent with the USACE ecosystem management principles. The USACE is developing a partnership with this agency for the restoration of coastal prairie, tall-grass prairie, bottomland hardwoods, and upland forest habitats in the reservoirs.

B. U.S. Geological Survey (USGS)

This agency is responsible for monitoring water wells and maintaining the gauging stations and related equipment at Addicks and Barker Reservoirs.

C. National Weather Service (NWS)

This agency is responsible for operating and maintaining the rain gauge located at the Houston Project Office facility.

D. 90th U.S. Army Reserve Command (90th ARCOM)

A Real Estate Permit, No. DACW64-4-95-4, was initially issued to the U.S. 5th Army for the use of 1,371 acres within Barker Reservoir to operate and maintain a local training area facility (LTA). The Permit was renewed in 1995, by the 90th ARCOM and expires on 31 December 2019. Activity is limited to only “weekend” type training with no “summer camps” permitted. The area will be made available to all branches of the military for training purposes, and other uses such as youth organizations, provided that prior approval is obtained from the Addicks Field Office.

6.03 STATE AGENCIES

A. Texas Parks and Wildlife Department (TPWD)

This agency has coordinated with the USACE in annual surveys for the endangered plant species Hymenoxys texana.

The USACE will cooperate with this agency to assure optimal habitat management and conservation of natural resources, consistent with the USACE ecosystem management principles. The USACE is developing a partnership with this agency for the restoration of coastal prairie, tall-grass prairie, and bottomland hardwoods habitats in the reservoirs.

B. Texas State Historical Preservation Officer

The Texas Historical Commission functions as the Texas State Historic Preservation Officer (SHPO). The SHPO administers the national historic preservation program at the State level, reviews National Register of Historic Places nominations, maintains data on historic properties that have been identified but not yet nominated, and consults with Federal agencies during Section 106 review.

C. Texas A&M University

Under a Memorandum of Understanding, this educational institution maintains a station and associated equipment for the purpose of detecting and studying lightening strikes at the Houston Project Office facility.

D. Texas Department of Transportation

6.04 LOCAL ENTITIES, AGENCIES, and ORGANIZATION

A. The City of Houston

The City of Houston has a Lease for Public Park and Recreational Development with the USACE, managed by the City of Houston Parks and Recreation Department. The lease is for the Cullen Park (9,270 acres) area in Addicks Reservoir.

B. Harris County Precinct 3

Harris County has two Park and Recreation leases with the USACE managed by Harris County Precinct Three. The leases are for: (1) the Bear Creek Pioneers Park and Extension (3,085 acres); and (2) the George Bush Park (8,000 acres). Both parks have hike and bike trails, picnic areas, and dog parks. Harris County has agreements with third-party concessionaires operating facilities in the leased areas. The third-party agreements are subject to the conditions of the County's lease with the USACE. The concessionaires operating in the leased areas are as follows:

1) Addicks Reservoir, Bear Creek Park Third-party Concessionaires:

   Bear Creek Soccer Club – Operates 16 soccer fields. Soccer club for age groups from 6-19 yrs, and 20+ yrs.

West Houston Youth Soccer Coalition – Operates 15 soccer fields for age groups from 4-19 yrs and adults 20+ yrs.

Cy-Fair Sports Association – Operates seven ball fields for age groups from 3-18 yrs.

Bear Creek Little League – Operates 11 ball fields for age group 5–18 yrs.

Houston Farm and Ranch Club – Hosts year-round activities and special events to promote 4H education on 151.8 acres.

Greater Houston Horseshoe Pitchers Association, Inc. – Operates 20 horseshoe courts for people of all ages.

Bear Creek Golf World. – Consists of three 18-hole golf courses, putting green, driving range, pro shop, and snack bar/restaurant.

2) Addicks Reservoir, Bear Creek Park Expansion Third-party Concessionaires:

Harris County does not currently have third-party agreements for the Bear Creek Park Expansion Area as this area is yet to be developed.

3) Barker Reservoir, George Bush Park Third-party Concessionaires:

Houston Area Model Council, Inc. (Model Airplanes). – Operates facilities for radio-controlled model airplanes and fly-by-wire model airplanes.

Alief Soccer League (dba West Houston Soccer Club). – Operates 16 soccer fields for age groups from 4-19 yrs and 20+ yrs.

West Oaks Little League, Inc. – Operates six ball fields for age groups 5-18 yrs.

American Shooting Centers. – Operates a 550-acre shooting facility including, rifle/pistol ranges, trap and skeet ranges, and sporting clay ranges

Fun Fair Positive Soccer. – Operates 29 soccer fields for age groups 5-18 yrs.

C. Fort Bend County

Fort Bend County has a Park and Recreation lease with the USACE managed by the Fort Bend County Parks and Recreation Department. The lease is for the Cinco Ranch Park area (1,980 acres). Fort Bend County has agreements with third-party concessionaires operating facilities in the leased area. The third-party agreements are subject to the conditions of the County's lease with the USACE. The concessionaires operating in the leased area are as follows:

1) Barker Reservoir, Cinco Ranch Park Third-party Concessionaires:

Young Men's Christian Association (YMCA) of the Greater Houston Area, Inc.

D. The City of Houston Public Works Department

The Public Works Department of the City of Houston is responsible for the installation and maintenance of the roadways, water and sewer that lies within the city limits.

E. Harris County Flood Control District

The Harris County Flood Control District is the Corps partner in the development of the Buffalo Bayou and Tributaries Flood Control Project as well as many other Federally funded flood control projects within Harris County. They also hold easements on most of the drainage channels that enter Addicks and Barker Reservoirs and are responsible for the routine operations and maintenance of these channels.

Harris County Flood Control District also maintains flood control ditches within the reservoirs.

F. Law Enforcement

Numerous law enforcement agencies have some form of jurisdiction that covers all or portions of Addicks and Barker Reservoirs. The primary agencies are listed below. Project Operations staff are able to call on any of these agencies should assistance be needed. The Houston Police Department handles major investigations into major criminal acts and incidents.

1) City of Houston Police Department

   Since both projects lay totally within the city limits of Houston, The Houston Police Department handles major investigations into major criminal acts and incidents that may occur at Addicks and Barker Dams and Reservoirs.

2) Harris County Sheriff Department

3) Harris County Precinct 5 Constables

   Harris County Constables Precinct 5 serves as the law enforcement agency for Harris County Commissioners Precinct 3 Parks including Bear Creek Park in Addicks Reservoir and George Bush Park in Barker Reservoir. Because of the amount of land managed by Commissioners Pct 3, Constables Pct 5 is the primary agency that the staff of the Addicks Field Office depends on for law enforcement assistance.

4) Fort Bend County Sheriff Department

   The Fort Bend County Sheriffs Department is the primary law enforcement agency for Fort Bend County Parks.

G. Fire and Rescue

The following organizations provide fire and rescue services within Addicks and Barker Reservoirs:

1) City of Houston Fire Department

   As with the Houston Police Department, the Houston Fire Department is responsible for all fires and medical emergency responses occurring within Addicks and Barker Reservoirs. However, since the back boundaries of Addicks and Barker Reservoirs also forms the city limits line for the City of Houston in most areas various volunteer fire departments and emergency rescue services will respond to fires and other emergencies along and within the back property line.

2) Various Local Volunteer Fire Fighting Organizations

3) Texas Forest Service

   The Texas Forest Service (TFS) serves as a resource for the fire departments in the area. Should a wild fire become large and appear to threaten private property adjacent to the projects or improvements within the projects the Texas Forest Service will respond with heavy wild fire fighting equipment such as bulldozers. However, since bulldozers can cause an extensive amount of damage if used improperly, their use is discouraged.

H. Boy Scouts of America

The USACE and the Boy Scouts of America established a cooperative agreement to foster communications between their respective programs and activities relating to the conservation, management, protection, and development of the nation's water resources. The Addicks and Barker Reservoirs are located within the jurisdiction of two regional entities of the Boy Scouts – the Sam Houston and Bay Area Councils.

I. Girl Scouts of America

The USACE and the Girl Scouts of America established a cooperative agreement to foster communications between their respective programs and activities relating to the conservation, management, protection, and development of the nation's water resources. The Addicks and Barker Reservoirs are located within the jurisdiction of the Girl Scouts of San Jacinto Council.

J. Houston Audubon Society

This organization uses the property to conduct a Christmas Bird Count.

K. Houston Natural History Museum

This organization provides educational and research opportunities for the Greater Houston region.

1) Cockerel Butterfly – This is a educational study of butterflies in Barker Reservoir

2) Adult Continuing Education – This is a program of educational lectures of the natural and cultural resources of the Addicks and Barker Reservoir.

L. West Houston Chamber of Commerce

This is a local organization that provides Wildflower plantings along the Addicks and Barker Reservoir dam crossings.

M. Grazing Leases

The USACE has several grazing leases totaling approximately 2,140 acres in Addicks Reservoir and 1,700 acres in Barker Reservoir.

1) Cypress Springs Future Farmers of America (FFA) of the Cypress Fairbanks Independent School District - This organization provides agricultural education projects for students.

2) Langham Creek Future Farmers of America (FFA) of the Cypress Fairbanks Independent School District - This organization provides agricultural education projects for students.

3) Four H - This organization provides agricultural education projects for students.

4) Special Cheers, Inc.

5) HALTER Inc.

6) Various individual grazing leases.

N. Bear Creek Cemetery Association

This organization provides maintenance for historic cemeteries in both Addicks and Barker Reservoirs.

O. Barker Heritage Society

This organization provides history and education of the Barker Reservoir region.

P. Energy Corridor District

This organization, a consortium of businesses along Interstate 10, is instrumental in coordinating with other entities to provide hike and bike trails in the region.

Q. Texas Society of Professional Surveyors

This organization operates and maintains a calibration baseline station at Addicks Dam for calibrating members' survey equipment.

R. Bayou, Inc.

Bayou, Inc. - Bayou Rifles, Inc. has a Nonprofit Organization (501(c)(3)) Lease for a rifle range (100 acres). The Bayou Rifles, Inc. historically operated a rifle range where membership is required (open to all persons interested in applying). The range must be made available by request for practice and/or qualification to all law enforcement agencies and military organizations, and to other nonprofit organizations. Bayou Rifles, Inc., a private rifle range, was grandfathered in to reservoir management having been in operation in the reservoir prior to the construction of the project.

6.05 OTHER RELATED ACTIVITIES AND PARTNERSHIPS

Partnering, both on and off the projects and at all levels of the USACE organization, is strongly encouraged. This partnering fosters cooperation and collaboration, as well as increase the potential to provide innovative solutions to meet a diversity of needs. In addition, it builds relationships based on common goals and allows resources to be shared while working together. In particular, it provides the Houston Project Office an opportunity to successfully manage interpretive and outreach programs, projects, and events.

A. Greater Houston Safe Kids Water Safety Coalition

Started in February 2001, the Greater Houston Safe Kids Water Safety Coalition is a 16-member organization consisting of Federal, state, county, city, and local organizations to help protect children from drowning. This strategic partnership builds awareness of water safety and the use of life jackets in various groups in the Greater Houston/Galveston region, especially in minority and non-English-speaking communities.

B. Houston Safe Boating Council

Recognized locally and nationally, the Houston Safe Boating Council began efforts in 1984 to reduce the numbers of accidents and fatalities from boating in the Houston/Galveston area. It is a strong advocate for boating safety and provides education and innovative programs like the Water Activity Day Event (W.A.D.E.).

C. The Council on Environment Education (CEE)

A Memorandum of Understanding was established between the USACE and CEE to provide environmental education assistance to participating schools across the nation.

SECTION 7. RESOURCE USE OBJECTIVES

7.01 GENERAL

The purpose of this section is to define and prescribe a series of resource use objectives for Addicks and Barker Reservoirs. Resource use objectives provide guidance and direction for the use and management of project resources. The objectives listed below have been developed for Addicks and Barker Reservoirs by study and analysis of environmental stewardship aspects, natural resource trends and regional recreational needs.

7.02 RESOURCE USE OBJECTIVES

Resource objectives applicable to the project are presented below. They are formulated to provide general guidance and direction to the overall management of Addicks and Barker Reservoir resources. The objectives are grouped into three categories: General, Environmental Stewardship, and Recreation.

A. General

1) Administration– Ensure that quality management of all project lands and other associated constructed and natural resources are consistent and thorough. Seek to continually increase efficiency, cost effectiveness, and innovation in projects while keeping with the mandated purpose of the project.

   Discussion: Project administrative and management decisions/actions will adhere to all applicable laws, regulations, policies, and agreements. Consistent coordination, both internally, and with other applicable Federal, state, and local government agencies, private organizations, and individuals will be maintained. The major concerns of management are maintaining the integrity of the operational structures (i.e. dams, water control structures, etc.), identification of facilities for rehabilitation or replacement, provision of efficient support facilities, public health and safety, and responsible stewardship of the environment.

B. Environmental Stewardship

1) Protection of Natural Resources - Remain committed to providing responsible stewardship by the conservation, maintenance and restoration of diverse habitat communities. Habitats identified for conservation and restoration within Addicks and Barker Reservoirs include prairie, riparian forest, other coastal forests, and habitat for the Federally listed endangered Hymenoxys texana. Lands will be managed to conserve and restore native vegetative communities.

   Discussion: Stewardship efforts include monitoring and inventorying natural resources including status of native communities, invasive species, overuse, incompatible land uses, insect and disease infestation, and taking corrective

actions when warranted. Environmental stewardship also means encouraging the public's use of natural areas in a sustainable manner in keeping with the Corps' Natural Resource Management Mission. Restoration and maintenance activities include but are not limited to prescribed burns, mowing, select herbicide application, reseeding and replanting. Cost Share Agreements and joint ventures with local counties, municipalities, private conservation groups and universities are potential opportunities for management and restoration efforts on site.

2) Maintain, protect, and restore wetlands to support wildlife diversity and provide habitat for wetland dependent species.

   Discussion: Soils within the project are well suited for retaining water resulting in seasonal wetlands which provide habitat for migrating birds and opportunities for bird enthusiasts. Negative impacts will be avoided, minimized, or mitigated for a "no net loss" approach to management in accordance with Section 404 of the Clean Water Act and other Federal and State regulations. Challenge Cost Share Agreements and joint ventures are potential opportunities available for other agencies and private conservation groups to restore or enhance wetland areas.

3) Wildlife - Public land will be managed to encourage optimal utilization by the greatest number of wildlife species through inventorying, manipulating, and protecting their habitats.

   Discussion: Management activities to provide food, nesting, and cover include but are not limited to: control of encroaching woody vegetation; vegetative plantings; soil manipulation; prescribed burning and other manmade disturbances; invasive species removal, and planting. All activities will be conducted in accordance with accepted scientific methods. Management activities will be performed in accordance with the USACE mission statement regarding ecosystem management (ER 1130-2-540 Chapter 2).

C. Recreation

1) Quality Recreational Experiences – Seek to increase the quality of the visiting public's experiences by maintaining and developing purposeful and functional recreation areas that meet the needs of the visitor while maintaining the integrity of the environment.

   Discussion: Maintain and develop coordination with Federal , state, and local entities to periodically assess current and future development of recreational, multi-use, and educational resources and facilities.

2) Facility Management - Provide quality recreation facilities that meet the needs of the visitors to the region, maintain, develop, and alter facilities in order to meet the changing and diverse use patterns of the visitors to the park. Future

recreation development must be dependant on the project's natural or other resources. The Corps will not support private exclusive use of any type of facility.

Discussion: Corps policy is to provide outdoor recreation where there is an unfulfilled demand and a corresponding deficit of those facilities. This shortfall is fulfilled by either the Corps constructing the facilities itself or allowing other public (State and local), private sector, quasi-private entities or individuals to do so on project lands through an outgrant. The need for additional recreation facilities will be identified using professionally accepted methods prior to or along with a development application submittal to the USACE. All costs associated with market studies, NEPA documents, land surveys, preparation and review of the ultimate lease by the Corps as well as any other administrative costs associated with Corps review and approval of any proposed development are the responsibility of the entity proposing the recreational development.

3) Environmental Protection - To provide a safe and healthy environment for project visitors by monitoring, maintaining, and improving the environmental quality and natural aesthetics of the area. Lands will be inventoried, monitored, and managed to prevent damage to project lands habitats and special status species (e.g. Hymenoxys texana) prior to approval of any facility proposed for construction.

   Discussion: The development of recreational facilities and opportunities by lessees shall incorporate environmental protection and enhancement techniques compatible with the USACE Natural Resources Management Mission and the Galveston District's Guiding Principles for Development for Addicks and Barker Reservoirs. Site designs, impact deterrence, natural landscaping, and appropriate maintenance measures will be used to accomplish this goal. Mowing practices should be balanced to maintain developed recreational areas while also managing invasive species and promoting open space for native prairie communities. The USACE will not approve the construction of proposed facilities that are incompatible with the USACE's natural resources stewardship program mission and principles.

4) Barrier-Free Access – Proposals for recreational facilities within Addicks or Barker Reservoirs shall encourage outdoor recreational opportunities for the elderly, disabled, and other disadvantaged groups by providing barrier-free access. We will continue to identify areas/facilities that can achieve a high standard of access to people with disabilities.

   Discussion: All persons must be given access to a wide range of outdoor recreation activities through careful and appropriate planning, design and program implementation. Accordingly, consideration is given to proposals that include facilities and services for disabled persons in the planning, design,

and operations of existing recreation areas, and the development of future public use areas at the project.

5) 5) Visitor Awareness - Continue to expand upon the distribution of information detailing the importance of natural habitat areas within the reservoir project lands and region, their conservation and restoration, applicable rules and regulations considerations and the importance of public safety.

Discussion: Education is the key factor to increased public knowledge and awareness of natural and cultural resources. Education is also the key factor in the reduction of impacts to natural resources on public lands. Public knowledge is enhanced through programs both on and off site, news releases, internet websites, informative handouts, posters, and various other public service announcements done on radio and television. Also, by cooperating with other agencies, public awareness of USACE programs is increased.

SECTION 8. RESOURCE PLAN

8.01 ALLOCATION AND CLASSIFICATION OF RESERVOIR LANDS

A. General

Project zoning provides guidance for the use and management of the reservoirs' resources. Resource planning recognizes the authorized project purposes and the opportunities and constraints that influence development and management. All development proposals will be screened to determine compatibility with the reservoirs' natural and cultural resources. Primary planning and zoning considerations include flooding; soils; ecological conditions; and applicable laws, regulations, and policies. Review of development proposals includes the planning and zoning considerations identified above as well as the demand for the proposed development.

B. Reservoir Land Allocation and Classification

The only authorized purpose of the Addicks and Barker floodwater detention structures (dams and reservoirs) is to reduce potential flood damages within the downstream floodplain of Buffalo Bayou and its tributaries, through the City of Houston. All other use of reservoir lands is subordinate to this purpose.

C. Land Classification

Allocated project lands are further classified to provide for development and resource management consistent with authorized project purposes and the provisions of NEPA and other Federal laws using guidance per ER 1130-2-550 and EP 1130-2-550; both dated November 15, 1996. Prior land use classifications for the reservoirs under the 1986 Master Plan Update are illustrated in Figure 8-1. Current Land classifications for Addicks and Barker Reservoirs are described below, and are shown in Figures 8-2 and 8-3.

1) Project Operations (Ops) - The purpose of this resource classification is to provide adequate land for the safe and efficient operation and maintenance of the reservoirs for their authorized purpose of flood risk management. Lands classified in this category include the dams, gage houses, outlet structures, and land required for administrative and maintenance needs.

2) Environmentally Sensitive (ES) - This classification includes areas where scientific, ecological, cultural, or aesthetic features have been identified and must be considered by management to ensure these sensitive areas area not adversely impacted. As native cover is converted to other uses, wildlife habitat is increasingly fragmented. Habitat fragmentation isolates plants and animals creating an "island" effect, potentially leading to interbreeding or the loss of wildlife if the area is too small to support viable populations. It is critical that remaining islands of habitat are tied together by vegetated corridors that permit the movement of populations through developed areas, exchange of genetic material, and the re-colonization of underutilized habitat areas.Limited or no

development shall be contemplated on land in this classification. Section 8.03 further details this classification.

3) High Impact Recreation

Existing High Impact Recreation (HIRec) – This classification includes high impact / intensive use recreational and multi-purpose lands already developed. Section 8.04, Project Operations Lands, further details this classification.

Proposed High Impact Recreation (PHIRec) – This classification includes lands set aside for future high impact / intensive use recreational development. Examples of high density recreation lands include, but are not limited to, ball fields, building facilities, paved areas, heavily mowed areas, or other consumptive uses of natural resources within reservoir lands. Factors such as road access, natural resources, recreational facility design, and management practices shall be considered when developing and reviewing project proposals. This land classification can also be used for any of the items listed under the following Multiple Resource Management (MRM) section. Section 8.05 further details this classification.

4) Multiple Resource Management (MRM) - This classification includes three categories that further define lands based on their location and natural resources: These areas include lands that may be managed for one or more of the three categories simultaneously to the extent that they are compatible with each other and the primary project authorization of flood risk management. Low Impact Recreation, Wildlife Management, and Vegetative Management. Low Impact Recreation Lands will offer the public opportunities for education, hiking and biking, wildlife viewing, sightseeing, photography, nature study, and other low-impact recreation activities in an unstructured natural setting. Examples of facilities include, but are not limited to, hike and bike trails, educational trails, and nature viewing platforms. Vegetative Management activities for these lands include protection and development of forest and grassland/prairie vegetative cover. Use for these lands also includes those examples listed in Recreation – Low Density when deemed compatible, as well as other approved activities. All lands in government fee ownership are being managed to maintain vegetative resources for recreation, wildlife, and scenic values. Lands being managed for vegetative habitats and may include practices and techniques employed to enhance or restore vegetative resources such as eradication of invasive species control and vegetation manipulation. Wildlife Management activities include management of areas for the benefit of specific wildlife species. Activities within these lands may also include protection and restoration of forest, vegetative cover, and prairie with the intent to manage a habitat for a specific wildlife species (e.g. waterfowl). Grazing is normally not permitted in MRM areas except on an interim or trial basis to maintain open spaces.

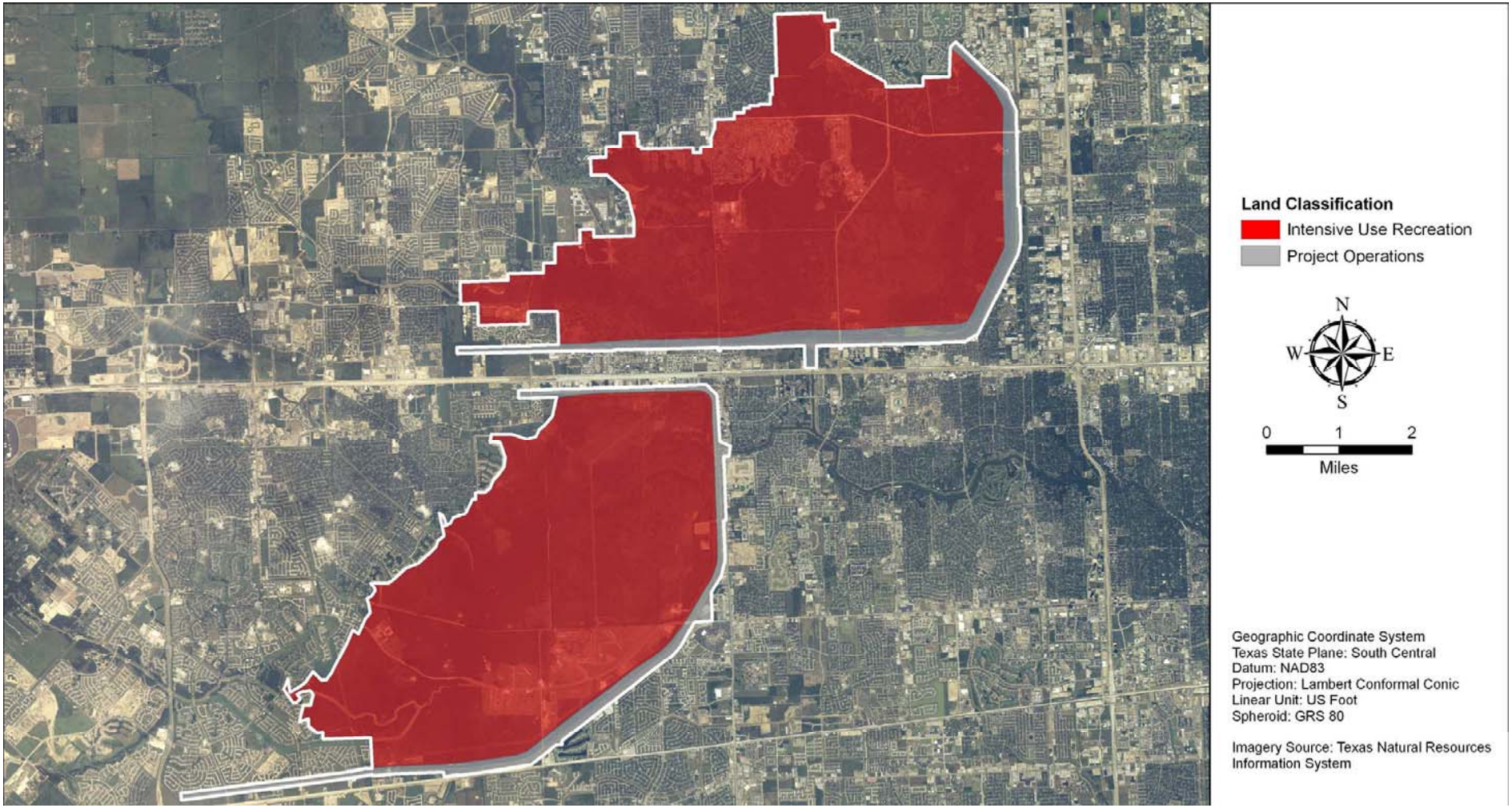

Figure 8-1. Prior Land Use Classifications – 1986 Master Plan Update, Addicks and Barker Reservoirs

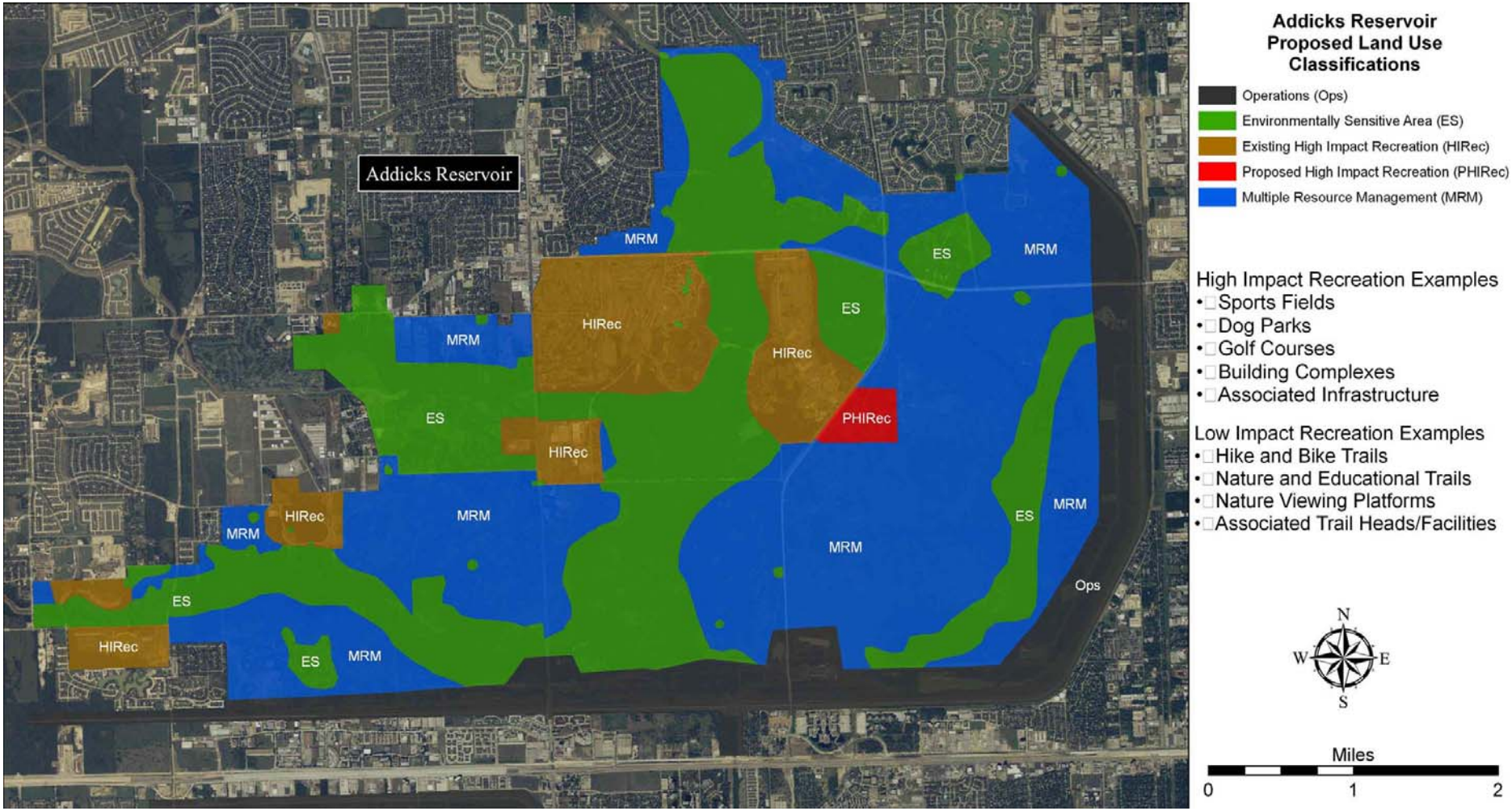

Figure 8-2. Proposed Land Use Classifications for Addicks Reservoir

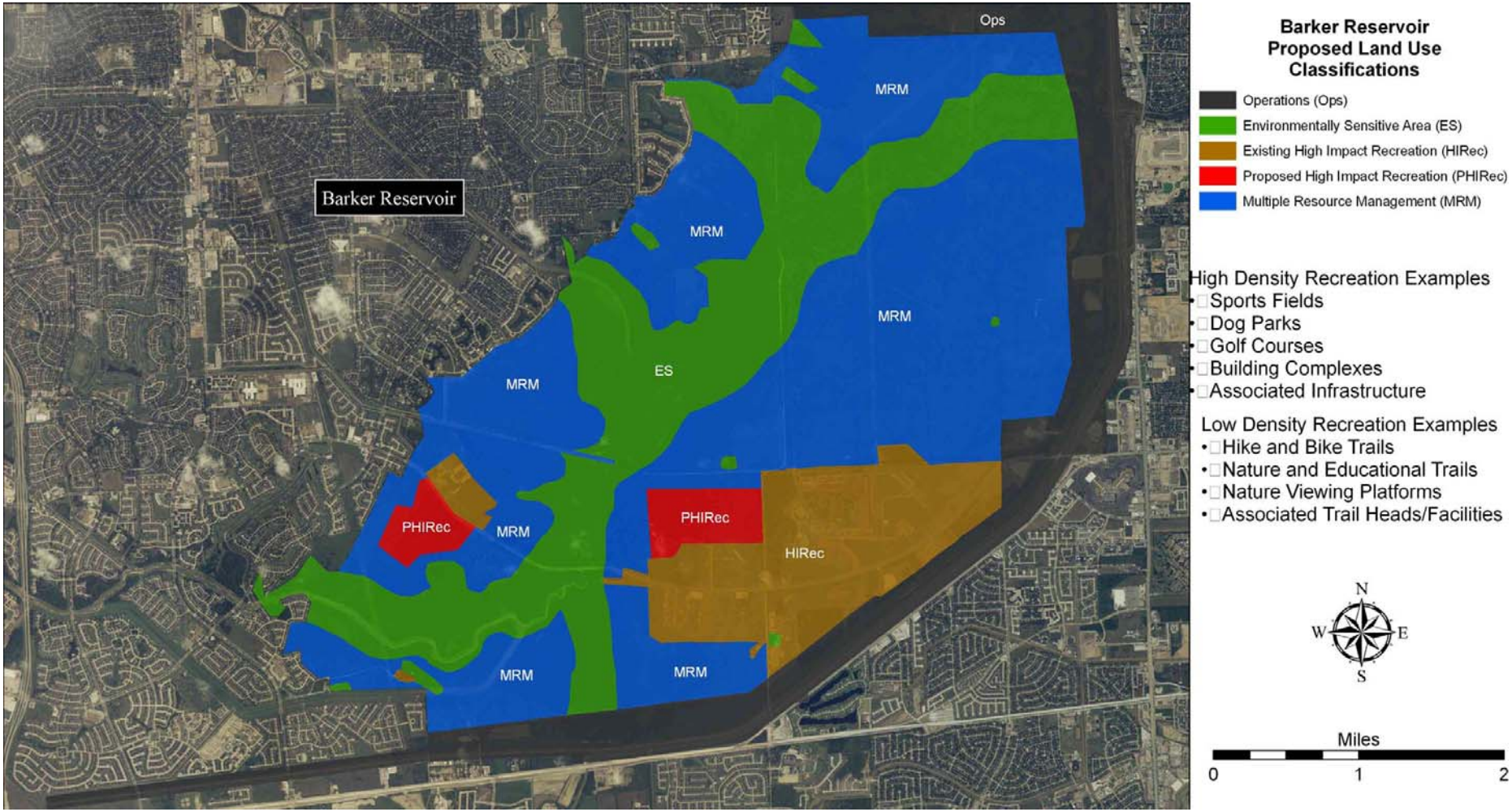

Figure 8-3. Proposed Land Use Classifications for Barker Reservoir

8.02 PROJECT OPERATIONS AND MAINTENANCE

This section includes descriptions of existing projects under the proposed project operations land classification. Proposed actions are listed under the heading Proposed New Actions, when applicable.

A. Project Operations (Ops) – Addicks Reservoir Operations and Maintenance Areas

This 1,900-acre area contains the main dam, outlet structures, and additional operations and maintenance areas (Figure 8-2). This area is necessary for the operation of Addicks Reservoir as a flood risk management project.

B. Project Operations (Ops) Barker Reservoir Operations and Maintenance Areas

This 2,200-acre area contains the main dam, outlet structures, Area Field Office and visitor center, and additional operations and maintenance areas (Figure 8-2). This area is necessary for the operation of Barker Reservoir as a flood risk management project.

Proposed New Actions: Plans and specifications are being developed in four phases for channel improvements of Clodine Ditch from Buffalo Bayou to FM 1093 (Long Point Slough). This project involves restoring alignments of the ditch and installation of articulated concrete block mats to prevent erosion of Clodine Ditch. The design and construction phases are incorporated in the Project's five-year plan and will be implemented as funding is provided by Congress.

8.03 ENVIRONMENTALLY SENSITIVE LANDS

This section includes descriptions of areas under the proposed Environmentally Sensitive (ES) classification. These lands include locations for the Federally listed endangered species Hymenoxys texana, cultural resources, prairie, riparian/bottomland hardwood and other forested areas. Included in the ES category are areas that have historical and archeological significance. In compliance with Federal law, these locations are not directly identified on the land classification map but are included in the ES designation. Best management practices shall be followed to ensure protection of these resources. Proposed actions are listed under the heading Proposed New Actions, when applicable.

A. Environmentally Sensitive (ES) Areas - Addicks Reservoir

These 4,300 acres of land include locations of the Federally listed Hymenoxy texana, riparian/bottomland hardwood, other forested areas, and cultural resources (Figure 8-2).

Proposed New Actions: Identify target areas; Develop and implement management plans for target areas.

B. Environmental Sensitive (ES) Areas – Barker Reservoir

These 2,900 acres of land include locations of the Federally listed Hymenoxy texana, riparian/bottomland hardwood, other forested areas, and cultural resources (Figure 8-3).

Proposed New Actions: Identify target areas; Develop and implement management plans for target areas.

8.04 HIGH IMPACT RECREATION

This section presents a description of areas under the proposed high impact recreation and/or multi-use areas (existing and proposed). Figures 8-2 and 8-3 (land classifications) show the corresponding mapped areas and Figures 3-1 and 3-2 (lease areas and facilities) can also be referenced for descriptions. Although it is assumed proposed high impact recreation (PHIRec) areas will be developed as high density recreational facilities, these areas are also available for development or management as low impact recreational, vegetative management or wildlife management areas. High impact recreation and multi-purpose development generally includes buildings, sports fields or facilities and accompanying infrastructure. Proposed actions are listed under the heading Proposed New Actions, when applicable.

A. Existing High Impact Recreation (HIRec) - Addicks Reservoir

1) Bear Creek Pioneers Park – There are approximately 1,350 acres of existing recreational development including: a Community Center with a greenhouse; three 18-hole golf courses; Farm and Ranch Club rodeo arena; 31 multi-sport soccer fields; 18 baseball fields; eight picnic pavilions; hundreds of picnic tables; more than five miles of designated equestrian and nature trails; paved and lighted jogging trails; restrooms; a war memorial; wildlife viewing enclosures with aviary; tennis courts, horseshoe pits, and paved parking (Figures 3-1 and 8-2).

2) Cullen Park - Of the total 9,270 acres of Cullen Park, approximately 350 acres are classified as existing recreation. Developed facilities within the park lease include ball fields, picnic pavilions and tables, restrooms, hike and bike trails, and other day use facilities (Figures 3-1 and 8-2).

B. Existing High Impact Recreation (HIRec) – Barker Reservoir

1) Bayou Rifles Shooting Range - The 130 acres surrounding this in Addicks Reservoir is considered developed recreation for the purposes of this master plan. Development consists of facilities for staging various target shooting activities.

2) George Bush Park - Approximately 1,380 acres of existing recreation (including multi-purpose facilities) including: soccer fields; baseball fields; playgrounds; picnic tables; hike, bike, and equestrian trials; a model airplane facility; shooting range; and paved parking (Figures 3-2 and 8-3).

3) Cinco Ranch Park, YMCA - This site within the larger 1,980-acre lease held by Fort Bend County is managed by the YMCA and provides area youths opportunity for camp-setting recreational activities. Although the YMCA is responsible for 200 acres, about 30 of these acres are considered to be developed for recreation (Figures 3-2 and 8-3).

C. Proposed HDRec – High Density Recreational Area – Addicks Reservoir

1) Cullen Park – Approximately 105 acres are identified as additional (proposed) HDRec (Figure 8-2).

D. Proposed HDRec – High Density Recreational Area - Barker Reservoir

1) George Bush Park – Approximately 200 acres are identified as additional (proposed) HDRec (Figure 8-3).

2) Cinco Ranch Park – Approximately 135 acres are identified as additional (proposed) HDRec (Figure 8-3).

8.05 MULTIPLE RESOURCE MANAGEMENT LANDS

Multiple Resource Management (MRM) areas for Addicks and Barker (Figures 8-2 and 8-3) include the three sub-categories discussed in section 8.01 (C) (4). These areas include lands that may be managed for one or more of the three categories simultaneously to the extent that they are compatible with the primary project authorization of flood risk management. Proposed actions are listed under the heading Proposed New Actions, when applicable.

MRM - LDRec – Multiple Resource Management Area - Recreation – Low Density: All areas identified MRM are available for low density recreation as defined in Section 8.07 (C).

MRM - Wild – Multiple Resource Management Area - Wildlife Management:

MRM - Veg – Multiple Resource Management Area - Vegetative Management

A. MRM – Multiple Resource Management Area - Addicks Reservoir - There are approximately 5,700 acres of multiple resource management area in Addicks Reservoir including existing hike and bike trails.

Proposed New Actions: Identify target areas; Develop restoration management plans and compatible low density recreation proposals; Implement restoration management plans. It may be necessary to reclassify multiple resource management lands as environmentally sensitive as additional information becomes available (e.g. Hymenoxys texana surveys).

B. MRM - Multiple Resource Management Area - Barker Reservoir - There are approximately 5,600 acres of multiple resource management area in Addicks Reservoir including existing hike, bike, and equestrian trails.

Proposed New Actions: Identify target areas; Develop restoration management plans and compatible low density recreation proposals; Implement restoration management plans. It may be necessary to reclassify multiple resource management lands as environmentally sensitive as additional information becomes available (e.g. Hymenoxys texana surveys).

8.06IMPLEMENTATION

A. Introduction

The means of accomplishing a development program is equally as important as the plan itself. Current environmental stewardship and other national priorities limit development options more than in the past. Growth of the surrounding residential communities intensifies pressure on remaining remnant prairies and forests within the region, affecting the area's remaining natural habitats' ability to support native vegetation and wildlife. At the same time, the rate of urban development has outpaced the development of community parks and open space which has added to the demand for recreational development within the reservoirs. The ability to pursue programs to restore native habitats while providing opportunities for low-density recreational experiences is dependant on many influences that could affect the manner and schedule for Master Plan implementation.

B. Implementation Methods

There are five basic implementation methods available for resource management and restoration at Addicks and Barker Reservoirs:

1) Cost Sharing - Requirements for cost sharing restoration efforts (including in-kind services) with non-Federal public interests will be considered when the benefits for such efforts can be sufficiently demonstrated and agreed upon. Although this Master Plan does not contain any cost-sharing proposals, it may in the future serve as a basis for initiating such actions. Cost-sharing is traditionally associated with development of recreational facilities; however, within the context of Addicks and Barker Reservoirs it is also appropriate to consider vegetative/wildlife management and ecological needs, including study of potential restoration methods and techniques.

2) Development Solely by Local Interests Under an Outgrant - As in the past, local governmental entities with all or part of a project in their jurisdiction, may obtain use under a lease or license. All costs are the sole responsibility of the local sponsor. Proposals must show there is justified demand for proposed facilities using professionally acceptable techniques and conform to applicable Federal and State laws and the USACE’s stated natural resource management mission objectives and guidance regarding development of natural resources within Addicks and Barker Reservoirs.

3) Regular MR&T General Funds - The use of MR&T O&M funds is restricted to normal O&M activities and to where facilities are in need of total renovation, reconstruction, or replacement. Changes or upgrades to facilities are restricted

to current MR&T O&M funding levels for replacement or rebuilding of existing facilities.

4) Challenge Cost-Share - The challenge cost-sharing program provides opportunities for public and non-Federal groups and individuals to contribute to and participate in the operation and/or management of recreation facilities and natural resources at USACE water resource development projects. Partnering with others provides a way to stretch the USACE budget by sharing the cost of operating and managing recreation facilities and natural resources. As stated in ER 1130-2-500, challenge cost sharing agreements may be used for the identification protection, improvement, rehabilitation, preservation, management, or interpretation of natural resources, environmental features, recreation areas and facilities, or cultural resources. Challenge cost share partners may contribute funds, materials, personal property, equipment, or services as their portion of the challenge cost-sharing agreement.

5) Congressional Mandate - A member of Congress or the Senate could sponsor a bill authorizing funds for specific facilities that cannot be obtained by conventional means.

SECTION 9. FACILITY LOAD AND OTHER DESIGN CRITERIA

9.01 SITING

All proposed structures will be constructed and located with consideration as to potential flood elevations while simultaneously meeting users' needs with site selection and consideration for soil type and erosion potential. Construction plans will abide by a no positive change in fill material within the reservoirs. All recreational facility siting proposals developed by a lessee require USACE approval prior to construction.

9.02 SIGNS

All new signs will conform to the USACE Sign Standards Manual. The USACE Sign Standards Manual covers all aspects of signs for the USACE and is a supplement to the USACE Graphics Standards Manual published as EP 310-1-6a and EP 310-1-6b .

9.03 SANITATION

Waste and Disposal - Sanitation services (trash, refuse, water, and sewer) are the responsibility of the lessee.

9.04 POLICIES AND PROCEDURES PUBLICATIONS

General policies and procedures for planning, design, operation, and maintenance of recreation facilities at USACE Civil Works projects are given in engineers manuals (EMs), engineers regulations (ERs), and engineer pamphlets (EPs) as referenced below:

1) EM 1110-1-400 - *Recreation Planning and Design Criteria*

2) ER 1110-2-400 - *Design of Recreation Sites, Area, and Facilities*

3) ER 1130-2-550 - *Recreation Operations and Maintenance Policies*

4) EP 1130-2-550 - *Recreation Operations and Maintenance Guidance and Procedures*

5) ER 1130-2-400 - *Management of Natural Resources and Outdoor Recreation at Civil Works Water Resource Projects*

6) ER 1165-2-400 - *Water Resource Policies and Authorities, Recreational Planning, Development, and Management Policies*

7) EP 310-1-6 - *Graphic Standards Manual*

8) EP310-1-6 a and b. *Sign Standards Manual*

These publications guide the development of recreational facilities to ensure that the facilities are of the highest quality while serving the health, safety, and enjoyment of the visiting public.

SECTION 10. SPECIAL CONSIDERATIONS

10.01 INVASIVE SPECIES

The movement of trees and plants across the globe for horticultural and agricultural purposes has dramatically affected ecosystems in the southern United States. With few natural pests or diseases, these introduced plants can become invasive over the course of a few decades and begin to alter native ecosystems. Problems arise mainly because of the growth characteristics of these plants which enable them to reach very large population levels relatively rapidly, thereby displacing and subsequently eliminating native vegetation. This in turn causes significant impacts on native wildlife including endangered species, disruption of delicate ecosystems by the replacement of native vegetation, decreases in land use and value as resting and feeding habitat for resident and migratory animal species, reduction of recreational and educational values, and potential hindrance of navigation along waterways.

The most common invasive species found within the reservoirs include: Chinese tallow (*Triadica sebifera*), deep-rooted sedge (*Cyperus entrerianus*), salt cedar (*Tamarix* spp.) narrowleaf cattail (*Typha angustifolia*), alligator weed (*Alternanthera philoxeroides*), common reed (*Phragmities australis*), MacCartney rose (*Rosa bracteata*), and mesquite (*Prosopis glandulosa*).

The Chinese tallow (*Triadica sebifera*) was purposely introduced into the southeastern United States as early as the 1700s as a potential agricultural source of seed oil to make soap (USFS, 2005). In the United States, it is primarily associated with ornamental landscapes. It grows rapidly and matures at an early age, and it favors the climate and soil conditions over a vast portion of the lower Texas coastal plain (Langeland, 2006). It is highly adapted to areas disturbed by human activity, including agriculture, forestry, and land development, and it grows in abandoned fields, pastures, waste areas, and forests (USFS, 2005). The fast-growing habit, massive seed production, and great seed germinability allow this species to invade areas occupied by natives (USGS, 2000). Once established, Chinese tallow tends to dominate areas by out-competing and displacing native plants. Chinese tallow has become naturalized in the southern coastal plain from South Carolina south to Florida and west to Texas (Barrow et al, 2005).

As with all prolific invaders, the key is to prevent new infestations, or at least eradicate them as soon as they begin. Control procedures mainly involve the use of herbicides, mowing, or cutting; however, this is expensive over a larger area (USGS, 2000). For Chinese tallow, flooding is not effective since seedlings tolerate brackish water or being inundated in freshwater (USGS, 2000). Burning during the dormant season (December), followed by burning or mowing during the growing season (July-August) may be effective, however tallow can also inhibit the spread of fire (USGS, 2000). Mechanical control, such as cutting alone, does not eradicate because plants resprout vigorously from the roots (McCormick, 2005). This technique however may temporarily prevent further encroachment of the tallow and may allow for some seasonal grassland species to establish.

The deep-rooted sedge (Cyperus entrerianus) is a wetland species native to South America and was introduced into the United States around 1990 (USDA, NRCS, 2001). This species invades wet, disturbed areas such as highway ditches and field margins, replacing native vegetation. Construction, agricultural activities, and road-side mowing spread the seeds and disperse this plant into new areas (USDA, NRCS, 2001).

An effective management strategy for long-term control Chinese tallow and deep-rooted sedge requires an integrated pest management (IPM) plan, which involves the application of chemical, mechanical, and physical control techniques. Implementation of an IPM plan may help to restore native prairie habitat within the Addicks and Barker Reservoirs. Currently, portions of Cullen-Barker Park are proposed for vegetation management for this species. The plan will be coordinated with USFWS and TPWD. The invasive species control plan should also include community outreach, public participation, and environmental education geared at the general public and municipal officials.

The primary nuisance animal species are feral hogs which have established populations in Addicks reservoirs. Brought over from Europe in the 1600's as domesticated livestock and progressively left to roam free, feral hogs have thrived in Texas. Feral hogs are the most prolific large, wild mammal in North America, with populations doubling in four months under optimal conditions. Currently, there are approximately two million feral hogs residing in Texas, accounting for more than 50 percent of the United States' feral hog population. These large populations can cause extensive agriculture and environmental damage primarily through rooting, wallowing, and consuming agricultural crops. Additionally, they compete with wildlife for habitat, harbor diseases, and transmit parasites to domestic animals. Control methods include fences, traps, and hunting, but it is nearly impossible to remove a feral hog population once it has become established (Mapston 2004).

10.02 CRIME AND LAW ENFORCEMENT

As the surrounding residential communities continue to develop, the opportunity for vandalism, illegal vehicle access, camping, theft, and destruction of public property within the reservoirs increases. Illegal trespassing, off-road vehicle use, poaching, camping, and vandalism, when left unabated, would adversely affect both ecological and recreational uses of the reservoirs.

SECTION 11. SPECIAL PROGRAMS

11.01 ENVIRONMENTAL COMPLIANCE

Action and activities that the USACE proposes or those submitted by other entities must comply with all applicable environmental laws and regulations. Chief among these is the National Environmental Policy Act (NEPA), which requires public officials to make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. Public involvement is to be encouraged and facilitated for decisions that will affect the quality of the human environment. Environmental consequences of proposed actions and alternatives are to be described in NEPA documents, which are circulated for public review.

The preparation of an environmental assessment (EA) is required for actions that may have substantial environmental effects. Examples of such actions are: construction of water control structures in natural habitats for the purpose of vegetative or wildlife management, or proposed construction of new facilities. Substantial revision or updates to an existing Master Plan, including the reclassification of lands from MR-LD into REC also requires the preparation of an EA. Before construction activities requiring an EA can proceed, a review of environmental consequences must conclude in a Finding of No Significant Impact (FONSI). If the review process results in a finding of significant impact, then an Environmental Impact Statement (EIS) needs to be prepared.

Per memorandum dated 06 December 2005, Recreation Development Policy for Outgranted Corps Lands (Appendix A) , all costs associated with market studies, NEPA documents, land surveys, preparation and review of the ultimate lease by the Corps as well as any other administrative costs associated with Corps review and approval of any proposed development are the responsibility of the entity proposing the recreational development.

An environmental assessment (EA) that will address proposed changes to operations and management activities, and land use classifications as contained in this Addicks and Barker Master Plan Revision (2008) is being prepared concurrently with the Master Plan. It is the USACE policy to identify and avoid adverse impacts as early in the planning process as possible. All proposed recreational and resource management projects will be designed to avoid adverse environmental impacts.

11.02 NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

In 1986, the United States and Canada signed the North American Waterfowl Management Plan (NAWMP) as an outgrowth of concerns over the dramatic loss of wetlands and declines in waterfowl populations. The NAWMP identifies habitat loss and degradation as the major factors limiting waterfowl habitat in North America. To address these problems, the NAWMP is a strategic plan that represents a framework for protecting, restoring, creating and enhancing critical waterfowl habitat in the United States and Canada. The overall goal of the NAWMP is to restore continental waterfowl populations to the levels that existed in the 1970s. This goal is to be achieved primarily

through the strategies of protection, restoration and enhancement of wetlands and their associated habitats throughout the United States and Canada.

The NAWMP recognized that a diversity of other wetland-dependent wildlife species would also benefit from implementation of the plan. In addition, significant wetland values, including water quality, ground-water recharge, flood control and recreational opportunities, would be realized. Under the plan, broad strategies are outlined to reverse the widespread destruction of wetland habitats. Waterfowl species are utilized as key indicators of the health of wetland environments.

The recommended strategy for implementation of the plan is to formulate a partnership within a joint venture area. This partnership is to be made up of representatives from governments, private organizations and individuals who are to cooperate in the planning, funding, and implementation of projects to conserve and enhance wetland habitat within their joint project area. Addicks and Barker Reservoirs are located within the Gulf Coast Joint Venture (USFWS, 1990). The joint venture objectives are to protect existing wetlands; restore bottomland hardwood forests and emergent wetlands; and enhance agricultural lands for the survival of waterfowl, songbirds, shorebirds, mammals and many threatened and endangered species.

11.03 PARTNERING

Federal reservoirs provide an important recreation resource in the United States. Facilities for support of recreation are expensive to build and operate. Federal involvement is presently limited to provide minimum facilities to meet health and safety requirements of the visiting public. Federal investment of 50 percent of costs is available if non-Federal participating agencies provide 50 percent and operate and maintain the facilities. Scarce funds and other priorities have limited non-Federal participation in recreation at Federal reservoirs. New USACE regulations allow non-Federal partners greater opportunities to participate in the operation and management of recreation facilities and environmental stewardship.

The Addicks and Barker Reservoir Project continues to seek new partnerships and strengthen existing ones as a means to accomplish Project initiatives. All existing partners are identified in Section VI, Coordination and Partnerships, which includes descriptions of those partnerships.

11.04 COOPERATING ASSOCIATIONS

Cooperating associations are used to accomplish broad goals such as natural resource management, interpretation, and visitor service activities on civil works water resource projects, fee-owned lands, and other areas for which the USACE has administrative and management responsibilities. Associations aid the USACE through a variety of activities, which may include the following:

1) Supporting special events; interpretive, educational or scientific activities; exhibits and programs; including presentations and demonstrations that further

public understanding and appreciation of the mission of the USACE or a particular water resource development project.

2) Supporting natural resource management or public programs at or near USACE projects through conservation and educational activities and special events; and also by providing scientific, logistical, maintenance and other support.

3) Acquiring display materials, historical objects, equipment, supplies, materials, goods or other items, or services appropriate for management, operation, interpretive, educational and visitor service functions.

4) Providing services to visitors through the sale, production, publication, and/or distribution of appropriate interpretive and educational items, such as publications, maps, visual aids, audio tapes, pamphlets, handicrafts and other objects directly related to the recreation, scientific, interpretive and educational goals and mission of a project, a group of projects and/or the USACE as a whole.

5) Acting as a principal distribution medium for those educational and scientific publications of the government and trade that relate to the USACE and/or project mission, mandate or management efforts and provide the public with inexpensive and technically accurate materials.

11.05 BUFFALO BAYOU CHRISTMAS DAY BIRD COUNT

The Christmas Bird Count (CBC) is part of an annual program coordinated by the National Audubon Society in which volunteer observers gather data on the birds within count areas throughout North and South America on a designated day (National Audubon Society, 2002). The Buffalo Bayou CBC was first held in 1978 and is the only CBC within Houston. It was established to document the birds on the west side of Houston, Texas, a part of the city containing good habitat yet also subject to fairly rapid residential and commercial development. The Buffalo Bayou CBC has been averaging approximately 120 species in recent years, and it has been the most popular CBC in Texas for the past two years.

The Buffalo Bayou CBC circle covers a 15-mile diameter circle on the west side of Houston and includes nearly all of Addicks and the eastern half of Barker. It is centered at the Houston Audubon Society's Edith L. Moore Nature Sanctuary in the Memorial/Wilcrest vicinity and also contains portions of the Great Texas Coastal Birding Trail and the Katy Prairie Loop.

As mentioned in Section 4.06, this area includes habitat for such birds as waders, waterfowl, hawks, shorebirds, woodpeckers, and songbirds (including a dozen or more species of sparrows each year). Woodcock (*Scolopax* sp.) are sometimes seen at dusk, as well as barn (*Tyto alba*), great horned (*Bubo virginianus*), and barred owls (*Strix varia*), Eastern screech-owl (*Megascops asio*), and more rarely common nighthawk (*Chordeiles minor*).

The results of the CBC are compiled into a database that is shared with Federal and state authorities and provide an indication of the long-term status of Houston's early winter avian populations. The information is vital for conservation efforts. Local trends can indicate habitat fragmentation due to widespread development or signal an immediate environmental threat, such as groundwater contamination. Fore more information regarding the Buffalo Bayou Christmas Bird Count please visit http://www.houstonaudubon.org and http://www.audubon.org.

SECTION 12. OPERATIONAL MANAGEMENT PLAN

Subsequent to completion of the Addicks and Barker Reservoirs Master Plan 2008 update and companion EA, the Galveston District Project Operations Branch is scheduled to revise the operational management plan for the reservoirs.

SECTION 13. CONCLUSIONS AND RECOMMENDATIONS

13.01 CONCLUSIONS

Since their construction I 1948, Addicks and Barker Reservoirs have had a tremendous influence on the surrounding communities and downstream interests. The authorized purpose of the reservoirs is the protection of urban development in the downstream flood plain of Buffalo Bayou and the City of Houston by reducing flooding potential. Simultaneously, the large area required by the reservoirs provides important open spaces that preserve native plant and animal resources while also providing recreation opportunities for the densely populated Houston metro area. As the region continues to grow and expand, development pressure to convert open space into housing is expected to continue increasing the ecological and recreational value of the open spaces provided by the reservoirs. These factors and considering the amount of existing recreational opportunities within the reservoirs has resulted in the determination that the highest and best use of Addicks and Barker Reservoirs Federal lands is primarily the conservation of natural resources in keeping with USACE Natural Resources Management Mission and Environmental Stewardship Principles and second, the provision of additional high density (intensive) recreational outdoor opportunities through the designation of future intensive recreational areas. Future recreation facilities should be compatible with Federal and State resource agency conservation and restoration goals and objectives. The revised land classifications and guidelines for development within Addicks and Barker Reservoirs as outlined in this Master Plan will provide quality recreation experiences while conserving and restoring natural habitat for the use and enjoyment of future generations.

13.02 RECOMMENDATIONS

It is recommended that the Addicks and Barker Master Plan Revision (2008) be approved and adopted as the basis for management of Federal lands at Addicks and Barker Reservoirs.

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APPENDIX A

Recreation Development Policy for Outgranted Corps Lands

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
WASHINGTON, D.C. 20314-1000

CECW-ZA

DEC 6 2005

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Recreation Development Policy for Outgranted Corps Land

1. **Background**. In executing the U.S. Army Corps of Engineers mission to provide public outdoor recreation opportunities, districts receive numerous and diverse proposals for recreation development of lands and waters at water resources development projects. No consistent nationwide criteria exist to evaluate these proposals and districts have taken different approaches that have created inconsistencies in the type and scope of recreation development provided. This policy was developed jointly by the Real Estate and Operations Communities of Practice.

2. **Purpose**. The purpose of this guidance is to establish consistent, nationwide policy that will be applied to evaluate requests for recreation development at Corps water resources development projects. The Corps intent is to provide public outdoor recreation opportunities that support project purposes and meet the recreation demands created by the project itself while sustaining our natural resources. Depending on specific project legislation, project purposes may also include navigation, hydropower, flood control, and or water supply. Additional statutes can assign missions responsibilities such as fish and wildlife management, and endangered species.

3. **Applicability**. This policy generally applies to all new requests for recreation development by public (State and local), private sector and quasi-public entities and individuals at Civil Works water resources development projects. Previously approved development plans for land currently outgranted for recreation development are grandfathered under this policy. When proposed development is not specifically addressed in a previously approved development plan for an existing outgrant instrument, the proposed development will be treated as a new request; however, land availability will not have to be reevaluated. New or existing sublessees that propose recreational development outside the terms and conditions of the current outgrant instrument will be considered as a new request. All new requests require a conceptual development plan in sufficient detail to evaluate the proposed recreation development.

4. **Policy.** The primary rationale for any future recreation development must be dependent on the project's natural or other resources. This dependency is typically reflected in facilities that accommodate or support water-based activities, overnight use, and day use such as marinas, campgrounds, picnic areas, trails, swimming beaches, boat launching ramps, and comprehensive resort facilities. Examples that do not rely on the project's natural or other resources include theme parks or ride-type attractions, sports or concert stadiums, and stand alone facilities such as restaurants, bars, motels, hotels, non-transient trailers, and golf courses. Normally, the recreation facilities that are dependent on the project's natural or other resources and accommodate or support water-based activities, overnight use, and day are approved first as primary facilities followed by those facilities that support them. Any support facility (e.g., playgrounds, multi-

purpose sports fields, overnight facilities, restaurants, camp stores, bait shops, comfort stations, boat repair facilities), must also enhance the recreation experience, be dependent on the resource-based facilities, be secondary to the original intent of the recreation development and the land base occupied by the outgrant. The Corps will not support private exclusive use of any type of facility.

Corps policy is to provide outdoor recreation opportunities to the public where there is an unfulfilled demand and a corresponding deficit of those facilities. This shortfall is fulfilled by either the Corps constructing the facilities itself or allowing other public (State and local), private sector, quasi-private entities or individuals to do so on project lands through an outgrant. Accordingly, outgrants that the Corps enters into should not unfairly compete with other established private or public recreational facilities. Existing outgrants with proposed facilities in development plans should be given priority to develop similar facilities within a reasonable timeframe before issuing a new outgrant for like facilities.

5. **Definitions.**

a. **Comprehensive Resort** – Typically, multi-faceted developments with facilities such as marinas, lodging, conference centers, golf courses, tennis courts, restaurants, and other similar facilities.

b. **Development Plan** – Requestor's or existing lessee's conceptual plan for development of an area of Corps land that shows existing and or proposed facilities, services, and acreage necessary to meet the current and potential public demand and the management and development activities to be undertaken.

c. **Master Plan** - A conceptual document guiding Corps responsibilities pursuant to Federal laws and regulations to preserve, conserve, develop, restore, maintain, and manage the project lands, waters, and associated resources. The primary goals of a Master Plan are to prescribe an overall land and water management plan, resource objectives, land use classifications, and associated design and management concepts. The plan addresses all resources including but not limited to fish and wildlife, vegetation, cultural, aesthetic, interpretive, recreational, mineral, commercial, and outgranted lands, easements and water.

d. **Outgrant** – Authorizes the right to use Army-controlled real property. It is a written legal document that establishes the timeframe, consideration, conditions and restrictions on the use of Army property. For the purposes of this policy, an outgrant is typically a lease or license authorized by 16 USC 460d, 10 USC 2667 and the general administrative authority of the Secretary of the Army (reference ER 405-1-12, Chapter 8 (Real Property Management) and the forthcoming EC 405-1-80 (Management and Outgrant Programs).

e. **Project Level Representative** – Person responsible for operations at a project or area level such as lake manager, operations project manager, resource manager, etc.

6. Evaluation Criteria. All new requests for recreation development must be in writing and will be reviewed by a district team. At a minimum, the team will consist of a project level representative, Real Estate, Operations, and other district legal/technical elements as appropriate (Engineering, Planning, Regulatory, etc.). Final authority to approve recreation development rests with the District Commander. In the rare circumstance that exceptions to this policy may be warranted, proposals for recreational developments may be forwarded to the Director of Civil Works through the Division Commander for review on a case by case basis.

Although these evaluation criteria are integral to any land availability determination, the preparation of the Report of Availability (ROA) will follow the processes established in ER 405-1-12, Chapter 8 (Real Property Management) and the forthcoming EC 405-1-80 (Management and Outgrant Programs) and ER 200-2-2 (Procedures for Implementing NEPA). In addition, the evaluation will be consistent with ER 1130-2-540 (Environmental Stewardship Operations and Maintenance Policies), ER 1130-2-550 (Recreation Operations and Maintenance Policies), and ER 1130-2-406 (Shoreline Management at Civil Works Projects.)

The team will evaluate requests for recreation development using the following criteria:

- Consistent with project purposes
- Reasonable connection to the project's natural and other resources
- Consistent with land use classifications and resource management objectives in the Project Master Plan (or supplement thereto)
- In the public interest
- Justified by public demand (market study- See Enclosure 1)
- Economically viable (feasibility study- See Enclosure 1)
- Meets the recreation demands created by the project itself while balancing natural resources requirements

Routine, minor expansions/requests of previously approved facilities within the lease footprint such as additional campsites at an existing campground, additional marina boat slips, enlargement of a restaurant, additional picnic sites or parking spaces may warrant a streamlined evaluation in accordance with established district procedures.

7. Implementation. This policy is effective immediately and supersedes any existing project, district, or MSC policy on evaluating proposed recreation development. This policy will remain in effect until incorporated into appropriate Engineer Regulations.

FOR THE COMMANDER:

Encl

DON T. RILEY
Major General, USA
Director of Civil Works

CECW-CO
SUBJECT: Recreation Development Policy for Outgranted Corps Land

DISTRIBUTION:

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COMMANDER, HONOLULU DISTRICT, ATTN: CEPOH-EC-T
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COMMANDER, JACKSONVILLE DISTRICT, ATTN: CESAJ-CO-OP
COMMANDER, MOBILE DISTRICT, ATTN: CESAM-OP-TR
COMMANDER, SAVANNAH DISTRICT, ATTN: CESAS-OP-SR
COMMANDER, WILMINGTON DISTRICT, ATTN: CESAW-OP-TN
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COMMANDER, ALBUQUERQUE DISTRICT, ATTN: CESPA-OD-O
COMMANDER, LOS ANGELES DISTRICT, ATTN: CESPL-CO-O
COMMANDER, SACRAMENTO DISTRICT, ATTN: CESPK-CO-O
COMMANDER, SAN FRANCISCO DISTRICT, ATTN: CESPN-CO-O
COMMANDER, SOUTHWESTERN DIVISION, ATTN: CESWD-ETO
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COMMANDER, TULSA DISTRICT, ATTN: CESWT-OD-R
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COMMANDER, ENGINEER RESEARCH AND DEV. CENTER, ATTN: CEWES-EE-R

MARKET AND FEASIBILITY STUDIES
ENCLOSURE 1

Market Study

A market study is contingent upon developing an inventory of the supply of existing types of recreational resources within a given area. The study must also include a recreational demand analysis that provides an indication of what people do, feel and want concerning recreational facilities (e.g., public demand). By comparing the inventory and the demand analysis it is possible to determine the types and amount of additional recreational facilities that are needed now or in the future. At a minimum, proposed recreation development by a by public (State and local), private sector and quasi-public entities and individuals will demonstrate a demand for the type of facilities proposed and a current or near future need for the type of facility being proposed.

Proposed demand studies shall contain data on the regional population and future projections, demographic characteristics and an inventory of similar types of recreational facilities (e.g., campgrounds, picnic areas, marinas, etc.) and their resources (e.g., 125 camping spurs, 150 picnic tables, etc) within a 30-mile radius of the proposed site requested for development. The study should demonstrate that the demand analysis was done through one or a combination of methods. These general categories of methods include but are not limited to, public input gathered through surveys and or workshops, using recreational standards (e.g., 1000 camping spurs per 50,000 people), participation levels/rates (e.g., 2.4 million people participate in picnicking which is 56 percent of the regional population), and trend analysis (e.g., extrapolating historical use statistics for those similar types of facilities over a ten to twenty year period).

The availability of information described above for use in the study will vary from region to region. Public (state and local), private sector and quasi-public entities and individuals should consult with State Census Bureaus, State Departments of Commerce, State and Federal Recreational Agencies, and travel bureaus for this information and to minimize study cost. Each state has a State Comprehensive Outdoor Recreation Plan that contains analysis criteria referenced above. In addition there are numerous Federal recreational studies such as the National Survey of Recreation and Environment that contain this type of information. Regional universities with outdoor recreational departments may also be a source for this information and assistance.

All costs associated with a market study, NEPA documents, land surveys, preparation and review of the ultimate lease by the Corps as well as any other administrative costs associated with Corps review and approval any proposed development are the responsibility of the entity proposing the recreation development.

Feasibility Study

The intent in requiring a private sector or individual to provide a feasibility study is to demonstrate that the entity can make a reasonable return of profit on a yearly basis for the proposed recreational development and that such development is economically viable. Factors such as the input of capital to develop the facility(s), maintenance cost, insurance, labor, etc. should be addressed. The type and size level of the facility(s) (e.g., 250 camping spurs vs. 100 spurs, 200 marina boat slips vs. 100) should also be addressed to demonstrate a reasonable rate of profit would occur. The numbers of visitors needed and the associated fee for these services should also be addressed. Detailed charts, graphs, and projections are not required; however, enough data must be provided to demonstrate such factors have been considered and that a profit can be generated.

Feasibility studies for public (State and local) or quasi-public entities will also be required. However the content of the analysis is limited to the types and size of the facility and evidence that yearly profits of the facility will offset or nearly offset the yearly operational cost or the proposed facility(s). Private sector or individuals working through a public entity for a development request (third party) will be required to furnish a feasibility study that complies with the requirements for a private requestor or individual as referenced above.

All costs associated with a market study, NEPA documents, land surveys, preparation and review of the ultimate lease by the Corps as well as any other administrative costs associated with Corps review and approval any proposed development are the responsibility of the entity proposing the recreation development.

APPENDIX B

Agency Coordination

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Division of Ecological Services
17629 El Camino Real #211
Houston, Texas 77058-3051
281/286-8282 FAX 281/488-5882

June 17, 2008

Colonel David C. Weston
U.S. Army Corps of Engineers, Galveston District
P.O. Box 1229
Galveston, Texas 77553

Dear Colonel Weston:

This U.S. Fish and Wildlife Service (Service) Planning Aid Letter provides Service analysis of impacts and recommendations for important fish and wildlife resources related to the proposed high density development areas and classification of resources located within the Addicks and Barker Reservoirs. It is in fulfillment of our draft joint Scope of Work on this project, dated March 10, 2008.

The U.S. Army Corp of Engineers (USACE) is the steward of lands and waters at USACE projects. Its Natural Resource Management Mission is to "manage and conserve those natural resources, consistent with ecosystem management principles, while providing quality public outdoor recreation experiences to serve the needs of present and future generation." In addition, the USACE promotes environmental awareness and values, sound environmental stewardship, protection, compliance and restoration practices on its lands (USACE, 2007).

Project Location and Environment

The project area occurs mostly in Harris County, a highly developed urbanized area of which the city of Houston is located. A small portion of Barker Reservoir falls within Fort Bend County. The dry-land reservoirs comprise approximately 26,000 acres and are strategically located above the confluence of Buffalo Bayou and South Mayde Creek. Both Reservoirs are located within the San Jacinto River basin and are directly upstream from the Buffalo Bayou Watershed.

The Addicks Reservoir watershed encompasses almost 130 square miles and includes four primary streams: Bear Creek, Horsepen Creek, Langham Creek and South Mayde Creek. Barker Reservoir watershed covers about 126 square miles and includes only two primary streams; Mason Creek and Upper Buffalo Bayou (HCFCD, 2007).

The Reservoirs are located approximately 17 miles upstream from the City of Houston and runoff eventually flows into downtown Houston via Buffalo Bayou, combines with White Oak Bayou and eventually passes through the Houston Ship Channel and connects to the San Jacinto River and Galveston Bay.

The land surrounding the Reservoirs has been almost completely developed and urbanized, thereby making the large tracts within the Reservoir more valuable for wildlife. There are several distinguishable habitats/ecosystems located in the Reservoirs. Coastal prairie, bottomland hardwood forests, disturbed prairie, other forested areas, and wetlands.

Coastal Prairie/Disturbed Prairie
Historically, the land surrounding and included in the Reservoirs is coastal prairie. This is characterized by meandering bayous and sloughs, riparian forested areas adjacent to the water ways, and grassland areas. Since the modern day settlement of this area, all that remains of the coastal prairie is less than 1% of the original 9 million acres. Conversion of the coastal prairie to crop land and grazing practices have degraded and fragmented the coastal prairie to the point that almost none exists. Remnant prairie can be found in some of the few sites that have not been urbanized in Harris County. Several of the surveyed sites within the Reservoirs were noted to be remnant coastal prairie and indeed presented with vegetation commonly found in a healthy coastal prairie ecosystem. However, these sites are quickly becoming invaded by woody and herbaceous invasive species that will crowd out and further degrade many of the surveyed coastal prairie sites. Table 1 (Native Plant and Wildlife Ranking Values of Addicks and Barker Reservoir Sites Visited) includes as ranking criteria for "plant community value ranking" diversity, richness, and disturbance for prairie sites.

Bottomland Hardwood Forests
This ecosystem is typically characterized by the presence of mature, hardwood-dominated, seasonally flooded forests within drainage basins. Several different forest cover types predominate in the Southeast Texas Gulf Coast region, including oak-hickory forest, cypress-tupelo forest in year-round wet regimes, cedar elm-American elm-hackberry forest, and other sub-types. Most of these forest cover types also contain diverse understory and vine communities, often dominated by yaupon holly, arrow-wood viburnum, hawthorn, dwarf palmetto, greenbriar, poison ivy, and wild grape. Most common herbaceous-layer plants in this region are Virginia creeper, slender woodoats, Cherokee sedge, wild iris, lizard-tail, and others.

Forests of the near-Gulf eastern Texas coast region are particularly important as stop-over habitat for nearctic neotropical migrant songbirds, as well as wintering and resident birds. At least 102 nearctic neotropical migrant bird species are know to utilize similar forests in the region. Several of these species, including the prothonotary warbler, northern parula, white-eyed vireo, and Kentucky warbler, remain to nest. All of these nesting birds have significantly declined on a continent-wide basis during the past 30 years (Sauer et al. 2007).

The diversity of the bottomland hardwood forest and the structure of the understory communities found on the reservoirs provide foraging and resting opportunities for these and other resident and migrant birds. In addition, this area provides year round foraging, breeding and nesting habitat for many mammals, reptile, and amphibian species. Large forest overstory and mast-producing trees, downed trees, abundant understory cover, and nearby wetland habitats provide cover, breeding and nesting habitats essential for wildlife. A comparison of breeding bird censuses in different habitats in Louisiana and east Texas (Dickson 1978) showed bird densities in three bottomland forest stands ranged from 752 to 1,400 territorial male birds per square kilometer, about 2 to 4 times that of the best upland stands.

Thirty-six species of amphibians and fifty-nine species of reptiles are known to inhabit bottomland hardwood forests in east Texas, more than any other habitat type in the state (Wharton et al. 1981). Table 1 includes "Plant Community Ranking" and "Wildlife Community Ranking" criteria which consider age and size, diversity, and coverage of forest sites and animal species lists.

Other Forested Areas

Invasive exotic and native vegetation has invaded much of the land, including wetlands, in Addicks and Barker Reservoirs and has resulted in large acreages of overgrown, scrubby forests of little native wildlife value. Chinese tallow (*Sapium sebiferum*) has invaded many disturbed prairie and forest sites, including wetlands, and many abandoned agricultural fields in southeast Texas since 1970. Brazilian pepper (*Schinus terribenthifolius*) has recently become a very invasive plant pest locally, but our surveys found no Brazilian pepper yet in Addicks or Barker. McCartney rose (*Rosa bracteata*) has long been a serious agricultural-land pest in east and coastal Texas, invading mostly fallow fields and pastures. Deep-rooted sedge (*Cyperus entrerianus*) has become a serious wetland invasive since 1990 in coastal Texas. Our surveys located several isolated stands, but no extensive coverage. Table 1 includes "Disturbance Ranking" criteria which consider invasive species abundance, diversity, and coverage.

Wetlands

As seen on maps using the National Wetlands Inventory layer, both Reservoirs have a considerable amount of acreage designated as wetlands (see figure 1.) These wetlands consist of forested wetlands and prairie potholes both of which are significant sources of foraging and breeding habitat for wildlife. Prairie potholes provide short term breeding habitats for amphibians and serve as watering holes for wildlife. The forested wetlands may be seasonally flooded by nearby creeks when experiencing high rain fall events and may serve as a catchment during regular rain storms. These areas are important as well and provide much needed cover for deer and other mammals.

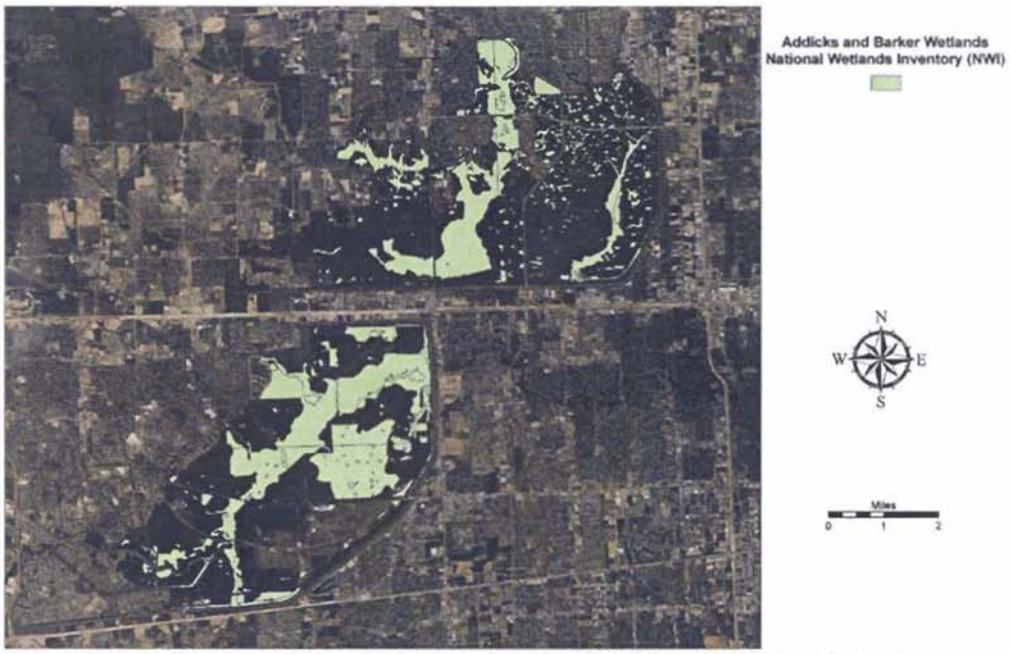

Figure 1 National Wetlands Inventory map of Addicks and Barker Reservoir

Many nearctic and neotropical birds use the bottomland hardwood, forested wetlands, prairie and wet prairie areas of the Reservoirs as important stopover habitat during long migrations. Waterbird migrants are more likely to winter in coastal Texas than their land bird counterparts. The reservoirs are located near the southern terminus of the Central Flyway, a major migration route for waterbirds which nest in the northern prairie states and Canada. Waterbird species seen during site surveys are: great blue heron, great egret, cattle egret, green-backed heron, and wood duck. Numerous other waterbirds have been seen on previous trips or could be expected to regularly occur.

Common amphibian species that may be found in the Reservoirs include, green tree frogs (*Hyla cinerea*), leopard frogs (*Rana sphenocephala*), bullfrogs (*Lithobates catesbeianus*), and Gulf Coast toad (*Bufo valliceps*). Reptiles include, snapping turtle (*Chelydra serpentina*), red eared sliders (*Trachemys scripta*), box turtles, slender glass lizard (*Ophisaurus attenuatus*), green anole (*Anolis carolinensis*), and five-lined skink (*Eumeces fasciatus*). Several species of snakes are commonly found within the reservoir: cottonmouth (*Agkistrodon piscivorus*), prairie king snake (*Lampropeltis calligaster*), racers, and various waters snakes.

Common fish species most likely found in the generally turbid streams of the Reservoirs are gar (*Lepisosteus* sp.), carp (*Cyprinus* sp.), catfish (*Ictalarus punctatus*), sunfish (Lepomis sp.), crappie (*Promoxis* sp.), mosquito fish (*Gambusia affinis*), and sheepshead minnow *(Cyprinodon variegates*). Invertebrates such as gastropods, insect larvae, and several species of crayfish also can tolerate the fluctuating water levels and nutrient loads (USACE, 1986)

The presence of large mammals may be limited to the species that have become more tolerate of human presence in a somewhat increasingly fragmented habitat. White-tailed deer (*Odocoileus viginianus*), coyote (*Canis latrans*), and the bobcat (*Lynx rufus*) are species common to the Reservoirs. Medium sized mammals such as the raccoon (*Procyon lotor*), beaver (*Castor canadensis*), eastern fox squirrel (*Sciurus niger*), opossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), cottontail rabbit (*Sylvilagus* sp.) and the nine-banded armadillo (*Dasypus novemcinctus*) are commonly found in the Reservoirs. Various rodents such as the deer mouse, whitefooted mouse and the hispid cotton rat, are common small mammals found in the area.

Project Background

Addicks and Barker Reservoirs is a flood reduction project that was designed to prevent downstream flooding of Buffalo Bayou in the city of Houston. Authorized by the Rivers and Harbors Act of June 20, 1938, and constructed in the 1940's both the Reservoirs are considered dry. Addicks, constructed in 1946, finished in 1948 is the larger of the two and comprises 13,693 acres and has a maximum storage capacity of 233,840 acre feet. This reservoir is located north of Interstate 10 with Highway 6 bisecting the reservoir north to south. Barker Reservoir began construction in 1942, finished in 1945, covers 12,583 acres and has a maximum storage capacity of 192,500 acre feet.

This reservoir is located south of Interstate 10 and west of State Highway 6. The Reservoirs are located approximately 17 miles from Houston with Barker Reservoir located directly on Buffalo Bayou and Addicks Reservoir located on Bear Creek, South Mayde Creek, Langham and Horsepen Creek, all tributaries of Buffalo Bayou. Houston has experienced periodic flooding and has seen the brunt of 12 major storms since 1853. These storms have produced death, destruction and have cumulatively cost upwards of $400 million to date. It is believed that the Reservoirs have provided a much needed relief for flooding waters heading to downtown Houston via Buffalo Bayou and prevented flood damages estimated to be approximately $3.8 billon through 2007.

The original Addicks and Barker Master Plan was developed in 1963 and served as a guide for the orderly and coordinated development of all land and water resources located in the Addicks and Barker reservoirs. The Master Plan was updated in 1973, 1977 and the current version was created in 1986. The USACE is in the process of developing a revised Master Plan for the Reservoirs. This new plan will examine the land and water resources within the reservoirs, the existing land use and plans for future land use.

Areas in both Reservoirs have been developed for various recreational needs. Partners such as Harris County, Precinct 3, City of Houston, and Fort Bend County have participated with the USACE in the planning and development of land inside the Reservoirs. Recreational facilities such as golf courses, tennis courts, soccer, rugby, softball and baseball fields, walking/jogging trials, shooting range, model plane flying area and equestrian trails have all been developed for recreational use. Several of the above partners have requested additional land to develop into high impact recreation facilities.

In addition to recreational activities, the Reservoirs have areas currently leased for livestock grazing (cattle and/or horses). Five-year leases for identified land parcels become available each year, with sealed bidding taking place in November.

Figure 2 Current existing conditions of Addicks and Barker Reservoirs

Proposed Work

Since 2006, the USACE has been revising their Master Plan for land usage. The Preliminary Draft Master Plan identifies, and provides GIS mapping information and map layers for several native forest and grassland habitat tracts and tracts identified for potential development as high impact recreational or multi-purpose facilities within the boundaries of Addicks and Barker. The USACE is seeking concurrence from the Service with it's determination of identified environmentally sensitive areas located within the Reservoir boundaries as well as areas that can be converted to multi-use facilities.

Selected Sites for Field Survey

The USACE is proposing revisions to existing Addicks and Barker Reservoirs land use classifications. The five land use classifications are (Figure 3):

Environmentally Sensitive– these may be defined as areas of significant ecological importance such as sites with records of Federally listed Threatened or Endangered species, remnant bottomland and forested wetlands and coastal prairie sites.

Proposed High Impact Recreation – these areas have been identified by the USACE as the best option for potential development as high impact recreational use.

Multiple Resource Management – areas identified for use of low impact activities such as hike and bike trails or nature watching, and wildlife or vegetation management.

Operations – Primarily includes the dams, outfall structures, rights of ways, etc.

Existing High Impact Recreation – these areas have been identified and developed as high impact recreation areas such as ball fields, tennis courts, golf course, shooting range and zoo.

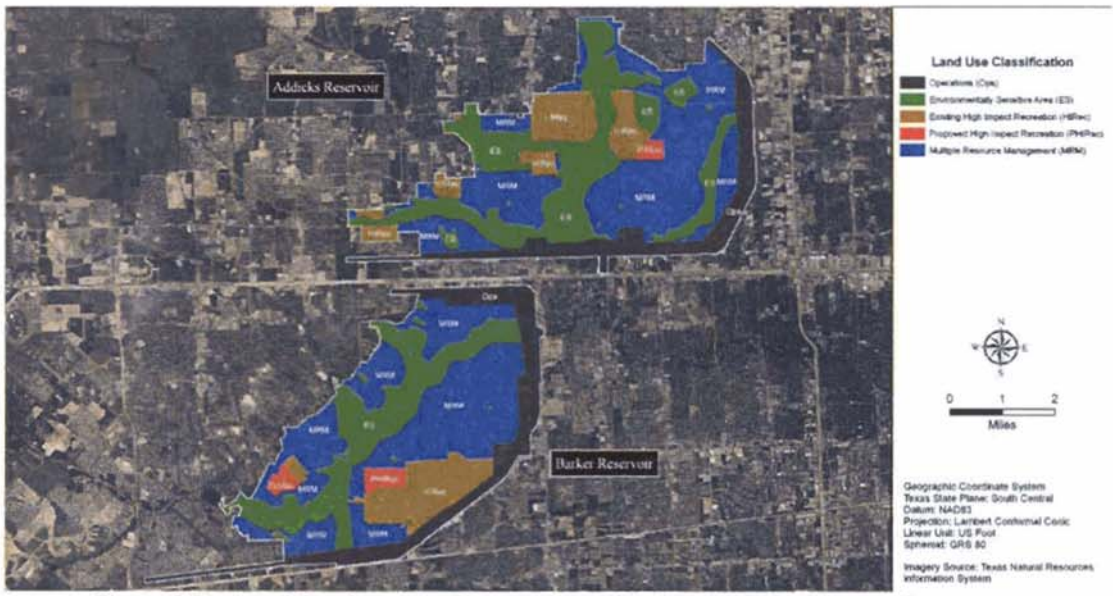

Figure 3 Proposed Land use classification for Addicks and Barker Reservoir

Survey Results

Field surveys conducted on April 8-9 and April 21-22 by biologists of the Clear Lake Ecological Services Field Office suggested that the classification of land use categories prepared by the USACE is useful for planning and establishing conservation priorities in Addicks and Barker Reservoir. Service biologists surveyed a total of 10 sites representative of each of the land use cover types (refer to fig. 4.) All sites were easily accessible by foot. Species list for each site are provided below. Exotic invasive species are indicated by the presence of an asterisk (*).

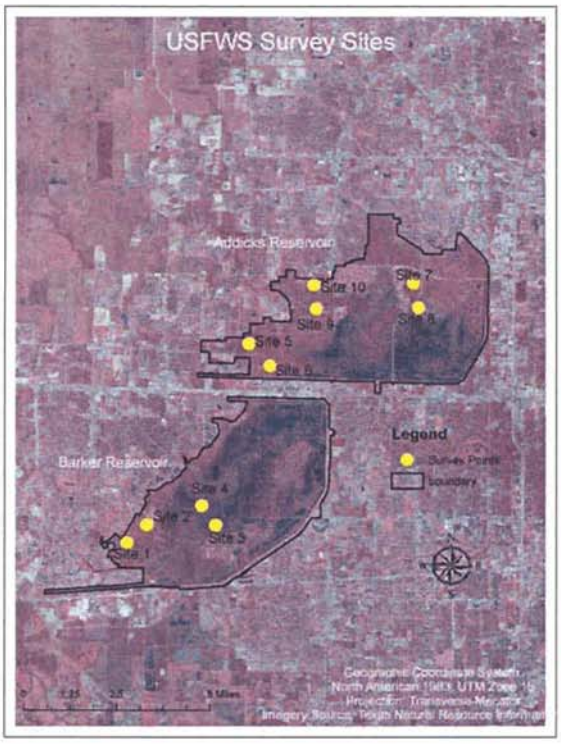

Figure 4 USFWS Survey Sites for Addicks and Barker Reservoirs

Barker Reservoir

Site 1-SW Barker at Cinco Ranch

This site comprised remnant bottomland hardwood, forested wetlands and areas disturbed by energy corridors and drainage features. We entered this site just north of Buffalo Bayou and traversed through an energy corridor of several hundred feet in width and came upon a large depressional wetland that led to this remnant site. Plant species diversity was very high in the canopy layer, understory and herbaceous layers. Disturbance at the site appeared to be low. Wildlife and bird species diversity was low but this could be due to the brief length of the survey, time of day and seasonal changes. We believe this site provides important habitat for fish and wildlife resources throughout the year, and is one of the last remaining intact and relatively undisturbed examples of forested wetlands in the region.

Plant species observed:

Wetland canopy

Fraxinus pennsylvanica (green ash)
Quercus nigra (water oak)
Quercus phellos (willow oak)
Ulmus americana (American elm)

Wetland understory

Berchemia scandens (Alabama supplejack)
Fraxinus pennsylvanica (green ash)
Ilex decidua (possumhaw)

Planera aquatica (planer tree)
Quercus nigra (water oak)
Quercus phellos (willow oak)
Sabal minor (dwarf palmetto)
**Sapium sebiferum* (Chinese tallow-tree)
Ulmus americana (American elm)

Wetland herbaceous
Brunnichia ovata (American buckwheat vine)
Callitriche heterophylla (water starwort)
Carex caroliniana (Carolina caric-sedge)
Carex complanata (flat-fruit caric-sedge)
Carex frankii (frank's caric-sedge)
Carex lupulina (hop caric-sedge)
Carex lurida (sallow caric-sedge)
Carex triangularus (triangular caric-sedge)
**Cyperus entrerianus* (deep-rooted sedge)
Cyperus pseudovegetus var. *pseudovegetus* (marsh flat-sedge)
Cyperus virens (green flatsedge)
Eleocharis palustris (common spikerush)
Hygrophila lacustris (gulf swampweed)
Hymenocallis liriosme (spring spider lily)
Juncus brachycarpus (white-root rush)
Juncus effusus (soft rush)
Juncus validis (round-head rush)
Justica ovata var. *lanceolata* (lance-leaf water-willow)
Leersia virginica (white grass)
Lemna obscura (duckweed)
Ludwigia octovalvis (Mexican primerose willow)
Ludwigia repens (creeping prim rose willow)
Mikania scandens (climbing hempvine)
Myriophyllum pinnatum (cut-leaf water-milfoil)
Panicum gymnocarpon (savannah panicgrass)
Panicum hians (gaping-grass)
Physostegia intermedia (obedient-plant)
Polygonum hydropiperoides (swamp smartweed)
Pontederia cordata (pickerelweed)
Rhynchospora caduca (angle-stem beakrush)
Saururus cernuus (lizard's tail)
Spirodela polyrhiza (duck weed)
Vernonia missurica (Missouri ironweed)

Upland Canopy
Celtis laevigata (sugar hackberry)
Quercus phellos (willow oak)
Ulmus americana (American elm)

Upland Understory
Callicarpa americana (beautyberry)
Celtis laevigata (sugar hackberry)
Ilex decidua (possumhaw)
Ilex vomitoria (yaupon)
**Ligustrum sinense* (Chinese privet)
**Lonicera japonica* (japanese honeysuckle)
**Rosa bracteata* (macartney rose)
**Sapium sebiferum* (Chinese tallow-tree)
Ulmus crassifolia (cedar elm)
Viburnum dentatum (arrowwood)

Upland herbaceous
Carex caroliniana (Carolina caric-sedge)
Carex complanata (flat-fruit caric-sedge)
Carex reniformis (kidney fruit caric-sedge)
Carex cherokeënsis (cherokee caric-sedge)
Chasmanthium laxum var. *laxum* (slender-leaf woodoats)
**Cyperus entrerianus* (deep-rooted sedge)
Elephantopus carolinianus (Carolina elephant's-foot)

Bird species observed:
Aix sponsa (wood duck)
Ardea alba (great egret)
Butorides virescens (green-backed heron)
Buteo jamaicensis (red-tailed hawk)
Cardinalis cardinalis (northern cardinal)
Cyanocitta cristata (blue jay)
Dryocopus pileatus (pileated woodpecker)
Melanerpes carolinus (red-bellied woodpecker)
Myiarchus crinitus (great crested flycatcher)
Passerina cyanea (indigo bunting)
Poecile carolinensis (Carolina chickadee)*Protonotaria citrea (p*rothonotary warbler*)*
Thryothorus ludivicianus (Carolina wren)
Troglodytes troglodytes (winter wren)
Vireo crassirostris (white-eyed vireo)

Wildlife species observed:
Agkistrodon piscivorus leucostoma (water moccasin)
Bufo valliceps (gulf coast toad)
Rana catesbeiana (bull frog)
Sus scrofa (feral hog)

Site 2- South of Soccer Fields

This site comprised severely degraded remnant prairies as indicated by the presence of conservative prairie species such as gulf muhly and little-toothed caric-sedge. Alterations to hydrology and topography and review or aerial photos suggest that this site had been converted to intensive agriculture use, such as rice rotation, and subsequently abandoned. This site is overgrown with invasive exotic and native woody plants and contributes little to the quality of habitat for wildlife as is reflected in the overall score for the site.

Plant species observed:

Herbaceous

Andropogon virginicus var. *virginicus* (broom-sedge bluestem)
Arnoglossum plantagineum (prairie indian-plantain)
Carex austrina (southern caric-sedge)
Carex cherokeënsis (cherokee caric-sedge)
Carex microdonta (little-toothed caric-sedge)
**Cyperus entrerianus* (deep-rooted sedge)
Muhlenbergia capillaries (gulf muhly)
Tridens strictus (long-spike tridens)

Woody

Baccharis halimifolia (eastern baccharis)
Cornus drummondii (rough-leaf dogwood)
Ilex vomitoria (yaupon holly)
**Rosa bracteata* (macartney rose)
Rubus argutus (highbush blackberry)
**Sapium sebiferum* (Chinese tallow-tree)

Site 3- NW Model Airplane Field

This site comprised very disturbed wet areas that were formerly rice fields. Old agricultural structures were noted on the aerial maps, verified during the site visit and may have contributed to the poorly drained and somewhat impounded soils. Woodlands were noted on the site but comprised exotic and native invasive species. No clear vertical plant community structure was observed with most woody plants having a low canopy. Overall, this site is degraded due to past agricultural activities, current grazing efforts and lack of management efforts to effectively restore the site back to a native prairie system.

Plant species observed:

Baccharis halimifolia (eastern baccharis)
Celtis laevigata (sugar hackberry)
Fraxinus pennsylvanica (green ash)
Ilex vomitoria (yaupon holly)
**Rosa bracteata* (macartney rose)
Rubus argutus (highbush blackberry)
**Sapium sebiferum* (Chinese tallow-tree)

Site 4 – Forested Wetlands and Oxbow by the Footbridge

This site adjacent to Buffalo Bayou comprises forested wetlands, oxbows and bottomland hardwoods. Structurally, this site still supported several rich forest cover types with well defined vegetation layers. The oxbows have a canopy dominated by planer-tree and, although hydrolically altered by draining, were still in relatively good condition. The riparian forest and planer-tree swamps provide breeding and foraging habitat for a variety of birds, reptiles and amphibian species. This planera swamp was mature by definition with trees toping 35 to 40 feet tall. While this is not a rare community in Texas, it may be considered a regional rarity in Harris County. Chinese tallow, an invasive exotic species was noted surrounding the edge of the swamp; however the ecological restoration potential at this location is great. Restoration of hydrology and removal and control of exotic invasive plant species should be a priority at this site.

Plant species observed:

Canopy

Carya aquatica (water hickory)
Celtis laevigata (sugar hackberry)
Fraxinus pennsylvanica (green ash)
Platanus occidentalis (American sycamore)
Quercus nigra (water oak)
Quercus phellos (willow oak)
**Sapium sebiferum* (Chinese tallow-tree)
Ulmus americana (American elm)
Ulmus crassifolia (cedar elm)

Understory

Campsis radicans (trumpet-creeper)
Cocculus carolinus (Carolina snailseed)
Ilex dicidua (possumhaw)
Planera aquatica (planer-tree)
Sabal minor (dwarf palmetto)
Toxicodendron radicans (poison ivy)

Herbaceous

Berchemia scandens (Alabama supplejack)
Brunnichia ovata (American buckwheat-vine)
Carex cherokeënsis (cherokee caric-sedge)
Carex crus-corvi - (crowfoot caric-sedge)
Cyperus eragrostis (flatsedge)
Leersia virginica (Virginia cut-grass)
Mikania scandens (climbing hempweed)
Myosotis macrosperma (spring forget-me-not)
Poa annua (annual blue-grass)
Polygonum punctatum (water smartweed)
Rumex crispus (curly-leaf dock)

Sanicula canadensis (canadian sanicle)
Valerianella woodsiana (woods' cornsalad)
Veronica arvensis (common speedwell)

Planer tree swamp
Herbaceous
Carex crus-corvi - (crowfoot caric-sedge)
Carex lurida (sallow caric-sedge)
Cephalanthus occidentalis (buttonbush)
**Cyperus entrerianus* (deep-rooted sedge)
Cyperus pseudovegetus (marsh flat-sedge)

Cyperus virens (green flatsedge)
Hydrocotyle verticillata (water-pennywort)
Ludwigia repens (creeping primrose-willow)
Ludwigia sp.
Myriophyllum pinnatum (cut-leaf water-milfoil)
Panicum gymnocarpon (savannah panicgrass)
Polygonum punctatum (water smartweed)
Rumex crispus (curly-leaf dock)
Sagittaria papillosa (arrowhead)

Bird species observed:
Baeolophus bicolor (tufted titmouse)
Buteo lineatus (red-shouldered hawk)
Icteria virens (yellow-breasted chat)
Icterus galbula (northern oriole)
Melaberous carolinus (red-bellied woodpecker)
Parula Americana (northern parula)
Strix varia (barred owl)
Thryorthorus ludovicianus (Carolina wren)
Vireo bellii (Bell's vireo)
Vireo crassirostris (white-eyed vireo)

Wildlife species observed:
Eumeces fasciatus (5 lined skink)
Lepisosteus sp. (Gar)
Rana utricularia (southern leopard frog)
Snake sp.

Addicks Reservoir

Site 5 – S. Maydee Creek

Leading into this site is a highly disturbed prairie characterized by native and invasive exotic woody species and some lingering coastal prairie species such as gulf muhly. However, the habitat adjacent to S. Maydee Creek is characterized as a second-growth forest with well defined and rich vegetation layers. This site provides breeding and foraging habitat for a variety of birds, reptiles and amphibian species.

Plant species observed:

Canopy

Acer negundo (box-elder)
Carya illinoinensis (pecan)

Celtis laevigata (sugar hackberry)
Fraxinus pennsylvanica (green ash)
Platanus occidentalis (American sycamore)
Quercus nigra (water oak)
Quercus virginiana (southern live oak)
Ulmus americana (American elm)

Understory

Ilex vomitoria (yaupon)
**Ligustrum sinense* (Chinese privet)
Matelea sp. (climbing milkweed)
Sambucus Canadensis (elderberry)
Vitis cinerea (pigeon grape)
Cocculus carolinus (carolina snailseed)
Cornus drummondii (rough-leaf dogwood)
Vitis rotundifolia (muscadine grape)
Campsis radicans (trumpet-creeper)
Sabal minor (dwarf palmetto)
Prunus caroliniana (carolina laurel-cherry)
Morus rubra (red mulberry)
Ilex decidua (possumhaw)
Vitis mustangensis (mustang grape)
Viburnum dentatum (arrowwood)
Diospyros virginiana (common persimmon)

Herbaceous

Allium canadense (canada meadow onion)
Berchemia scandens (Alabama supplejack)
Callicarpa americana (american beautyberry)
Carex blanda (charming caric-sedge)
Carex cherokeënsis (cherokee caric-sedge)
Carex corrugata (wringle-fruit caric-sedge)
Carex flaccosperma (flaccid-fruit caric-sedge)
Chasmanthium latifolium (broad-leaf woodoats)
Dichanthelium spp. (panic grass)
Elephantopus carolinianus (carolina elephant's-foot)
Galium aparine (catchweed bedstraw)
Geum canadense (white avens)
Juncus coriaceus (leather-flower rush)
**Lonicera japonica* (Japanese honeysuckle)
Myosotis macrosperma (spring forget-me-not)
Parthenocissus quinquefolia (virginia creeper)

Poa autumnalis (autumn blue-grass)
Polygonum punctatum (water smartweed)
Sanicula canadensis (Canadian sanicle)
**Sapium sebiferum* (Chinese tallow-tree)
Smilax spp. (greenbrier)
Thelypteris kunthii (southern shield fern)

Toxicodendron radicans (poison ivy)
Valerianella woodsiana (woods' cornsalad)
Viola sororia (bayou violet)

Bird species observed:
Accipiter cooperii (Cooper's hawk)
Bombycilla garrulous (cedar waxwing)
Bubulcus ibis (cattle egret)
Caracara cheriway (crested caracara)
Cardinalis cardinalis (northern cardinal)
Corvus brachyrhynchos (American crow)
Mimus polyglottos (northern mockingbird) *Baeolophus bicolor* (tufted titmouse)
Cardinalis cardinalis (northern cardinal)
Mimus polyglottos (northern mockingbird)
Quiscalus quisula (common grackle)
Vireo crassirostris (white-eyed vireo)
Zenaida macroura (mourning dove)
Zenaida macroura (mourning dove)

Wildlife species observed:
Eumeces fasciatus (5 lined skink)
Gar sp.
Rana utricularia (Southern leopard frog)
Sciurus niger (Fox squirrel)
Trachemys scripta elegans (Red eared slider)

Site 6 – S.W. Corner Addicks Reservoir

This site is remnant coastal prairie evident by the diversity of prairie species found at several locations. Much of this area is overgrown with native and invasive exotic woody plant species due to protection from fire. This site also has a past history of intensive agriculture as evident by the altered hydrology and the presence of irrigation ditches and levees. Currently, this site appears to have been heavily grazed. This site does have some pockets of wetland prairie vegetation that have been invaded by Chinese tallow. This area does support some wildlife species such as feral hogs, mourning dove, Cooper's hawk, cattle egrets, American crow. There is some potential at this site for ecological restoration.

Plant species observed:
Herbaceous
Andropogon virginicus var. *virginicus* (broom-sedge bluestem)
Arnoglossum plantagineum (prairie indian-plantain)
Baptisia bracteata var. *leucophaea* (plains wild indigo)
Callirhoe involucrata (wine-cup)
Carex bushii (bush's caric-sedge)
Carex complanata (flat-fruit caric-sedge)
Cirsium horridulum (bull thistle)
Dichanthelium aciculare (needle leaf panic grass)
Dichanthelium scoparium (panic grass)
Fimbristylis puberula (hairy fimbry)

Muhlenbergia capillaries (gulf muhly)
Neptunia pubescens var. *pubescens* (prairie neptunia)
Paspalum plicatulum (brown-seed paspalum)
Polytaenia nuttallii (prairie-parsley)
Rhynchospora caduca (angle-stem beakrush)
Rhynchospora globularis (globe beakrush)
**Rosa bracteata* (macartney rose)
Rudbeckia hirta (brown-eyed susan)
Schizachyrium scoparium var. *scoparium* (little bluestem)
Scleria pauciflora (few-flowered nutrush)
Silphium gracile (slender rosinweed)
Verbena halei (texas vervain)
**Verbena rigida* (tuber vervain)
**Sapium sebiferum* (Chinese tallow-tree)

Site 7 – E. of War Memorial Drive

This site was historically coastal prairie that had agricultural disturbance and is now invaded with native and exotic invasive species. Although Texas prairie cone flower and gulf muhly were noted along with other prairie species, this site was disturbed and overgrown by native and exotic woody plant species.

Plant species observed:
Arnoglossum plantagineum (prairie indian-plantain)
Carex bushii (bush's caric-sedge)
Carex microdonta (little-toothed caric-sedge)
Fimbristylis puberula (hairy fimbry)
Ilex vomitoria (yaupon)
Muhlenbergia capillaries (gulf muhly)
Myrica cerifera (southern wax-myrtle)
Pinus sp. (pine)
Quercus virginiana (southern live oak)
**Sapium sebiferum* (Chinese tallow-tree)
Schizachyrium scoparium var. *scoparium* (little bluestem

Bird species observed:
Baeolophus bicolor (tufted titmouse)
Cardinalis cardinalis (northern cardinal)
Mimus polyglottos (northern mockingbird)
Quiscalus quisula (common grackle)
Vireo crassirostris (white-eyed vireo)
Zenaida macroura (mourning dove)

Site 8 – East of Eldridge Road

This site comprises highly disturbed and overgrazed areas and is severely infested with *Cyperus entrerianus* (deep-rooted sedge). A review of historic aerial photos suggests that this site was originally Coastal Prairie that was converted to intensive agriculture use and later abandoned. In its current state, the original prairie vegetation has been eliminated, and this site is almost entirely dominated by native and exotic invasive woody species.

Plant species observed:
**Cyperus entrerianus*
Fraxinus pennsylvanica (green ash)
Quercus nigra (water oak)
**Sapium sebiferum* (Chinese tallow-tree)
Ulmus americana (American elm)

Site 9 – North of Groeschke Road

This site comprised coastal prairie in various states ranging from areas infested with native and exotic invasive woody species to several areas with excellent examples of Coastal Prairie and freshwater prairie wetlands. Of particular interest at this site is a well developed and endemic element of the Coastal Prairie previously described as Houston Prairie. Dominants included *Muhlenbergia capillaris*, *Schizachyrium scoparium*, and *Spartina spartinae*. Other species present were those typical of coastal prairie in excelent condition, including the Federally Listed *Hymenoxys texana* in the small highly saline grass-free openings adjacent to pimple mounds. This rare community, known only from the coastal plain of Texas, has a conservation rank of G1G2. Very few occurrences of this community are known outiside the reservoirs, and nearly all are degraded by over-grazing, fire protection, onvasion of native and exotic invasive woody plants, and alteration of hydrology.

Plant species observed:
Andropogon virginicus var. *virginicus* (broom-sedge bluestem)
Arnoglossum plantagineum (prairie indian-plantain)
Baptisia bracteata var. *leucophaea* (plains wild indigo)
Callirhoe involucrata (wine-cup)
Carex bushii (bush's caric-sedge)
**Cyperus entrerianus*
Dichanthelium aciculare (needle leaf panic grass)
Dichanthelium scoparium (panic grass)
Fimbristylis puberula (hairy fimbry)
Hymenoxys texana (prairie dawn)
Muhlenbergia capillaries (gulf muhly)

Neptunia pubescens var. *pubescens* (prairie neptunia)
Paspalum plicatulum (brown-seed paspalum)
Rhynchospora caduca (angle-stem beakrush)
Rhynchospora globularis (globe beakrush)
Rudbeckia hirta (brown-eyed susan)
**Sapium sebiferum* (Chinese tallow-tree)
Schizachyrium scoparium var. *scoparium* (little bluestem)
Scleria pauciflora (few-flowered nutrush)
Silphium gracile (slender rosinweed)
Spartina spartinae (gulf cordgrass)
Verbena halei (texas vervain)

Site 10 - South of Pine Forest Road

A review of historical aerial photos suggests that this area was Coastal Prairie that was converted to intensive agricultural usage, mainly grazing. In its current state most of the original vegetation has been removed and is now dominated by native and exotic invasive species.

Site Ranking

Each site was ranked on 3 variables with values ranging from 0-5. Table 1, lists each site visited and are scored appropriately and then added together to get a cumulative score. Descriptions for each variable are as follows:

- Disturbance Ranking (1-5) - this ranking describes the extent to which the site exhibits disturbance. This ranking would include disturbance by invasive native and exotic species both faunal and floral, altered site or wetland hydrology, and other obvious alterations of topography such as roads and levees. A highly disturbed site would have a low quality value of 1 and an undisturbed site would have a higher quality ranking value of 5.
- Wildlife Habitat Quality Ranking (1-5) – this ranking describes the quality of the site in relation to forage, breeding and nesting for wildlife. The more diverse, native, and mature the herbaceous or tree stand, the higher the score (5). Site plant and wildlife lists were considered, although limited field survey times undoubtedly limited the numbers of bird species seen.
- Plant Community Quality Ranking (1-5) - this ranking describes the integrity of the plant communities found at each site. Sites that had a very high diversity of native vegetation scored higher (5) than sites with low vegetation diversity (1).

*Note: Wildlife and plant species lists provided are not all inclusive and should be considered only as a visual inspection or observation list. No timed or measured wildlife surveys were conducted and no plot level vegetation data was collected.

Table 1: Site Ranking

Site	Site Name	Community Type	Disturbance Ranking (1-5)	Wildlife Habitat Quality Ranking (1-5)	Plant Community (1-5)	Total Site Ranking (0-15)
1	S.W. Barker at Cinco Ranch	Bottomland hardwood forest (Green ash-Water oak-Willow oak-American elm	4	4	4	12
2	S. of Soccer Fields	Coastal Prairie	1	2	2	5
3	N.W. Model Airplane Field	Coastal Prairie	1	2	2	5
4	Footbridge	Bottomland hardwood Forest (Sycamore-American elm)	3	4	4	11
5	S. Mayde Creek	Bottomland hardwood Forest (Pecan-Sycamore-American elm)	4	4	4	12
6	S.W. Corner of Addicks	Coastal Prairie	2	2	3	7
7	War Memorial Dr.	Coastal Prairie	2	3	2	7
8	E. Eldridge Rd.	Coastal Prairie	1	2	1	4
9	N. of Groeschke Rd.	Coastal Prairie	4	4	4	12
10	S. of Pine Forest	Coastal Prairie	2	2	1	5

Endangered Species and Critical Habitat

A review of Service files indicates that the federally listed threatened Texas prairie dawn (*Hymenoxys texana*) is present on both Reservoirs (see figure 5). A development and implementation of a management plan for this species has not been developed in conjunction with the Service but should be made a priority. Surveys have been conducted through 2007 when USACE had to apply resources to the Master Plan Revision. Excessive mowing by Harris County staff has been a concern and has been addressed in a letter from the USACE to Harris County.

Texas prairie dawn was Federally listed in March 1995, and is a small plant that matures in March to late April and is only found in specific habitats. It prefers small sparsely vegetated patches of fine-sandy compacted soils located on the edge or on flats between the naturally occurring pimple mounds that are characteristic of native prairie in this area. In addition to the pimple mounds, this species can be found in bare spots of soil located in highly disturbed open areas such as grazed pastures and abandoned rice fields (both which occur in the Reservoirs.) Texas prairie dawn is intolerant of drought conditions and in dry years or on sites with altered hydrology or excessive evapotranspiration by woody plants may have poor reproductive success.

Thus, timing of flowering and fruit development is tied to seasonal precipitation. One known Texas prairie dawn site was visited during one of the site visits and no plants were seen. This may be attributed to the lack of rain during the last several months as well as other factors. The plant is a very poor competitor and is losing what little habitat there is left in the Reservoirs to encroachment of native and exotic invasive woody plants and exotic invasive herbaceous plant species such as deep-rooted sedge. As the woody and herbaceous species invade, they out compete Texas prairie dawn for soil resources, shades it out directly, or both. Excessive mowing is known to remove the seed head before it matures.

Beginning in 1987, the USACE began a biological assessment for threatened and endangered species in the Reservoirs. The biological assessment revealed Barker Reservoir had only one prairie dawn population of about 900 individual plants. Addicks Reservoir had 15 populations that ranged in size from a few hundred to a thousand or more individual plants (Draft Management plan). Surveys conducted through 2007 have identified 114 known sites with a high count of approximately 62,000 plants in 2001.

There is no critical habitat designated in either of the Reservoirs.

SEC. 7. (a) FEDERAL AGENCY ACTIONS AND CONSULTATIONS.—(1) The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act. All other Federal agencies shall, in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of this Act.

According to Section 7(a)(2) of the Endangered Species Act and the implementing regulations, it is the responsibility of each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally listed species. Therefore, you should use this and other current information to evaluate the project for its potential effects to listed species. The Service's Consultation Handbook (http://endangered.fws.gov/consultations/s7hndbk/s7hndbk.htm) is available to assist you with further information on definitions, process, and fulfilling Endangered Species Act requirements.

Figure 5 Known prairie dawn locations

Exotic Invasive Plants

Both Reservoirs lack necessary management to reduce the exotic and native invasive faunal and floral species. Areas that have been identified as "Environmentally Sensitive" may have been compromised by invasive species. Signs of feral hogs were noted on several of the sites visited. This species can destroy valuable habitat by creating large ruts thereby disturbing the soil and vegetation communities. In addition to the feral hog, Chinese tallow tree and deep-rooted sedge were seen on many of the sites. Chinese tallow tree, McCartney rose, Japanese honeysuckle, appears to have taken over much of the disturbed prairie sites. Site 2, Across from the Soccer field, the Model Airplane, and the S.W. Addicks Dam site (Pasture) have all become overgrown with native and exotic and invasive species due to fire suppression. This area was subject to regular burns naturally which suppressed the woody invaders and promoted natural seed regeneration. Fire suppression in conjunction with cattle grazing has allowed the coastal prairies sites in the Reservoirs to become overgrown. Native coastal prairie species are being crowded and out competed by these invasive species. In general, effective treatments for invasive species prevention and control include, mechanical (disking, roller chopping and cutting), herbicidal and controlled burns. The Service would welcome the opportunity to assist with creating an exotic plant species management plan for the Reservoirs.

Recommendations

- The Service requests that the USACE continue to coordinate with the Service as plans are developed for this project.
- The Service would recommend that the USACE manage the Texas prairie dawn populations by developing and implementing a coordinated management plan within one year from the date of this letter to include performing annual surveys for the species and brush control.
- Create an exotic and native invasive species management plan to remove/control the invasive species that are invading many of the environmentally sensitive areas.
- The Service agrees with the USACE's determination on the use of Sites 2, 3, 8 and 10 for high impact development due to its low wildlife habitat quality value, high disturbance and lack of diverse plant communities. This area has been identified as being extremely overgrown with exotic and native invasive species and really does not support the diversity of vegetation necessary to sustain many wildlife species.
- The Service agrees with the USACE's determination that Sites 1, 5 and 9 are located in Environmentally Sensitive area and should remain as such. This area supports the diversity of vegetation and proper community structure necessary to sustain many avian, mammal, reptile and invertebrate communities.
- The Service feels that Sites 6 and 7 are restorable and should be classified as Multiple Resource Management.
- Site 4 at the Footbridge, exhibits restoration potential. Once restoration is complete, this site may be well suited as a hike/bike trail.
- The Service would be willing to assist with the development of a restoration plan and plans of control for invasive exotic plant species.

Thank you for the opportunity to provide input to assist the USACE in planning projects which protect and restore these important native Texas coastal fish and wildlife habitats. Please contact staff biologist Donna Anderson at 281/286-8282 if you have questions concerning these recommendations.

Sincerely,

Stephen D. Parris

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cc:
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APPENDIX C

Public Coordination

APPENDIX D

State Listed Species – Harris and Fort Bend Counties

Table 1. State Listed Threatened and Endangered Species – Fort Bend County, Texas

Common Name	Scientific Name	State Status
	AMPHIBIANS	
Houston toad	*Bufo houstonensis*	E
	BIRDS	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	T
Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Henslow's Sparrow	*Ammodramus henslowii*	
Interior Least Tern	*Sterna antillarum athalassos*	E
Peregrine Falcon	*Falco peregrinus*	E T
Western Burrowing Owl	*Athene cunicularia hypugaea*	
White-faced Ibis	*Plegadis chihi*	T
White-tailed Hawk	*Buteo albicaudatus*	T
Whooping Crane	*Grus americana*	E
Wood Stork	*Mycteria americana*	T
	FISHES	State Status
American eel	*Anguilla rostrata*	
Sharpnose shiner	*Notropis oxyrhynchus*	
	MAMMALS	State Status
Louisiana black bear	*Ursus americanus luteolus*	T
Plains spotted skunk	*Spilogale putorius interrupta*	
Red wolf	*Canis rufus*	E
	MOLLUSKS	State Status
False spike mussel	*Quincuncina mitchelli*	
Pistolgrip	*Tritogonia verrucosa*	
Rock pocketbook	*Arcidens confragosus*	
Smooth pimpleback	*Quadrula houstonensis*	
Texas fawnsfoot	*Truncilla macrodon*	
	REPTILES	State Status
Alligator snapping turtle	*Macrochelys temminckii*	T
Texas horned lizard	*Phrynosoma cornutum*	T
Timber/Canebrake rattlesnake	*Crotalus horridus*	T
	PLANTS	State Status
Texas prairie dawn-flower	*Hymenoxys texana*	E
Threeflower broomweed	*Thurovia triflora*	

Table 2. State Listed Threatened and Endangered Species – Harris County, Texas

Common Name	Scientific Name	Listing Status
	AMPHIBIANS	State Status
Houston toad	*Bufo houstonensis*	E
	BIRDS	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	E
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	T
Bald Eagle	*Haliaeetus leucocephalus*	T
Black Rail	*Laterallus jamaicensis*	
Brown Pelican	*Pelecanus occidentalis*	E
Henslow's Sparrow	*Ammodramus henslowii*	
Mountain Plover	*Charadrius montanus*	
Peregrine Falcon	*Falco peregrinus*	E T
Red-cockaded Woodpecker	*Picoides borealis*	E
Snowy Plover	*Charadrius alexandrinus*	
Southeastern Snowy Plover	*Charadrius alexandrinus tenuirostris*	
White-faced Ibis	*Plegadis chihi*	T
White-tailed Hawk	*Buteo albicaudatus*	T
Whooping Crane	*Grus americana*	E
Wood Stork	*Mycteria americana*	T
	FISHES	State Status
American eel	*Anguilla rostrata*	
Creek chubsucker	*Erimyzon oblongus*	T
	MAMMALS	State Status
Louisiana black bear	*Ursus americanus luteolus*	T
Plains spotted skunk	*Spilogale putorius interrupta*	
Rafinesque's big-eared bat	*Corynorhinus rafinesquii*	T
Red wolf	*Canis rufus*	E
Southeastern myotis bat	*Myotis austroriparius*	
	MOLLUSKS	State Status
Little spectaclecase	*Villosa lienosa*	
Louisiana pigtoe	*Pleurobema riddellii*	
Pistolgrip	*Tritogonia verrucosa*	
Rock pocketbook	*Arcidens confragosus*	
Sandbank pocketbook	*Lampsilis satura*	
Texas pigtoe	*Fusconaia askewi*	
Wabash pigtoe	*Fusconaia flava*	

continued

(Table 20 continued)

Common Name	Scientific Name	Listing Status
	REPTILES	State Status
Alligator snapping turtle	*Macrochelys temminckii*	T
Green sea turtle	*Chelonia mydas*	T
Leatherback sea turtle	*Dermochelys coriacea*	E
Loggerhead sea turtle	*Caretta caretta*	T
Smooth green snake	*Liochlorophis vernalis*	T
Texas horned lizard	*Phrynosoma cornutum*	T
Timber/Canebrake rattlesnake	*Crotalus horridus*	T
	PLANTS	State Status
Coastal gay-feather	*Liatris bracteata*	
Giant sharpstem umbrella-sedge	*Cyperus cephalanthus*	
Houston daisy	*Rayjacksonia aurea*	
Texas meadow-rue	*Thalictrum texanum*	
Texas prairie dawn-flower	*Hymenoxys texana*	E
Texas windmill-grass	*Chloris texensis*	
Threeflower broomweed	*Thurovia triflora*	